INTERNATIONAL ECOLOGICAL CLASSIFICATION STANDARD:

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

NVC Groups of the Eastern U.S. on the LANDFIRE Legend

28 August 2018

by

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This subset of the International Ecological Classification Standard include Groups occurring in the eastern U.S. and that are on the LANDFIRE legend. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, NC <mary_russo@natureserve.org> and Pat Comer, Chief Terrestrial Ecologist, Boulder, CO <pat_comer@natureserve.org>.

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[1] NatureServe is an international organization including NatureServe regional offices, a NatureServe central office, U.S. State Natural Heritage Programs, and Conservation Data Centres (CDC) in Canada and Latin America and the Caribbean. Ecologists from the following organizations have contributed the development of the ecological systems classification:

United States

Central NatureServe Office, Arlington, VA; Eastern Regional Office, Boston, MA; Midwestern Regional Office, Minneapolis, MN; Southeastern Regional Office, Durham, NC; Western Regional Office, Boulder, CO; Alabama Natural Heritage Program, Montgomery AL; Alaska Natural Heritage Program, Anchorage, AK; Arizona Heritage Data Management Center, Phoenix AZ; Arkansas Natural Heritage Commission Little Rock, AR; Blue Ridge Parkway, Asheville, NC; California Natural Heritage Program, Sacramento, CA; Colorado Natural Heritage Program, Fort Collins, CO; Connecticut Natural Diversity Database, Hartford, CT; Delaware Natural Heritage Program, Smyrna, DE; District of Columbia Natural Heritage Program/National Capital Region Conservation Data Center, Washington DC; Florida Natural Areas Inventory, Tallahassee, FL; Georgia Natural Heritage Program, Social Circle, GA; Great Smoky Mountains National Park, Gatlinburg, TN; Gulf Islands National Seashore, Gulf Breeze, FL; Hawaii Natural Heritage Program, Honolulu, Hawaii; Idaho Conservation Data Center, Boise, ID; Illinois Natural Heritage Division/Illinois Natural Heritage Database Program, Springfield, IL; Indiana Natural Heritage Data Center, Indianapolis, IN; Iowa Natural Areas Inventory, Des Moines, IA; Kansas Natural Heritage Inventory, Lawrence, KS; Kentucky Natural Heritage Program, Frankfort, KY; Louisiana Natural Heritage Program, Baton Rouge, LA; Maine Natural Areas Program, Augusta, ME; Mammoth Cave National Park, Mammoth Cave, KY; Maryland Wildlife & Heritage Division, Annapolis, MD; Massachusetts Natural Heritage & Endangered Species Program, Westborough, MA; Michigan Natural Features Inventory, Lansing, MI; Minnesota Natural Heritage & Nongame Research and Minnesota County Biological Survey, St. Paul, MN; Mississippi Natural Heritage Program, Jackson, MI; Missouri Natural Heritage Database, Jefferson City, MO; Montana Natural Heritage Program, Helena, MT; National Forest in North Carolina, Asheville, NC; National Forests in Florida, Tallahassee, FL; National Park Service, Southeastern Regional Office, Atlanta, GA; Navajo Natural Heritage Program, Window Rock, AZ; Nebraska Natural Heritage Program, Lincoln, NE; Nevada Natural Heritage Program, Carson City, NV; New Hampshire Natural Heritage Inventory, Concord, NH; New Jersey Natural Heritage Program, Trenton, NJ; New Mexico Natural Heritage Program, Albuquerque , NM; New York Natural Heritage Program, Latham, NY; North Carolina Natural Heritage Program, Raleigh, NC; North Dakota Natural Heritage Inventory, Bismarck, ND; Ohio Natural Heritage Database, Columbus, OH; Oklahoma Natural Heritage Inventory, Norman, OK; Oregon Natural Heritage Program, Portland, OR; Pennsylvania Natural Diversity Inventory, PA; Rhode Island Natural Heritage Program, Providence, RI; South Carolina Heritage Trust, Columbia, SC; South Dakota Natural Heritage Data Base, Pierre, SD; Tennessee Division of Natural Heritage, Nashville, TN; Tennessee Valley Authority Heritage Program, Norris, TN; Texas Conservation Data Center, San Antonio, TX; Utah Natural Heritage Program, Salt Lake City, UT; Vermont Nongame & Natural Heritage Program, Waterbury, VT; Virginia Division of Natural Heritage, Richmond, VA; Washington Natural Heritage Program, Olympia, WA; West Virginia Natural Heritage Program, Elkins, WV; Wisconsin Natural Heritage Program, Madison, WI; Wyoming Natural Diversity Database, Laramie, WY

Canada

Alberta Natural Heritage Information Centre, Edmonton, AB, Canada; Atlantic Canada Conservation Data Centre, Sackville, New Brunswick, Canada; British Columbia Conservation Data Centre, Victoria, BC, Canada; Manitoba Conservation Data Centre. Winnipeg, MB, Canada; Ontario Natural Heritage Information Centre, Peterborough, ON, Canada; Quebec Conservation Data Centre, Quebec, QC, Canada; Saskatchewan Conservation Data Centre, Regina, SK, Canada; Yukon Conservation Data Centre, Yukon, Canada

Latin American and Caribbean

Centro de Datos para la Conservacion de Bolivia, La Paz , Bolivia; Centro de Datos para la Conservacion de Colombia, Cali,Valle, Columbia; Centro de Datos para la Conservacion de Ecuador, Quito, Ecuador; Centro de Datos para la Conservacion de Guatemala, Ciudad de Guatemala , Guatemala; Centro de Datos para la Conservacion de Panama, Querry Heights , Panama; Centro de Datos para la Conservacion de Paraguay, San Lorenzo , Paraguay; Centro de Datos para la Conservacion de Peru, Lima, Peru; Centro de Datos para la Conservacion de Sonora, Hermosillo, Sonora , Mexico; Netherlands Antilles Natural Heritage Program, Curacao , Netherlands Antilles; Puerto Rico-Departmento De Recursos Naturales Y Ambientales, Puerto Rico; Virgin Islands Conservation Data Center, St. Thomas, Virgin Islands.

NatureServe also has partnered with many International and United States Federal and State organizations, which have also contributed significantly to the development of the International Classification. Partners include the following The Nature Conservancy; Provincial Forest Ecosystem Classification Groups in Canada; Canadian Forest Service; Parks Canada; United States Forest Service; National GAP Analysis Program; United States National Park Service; United States Fish and Wildlife Service; United States Geological Survey; United States Department of Defense; Ecological Society of America; Environmental Protection Agency; Natural Resource Conservation Services; United States Department of Energy; and the Tennessee Valley Authority. Many individual state organizations and people from academic institutions have also contributed to the development of this classification.

NOTE: this document contains descriptions of NVC Groups designated as on the LANDFIRE ReMap legend as of late 2015 when auto-keys were completed and delivered. These are the Groups found in eastern CONUS and Puerto Rico; the document does not include Groups in Hawai'i or Alaska. It also has complete descriptions of the Macrogroups within which Groups are placed. When navigating the document be aware of whether you are looking at a Macrogroup description or one for the Groups within the macrogroup.

TABLE OF CONTENTS

1. FOREST & WOODLAND

Tropical, temperate and boreal forests, woodlands and tree savannas characterized by broadly mesomorphic (including scleromorphic) tree growth forms (including *broad-leaved, needle-leaved, sclerophyllous, palm, bamboo trees*, and *tree ferns*), typically with at least 10% cover (but tropical tree savannas up to 40% cover, when trees <8 m tall), irregular horizontal spacing of vegetation structure, and spanning humid to seasonally dry tropical to boreal and subalpine climates and wet to dry substrate conditions. Includes native forests, as well as managed, and some plantation forests where human management is infrequent.

1.A. Tropical Forest & Woodland

Tropical forests found at lowland and montane elevations including tropical dry forests, and lowland to montane humid forests (tropical rainforests) and tropical forested wetlands, where frost is essentially absent at sea level.

1.A.1. Tropical Dry Forest & Woodland

Tropical Dry Forest & Woodland is dominated by broad-leaved drought-deciduous, semi-deciduous, and small-leaved or sclerophyllous evergreen trees where rainfall is lower, often associated with more strongly seasonal, tropical climates, rainshadows, or drying winds. At continental scales, the largest areas occur between 10° and 23°N and S latitude.

1.A.1.Ea. Caribbean-Mesoamerican Dry Forest & Woodland

This division includes seasonally drought-deciduous to semi-deciduous tropical forests distributed from sea level up to 1400 m elevation throughout the Caribbean Basin, southern Gulf of Mexico, and in the Pacific Basin from the Gulf of California through Panama.

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1. Forest & Woodland
1.A.1.Ea. Caribbean-Mesoamerican Dry Forest & Woodland

M134. Caribbean Coastal Lowland Dry Forest

Type Concept Sentence: This vegetation is found in flat lowlands and low hills (ca. 300 m elevation) with a pronounced dry season along south Florida and the Antilles. Forests have low stature, high density of small and medium-sized trees, and have single-layer canopies with no emergent trees. The herb layer is poorly developed or completely lacking. Floristic diversity is low compared to more humid forests, and high species dominance is common. Variation in the dry season period, topography, and substrate determine the specific characteristics of the vegetation communities in this macrogroup since all of these have great importance in dry forests as determinants of variation in water availability.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.A.1.Ea.2. Caribbean-Mesoamerican Dry Forest & Woodland (D099)

Elcode: M134
***Scientific Name:** *Bursera simaruba - Coccoloba diversifolia - Eugenia* sp. Caribbean Coastal Lowland Dry Forest Macrogroup
***Common (Translated Scientific) Name:** Gumbo Limbo - Tie-tongue - Stopper species Caribbean Coastal Lowland Dry Forest Macrogroup
***Colloquial Name:** Caribbean Coastal Lowland Dry Forest

***Type Concept:** This macrogroup encompass tropical and subtropical forests characterized by a dry season of several months that occur in coastal lowlands and low hills, littoral or sublittoral flatlands with rock outcrops and higher terraces facing the sea, on limestone coral shelves, humic carbonate soils, shallow red ferralitic soils, or sandy soils of stabilized, old coastal dunes in south Florida, the Florida Keys, the Greater Antilles, and other Caribbean islands such as those of the Bahamas and Virgin Islands archipelagos. The species composition and structure of these forests vary depending upon the substrate and climate across their distribution. They are broadleaf semi-deciduous to evergreen forests with a canopy between 6-10 m of height. The density of stems tends to be very high. The woody understory is mostly evergreen. The herb layer is poorly developed or completely lacking. In the continental U.S., the Caribbean dry forest occurs in two settings: the hardwood hammock forest in southern Florida, on elevated outcrops of limestone, and the strand forest - a narrow band of hardwood forest and tall shrublands lying just inland of the coastal dune system in south Florida. The latter occur on stabilized, old coastal dunes, often with substantial shell components. In both cases the vegetation is characterized by hardwood species with tropical affinities, with *Eugenia axillaris* as the most commonly shared species. The Florida hammock forest occurs in three discrete regions, including the Florida Keys, southeastern Big Cypress, and the Miami Rock Ridge. Tropical hardwood species likely to be encountered include *Ardisia escallonoides, Bursera simaruba, Coccoloba diversifolia, Eugenia axillaris*, and *Guapira discolor*. The northward ranges of these species are limited by the incidence of frost. These forests tend to have a dense canopy that produces deeper shade, less evaporation, and lower air temperature than surrounding vegetation in these locations. This microclimate, in combination with high water tables, tends to keep humidity levels high. A number of orchid and bromeliad species thrive in such conditions. Unlike much U.S. coastal plain vegetation, fire is a major threat to these hardwood hammock forests.

Dry forests of the Caribbean islands share some features with the Florida dry forests, such as the high density of stems, low stature and relative low floristic diversity, with several shared species among the dominant ones (*Bursera simaruba, Coccoloba diversifolia, Eugenia foetida, Gymnanthes lucida*). Diagnostic species of this type include *Amyris elemifera, Bursera simaruba, Bucida buceras, Coccoloba diversifolia, Coccoloba uvifera, Coccoloba krugii, Eugenia axillaris, Eugenia foetida, Erithalis fruticosa, Exostema caribaeum, Haematoxylum campechianum, Gymnanthes lucida, Guettarda krugii, Guaiacum officinale, Guaiacum sanctum, Jacquinia armillaris, Krugiodendron ferreum, Nectandra coriacea, Pisonia albida, Sabal palmetto, Simarouba glauca, Savia sessiliflora*, and *Thouinia striata var. portoricensis*. These forests also share the limestone substrate which is widespread among the coastal Antilles. Caribbean coastal dry forests in Cuba are slightly taller and have two canopy layers; with the upper layer reaching 12-15 m. This macrogroup also includes lowland semi-deciduous forests on richer substrates in Cuba, Hispaniola, and several smaller Caribbean islands. However, centuries of human occupation and agricultural land use have largely replaced these natural forests described in the literature as more diverse, semi-deciduous, and with the canopy up to 15-20 m height.

***Diagnostic Characteristics:** Diagnostic characteristics for this forest macrogroup are low stature with few or no emergent trees, poorly distinguished canopy layers, a high density of stems resulting from the majority of tree species having a tendency to develop several main stems (to coppice), and a dry season severe enough to select for drought-deciduous or evergreen, drought-tolerant trees. Among the species likely to be encountered throughout are *Bursera simaruba, Coccoloba diversifolia*, and *Eugenia axillaris*. The tree species of the tropical hammocks of Florida are a subset of the native Caribbean dry forests species that can withstand extremely rare frost events (Gillespie 2006).

***Classification Comments:** The distinction between this macrogroup and Caribbean Dry Limestone Forest Macrogroup (M294) should be clarified, since the latter refers to plant communities that grow on limestone substrates in dry climates, but also in other dry geophysical settings within humid climates. Calcium carbonate-rich soils create physiological and nutrient stress on the plant communities growing on them which results in distinct structure and composition.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The dry forests of south Florida and the Caribbean have a greater density of individual stems and shorter canopy heights than tropical dry forests in the mainland Neotropics (Gillespie 2006, Lugo et al. 2006). Density varies from 14,000 stems >2.5 cm/ha in Puerto Rico dry forest to 4600 stems/ha in Florida. Canopy height ranges between 5 and 10 m, with a higher mean height in Florida hammock forest stands than in Puerto Rico dry forest, and few trees reaching 18-20 m height. The canopy is seasonally open; however, there are few truly deciduous species in these forests, with early-successional forests dominated by broadleaf semi-deciduous species and late-successional forests dominated by broadleaf evergreen species. Drought-deciduousness is the principal adaptive mode of tropical dry deciduous forests, and at the dry extremes, small evergreen trees are important (Lugo et al. 2006). There is a notable lack of lianas compared with dry forests in the mainland Neotropics (Gillespie 2006). Despite relatively low species diversity, lifeform diversity is common and is accompanied by diversity in plant habit, leaf size and structure, drought tolerance and growth seasonality; this diversity is attributed to habitat heterogeneity coupled with strong rainfall seasonality (Lugo et al. 1978, Medina 1995, as cited in Lugo et al. 2006). In south Florida, dry tropical forests occurring in sites with higher mean temperature and lower precipitation have greater stand density, while higher precipitation and lower temperatures result in greater canopy heights (Gillespie 2006). Epiphytic orchid and bromeliad species are often found in areas where frosts or anthropogenic disturbances have not occurred in a long time.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The vegetation is characterized by hardwood species with tropical affinities. Common species in south Florida, the Bahamas, Cuba and Puerto Rico are *Amyris elemifera, Bursera simaruba, Coccoloba diversifolia, Coccoloba uvifera, Eugenia axillaris, Eugenia foetida, Gymnanthes lucida, Krugiodendron ferreum, Nectandra coriacea, Sabal palmetto*, and *Simarouba glauca*. Dominant species in Puerto Rico coastal dry forest are *Coccoloba krugii, Erithalis fruticosa, Exostema caribaeum, Guettarda krugii, Gymnanthes lucida, Pisonia albida, Savia sessiliflora*, and *Thouinia striata var. portoricensis*. Given the harsh conditions of the Antillean dry forests, those relatively few species that thrive under the stress are able to dominate sites (Lugo et al. 2006). Endemism is very high and represents about 50% of the species. The northern extent of this macrogroup is limited by periodic freezes and cold-tolerance of tropical constituent species, such as *Ardisia escallonoides, Eugenia axillaris, Exothea paniculata, Guapira discolor, Metopium toxiferum, Nectandra coriacea*, and *Piscidia piscipula* (Johnson and Muller 1993a).

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Along the Florida distribution of this macrogroup, the coastal maritime hammocks are prone to disturbance from hurricanes, which can include extremely high winds, and in coastal areas salt spray, and saltwater storm surge. The rockland habitats on the Florida mainland are mostly inland and not subject to the salt spray and storm surge associated with hurricanes. However, winter freezes sometimes occur and result in damage of the tropical woody plants. In the Florida Keys, freezing temperatures are very unusual.

Drought-deciduousness is the principal adaptive mode of tropical dry deciduous forests, and at the dry extremes, small evergreen trees are important (Lugo et al. 2006). There is a notable lack of lianas compared with dry forests in the mainland Neotropics (Gillespie 2006). Despite relatively low species diversity, lifeform diversity is common and is accompanied by diversity in plant habit, leaf size and structure, drought tolerance and growth seasonality; this diversity is attributed to habitat heterogeneity coupled with strong rainfall seasonality (Lugo et al. 1978, Medina 1995, as cited in Lugo et al. 2006). Caribbean dry forests have to cope with highly stressful conditions given the combination of environmental features such as low moisture availability, long dry seasons, decadal cycles of pronounced drought, wind exposure and salt spray in littoral locations. These forests are also periodically exposed to hurricane conditions with effects that span from flooding with seawater to defoliation, treefall and other structural changes due to strong winds.

Overall, Caribbean coastal dry forests are exposed to harsh environmental conditions that, depending on their intensity, can cause damage or diebacks, such as seasonal water deficit, nutrient stress, strong winds and salt spray, and saltwater storm surge. This has influenced the development of structural and physiological mechanisms to cope, making them very resilient to disturbance. Among the more outstanding ones are a high resistance to wind (short stature), a high proportion of root biomass, high soil carbon and nutrient accumulation below ground, the ability of most tree species to resprout, and high nutrient use efficiency (Lugo et al. 2006).

Fire is not part of the natural dynamics of Caribbean coastal dry forests (though many dry forests are now subject to anthropogenic fires). This is why many examples occur alongside natural firebreaks, such as the leeward side of exposed limestone (Robertson 1955), moats created by limestone solution (Duever et al. 1986), and elevated outcrops above marshes, scrub cypress, or sometimes mangrove swamps (Snyder et al. 1990), or isolated on ridges in pine woodlands.

ENVIRONMENT

Environmental Description: *Climate*: Caribbean dry forests occurring on the mainland in Florida and the Upper Keys are periodically exposed to short-term frost and their flora is composed of a subset of native tropical trees that can withstand rare frost events. Mean annual temperatures in the Caribbean dry forest region range from 23°C (74°F) in the north to 26°C (77°F) in the Lower Keys. Precipitation primarily occurs from June to October and ranges from 1650 mm along the Atlantic coast decreasing southward to less than 1000 mm in the Lower Keys (Gillespie 2006). Precipitation in the distribution range of this forest in Puerto Rico and over most of the islands of Culebra and Vieques ranges from 600 to 1100 mm per year (Brandeis et al. 2009), with two dry seasons. U.S. Virgin Islands examples may be even drier. Some of the U.S. Virgin Islands examples reach 1200 mm per year.

Soil/Substrate: Limestone is the dominant substrate in Caribbean dry forests of Florida and the Bahamas, with skeletal organic soils with minor mineral components, rarely exceeding 20 cm in depth (Snyder et al. 1990, as cited in Gillespie 2006). In Florida, the coastal maritime hammocks are found on stabilized coastal dunes, often with substantial shell components. In the Greater Antilles the distribution of dry forests is indicative of limestone substrates occurring in narrow strips on the northern and southern coastal areas. Isolated inland, ultramafic soils associated with limestone also support dry forests. In flat low-lying limestone archipelagos, such as the Bahamas, the Cayman Islands, Mona and Anegada, dry forests and shrublands dominate. In volcanic, low mountainous islands of the Lesser Antilles, dry forests dominate except for protected sites and ravines where moist forest can grow (Lugo et al. 2006).

Caribbean dry forests have to cope with highly stressful conditions given the combination of environmental features such as low moisture availability, long dry seasons, decadal cycles of pronounced drought, wind exposure and salt spray in littoral locations. These forests are also periodically exposed to hurricane conditions with effects that span from flooding with seawater to defoliation, treefall and other structural changes due to strong winds.

DISTRIBUTION

***Geographic Range:** This macrogroup is found in south Florida, the Florida Keys, the Bahamas, Cayman Islands, Cuba, Hispaniola, Jamaica, Leeward Islands, Puerto Rico, Trinidad and Tobago, and Windward Islands.
Nations: BS, CU, DO, HT, JM, MQ, PR, TC, TT, US, VE, VG?, VI, XD
States/Provinces: FL
USFS Ecoregions (2007) [optional]: 232D:CC, 232G:CC, 411A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G476	Caribbean Coastal Dry Evergreen Forest
G765	Caribbean Hardwood Hammock & Coastal Strand Forest

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Rockland Forest	Ross et al. 1992	
=	Tropical Hammock	Snyder et al. 1990	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse, in Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse, C.W. Nordman, and D. Faber-Langendoen
Acknowledgments [optional]:
Version Date: 30 Oct 2015

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1. Forest & Woodland
1.A.1.Ea. Caribbean-Mesoamerican Dry Forest & Woodland

G476. Caribbean Coastal Dry Evergreen Forest

Type Concept Sentence: These Caribbean dry forests are found in coastal areas, lowlands and low hills (about 300 m elevation), which are characterized by a dry season, and occur on a variety of substrates, such as sand, rocky areas and rock outcrops which contribute to seasonal plant moisture stress, as well as on sites with better soils.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.A.1.Ea.2. Caribbean Coastal Lowland Dry Forest (M134)

Elcode: G476
***Scientific Name:** Caribbean Coastal Dry Evergreen Forest Group
***Common (Translated Scientific) Name:** Caribbean Coastal Dry Evergreen Forest Group
***Colloquial Name:** Caribbean Coastal Dry Evergreen Forest

***Type Concept:** These Caribbean dry forests are found in coastal areas, lowlands and low hills (about 300 m elevation). Forests are characterized by a dry season, and occur on a variety of substrates, such as sand, rocky areas and rock outcrops which contribute to seasonal plant moisture stress, as well as on sites with better soils, but which are seasonally dry. Coastal forests are evergreen, or mostly evergreen, with thick, sclerophyllous, small leaves and only a third of the trees deciduous or semi-deciduous. They have relative low floristic diversity and a tendency to have high species dominance. The canopy is somewhat open, between 6-10 m in height or taller in the case of occurrences in Cuba and sites in St. John where they have two canopy layers, with the upper layer reaching 12-15 m and occasional emergents up to 20 m tall. The density of stems tends to be very high. Inland forests are composed of two canopy layers with the upper canopy 18-25 m tall and about 75% deciduous species. The prevailing conditions determine if this forest type is deciduous or semi-deciduous. In both coastal and inland dry forests, the woody understory is mostly evergreen. The herb layer is poorly developed or completely lacking. Species composition varies depending on past uses, substrate, and local climate. In sandy or rocky areas with nutrient-poor soils, especially in coastal areas, forests are lower in height and include a spiny sclerophyllous shrub layer. The trees have a high proportion of root biomass, which allows these forests to be resilient to hurricane damage. In coastal dry forests, the following list of species is diagnostic for this group: *Bursera simaruba, Coccoloba diversifolia, Erythroxylum areolatum, Eugenia axillaris, Exostema caribaeum, Exothea paniculata, Guettarda krugii, Guaiacum sanctum, Guapira obtusata, Gymnanthes lucida, Metopium toxiferum, Sideroxylon foetidissimum*, and *Sideroxylon salicifolium*. In inland dry forests diagnostic species are *Acacia muricata, Allophylus cominia, Amyris balsamifera, Andira inermis, Ateleia cubensis, Brya ebenus, Byrsonima spicata, Capparis* spp., *Catalpa macrocarpa, Cedrela odorata, Coccoloba* spp., *Copernicia baileyana, Copernicia sueroana, Copernicia textilis, Cordia laevigata, Diospyros crassinervis, Diospyros halesioides, Eugenia confusa, Ficus citrifolia, Hymenaea courbaril, Manilkara jaimiqui, Manilkara bidentata, Maytenus buxifolia, Myrcia citrifolia, Myrciaria floribunda, Phyllostylon brasiliensis, Picramnia pentandra, Guapira fragrans, Pisonia subcordata, Savia sessiliflora, Swietenia mahagoni, Tabebuia heterophylla, Tabebuia shaferi, Trichilia hirta, Trichilia pallida*, and *Zanthoxylum martinicense*. In Puerto Rico, the following species are typical in inland examples: *Bucida buceras, Citharexylum spinosum, Coccoloba diversifolia, Cordia laevigata, Guaiacum officinale, Guazuma ulmifolia, Lonchocarpus domingensis*, and *Rauvolfia nitida*.

***Diagnostic Characteristics:**

***Classification Comments:** This group includes coastal and inland low-elevation seasonal dry forests. The inland forests (CES411.419) tend to have higher stature and density of the stand and predominance of mesophyllous and deciduous trees. The coastal forests (CES411.421) have more sclerophyllous, evergreen foliage, and only a third of the trees are deciduous or semi-deciduous (Wadsworth 1964, cited in Murphy and Lugo 1995). Nevertheless, the composition varies within this group and some species among the top dominant trees are present in both subtypes, for example *Guapira fragrans* or *Tabebuia heterophylla*.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are evergreen, semi-deciduous or in some cases deciduous forests with somewhat open short tree canopy. There is an evergreen understory, mostly with small leaves, including sclerophyllous leaves. Herbaceous plants are very sparse. These trees have a high proportion of root biomass, which allows these forests to be resilient to hurricane damage (Lugo et al. 2006). Coastal forests are evergreen, or mostly evergreen, with thick, sclerophyllous, small leaves and only a third of the trees deciduous or semi-deciduous (Wadsworth 1964, cited in Murphy and Lugo 1995).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Coastal examples have the following list of species as diagnostic: *Bursera simaruba, Coccoloba diversifolia, Erythroxylum areolatum, Eugenia axillaris, Exostema caribaeum, Exothea paniculata, Guettarda krugii, Guaiacum sanctum, Guapira obtusata, Gymnanthes lucida, Metopium toxiferum, Sideroxylon foetidissimum*, and *Sideroxylon salicifolium*. Common accompanying species are *Amyris elemifera, Ateleia gummifera, Bourreria succulenta, Bucida buceras, Caesalpinia* spp., *Capparis cynophallophora, Capparis flexuosa, Chionanthus ligustrinus (= Linociera ligustrina), Chrysobalanus icaco, Chrysophyllum oliviforme, Coccoloba krugii, Coccothrinax littoralis, Colubrina* spp., *Erithalis fruticosa, Erythroxylum rotundifolium, Eugenia confusa, Eugenia foetida, Ficus aurea, Guettarda elliptica, Krugiodendron ferreum, Lysiloma latisiliquum (= Lysiloma bahamense), Pictetia aculeata, Pisonia albida, Randia aculeata, Sabal parviflora, Tabernaemontana amblyocarpa, Terminalia neglecta, Thouinia striata var. portoricensis*, and *Thrinax radiata*. The species composition reported for St. John includes as dominants *Bourreria succulenta, Coccoloba microstachya, Guapira fragrans (= Pisonia fragrans), Maytenus laevigata, Nectandra coriacea (= Ocotea coriacea)*, and *Tabebuia heterophylla (= Tabebuia pallida)*. Examples in the lowlands and low hills in sandy or rocky areas with nutrient-poor soils are lower in height and include a spiny sclerophyllous shrub layer. The following list of species is diagnostic in the lowlands and low hills: *Acacia muricata, Allophylus* *cominia, Amyris balsamifera, Andira inermis, Ateleia cubensis, Brya ebenus, Byrsonima spicata, Capparis* spp., *Catalpa macrocarpa (= Catalpa punctata), Cedrela odorata (= Cedrela mexicana), Coccoloba* spp., *Copernicia baileyana, Copernicia sueroana, Copernicia textilis, Cordia laevigata, Diospyros crassinervis, Diospyros halesioides, Eugenia confusa, Ficus citrifolia, Hymenaea courbaril, Manilkara jaimiqui, Manilkara bidentata, Maytenus buxifolia, Myrcia citrifolia, Myrciaria floribunda, Phyllostylon brasiliensis, Picramnia pentandra, Guapira fragrans, Pisonia subcordata, Savia sessiliflora, Swietenia mahagoni, Tabebuia heterophylla, Tabebuia shaferi, Trichilia hirta, Trichilia pallida*, and *Zanthoxylum martinicense*. In Puerto Rico, the following species are typical: *Bucida buceras, Citharexylum spinosum (= Citharexylum fruticosum), Coccoloba diversifolia, Cordia laevigata, Guaiacum officinale, Guazuma ulmifolia, Lonchocarpus domingensis*, and *Rauvolfia nitida*. The species composition reported for St. John includes as dominants *Acacia muricata, Byrsonima spicata, Chionanthus compactus, Faramea occidentalis, Guazuma ulmifolia, Inga laurina, Nectandra coriacea*, and *Tabebuia heterophylla*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Caribbean coastal dry forests are exposed to harsh environmental conditions that, depending on their intensity, can cause damage or diebacks, such as seasonal water deficit, nutrient stress, strong winds and salt spray, and saltwater storm surge. This has influenced the development of structural and physiological mechanisms to cope, making them very resilient to disturbance. Among the more outstanding ones are a high resistance to wind (short stature), a high proportion of root biomass, high soil carbon and nutrient accumulation below ground, the ability of most tree species to resprout, and high nutrient use efficiency (Lugo et al. 2006). Fire is not part of the natural dynamics of Caribbean coastal dry forests, but hurricanes are, which naturally results in considerable heterogeneity in habitat structure and food availability on small spatial scales. This structuring of coastal dry forest by frequent natural disturbance may favor their resilience to anthropogenic disturbance and fragmentation.

ENVIRONMENT

Environmental Description: *Climate:* Precipitation in the distribution range of this forest in Puerto Rico and over most of the islands of Culebra and Vieques ranges from 600 to 1100 mm per year (Brandeis et al. 2006), with two dry seasons, the longer one from December to April and a shorter one from June to August. Caribbean dry forests are subject to stressful conditions due to low moisture availability, long dry seasons, and decadal cycles of pronounced drought. In addition, hurricanes bring very high winds and intense rainfall. Mean temperatures between 24-27°C are typical. The annual precipitation range is somewhat higher across much of the distribution of this forest type (800-1300 mm) (Murphy and Lugo 1995).

Soil/substrate/hydrology: In the Greater Antilles the distribution of dry forests is indicative of limestone substrates occurring in narrow strips on the northern and southern coastal areas. Rocky limestone soils have low water-holding capacity and nutritional limitations imposed by their calcareous composition. Isolated inland, ultramafic soils associated with limestone also support dry forests. In flat low-lying limestone archipelagos, such as the Bahamas, the Cayman Islands, Mona and Anegada, dry forests and shrublands dominate. In volcanic, low mountainous islands of the Lesser Antilles, dry forests dominate except for protected sites and ravines where moist forest can grow (Lugo et al. 2006).

DISTRIBUTION

***Geographic Range:** This group occurs in coastal and low-elevation Caribbean areas including the Bahamas, Greater Antilles, and Lesser Antilles.
Nations: BS, CU, DO, JM, PR, TT, VE, VI, XD
States/Provinces:
USFS Ecoregions (2007) [optional]: M411Aa:CCC, M411Ab:CCP, M411Ad:CCC, M411Ae:CCC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low - Poorly Documented
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Cuban Dry Forests on volcanic, sedimentary and alluvial substrates	Huggins et al. 2007	
<	Hispaniola Dry Forests on volcanic, sedimentary and alluvial substrates	Huggins et al. 2007	
<	Lesser Antillean Dry Forests on volcanic, sedimentary and alluvial substrates	Huggins et al. 2007	
<	Puerto Rican Dry Forests on volcanic, sedimentary and alluvial substrates	Huggins et al. 2007	
<	Puerto Rico land cover type 1, Mature secondary lowland dry alluvial semideciduous forest	Gould et al. 2008	These remnants are in relatively undisturbed areas, often along riparian corridors, northeast and south coast of Puerto Rico, Vieques, Culebra and Mona Island.
<	Puerto Rico land cover type 13, Mature secondary lowland dry noncalcareous semideciduous forest	Gould et al. 2008	Mature dry forest on volcanic substrates, coastal hills in northeast Puerto Rico and in the Sierra Bermeja range in the southwest part of Puerto Rico.
?	Semi-deciduous Forest	Dansereau 1966	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse and C. Nordman, in Faber-Langendoen et al. (2016)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse and C. Nordman

Acknowledgments [optional]:

Version Date: 15 Jul 2016

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1. Forest & Woodland
1.A.1.Ea. Caribbean-Mesoamerican Dry Forest & Woodland

G765. Caribbean Hardwood Hammock & Coastal Strand Forest

Type Concept Sentence: This hardwood hammock forest group occurs in southern Florida, on elevated ridges of limestone or sandy shells. Tropical hardwood species likely to be encountered throughout are *Bursera simaruba, Coccoloba diversifolia*, and *Eugenia axillaris*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.A.1.Ea.2. Caribbean Coastal Lowland Dry Forest (M134)

Elcode: G765
***Scientific Name:** *Bursera simaruba - Coccoloba diversifolia - Eugenia axillaris* Forest Group
***Common (Translated Scientific) Name:** Gumbo Limbo - Tie-tongue - White Stopper Forest Group
***Colloquial Name:** Caribbean Hardwood Hammock & Coastal Strand Forest

***Type Concept:** In the U.S., this hardwood hammock forest group occurs in southern Florida, on rockland sites. It consists of upland hardwood forest on elevated ridges of limestone in three discrete regions: the Florida Keys, southeastern Big Cypress, and the Miami Rock Ridge. Tropical hardwood species likely to be encountered throughout are *Bursera simaruba, Coccoloba diversifolia*, and *Eugenia axillaris*. The northward ranges of these species are limited by the incidence of frosts. These forests tend to have a dense canopy that produces deeper shade, less evaporation, and lower air temperature than surrounding vegetation. This microclimate, in combination with high water tables, tends to keep humidity levels high and the community quite mesic. A number of orchid and bromeliad species thrive in such conditions. Unlike most coastal plain systems, fire is a major threat to these hardwood hammock forests.

In the U.S., this group also occurs as a narrow band of hardwood forest and tall shrublands lying just inland of the coastal dune system in south Florida. It is found on stabilized, old, coastal dunes, often with substantial shell components. The vegetation is characterized by hardwood species with tropical affinities. As such, the northern extent of this group is limited by periodic freezes and cold-tolerance of tropical constituent species, such as *Piscidia piscipula, Guapira discolor, Exothea paniculata*, and *Eugenia axillaris*. These stands are closely related to the rockland based tropical hammocks.

***Diagnostic Characteristics:** Tropical hardwood species are diagnostic of this group, although few are common or dominant in all regions where these hammocks occur (Snyder et al. 1990). Among the species likely to be encountered throughout are *Bursera simaruba, Coccoloba diversifolia*, and *Eugenia axillaris*. These tropical hammocks lack the more temperate species of maritime forests further north, including *Persea borbonia, Quercus virginiana, Magnolia grandiflora*, and *Juniperus virginiana var. silicicola* (Johnson and Muller 1993a).

***Classification Comments:** The coastal maritime hammocks are closely related to the rockland hammocks, though those stands support a higher diversity of trees and shrubs. For instance, *Leucothrinax morrisii* and *Thrinax radiata* are found in rockland hammocks, but absent from the coastal maritime hammocks. The coastal maritime hammocks are distinguished from maritime forests further north which contain temperate species, including *Persea borbonia, Quercus virginiana, Magnolia grandiflora*, and *Juniperus virginiana var. silicicola* (Johnson and Muller 1993a).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The vegetation of this group is tropical hardwood forest, dominated by broadleaf evergreen trees and shrubs. Epiphytic orchid and bromeliad species are often found in areas where frosts have not occurred in a long time.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The rockland hammock forests lack strong dominance. Some typical dominant to common tree species, in no real order, are *Bursera simaruba, Coccoloba diversifolia, Metopium toxiferum, Swietenia mahagoni, Zanthoxylum fagara, Gymnanthes lucida (= Ateramnus lucidus), Piscidia piscipula*, and *Pithecellobium keyense* (T. Armentano pers. comm.). Other species can include *Lysiloma latisiliquum, Nectandra coriacea, Ficus aurea, Sideroxylon foetidissimum, Eugenia foetida, Guapira discolor, Coccoloba uvifera, Thrinax morrisii, Thrinax radiata, Erithalis fruticosa, Krugiodendron ferreum, Casasia clusiifolia, Erithalis fruticosa, Byrsonima lucida*, and *Capparis flexuosa*.

The coastal maritime hammocks are also characterized by hardwood species with tropical affinities. As such, the northern extent of this type is limited by periodic freezes and cold-tolerance of tropical constituent species, such as *Piscidia piscipula, Guapira discolor, Exothea paniculata*, and *Eugenia axillaris* (Johnson and Muller 1993a). These communities in southeast Florida are distinguished from those in southwest Florida by two frequently occurring trees: *Guapira discolor* and *Exothea paniculata*. In addition, they are substantially richer floristically than southwestern coast hammocks. Other species occurring in eastern coast hammocks but not western coast examples include *Nectandra coriacea, Amyris elemifera, Metopium toxiferum, Krugiodendron ferreum, Coccothrinax argentata*, and *Simarouba glauca*. The very diverse canopy can be dominated or codominated by many species not included in the name, including *Simarouba glauca, Coccoloba uvifera, Coccoloba diversifolia, Exothea paniculata, Sabal palmetto*, and others.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: These forests are prone to disturbance from hurricanes, which can include extremely high winds, and in coastal areas salt spray, and saltwater storm surge. Winter freezes sometimes occur which can damage the tropical woody plants which characterize this vegetation. The rockland habitats on the Florida mainland are mostly inland and not subject to the salt spray and storm surge associated with hurricanes. In the Florida Keys, freezing temperatures are very unusual. Fire is a major threat to the vegetation of this group. For this reason, many examples occur alongside natural firebreaks, such as the leeward side of exposed limestone (Robertson 1955), moats created by limestone solution (Duever et al. 1986), and elevated outcrops above marshes, scrub cypress, or sometimes mangrove swamps (Snyder et al. 1990).

ENVIRONMENT

Environmental Description: These forests tend to have a dense canopy that produces deeper shade, less evaporation, and lower air temperature than surrounding vegetation. This microclimate, in combination with high water tables, tends to keep humidity levels high and the community quite mesic (FNAI 1990). In the United States, the rockland hammocks occur on alkaline soil on elevated ridges of limestone in three discrete regions: the Florida Keys, southeastern Big Cypress, and the Miami Rock Ridge. *Climate:* The climate is humid subtropical. The northward ranges of the tropical hardwood species *Bursera simaruba, Coccoloba diversifolia*, and *Eugenia axillaris* are limited by the incidence of frosts (Drew and Schomer 1984). *Soil/substrate/hydrology:* The underlying geology and soils are somewhat different among the three regions of occurrence. Generally, soils are highly organic with uneven and widely ranging thickness (Snyder et al. 1990). Many examples occur alongside natural firebreaks, such as the leeward side of exposed limestone (Robertson 1955), moats created by limestone solution (Duever et al. 1986), and elevated outcrops above marshes, scrub cypress, or sometimes mangrove swamps (Snyder et al. 1990).

The coastal maritime hammocks are found on stabilized, old, coastal dunes, often with substantial shell components. *Climate:* Humid warm temperate and humid subtropical. *Soil/substrate/hydrology:* Generally the vegetation of this group occurs on sands, which contain a larger portion of shell fragments further south in Florida.

DISTRIBUTION

***Geographic Range:** This group occurs in south Florida (including the Florida Keys), Cuba and likely other Caribbean islands. The northern extent of this group is limited by periodic freezes and cold-tolerance of tropical constituent species.
Nations: BS, CU, US
States/Provinces: FL
USFS Ecoregions (2007) [optional]: 232D:CC, 232G:CC, 411A:CC
Omernik Ecoregions L3, L4 [optional]: 8.5.3.75b:C, 8.5.3.75d:C, 15.4.1.76a:C, 15.4.1.76b:C, 15.4.1.76c:C, 15.4.1.76d:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A2030	*Bursera simaruba - Coccoloba diversifolia - Eugenia axillaris* Forest Alliance
A2031	*Sideroxylon foetidissimum - Eugenia foetida - Coccoloba uvifera* Forest & Scrub Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-05-29	G128 Sideroxylon foetidissimum - Eugenia foetida - Coccoloba uvifera Forest Group	G001 & G128 merged to form G765
2013-05-29	G001 Bursera simaruba - Coccoloba diversifolia - Eugenia axillaris Forest Group	G001 (changed to A2030) & G128 merged to form new G765

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
?	Coastal Berm	FNAI 1990	
><	Coastal Rock Barren	FNAI 1990	
><	Coastal Strand	FNAI 1990	
><	Maritime Hammock	FNAI 1990	
=	Rockland Forest	Ross et al. 1992	
<	Rockland Hammock	FNAI 1990	
><	Shell Mound	FNAI 1990	
=	Tropical Hammock	Snyder et al. 1990	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.R. Snyder, A. Herndon, and W.B. Robertson, Jr. (1990)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman and D. Faber-Langendoen

Acknowledgments [optional]:

Version Date: 29 May 2013

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M294. Caribbean Dry Limestone Forest

Type Concept Sentence: These are relatively species-poor dry forests but with high plant endemism. They occur in seasonal climates with 800-1500 mm rainfall per year and the dry season can last two to several months. The canopy is somewhat open, mostly deciduous and 6-15 m height, with emergent trees only in locations with higher precipitation. A lower layer may or may not be present and typically is mostly evergreen, ground vegetation is sparse. Lower annual precipitation on a limestone substrate and shallow soils results in a dense shrub layer about 2-4 m high.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.A.1.Ea.3. Caribbean-Mesoamerican Dry Forest & Woodland (D099)

Elcode: M294
***Scientific Name:** Caribbean Dry Limestone Forest Macrogroup
***Common (Translated Scientific) Name:** Caribbean Dry Limestone Forest Macrogroup
***Colloquial Name:** Caribbean Dry Limestone Forest

***Type Concept:**

***Diagnostic Characteristics:**

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary:

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary:

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description:

DISTRIBUTION

***Geographic Range:** This macrogroup is found in Cuba, Jamaica, and Puerto Rico, and likely in other Caribbean islands.
Nations: CU, DO, JM, PR
States/Provinces:
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low - Poorly Documented
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G478	East Caribbean Karstic Forest
G477	West Caribbean Karstic Forest

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-04-24	M293 Caribbean Dry Broadleaf Forest Macrogroup	M293 merged into M294

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al.

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:**
Acknowledgments [optional]:
Version Date: 08 Jan 2015

REFERENCES

***References [Required if used in text]:**

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1. Forest & Woodland
1.A.1.Ea. Caribbean-Mesoamerican Dry Forest & Woodland

G478. East Caribbean Karstic Forest

Type Concept Sentence: Dry forests on outcrops of limestone in submontane or montane rainforest zones, composed of drought-tolerant deciduous trees with open canopy layers (6-8 m tall), shrub layer is very dense (2-3 m tall), and rocks and trunks are covered by mosses and epiphytes.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.A.1.Ea.3. Caribbean Dry Limestone Forest (M294)

Elcode: G478
***Scientific Name:** East Caribbean Karstic Forest Group
***Common (Translated Scientific) Name:** East Caribbean Karstic Forest Group
***Colloquial Name:** East Caribbean Karstic Forest

***Type Concept:** This group occurs as small patches in submontane or montane rainforest zones, below 600 m elevation in Puerto Rico and up to 1100 m in higher mountains with karst outcrops. It is composed of drought-tolerant deciduous trees with open canopy layers, 6-8 m tall. The shrub layer is 2-3 m high and very dense. Rocks and trunks are covered by mosses and epiphytes. The following list of species is diagnostic for this group: *Agave* spp., *Bernardia dichotoma, Citharexylum matheanum, Coccothrinax trinitensis, Erythroxylum clarense, Fadyenia hookeri, Karwinskia potrerilloana, Mahonia tenuifolia, Ocotea floribunda, Psychotria martii, Savia sessiliflora, Tabebuia bibracteolata, Tabebuia sauvallei, Terminalia neglecta, Thouinia clarensis, Zanthoxylum cubense*, and Cactaceae. In Puerto Rico, the following species are typical: *Bucida buceras, Bursera simaruba, Coccoloba diversifolia*, and *Zanthoxylum martinicense*. In Jamaica common species are *Cedrela odorata, Cinnamomum montanum, Coccoloba swartzii, Guapira fragrans, Nectandra patens, Pisonia subcordata*, and *Sideroxylon portoricense*.

***Diagnostic Characteristics:**

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The vegetation is composed of drought-tolerant deciduous trees with open canopy layers, 6-8 m tall. The shrub layer is 2-3 m high and very dense. Rocks and trunks are covered by mosses and epiphytes.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The following list of species is diagnostic for this group: *Agave* spp., *Bernardia dichotoma, Citharexylum matheanum, Coccothrinax trinitensis, Erythroxylum clarense, Fadyenia hookeri (= Garrya fadyenii), Karwinskia potrerilloana, Mahonia tenuifolia (= Berberis tenuifolia), Ocotea floribunda, Psychotria martii, Savia sessiliflora, Tabebuia bibracteolata, Tabebuia sauvallei, Terminalia neglecta, Thouinia clarensis, Zanthoxylum cubense*, and Cactaceae. In Puerto Rico, the following species are typical: *Bucida buceras, Bursera simaruba, Coccoloba diversifolia*, and *Zanthoxylum martinicense*. Other characteristic species include *Aiphanes minima (= Aiphanes acanthophylla), Coccothrinax barbadensis (= Coccothrinax alta), Eugenia confusa, Eugenia* spp., *Gaussia attenuata, Guettarda scabra, Nectandra coriacea (= Ocotea coriacea), Rondeletia inermis, Tetrazygia elaeagnoides, Thouinia striata*, and *Thrinax morrisii*. In Jamaica (in less humid areas) common species are *Cedrela odorata, Cinnamomum montanum, Coccoloba swartzii, Guapira fragrans, Nectandra patens, Pisonia subcordata*, and *Sideroxylon portoricense (= Bumelia nigra)* (Huggins et al. 2007).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Droughts and hurricanes are the main drivers of the natural dynamics of this group. Low rainfall intensities of 76 mm/d have a recurrence interval of 1 year while high rainfall intensities of >305 mm/d are possible during hurricane conditions or when low-pressure systems become stationary. These events have a recurrence interval of 100 years (Gómez Gómez 1984). Forests and other natural ecosystems of the limestone region recover quickly from hurricanes and storms (Wadsworth and Englerth 1959, cited in Lugo et al. 2001). Moreover, these events transport vast amounts of freshwater to the island and trigger many ecologically beneficial functions such as the reproduction of karst forest plants and animals.

ENVIRONMENT

Environmental Description: *Climate:* This group occurs as small patches in submontane or montane rainforest zones, below 600 m elevation in Puerto Rico and up to 1100 m in higher mountains with karst outcrops. *Soil/substrate/hydrology:* Occurs on carbonate soils and limestone outcrops in submontane or montane rainforest zones, including on higher mountains.

DISTRIBUTION

***Geographic Range:** This group occurs on islands of the Greater Antilles, in submontane or montane rainforest zones.
Nations: CU, DO?, JM, PR
States/Provinces:
USFS Ecoregions (2007) [optional]: M411Ab:CC?, M411Ac:CCC, M411Ad:CC?
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low - Poorly Documented
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Hill Scrub Zone	Dansereau 1966	This is related to the "Spurs (subxerophytia)" subtype of the Hill Scrub Zone.
<	Jamaican Dry Forests on limestone substrate	Huggins et al. 2007	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse, in Faber-Langendoen et al. (2016)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse and C. Nordman
Acknowledgments [optional]:
Version Date: 15 Jul 2016

REFERENCES

***References [Required if used in text]:**

Areces-Mallea, A. E., A. S. Weakley, X. Li, R. G. Sayre, J. D. Parrish, C. V. Tipton, and T. Boucher. 1999. A guide to Caribbean vegetation types: Preliminary classification system and descriptions. The Nature Conservancy, Arlington, VA. 166 pp.

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TNC [The Nature Conservancy]. 2000. Maps of vegetation and land cover in Jamaica. Unpublished preliminary map with field verification. The Nature Conservancy, Arlington, VA.
TNC [The Nature Conservancy]. 2004a. Greater Caribbean Ecoregional Plan. An ecoregional plan for Puerto Rico: Portfolio design. Unpublished report. The Nature Conservancy, Arlington, VA.

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1. Forest & Woodland
1.A.1.Ea. Caribbean-Mesoamerican Dry Forest & Woodland

G477. West Caribbean Karstic Forest

Type Concept Sentence: Dry forests on the slopes and tops of towerlike karstic hills and the narrow valleys and gorges in between. Leaf scleromorphy as well as a high proportion of deciduous tree species characterize these forests. Forest structure varies depending on the position on the hill and the substrate, but water stress is common.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.A.1.Ea.3. Caribbean Dry Limestone Forest (M294)

Elcode: G477
***Scientific Name:** West Caribbean Karstic Forest Group
***Common (Translated Scientific) Name:** West Caribbean Karstic Forest Group
***Colloquial Name:** West Caribbean Karstic Forest

***Type Concept:** This group includes the steep slopes and plateaus of towerlike karstic hills up to 300-600 m elevation, with bare karstic rock or more-or-less eroded skeletal soils, or limestone cliffs, and the narrow valleys and gorges in between. Puerto Rican karst forests, regardless of rainfall conditions, share common characteristics, including physiognomy and leaf characteristics. Karst forests are characterized by trees of small diameter, high tree density, and leaf scleromorphy. Stands have a tendency to show signs of being exposed to frequent drought conditions. Even in the moist and wet karst belt, forests have a high proportion of deciduous tree species and show a high degree of scleromorphism. This is probably due to the rapid rate of runoff and infiltration of rainwater, low water storage in shallow soils, and high sunlight. At the base of mogotes the forest can be mesic with a closed canopy of evergreen species 25-30 m tall. On slopes and tops the vegetation is a deciduous forest/woodland with trees of 16-18 m and sclerophyllous leaves. In Cuban mogotes, the slope forest has a 10- to 16-m high open canopy of deciduous trees with barrel-like trunks and abundant columnar cacti, but can grade to a shrubland dominated by terrestrial bromeliads and diverse sclerophyllous shrubs and trees.

***Diagnostic Characteristics:**

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Karst forests are characterized by trees of small diameter, high tree density, and leaf scleromorphy. Stands have a tendency to show signs of being exposed to frequent drought conditions. Even in the moist and wet karst belt, forests have a high proportion of deciduous tree species and show a high degree of scleromorphism (Chinea 1980, Lugo et al. 2001).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The following list of species is diagnostic for this group: *Agave tubulata, Agave* spp., *Alvaradoa arborescens, Bernardia dichotoma, Bombacopsis cubensis, Catalpa brevipes, Ceratopyxis verbenacea, Coccothrinax elegans, Colubrina elliptica, Cordia alliodora, Dendropanax arboreus, Eugenia galeata, Eugenia monticola (= Eugenia maleolens), Forsteronia corymbosa, Gaussia princeps, Guettarda calcicola, Hohenbergia penduliflora, Leptocereus assurgens, Malpighia roigiana, Microcycas calocoma, Omphalea hypoleuca, Pilosocereus brooksianus, Plumeria emarginata, Plumeria* spp., *Psidium vicentinum, Siemensia pendula, Spathelia brittonii, Swietenia mahagoni, Tabebuia albicans*(?), *Thrinax punctulata, Tillandsia* spp., *Trichilia havanensis, Vriesea dissitiflora*, and *Zanthoxylum spinosum*. In Puerto Rico, *Dendropanax arboreus* and *Quararibea turbinata* are common in the mesic forest, *Coccoloba diversifolia* and *Bursera simaruba* in the deciduous forest, and *Clusia rosea* on the cliffs. Puerto Rican forests have few dominant trees and a large number of rare or uncommon species (Lugo et al. 2001).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Droughts and hurricanes are the main drivers of the natural dynamics of this group. Low rainfall intensities of 76 mm/d have a recurrence interval of 1 year while high rainfall intensities of >305 mm/d are possible during hurricane conditions or when low-pressure systems become stationary. These events have a recurrence interval of 100 years (Gómez Gómez 1984). Forests and other natural ecosystems of the limestone region recover quickly from hurricanes and storms (Wadsworth and Englerth 1959, cited in Lugo et al. 2001). Moreover, these events transport vast amounts of freshwater to the island and trigger many ecologically beneficial functions such as the reproduction of karst forest plants and animals, and the maintenance of the hydrological cycle of the karst area (Lugo et al. 2001).

ENVIRONMENT

Environmental Description: *Climate:* The climate of the Greater Antilles is subtropical, with a dry season. The northwestern part of Puerto Rico has climate gradients, drying from east to west and with more rainfall at higher elevations from the northern coast towards the highlands to the south. Tradewinds are mainly from the northeast (Lugo et al. 2001). Other islands of the Greater Antilles also have local climate patterns influenced by tradewinds, topography and orthographic effects.

Soil/substrate/hydrology: In northern Puerto Rico karst, mogotes are isolated, steep-sided hills or towers that rise out of the blanket sand deposits. Mogotes may be aligned in ridges along which they form a series of sawteeth. Solution caves are visible on the sides of the mogotes, but they don't usually pass through the hill. Mogotes have a rounded or pointed hard cap, generally 5 to 10 m thick. Reprecipitated limestone on slopes tends to form nearly vertical slopes. Since the rate of this process is dependent on climatic factors which are not uniform around the hill, the mogote tends to become asymmetric, with a steep slope on one side and a gentler slope on the other (Lugo et al. 2001). The group includes a diversity of vegetation types resulting from ecological gradients due to different exposures to precipitation, wind and substrates, with deep fertile soils in valleys and shallow, rocky, and infertile soils on tops of mogotes, and slopes exhibiting intermediate edaphic conditions (Aukema et al. 2007). Karst mogotes also occur at Los Haitises in the Dominican Republic (Huggins et al. 2007).

DISTRIBUTION

***Geographic Range:** This group occurs in the northern and northwestern part of Puerto Rico on extensive karst, as well as in Cuba, Jamaica, and the Dominican Republic (on Hispaniola).
Nations: CU, DO, HT?, JM, PR
States/Provinces:
USFS Ecoregions (2007) [optional]: M411Aa:CCC, M411Ae:CCC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low - Poorly Documented
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Cuban Dry Forests on limestone substrate	Huggins et al. 2007	
?	Dry evergreen forest, Xerophytic semi-deciduous forest: *Bombacopsis cubensis-Catalpa punctata forests, Coccoloba diversifolia-Bursera simaruba* forests and *Zanthoxylum elephantiasis-Bursera* simaruba forests	Borhidi 1991	
<	Hispaniola Dry Forests on limestone substrate	Huggins et al. 2007	
<	Jamaican Dry Forests on limestone substrate	Huggins et al. 2007	
<	Lesser Antillean Dry Forests on limestone substrate	Huggins et al. 2007	
<	Mogote side plant communities	Aukema et al. 2007	
<	Mogote top plant communities	Aukema et al. 2007	
<	Puerto Rican Dry Forests on limestone substrate	Huggins et al. 2007	
?	Puerto Rico land cover type 23, Mature secondary moist limestone evergreen and semideciduous forest	Gould et al. 2008	"in the haystack hills or 'mogotes' of the northern karst region of Puerto Rico, drier on ridges and slopes, more mesic on lower slopes and valley bottoms."
<	Puerto Rico land cover type 4, Mature secondary lowland dry limestone evergreen forest	Gould et al. 2008	southwest part of Puerto Rico, sinkholes on Mona Island.

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Puerto Rico land cover type 5, Mature secondary lowland dry limestone semideciduous forest	Gould et al. 2008	southwest part of Puerto Rico, limestone plateau on Mona Island.
?	Puerto Rico land cover type 6, Young secondary lowland dry limestone semideciduous forest	Gould et al. 2008	mid and upper slopes of limestone hills, southwest part of Puerto Rico, often on abandoned agricultural land.
?	Puerto Rico land cover type 7, Lowland dry limestone woodland and shrubland	Gould et al. 2008	southwest part of Puerto Rico, Caja de Muertos, Mona Island, often on abandoned agricultural land or semi-active pastures.
>	Seasonal-evergreen Forest Zone	Dansereau 1966	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse and C. Nordman, in Faber-Langendoen et al. (2016)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse and C. Nordman
Acknowledgments [optional]:
Version Date: 15 Jul 2016

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***References [Required if used in text]:**

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Chinea, J. D. 1980. The forest vegetation of the limestone hills of northern Puerto Rico. M.S. thesis, Cornell University, NY. 70 pp.

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Figueroa Colon, J. 1996. Geoclimatic regions of Puerto Rico (map). USGS Water Resources Division. San Juan, Puerto Rico.

Gould, W. A., C. Alarcón, B. Fevold, M. E. Jiménez, S. Martinuzzi, G. Potts, M. Quiñones, M. Solórzano, and E. Ventosa. 2008. The Puerto Rico Gap Analysis Project. Volume 1: Land cover, vertebrate species distributions, and land stewardship. General Technical Report IITF-GTR-39. USDA Forest Service, International Institute of Tropical Forestry, Río Piedras, PR. 165 pp.

Gómez Gómez, F. 1984. Water resources of the lower Río Grande de Manatí valley, Puerto Rico. Water Resources Investigations Report 83-4199. U.S. Geological Survey, San Juan, PR. 42 pp.

Huggins, A. E., S. Keel, P. Kramer, F. Núñez, S. Schill, R. Jeo, A. Chatwin, K. Thurlow, M. McPherson, M. Libby, R. Tingey, M. Palmer, and R. Seybert. 2007. Biodiversity conservation assessment of the insular Caribbean using the Caribbean Decision Support System, Technical Report, The Nature Conservancy.

Josse, C., G. Navarro, P. Comer, R. Evans, D. Faber-Langendoen, M. Fellows, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological systems of Latin America and the Caribbean: A working classification of terrestrial systems. NatureServe, Arlington, VA.

Lugo, A. E., L. M. Castro, A. Vale, T. del Mar López, E. H. Prieto, A. G. Martinó, A. R. Puente Rolón, A. G. Tossas, D. A. McFarlane, T. Miller, A. Rodríguez, J. Lundberg, J. Thomlinson, J. Colón, J. H. Schellekens, O. Ramos, and E. Helmer. 2001. Puerto Rican karst: A vital resource. General Technical Report WO- 65. USDA Forest Service, Washington, DC. [http://www.fs.fed.us/global/iitf/karst.pdf]

Pool, D. J., and G. Morris. 1979. Land use in the mogotes. Pages 124-132 in: Memorias del tercer simposio de los recursos naturales. Departamento de Recursos Naturales, San Juan, PR.

1.A.2. Tropical Lowland Humid Forest

Tropical Lowland Humid Forest is dominated by broad-leaved evergreen trees, often with multiple complex strata and growth forms in lowland to submontane or premontane elevations with aseasonal to moderately seasonal rainfall and warm temperatures.

1.A.2.Eg. Caribbean-Mesoamerican Lowland Humid Forest

1. Forest & Woodland
1.A.2.Eg. Caribbean-Mesoamerican Lowland Humid Forest

M281. Caribbean Lowland Humid Forest

Type Concept Sentence: These are moist forests with high canopy closure and usually without emergent trees. They are located in the lowlands of the Caribbean islands, in areas that do not have a regular dry season and usually with an average monthly rainfall of 100 mm or more, or where water stress is intermittent but very short.

Bosques húmedos con un dosel alto, cerrado y generalmente sin árboles emergentes. Se encuentra en las tierras bajas de las islas del Caribe, en áreas que no presentan una estación seca regular y generalmente con una precipitación promedio mensual de 100 mm o más, o donde el estrés hídrico es intermitente pero muy corto.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.A.2.Eg.1. Caribbean-Mesoamerican Lowland Humid Forest (D091)

Elcode: M281
***Scientific Name:** Caribbean Lowland Humid Forest Macrogroup
***Common (Translated Scientific) Name:** Caribbean Lowland Humid Forest Macrogroup
***Colloquial Name:** Caribbean Lowland Humid Forest

***Type Concept:**

***Diagnostic Characteristics:**

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary:

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary:

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Diversity of above-ground plant functional groups (species that share morphological, chemical, structural or life history characteristics) determines the role of biodiversity in ecosystem functioning such as nutrient cycling, forest regeneration and successional patterns. Diversity of animal functional groups determines a number of key ecological processes such as trophic structure, nutrient cycling, and the system's resilience to disturbance. Community composition/diversity /structure affects species diversity and several ecosystem-level processes. Gap dynamics provide light, the major environmental limiting factor to plant growth in the closed-canopy humid tropical forest, and maintains the forest in shifting mosaic steady state.

Biotic interactions: pollination (bees, butterflies, beetles, moths, bats, and hummingbirds) is important for reproductive success and pollinators influence the frequency and distribution pattern of plant species; seed dispersal is executed by fruit-eating birds, mammals and ants, is important for reproductive success, and seed dispersal agents affect food webs in tropical forests by making available reproductive resources to other consumers and influencing the frequency and distribution pattern of plant species, especially woody species; seed predation is important for reproductive success and seed predation affects population recruitment and establishment of diverse plant species (e.g., palms and legumes). Seed predators occasionally act as dispersers. Seed predation is a specialized form of herbivory. Vertebrates involved are often objects of hunting by humans. Herbivores, including insects, parasitic fungi, and vertebrates, affect vigor and mortality of plants of all sizes, especially understory seedlings, and influences food chain and species composition of understory. The presence of top predators controls the populations of small mammals and herbivores. Species diversity and composition of soil biota, e.g., mycorrhizae, fungi, microbes, soil mesofauna such as leaf-cutter ants, termites, nematodes, collembola, dung beetles, etc., are fundamental for nutrient cycling and soil structure.

Disturbance regimes from catastrophic natural causes, e.g., hurricanes, rare catastrophic floods, or multiple landslides, or volcanism, or earthquakes, rare extreme cold fronts, rare extreme droughts, are rare events that can be very important for ecological dynamics. Create canopy gaps of great size allowing pioneer species to colonize and initiate successional processes, e.g., hurricanes play a major role in landscape-scale dynamics of forests on Caribbean islands. Fire due to dry spell or prolonged dry seasons or human activities: Certain species might be maintained because of this big, very rare catastrophic event. For example, mahogany thrives on fire outbreaks. Background disturbances, such as small gaps, small landslides, downbursts, normal cold fronts, and normal seasonal precipitation variability. Important for creating and maintaining habitat heterogeneity and species and structural diversity, preventing competitive exclusion. Drives regeneration.

Spatial integration and coverage (e.g., connectivity by riparian habitats) allowing migration of animals and plants outside of lowland forest: Allow to define at landscape level integrity of ecosystem. Allow to assess the extent of potential for species extinction. Spatial integration important for species to maintain contact with all habitats required for life cycles.

Biogeochemical dynamics (referring to regional and global processes such as global warming, ozone depletion, CO_2 concentration, atmospheric and soil pollution, etc.): Affects basic ecosystem functioning at both global and local levels. Soil type or fertility: Affects forest primary productivity and species richness. Soil type is also relevant to tree mortality rate, treefall frequency, forest regeneration mode, and stand turnover time (Hartshorn 1990).

ENVIRONMENT

Environmental Description: Major factors that determine variation in community types within lowland tropical moist forest include precipitation, temperature, topography, edaphic conditions, and natural disturbance. The amount of rainfall and length of dry season determine the occurrences of evergreen forest or seasonally dry forest. Yearly extreme temperature fluctuations result in cold-front stressed forests in southwestern Amazonia and the southern Atlantic region and non-cold-front stressed forests in Mexico and Central America.: Zonation may occur depending on whether the forest is on a plain, or rolling hills, or foothills of a mountain range. Edaphic conditions (soil quality or fertility) can create special community types. Forests on white sand soil, on clay soil, or over limestone/ultrabasic rock differ considerably in species composition. Natural disturbance includes hurricanes and landslides. Hurricanes are the most frequent causes of landslides.

DISTRIBUTION

***Geographic Range:** Northern part of eastern Cuba, northern Jamaica, eastern Dominican Republic, northern Puerto Rico, Trinidad and Tobago and the Lesser Antilles in small areas.

Parte norte de Cuba oriental, norte de Jamaica, el este de República Dominicana, el norte de Puerto Rico, Trinidad y Tobago y áreas pequeñas en las Antillas Menores.

Nations: BS, CU, DO, JM, MQ, PR, TT, VE, VI, XD

States/Provinces:

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low - Poorly Documented

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G455	Caribbean Seasonal Evergreen Lowland Rainforest
G456	Caribbean Evergreen Lowland Rainforest
G845	Caribbean Lowland Ruderal Rainforest

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-01-04	M282 Caribbean Lowland Seasonal Evergreen Rainforest Macrogroup	M282 merged into M281

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:**

Acknowledgments [optional]:

Version Date: 08 Jan 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Hartshorn, G. S. 1990. An overview of Neotropical forest dynamics. Pages 585-599 in: A. H. Gentry, editor. Four Neotropical rainforests. Yale University Press, New Haven.

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1. Forest & Woodland
1.A.2.Eg. Caribbean-Mesoamerican Lowland Humid Forest

G455. Caribbean Seasonal Evergreen Lowland Rainforest

Type Concept Sentence: These are lowland and submontane seasonal evergreen forests of the Antilles dominated by mostly evergreen species of tropical affinities.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.A.2.Eg.1. Caribbean Lowland Humid Forest (M281)

Elcode: G455

***Scientific Name:** Caribbean Seasonal Evergreen Lowland Rainforest Group

***Common (Translated Scientific) Name:** Caribbean Seasonal Evergreen Lowland Rainforest Group

***Colloquial Name:** Caribbean Seasonal Evergreen Lowland Rainforest

***Type Concept:** This group includes upland forests growing below 700 m elevation in moist but seasonal climates in the Caribbean Islands. Forests within this group have a canopy height of 20-25 m, not densely closed, and a second denser layer 8-15 m high. About 70% of canopy species are evergreen. Understory vegetation is rather sparse and terrestrial ferns can dominate the herb layer. Lianas can be present or even abundant, especially in forests growing on calcareous and alluvial soils. Pinnate and broadleaf species are dominant, but this group includes shorter, open canopy sclerophyllous forests with succulents and cacti on poor, serpentine substrates in moist areas of eastern Cuba, southwestern Puerto Rico, and south Tobago. Floristically, these are diverse forests and different islands have different composition.

***Diagnostic Characteristics:**

***Classification Comments:** Besides moisture availability and lowland distribution, the composition of this group is influenced by the substrate and past land use. Extensive areas of lowland seasonal evergreen forests in the islands have been converted and current "mature" forest cover can represent secondary forest grown after such distinct land uses as shade coffee plantations, pastures or sugar cane. Past land use and its effects on the soils influence current composition. Some of the diagnostic tree species of successional forests are *Cecropia schreberiana, Andira inermis, Schefflera morototonii*, and *Bocconia frutescens*.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group includes mostly evergreen, 20- to 25-m tall forests of semi-closed canopy and at least two canopy strata. Presence of lianas and the structure and composition of the understory depend on soils and the stand history. Under the same favorable climatic conditions this group includes a type of shorter and more open moist forest or woodland that grows on ferritic soils derived from serpentine bedrock in areas of Cuba and Puerto Rico. This forest is less than 15 m tall, has two canopy layers, slender trees, mostly sclerophyllous and lauraceous trees and shrubs, abundant lianas, presence of cacti, and is poor in epiphytes.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Common tree species on limestone substrate are *Dendropanax arboreus, Quararibea turbinata, Coccoloba diversifolia, Coccoloba pubescens, Zanthoxylum martinicense, Bursera simaruba, Cedrela odorata, Clusia rosea*, and *Bucida buceras*. In Jamaica the seasonal evergreen forest occurring in the so-called Cockpit country and on limestone peaks from about 300 to 700 m elevation include *Brosimum alicastrum, Buchenavia tetraphylla (= Buchenavia capitata), Cecropia schreberiana (= Cecropia peltata), Dipholis nigra, Manilkara zapota (= Lucuma mammosa), Manilkara excisa (= Mimusops excisa), Cojoba arborea (= Pithecellobium arboreum), Podocarpus purdieanus, Prunus occidentalis, Zanthoxylum martinicense*, and the endemic *Nectandra hihua (= Nectandra antillana), Psidium montanum, Sloanea jamaicensis*, and *Ziziphus chloroxylon*. The dense subcanopy which reaches heights of about 12 m consists of its own characteristic species such as *Simaruba glauca, Trophis racemosa, Zanthoxylum flavum*, and several endemic species such as *Stenostomum jamaicense (= Antirhea jamaicensis), Comocladia pinnatifolia, Mosquitoxylon jamaicense, Ocotea staminea, Sapium laurifolium (= Sapium jamaicense)*, and *Spathelia glabrescens*. Seasonal evergreen forests on volcanic, sedimentary, and alluvial substrates include *Andira inermis, Manilkara bidentata ssp. surinamensis, Melicoccus bijugatus, Roystonea borinquena, Roystonea elata, Capparis baducca, Chionanthus compactus*, and *Cordia alliodora*, among many other species. In St. John in the Virgin Islands dominant species are *Ardisia obovata, Cestrum laurifolium, Eugenia monticola, Nectandra coriacea*, and *Poitea florida (= Sabinea florida)*. Diagnostic species of forests growing on serpentine substrate are *Pilosocereus royenii, Thouinia striata var. portoricensis, Plumeria alba, Croton lucidus, Pictetia aculeata*, and *Comocladia dodonaea*; endemic species of Puerto Rico restricted to serpentine substrate are *Mikania stevensiana, Calyptranthes triflora, Myrcia maricaensis*, and *Brunfelsia densifolia*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Normal gap dynamics provide light, the major environmental limiting factor to plant growth in the closed-canopy humid tropical forest, and maintain the forest in shifting mosaic steady state. Major disturbance regimes caused by hurricanes are quite common throughout the Caribbean forests. Studies have found that elevation, slope and aspect play a more important role in the relative damage caused by hurricanes than latitudinal or longitudinal location, with lower elevation, windward slopes experiencing more damage than higher elevation, leeward slopes.

ENVIRONMENT

Environmental Description: Forests in this group occur below 700 m above sea level, in flatlands, basins, or well-drained slopes of the Caribbean Islands, under moist climate and on several different substrates.

Climate: In the Caribbean, moist forests occur mainly in lowland areas influenced by northeasterly or northwesterly winds, and windward mountain slopes, e.g., northern part of eastern Cuba, northern Jamaica, eastern Hispaniola, northern Puerto Rico, and small patches in the Lesser Antilles. Seasonal evergreen forests occur where annual mean precipitation is over 1100 mm and below 2800 mm, and only experience water stress during a short dry season from December through April of monthly rainfall of 60 mm or more, or due to particular soil conditions. This factor is coupled with high temperature (mean temperature 18°C or more in the coldest month of the year) and a strong evapotranspiration.

Soil/substrate/hydrology: Forests in this group grow on volcanic, sedimentary and alluvial substrates, also on limestones and on ultramafic substrate derived from serpentine bedrock. The latter two confer a distinct physiognomy to otherwise dense, tall forests.

DISTRIBUTION

***Geographic Range:** This group is found on all the islands in the Greater Antilles and most of the Lesser Antilles.
Nations: BS, CU, DM, DO, GD, GP, HT, JM, LC, MQ, PR, TT, VC, VE, VI
States/Provinces:
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low - Poorly Documented
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-05-14	G454 Caribbean Moist Lowland-Submontane Rainforest Group	G454 concept covered by G455

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
?	Lowland Rainforest Zone, Upland vegetation	Dansereau 1966	
?	Seasonal-evergreen Forest Zone	Dansereau 1966	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse and D. Faber-Langendoen, in Faber-Langendoen et al. (2016)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse
Acknowledgments [optional]:
Version Date: 04 Feb 2016

REFERENCES

***References [Required if used in text]:**

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1. Forest & Woodland
1.A.2.Eg. Caribbean-Mesoamerican Lowland Humid Forest

G456. Caribbean Evergreen Lowland Rainforest

Type Concept Sentence: This group is characterized by lowland and submontane evergreen forest, dominated by evergreen, broadleaf species of tropical affinities. Natural communities within this group are distributed in all the islands of the Greater Antilles and most of the Lesser Antilles.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.A.2.Eg.1. Caribbean Lowland Humid Forest (M281)

Elcode: G456
***Scientific Name:** Caribbean Evergreen Lowland Rainforest Group
***Common (Translated Scientific) Name:** Caribbean Evergreen Lowland Rainforest Group
***Colloquial Name:** Caribbean Evergreen Lowland Rainforest

***Type Concept:** This group is characterized by forests growing in the lowland and submontane areas of the Caribbean Islands, mostly below 600 m elevation and with total annual precipitation above 1500 mm and reaching over 3000 mm. The canopy of these forests is 30 m or up to 35 m tall and formed by emergent trees, with a middle, more continuous layer 20-25 m high, and a third canopy layer 6-15 m high, all of them very rich in species. The canopy's dominant species vary from island to island. Along creeks, palms are frequent in the understory.

***Diagnostic Characteristics:**

***Classification Comments:** Some of the species included in forest communities in the submontane areas within this group are also present in montane forest types at higher elevations; however, dominant tree species included here reach their highest elevation distributions at about 800-900 m. *Prestoea acuminata var. montana* is a typical species of this transitional belt between lowland forests and montane or cloud forests.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Evergreen lowland rainforests of the Caribbean present many of the characteristics for which tropical rainforests are characterized, several strata of trees forming a dense, closed canopy that limits the growth of plants at the ground level which is only scarcely vegetated, while epiphytes are abundant on trees. Some tree species feature large buttress roots that help support the heavy canopy of large trees growing in very wet soil. Some forest associations in this group are more common and reach a larger structure on upper slopes and ridges, where they may form nearly pure groups whose roots are grafted. Presumably this reflects the better drainage of soils at such locations or the superior anchorage against hurricane winds that the prominent boulders may offer.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The following list of species is diagnostic for this group: *Bactris cubensis, Buchenavia tetraphylla (= Buchenavia capitata), Calophyllum antillanum (= Calophyllum calaba), Calophyllum jacquinii, Calophyllum utile, Calyptronoma occidentalis, Calyptronoma plumeriana (= Calyptronoma clementis), Carapa guianensis, Cinnamomum montanum (= Phoebe montana), Clusia rosea, Cupania americana, Cyrilla racemiflora, Dacryodes excelsa, Ficus* spp., *Guarea guidonia, Magnolia splendens, Manilkara bidentata, Meliosma herbertii, Micropholis garciniifolia, Micropholis guyanensis, Ocotea leucoxylon, Ocotea spathulata, Ormosia krugii, Prestoea acuminata var. montana (= Prestoea montana), Roystonea regia, Sloanea berteriana, Sloanea curatellifolia*, and *Tetragastris balsamifera*. Above 600 m elevation, tree ferns are frequent, particularly *Alsophila bryophila (= Cyathea pubescens)*. *Dacryodes excelsa* is typically associated with *Sloanea berteriana, Guarea guidonia*, and *Manilkara bidentata* forming a forest type locally called Tabonuco forest which extends from Puerto Rico into the Lesser Antilles.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Background disturbances, such as small gaps, small landslides, downbursts, normal cold fronts, and normal seasonal precipitation variability are important for creating and maintaining habitat heterogeneity and species and structural diversity, preventing competitive exclusion. Disturbance regimes from catastrophic natural causes, e.g., hurricanes, rare catastrophic floods, multiple landslides, volcanism, rare extreme cold fronts, and rare extreme droughts, are rare events that can be very important for ecological dynamics. Hurricanes play a major role in landscape-scale dynamics of forests on Caribbean Islands, and species that are dominant in these forests have developed a capability for dealing with hurricanes.

ENVIRONMENT

Environmental Description: Forest included within this group are more common and reach a larger structure on protected slopes at elevations above 400 m which probably capture more humidity than forests on the flatlands.

Climate: Forests of this group occur in areas with a mean temperature range of 21° to 25°C (70-77°F) and a mean annual precipitation from 2000 to 4000 mm. Precipitation is generally abundant except from February through April, when it decreases down to 75 mm per month. Mean relative humidity is very high.

Soil/substrate/hydrology: Forests of this groups grow on volcanic and sedimentary substrates. Tall, dense "Tabonuco" forests dominated by *Dacryodes excelsa* and *Sloanea berteriana* grow on deep, red, acidic (pH 4.5 to 5.5), clay soils derived from igneous rock. Typically these soils are stony, often with large boulders, and internal drainage is good. Forests growing on swales are shorter or show lower growth rates.

DISTRIBUTION

***Geographic Range:** This group is found on the islands of the Greater and Lesser Antilles.
Nations: CU, DM, DO, GD, GP, JM, KN, LC, MQ, MS, PR, VC, XD
States/Provinces:
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low - Poorly Documented
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
?	Lower Montane Rainforest	Dansereau 1966	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse and D. Faber-Langendoen, in Faber-Langendoen et al. (2016)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse
Acknowledgments [optional]:
Version Date: 04 Feb 2016

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***References [Required if used in text]:**

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Borhidi, A. 1991. Phytogeography and vegetation ecology of Cuba. Akademiai Kiado. Budapest, Hungary. 858 pp. plus color plates and map by A. Borhidi and O. Muniz (1970) inside of back cover.
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International Institute of Tropical Forestry. No date. Maps of vegetation and land cover in Puerto Rico. [in press]
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Weaver, P. L. 1990. Succession in the elfin woodland of the Luquillo Mountains of Puerto Rico. Biotropica 22:83-89.

1.A.3. Tropical Montane Humid Forest

Tropical Montane Humid Forest is dominated by broad-leaved evergreen trees, with increasingly small leaves and stems, often gnarly, with dense crowns as elevations increase. These forests are generally found within 23°N and S latitude of the equator between 1000 and 3500 m in elevation.

1.A.3.Eg. Caribbean-Mesoamerican Montane Humid Forest

1. Forest & Woodland
1.A.3.Eg. Caribbean-Mesoamerican Montane Humid Forest

M598. Caribbean Montane Humid Forest

Type Concept Sentence: In the Caribbean, forests between 700 and 1600 m altitude, grow on mountain summits that penetrate the base of trade wind clouds. Therefore most of these forests are cloud forests. The cloud forest, variously called elfin woodland, mossy forest, montane thicket, or dwarf forest, is characterized by gnarled, open-crowned trees less than 7 m tall, high stem density, high basal area, small diameters, and slow growth rates, with greater abundance of epiphytes, palms, and tree ferns than lowland forests. Leaves tend to be coriaceous and grouped toward the ends of the branches. Dwarf stature of trees may be attributed to strong winds and water-saturated soils. Tree roots form a tight mat on the surface.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.A.3.Eg.1. Caribbean-Mesoamerican Montane Humid Forest (D228)

Elcode: M598
***Scientific Name:** Caribbean Montane Humid Forest Macrogroup
***Common (Translated Scientific) Name:** Caribbean Montane Humid Forest Macrogroup
***Colloquial Name:** Caribbean Montane Humid Forest

***Type Concept:**

***Diagnostic Characteristics:**

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary:

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary:

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Landslides and hurricanes are the key triggers of dynamic processes of these forests. Substrate and topography and their interaction with the vegetation are the most important factors for the survival of these forests during hurricanes - probably the single most important natural trigger of the successional dynamic. Surviving trees have their roots securely anchored in the substrate. These factors are also critical for regulating surface runoff and maintaining the water balance under very humid conditions on exposed ridges and steep slopes. Forest recovery after disturbance is slow. Monitoring of dwarf forest in Puerto Rico's Luquillo Mountains showed that it can take up to 20 years for woody species to establish and after that their growth rate is very slow. It took almost 35 years until the canopy closing decreased the grass and fern cover (Weaver 2008). Moreover, the succession process is often subjected to setbacks due to periodic hurricane disturbance. This study also showed that hurricanes cause delayed mortality, with declines in biomass and stem numbers exceeding ingrowth during 15 years after Hurricane Hugo hit. Another important finding of this study is that more than half of the arborescent species growing in dwarf forest, where they play a prominent role in post disturbance recovery, are endemic to Puerto Rico (Weaver 2008). Cloud forests are known as places of high endemism but not necessarily as areas with rich biotas (Weaver 2000, 2008).

ENVIRONMENT

Environmental Description: Ecosystems of this macrogroup occur above 700 m elevation in areas with mean annual precipitation >1600 mm, frequently or seasonally surrounded by clouds, and on different topographies but mostly slopes, exposed ridges, and ravines. Forests growing on exposed areas are of smaller stature and very dense. Taller forests grow on protected areas on lower slopes to the leeward of ridges or spurs. With montane forests, one of the most critical climatic factors is the frequency and duration of the cloud cover; condensation can contribute 10% or more of the precipitation amount that these forests receive. In the Caribbean, the trade winds forming clouds have saline components which have an effect on the chemistry of the ecophysiology of these forests. Cloud cover causes less solar radiation, lower temperatures, decreased transpiration and lower photosynthetic rates, resulting in lower growth rates and lower nutrient-cycling rates. The efficiency shown by these forests in the use of nutrients is high though, which is important to avoid nutrient loss due to leaching (Silver et al. 2001).

DISTRIBUTION

***Geographic Range:** This type of forest is distributed in the Caribbean islands with mountains above 600-700 m elevation and on different geologies and substrates. This system is found in Cuba, Dominican Republic, Jamaica, Puerto Rico and mountainous islands of the Lesser Antilles.
Nations: CU, DO, HT, JM, KN, MQ, PR, XC, XD, XE
States/Provinces:
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low - Poorly Documented

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G451	Caribbean Montane Cloud Forest & Scrub
G449	Caribbean Montane Rocky Riverine Scrub
G446	Caribbean Moist Montane Mixed Pine - Broad-leaved Forest
G448	Caribbean Wet Montane Forest
G447	Caribbean Wet Montane Serpentine Forest & Scrub
G846	Caribbean Montane Ruderal Forest

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-05-10	M599 Caribbean Montane Pine Forest Macrogroup	M599 concept covered by M598

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:**

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse

Acknowledgments [optional]:

Version Date: 08 Jan 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Silver, W. L., E. Marin-Spiotta, and A. E. Lugo. 2001. El Caribe. En: M. Kappelle and A. D. Brown, editors. Bosques nublados del Neotrópico. Instituto Nacional de Biodiversidad, INBio, Santo Domingo de Heredia, Costa Rica. 704 pp.

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Weaver, P. L. 2000. Elfin woodland recovery 30 years after a plane wreck in Puerto Rico's Luquillo Mountains. Caribbean Journal of Science 36(1-2):1-9.

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1. Forest & Woodland
1.A.3.Eg. Caribbean-Mesoamerican Montane Humid Forest

G451. Caribbean Montane Cloud Forest & Scrub

Type Concept Sentence: This group is characterized by dwarf or "elfin" forests adapted to the unique conditions occurring on the exposed summits of the Caribbean mountain peaks, which stand the increase of both wind and rain and the almost constant presence of fog.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.A.3.Eg.1. Caribbean Montane Humid Forest (M598)

Elcode: G451
***Scientific Name:** Caribbean Montane Cloud Forest & Scrub Group
***Common (Translated Scientific) Name:** Caribbean Montane Cloud Forest & Scrub Group
***Colloquial Name:** Caribbean Montane Cloud Forest & Scrub

***Type Concept:** This group consists of open woodlands of gnarled and twisted trees laden with mosses and other epiphytes, usually growing above 1600 m elevation in the Caribbean; though in the Luquillo Mountains in Puerto Rico and in John Crow Mountains in Jamaica, it occurs above 700 m. Stands have an irregular canopy which is typically 6-12 m high with trees with gnarled trunks, compact crowns and small leaves. The group also includes a short scrub, 1.5-2 m high, with many thorny shrubs and herbaceous-leaved succulents which grows on steep rocky ridges of the highest peaks of Luquillo Mountains (900-1050 m elevation), and of Sierra Maestra in Cuba, between 1800 and 1970 m.

***Diagnostic Characteristics:**

***Classification Comments:** This group shares some of the tree dominant species with Caribbean Wet Montane Forest Group (G448), but at higher elevations and with increased influence of wind and clouds, these species tend to grow shorter and more twisted.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G448	Caribbean Wet Montane Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Open forests or woodlands with an irregular canopy which is typically 6-10 m high. Trees have gnarled trunks, compact crowns and small leaves. The shrub layer is almost impenetrable. Tree ferns and epiphytes are abundant. Forest floor, tree trunks and branches are covered by bryophytes. In Cuba, elfin woodland is mainly composed of a dense bush of stunted, microphyllous, nanophyllous, evergreen trees and shrubs, many of which are endemic.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: In Cuba the following list of species are diagnostic for the montane cloud forest: *Alsophila aspera, Cyathea arborea, Cyathea balanocarpa, Cyrilla racemiflora, Didymopanax tremulus, Duranta fletcheriana, Hedyosmum cubense, Henriettea ekmanii, Miconia turquinensis, Myrsine microphylla, Nectandra reticularis, Persea anomala, Podocarpus aristulatus, Sapium maestrense, Symplocos leonis, Tabebuia rigida, Tabebuia turquinensis, Tabebuia vinosa, Torralbasia cuneifolia, Vaccinium leonis*, and *Weinmannia pinnata*. In windswept mountain ridges and summits from 500-1350 m a.s.l. in Puerto Rico and islands of the Lesser Antilles, the following species are typical: *Croton poecilanthus, Cyrilla racemiflora, Magnolia splendens, Miconia laevigata, Micropholis garciniifolia, Micropholis guyanensis, Ocotea leucoxylon, Ocotea spathulata, Podocarpus coriaceus, Prestoea acuminata var. montana (= Prestoea montana), Ternstroemia luquillensis, Ternstroemia subsessilis* and stunted trees of *Sloanea* spp. Diagnostic species for the wet short shrubland type in Cuba are *Agave pendentata, Cassia turquinae, Eugenia maestrensis, Eupatorium* sp., *Ilex nunezii, Ilex turquinensis, Juniperus saxicola, Lepanthes* spp., *Lobelia cacuminis, Mitracarpus acunae, Myrica cacuminis, Persea similis, Pleurothalis* spp., *Schoepfia stenophylla, Vernonia* sp., *Viburnum villosum*, and *Weinmannia pinnata*. In Puerto Rico and Martinique, *Alsophila bryophila (= Cyathea bryophila), Ardisia luquillensis, Clidemia cymosa (= Heterotrichum cymosum), Daphnopsis* *philippiana, Eugenia borinquensis, Gonocalyx portoricensis, Henriettea squamulosa, Marcgravia sintenisii, Micropholis garciniifolia, Ocotea spathulata*, and *Tabebuia rigida* are typical of this type. On mountain summits of St. Kitts and Nevis, *Clusia rosea, Cyathea arborea, Hedyosmum arborescens, Myrsine coriacea*, and *Podocarpus coriaceus* are common.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Landslides and hurricanes are the key triggers of dynamic processes of these forests. Hurricanes play a major role in controlling composition and complexity of forest vegetation and periodic disruption is variable due to storm direction and intensity. Substrate and topography and their interaction with the vegetation are the most important factors for the survival of these forests during hurricanes - probably the single most important natural trigger of the successional dynamic. Surviving trees have their roots securely anchored in the substrate. These factors are also critical for regulating surface runoff and maintaining the water balance under very humid conditions on exposed ridges and steep slopes. Forest recovery after disturbance is slow. Monitoring of dwarf forest in Puerto Rico's Luquillo Mountains showed that it can take up to 20 years for woody species to establish and after that their growth rate is very slow. It took almost 35 years until the canopy closing decreased the grass and fern cover (Weaver 2008). Moreover, the succession process is often subjected to setbacks due to periodic hurricane disturbance.

ENVIRONMENT

Environmental Description: Forests and scrub of this group occur above 700 m elevation in areas with mean annual precipitation >1600 mm, frequently surrounded by clouds, and on different topographies but mostly slopes, exposed ridges, and ravines. Forests growing on exposed areas are of smaller stature and very dense. Taller forests grow on protected areas on lower slopes to the leeward of ridges or spurs. With cloud forests, one of the most critical climatic factors is the frequency and duration of the cloud cover; condensation can contribute 10% or more of the precipitation amount that these forests receive. In the Caribbean, the trade winds forming clouds have saline components which have an effect on the chemistry of the ecophysiology of these forests. Cloud cover causes less solar radiation, lower temperatures, decreased transpiration and lower photosynthetic rates, resulting in lower growth rates and lower nutrient-cycling rates. The efficiency shown by these forests in the use of nutrients is high though, which is important to avoid nutrient loss due to leaching.

Climate: Forests in this group are associated with high annual rainfall of over 1600 mm, extremely high moisture levels, frequent overcast conditions, abundant fog condensation, and high winds.

Soil/substrate/hydrology: Forests of this groups grow on limestone, volcanic, and sedimentary substrates. The soil is often waterlogged, but due to the gradient of the slope, runoff is high.

DISTRIBUTION

***Geographic Range:** This group occurs in Luquillo Mountains and Cordillera Central in Puerto Rico, Pico Turquino, the highest mountain of Sierra Maestra in eastern Cuba, the northern ridges of the Blue Mountains and on the wet slopes of the John Crow Mountains in Jamaica, and in the Lesser Antilles, on mountain summits of St. Kitts and Nevis and Martinique.
Nations: CU, DO, JM, KN, MQ, PR, XD
States/Provinces:
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low - Poorly Documented
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-05-13	G452 Caribbean Montane Elfin Thicket Group	G452 concept covered by G451

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
?	Elfin woodland	Beard 1949	
?	Montane Scrub Zone	Dansereau 1966	
?	Montane thicket	Beard 1949	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse and D. Faber-Langendoen, in Faber-Langendoen et al. (2016)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse

Acknowledgments [optional]:

Version Date: 04 Feb 2016

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***References [Required if used in text]:**

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1. Forest & Woodland
1.A.3.Eg. Caribbean-Mesoamerican Montane Humid Forest

G449. Caribbean Montane Rocky Riverine Scrub

Type Concept Sentence: Open woodlands and thickets of the riverbanks of the headwaters and mid-elevation rivers of the Caribbean Islands.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.A.3.Eg.1. Caribbean Montane Humid Forest (M598)

Elcode: G449
***Scientific Name:** Caribbean Montane Rocky Riverine Scrub Group
***Common (Translated Scientific) Name:** Caribbean Montane Rocky Riverine Scrub Group
***Colloquial Name:** Caribbean Montane Rocky Riverine Scrub

***Type Concept:** This group is composed of riparian communities along rivers and creeks, including forests and woody grass thickets. Due to human alteration and flash floods, it is common to find secondary stands with tall sedges or bamboos. Being montane vegetation, generally these communities occur at the riverbanks of headwater streams and mid-elevation rivers.

***Diagnostic Characteristics:**

***Classification Comments:** References about riparian plant communities in the upland and montane areas of the Caribbean region, which are not subject of extensive flooding, are very scarce and superficial. One reason might be the very small areas occupied by this type of vegetation. Therefore, the list of species and other environmental features provided to characterize this group most likely are incomplete.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group consists of riparian communities along rivers and creeks, including open, short-statured forests and woody grass thickets.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The following list of species is diagnostic for this group: *Bucida buceras, Dalbergia ecastophyllum, Gynerium sagittatum, Lonchocarpus domingensis, Lysiloma latisiliquum (= Lysiloma bahamense)*, and *Roystonea regia*. In Puerto Rico, *Pterocarpus officinalis* and *Sapium laurocerasus* are typical; the mountain palm *Prestoea acuminata var. montana (= Prestoea montana)* is another common species in this type of habitat. The exotic grasses *Arundo donax* and *Bambusa vulgaris* may be found in examples of this vegetation.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**

***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Due to human alteration and flash floods, it is common to find secondary stands with tall sedges or bamboos.

ENVIRONMENT

Environmental Description: Riverbanks at mid to high elevations with alluvial substrate subject to flash flooding. *Climate:* Submontane and montane areas where this vegetation occurs are associated with annual rainfall of over 1600 mm and mean temperature of 18-19°C. *Soil/substrate/hydrology:* Riverbanks with alluvial substrate subject to flash flooding.

DISTRIBUTION

***Geographic Range:** This group may occur in most islands of the Caribbean with catchments above 400 m elevation and humid climate.
Nations: CU, JM, PR, XC
States/Provinces:
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low - Poorly Documented
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-05-13	G450 Caribbean Riverine Serpentine Forest & Scrub [Montane] Group	G450 concept covered by G449

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse and D. Faber-Langendoen, in Faber-Langendoen et al. (2016)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse
Acknowledgments [optional]:
Version Date: 04 Feb 2016

REFERENCES

***References [Required if used in text]:**

Areces-Mallea, A. E., A. S. Weakley, X. Li, R. G. Sayre, J. D. Parrish, C. V. Tipton, and T. Boucher. 1999. A guide to Caribbean vegetation types: Preliminary classification system and descriptions. The Nature Conservancy, Arlington, VA. 166 pp.

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Tolentino, L., and M. Peña. 1998. Inventario de la vegetacion y uso de la tierra en la Republica Dominicana. Moscosoa 10:179-202.

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1. Forest & Woodland
1.A.3.Eg. Caribbean-Mesoamerican Montane Humid Forest

G448. Caribbean Wet Montane Forest

Type Concept Sentence: Tall rainforests covered with epiphytes, growing above 800 m and up to nearly 2000 m elevation on tall mountains in Cuba, Jamaica, Puerto Rico and the Dominican Republic. They have a closed canopy and a second layer with abundant palms and tree ferns.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.A.3.Eg.1. Caribbean Montane Humid Forest (M598)

Elcode: G448
***Scientific Name:** Caribbean Wet Montane Forest Group
***Common (Translated Scientific) Name:** Caribbean Wet Montane Forest Group
***Colloquial Name:** Caribbean Wet Montane Forest

***Type Concept:** This group includes tall rainforests growing above 800 m and up to nearly 2000 m elevation on tall mountains in Cuba, Jamaica, Puerto Rico and the Dominican Republic, where the moisture caused by almost daily presence of mist is enough to influence the structure and composition of the forest, characterized by bryophytes covering most tree trunks and branches, as well as being abundant in the ground layer. Bromeliads, ferns and orchids are also abundant as epiphytes and in some of these forests the presence of palms and tree ferns is common.

***Diagnostic Characteristics:**

***Classification Comments:** This group does not include the stunted or elfin cloud forest typical of the highest elevations, usually on windward slopes of mountains in the Greater Antilles, which often remain shrouded in fog. This group includes the so called Sierra Palm forest of Puerto Rico, characterized by stands dominated by the palm *Prestoea acuminata var. montana*.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G451	Caribbean Montane Cloud Forest & Scrub	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Remnants of these evergreen tall forests have a closed or open canopy, 15-25 m high, consisting of microphylls and notophylls. When in good condition, the upper layer is closed and has a second layer with abundant palms, tree ferns and epiphytes, all of them rich in species. Lianas are rare but there are many climbing, scrambling and epiphytic shrubs. The shrub layer in general tends to be scattered, rarely reaching more that about 3 m, or in very humid occurrences the shrub layer forms an almost impenetrable bush tangled with pteridophytic lianas, as is the case in the high mountains of Pico Turquino in Cuba.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: As with the composition of other Caribbean groups, different islands have different species assemblages. In Puerto Rico, the following species are typical: *Banara portoricensis, Brachionidium ciliolatum, Myrcia margarettiae (= Eugenia margarettiae), Gonocalyx concolor, Habenaria amalfitana (= Habenaria dussii), Ternstroemia luquillensis*, and *Ternstroemia subsessilis*. In Cuba above 800 m elevation in the humid mountains of Sierra Maestra and Escambray typical species are *Magnolia cubensis* and various species of *Ocotea* such as the endemic *Ocotea leucoxylon*. These trees reach heights of about 25 m and below this a subcanopy can usually be characterized by *Clusia tetrastigma, Gomidesia lindeniana*, and several endemic species such as *Fadyenia hookeri (= Garrya fadyenii)* and *Ossaea ottoschmidtii*. At elevations above 1600 m with annual rainfall exceeding 3000 mm, the low canopy is characterized by various endemics such as *Ageratina paucibracteata (= Eupatorium paucibracteatum), Myrsine microphylla, Nectandra reticularis, Persea anomala, Sapium maestrense, Symplocos leonis, Torralbasia cuneifolia*, and several tree ferns. In Jamaica, in the upper reaches of the Blue Mountains, the dominant trees are *Cyrilla racemiflora, Clusia havetioides, Eugenia marchiana, Ilex macfadyenii, Laplacea haematoxylon, Podocarpus urbanii, Rhamnus sphaerosperma, Solanum punctulatum, Turpinia occidentalis*, and *Viburnum villosum*. *Buchenavia tetraphylla (= Buchenavia capitata), Calyptronoma plumeriana (= Calyptromona dulcis), Cyathea arborea, Cyrilla racemiflora, Mora abbottii, Ormosia krugii, Prestoea acuminata var. montana (= Prestoea montana)*, and *Sloanea berteriana* are common in the montane humid broadleaf forests of Hispaniola.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Landslides and hurricanes are the key triggers of dynamic processes of these forests. Substrate and topography and their interaction with the vegetation are the most important factors for the survival of these forests during hurricanes - probably the single most important natural trigger of the successional dynamic. Surviving trees have their roots securely anchored in the substrate. These factors are also critical for regulating surface runoff and maintaining the water balance under very humid conditions on exposed ridges and steep slopes. Forest recovery after disturbance is slow.

ENVIRONMENT

Environmental Description: Forests within this group occur over 800 m and up to about 2000 m elevation on yellowish or red ferrallitic soils or clay-loam derived from limestones. In mountains exposed to higher precipitation, it is found as low as 450 m.

Climate: Due to elevational gradients and geographic position, the climate of the Caribbean wet montane forest is cooler and wetter than in the lowlands, with temperatures at high-elevation sites averaging 18.5°C or less and precipitation averaging greater than 3000 mm annually. These areas above 800 m experience frequent cloud cover and relative humidity near 100% due to passing low clouds and the upward transport of moisture from warm Caribbean waters.

Soil/substrate/hydrology: Forests growing on exposed areas are of smaller stature and very dense. Taller forests grow on protected areas on lower slopes to the leeward of ridges or spurs. With montane forests, one of the most critical climatic factors is the frequency and duration of the cloud cover; condensation can contribute 10% or more of the precipitation amount that these forests receive. In the Caribbean, the trade winds forming clouds have saline components which have an effect on the chemistry of the ecophysiology of these forests. Cloud cover causes less solar radiation, lower temperatures, decreased transpiration and lower photosynthetic rates, resulting in lower growth rates and lower nutrient-cycling rates. The efficiency shown by these forests in the use of nutrients is high though, which is important to avoid nutrient loss due to leaching.

DISTRIBUTION

***Geographic Range:** Forests within this group occur in the Luquillo Mountains of northeast Puerto Rico, Sierra Maestra and Sierra del Purial in south eastern Cuba, and the Escambray Mountains in the south-central region of Cuba, in the windward slopes of the Central and Northern Cordilleras and the Sierra de Neiba in the Dominican Republic, and the upper reaches of the Blue Mountains in Jamaica. Forests of this group might occur also on mountain slopes of several of the volcanic islands of the Lesser Antilles, but references have not been consulted.
Nations: CU, DO, JM, PR, XD
States/Provinces:
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low - Poorly Documented
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
?	Montane Forest Zone	Dansereau 1966	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse and D. Faber-Langendoen, in Faber-Langendoen et al. (2016)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse
Acknowledgments [optional]:
Version Date: 04 Feb 2016

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Walter, H. 1971. The ecology of tropical and subtropical vegetation. Oliver and Boyd, Edinburg.
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1. Forest & Woodland
1.A.3.Eg. Caribbean-Mesoamerican Montane Humid Forest

G447. Caribbean Wet Montane Serpentine Forest & Scrub

Type Concept Sentence: Sclerophyllous, evergreen forests and scrub that occur in hyperhumid areas between 400 and 1000 m elevation on ferritic soils derived from serpentine bedrock of the Crystal and Moa mountains of eastern Cuba and in western Puerto Rico.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.A.3.Eg.1. Caribbean Montane Humid Forest (M598)

Elcode: G447
***Scientific Name:** Caribbean Wet Montane Serpentine Forest & Scrub Group
***Common (Translated Scientific) Name:** Caribbean Wet Montane Serpentine Forest & Scrub Group
***Colloquial Name:** Caribbean Wet Montane Serpentine Forest & Scrub

***Type Concept:** This group includes sclerophyllous, evergreen forests and scrub that occur between 400 and 1000 m elevation on ferritic soils derived from serpentine bedrock of the Crystal and Moa mountains of eastern Cuba and in western Puerto Rico, where annual precipitation can reach 3200 mm and there is no dry season. Forests are characterized by two canopy layers, mostly sclerophyllous and lauraceous trees up to 20 m tall and a lower stratum of shrubs. Lianas are abundant but the density and diversity of epiphytes decrease. The scrub type in the Moa Mountains consists of a dense bush of shrubs and stunted trees up to about 6 m tall with some emergents up to 10 m. It is very rich in endemics.

***Diagnostic Characteristics:**

***Classification Comments:** Caribbean Seasonal Evergreen Lowland Rainforest Group (G455) includes types growing on substrates derived from serpentine bedrock at lower elevation and drier, more seasonal climate, in which case succulents are common members of the plant communities. Serpentine communities growing at higher elevation and with high precipitation represent this group (G447) which includes two physiognomically different plant communities, the woodland or forest one with taller trees and a more uniform canopy present in Puerto Rico and Cuba, and a scrub or sclerophyllous shrubland type of shorter and more irregular canopy. The latter has only been described from mountains in eastern Cuba.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The forests within this group have an open canopy, 15-22 m high. The lower stratum, 5-12 m tall, is dense. Most of the trees and shrubs are sclerophyllous, and lianas are common. Due to the relative openness of these forests, the epiphytic flora is poorly developed, but includes a number of small orchids, while shade-tolerant species are largely absent. In the wet montane serpentine forest, the density of the herb layer varies and in the more humid areas a ground layer of herbs and mosses may be present. In the scrub type the herb layer is poorly developed but may include several endemic species such as the endemic grass *Ekmanochloa aristata*.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Typical species of the upper canopy of the wet serpentine forest in Cuba include *Bonnetia cubensis, Byrsonima biflora, Byrsonima orientensis, Byrsonima spicata (= Byrsonima coriacea), Calophyllum utile, Chionanthus domingensis, Dipholis jubilla, Hyeronima nipensis, Ilex berteroi, Magnolia cubensis, Magnolia minor (= Talauma minor), Matayba domingensis, Ocotea leucoxylon, Ocotea* spp., *Pinus cubensis, Podocarpus ekmanii, Spathelia pinetorum, Tabebuia dubia, Tapura cubensis*, and *Tetrazygia cristalensis*. In addition, endemic species *Moacroton ekmanii, Psychotria moaensis*, and *Rauvolfia salicifolia* are typical in the shrub layer together with species of *Myrica, Eugenia, Baccharis, Ossaea, Eupatorium*, and *Vernonia*. In Puerto Rico, the following species are typical: *Alsophila brooksii, Calyptranthes peduncularis, Calyptranthes triflora, Cnemidaria horrida, Cordia bellonis, Crescentia portoricensis, Croton impressus, Croton poecilanthus, Cyathea arborea, Diospyros revoluta, Eugenia glabrata, Gesneria pauciflora, Gleichenia nervosa (= Dicanopteris nervosa), Lunania ekmanii, Magnolia portoricensis, Magnolia splendens, Micropholis guyanensis (= Micropholis chrysophylloides), Mikania stevensiana, Myrcia maricaensis, Phialanthus grandifolius, Phialanthus myrtilloides, Schefflera gleasonii (= Didymopanax gleasonii), Sticherus bifidus, Thelypteris hastata var. heterodoxa, Xylosma pachyphyllum*, and *Xylosma* sp. In the scrub type in the Moa Formation in Cuba, the vast majority of species is endemic and typically includes *Acrosynanthus trachyphyllus, Clusia moaensis, Clusia callosa, Clusia monocarpa, Clusia nipens, Ilex berteroi, Ilex alainii (= Ilex victorini), Ilex hypaneura, Ilex shaferi, Illicium cubense, Jacaranda arborea*, and *Laplacea moaensis*. *Feddea cubensis* and *Morinda moaensis* are among the endemic sclerophyllous lianas.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Landslides and hurricanes are the key triggers of dynamic processes of these forests. Substrate and topography and their interaction with the vegetation are the most important factors for the survival of these forests during hurricanes - probably the single most important natural trigger of the successional dynamic. Surviving trees have their roots securely anchored in the substrate. These factors are also critical for regulating surface runoff and maintaining the water balance under very humid conditions on exposed ridges and steep slopes. Forest recovery after disturbance is slow.

ENVIRONMENT

Environmental Description: This system occurs between 600 and 1000 m elevation, on poor acidic ferrallitic soils in the serpentine areas of the Crystal and Moa mountains of eastern Cuba and in western Puerto Rico. Fog condensation provides additional moisture to these plant communities. *Climate:* Annual total precipitation range is 1800-3200 mm and mean annual temperature range from 18° to 24°C. *Soil/substrate/hydrology:* Forests and scrubs of this group occur on poor, ferrallitic soils derived from serpentine bedrock.

DISTRIBUTION

***Geographic Range:** This group is found above 400 m elevation in wet mountains with ferrallitic soils derived from serpentine bedrock in the Moa and Cristal mountains of eastern Cuba and in western Puerto Rico.
Nations: CU, PR
States/Provinces:
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low - Poorly Documented
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-05-14	G453 Caribbean Montane Serpentine Elfin Thicket Group	G453 concept covered by G447

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse and D. Faber-Langendoen, in Faber-Langendoen et al. (2016)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse
Acknowledgments [optional]:
Version Date: 04 Feb 2016

REFERENCES

***References [Required if used in text]:**

Areces-Mallea, A. E., A. S. Weakley, X. Li, R. G. Sayre, J. D. Parrish, C. V. Tipton, and T. Boucher. 1999. A guide to Caribbean vegetation types: Preliminary classification system and descriptions. The Nature Conservancy, Arlington, VA. 166 pp.

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Weaver, P. L. 2008. Dwarf forest recovery after disturbance in the Luquillo Mountains of Puerto Rico. Caribbean Journal of Science 44(2):150-163.

1.A.4. Tropical Flooded & Swamp Forest

Tropical Flooded & Swamp Forest is a forested or wooded wetland and peatland found in margins of freshwater lakes, alluvial plains, rivers and depressions around the globe.

1.A.4.Ed. Caribbean-Central American Flooded & Swamp Forest

1. Forest & Woodland
1.A.4.Ed. Caribbean-Central American Flooded & Swamp Forest

M618. Caribbean Floodplain Forest

Type Concept Sentence: Several types of seasonally flooded forests located on alluvial plains in climates that vary from very humid to seasonal and therefore the length of the flooding period influences the composition and structure of the included communities.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.A.4.Ed.1. Caribbean-Central American Flooded & Swamp Forest (D093)

Elcode: M618
***Scientific Name:** Caribbean Floodplain Forest Macrogroup
***Common (Translated Scientific) Name:** Caribbean Floodplain Forest Macrogroup
***Colloquial Name:** Caribbean Floodplain Forest

***Type Concept:**

***Diagnostic Characteristics:**

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary:

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary:

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Based on the length of the hydroperiod, flooded forests can be grouped into permanently inundated swamp forest and periodically inundated swamp forest. Swamp forest is usually found on soils that have a high water table, e.g., *Mauritia flexuosa* (palm) swamp in Trinidad grows on land perpetually inundated with 30 to 100 cm of water; while periodically-inundated swamp occurs in areas subjected to inundation during the rainy season. Species richness generally decreases with increasing hydroperiod. Based on the type of dominant species, swamp forests can be conveniently divided into two types: forests dominated by hardwood species and those dominated by palms. Dominance by palms becomes stronger with increasing hydroperiod or soil moisture conditions (Bacon 1990, Lugo et al. 1990).

Key Factors for evaluating integrity include hydrodynamics that are frequently altered by human uses: flood regime duration, magnitude and return interval of flooding should fall within historical ranges for the type, and channel dynamics, or the rate of change and/or lateral migration in riverine portions of swamps create habitat mosaics such as oxbow lakes, levees, seasonal lakes, canals, forested terraces, and associated successional patterns in vegetation. Water Quality: chemistry (pH, salinity gradient, N, C, P), transparency (suspended sediment, phytoplankton count, fish composition).

ENVIRONMENT

Environmental Description: Located on alluvial plains in climates that vary from very humid to seasonal.

DISTRIBUTION

***Geographic Range:**

Nations: BZ, CU, DO, GT, HN, NI, PR, TT

States/Provinces:

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low - Poorly Documented

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G459	Caribbean Flooded Forest

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-03-26	M001 Caribbean & Central American Flooded & Swamp Forest Macrogroup	M001 split into M617 & M618

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:**

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:**

Acknowledgments [optional]:

Version Date: 08 Jan 2015

REFERENCES

***References [Required if used in text]:**

Bacon, P. R. 1990. Ecology and management of swamp forests in the Guianas and Caribbean region. Pages 213-250 in: A. E. Lugo, M. Brinson, and S. Brown, editors. Ecosystems of the World 15. Forested wetlands. Elsevier Scientific Publishing Company, New York.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Lugo, A. E., S. Brown, and M. M. Brinson 1990. Synthesis and search for paradigms in wetland ecology. Pages 447-460 in: A. E. Lugo, M. Brinson, and S. Brown, editors. Ecosystems of the World 15. Forested wetlands. Elsevier Scientific Publishing Company, New York.

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1. Forest & Woodland
1.A.4.Ed. Caribbean-Central American Flooded & Swamp Forest

G459. Caribbean Flooded Forest

Type Concept Sentence: These are Caribbean broadleaf evergreen- and palm-dominated floodplain forests which occur in the wide valleys of lowland rivers, or on rich, black alluvial soils, most commonly in the Greater Antilles.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.A.4.Ed.1. Caribbean Floodplain Forest (M618)

Elcode: G459
***Scientific Name:** *Pterocarpus officinalis* Caribbean Flooded Forest Group
***Common (Translated Scientific) Name:** Terocarpo Caribbean Flooded Forest Group
***Colloquial Name:** Caribbean Flooded Forest

***Type Concept:** This Caribbean group occurs in basins and plains along the coast, in the wide valleys of lowland rivers, or on rich, black alluvial soils. It can also occur right behind the mangrove communities in coastal areas with high rainfall and/or abundant riverflow. Depending on the duration of the flooding period, forests can have one or more tree layers; broadleaf evergreen trees and palms are typical. The canopy can be 10-15 m, 15-18 m, or 20-25 m high. The following list of species is diagnostic: *Acoelorraphe wrightii, Bucida buceras, Calophyllum antillanum, Cladium mariscus ssp. jamaicense, Ficus* spp., *Melicoccus bijugatus, Myrsine cubana, Nephrolepis biserrata, Prestoea acuminata var. montana, Pterocarpus officinalis, Roystonea borinquena, Roystonea regia, Sabal parviflora, Sabal yapa, Sideroxylon portoricense, Swietenia mahagoni, Symphonia globulifera, Tabebuia angustata*, and *Tabernaemontana amblyocarpa*.

***Diagnostic Characteristics:** Caribbean alluvial swamp forests with broadleaf evergreen trees and palms. *Pterocarpus officinalis* is most often a dominant tree.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Forests with broadleaf evergreen trees and palms. These can be up to 25 m tall.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Broadleaf evergreen trees and palms are typical. The following list of species is diagnostic: *Acoelorraphe wrightii, Bucida buceras, Calophyllum antillanum (= Calophyllum brasiliense), Cladium mariscus ssp. jamaicense (= Cladium jamaicense), Ficus* spp., *Melicoccus bijugatus, Myrsine cubana, Nephrolepis biserrata, Prestoea acuminata var. montana (= Prestoea* *montana), Pterocarpus officinalis, Roystonea borinquena, Roystonea regia, Sabal parviflora, Sabal yapa, Sideroxylon portoricense (= Bucida subinermis), Swietenia mahagoni, Symphonia globulifera, Tabebuia angustata*, and *Tabernaemontana amblyocarpa*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In the Caribbean, hurricanes constitute a trigger of periodic disturbance that provides long-term opportunities for species invasions and long-term ecosystem response in floodplain forests. A study about the effects of a hurricane in a Puerto Rican floodplain palm forest (Frangi and Lugo 1998), showed that the dominant species became more dominant and created low instantaneous tree mortality (1% of stems) and reductions in tree biomass (-16 Mg/ha/yr) and density, although not in basal area. Five years after the hurricane, the palm floodplain forest had exceeded its pre-hurricane above-ground tree biomass, tree density, and basal area. Delayed tree mortality was twice as high as instantaneous tree mortality after the storm and affected dicotyledonous trees more than it did palms. Regeneration of dicotyledonous trees, palms, and tree ferns was influenced by a combination of factors including hydroperiod, light, and available space (Frangi and Lugo 1998).

ENVIRONMENT

Environmental Description: *Pterocarpus officinalis* is indicative of this group. It occurs in floodplains in low-elevation areas, but also up to 450 m elevation in the Luquillo forest of Puerto Rico (Wadsworth and Little 1964).

Climate: Climates vary from very humid to seasonal. *Soil/substrate/hydrology:* This group occurs in basins and plains along the coast, in the wide valleys of lowland rivers, or on rich, black alluvial soils. It can also occur right behind the mangrove communities in coastal areas with high rainfall and/or abundant riverflow. Areas of karst may have few rivers, and the floodplain forests are only where groundwater emerges, such as in low areas near the coast in northeastern Puerto Rico.

DISTRIBUTION

***Geographic Range:** This Caribbean group occurs in Cuba, Dominican Republic, Puerto Rico and Trinidad and Tobago.
Nations: CU, DO, PR, TT
States/Provinces:
USFS Ecoregions (2007) [optional]: M411Aa:CCC, M411Ab:CCC, M411Ac:CCC, M411Ad:CC?, M411Ae:CC?
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low - Poorly Documented
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	*Pterocarpus* Swamp -- 39.1	Dansereau 1966	
=	Puerto Rico land cover type 45, Freshwater *Pterocarpus* swamp	Gould et al. 2008	Flooded freshwater swamps on the coastal plain and along riparian areas.
>	Seasonal-Swamp Forest	Beard 1955	
=	Seasonally flooded rainforest formation	Areces-Mallea et al. 1999	
>	Swamp Forest	Beard 1955	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse and C. Nordman, in Faber-Langendoen et al. (2016)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse and C. Nordman

Acknowledgments [optional]:

Version Date: 18 Jul 2016

REFERENCES

***References [Required if used in text]:**

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1. Forest & Woodland

1.A.4.Ed. Caribbean-Central American Flooded & Swamp Forest

M617. Caribbean Swamp Forest

Type Concept Sentence: This macrogroup represents freshwater forested wetlands that occur in relatively geographically restricted locations in southern Florida, Cuba and Puerto Rico, and possibly other Caribbean islands, where they are surrounded by sawgrass marsh and wet prairies. The extensive and flat terrain is a rainfall-driven and nutrient-poor fen peatland. The floristic composition is characterized by the combination of broad-leaved evergreen trees of tropical affinities, temperate broad-leaved deciduous trees, and, in Florida, may include the deciduous needle-leaved *Taxodium* spp.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.A.4.Ed.2. Caribbean-Central American Flooded & Swamp Forest (D093)

Elcode: M617
***Scientific Name:** *Sabal palmetto - Annona glabra - Pterocarpus officinalis* Swamp Forest Macrogroup
***Common (Translated Scientific) Name:** Cabbage Palmetto - Pond-apple - Terocarpo Swamp Forest Macrogroup
***Colloquial Name:** Caribbean Swamp Forest

***Type Concept:** This macrogroup includes tree-dominated, stillwater wetlands, including hydric hammock, and tree swamps that occur amidst low-lying marshes of south Florida, Cuba and Puerto Rico, and possibly other Caribbean islands. They represent either poorly drained depressions, emergent tree islands, slightly higher than the surrounding marshes. Composition and dominance vary depending on the community, but it is characterized by the combination of broad-leaved evergreen trees of tropical affinities, temperate broad-leaved deciduous trees, and the deciduous needle-leaved *Taxodium* spp. Species common to the different settings where the macrogroup occurs are *Annona glabra, Chrysobalanus icaco, Fraxinus caroliniana, Ilex cassine, Magnolia virginiana, Psychotria nervosa, Quercus laurifolia*, and *Sabal palmetto*. Composition of the Florida bayhead swamp is closest to the Cuban palm swamps because of the shared presence of *Conocarpus erectus* and the palm *Acoelorraphe wrightii*. Communities within this macrogroup are very gently sloping or depression forested wetlands usually saturated and occasionally inundated, often with peat accumulation on sand/marl/limestone substrate. In the case of Florida's "hydric hammocks," they are hardwood wetlands occupying flat lowlands with high water tables or ponded surface water, often underlain by limestone substrate and adjacent to coastal marshes. The most important natural controlling factors for vegetation of the macrogroup are climate and hydrology.

***Diagnostic Characteristics:** This macrogroup includes tree-dominated wetlands in the Caribbean. The physiognomy is a combination of broad-leaved evergreen trees of tropical affinities, including palms, temperate broad-leaved deciduous trees, and, in Florida, the deciduous needle-leaved *Taxodium* spp. may be present.

***Classification Comments:** Information for this macrogroup is best available from Florida, and further work is needed to characterize it across its range. In Florida, this macrogroup includes wet open woodlands and closed wetland forests of mostly subtropical broad-leaved evergreen trees. The physiognomy is diverse. The open woodlands or savannas dominated by *Taxodium ascendens* in south Florida are now placed in *Taxodium ascendens / Annona glabra / Rhynchospora* spp. Subtropical Swamp Forest Alliance (A4085), Pond-cypress Basin Swamp Group (G036), Pond-cypress Basin Swamp Macrogroup (M161).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The physiognomy of these forested wetlands responds to the slightly different physical settings of the component communities. In Florida, bayhead swamps and hydric hammocks are both dominated by broad-leaved trees forming tree islands with a round or tear-drop shape. The canopy of hydric hammocks is dense, about 17-21 m high, and is dominated by one or more oak species, *Sabal palmetto*, or a combination of these. Palms are common, even dominant, in some stands. The understory is formed by young canopy trees, shrubs and abundant ferns (Vince et al. 1989). These forests are found on the highest sites, on peat, and remain wet 2-6 months per year (Richardson 2000).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Trees that may be present include *Annona glabra, Chrysobalanus icaco, Conocarpus erectus, Ficus aurea, Fraxinus caroliniana, Juniperus virginiana, Metopium toxiferum, Nyssa sylvatica, Persea borbonia, Persea palustris, Quercus laurifolia, Quercus nigra, Quercus virginiana, Roystonea elata, Sabal palmetto*, and *Taxodium* spp. These are a combination of broad-leaved evergreen trees of tropical affinities, temperate broad-leaved deciduous trees, and the deciduous needle-leaved *Taxodium* spp. In the broad-leaved evergreen forests, characteristic shrubs include *Cornus foemina, Diospyros virginiana, Morella cerifera (= Myrica cerifera), Myrsine cubana (= Myrsine floridana), Psychotria nervosa*, and *Salix caroliniana*. Herbaceous plants in the broad-leaved evergreen forests include *Acrostichum aureum, Acrostichum danaeifolium, Bacopa caroliniana, Crinum americanum, Nephrolepis exaltata*, and *Sagittaria graminea*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Information on the role of fire is best described for Florida's swamps. There, fire is not considered an important disturbance of the hydric hammock. However, the hammocks do burn occasionally. *Sabal palmetto* are fire-tolerant and intense fires favor this species. *Quercus virginiana* can survive low-intensity fires, but *Acer rubrum* is highly susceptible to fire. Flooding duration and frequency are primary factors in species composition. While most hydric hammock trees are at least somewhat adapted to flooding, the ranges of tolerance vary according to timing and depth of inundation (FNAI 1990). Increased salinity is a factor often limiting certain species. Although adult cypress trees are tolerant of extended inundation, their seeds cannot germinate under water and cypress seedlings may not survive if submerged (Vernon 1947, Kurz and Wagner 1953, cited in FNAI 2010a). The broad-leaved evergreen forests are generally not prone to fire except in extreme drought conditions (due to weather or hydrological alteration). The peat substrate can also burn under these forests. Severe fires reverse the succession sequence moving the forest communities back to wet prairies due to the elimination of the peat-based raised topography where the forest wetlands thrive (Richardson 2000).

ENVIRONMENT

Environmental Description: *Climate*: The climate is subtropical, with a dry season in the North American winter, and a rainy season in the North American summer. Average annual precipitation is 1325 to 1525 mm and 80% of the precipitation falls from mid-May to October. Average annual temperature ranges between 22-23°C; temperature drops below freezing only occasionally (FNAI 1990).

Soil/substrate/hydrology: The soils are generally peats (which may be deep) or muck, or limestone-influenced wet soils. The pH of soils varies from somewhat acidic to slightly alkaline with little organic matter. In areas underlain by limestone, depression swamps are often formed when poor surface drainage causes water to move downward and dissolve the limestone bedrock. These depressions then fill in with peat or marl (Duever et al. 1984). In the case of Florida's hydric hammocks, soil moisture is kept high mainly by rainfall accumulation on poorly drained soils and flooding lasts only for short periods after heavy rains (FNAI 1990). In general, rainfall, surface water, seepage, and ground water provide an abundance of water, and especially in the lowest lying natural wetlands, shallow water covers the surface during much of the rainy season.

DISTRIBUTION

***Geographic Range:** This macrogroup occurs in Florida along the Gulf of Mexico from Aripeka to St. Marks, just landward of salt marsh. Smaller stands are scattered in the northern and central regions of peninsular Florida and in the south Florida Everglades and Big Cypress regions. Other known locations are in Cuba, Puerto Rico, and the Bahamas.
Nations: BS, CU, MQ, PR, TT, US
States/Provinces: FL
USFS Ecoregions (2007) [optional]: 411A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G002	Caribbean Lowland Swamp Forest

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-03-26	M001 Caribbean & Central American Flooded & Swamp Forest Macrogroup	M001 split into M617 & M618

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Inland Swamps, Cypress and Bay Tree Forests	Davis 1943	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.H. Davis, Jr. (1943)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse and C.W. Nordman

Acknowledgments [optional]:

Version Date: 07 Oct 2015

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1. Forest & Woodland
1.A.4.Ed. Caribbean-Central American Flooded & Swamp Forest

G002. Caribbean Lowland Swamp Forest

Type Concept Sentence: These are forested wetlands of the Caribbean region and south Florida which are dominated by a combination of broad-leaved evergreen trees of tropical affinities, palms, and (in Florida) temperate deciduous trees.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.A.4.Ed.2. Caribbean Swamp Forest (M617)

Elcode: G002
***Scientific Name:** *Annona glabra / Chrysobalanus icaco* Swamp Forest Group
***Common (Translated Scientific) Name:** Pond-apple / Coco-plum Swamp Forest Group
***Colloquial Name:** Caribbean Lowland Swamp Forest

***Type Concept:** This group includes tree-dominated wetlands in the southern Florida Peninsula. These wetlands include wet open woodlands and closed wetland forests of broad-leaved evergreen trees. Some examples are wet hardwood-dominated hammocks, stands of predominately broad-leaved hardwoods often called "tree islands" on slightly elevated sites within marshes of the south Florida Everglades region. The trees present are a combination of broad-leaved evergreen trees of tropical affinities, temperate broad-leaved deciduous trees, and the deciduous needle-leaved *Taxodium* spp.

***Diagnostic Characteristics:** This group includes tree-dominated wetlands in the southern Florida Peninsula.

***Classification Comments:** This group includes wet open woodlands and closed wetland forests of mostly subtropical broad-leaved evergreen trees. The physiognomy is diverse. The group also includes many subtropical broad-leaved evergreen forest associations which occur in wetlands in the southern Florida Peninsula. The open woodlands or savannas dominated by *Taxodium ascendens* in south Florida are now placed in *Taxodium ascendens / Annona glabra / Rhynchospora* spp. Subtropical Swamp Forest Alliance (A4085), Pond-cypress Basin Swamp Group (G036), Pond-cypress Basin Swamp Macrogroup (M161).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G036	Pond-cypress Basin Swamp	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group includes wet open woodlands and closed wetland forests of mostly subtropical broad-leaved evergreen trees. The physiognomy is diverse.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Trees that may be present include *Annona glabra, Chrysobalanus icaco, Ficus aurea, Persea palustris, Conocarpus erectus, Roystonea elata, Taxodium ascendens, Taxodium distichum, Quercus laurifolia, Quercus virginiana, Sabal palmetto, Metopium toxiferum, Chrysobalanus icaco, Fraxinus caroliniana*, and *Acer rubrum*. These are a combination of broad-leaved evergreen trees of tropical affinities, temperate broad-leaved deciduous trees, and the deciduous needle-leaved *Taxodium* spp. In the broad-leaved evergreen forests, characteristic shrubs include *Myrsine cubana (= Myrsine floridana), Psychotria nervosa, Persea palustris*, and *Chrysobalanus icaco*. Herbaceous plants in the broad-leaved evergreen forests include *Crinum americanum, Bacopa caroliniana, Acrostichum aureum, Acrostichum danaeifolium, Nephrolepis exaltata*, and *Sagittaria graminea*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The broad-leaved evergreen forests included in this group are generally not prone to fire except in extreme drought conditions (due to weather or hydrological alteration). The peat substrate can also burn under these forests.

ENVIRONMENT

Environmental Description: This group is limited to low-elevation wetlands in the southern Florida Peninsula and occurs in the Everglades and Big Cypress areas. *Climate*: The climate is subtropical, with a dry season in the North American winter, and a rainy season in the North American summer. *Soil/substrate/hydrology*: This group occurs in wetlands, such as floodplains, depressions, low areas surrounding marshes or in tree islands in the Everglades (which generally are slightly higher than the surrounding marshes). The soils are generally peats (which may be deep) or muck, or limestone-influenced wet soils.

DISTRIBUTION

***Geographic Range:** This group occurs on the southern Florida Peninsula and on islands in the Caribbean.
Nations: BS, CU, MQ, PR, TT, US
States/Provinces: FL
USFS Ecoregions (2007) [optional]: 411A:CC
Omernik Ecoregions L3, L4 [optional]: 8.5.3.75a:C, 8.5.3.75b:C, 8.5.3.75c:C, 8.5.3.75d:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-05-14	G460 Caribbean Coastal Swamp Group	G460 is covered by G002

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Inland Swamps, Cypress and Bay Tree Forests	Davis 1943	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.H. Davis, Jr. (1943)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman

Acknowledgments [optional]:

Version Date: 07 Oct 2015

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***References [Required if used in text]:**

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Gunderson, L. H., and W. F. Loftus. 1993. The Everglades. Pages 199-255 in: W. H. Martin, S. G. Boyce, and A. C. Echternacht, editors. Biodiversity of the southeastern United States: Lowland terrestrial communities. John Wiley and Sons, New York. 502 pp.
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Monk, C. D., and T. W. Brown. 1965. Ecological considerations of cypress heads in north central Florida. The American Midland Naturalist 74:126-140.

1.A.5. Mangrove

Mangroves are dominated by broad-leaved evergreen trees, with complex aerial root systems, found in estuarine and coastal marine habitats that form a typically narrow fringe along the coasts of tropical latitudes worldwide.

1.A.5.Ua. Atlantic-Caribbean & East Pacific Mangrove

1. Forest & Woodland
1.A.5.Ua. Atlantic-Caribbean & East Pacific Mangrove

M005. Western Atlantic & Caribbean Mangrove

Type Concept Sentence: This mangrove vegetation occurs in saline wetlands along the southwest coast of Florida, the Gulf Coast of Texas, and Mexico, the Caribbean Islands, the Caribbean coast of Central America and the northern coast of South America. It is dominated by *Avicennia germinans, Laguncularia racemosa*, and *Rhizophora mangle*, growing with few other associate species in communities that vary depending upon tidal, hydrologic and topographic conditions.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.A.5.Ua.3. Atlantic-Caribbean & East Pacific Mangrove (D004)

Elcode: M005
***Scientific Name:** *Avicennia germinans - Laguncularia racemosa - Rhizophora mangle* Macrogroup
***Common (Translated Scientific) Name:** Black Mangrove - White Mangrove - Red Mangrove Macrogroup
***Colloquial Name:** Western Atlantic & Caribbean Mangrove

***Type Concept:** The mangrove vegetation of this macrogroup forms coastal saline swamps, dominated by *Avicennia germinans, Laguncularia racemosa*, and *Rhizophora mangle* varying in dominance and structure depending upon tidal, hydrologic and topographic conditions. It is found along the southwest coast of Florida, the Gulf Coast of Texas, Mexico, Caribbean coast of Central America, the Caribbean Islands, and the northern coast of South America. Relatively few mangrove species form these forests and they are all of tropical affinity. Common saltmarsh species are associated in the understory layer, especially in transitional areas to salt marshes and in open tree canopy conditions. Among these halophytic species are several saltmarsh grasses (*Juncus, Sporobolus, Monanthochloe, Distichlis*) and succulent herbs (*Salicornia, Sesuvium, Batis*). Mangrove forests occur in three main geophysical settings that define their structure and composition: fringe, basin, and riverine. Fringe mangroves occur in close proximity to the ocean, are dominated by *Rhizophora mangle*, and may have leeward zones dominated by *Avicennia germinans* or *Laguncularia racemosa*. These tidal forests can reach 20 m (66 feet) high. Stands occur in frost-free zones, on soils that are permanently saturated with brackish water and which become inundated during high tides. The brackish environment tends to limit competition from other species. Basin mangroves occur in flats or lagoons that form around inland basins and depressions, which may have water of various salinities, and in tidal brackish estuary channels; the latter typically lack *Rhizophora mangle*. Influences from tides decrease further inland. The basin mangrove also includes short, tidal mangrove forests on seasonally flooded peat soils of interior depressions in the Florida Keys and southern peninsular Florida. The tree canopy of the basin mangrove communities is closed, usually 3-12 m high, and is codominated by *Avicennia germinans, Laguncularia racemosa*, and/or *Conocarpus erectus*. *Rhizophora mangle* can occur but is not dominant. *Avicennia* is the only mangrove genus that can stand cold temperatures and occasional frosts thus reaching up to 30° N latitude on the coast of Florida to Texas. Riverine mangrove, the third setting, occurs farther south in the floodplains and along embankments of tidal creeks and rivers, with daily tides. Riverine forests have higher levels of productivity than the other mangrove types as a result of increased nutrient availability, litter fall, and tidal flushing. All three species are present and the canopy layer can reach heights of 18 to 20 m (59-66 feet). Finally, one of the most distinctive traits of Caribbean mangroves is the presence of mangrove forests on large flooded limestone plains, such as the Florida Everglades or the mangrove swamps of Belize and Quintana Roo, in Mexico. These communities are composed by dwarf trees of red mangrove (*Rhizophora mangle*) accompanied by a characteristic community with golden ferns (*Acrostichum aureum*) and the myrmecophilous orchid *Schomburgkia tibicinis*.

***Diagnostic Characteristics:** Mangrove species form tidal communities of various physiognomies depending on the geomorphic and hydrological processes that characterize the stand. All dominants are woody species which can attain heights of 5-20 m depending on the substrate, climate and extent of disturbance. All are tolerant of constant saturation and high levels of salinity. *Rhizophora mangle, Avicennia germinans*, and *Laguncularia racemosa* are diagnostic species which can co-occur, but usually one dominates over the others based on structural or functional features that confer advantages in particular settings. In addition, *Conocarpus erectus*, another mangrove species, can dominate in areas seldom inundated by tidal waters in the rocky, dry habitats associated with the Florida Keys archipelago. No other mangrove species are present in the type. These dominants are accompanied by saltmarsh species *Salicornia, Sesuvium, Batis, Spartina, Juncus*, and *Distichlis*.

***Classification Comments:** Two broad groups of mangrove vegetation in the Western Atlantic and Caribbean can be recognized: fringe (including both coastal and riverine) and basin mangrove (including hammock mangrove) (Lugo et al. 1988). The decision to include coastal and riverine mangrove forests within the fringe mangrove group needs further review of floristic distinctions, given differences in water salinity and tidal/wave energy between both settings. Peinado et al. (1995b) restrict this macrogroup to the tropical regions, excluding Louisiana. Although mangroves (especially *Avicennia germinans*) occur in Louisiana and the Florida panhandle, they are better treated there as part of Gulf Coast salt marshes.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M004	Eastern Pacific Mangrove	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are evergreen, tidal swamps, dominated by mangrove species of variable heights. Mangrove trees in south Florida can be up to 60 cm (2 feet) in diameter and 150 years old. But there are also mangrove forests 10-20 m tall. Canopy heights and density depend upon climate, topography, salinity and substrate type, with stunted, shrub-like growth forms shorter than 1.5 m on rocky substrates or at the northern edge of their range, in areas subjected periodically to freezing temperatures (Medina 1999, Lugo et al. 2007). *Avicennia germinans* has distinctive horizontal cable roots that radiate from the tree with short, vertically erect aerating branches (pneumatophores) extending 2 to 20 cm (0.8 to 7.9 inches) above the substrate. The trees of *Rhizophora mangle* have extensive prop roots extending from the trunk and lower branches to the soil. The prop roots are important adaptations to living in anaerobic substrates and in providing gas exchange, anchoring system, and absorbing ability. Undisturbed mature mangrove communities vary from a high, dense, continuous canopy to a low, open canopy (Tomlinson 1986b, E. Helmer pers. comm. 2014).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This macrogroup includes mangrove forests dominated or codominated by *Avicennia germinans, Laguncularia racemosa, Rhizophora mangle*, and/or *Conocarpus erectus*. The standard zonation of mangroves consists of *Rhizophora mangle* in the lower and middle intertidal zone, *Avicennia germinans* in the upper intertidal areas that are occasionally flooded, and *Laguncularia racemosa* in patches on higher elevations that are less frequently flooded. *Conocarpus erectus* is located further inland in areas that are within the limits of the highest tides (Tomlinson 1986). Landward zones exhibit various patterns though, where vegetation may be composed of a mixture of co-occurring mangrove species or form monospecific stands (Barbour and Billings 2000). Dense mangrove forests do not typically have understory plant associations, except for mangrove seedlings (FNAI 1990). However, under open or irregular canopy other herbaceous salt-tolerant species may also be present such as *Batis maritima, Distichlis spicata, Salicornia depressa (= Salicornia virginica)*, and *Sesuvium portulacastrum*. The mangrove forests on large flooded limestone plains are composed of dwarf trees of *Rhizophora mangle* accompanied by a characteristic community with *Acrostichum aureum* and the myrmecophilous orchid *Schomburgkia tibicinis* (E. Ezcurra pers. comm. 2014).

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Disturbance in mangrove forests may be caused by large-scale events such as hurricanes, frost damage or clearcutting, but also by small-scale events such as attack by wood-boring beetles or lightning, causing mangrove trees to die in small areas around lightning strikes. The relative importance of these different types of disturbance varies with geography, with some localities more often subjected to the impact of hurricanes or lightning. Hurricane Andrew in 1992 resulted in large areas of mangrove being knocked down by wind. The regeneration of these mangroves since 1992 has been studied (Smith et al. 2009). Recovery from large-scale disturbance may be slow and may vary depending on species composition and intensity of stress factors subsequent to the disturbance event, with increases in solar exposure, soil temperature and/or salinity capable of inhibiting regeneration (McKee and Feller 1994 in Barbour and Billing 2000, Smith et al. 2009).

Mangroves are considered pioneer species because of their ability to establish on otherwise unvegetated substrates. Once individuals begin to colonize a disturbed area, even-aged stands are established with little variation in the structure because new development of successive colonizers is arrested by the closed canopy. On shorter time scales, the pulses of the tides and freshwater runoff are very important factors in the dynamics of mangroves because these control the rates of sedimentation and vertical accretion and thus determine their intertidal position. The distribution of the different mangrove species and the mangrove community can experience fluctuations in habitat type and species composition as a result of changes affecting the hydrologic patterns.

ENVIRONMENT

Environmental Description: Mangrove forests occur in three main geophysical settings that define their structure and composition: fringe, basin, and riverine. Fringe mangroves occur in close proximity to the ocean, are dominated by *Rhizophora mangle*, and may have leeward zones dominated by *Avicennia germinans* or *Laguncularia racemosa*. These tidal forests can reach 20 m high (66 feet). The brackish environment tends to limit competition from other species. Basin mangroves occur in flats or lagoons that form around inland basins and depressions and which may have water of various salinities, and in tidal brackish estuary channels; the latter typically lacking *Rhizophora mangle*. Influences from tides decrease further inland. The tree canopy of the basin mangrove communities is closed, usually 3-12 m high, and is co- dominated by *Avicennia germinans, Laguncularia racemosa*, and/or *Conocarpus erectus*. *Rhizophora mangle* can occur but is not dominant.

Climate: Mangroves are essentially tropical species that occur only infrequently in areas where the average annual temperature is below 19° C; fluctuations greater than 10° C and short-duration freezes are detrimental to all species. As frost frequency increases, species substitutions occur; *Avicennia germinans* move to the fringe, and they become scrubby. Populations of *Rhizophora mangle* and *Laguncularia racemosa* reach approximately 29° N latitude on both coasts of Florida (Rehm 1976, Odum et al. 1982). However, the northern limits of mangrove species fluctuate due to short-term climatic swings making exact delineations impossible.

Soil/substrate: Mangroves can grow on many different types of substrates and can alter their substrate through peat formation and sedimentation. Mangroves are found on fine inorganic muds, muds with high organic content, peat, sand, rock, coral, oysters, and some man-made surfaces if there are sufficient crevices for root attachment. Black mangroves grow best in soils of high salinity, red mangroves grow best in areas of estuarine salinity with regular flushing, and white mangroves grow best in areas with freshwater input on sandy soils (FNAI 1990). Red, black, and white mangroves can grow in completely anaerobic soils (Lee 1969). Mangroves grow better in areas of low wave-energy shorelines, river deltas, and floodplains with depositional environments (Odum et al. 1982). Fluctuating tidal waters are important for transporting nutrients, controlling soil salinities, and dispersing propagules, but high wave energy prevents establishment and may destroy their shallow root systems (Odum and McIvor 1990). Basin mangrove forests occur in depressions along the coast and further inland that collect precipitation and sheetflow, that are tidally influenced and can attain heights of 15 m (49 feet). Mangroves species sometimes sort along salinity gradients, with *Rhizophora* limited to salinities below 60-65 ppt, while *Avicennia* and *Laguncularia* tolerate levels above 80-95 ppt [see references in Odum and McIvor (1990)]. Elsewhere, including Mexico and Puerto Rico, *Laguncularia racemosa* can grow at a wide range of salinity, reaching its greater heights where salinity is very low (A.E. Lugo pers. comm. 2011). Riverine mangroves have higher levels of productivity than the other mangrove types as a result of increased nutrient availability, litter fall, and tidal flushing. All three species are present and the canopy layer can reach heights of 18 to 20 m. Mangroves can grow on many different types of substrates and can alter their substrate through peat formation and sedimentation. Mangroves are found on fine inorganic muds, muds with high organic content, peat, sand, rock, coral, oysters, and some man-made surfaces if there are sufficient crevices for root attachment.

One of the most distinctive traits of Caribbean mangroves is the presence of mangrove forests on large flooded limestone plains, such as the Florida Everglades or the mangrove swamps of Belize and Quintana Roo, in Mexico. Because coastal karst substrates occur on the Caribbean but not on the Pacific side of the Americas, this formation is very specific to the Caribbean, and presents a number of very unique features. The *Rhizophora* trees are stunted because the excess calcium limits the intake of phosphorus by the plants. The accompanying community is quite unique, as these mangroves often grow in almost completely freshwater (E. Ezcurra pers. comm. 2014).

DISTRIBUTION

***Geographic Range:** This mangrove vegetation occurs in saline wetlands along the southwest coast of Florida, the Gulf Coast of Louisiana, Texas, and Mexico, the Caribbean islands, the Caribbean coast of Central America and the northern coast of South America.

Nations: BR, BS, BZ, CO, CR, CU, GF, GT, GY, HN, MQ, MX, NI, PA, PR, SR, US, VE, XA, XB, XC

States/Provinces: FL, LA?, TX

USFS Ecoregions (2007) [optional]: 232D:CC, 411A:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G003	Caribbean Basin Mangrove
G004	Caribbean Fringe Mangrove

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	*Rhizophoro mangle-Laguncularietea racemosae*	Peinado et al. 1995b	
=	Mangrove Swamp	Odum et al. 1982	
=	Tidal Swamp	FNAI 1990	

AUTHORSHIP

***Primary Concept Source [if applicable]:** M. Peinado et al. (1995b)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse and C.W. Nordman

Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by E.l. Ezcurra and E. Helmer.

Version Date: 08 Jan 2015

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1. Forest & Woodland
1.A.5.Ua. Atlantic-Caribbean & East Pacific Mangrove

G003. Caribbean Basin Mangrove

Type Concept Sentence: This group includes tidal mangrove wetlands of the Caribbean basins dominated or codominated by *Avicennia germinans, Laguncularia racemosa*, and/or *Conocarpus erectus*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.A.5.Ua.3. Western Atlantic & Caribbean Mangrove (M005)

Elcode: G003
***Scientific Name:** *Avicennia germinans - Laguncularia racemosa* Forest Group
***Common (Translated Scientific) Name:** Black Mangrove - White Mangrove Forest Group
***Colloquial Name:** Caribbean Basin Mangrove

***Type Concept:** This group includes tidal mangrove wetlands of the Caribbean basins dominated or codominated by *Avicennia germinans, Laguncularia racemosa*, and/or *Conocarpus erectus*. These forests are in hypersaline flats or lagoons; that is, basins which may have water of various salinities, and tidal brackish areas which are not dominated by *Rhizophora mangle*. This group also includes short, tidal mangrove forests on seasonally flooded peats of interior depressions in the Florida Keys and southern peninsular Florida. The canopy of these basin mangrove communities is usually 3-12 m high, closed, and consists of a variable mixture of *Rhizophora mangle* (present but not dominant), *Avicennia germinans, Laguncularia racemosa*, and *Conocarpus erectus*.

***Diagnostic Characteristics:** This group includes mangrove forests in basins dominated or codominated by *Avicennia germinans, Laguncularia racemosa*, and *Conocarpus erectus*. It also can include mangrove forests with *Rhizophora mangle*, but not fringe or riverine mangrove dominated by *Rhizophora mangle*.

***Classification Comments:** At least three broad variants of mangrove vegetation in the Caribbean can be recognized, i.e., fringe (coastal), riverine (here treated as part of fringe), and basin mangrove (including hammock mangrove) (Lugo et al. 1988). This group mainly consists of basin mangrove forests. Fringe and riverine mangrove forests, generally dominated by *Rhizophora mangle*, are classified in Caribbean Fringe Mangrove Group (G004). Tidal mangrove dominated by *Avicennia germinans* may be slightly above the normal high-tide line and have characteristics of hypersaline flats. No known examples of tidal freshwater mangroves are known from the Neotropics (Lugo pers. comm. 2011). Tidal wetlands dominated or codominated by *Conocarpus erectus* are currently grouped with fringe mangroves (but this decision needs further review).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G004	Caribbean Fringe Mangrove	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are evergreen forests of variable heights. Mangrove trees in south Florida can be up to 60 cm (2 feet) in diameter and 150 years old.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This group includes mangrove forests dominated or codominated by *Avicennia germinans, Laguncularia racemosa*, and/or *Conocarpus erectus*. It also can include mangrove forests with, but not dominated by, *Rhizophora mangle*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Mangroves are limited by the effects of freezing weather, as mangroves are not adapted to freezing (Lugo and Zucca 1977). Hurricanes also reduce mangrove forests. For example, a well-developed mangrove forest with trees up to 60 cm (2 feet) in diameter and 150 years old was destroyed by Hurricane Donna in 1960 (Craighead 1971). Hurricane Andrew in 1992 resulted in areas of mangrove being knocked down by wind. The regeneration of these mangroves since 1992 has been studied. The pulses of the tides and freshwater runoff are also very important factors in the dynamics of mangroves and the distribution of the different mangrove species. This group includes areas which are hypersaline, slightly higher than the areas flushed by regular tides. Lightning is also an important disturbance factor, causing mangrove trees to die in small areas around lightning strikes.

ENVIRONMENT

Environmental Description: *Climate:* Mangroves are essentially tropical species that occur only infrequently in areas where the average annual temperature is below 19°C; fluctuations greater than 10°C and short-duration freezes are detrimental to all species. As frost frequency increases, species substitutions occur; black mangroves move to the fringe, and they become scrubby. The relation of mangroves with salt marshes is inverse to frost frequency (Kangas and Lugo 1990). Low-temperature stress leads to decreased height, leaf area, and increased tree density (Odum and McIvor 1990). *Laguncularia racemosa* reaches approximately 29°N latitude on both coasts of Florida (Rehm 1976, Odum et al. 1982). However, the northern limits of mangrove species fluctuate due to short-term climatic swings making exact delineations impossible. *Soil/substrate/hydrology:* Odum and McIvor (1990) show a diagram displaying the community zonation present in Tampa Bay. A narrow high marsh zone of *Batis* and *Juncus* grades into low mangrove forests with *Laguncularia racemosa, Avicennia germinans*, and *Rhizophora mangle*.

DISTRIBUTION

***Geographic Range:** This group occurs in south Florida and the Caribbean Islands.
Nations: CU, PR, US
States/Provinces: FL
USFS Ecoregions (2007) [optional]: 232D:CC, 411A:CC
Omernik Ecoregions L3, L4 [optional]: 8.5.3.75b:C, 8.5.3.75d:C, 15.4.1.76d:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0075	*Avicennia germinans - Laguncularia racemosa* Basin Mangrove Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** M.S. Ross, J.J. O'Brien, and L.J. Flynn (1992)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman
Acknowledgments [optional]: A.E. Lugo
Version Date: 27 Mar 2013

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Teas, H. 1977. Ecology and restoration of mangrove shorelines in Florida. Environmental Conservation 4:51-57.

1. Forest & Woodland
1.A.5.Ua. Atlantic-Caribbean & East Pacific Mangrove

G004. Caribbean Fringe Mangrove

Type Concept Sentence: This group includes tidal fringe mangrove and tidal riverine mangrove of the Caribbean, dominated by *Rhizophora mangle*. This group attains best development in low wave-energy, depositional environments.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.A.5.Ua.3. Western Atlantic & Caribbean Mangrove (M005)

Elcode: G004
***Scientific Name:** *Rhizophora mangle* Forest Group
***Common (Translated Scientific) Name:** Red Mangrove Forest Group
***Colloquial Name:** Caribbean Fringe Mangrove

***Type Concept:** This tidal forest wetland group of the Caribbean occurs in low-energy tidal areas and along intertidal shorelines. The primary species comprising this group is *Rhizophora mangle*, with essentially tropical affinities and intolerant of cold temperatures. This group attains best development in low wave-energy, depositional environments. Examples occur on soils generally saturated with brackish water at all times and which become inundated during high tides. The brackish environment tends to limit competition from other species. This group includes tidal fringe mangrove forests and the tidal riverine mangrove forests dominated by *Rhizophora mangle*.

***Diagnostic Characteristics:** This group is dominated by *Rhizophora mangle* and occurs in tidal brackish or saltwater situations, including forests along tidal rivers and creeks. This group does not include the mangrove vegetation of hypersaline areas, which are not dominated by *Rhizophora mangle*.

***Classification Comments:** Although at least three broad variants of mangrove vegetation in Florida can be recognized, i.e., riverine mangrove forests, fringe mangrove forests, and basin mangrove forests (Lugo et al. 1988), this group includes tidal fringe mangrove forests and the tidal riverine mangrove forests dominated by *Rhizophora mangle*.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G003	Caribbean Basin Mangrove	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are evergreen forests. The trees of *Rhizophora mangle* have extensive prop roots.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The primary species comprising this group is a true mangrove, *Rhizophora mangle*. The combined stresses of flooding and salinity tend to result in limited competition (FNAI 1990), lack of plant species richness, and relatively simple stand structure (Mendelssohn and McKee 1988). However, other salt-tolerant species may also be present. Broad classifications of mangroves have included six types (Lugo and Snedaker 1974) and more recently three broad variants (Lugo et al. 1988), i.e., riverine mangrove forests, fringe mangrove forests, and basin mangrove forests [see also Mendelssohn and McKee (1988)]. This group includes tidal fringe mangrove forests and the tidal riverine mangrove forests dominated by *Rhizophora mangle*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Mangroves are limited by the effects of freezing weather, as they are not adapted to freezing (Lugo and Zucca 1977). Hurricanes also reduce mangrove forests. For example, a well-developed mangrove forest with trees up to 60 cm (2 feet) in diameter and 150 years old was destroyed by Hurricane Donna in 1960 (Craighead 1971). Hurricane Andrew in 1992 resulted in areas of mangrove being knocked down by wind. The regeneration of these mangroves since 1992 has been studied. The pulses of the tides and freshwater runoff are also very important factors in the dynamics of mangroves and the distribution of the different mangrove species. Fringe mangroves are flushed by regular tides, and many areas have significant brackish water influence (i.e., riverine mangrove). Lightning is also an important disturbance factor, causing mangrove trees to die in small areas around lightning strikes.

ENVIRONMENT

Environmental Description: *Climate:* Mangroves are essentially tropical species that occur only infrequently in areas where the average annual temperature is below 19°C; fluctuations greater than 10°C and short-duration freezes are detrimental to all species. Frost temperatures only occur in the Florida part of its range (A.E. Lugo pers. comm. 2011). As frost frequency increases, species substitutions occur, black mangroves move to the fringe, and they become scrubby. The relation of mangroves with salt marshes is inverse to frost frequency (Kangas and Lugo 1990). Low-temperature stress leads to decreased height, leaf area, and increased tree density (Odum and McIvor 1990). *Rhizophora* reaches approximately 29°N latitude on both coasts of Florida (Rehm 1976, Teas 1977, Odum et al. 1982). However, the northern limits of mangrove species fluctuate due to short-term climatic swings making exact delineations impossible.

Soil/substrate/hydrology: Mangroves are affected by substrate type and wave energy, with best development in low wave-energy, depositional environments; high wave energy prevents establishment and may destroy their shallow root systems (Odum and McIvor 1990). The species sometimes sort along salinity gradients, with *Rhizophora* limited to salinities below 60-65 ppt, while *Avicennia* and *Laguncularia* tolerate levels above 80-95 ppt [see references in Odum and McIvor (1990)]. Elsewhere, including Mexico and Puerto Rico, *Laguncularia racemosa* can grow at a wide range of salinity, reaching its greater heights where salinity is very low (A.E. Lugo pers. comm. 2011).

DISTRIBUTION

***Geographic Range:** This group is best developed in the Caribbean, including southern Florida, extending north in Florida to approximately 29°N latitude on both coasts. In Florida, mangrove forests occur primarily along saltwater shorelines in southern Florida, in backbays and estuary fringes with mild wave action. It is most prevalent in the Ten Thousand Islands in southwest Florida (Soil Conservation Service 1981a).
Nations: BS, CO, CU, MQ, MX, PR, US, VE, XA, XB, XC
States/Provinces: FL
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]: 8.5.3.75b:C, 8.5.3.75d:C, 15.4.1.76d:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0473	*Conocarpus erectus* Fringe Mangrove Alliance
A3188	*Rhizophora mangle* Fringe Mangrove Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Tidal Swamp	FNAI 1990	

AUTHORSHIP

***Primary Concept Source [if applicable]:** M.S. Ross, J.J. O'Brien, and L.J. Flynn (1992)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman and D. Faber-Langendoen

Acknowledgments [optional]: A.E. Lugo

Version Date: 16 Apr 2013

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1.B. Temperate & Boreal Forest & Woodland

Temperate & Boreal Forest & Woodland is typically dominated by broad-leaved deciduous and needle-leaved trees, with some broad-leaved evergreens in warmer regions, and a climate that varies from warm-temperate with only rare frosts to very cold subarctic conditions. It is found across the globe in the mid-latitudes, typically between 25° and 60-70°N and S latitude, and includes boreal, cool-temperate, and warm-temperate/Mediterranean forests.

1.B.1. Warm Temperate Forest & Woodland

Warm Temperate Forest & Woodland is dominated by broad-leaved evergreen trees, sometimes with dwarfed stems and small, sclerophyllous leaves (in Mediterranean climates), or various combinations of broad-leaved deciduous, broad-leaved evergreen and needle-leaved evergreen conifer trees. Winters are mild (mostly frost-free) and may be the rainiest season, springs are temperate-humid, summers are hot-dry, and autumn is often dry.

1.B.1.Na. Southeastern North American Forest & Woodland

This mixed broadleaf evergreen (oak, magnolia) and pine (longleaf) forest and woodlands occur in the southeastern U.S. Coastal Plain from southern Virginia, south to Florida and west to east Texas.

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1. Forest & Woodland
1.B.1.Na. Southeastern North American Forest & Woodland

M007. Longleaf Pine Woodland

Type Concept Sentence: This formerly common open woodland vegetation, of which only about 5% remains, is found in the coastal plains of the southeastern United States, and is dominated by *Pinus palustris* or *Pinus clausa* in parts of central Florida.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.1.Na.1. Southeastern North American Forest & Woodland (D006)

Elcode: M007
***Scientific Name:** *Pinus palustris / Aristida stricta* Woodland Macrogroup
***Common (Translated Scientific) Name:** Longleaf Pine / Pineland Three-awn Woodland Macrogroup
***Colloquial Name:** Longleaf Pine Woodland

***Type Concept:** This woodland vegetation is found in the coastal plains of the southeastern United States from Virginia south to Florida and west to Texas. It is dominated primarily by *Pinus palustris*, but stands of *Pinus clausa* in parts of central Florida are also included here. Until the mid-nineteenth century, most of the wooded Southeastern Coastal Plain consisted of this vegetation. The original longleaf ecosystems of the southeastern United States were generally bi-layered communities with the physiognomy maintained by frequent, low-intensity surface fires that removed most small woody plants and thereby kept the canopy open. However, this obscures the remarkable floristic diversity of these systems. This vegetation covers both a large geographic range and a wide latitude of hydrological variation, from very dry to very wet. The components of the understory and ground layer vary greatly across this range of biogeography and hydrology. The driest examples include both sand barrens and scrub dominated by *Pinus palustris* or *Pinus clausa*. The sand pine scrub (G008) consists of *Pinus clausa* over xeromorphic *Quercus*-dominated shrub vegetation, including *Quercus chapmanii, Quercus geminata, Quercus inopina*, and *Quercus myrtifolia*. Xeric longleaf pine-dominated vegetation (G154) consists of open woodlands of *Pinus palustris* over understories of *Quercus incana, Quercus laevis*, and/or *Quercus margarettae*. The ground layer may be sparse, with *Schizachyrium scoparium* and/or one of the wiregrass forms of *Aristida* being characteristic. The dry-mesic loamy longleaf (G009) is intermediate in moisture status, with irregularly scattered trees of *Pinus palustris*, and usually clumps of midstory *Quercus* spp. and a grassy understory. Mesic longleaf pine flatwoods (G596) are typically found on Spodosol soils, and exhibit an open canopy of *Pinus palustris* with a grass-dominated ground layer, and a high diversity of forbs. Wet and mesic longleaf pine savannas and flatwoods (G190) are characterized by poorly drained, somewhat poorly drained, and seasonally saturated mineral soils, over a wide range of textures, with at least seasonally high water tables. In natural condition, canopies are open and are commonly monospecific stands of *Pinus palustris* or may contain other pines such as *Pinus elliottii var. elliottii, Pinus serotina*, or *Pinus taeda*. In south Florida, stands are dominated by *Pinus elliottii var. densa*. In high-quality stands, the ground layer contains a diverse mix of grasses, herbs, and low shrubs. Among the grasses, *Aristida beyrichiana* or *Aristida stricta* often dominate within their respective ranges, but *Andropogon capillipes*, other *Andropogon* spp., *Ctenium aromaticum, Muhlenbergia expansa, Schizachyrium scoparium, Sporobolus floridanus, Sporobolus pinetorum, Sporobolus teretifolius*, or other grasses may also dominate.

In all of the various kinds of *Pinus palustris* woodlands, the absence of fire for only a few years to a decade may dramatically alter the physiognomy and composition of the lower strata, with understory hardwoods and shrubs crowding out the grasses and forbs. Exposure to frequent, low-intensity surface fires is the dominant natural ecological process structuring the physiognomy of all of the *Pinus palustris* savannas and woodlands, influencing the local biodiversity. In some parts of the coastal plain, this vegetation historically constituted one of the most extensive types in the region. Widespread alterations, which followed European settlement, including changes to natural fire regimes, have produced drastic changes to this vegetation, and few large examples are extant that are managed using historical fire regimes. At present, many areas have undergone long periods of time without fire, and this has resulted in greater dominance by shrubs, including *Ilex glabra, Serenoa repens*, and *Vaccinium* spp., as well as denser canopies of *Pinus elliottii* or *Pinus taeda* rather than *Pinus palustris*.

***Diagnostic Characteristics:** With the exception of the *Pinus clausa*-dominated Sand Pine Scrub Forest & Open Woodland Group (G008), the dominance of *Pinus palustris* in stands of this vegetation is characteristic. Canopies are naturally open, but may become more closed with ingrowth of hardwoods with the absence of fire. The components of the understory and ground layer of this vegetation will vary greatly across both its large geographic range and its wide latitude of hydrological variation.

***Classification Comments:** This macrogroup is part of 1.B.1.Na Southeastern North American Forest & Woodland Division (D006), but this definition includes vegetation that may have tree cover to as low as 10%, thereby accommodating savannas as conventionally defined. The variation among associations in this macrogroup will be accounted for in the delimiting of the component alliances (e.g., *Pinus palustris* versus *Pinus elliottii*, "flatwoods" versus "savannas," etc.). Unfortunately, nomenclature offered by various workers has often been inconsistent and contradictory, particularly regarding moisture conditions (e.g., mesic pine forest, wet savanna, flatwoods, etc.) (Rheinhardt et al. 2002). No associations have currently been described in the USNVC for the south Florida components. More information may be available in DeCoster et al. (1999).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M162	Florida Peninsula Scrub & Herb	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Stands of this vegetation are naturally open in their degree of canopy closure (woodlands to savannas), dominated by tall evergreen needle-leaved trees that are straight, well-formed, and moderately tall. The original longleaf pine ecosystems of the southeastern United States were generally bi-layered communities with the physiognomy maintained by frequent, low-intensity surface fires that removed most small woody plants and thereby kept the canopy open (Peet 2006). These more open canopies with grass-dominated understories were more prevalent prior to the twentieth century. Without frequent fire, broad-leaved woody plants may occupy more of the cover of the stand, leading to loss of most of the biodiversity (Frost 2000, Peet 2006). Stands of sand pine scrub (G008) have an emergent overstory of *Pinus clausa* over xeromorphic shrub vegetation (mostly *Quercus* species). According to Harper (1927), "the vegetation is mostly dwarfed, gnarled and crooked, and presents a tangled, scraggly aspect."

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This woodland vegetation is dominated primarily by *Pinus palustris*, but stands of *Pinus clausa* are also included here. This vegetation covers both a large geographic range and a wide latitude of hydrological variation, from very dry to very wet. The components of the understory and ground layer will vary greatly across this range of biogeography and hydrology. The driest examples include both sand barrens and scrub dominated by *Pinus palustris* or *Pinus clausa*. The sand pine scrub (G008) consists of *Pinus clausa* over xeromorphic *Quercus*-dominated shrub vegetation, including *Quercus chapmanii, Quercus geminata, Quercus inopina*, and *Quercus myrtifolia*. The most important shrub species include *Ceratiola ericoides, Lyonia ferruginea, Quercus chapmanii, Quercus geminata, Quercus inopina, Quercus myrtifolia*, and *Serenoa repens*. The ground cover is always sparse but typically includes *Andropogon floridanus, Licania michauxii, Rhynchospora megalocarpa*, and a variety of lichens (*Cladonia* species). Xeric longleaf pine-dominated vegetation (G154) consists of open woodlands of *Pinus palustris* over understories of *Quercus incana, Quercus laevis*, and/or *Quercus margarettae*. *Schizachyrium scoparium* is an important grass throughout. Sites in North Carolina and northern South Carolina often have *Aristida stricta* as a dominant, and sites from southern South Carolina through much of Georgia and Florida often have *Aristida beyrichiana* as a dominant. West of the Apalachicola River, *Aristida beyrichiana* is constrained in distribution to the lowest coastal plain, dropping out in eastern-most Mississippi, though other *Aristida* species are important, such as *Aristida purpurascens* and *Aristida condensata*. Other frequent herbaceous plants include *Chrysopsis gossypina, Pityopsis* spp., *Pteridium aquilinum, Rhynchosia cytisoides, Rhynchospora grayi, Sorghastrum secundum, Stipulicida setacea*, and *Stylisma pickeringii*. Important shrubs include *Gaylussacia dumosa, Licania michauxii*, and *Rhus copallinum*. In addition, *Serenoa repens* may form shrubby thickets from southern Georgia across Florida and southern Alabama.

The dry-mesic loamy longleaf (G009) has irregularly scattered trees of *Pinus palustris*, and usually clumps of midstory *Quercus* spp., such as *Quercus falcata, Quercus incana, Quercus margarettae, Quercus marilandica*, and sometimes *Quercus laevis*, and a grassy understory. Low shrubs, mostly ericaceous, may be abundant. East of the Mississippi River, *Aristida stricta* (in North and South Carolina) or *Aristida beyrichiana* (from South Carolina to Mississippi) are usually the dominant or at least a characteristic herb. In central South Carolina and west of the Mississippi River, both of the *Aristida* species are absent and various other grass species dominate. Some typical mesic to dry-mesic herbaceous species include *Andropogon ternarius, Andropogon gyrans var. gyrans, Andropogon virginicus, Panicum virgatum, Schizachyrium scoparium, Schizachyrium tenerum, Sorghastrum nutans, Sorghastrum elliottii, Sorghastrum secundum, Sporobolus clandestinus*, and *Sporobolus junceus*.

Mesic longleaf pine flatwoods (G596) exhibit an open canopy of *Pinus palustris* with a grass-dominated ground layer, and a high diversity of forbs. Low shrubs, mostly ericaceous, may be abundant, such as *Vaccinium* spp. and *Ilex* spp. In addition, *Serenoa repens* is a characteristic species, particularly in South Carolina, Georgia, and Florida. The ground layer flora is similar to that of dry-mesic loamy longleaf (G009), but perhaps more diverse. Stands in south-central Florida contain *Panicum abscissum*.

Wet and mesic longleaf pine savannas and flatwoods (G190) are characterized by poorly drained, somewhat poorly drained, and seasonally saturated mineral soils, over a wide range of textures, with at least seasonally high water tables. In natural condition, canopies are open and are commonly monospecific stands of *Pinus palustris* or may contain other pines such as *Pinus elliottii var. elliottii, Pinus serotina*, or *Pinus taeda*. In south Florida, stands are dominated by *Pinus elliottii var. densa*. In high-quality stands, the ground layer contains a diverse mix of grasses, herbs, and low shrubs. Grasses naturally dominate the ground cover (Streng et al. 1993). *Aristida beyrichiana* or *Aristida stricta* often dominate within their respective ranges, but *Andropogon capillipes*, other *Andropogon* spp., *Ctenium aromaticum, Muhlenbergia expansa, Schizachyrium scoparium, Sporobolus floridanus, Sporobolus pinetorum, Sporobolus teretifolius*, and/or other grasses and sedges, including *Rhynchospora* spp. may also dominate. A great diversity of other herbs is often present, including composites, legumes, insectivorous plants, and variety of showy forbs. Some forbs may include species of *Agalinis, Baptisia, Carphephorus, Crotalaria, Helianthus, Liatris, Polygala, Rhynchosia, Sarracenia, Solidago, Symphyotrichum, Tephrosia*, and many others. Shrubs may include *Cyrilla racemiflora, Ilex coriacea, Ilex glabra, Ilex vomitoria, Lyonia lucida, Quercus geminata, Quercus minima, Quercus pumila, Serenoa repens, Vaccinium darrowii, Vaccinium myrsinites*, as well as *Morella cerifera* and *Baccharis halimifolia* in near-coastal habitats.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In all of these various kinds of longleaf pine woodlands, the absence of fire for only a few years may dramatically alter the physiognomy and composition of the lower strata, with understory hardwoods and shrubs crowding out the grasses and forbs. Exposure to frequent, low-intensity surface fires is the dominant natural ecological process structuring the physiognomy of all of these savannas and woodlands, influencing the local biodiversity. In some parts of the coastal plain, this vegetation historically constituted one of the most extensive types in the region. *Pinus palustris* is shade-intolerant and slow to reach reproductive age but is very long-lived, with some trees in old-growth stands 200-500 years of age (West et al. 1993). Widespread alterations followed European settlement, including conversion to agriculture and reduction in fire frequency, and have produced drastic changes to this vegetation. Large remaining examples on conservation lands are managed using prescribed fire. At present, many areas have undergone long periods of time without fire, and this has resulted in greater dominance by shrubs, including *Ilex glabra, Serenoa repens*, and *Vaccinium* spp., as well as denser canopies of *Pinus elliottii* or *Pinus taeda* rather than *Pinus palustris* (Huffman and Judd 1998, Noel et al. 1998). Hurricanes can also play a role in the dynamics of *Pinus palustris* vegetation, creating openings where tree regeneration can take place. Sand pine scrub vegetation (G008) is prone to infrequent, intense fire which can crown and consume *Pinus clausa* trees; its serotinous cones open following fire. The common shrubs resprout after fire, and there are many herbaceous plants that benefit from fire as well. Myers (1990) indicates that much of the variability in Florida scrub is due to variation in fire-return interval which ranges from 10 to 100 years.

Frequent fire is the predominant natural disturbance of Dry-Mesic Loamy Longleaf Pine Woodland Group (G009) and Mesic Longleaf Pine Flatwoods - Spodosol Woodland Group (G596), and this vegetation has a natural fire-return interval of from two to three years. These fires are low to moderate in intensity, removing above-ground parts of herbs and shrubs, but having little effect on the fire-tolerant *Pinus palustris* trees. The vegetation recovers very quickly from fire, with live herbaceous biomass often restored in just a few weeks; many ground layer plants have their flowering triggered by burning (Platt et al. 1988a). In the absence of fire, species which are less able to withstand fire increase, including *Quercus* spp. and other shrubs. These are kept to low density and mostly reduced to shrub size with fire, but become tall and dense in the absence of fire. This can reduce *Pinus palustris* tree regeneration, and lead to a decline in ground layer density and diversity. Frequent, low-intensity fire was the dominant natural ecological force. Natural stochastic variation in fire, as well as the relative flammability of the vegetation, was presumably important in determining the relative intensity of fire and its effects on vegetation at a local scale (Beckage et al. 2009, Gagnon et al. 2010).

Under natural conditions, the overstories of wet and mesic pine savannas (G190) are multi-aged (Platt et al. 1988), consisting of a fine mosaic of small even-aged groves driven by gap-phase regeneration and hurricanes that opened stands periodically (Platt and Rathbun 1993, Noel et al. 1998, Gilliam et al. 2006).

The ground cover of some wet and mesic pine savannas (G190) is being invaded by non-native plant species that include grasses (e.g., *Imperata cylindrica*), shrubs (e.g., *Ligustrum sinense, Triadica sebifera)*, as well as ferns (e.g., *Lygodium japonicum, Lygodium microphyllum)* (Platt and Gottschalk 1991, Platt et al. 2006b, Leichty et al. 2011).

ENVIRONMENT

Environmental Description: The climate of the Southeastern Coastal Plain is humid and warm-temperate, and characterized by hot summers and mild winters. Annual mean temperatures range from 16-23°C (60-74°F). Annual precipitation ranges from 109 to 175 cm (43-69 inches) (Boyer 1990). Fall is the driest season of the year, although periods of drought during the growing season are not unusual (Boyer 1990). Some parts of the range, particularly central Florida, has a very high frequency of lightning strikes.

Xeric longleaf pine woodlands are typically found on deep coarse sands. The dry-mesic loamy longleaf (G009) is intermediate in moisture status, and occurs on deep, well-drained sandy to loamy soils on upland sites of the coastal plain, on landforms that include loamy to sandy flats, relict beach system deposits, eolian sand deposits, Carolina bay rims (Bennett and Nelson 1991), and occasional low rolling hills. Soils range from mesic to xeric and from sandy to loamy or occasionally clayey. Most natural remnants are on coarse sands, but many examples probably once occurred on loamy soils. Soils are largely acidic and infertile, and the coarsest sands are excessively drained and sterile, though local richer, mesic sites occur. Ultisols most commonly associated with longleaf pine are Typic Paleudults and Plinthic Paleudults. Some areas are occupied by Psamments and other coarser-textured soils.

Wet-mesic longleaf pine woodlands (G190) occur on wet mineral soils in the middle and outer coastal plains. Typical landforms on which they are found include broad, poorly drained clayey, loamy or sandy flats, coastal alluvial plains, as well as low areas in relict beach ridge systems and eolian sand deposits. Examples are found on relatively recent (Pliocene-Pleistocene) geologic formations. Stands occasionally occur on river terraces above current flood levels and on perched water tables. Soils vary in texture from clayey to sandy, with no accumulations of organic surface layer (although they may be buried beneath surface sands). Soils are seasonally saturated due to high water table or poor soil drainage. The degree of seasonal saturation varies greatly among sites and depends on water supply, impediments to drainage, and evaporation.

DISTRIBUTION

***Geographic Range:** This vegetation is found in the coastal plains of the southeastern United States from southeastern Virginia south to Florida and west to eastern Texas, exclusive of the Mississippi Alluvial Plain. The sand pine scrub (G008) is mainly found in central Florida, particularly on the Lake Wales Ridge.
Nations: US
States/Provinces: AL, FL, GA, LA, MS, NC, SC, TX, VA
USFS Ecoregions (2007) [optional]: 231B:CC, 231E:CC, 232B:CC, 232C:CC, 232D:CC, 232E:CC, 232F:CC, 232G:CC, 232H:CC, 232I:CC, 232J:CC, 232K:CC, 232L:CC, 411A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G005	South Florida Slash Pine Rockland
G008	Sand Pine Scrub Forest & Open Woodland
G154	Xeric Longleaf Pine Woodland
G009	Dry-Mesic Loamy Longleaf Pine Woodland
G596	Mesic Longleaf Pine Flatwoods - Spodosol Woodland
G190	Wet-Mesic Longleaf Pine Open Woodland

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Flatwoods	Peet 2006	
=	Flatwoods - mesic flatwoods	Myers 1990a	
?	Grossarenic Dry Uplands	Turner et al. 1999	
<	Longleaf Pine - Scrub Oak: 59	Eyre 1980	
<	Longleaf Pine: 70	Eyre 1980	
=	Longleaf-Blackgum Savannahs	Ajilvsgi 1979	
<	Longleaf-Bluestem Uplands	Ajilvsgi 1979	
=	Mesic flatwoods	FNAI 2010a	
<	Pine Forest	Duever et al. 1986	
<	Sandhill Pine Forest	Marks and Harcombe 1981	
?	Upland Pine Forest	Marks and Harcombe 1981	
?	Wetland Pine Savanna	Marks and Harcombe 1981	
=	Xeric Sand Barrens and Uplands	Peet 2006	
<	Xeric Sandhill Scrub	Bennett and Nelson 1991	
<	Xeric stream terrace sand ridge subtype (of Upland Longleaf Pine Savanna)	Bridges and Orzell 1989a	

AUTHORSHIP

***Primary Concept Source [if applicable]:** R.K. Peet (2006)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne

Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by R.K. Peet, B. Sorrie, A.S. Weakley, and C.W. Nordman.

Version Date: 12 May 2015

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1. Forest & Woodland
1.B.1.Na. Southeastern North American Forest & Woodland

G005. South Florida Slash Pine Rockland

Type Concept Sentence: This group includes pine rocklands of southern Florida with *Chrysobalanus icaco, Coccothrinax argentata, Ilex cassine, Pinus elliottii var. densa, Sideroxylon salicifolium, Tetrazygia bicolor*, and *Leucothrinax morrisii*, with many rare and endemic plants growing on limestone, or on thin sandy soils over limestone, on the Miami Ridge, Florida Keys, and in Big Cypress.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.1.Na.1. Longleaf Pine Woodland (M007)

Elcode: G005
***Scientific Name:** *Pinus elliottii var. densa / Coccothrinax argentata - Sideroxylon salicifolium* Woodland Group
***Common (Translated Scientific) Name:** Florida Slash Pine / Florida Silver Palm - White Bully Woodland Group
***Colloquial Name:** South Florida Slash Pine Rockland

***Type Concept:** This group includes pinelands of extreme southern Florida growing on limestone, or on thin sandy soils over limestone. The uniqueness of the flora associated with this type has long been recognized, including the number of endemic and West Indian species. It has been estimated that nearly one-third of the taxa found in this group are restricted to it, including half of south Florida's endemic plants. *Pinus elliottii var. densa* is the dominant and characteristic pine species in this group on the southern Florida Peninsula. The understory vegetation consists of many hardwood species, including a number with tropical origins, and the herbaceous flora is species-rich and fire-adapted. Shrubs include *Chrysobalanus icaco, Coccothrinax argentata, Ilex cassine, Sideroxylon salicifolium, Tetrazygia bicolor*, and *Leucothrinax morrisii*. Different shrubs are found on the Miami Ridge than in the Florida Keys. *Leucothrinax morrisii* is a typical shrub only in the Florida Keys. More common and representative (if not diagnostic) species on the mainland and Florida Keys include *Guettarda scabra, Guettarda elliptica, Dodonaea viscosa, Serenoa repens*, and *Byrsonima lucida*.

***Diagnostic Characteristics:** *Pinus elliottii var. densa* is the dominant and characteristic canopy tree and is nearly always present in every stand. A suite of broadleaf evergreen shrub species and herb species could serve as diagnostic species, given that it is estimated that nearly one-third of the taxa found in this group are restricted to it, including half of south Florida's endemic plants. Diagnostic tropical shrubs include *Coccothrinax argentata, Leucothrinax morrisii, Sideroxylon salicifolium, Chrysobalanus icaco, Ilex cassine*, and *Tetrazygia bicolor*. Different shrubs are found on the Miami Ridge than in the Florida Keys. *Leucothrinax morrisii* is a typical shrub only in the Florida Keys. More common and representative (if not diagnostic) species on the mainland and Florida Keys include *Guettarda scabra, Guettarda elliptica, Dodonaea viscosa, Serenoa repens*, and *Byrsonima lucida*. For now, an environmental modifier "Rockland" has been added; "Rockland" is a common term for the limestone-influenced habitats in south Florida where this vegetation occurs.

***Classification Comments:** These communities bear a strong resemblance to the rocky pinelands in the Caribbean, particularly in the eastern Bahama Archipelago on Grand Bahama, Abaco, New Providence, and Andros islands. These Bahamian pinelands have a canopy of *Pinus caribaea var. bahamensis*, but are similar to the South Florida types in substrate, physiognomy, and tropical understory species (Snyder et al. 1990). The southwestern Florida *Pinus elliottii var. densa*-dominated flatwoods on sands not influenced by limestone are not included in this group. The flatwoods tend to have *Serenoa repens*, an evergreen palm, as a common low shrub, and *Aristida beyrichiana* as a common grass. The flatwoods lack the tropical broadleaf evergreen shrubs characteristic of the pine rockland.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G482	Caribbean Pine-Oak Woodland	
G596	Mesic Longleaf Pine Flatwoods - Spodosol Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The pine rockland vegetation is characterized by an open canopy of the needle-leaved evergreen conifer *Pinus elliottii var. densa* with a diversity of shrubs and herbaceous plants.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Pinus elliottii var. densa* is the characteristic and often dominant pine species. It has been estimated that nearly one-third of the taxa found in this group are restricted to it, including half of south Florida's endemic plants (Stout and Marion 1993). Shrubs include *Coccothrinax argentata, Leucothrinax morrisii (= Thrinax morrisii), Sideroxylon salicifolium, Chrysobalanus icaco, Ilex cassine*, and *Tetrazygia bicolor*. Different shrubs are found on the Miami Ridge than in the Florida Keys. *Thrinax morrisii* is a typical shrub only in the Florida Keys. More common and representative (if not diagnostic) species on the mainland and Florida Keys are species such as *Guettarda scabra, Guettarda elliptica, Dodonaea viscosa, Serenoa repens*, and *Byrsonima lucida* (T. Armentano pers. comm. 2003). More than 250 native herbaceous plant species have been recorded in the pine rockland; they are a mixture of tropical and temperate species with a high percentage of endemic plants (Snyder et al. 1990).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In the absence of fire, this group may be replaced by hardwood species within several decades (Stout and Marion 1993). The southern part of the Florida Peninsula is prone to hurricanes, which can be severe (i.e., Hurricane Andrew in 1992).

ENVIRONMENT

Environmental Description: The pine rockland occurs on areas influenced by limestone. In many areas the limestone is sticking up and has an uneven surface with holes and higher areas. The holes can hold water and contribute to the diversity of small habitats within the pine rockland. *Climate:* Subtropical, with a dry season in the North American winter, and a rainy season in the North

American summer. *Soil/substrate/hydrology:* Along the southeast coast of Florida, this group occurs on Miami Oolitic Limestone, while in the Big Cypress region (southwest Florida), it is found on outcrops of Tamiami Limestone.

DISTRIBUTION

***Geographic Range:** This group is found in the southern Florida Peninsula. Davis (1943) mapped this group, which occurs primarily on the Miami ridge bordering the Everglades, with disjunct examples found in the Big Cypress Swamp. In the Florida Keys, it is found on Big Pine Key, No Name Key, Little Pine Key, Cudjoe Key, and Upper Sugarloaf Key.
Nations: US
States/Provinces: FL
USFS Ecoregions (2007) [optional]: 411A:CC
Omernik Ecoregions L3, L4 [optional]: 15.4.1.76b:C, 15.4.1.76c:C, 15.4.1.76d:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0491	*Pinus elliottii var. densa* Rockland Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Pine Forest	Duever et al. 1986	
=	Pine Rockland	FNAI 2010a	
=	Rockland Pine Forest	Davis 1943	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.H. Davis, Jr. (1943)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman
Acknowledgments [optional]: The work of J.H. Davis, Jr. over 70 years ago, and the recent work of the staff of Florida Natural Areas Inventory are gratefully acknowledged.
Version Date: 12 May 2015

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1. Forest & Woodland
1.B.1.Na. Southeastern North American Forest & Woodland

G008. Sand Pine Scrub Forest & Open Woodland

Type Concept Sentence: The vegetation of this group generally has an emergent overstory of *Pinus clausa* over xeromorphic shrub vegetation, including *Quercus geminata, Quercus chapmanii, Quercus myrtifolia*, and *Quercus inopina*. It occurs on deep sands in Florida, especially along the Lake Wales Ridge.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.1.Na.1. Longleaf Pine Woodland (M007)

Elcode: G008
***Scientific Name:** *Pinus clausa / Quercus geminata - Quercus myrtifolia* Scrub Forest & Woodland Group
***Common (Translated Scientific) Name:** Sand Pine / Sand Live Oak - Myrtle Oak Scrub Forest & Woodland Group
***Colloquial Name:** Sand Pine Scrub Forest & Open Woodland

***Type Concept:** The vegetation of this group generally has an emergent overstory of *Pinus clausa* over xeromorphic shrub vegetation, including *Quercus geminata, Quercus chapmanii, Quercus myrtifolia*, and *Quercus inopina*. Ground cover is always sparse, and bare soil patches are typically evident. It is found on a sequence of sand ridges and ancient dune fields which are oriented from north to south in the Florida Peninsula. The appearance, floristics, and boundary of Florida scrub contrast dramatically with the "high pine" or sandhill vegetation which can be adjacent.

***Diagnostic Characteristics:** *Pinus clausa* over xeromorphic shrub vegetation, including *Quercus geminata, Quercus chapmanii, Quercus myrtifolia*, and *Quercus inopina*, on deep sand ridges in central Florida are the diagnostic characteristics.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G154	Xeric Longleaf Pine Woodland	
G177	Florida Xeric Scrub	has similar vegetation but without an emergent overstory of *Pinus clausa* and is only dominated by shrubs (not trees).

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Stands of this group have an emergent overstory of *Pinus clausa* over xeromorphic evergreen shrub vegetation (mostly *Quercus* species). According to Harper (1927), "the vegetation is mostly dwarfed, gnarled and crooked, and presents a tangled, scraggly aspect."

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The canopy is dominated by *Pinus clausa*. The most important shrub species include *Quercus myrtifolia, Quercus inopina, Serenoa repens, Quercus geminata, Quercus chapmanii, Lyonia ferruginea*, and *Ceratiola ericoides*. The ground cover is always sparse but typically includes *Licania michauxii, Rhynchospora megalocarpa, Andropogon floridanus*, and a variety of lichens (*Cladonia* species). There are a number of endemic plant species which may occur in inland Florida scrubs, including at least 13 federally listed species; many of the rarest scrub species are found only in the Lake Wales region. This group has long been noted for its unique and interesting vegetation by authors such as Vignoles (1823), Harper (1914), Mulvania (1931), Kurz (1942), and Laessle (1958, 1968). More recent treatments by Myers (1990a) and Menges (1999) have provided comprehensive summaries of scrub.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: This vegetation is prone to infrequent, intense fire which can crown and consume *Pinus clausa* trees. The cones of *Pinus clausa* are mostly serotinous, which means they open and release seed right after fire. The common shrubs resprout after fire, and there are many herbaceous plants that benefit from fire as well. Much of the variability in Florida scrub is due to variation in fire-return interval, ranging from once every 10 to 100 years (Myers 1990a).

ENVIRONMENT

Environmental Description: *Climate:* Humid, warm temperate. The area of central Florida where this group occurs has very high frequency of lightning strikes. *Soil/substrate/hydrology:* Mainly found on deep coarse sands in central Florida, especially on ridges such as the Lake Wales Ridge. Despite high rainfall, the coarse sands seriously limit water and nutrient availability. According to Harper (1927), "the nearly pure white sand of the ground surface, when viewed from a short distance, gives the impression of a thin rift of wind-driven snow."

DISTRIBUTION

***Geographic Range:** This vegetation is mainly found in Central Florida, especially on the Lake Wales Ridge.
Nations: US
States/Provinces: FL
USFS Ecoregions (2007) [optional]: 232G:CC, 232K:CC
Omernik Ecoregions L3, L4 [optional]: 8.5.3.75c:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3117	*Pinus clausa* Scrub Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Sand Pine: 69	Eyre 1980	

AUTHORSHIP

***Primary Concept Source [if applicable]:** A.M. Laessle (1958)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman

Acknowledgments [optional]:

Version Date: 12 May 2015

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Menges, E. S., W. G. Abrahamson, K. T. Givens, N. P. Gallo, and J. N. Layne. 1993. Twenty years of vegetation change in five long-unburned Florida plant communities. Journal of Vegetation Science 4:375-386

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1. Forest & Woodland
1.B.1.Na. Southeastern North American Forest & Woodland

G154. Xeric Longleaf Pine Woodland

Type Concept Sentence: These are open woodlands dominated by *Pinus palustris*, with *Quercus laevis* or, west of the Mississippi River, *Quercus incana*, and an herbaceous layer dominated by the native warm-season perennial grasses *Schizachyrium scoparium, Andropogon* spp., and *Aristida* spp., which occurs on dry deep sands in the southern coastal plains.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.1.Na.1. Longleaf Pine Woodland (M007)

Elcode: G154
***Scientific Name:** *Pinus palustris / Quercus laevis* Xeric Woodland Group
***Common (Translated Scientific) Name:** Longleaf Pine / Turkey Oak Xeric Woodland Group
***Colloquial Name:** Xeric Longleaf Pine Woodland

***Type Concept:** This group encompasses dry upland forest or woodland vegetation on deep, coarse sands and sandy loams on the southern coastal plains from North Carolina south to central Florida and west to eastern Texas. Generally, these are open woodlands dominated by *Pinus palustris* with an understory of *Quercus laevis*, though sites that are somewhat fire-suppressed or have experienced high-grading of the pine canopy can be dominated by *Quercus laevis*. *Quercus incana* and *Quercus margarettae* occur in the subcanopy throughout, though more commonly on somewhat silty sites. West of the Mississippi River *Quercus laevis* is absent with its role filled by *Quercus incana*. These habitats are consistently dry and have low nutrient availability with the consequence that *Pinus palustris* grows slower and reaches smaller stature than in other longleaf pine-dominated groups such as Dry-Mesic Loamy Longleaf Pine Woodland Group (G009), Wet-Mesic Longleaf Pine Open Woodland Group (G190) and Mesic Longleaf Pine Flatwoods - Spodosol Woodland Group (G596). On the most xeric sites, often referred to as barrens, the grass layer is minimal and litter accumulation is slow with the consequence that the natural frequency of fire is less than in other habitats where *Pinus palustris* grows. All but the most xeric associations have a well-developed grass layer with *Schizachyrium scoparium* common throughout, often with one of the wiregrass forms of *Aristida*. The dominant *Aristida* shifts geographically with *Aristida stricta* important in the southern two-thirds of North Carolina and northern-most South Carolina and *Aristida beyrichiana* dominant in southern South Carolina and across much Georgia and Florida, though west of the Apalachicola it is confined to the lower regions of the coastal plain and finally drops out in eastern-most Mississippi. South of the Savanna River *Gopherus polyphemus* (gopher tortoise) is a keystone species in this habitat; many other animals are associated with the burrows it digs and lives in.

***Diagnostic Characteristics:** Dominated by *Pinus palustris* with *Quercus laevis* and, to a lesser extent, *Quercus incana* and *Quercus margarettae*. West of the Mississippi River, *Quercus laevis* is absent and its role is filled by a greater abundance of *Quercus incana*. This vegetation occurs on xeric sites with infertile deep coarse sands and loamy sands. On the most xeric sites, herbaceous species diversity can be very low.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G008	Sand Pine Scrub Forest & Open Woodland	
G009	Dry-Mesic Loamy Longleaf Pine Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are open woodlands dominated by *Pinus palustris*, with sparse subcanopy and tall-shrub strata dominated by *Quercus laevis* or, west of the Mississippi River, *Quercus incana*. The herbaceous layer is dominated by the native warm-season perennial grasses *Schizachyrium scoparium, Andropogon* spp., and *Aristida* spp.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Generally, these are open woodlands dominated by *Pinus palustris*, with a subcanopy dominated by *Quercus laevis*, sometimes also with *Quercus incana* and *Quercus margarettae*. West of the Mississippi River *Quercus incana* replaces *Quercus laevis* as the dominant understory shrub species. *Schizachyrium scoparium* is an important grass throughout. Sites in North Carolina and northern South Carolina often have *Aristida stricta* as a dominant, and sites from southern South Carolina through much of Georgia and Florida often have *Aristida beyrichiana* as a dominant. West of the Apalachicola River, *Aristida beyrichiana* is constrained in distribution to the lowest coastal plain, dropping out in eastern-most Mississippi, though other *Aristida* species are important, such as *Aristida purpurascens* and *Aristida condensata*. Important shrubs include *Gaylussacia dumosa, Licania michauxii*, and *Rhus copallinum*. *Serenoa repens* may form shrubby thickets from southern Georgia across Florida and southern Alabama. Frequent herbaceous plants are sparse and include *Chrysopsis gossypina, Chrysopsis gossypina ssp. hyssopifolia, Pityopsis* spp., *Pteridium aquilinum, Rhynchosia cytisoides, Rhynchospora grayi, Sorghastrum secundum, Stipulicida setacea, Stylisma pickeringii*, and west of the Mississippi *Stylisma pickeringii var. pattersonii*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Wildland fire is a part of the natural dynamics of this vegetation. Historically, these fires have been started either by lightning or by humans. Today, remaining intact examples of this vegetation need to be professionally managed with prescribed fire in order to maintain their biological diversity. Hurricanes can also play a role in the dynamics, creating openings where tree regeneration can take place. *Pinus palustris* is a mast-producing tree, but in most years very little seed is produced. In certain mast years (which occur irregularly), trees throughout the range produce large amounts of seed. The seeds of *Pinus palustris* germinate best when they land on exposed sand, and not on litter. This is one reason that wildland fire is necessary for the regeneration of *Pinus palustris*.

ENVIRONMENT

Environmental Description: *Climate:* Warm temperate, humid. There are a large number of lightning strikes in the southern coastal plain region, especially in Florida. *Soil/substrate/hydrology:* This group encompasses dry upland woodland vegetation on deep coarse sands.

DISTRIBUTION

***Geographic Range:** This vegetation occurs in the coastal plain from North Carolina south to Florida and west to eastern Texas.
Nations: US
States/Provinces: AL, FL, GA, LA, MS, NC, SC, TX
USFS Ecoregions (2007) [optional]: 231B:CC, 232B:CC, 232C:CC, 232D:CC, 232F:CC, 232G:CC, 232H:CC, 232I:CC, 232J:CC, 232K:CC, 232L:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.5.65c:C, 8.3.5.65d:C, 8.3.5.65f:C, 8.3.5.65g:C, 8.3.5.65h:C, 8.3.5.65i:C, 8.3.5.65k:C, 8.3.5.65l:C, 8.3.5.65o:C, 8.3.7.35e:C, 8.5.1.63h:C, 8.5.3.75c:C, 8.5.3.75h:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3122	*Pinus palustris / Quercus incana* Woodland Alliance
A4076	*Pinus palustris / Quercus laevis - Quercus geminata* Woodland Alliance
A4075	*Pinus palustris / Quercus laevis / Schizachyrium scoparium* Woodland Alliance
A4077	*Pinus palustris / Quercus laevis / Aristida condensata* Woodland Alliance
A4074	*Pinus palustris / Quercus laevis / Aristida stricta* Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Longleaf Pine - Scrub Oak: 71	Eyre 1980	
=	Sandhill	FNAI 2010a	
=	Sandhills and River Dunes	Edwards et al. 2013	
=	Xeric Sand Barrens and Uplands	Peet 2006	

AUTHORSHIP

***Primary Concept Source [if applicable]:** R.K. Peet (2006)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman, B. Sorrie and R. Peet

Acknowledgments [optional]: B. Sorrie and R. Peet

Version Date: 12 May 2015

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Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina. Third approximation. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program, Raleigh. 325 pp.
Turner, R. L., J. E. Van Kley, L. S. Smith, and R. E. Evans. 1999. Ecological classification system for the national forests and adjacent areas of the West Gulf Coastal Plain. The Nature Conservancy, Nacogdoches, TX. 95 pp. plus appendices.
Wharton, C. H. 1978. The natural environments of Georgia. Georgia Department of Natural Resources, Atlanta. 227 pp.

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1. Forest & Woodland
1.B.1.Na. Southeastern North American Forest & Woodland

G009. Dry-Mesic Loamy Longleaf Pine Woodland

Type Concept Sentence: This group represents stands of *Pinus palustris* with scattered tall shrubs or small trees of *Quercus marilandica, Quercus incana, Quercus margarettae*, or *Quercus falcata*, and a grass-dominated understory often with *Schizachyrium scoparium, Aristida stricta*, or *Aristida beyrichiana* on sandy to loamy soils of uplands in the southern coastal plain.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.1.Na.1. Longleaf Pine Woodland (M007)

Elcode: G009
***Scientific Name:** *Pinus palustris / Quercus margarettae / Aristida* spp. Woodland Group
***Common (Translated Scientific) Name:** Longleaf Pine / Sand Post Oak / Three-awn species Woodland Group
***Colloquial Name:** Dry-Mesic Loamy Longleaf Pine Woodland

***Type Concept:** This group represents stands of *Pinus palustris* on sandy to loamy soils on uplands ranging from gently rolling, broad ridgetops to steeper sideslopes, and in mesic swales and terraces. The vegetation is generally open woodlands, with irregularly scattered trees of *Pinus palustris*, and usually clumps of midstory *Quercus* spp. and a grassy understory. There tends to be a fairly high diversity of forbs (broadleaf herbaceous plants), especially in sites that have been burned frequently (i.e., three or more times per decade). This group does not include the xeric and subxeric *Pinus palustris - Quercus laevis* habitats. It is found from southeastern Virginia to east Texas, including most of Florida. It does not occur in the Mississippi Alluvial Plain.

***Diagnostic Characteristics:** This group represents stands of *Pinus palustris* on loamy sand or sandy loam soils on upland sites. This group does not include the dry *Pinus palustris - Quercus laevis* habitats, but represents those that have moderate moisture and nutrient availability.

***Classification Comments:** Classification units below the group such as NVC alliances representing vegetation dominated by *Pinus palustris* can be subdivided by biogeography, from northeast to southwest across the coastal plains from Virginia to Texas. Longleaf pine-dominated stands in the rocky submontane areas of the Piedmont as well as the Ridge and Valley (from North Carolina to Alabama) are classified as a separate forest group. This group includes upland, not wet, longleaf pine habitats.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G154	Xeric Longleaf Pine Woodland	
G190	Wet-Mesic Longleaf Pine Open Woodland	
G596	Mesic Longleaf Pine Flatwoods - Spodosol Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are open woodlands; the trees are primarily needle-leaved evergreen conifers and on loamy soils can be straight, well-formed, and moderately tall. Open canopies and grass-dominated understories are typical of sites managed with prescribed fire. Sites lacking a hardwood midstory were more prevalent prior to the twentieth century.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This vegetation is naturally dominated by *Pinus palustris*. Scrub oaks, such as *Quercus marilandica, Quercus incana, Quercus margarettae, Quercus falcata*, and sometimes *Quercus laevis* form a sparse or clumped understory in most stands, in fact in all but the most mesic ones. Low shrubs, mostly ericaceous, may be abundant. East of the Mississippi River, *Aristida stricta* (in North and South Carolina) or *Aristida beyrichiana* (from South Carolina to Mississippi) are usually the dominant or at least a characteristic herb. In central South Carolina and west of the Mississippi River, both *Aristida beyrichiana* and *Aristida stricta* are absent and various other grasses dominate. Many examples have moderate to high plant species richness, with most of the species in the herb layer. Some mesic associations have high species richness values measured at the 1/10-hectare scale. Forbs, especially composites and legumes, are usually also an important herb component. Some typical mesic to dry-mesic grass species include *Andropogon gyrans var. gyrans, Andropogon ternarius, Andropogon virginicus, Panicum virgatum, Schizachyrium scoparium, Schizachyrium tenerum, Sorghastrum elliottii, Sorghastrum nutans, Sorghastrum secundum, Sporobolus clandestinus*, and *Sporobolus junceus*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Frequent fire is the predominant natural disturbance of this group, and it is dependent on frequent prescribed fire every 2-3 years. Fires are mostly low to moderate in intensity, removing above-ground vegetation of herbs and shrubs, but have little effect on the fire-tolerant *Pinus palustris* trees. Vegetation recovers very quickly from fire, with live herbaceous biomass often restored in just a few weeks after a growing season fire. Many plants have their flowering triggered by burning. In the absence of fire, species which are less able to withstand fire increase. *Quercus* spp. and other shrubs, kept to low density and mostly reduced to shrub size by fire, become tall and dense and can reduce *Pinus palustris* tree regeneration. Herb layer density and diversity declines in the absence of fire. On most soils, vegetation undergoes substantial structural alteration and reduction in species richness with lack of fire. Canopies are multi-aged, consisting of a fine mosaic of small even-aged patches driven by gap-phase regeneration. *Pinus palustris* is shade-intolerant and slow to reach reproductive age but is very long-lived, and continues to produce more cones as it grows older, after age 100. Some insect populations recolonize burned areas from nearby unburned patches. Sites managed with late spring or growing season prescribed fire provide high arthropod biomass (James et al. 2001, Taylor 2003).

ENVIRONMENT

Environmental Description: The vegetation of this group occurs on well-drained sandy to loamy soils on upland sites of the coastal plain, on landforms that include loamy to sandy flats, relict beach system deposits, eolian sand deposits, Carolina bay rims (Bennett and Nelson 1991), and low rolling hills. *Climate:* Longleaf pine grows in humid, warm temperate climates characterized by hot summers and mild winters. Annual mean temperatures range from 16-23°C (60-74°F). Annual precipitation ranges from 109 to 175 cm (43-69 inches) (Boyer 1990). Fall is the driest season of the year, although periods of drought during the growing season are not unusual (Boyer 1990). *Soil/substrate/hydrology:* Soils range from mesic to dry and from sandy to loamy or occasionally clayey. Most natural remnants are on sand, but many examples probably once occurred on loamy soils. Soils are largely acidic and infertile, though local richer, mesic sites occur. Ultisols most commonly associated with longleaf pine are the Typic Paleudults and Plinthic Paleudults. Some areas are occupied by Psamments and other coarser-textured soils.

DISTRIBUTION

***Geographic Range:** The vegetation of this group is found from southeastern Virginia to east Texas, including most of Florida. It does not occur in the Mississippi Alluvial Plain.
Nations: US
States/Provinces: AL, FL, GA, LA, MS, NC, SC, TX, VA
USFS Ecoregions (2007) [optional]: 231B:CC, 231E:CC, 232B:CC, 232C:CC, 232D:CC, 232F:CC, 232G:CC, 232H:CC, 232I:CC, 232J:CC, 232K:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.5.65c:C, 8.3.5.65d:C, 8.3.5.65f:C, 8.3.5.65g:C, 8.3.5.65h:C, 8.3.5.65i:C, 8.3.5.65k:C, 8.3.5.65l:C, 8.3.5.65m:C, 8.3.5.65o:C, 8.3.5.65q:C, 8.3.6.74c:C, 8.3.7.35a:C, 8.3.7.35c:C, 8.3.7.35e:C, 8.3.7.35g:C, 8.5.1.63e:C, 8.5.1.63h:C, 8.5.3.75b:C, 8.5.3.75c:C, 8.5.3.75d:C, 8.5.3.75e:C, 8.5.3.75f:C, 8.5.3.75h:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3126	*Pinus palustris / Quercus marilandica / Aristida* spp. Southeastern Coastal Plain Clayhill Woodland Alliance
A3125	*Pinus palustris / Quercus margarettae / Aristida* spp. Southeastern Coastal Plain Woodland Alliance
A3127	*Pinus palustris / Aristida* spp. - *Schizachyrium scoparium* Southeastern Coastal Plain Woodland Alliance
A3123	*Pinus palustris / Quercus marilandica / Schizachyrium scoparium* West Gulf Coastal Plain Woodland Alliance
A3124	*Pinus palustris / Schizachyrium scoparium* West Gulf Coastal Plain Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Dry Upland Longleaf Pine Woodlands	Edwards et al. 2013	
?	Grossarenic Dry Uplands	Turner et al. 1999	
<	Longleaf-Bluestem Uplands	Ajilvsgi 1979	
<	Mesic Upland Longleaf Pine Woodlands	Edwards et al. 2013	
<	Sandhill Pine Forest	Marks and Harcombe 1981	
=	Upland Pine	FNAI 2010a	
?	Upland Pine Forest	Marks and Harcombe 1981	
<	Xeric Sandhill Scrub	Bennett and Nelson 1991	
<	Xeric stream terrace sand ridge subtype (of Upland Longleaf Pine Savanna)	Bridges and Orzell 1989a	

AUTHORSHIP

***Primary Concept Source [if applicable]:** W.G. Wahlenberg (1946)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman
Acknowledgments [optional]:
Version Date: 12 May 2015

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1. Forest & Woodland

1.B.1.Na. Southeastern North American Forest & Woodland

G596. Mesic Longleaf Pine Flatwoods - Spodosol Woodland

Type Concept Sentence: This group represents typically open stands of *Pinus palustris* with evergreen shrubs such as *Ilex glabra* or *Serenoa repens* and native warm-season grasses, found on flat southern coastal plain sites with Spodosol soils, which inhibit drainage due to a spodic horizon.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.1.Na.1. Longleaf Pine Woodland (M007)

Elcode: G596
***Scientific Name:** *Pinus palustris / Ilex glabra - Serenoa repens* Woodland Group
***Common (Translated Scientific) Name:** Longleaf Pine / Inkberry - Saw Palmetto Woodland Group
***Colloquial Name:** Mesic Longleaf Pine Flatwoods - Spodosol Woodland

***Type Concept:** This group represents open woodlands of *Pinus palustris* found on flat sites with Spodosol soils. These are mostly uplands but are moist flatwoods. These open woodlands have irregularly scattered trees of *Pinus palustris* and a grass-dominated herbaceous layer. There tends to be a high diversity of forbs (broadleaf herbaceous plants), especially in sites that have been burned frequently (i.e., every 1-3 years). This group does not include dry nor dry-mesic *Pinus palustris* habitats, but represents those that have more available moisture, at least seasonally. It also does not include the wettest flatwoods, which are found in a different group. The vegetation of this group is found from southeastern Virginia to eastern Texas, including most of Florida. It does not occur in the Mississippi River Alluvial Plain.

***Diagnostic Characteristics:** This moist flatwoods vegetation is naturally dominated by *Pinus palustris*, and is found on flat sites with Spodosol soils.

***Classification Comments:** Group should be reviewed by R. Peet to ensure it is well-described.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G009	Dry-Mesic Loamy Longleaf Pine Woodland	
G005	South Florida Slash Pine Rockland	
G190	Wet-Mesic Longleaf Pine Open Woodland	
G176	Florida Dry Prairie	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are open woodlands. The trees are primarily needle-leaved evergreen conifers and often are straight, well-formed, and moderately tall. Open canopies and grass-dominated understories are typical of sites managed with prescribed fire. Sites lacking a hardwood midstory were more prevalent prior to the twentieth century. *Serenoa repens* is a dwarf palm shrub which is common in southern examples of this vegetation. These forests occur in flat lower coastal plain landscapes.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This vegetation is naturally dominated by *Pinus palustris*. Low shrubs, mostly ericaceous, may be abundant, such as *Vaccinium* spp. and *Ilex* spp. In addition, *Serenoa repens* is a characteristic species, particularly in South Carolina, Georgia, and Florida. East of the Mississippi River, *Aristida stricta* (in North and South Carolina) or *Aristida beyrichiana* (from South Carolina to Mississippi) is usually the dominant or at least a characteristic herb. In central South Carolina and west of the Mississippi River, both of the *Aristida* species are absent and various other grass species dominate (*Andropogon* spp., among others). Some of these mesic flatwoods associations have among the highest species richness values measured at the 1/10-ha scale. Forbs, especially composites, are usually also an important herb component, and lichens are abundant in some associations. Some typical mesic to dry-mesic herbaceous species include *Andropogon ternarius, Andropogon gyrans var. gyrans, Schizachyrium scoparium, Sorghastrum nutans*, and *Panicum virgatum*. Stands in south-central Florida may contain *Panicum abscissum*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Frequent fire is the predominant natural disturbance of this group. Sites naturally burned every few years, many averaging as often as every two years. Fires are naturally low to moderate in intensity. They burn above-ground parts of herbs and shrubs but have little effect on the fire-tolerant *Pinus palustris* trees. Vegetation recovers very quickly from fire, with live herbaceous biomass often restored in just a few weeks after growing season fire. Many plants have their flowering triggered by burning. In the absence of fire, species which are less able to withstand fire increase. *Acer rubrum, Liquidambar styraciflua, Quercus nigra, Ilex* spp., and other shrubs are reduced by fire, but without fire these broad-leaved woody plants can become tall and dense and can reduce *Pinus palustris* tree regeneration. Herb layer density and diversity decline in the absence of fire. On most soils, vegetation undergoes substantial structural alteration and reduction in species richness after just a few years without burning. Canopies are naturally many-aged, consisting of a fine mosaic of small even-aged patches of *Pinus palustris* driven by regeneration in canopy gaps. Longleaf pine is shade-intolerant and slow to reach reproductive age but is very long-lived. Some insect populations recolonize burned areas from nearby unburned patches. Sites managed with late spring or growing season prescribed fire provide high arthropod biomass (James et al. 2001, Taylor 2003).

ENVIRONMENT

Environmental Description: *Climate:* Longleaf pine grows in humid, warm temperate climates characterized by hot summers and mild winters. Annual mean temperatures range from 16-23°C (60-74°F). Annual precipitation ranges from 109 to 175 cm (43-69 inches) (Boyer 1990). Fall is the driest season of the year, although periods of drought during the growing season are not unusual (Boyer 1990). *Soil/substrate/hydrology:* Soils are typically mesic to moist Spodosols.

DISTRIBUTION

***Geographic Range:** The vegetation of this group is found from southeastern Virginia to eastern Texas, including most of Florida. It does not occur in the Mississippi River Alluvial Plain.
Nations: US
States/Provinces: AL, FL, GA, LA, MS, NC, SC, VA
USFS Ecoregions (2007) [optional]: 231B:CC, 231E:CC, 232B:CC, 232C:CC, 232D:CC, 232F:CC, 232G:CC, 232H:CC, 232I:CC, 232J:CC, 232K:CC, 232L:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.5.65c:C, 8.3.5.65d:C, 8.3.5.65f:C, 8.3.5.65g:C, 8.3.5.65h:C, 8.3.5.65i:C, 8.3.5.65k:C, 8.3.5.65l:C, 8.3.5.65m:C, 8.3.5.65o:C, 8.3.5.65q:C, 8.3.6.74c:C, 8.3.7.35a:C, 8.3.7.35c:C, 8.3.7.35e:C, 8.3.7.35g:C, 8.5.1.63e:C, 8.5.1.63h:C, 8.5.3.75b:C, 8.5.3.75c:C, 8.5.3.75d:C, 8.5.3.75e:C, 8.5.3.75f:C, 8.5.3.75h:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3161	*Pinus palustris / Vaccinium crassifolium / Aristida stricta* Woodland Alliance
A3160	*Pinus palustris / Serenoa repens / Aristida beyrichiana* Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Flatwoods	Peet 2006	
=	Flatwoods - mesic flatwoods	Myers 1990a	
<	Longleaf Pine - Slash Pine: 83	Eyre 1980	
><	Longleaf Pine: 70	Eyre 1980	
=	Mesic Flatwoods	FNAI 2010a	
=	Pine Flatwoods	Edwards et al. 2013	

AUTHORSHIP

***Primary Concept Source [if applicable]:** R.K. Peet (2006)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne and C.W. Nordman

Acknowledgments [optional]: K. Palmquist, R. Peet

Version Date: 12 May 2015

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Peet, R. K., and D. J. Allard. 1993. Longleaf pine vegetation of the Southern Atlantic and Eastern Gulf Coast regions: A preliminary classification. Pages 45-81 in: S. M. Hermann, editor. The Longleaf Pine Ecosystem: Ecology, restoration and management. Proceedings of the eighteenth Tall Timbers fire ecology conference. Tall Timbers Research Station, Tallahassee, FL.

Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina. Third approximation. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program, Raleigh. 325 pp.

Stout, I. J., and W. R. Marion. 1993. Pine flatwoods and xeric pine forests of the southern (lower) coastal plain. Pages 373-446 in: W. H. Martin, S. G. Boyce, and A. C. Echternacht, editors. 1993. Biodiversity of the southeastern United States: Lowland terrestrial communities. John Wiley and Sons, New York.
Taylor, T. B. 2003. Arthropod assemblages on longleaf pines: A possible link between the red-cockaded woodpecker and groundcover vegetation. M.S. thesis, Virginia Polytechnic Institute and State University, Blacksburg. 106 pp.
Turner, R. L., J. E. Van Kley, L. S. Smith, and R. E. Evans. 1999. Ecological classification system for the national forests and adjacent areas of the West Gulf Coastal Plain. The Nature Conservancy, Nacogdoches, TX. 95 pp. plus appendices.

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1. Forest & Woodland
1.B.1.Na. Southeastern North American Forest & Woodland

G190. Wet-Mesic Longleaf Pine Open Woodland

Type Concept Sentence: These wet open woodlands are dominated by *Pinus palustris*, sometimes with *Pinus elliottii var. elliottii, Pinus serotina*, or *Pinus taeda*, with a grass-dominated ground cover with many wetland graminoid plants. It occurs in the Southern Coastal Plain.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.1.Na.1. Longleaf Pine Woodland (M007)

Elcode: G190
***Scientific Name:** *Pinus palustris - Pinus elliottii - Pinus serotina* Open Woodland Group
***Common (Translated Scientific) Name:** Longleaf Pine - Slash Pine - Pond Pine Open Woodland Group
***Colloquial Name:** Wet-Mesic Longleaf Pine Open Woodland

***Type Concept:** This group encompasses the wet and mesic pine savanna vegetation of the (mainly outer) coastal plains of the United States from southern Virginia to Texas. This group includes wet pine flatwoods and wet pine savannas. These habitats are characterized by poorly drained, somewhat poorly drained, and seasonally saturated mineral soils with at least seasonally high water tables. Examples occur on a wide range of soil textures. This variability in soil texture strongly affects the composition of the ground cover, which is itself an important factor in distinguishing among the different plant associations in this group. In natural condition, canopies are open and dominated by *Pinus palustris*, sometimes with *Pinus elliottii var. elliottii, Pinus serotina*, or *Pinus taeda*. In south Florida, very open stands are naturally dominated by *Pinus elliottii var. densa*. There is a diverse mix of grasses, herbs, and low shrubs that comprise the ground layer in high-quality stands of this vegetation. Grasses are typically dominant, but there is often a large diversity of other herbs. Among the grasses, *Aristida stricta* or *Aristida beyrichiana* often dominate within their ranges, but *Ctenium aromaticum, Muhlenbergia expansa, Schizachyrium scoparium, Sporobolus floridanus, Sporobolus pinetorum, Sporobolus teretifolius, Andropogon capillipes*, other *Andropogon* spp., or other grasses may also dominate. Understory conditions may be dramatically altered by fire frequency and seasonality. Exposure to frequent, low-intensity fires in the transition from dry springs to wet summers (with a short fire-return interval ranging typically from 1 to 2 years, and less commonly to 3 or 4 years) is the dominant natural ecological process structuring the savanna physiognomy and along with hurricanes, influencing the local biodiversity. In some parts of the coastal plain, this vegetation historically constituted one of the most extensive types in the region. Widespread alterations, which followed European settlement, including changes to natural fire regimes, have produced drastic changes to this group, and few large examples are extant that are managed using historical fire regimes. At present, many areas have undergone long periods of time without fire, and this has resulted in greater dominance by shrubs and *Serenoa repens*, as well as denser canopies of *Pinus elliottii* rather than *Pinus palustris*. The ground cover of low-elevation pine savannas also are being invaded by non-native plant species that include grasses, such as *Imperata cylindrica*, shrubs such as *Ligustrum sinense* and *Triadica sebifera*, and climbing ferns *Lygodium japonicum* and *Lygodium microphyllum*.

***Diagnostic Characteristics:** The stands of this group are naturally open, wet woodlands or savannas, dominated by tall evergreen needle-leaved trees (*Pinus palustris, Pinus serotina, Pinus elliottii*) with a grass-dominated herbaceous layer. They occur on wet flats with mineral soil in the middle and outer coastal plains of the southeastern United States. The presumed fire-return time is between 1 and 3 years, and without this disturbance, broad-leaved trees and shrubs may occupy more of the midstory of stands, altering its character and composition.

***Classification Comments:** This group is found in a macrogroup that is part of 1.B.1.Na Southeastern North American Forest & Woodland Division (D006), but this definition includes vegetation that may have tree cover to as low as 10%, thereby accommodating savannas as conventionally defined. The variation among associations in this group will be accounted for in the delimiting of the component alliances (e.g., *Pinus palustris* versus *Pinus elliottii*, "flatwoods" versus "savannas," etc.). Unfortunately, nomenclature offered by various workers has often been inconsistent and contradictory, particularly regarding moisture conditions (e.g., mesic pine forest, wet savanna, flatwoods, etc.) (Rheinhardt et al. 2002). Despite this possible confusion, the concepts of "flatwoods" and "savannas" are employed in local classification and conservation practice, as in several state Natural Heritage Programs (e.g., Florida, North Carolina, Louisiana). For example, in Louisiana, two different Natural Heritage communities are recognized: *Pinus palustris* "flatwoods" (which are mesic to dry-mesic [non-wetland] stands) and the true "savannas" which occupy poorly drained and seasonally saturated/flooded depressional areas and low flats. It should also be pointed out that the Louisiana flatwoods are not synonymous with Florida flatwoods and do not share many species. The pH of Louisiana flatwoods is circumneutral and that in Florida flatwoods is very low (acidic). The degree of saturation of the soils and particularly the relationship between fire and flooding (Platt et al. 2006b) is critical to the formation and maintenance of the more open savanna types as distinguished by the Louisiana Heritage Program (B. Platt pers. comm. 2012). This distinction between "flatwoods" and "savannas" has informed the delineation of this and related groups; however, the "dry-mesic" types of flatwoods may be found in the non-wetland *Pinus palustris*-related vegetation Dry-Mesic Loamy Longleaf Pine Woodland Group (G009), depending on their floristic composition. The membership of associations in these groups largely follows Peet (2006). The cited map in Peet and Allard (1993) includes a part of Georgia in the East Gulf Coastal Plain as part of the "Coastal Flatlands." This area is part of Level III Ecoregion 65, not 75 of EPA (Griffith et al. 2001). This distributional inconsistency needs to be resolved. See newer map in Peet (2006). No associations have currently been described in the USNVC for the South Florida components of this group. More information may be available in DeCoster et al. (1999).

Soil texture is probably the most important factor determining variation in these sites and vegetation.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G596	Mesic Longleaf Pine Flatwoods - Spodosol Woodland	
G009	Dry-Mesic Loamy Longleaf Pine Woodland	
G553	Southeastern Native Ruderal Flooded & Swamp Forest	
G111	Atlantic & Gulf Coastal Plain Pondshore & Wet Prairie	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Stands of this group are naturally open woodlands or savannas, dominated by tall evergreen needle-leaved trees. Without frequent fire, broad-leaved trees and shrubs may occupy more of the midstory of the stand.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Stands of this group naturally occur as woodlands or savannas dominated by *Pinus palustris* or, less frequently, by *Pinus serotina, Pinus elliottii*, or some combination of these. Hardwood trees are present in any abundance only if composition has been altered by the lack of fire. Shrub cover is patchy and variable. The ground cover is a dense combination of herbs (grasses and forbs) and low shrubs. A variety of ericaceous shrubs and *Ilex* spp. is common, with their height and density determined by time since most recent fire. Shrubs may include *Quercus geminata, Quercus minima, Quercus pumila, Serenoa repens, Cyrilla racemiflora, Ilex coriacea, Ilex glabra, Ilex vomitoria, Vaccinium darrowii, Vaccinium myrsinites*, and *Lyonia lucida*, as well as *Morella cerifera* and *Baccharis halimifolia* in near-coastal habitats. Grasses naturally dominate the ground cover (Streng et al. 1993). *Aristida stricta* or *Aristida beyrichiana* often dominate within their ranges, but *Ctenium aromaticum, Muhlenbergia expansa, Schizachyrium scoparium*, other *Schizachyrium* spp., *Sporobolus floridanus, Sporobolus pinetorum, Sporobolus teretifolius, Dichanthelium* spp., *Andropogon capillipes*, other *Andropogon* spp., and/or other grasses and sedges, including *Rhynchospora* spp. may also dominate. A great diversity of other herbs is often present, including composites, legumes, insectivorous plants, and variety of showy forbs. Some forbs may include *Symphyotrichum* spp., *Helianthus* spp., *Liatris* spp., *Carphephorus* spp., *Solidago* spp., *Tephrosia* spp., *Crotalaria* spp., *Rhynchosia* spp., *Baptisia* spp., *Agalinis* spp., as well as *Sarracenia* spp., *Polygala* spp., and many others. The vegetation of this group is highly diverse and variable; the dominant species in the overstory and ground cover change across the Southeastern Coastal Plain, with the dominant species frequently not overwhelmingly dominant and therefore a number of species may share dominance, and in addition there is a high level of endemism among the dominant species in a given area. Lack of fire and past overgrazing have limited grass dominance, and the most common species often are shrubs, both native, such as *Ilex coriacea, Ilex glabra*, and *Morella cerifera*, and invasive exotic plant species, such as *Ligustrum sinense* and *Triadica sebifera*. Other non-native plant species include climbing ferns *Lygodium japonicum* and *Lygodium microphyllum* (Platt and Gottschalk 2001, Platt et al. 2006b, Leichty et al. 2011).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**

***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Exposure to frequent, low-intensity fires in the transition from dry springs to wet summers (with a short fire-return interval ranging typically from 1 to 2 years, and less commonly to 3 or 4 years) (Huffman et al. 2004, Beckage et al. 2009, Slocum et al. 2010) is the dominant natural ecological process structuring the savanna physiognomy (Gilliam et al. 2006) and along with hurricanes, influencing the local biodiversity (Platt et al. 2006b). In some parts of the coastal plain, this vegetation historically constituted one of the most extensive types in the region. Widespread alterations, which followed European settlement, including changes to natural fire regimes, have produced drastic changes to this group, and few large examples are extant that are managed using historical fire regimes (e.g., Platt et al. 2006b).

Frequent fire, historically caused by lightning and by people, is the predominant natural disturbance of this group and is crucial in maintaining its open structure and composition. Communities naturally burned every few years, many averaging as often as every 1 to 2 years. Fires are naturally low to moderate in intensity. They burn above-ground parts of herbs and shrubs but have little effect on the fire-tolerant *Pinus* spp. trees, except for seedlings. It is the frequent fire that keeps these communities open savanna. Vegetation recovers very quickly from fire during the growing season, with plants reappearing in just a few weeks, most prominently in the finer-textured soils. Many plants have their flowering triggered by burning (Platt et al. 1988). In the absence of fire, the shrubs increase and hardwoods invade, their seeds brought in by birds (Hinman et al. 2008). Herb layer density and diversity decline after just a couple of years without fire. In natural condition, examples are generally open with a variety of low-shrub and grass species forming a dense ground cover. Frequent, low-intensity fire was the dominant natural ecological disturbance. Natural stochastic variation in fire was likely important, as was the relative flammability of the vegetation, in determining the relative intensity of fire and its effects on vegetation at a local scale (Beckage et al. 2009, Gagnon et al. 2010). At present, many areas have undergone long periods of time without fire, and this has resulted in greater dominance by shrubs, such as *Ilex coriacea, Ilex glabra, Morella cerifera*, and *Serenoa repens*, as well as denser canopies of *Acer rubrum* and *Pinus elliottii var. elliottii* rather than *Pinus palustris* (Huffman and Judd 1998, Noel et al. 1998).

Under natural conditions, the overstories were multi-aged (Platt et al. 1988), consisting of a fine mosaic of small even-aged groves driven by gap-phase regeneration and hurricanes that opened stands periodically (Platt and Rathbun 1993, Noel et al. 1998, Gilliam et al. 2006). Longleaf pine is shade-intolerant and slow to reach reproductive age but is very long-lived, with some trees in old-growth stands 200-500 years of age (West et al. 1993). Many herbaceous perennial plants live a long time and flower in response to fire. Other plants persist as dormant seeds which germinate after fire or after hurricanes open stands. The Federally endangered red-cockaded woodpecker (*Picoides borealis*) nests in older but live trees of *Pinus palustris*. Wet-mesic longleaf pine woodlands support many reptile and amphibian species. Some insect populations recolonize burned areas from nearby unburned patches. Sites managed with late spring or growing season prescribed fire provide high arthropod biomass (James et al. 2001, Taylor 2003).

The unifying feature of this group is wet mineral soils associated with a high frequency of fire. Variation in soil texture appears to be a primary driver of differences among associations within the group, with biogeography also important. Communities in this group are often very high in species richness, with some of the highest values measured anywhere at the 1/10-hectare, 1/100-hectare, and 1-square-meter levels (Peet and Allard 1993). However, some associations are naturally low to moderate in species richness.

ENVIRONMENT

Environmental Description: The vegetation of this group occurs on wet mineral soil sites, in the middle and outer coastal plains. Typical landforms on which it is found include broad, poorly drained clayey, loamy or sandy flats, coastal alluvial plains, as well as low areas in relict beach ridge systems and eolian sand deposits. Examples are found on relatively recent (Pliocene-Pleistocene) geologic formations. Stands occasionally occur on river terraces above current flood levels and on perched water tables. Soils vary in texture from clayey to sandy, with no accumulations of organic surface layer (although they may be buried beneath surface sands). Soils are seasonally saturated due to high water table or poor soil drainage. The degree of seasonal saturation varies greatly among sites and depends on water supply, impediments to drainage, and evaporation.

DISTRIBUTION

***Geographic Range:** This vegetation ranges from eastern Texas and Louisiana, across the Gulf Coastal Plain to Florida (with one distinctive set of associations ranging into south Florida), and north in the Atlantic Coastal Plain to southern Virginia.
Nations: US
States/Provinces: AL, FL, GA, LA, MS, NC, SC, TX, VA
USFS Ecoregions (2007) [optional]: 232B:CC, 232C:CC, 232D:CC, 232F:CC, 232G:CC, 232H:CC, 232I:CC, 232J:CC, 232L:CC

Omernik Ecoregions L3, L4 [optional]: 8.3.5.65c:?, 8.3.5.65l:?, 8.3.5.65m:?, 8.3.7.35e:C, 8.3.7.35f:C, 8.3.7.35g:C, 8.5.1.63e:C, 8.5.1.63g:C, 8.5.1.63h:C, 8.5.2.73h:C, 8.5.3.75a:C, 8.5.3.75b:C, 8.5.3.75c:C, 8.5.3.75d:C, 8.5.3.75f:C, 8.5.3.75h:?, 8.5.3.75j:C, 9.5.1.34a:C, 9.5.1.34g:C, 15.4.1.76b:C, 15.4.1.76c:C

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3305	*Pinus palustris - Pinus serotina* Atlantic Coastal Plain Wet Open Woodland Alliance
A4104	*Pinus palustris - Pinus elliottii* East Gulf Coastal Plain Wet Open Woodland Alliance
A3306	*Pinus palustris* West Gulf Coastal Plain Wet Open Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Longleaf-Blackgum Savannahs	Ajilvsgi 1979	
<	Pine Forest	Duever et al. 1986	
=	Wet Flatwoods	FNAI 2010a	
?	Wetland Pine Savanna	Marks and Harcombe 1981	

AUTHORSHIP

***Primary Concept Source [if applicable]:** R.K. Peet (2006)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne and C.W. Nordman

Acknowledgments [optional]: W.J. Platt

Version Date: 12 May 2015

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1. Forest & Woodland
1.B.1.Na. Southeastern North American Forest & Woodland

M885. Southeastern Coastal Plain Evergreen Oak - Mixed Hardwood Forest

Type Concept Sentence: These are primarily evergreen broadleaf forests, dominated by evergreen *Quercus* spp. (*Quercus virginiana, Quercus hemisphaerica*), and are found both along the coast and inland in the Southeastern Coastal Plain from North Carolina south and west to Texas.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.1.Na.2. Southeastern North American Forest & Woodland (D006)

Elcode: M885
***Scientific Name:** *Quercus virginiana - Quercus fusiformis - Quercus hemisphaerica* Forest Macrogroup
***Common (Translated Scientific) Name:** Live Oak - Texas Live Oak - Darlington Oak Forest Macrogroup
***Colloquial Name:** Southeastern Coastal Plain Evergreen Oak - Mixed Hardwood Forest

***Type Concept:** This macrogroup accommodates primarily evergreen broadleaf forests of the coastal plains of the southeastern United States from North Carolina south and west to Texas. Stands are dominated by *Quercus virginiana* and/or *Quercus hemisphaerica*, found from North Carolina south into Florida and west to Mississippi, as well as stands dominated by various combinations of *Quercus fusiformis, Quercus geminata, Quercus hemisphaerica*, and/or *Quercus virginiana*, the particular combinations varying with geography, found from North Carolina to Florida and along the Gulf of Mexico coast from Florida to Texas. The near-coastal maritime examples are affected by coastal processes, and are prone to salt spray effects and storm surge from major hurricanes. The inland examples tend to occur on upper to mid slopes, but occasionally on broader uplands with reduced fire frequencies.

***Diagnostic Characteristics:** In the coastal plains, the various regionally variable combinations of *Quercus fusiformis, Quercus geminata, Quercus hemisphaerica*, and/or *Quercus virginiana* are diagnostic. For the maritime coastal examples of this macrogroup, *Quercus virginiana* is a strong diagnostic species. Pines, particularly *Pinus taeda*, may be present but are not diagnostic for this type.

***Classification Comments:** According to Nixon and Muller (1997), all "live oaks" of coastal Texas southwest of the Brazos are considered *Quercus fusiformis*, although these are likely introgressed with *Quercus virginiana* and/or the Mexican species *Quercus oleoides*.

There is vegetation that appears similar to this macrogroup but is found within the range of longleaf pine. Marks and Harcombe (1981) address this issue in relation to vegetation of the Big Thicket region of Texas, within the range of longleaf pine. Their "Upper Slope Pine Oak Forest" may represent successional vegetation which has developed under longer fire-return intervals on portions of the landscape which would have historically been occupied by longleaf pine-dominated vegetation if fire had been more frequent. In contrast, their "Mid Slope Oak Pine Forest" may actually represent examples of this vegetation macrogroup which occur adjacent to longleaf pine-dominated uplands, but which are found on lower slopes where fire is infrequent enough that longleaf pine is absent. More investigation of this question is needed.

Lee Elliott (pers. comm.) suggests that the *Quercus fusiformis* types of south Texas may be more closely related to Tamaulipan vegetation (*Prosopis, Colubrina, Celtis ehrenbergiana*) and that there is a need to recognize the relationship of these live oaks to *Quercus oleoides* of Mexico.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M008	Southern Mesic Mixed Broadleaf Forest	
M016	Southern & South-Central Oak - Pine Forest & Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are typically predominantly evergreen broadleaf or mixed evergreen-deciduous forests. *Quercus virginiana* stands are generally short-statured forests, where exposure to the wind and salt spray along the shore can impart a dwarfed and sculpted shape to the vegetation. Broadleaf evergreen shrubs are common and herbaceous plants are usually sparse.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: These are primarily evergreen forests of the coastal plains of the southeastern United States. From North Carolina west to Texas, these are forests dominated by evergreen *Quercus* spp., including broadleaf evergreen forests dominated by *Quercus hemisphaerica*, found from North Carolina south into Florida and west to Mississippi, as well as stands primarily dominated by *Quercus fusiformis, Quercus geminata, Quercus hemisphaerica*, and/or *Quercus virginiana*, found from North Carolina to Florida and along the Gulf of Mexico coast from Florida to Texas. In these forests, a wide variety of broadleaf evergreen shrubs are present, but the herbaceous cover is usually sparse. There is regional variation, both from north to south, and among coastward and landward examples. In Louisiana, *Celtis laevigata* may be a common canopy tree. Other canopy trees can include *Carya glabra, Carya pallida, Diospyros virginiana, Magnolia grandiflora, Pinus* spp., *Quercus nigra*, and *Sabal palmetto*. Understory trees and shrubs may include *Callicarpa americana, Conradina canescens, Erythrina herbacea, Ilex glabra, Ilex vomitoria, Juniperus virginiana var. silicicola, Morella cerifera, Persea borbonia, Persea palustris, Quercus chapmanii, Quercus geminata, Quercus myrtifolia, Serenoa repens, Sideroxylon* spp., *Vaccinium arboreum*, and *Zanthoxylum clava-herculis*. Vines can include *Parthenocissus quinquefolia, Smilax* spp., *Toxicodendron radicans*, and *Vitis* spp. Herbaceous plants are usually sparse and include *Chasmanthium* spp., *Dichanthelium* spp., *Mitchella repens, Panicum virgatum, Paspalum* spp., and *Scleria triglomerata*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Maritime *Quercus virginiana*-dominated examples are influenced by coastal processes. Coastal erosion and accretion cause shifting of coastal landforms. Hurricanes and other storms can knock down large areas of coastal forests, and the influence of salt spray limits the plants that can survive along the coast. Related more Inland examples occur in patches called hammocks, mottes, or cheniers. In Florida, lower frequency of growing-season fires apparently has contributed to the increased size and number of xeric hammocks (Myers 1990a). This oak hammock vegetation occurs as patches within the longleaf pine ecosystem. The litter of the broadleaf evergreen trees that dominate this vegetation does not readily burn, so fires that burn the surrounding longleaf pine habitats will generally not burn the hammocks.

ENVIRONMENT

Environmental Description: In the Atlantic Coastal Plain, these forests may occur in inland locations, as well as on barrier islands. Inland examples tend to occur on upper to mid slopes, but occasionally on broader uplands with reduced fire frequencies. A range of soils may be present from loamy and clayey to coarse sands, but soils are generally well-drained but not excessively drained. Soils are generally acidic, though calcareous soils occur occasionally. Sites are somewhat protected from most natural fires by steep topography and by limited flammability of the vegetation. Fires that penetrate these forests are generally low in intensity and have fairly limited ecological effect. Maritime forest examples are found on stabilized dunes and other related landforms composed of reworked well-drained coastal sands, which can be deep (>130 cm) (Drew et al. 1998). In Georgia, more mesic examples have relatively thin soils (to 50 cm) above clay. Topography varies from larger dunes to smaller ridges and swales, upland flat areas, salt domes, or coastal ridges called cheniers (in Louisiana). On the Atlantic Coast, these forests occur on the southeast coast of North Carolina and on the Sea Islands, a chain of low islands along the coast of South Carolina, Georgia, and northern Florida, from the Cooper River to the St. Johns River. The climate is warm-temperate and humid. Coastal hurricanes and other storms can be an important influence on this vegetation. Where these forests occur along the coast, they are prone to salt spray and storm surge from major hurricanes.

DISTRIBUTION

***Geographic Range:** These predominantly evergreen broadleaf forests are found in the coastal plains of the southeastern United States from North Carolina south into Florida and eastern Texas.
Nations: MX?, US
States/Provinces: AL, FL, GA, LA, MS, NC, SC, TX
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G798	Coastal Live Oak - Hickory - Palmetto Forest
G790	Southern Evergreen Oak Forest
G799	Texas Live Oak - Wax Mallow Motte & Coastal Forest

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-11-06	M157 Quercus hemisphaerica - Quercus virginiana - Pinus taeda Subxeric Forest Macrogroup	M157 replaced by M885

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** R.K. Peet, in Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne

Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by Judy Teague and Carl Nordman.

Version Date: 25 Nov 2014

REFERENCES

***References [Required if used in text]:**

Drew, M. B., L. K. Kirkman, and A. K. Gholson, Jr. 1998. The vascular flora of Ichauway, Baker County, Georgia: A remnant longleaf pine/wiregrass ecosystem. Castanea 63(1):1-24.

FNAI [Florida Natural Areas Inventory]. 1990. Guide to the natural communities of Florida. Florida Natural Areas Inventory and Florida Department of Natural Resources, Tallahassee. 111 pp.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Marks, P. L., and P. A. Harcombe. 1981. Forest vegetation of the Big Thicket, southeast Texas. Ecological Monographs 51:287-305.

Myers, R. L. 1990a. Scrub and high pine. Pages 150-193 in: R. L. Myers and J. L. Ewel, editors. Ecosystems of Florida. University of Central Florida Press, Orlando.

Nixon, K. C., and C. H. Muller. 1997. 5c. Quercus Linnaeus sect. Quercus. White oaks. Pages 471-506 in: Flora of North America Editorial Committee. Flora of North America, North of Mexico. Volume 3. Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, New York.

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1. Forest & Woodland

1.B.1.Na. Southeastern North American Forest & Woodland

G798. Coastal Live Oak - Hickory - Palmetto Forest

Type Concept Sentence: These are the more diverse, nutrient-rich *Quercus virginiana*-dominated, broad-leaved evergreen forests of coastal areas along the southern Atlantic and Gulf coasts, from North Carolina to Florida and west to Texas. Stands may also contain *Carya* species, *Celtis laevigata, Magnolia grandiflora*, or other species indicative of circumneutral or more nutrient-rich soils.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.1.Na.2. Southeastern Coastal Plain Evergreen Oak - Mixed Hardwood Forest (M885)

Elcode: G798

***Scientific Name:** *Quercus virginiana - Carya glabra - Sabal palmetto* Forest Group

***Common (Translated Scientific) Name:** Live Oak - Pignut Hickory - Cabbage Palmetto Coastal Forest Group

***Colloquial Name:** Coastal Live Oak - Hickory - Palmetto Forest

***Type Concept:** This group includes the more diverse, nutrient-rich *Quercus virginiana*-dominated, broad-leaved evergreen forests of coastal areas along the southern Atlantic coast, from North Carolina to Florida and along the Gulf of Mexico coast from Florida to Texas. Though common on barrier islands and the nearby mainland, these forests also occur inland, throughout northern Florida and also inland in Louisiana on salt domes. Most typical stands are dominated by *Quercus* spp., primarily *Quercus hemisphaerica* and/or *Quercus virginiana*. In Louisiana, *Celtis laevigata* may be a common canopy component, and *Pinus* species, particularly *Pinus taeda*, may be present. There are a wide variety of broad-leaved evergreen shrubs, but the herbaceous cover is sparse. While this vegetation is called maritime forest along the coast, inland the vegetation of this group occurs in patches called hammocks, mottes, or cheniers. These habitats are important for Neotropical migrant songbirds. The forests are now very much reduced due to commercial and residential development in coastal areas.

***Diagnostic Characteristics:** These are upland near-coastal forests, influenced by salt spray, and typically dominated by broad-leaved evergreen *Quercus virginiana* and/or *Quercus hemisphaerica*.

***Classification Comments:** According to Nixon and Muller (1997), all live oaks of coastal Texas northeast of the Brazos River are considered *Quercus virginiana*. Those southwest of the Brazos are considered *Quercus fusiformis*, although these are likely introgressed with *Quercus virginiana* and/or the Mexican species *Quercus oleoides*.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G007	Southern Mesic Beech - Magnolia - Oak Forest	
G790	Southern Evergreen Oak Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are broad-leaved evergreen forests, but examples can include deciduous trees as well, such as *Carya* species and *Celtis laevigata*. Generally these are short forests. When exposed to wind and salt spray along the shore, the vegetation can have a dwarfed and sculpted shape to it. Broad-leaved-evergreen shrubs are common and herbaceous plants are usually sparse.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Most typical stands are dominated primarily by *Quercus hemisphaerica* and/or *Quercus virginiana*. There is a wide variety of broad-leaved evergreen shrubs, but the herbaceous cover is usually sparse. There is regional variation, both from north to south, and between coastward and landward examples. In Louisiana, *Celtis laevigata* may be a common canopy tree. Other canopy trees can include *Carya glabra, Carya pallida, Diospyros virginiana, Magnolia grandiflora, Pinus* spp., *Quercus nigra*, and *Sabal palmetto*. Understory trees and shrubs may include *Callicarpa americana, Conradina canescens, Erythrina herbacea, Ilex glabra, Ilex vomitoria, Juniperus virginiana var. silicicola, Morella cerifera, Persea borbonia, Persea palustris, Quercus chapmanii, Quercus geminata, Quercus myrtifolia, Serenoa repens, Sideroxylon* spp., *Vaccinium arboreum*, and *Zanthoxylum clava-herculis*. Vines can include *Parthenocissus quinquefolia, Smilax* spp., *Toxicodendron radicans*, and *Vitis* spp. Herbaceous plants are usually sparse and include *Chasmanthium* spp., *Dichanthelium* spp., *Mitchella repens, Panicum virgatum, Paspalum* spp., and *Scleria triglomerata*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The dynamics of this evergreen forest are influenced by coastal processes. Coastal erosion and accretion cause shifting of coastal landforms. Hurricanes and other storms can knock down large areas of coastal forests, and the influence of salt spray limits the plants that can survive along the coast. Inland, the vegetation of this group occurs in patches called hammocks, mottes, or cheniers. In Florida, there has been an increase in the size and number of hammocks, occurring as patches within the longleaf pine ecosystem. Lower frequency of growing-season fire apparently has contributed to the increased size and number of these xeric hammocks (Myers 1990a). The litter of the broadleaf evergreen trees that dominate this forest group does not readily burn, so fires that burn the surrounding longleaf pine habitats will generally not burn these hammocks.

ENVIRONMENT

Environmental Description: The most characteristic examples occur as maritime forests on stabilized dunes and other related landforms composed of reworked well-drained coastal sands, which can be deep (>130 cm) (Drew et al. 1998). Inland examples tend to occur on upper to mid slopes, but occasionally on broader uplands with reduced fire frequencies. A range of soils may be present from loamy and clayey to coarse sands, but soils are generally well-drained but not excessively drained. Soils are generally acidic, though calcareous soils occur occasionally. Sites are somewhat protected from most natural fires by steep topography and by limited flammability of the vegetation. Fires that penetrate these forests are generally low in intensity and have fairly limited ecological effect.

Climate: Warm-temperate, humid. Coastal hurricanes and other storms can be an important influence on this vegetation. *Soil/substrate/hydrology:* This forest group generally occurs on sands, but some occurrences are on calcareous soils. In Georgia, more mesic examples of this system have relatively thin soils (to 50 cm) above clay, while xeric examples occupy deep (>130 cm) well-drained sands (Drew et al. 1998). Topography varies from larger dunes to smaller ridges and swales, upland flat areas, salt domes, or coastal ridges called cheniers (in Louisiana). On the Atlantic coast, these forests occur on the southeast coast of North Carolina and on the Sea Islands, a chain of low islands along the coast of South Carolina, Georgia, and northern Florida, from the Cooper River to the St. Johns River. Where these forests occur along the coast, they are prone to salt spray and storm surge from major hurricanes.

DISTRIBUTION

***Geographic Range:** The range is from coastal North Carolina south to Florida and west to Texas. It is predominantly found near the coast, but occurs throughout northern Florida.
Nations: US
States/Provinces: AL, FL, GA, LA, NC, SC, TX
USFS Ecoregions (2007) [optional]: 232C:CC, 232E:CC, 232L:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0372	*Quercus hemisphaerica - Carya glabra - Magnolia grandiflora* Forest Alliance
A0374	*Quercus virginiana - Celtis laevigata* Chenier Forest Alliance
A3192	*Quercus virginiana - Sabal palmetto* Coastal Evergreen Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-11-25	G740 Quercus hemisphaerica Coastal Plain Forest Group	G740 & G746 merged/split into G790, G798, G799
2014-11-25	G006 Quercus hemisphaerica - Quercus geminata - Quercus virginiana Forest Group	G740 & G746 merged/split into G790, G798, G799
2014-11-25	G746 Quercus virginiana Coastal Forest Group	G740 & G746 merged/split into G790, G798, G799

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** B.W. Wells (1939)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman
Acknowledgments [optional]: T. Wentworth
Version Date: 12 May 2015

REFERENCES

***References [Required if used in text]:**

Drew, M. B., L. K. Kirkman, and A. K. Gholson, Jr. 1998. The vascular flora of Ichauway, Baker County, Georgia: A remnant longleaf pine/wiregrass ecosystem. Castanea 63(1):1-24.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Myers, R. L. 1990a. Scrub and high pine. Pages 150-193 in: R. L. Myers and J. L. Ewel, editors. Ecosystems of Florida. University of Central Florida Press, Orlando.

Nixon, K. C., and C. H. Muller. 1997. 5c. Quercus Linnaeus sect. Quercus. White oaks. Pages 471-506 in: Flora of North America Editorial Committee. Flora of North America, North of Mexico. Volume 3. Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, New York.

Wells, B. W. 1939. A new forest climax: The salt spray climax of Smith Island, N.C. Bulletin of the Torrey Botanical Club 66:629-634.

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1. Forest & Woodland
1.B.1.Na. Southeastern North American Forest & Woodland

G790. Southern Evergreen Oak Forest

Type Concept Sentence: This group includes broad-leaved evergreen forests of coastal areas in the southern Atlantic Coastal Plain, from North Carolina south into Florida and west to Alabama, dominated variably by *Quercus hemisphaerica, Quercus geminata*, and/or *Quercus nigra*. *Pinus* species, particularly *Pinus taeda*, may also be present.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.1.Na.2. Southeastern Coastal Plain Evergreen Oak - Mixed Hardwood Forest (M885)

Elcode: G790
***Scientific Name:** *Quercus hemisphaerica - Quercus geminata - Quercus nigra* Coastal Plain Forest Group
***Common (Translated Scientific) Name:** Sand Laurel Oak - Sand Live Oak - Water Oak Coastal Plain Forest Group
***Colloquial Name:** Southern Evergreen Oak Forest

***Type Concept:** This group includes broad-leaved evergreen forests of coastal areas in the southern Atlantic Coastal Plain, from North Carolina south into Florida and west to Alabama. These forests occur in inland portions of the Coastal Plain, as well as on barrier islands, bayside shores, and related near-coastal environments. Most typical stands are dominated by *Quercus* spp., primarily *Quercus hemisphaerica*, but also *Quercus falcata, Quercus geminata, Quercus nigra*, and *Quercus virginiana*. In addition, *Pinus* species, particularly *Pinus taeda*, may be present. There are two suites of vegetation types placed here, represented by the two member alliances. One of these includes dry inland hammocks dominated by *Quercus geminata*, often with *Serenoa repens*. The other includes dry-mesic to mesic forests of lower and adjacent upper coastal plains, including those found in fire-sheltered topographic situations, or in fire-prone topographic situations from which fire has been excluded.

***Diagnostic Characteristics:** These are upland forests of the outer coastal plains of the southeastern United States, dominated by a mixture of broad-leaved evergreen trees, broad-leaved deciduous trees, and needle-leaved evergreen trees.

***Classification Comments:** The related Coastal Live Oak - Hickory - Palmetto Forest Group (G798) includes vegetation of presumably more nutrient-rich environments, dominated primarily by *Quercus virginiana*, found on barrier islands but also on slopes and broad uplands further inland. These two groups, G790 and G798, were reworked on a floristic basis, instead of being "maritime" and "non-maritime."

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G007	Southern Mesic Beech - Magnolia - Oak Forest	

Elcode	Scientific or Colloquial Name	Note
G798	Coastal Live Oak - Hickory - Palmetto Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These forests are generally dominated by broad-leaved evergreen trees, particularly *Quercus geminata, Quercus hemisphaerica*, and/or *Quercus virginiana*. Examples can also include tardily deciduous trees, particularly *Quercus nigra*, and other deciduous *Quercus* spp., as well as needle-leaved evergreen trees, particularly *Pinus taeda*. The subcanopy and shrub layers are also a mixture of physiognomies, with broad-leaved evergreen shrubs and understory trees being diverse and prominent.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Most typical stands are dominated by broad-leaved evergreen *Quercus* spp., primarily *Quercus hemisphaerica* and/or *Quercus virginiana*, but also the deciduous or tardily deciduous *Quercus falcata, Quercus geminata, Quercus nigra*, and *Quercus virginiana*. *Pinus* species, particularly *Pinus taeda*, may also be present. One suite of communities included in this group are dry inland hammocks dominated by *Quercus geminata*. They often have *Serenoa repens*, and also may include *Lyonia ferruginea, Morella cerifera (= Myrica cerifera), Osmanthus americanus var. americanus, Persea borbonia*, and *Quercus myrtifolia*. Some characteristic shrubs include *Ilex vomitoria, Lyonia fruticosa, Serenoa repens*, and *Sideroxylon lanuginosum*. Inland subxeric hammocks of Florida are dominated by *Quercus geminata*, and may have other *Quercus* spp. The understory typically contains *Ilex opaca, Serenoa repens, Smilax* spp., *Vaccinium arboreum*, and *Vaccinium stamineum*. *Sabal etonia* is a characteristic shrub of stands on the Lake Wales Ridge. This group also contains dry-mesic to mesic forests of the lower and adjacent upper coastal plains; this vegetation is characteristically dominated or codominated by the evergreen oak *Quercus hemisphaerica*, typically with *Pinus taeda* and *Quercus nigra*. Other typical tree species found in these stands include *Ilex opaca var. opaca, Quercus falcata, Quercus geminata*, and *Quercus virginiana*. Other characteristic species may include *Lyonia lucida, Osmanthus americanus var. americanus, Persea borbonia, Persea palustris*, and *Vitis rotundifolia*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The critical environmental parameters of the dry-mesic to mesic component vegetation types include longer fire-return times than are found in adjacent pine-dominated vegetation. The litter of the broad-leaved evergreen trees that dominate this forest group does not readily burn, so fires that burn the surrounding longleaf pine habitats will generally not burn these hammocks. In natural types, this absence of fire naturally results from topographic position. In early-successional ruderal types, this relative absence of fire is the result of fragmentation of the landscape and loss of fine fuels in remaining fragments. In Florida, there has been an increase in the size and number of oak hammocks, occurring as patches within the longleaf pine ecosystem. Lower frequency of growing-season fires apparently has contributed to the increased size and number of these xeric hammocks (Myers 1990a).

ENVIRONMENT

Environmental Description: These forests occur in inland portions of the southern Atlantic Coastal Plain, as well as on barrier islands, bayside shores, and related near-coastal environments. The soils at sites with dry inland hammocks dominated by *Quercus geminata* typically contain deep, infertile sands. Habitat for these forests is decreasing and many associations are now rare. The dry-mesic to mesic forests of the lower and adjacent upper coastal plains typically occur in fire-sheltered topographic situations, or in more fire-prone topographic situations as the result of fire suppression. These environments include submesic to xeric upland sands of slopes and bluffs, topographically isolated ridges and other sandy uplands, and swamp islands. Some of these sites are called high hammocks or pioneer hammocks. Soils are typically sandy and nutrient-poor. Examples also occur on nutrient-poor sandy and gravelly sites where the topsoil has been lost due to heavy erosion.

DISTRIBUTION

***Geographic Range:** This vegetation is found from coastal North Carolina south into Florida and west to Alabama.
Nations: US
States/Provinces: AL, FL, GA, NC, SC
USFS Ecoregions (2007) [optional]: 232B:CC, 232C:CC, 232H:CC, 232I:CC, 232J:CC, 232K:CC, 232L:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0053	*Quercus hemisphaerica - Quercus nigra* Forest Alliance
A0052	*Quercus geminata - Serenoa repens* Dry Sclerophyll Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-11-25	G740 Quercus hemisphaerica Coastal Plain Forest Group	G740 & G746 merged/split into G790, G798, G799
2014-11-25	G006 Quercus hemisphaerica - Quercus geminata - Quercus virginiana Forest Group	G740 & G746 merged/split into G790, G798, G799
2014-11-25	G746 Quercus virginiana Coastal Forest Group	G740 & G746 merged/split into G790, G798, G799

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** M. Pyne, in Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne
Acknowledgments [optional]:
Version Date: 12 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Myers, R. L. 1990a. Scrub and high pine. Pages 150-193 in: R. L. Myers and J. L. Ewel, editors. Ecosystems of Florida. University of Central Florida Press, Orlando.

1. Forest & Woodland
1.B.1.Na. Southeastern North American Forest & Woodland

G799. Texas Live Oak - Wax Mallow Motte & Coastal Forest

Type Concept Sentence: This treed vegetation with an open to closed canopy is dominated by *Quercus fusiformis* and is interspersed with grasslands on deep sands in coastal and near-coastal areas of Texas south of the Brazos River.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.1.Na.2. Southeastern Coastal Plain Evergreen Oak - Mixed Hardwood Forest (M885)

Elcode: G799
***Scientific Name:** *Quercus fusiformis - Malvaviscus arboreus var. drummondii* Forest Group
***Common (Translated Scientific) Name:** Texas Live Oak - Wax Mallow Forest Group
***Colloquial Name:** Texas Live Oak - Wax Mallow Motte & Coastal Forest

***Type Concept:** This vegetation represents tall and short-statured woodlands, forest mottes, and savannas dominated by *Quercus fusiformis* occurring on deep sands in coastal and near-coastal areas of Texas south of the Brazoria River. Patch size may be small to large and examples are often associated with a matrix of deep sand grassland vegetation. The deep sands on which this vegetation occurs are relictual Pleistocene-aged barrier-strandplains, and Holocene-aged eolian deposits. Topography varies from larger dunes to smaller ridges and swales. Important processes include sand movement and moisture variability in the ridge-and-swale topography. In addition to *Quercus fusiformis*, the shrub *Malvaviscus arboreus var. drummondii*, vine *Vitis mustangensis*, and grasses and forbs *Froelichia floridana, Helianthemum georgianum, Paspalum plicatulum, Schizachyrium littorale*, and *Thelesperma nuecense* are also a fairly constant across the range of this group. Otherwise, species composition varies in a north-south gradient, with northern expressions including species more common in the southeastern U.S., and southern expressions including species more common in southern, southwestern and central Texas. Some examples of this vegetation have been very much reduced due to commercial and residential development in coastal areas.

***Diagnostic Characteristics:** This vegetation is characterized by *Quercus fusiformis* woodlands and forests occurring in the coastal plain of Texas south of the Brazos River. Other constant species include *Froelichia floridana, Helianthemum georgianum, Malvaviscus arboreus var. drummondii, Paspalum plicatulum, Schizachyrium littorale, Thelesperma nuecense*, and *Vitis mustangensis*.

***Classification Comments:** Live oak taxonomy follows that suggested by Nixon and Muller (1997), where all live oaks of coastal Texas southwest of the Brazos are considered *Quercus fusiformis*, likely introgressed with *Quercus virginiana* and/or the Mexican species *Quercus oleoides*. Though *Quercus fusiformis* is the dominant species across the range of this group, associated species vary in a north-south manner. There are probably more associations to be developed for this group. Northern expressions have more species with ranges extending to the northeast, such as *Callicarpa americana, Ilex vomitoria, Morella cerifera, Persea borbonia, Quercus hemisphaerica, Quercus marilandica, Smilax bona-nox*, and *Vitis mustangensis*. Southern expressions have species whose ranges extend to the west, such as *Condalia hookeri, Prosopis glandulosa*, and *Zanthoxylum hirsutum*. This northern and southern variability may warrant separate alliances, but more information is needed to make this determination. On the Ingleside Barrier strandplain, *Quercus fusiformis* may occur in dense patches of short-statured forests/shrublands (1.5-6 m in height). This "shrubland" variant may warrant separate classification. It often appears to be a monoculture of shrubby *Quercus fusiformis*, but may include emergent larger *Quercus fusiformis* trees. Present at Aransas National Wildlife Refuge, these "running-live oak" thickets could be considered a modified community that is the result of years of fire suppression and severe grazing pressures. Once this shrubland is established, it is difficult to restore the grassland community to these areas.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This vegetation consists of forests that form closed- to open-canopy "mottes" surrounded by grasslands, and open canopy savannas. It includes a variety of associations dominated or codominated by tree-sized *Quercus fusiformis*. Cover of shrub and field layers varies with canopy closure from sparse to dense.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This vegetation is characterized by *Quercus fusiformis* woodlands and forests occurring in the coastal plain of Texas south of the Brazos River. Other constant species include *Froelichia floridana, Helianthemum georgianum, Heteropogon contortus, Malvaviscus arboreus var. drummondii, Paspalum plicatulum, Schizachyrium littorale (= Schizachyrium scoparium ssp. littorale), Thelesperma nuecense*, and *Vitis mustangensis*. These communities are typically intermixed with grasslands, and open-canopy woodland ecotones are common between the forest and grassland components in these landscapes. Associated species vary in a north-south manner across the range of this group. Northern expressions have woody species with ranges extending to the northeast, such as *Callicarpa americana, Celtis laevigata, Ilex vomitoria, Morella cerifera, Persea borbonia, Quercus hemisphaerica, Quercus marilandica, Smilax bona-nox, Vaccinium arboreum*, and *Vitis mustangensis*. Other grass-like plants and forbs found in northern examples include *Andropogon gerardii, Croton glandulosus, Eriogonum multiflorum, Lechea mucronata, Liatris elegans var. carizzana, Palafoxia hookeriana, Paspalum setaceum, Physalis cinerascens var. spathulifolia, Scleria triglomerata, Scleria triglomerata, Sorghastrum nutans, Stylosanthes viscosa, Tradescantia humilis*, and *Trichoneura elegans*. Southern expressions have woody species whose ranges extend to the west, such as *Condalia hookeri, Prosopis glandulosa*, and *Zanthoxylum hirsutum*. Other grasses and forbs found in southern examples include *Acalypha radians, Argythamnia mercurialina var. pilosissima, Chamaecrista flexuosa var. texana, Cnidoscolus texanus, Croton argyranthemus, Dalea phleoides, Eragrostis* spp., *Froelichia floridana, Galactia canescens, Gaura mckelveyae, Monarda fruticulosa (= Monarda punctata var. fruticulosa), Phlox cuspidata, Rhynchosia americana*, and *Stillingia sylvatica*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Drought, grazing, fire, and the effects of hurricanes contribute to the dynamics of this vegetation.

ENVIRONMENT

Environmental Description: This vegetation occurs on deep sands of the Pleistocene-aged Ingleside barrier-strandplain and the Holocene- and Pleistocene-aged eolian sand deposits of the South Texas Sand Sheet. Sites are characterized by generally level to gently rolling, ridge-and-swale topography. Some dunes to a height of more than 15 m (50 feet) occur, adding significant relief. Low swales and round pothole wetlands typify low landscape positions, and significant drainage systems (in the form of streams) are generally lacking.

DISTRIBUTION

***Geographic Range:** This group is endemic to Texas. This vegetation is found on the Quaternary sands of the South Texas Sand Sheet in Kenedy and Brooks counties, as well as on the Ingleside barrier-strandplain along the Texas Coastal Bend south of the Brazos River. It is found within 10 km of the coast on deep sands of ancient Pleistocene strandplains (the Ingleside barrier-strandplain) at its northern extent, and within a much greater distance from the coast (100 km) on the Holocene-aged eolian sand deposits of the South Texas Sand Sheet (primarily Kenedy and Brooks counties but extending into adjacent Jim Hogg, Hidalgo, and Willacy counties) at its southern extent.
Nations: US
States/Provinces: TX
USFS Ecoregions (2007) [optional]: 255Da:CCC, 255Dc:CCC, 315Ea:CCC
Omernik Ecoregions L3, L4 [optional]: 9.5.1.34b:C, 9.5.1.34i:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3190	*Quercus fusiformis - Malvaviscus arboreus var. drummondii* Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-11-25	G740 Quercus hemisphaerica Coastal Plain Forest Group	G740 & G746 merged/split into G790, G798, G799
2014-11-25	G006 Quercus hemisphaerica - Quercus geminata - Quercus virginiana Forest Group	G740 & G746 merged/split into G790, G798, G799
2014-11-25	G746 Quercus virginiana Coastal Forest Group	G740 & G746 merged/split into G790, G798, G799

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** M. Pyne, in Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne and J. Teague

Acknowledgments [optional]: This description was built on the work of Bill Carr, Alan Weakley, Judy Teague, Lee Elliott, and David Diamond.

Version Date: 22 May 2015

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Nixon, K. C., and C. H. Muller. 1997. 5c. Quercus Linnaeus sect. Quercus. White oaks. Pages 471-506 in: Flora of North America Editorial Committee. Flora of North America, North of Mexico. Volume 3. Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, New York.

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1. Forest & Woodland
1.B.1.Na. Southeastern North American Forest & Woodland

M008. Southern Mesic Mixed Broadleaf Forest

Type Concept Sentence: The southern coastal plain vegetation of these broad-leaved ravine, bluff and slope forests typically includes many tree species such as *Fagus grandifolia, Magnolia grandiflora* (within its range), *Quercus alba, Pinus glabra* (east of the Mississippi River), *Carya* spp., *Liriodendron tulipifera, Liquidambar styraciflua, Acer floridanum, Acer rubrum, Nyssa sylvatica*, and *Fraxinus americana*.

OVERVIEW

***Hierarchy Level:** Macrogroup

***Placement in Hierarchy:** 1.B.1.Na.3. Southeastern North American Forest & Woodland (D006)

Elcode: M008
***Scientific Name:** *Fagus grandifolia - Magnolia grandiflora - Quercus alba* Forest Macrogroup
***Common (Translated Scientific) Name:** American Beech - Southern Magnolia - White Oak Forest Macrogroup
***Colloquial Name:** Southern Mesic Mixed Broadleaf Forest

***Type Concept:** This macrogroup occurs on the Gulf and Atlantic coastal plains on slopes, bluffs, or sheltered ravines where fire is naturally rare. It includes mixed evergreen broad-leaved forests within the warm-temperate climate zone, represented by the codominance of *Magnolia grandiflora*, within its range. Also included are deciduous broad-leaved forests on the inner coastal plains, north or inland of the range of *Magnolia grandiflora*. Stands are on mesic or dry-mesic sites on a variety of soils. The vegetation typically includes species such as *Fagus grandifolia, Magnolia grandiflora, Quercus alba, Pinus glabra* (east of the Mississippi River), *Carya* spp., *Liriodendron tulipifera, Liquidambar styraciflua, Acer floridanum, Acer rubrum, Nyssa sylvatica, Fraxinus americana, Magnolia acuminata, Magnolia macrophylla, Magnolia pyramidata*, and *Magnolia tripetala* (these four occur in scattered areas in the coastal plain). On sites with richer soils there tend to be spring ephemeral wildflowers typical of areas further north, such as *Trillium* spp. Examples in the Florida Panhandle have among the highest diversity of trees and shrubs of any forests in the United States.

***Diagnostic Characteristics:** The vegetation of these southern coastal plain forests includes species such as *Fagus grandifolia, Quercus alba, Magnolia grandiflora, Acer floridanum, Pinus glabra* (east of the Mississippi River), and other species of broadleaf evergreen or deciduous trees and shrubs, such as *Nyssa sylvatica, Fraxinus americana, Carya tomentosa, Carya glabra, Ulmus alata, Ulmus americana, Ulmus rubra, Liriodendron tulipifera*, and *Liquidambar styraciflua*.

***Classification Comments:** The range of this macrogroup includes warm-temperate forests with *Magnolia grandiflora* as well as coastal plain forests north and inland of the range of *Magnolia grandiflora*. See Greller (1989) for comments on the definition of this type.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M885	Southeastern Coastal Plain Evergreen Oak - Mixed Hardwood Forest	
M883	Appalachian-Interior-Northeastern Mesic Forest	
M016	Southern & South-Central Oak - Pine Forest & Woodland	occurs just to the north on a variety of sites in the coastal plain and Piedmont, perhaps some associations occurring in the cool temperate climatic zone need to be moved from M008 to M016.
M882	Central Midwest Mesic Forest	

Similar NVC Types General Comments [optional]: There is some area of overlap between M008 and M016, M882, M883 and M885. More in-depth and quantitative analysis of vegetation plot datasets could help inform and improve the USNVC for these macrogroups in the boundary area between the warm-temperate and cool-temperate climatic zones. The environment of G166 is described as cool-temperate (but includes both warm-temperate and cool-temperate vegetation), while G007 is entirely within the warm-temperate climatic zone.

VEGETATION

Physiognomy and Structure Summary: These are mesic forests on slopes and in ravines (and less frequently upper stream and river terraces) of the southern coastal plains typically with a combination of broad-leaved evergreen trees, broad-leaved deciduous trees, and evergreen needle-leaved trees. Stands lacking *Magnolia grandiflora* especially north of its range, are dominated by deciduous broad-leaved trees.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The vegetation of these forests typically includes species such as *Fagus grandifolia, Magnolia grandiflora, Quercus alba, Pinus glabra* (east of the Mississippi River), *Carya* spp., *Liriodendron tulipifera, Liquidambar styraciflua, Acer floridanum (= Acer barbatum), Acer rubrum, Nyssa sylvatica*, and *Fraxinus americana*. Trees and shrubs include both broad-leaved deciduous and evergreen species. The dominance of evergreen species increases to the south, especially within the range of *Magnolia grandiflora*. Needle-leaved evergreen species also may be present, such as *Pinus glabra* or *Pinus taeda*. North of the range of *Magnolia grandiflora*, broad-leaved evergreen shrubs and lianas may still be present, such as *Prunus caroliniana, Symplocos tinctoria, Persea palustris, Ilex opaca, Decumaria barbara, Smilax tamnoides (= Smilax hispida), Gelsemium sempervirens, Sabal minor*, and *Viburnum rufidulum*. Particularly on richer soil sites, there tend to be spring ephemeral wildflowers typical of areas further north, such as *Trillium* spp. Examples in the Florida Panhandle have the highest diversity of trees and shrubs of any forests in the United States (Platt and Schwartz 1990).

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In these forests, natural disturbance occurs in in the form of canopy gaps. These forests occur in ravines and on slopes near rivers or creeks, and are naturally protected from wildland fire. Wind and heavy rain from hurricanes can cause canopy gaps where trees are toppled or broken. Certain trees particularly benefit from canopy gaps and other canopy disturbances, these include *Liquidambar styraciflua, Pinus glabra*, and *Pinus taeda*.

ENVIRONMENT

Environmental Description: Sites are often found along slopes, bluffs, or sheltered ravines above perennial streams and rivers in the coastal plain region. This system occurs in limited areas on a variety of mesic to dry-mesic, upland sites. Some examples occur on mesic flats between drier pine-dominated uplands and floodplains or on local high areas within bottomland terraces or nonriverine wet flats. The climate zone is mainly warm-temperate, humid. Average rainfall is 100-150 cm (40-60 inches) annually. Greller (2013) describes the climatic relations of this type to other eastern U.S. and Asian cool-temperate forest types. *Soil/substrate/hydrology:* These sites mostly have moderate to high fertility and moisture retention. Soils can be quite variable, ranging from coarse to loamy in surface texture. Soils are not saturated for any significant time during the growing season and seldom are extremely dry. Soils developed from calcareous materials or rich alluvium may be basic; others are strongly acidic. Bluffs in Mississippi (such as along the eastern edge of the Mississippi Alluvial Plain) generally have loess soil, which is fine-textured. Richer and more mesic stands occur in more strongly concave areas with fine textured soil, including loess.

DISTRIBUTION

***Geographic Range:** The range of this forest macrogroup is from southeastern Maryland and eastern Virginia to central Florida, and west to Arkansas and eastern Texas. In Mississippi and Tennessee it occurs along the Loess Bluffs on the east side of the Mississippi River Alluvial Plain.
Nations: US
States/Provinces: AL, AR, DE?, FL, GA, LA, MD, MS, NC, SC, TN, TX, VA
USFS Ecoregions (2007) [optional]: 231B:CC, 231E:CC, 231G:CC, 231H:CC, 232B:CC, 232C:CC, 232F:CC, 232H:CC, 232I:CC, 232J:CC, 234D:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G007	Southern Mesic Beech - Magnolia - Oak Forest
G166	Southern Mesic Beech - Oak - Mixed Deciduous Forest

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Beech-Magnolia Forest	Braun 1950	
><	Floodplain Hardwood Pine Forest	Marks and Harcombe 1981	
><	Lower Slope Hardwood Pine Forest	Marks and Harcombe 1981	
=	Mesic Slope Forests	Edwards et al. 2013	
<	Mesophytic Mixed Hardwoods	Braun 1950	
=	Southeastern evergreen forests	Delcourt and Delcourt 2000	
=	Southern Mixed Hardwood Forest	Quarterman and Keever 1962	
=	Southern Mixed Hardwoods Group	Monk et al. 1989	
=	Temperate Hardwood Forest	Platt and Schwartz 1990	
=	southern mixed hardwoods	Monk et al. 1990	
=	upland mixed hardwoods	Christensen 2000	

AUTHORSHIP

***Primary Concept Source [if applicable]:** Monk et al. (1989)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman and R.K. Peet

Acknowledgments [optional]:

Version Date: 15 Oct 2014

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1. Forest & Woodland
1.B.1.Na. Southeastern North American Forest & Woodland

G007. Southern Mesic Beech - Magnolia - Oak Forest

Type Concept Sentence: This southern upland forest includes species such as *Fagus grandifolia, Magnolia grandiflora, Pinus glabra* (east of the Mississippi River), and other species representing a mixture of broadleaf evergreen and deciduous trees and shrubs, mostly occurring on slopes.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.1.Na.3. Southern Mesic Mixed Broadleaf Forest (M008)

Elcode: G007
***Scientific Name:** *Fagus grandifolia - Magnolia grandiflora - Quercus* spp. Forest Group
***Common (Translated Scientific) Name:** American Beech - Southern Magnolia - Oak species Forest Group
***Colloquial Name:** Southern Mesic Beech - Magnolia - Oak Forest

***Type Concept:** This group occurs on the southern Gulf and Atlantic coastal plains on slopes, bluffs, or sheltered ravines where fire is naturally rare. It is generally within the warm temperate broadleaf evergreen climate zone, represented by the range of *Magnolia grandiflora*. Stands are mesic or dry-mesic, and vegetation typically includes species such as *Fagus grandifolia, Magnolia grandiflora, Pinus glabra* (east of the Mississippi River), and other species rarely encountered outside this group in the region. Other canopy taxa may include *Quercus* spp., *Carya* spp., *Liriodendron tulipifera, Liquidambar styraciflua*, and others. There is a mixture of broadleaf evergreen and deciduous trees and shrubs, and there also tend to be spring ephemeral wildflowers typical of areas further north, such as *Trillium* spp. Some component associations are also found in temporarily flooded floodplains adjacent to these slopes, but this is primarily an upland type. Soils are generally deep, but can be quite variable in texture and reaction chemistry, ranging from coarse to loamy and from basic to acidic. They are not saturated for any significant time during the growing season and seldom, if ever, are extremely dry.

***Diagnostic Characteristics:** The vegetation typically includes species such as *Fagus grandifolia, Magnolia grandiflora, Pinus glabra* (east of the Mississippi River), and other species representing a mixture of broadleaf evergreen and deciduous trees and shrubs in southern upland forests, mostly on slopes.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G166	Southern Mesic Beech - Oak - Mixed Deciduous Forest	
G798	Coastal Live Oak - Hickory - Palmetto Forest	
G790	Southern Evergreen Oak Forest	
G034	Oak - Sweetgum Floodplain Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are mesic (and often rich) forests on slopes and in ravines (and less frequently upper terraces) of the southern coastal plains typically with a combination of broad-leaved evergreen trees, broad-leaved deciduous trees, and possibly evergreen needle-leaved trees. Woody plant diversity can be very high and forbs include spring ephemeral wildflowers.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Stands are mesic, and vegetation typically includes species such as *Fagus grandifolia, Magnolia grandiflora, Pinus glabra*, and other species rarely encountered outside of bluffs or ravines. All woody strata contain a mixture of evergreen and deciduous species. Canopies are diverse; in addition to the aforementioned taxa, other canopy taxa may include *Quercus alba, Quercus pagoda, Quercus michauxii, Quercus falcata, Quercus shumardii, Quercus velutina, Quercus laurifolia, Quercus nigra, Quercus hemisphaerica, Pinus echinata, Pinus taeda, Nyssa sylvatica, Fraxinus americana, Carya tomentosa (= Carya alba), Carya glabra, Ulmus alata, Ulmus americana, Ulmus rubra, Liriodendron tulipifera*, and *Liquidambar styraciflua* (NatureServe Ecology unpubl. data 2003). The presence of *Pinus taeda* is normal at lower frequencies, but higher ones may indicate past disturbance or removal of the hardwood canopy and subsequent increase of *Pinus taeda*. Additional subcanopy taxa may include *Acer floridanum (= Acer barbatum), Acer rubrum, Oxydendrum arboreum, Carpinus caroliniana ssp. caroliniana, Ostrya virginiana, Prunus caroliniana, Prunus serotina, Symplocos tinctoria, Persea palustris, Magnolia macrophylla, Halesia diptera, Styrax grandifolius, Sassafras albidum, Ilex opaca, Hamamelis virginiana, Magnolia pyramidata, Tilia americana var. caroliniana, Zanthoxylum clava-herculis, Crataegus marshallii, Morus rubra*, and *Cornus florida*. The shrub layer can be very diverse. Trees may support lianas and epiphytes. Shrubs and woody vines include *Illicium floridanum, Hydrangea quercifolia, Arundinaria gigantea, Halesia diptera, Aesculus pavia, Calycanthus floridus var. floridus, Toxicodendron radicans, Parthenocissus quinquefolia, Viburnum rufidulum, Viburnum dentatum, Ilex vomitoria, Berchemia scandens, Vitis rotundifolia, Decumaria barbara, Callicarpa americana, Nekemias arborea (= Ampelopsis arborea), Frangula caroliniana, Smilax tamnoides (= Smilax hispida), Gelsemium sempervirens, Sabal minor, Schisandra glabra, Lindera benzoin, Asimina parviflora, Cornus drummondii, Bignonia capreolata*, and *Euonymus americanus*. Except in gaps, herbs are scarce (Batista and Platt 1997). Herbs and herbaceous vines include *Thelypteris kunthii, Cystopteris protrusa, Viola walteri, Polystichum acrostichoides, Galium obtusum, Chasmanthium sessiliflorum, Aristolochia serpentaria, Trillium foetidissimum, Desmodium nudiflorum, Lithospermum tuberosum, Boehmeria cylindrica, Ageratina altissima var. altissima, Sanicula canadensis, Sanicula marilandica, Arisaema dracontium, Tillandsia usneoides, Cryptotaenia canadensis, Adiantum pedatum, Passiflora lutea, Cynoglossum virginianum, Botrychium virginianum, Ranunculus recurvatus, Mikania scandens*, and *Clematis crispa* (NatureServe Ecology unpubl. data 2003).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In these forests, natural disturbance occurs in canopy gaps. These forests occur in ravines and on slopes near rivers or creeks, and are naturally protected from wildland fire. Wind and heavy rain from hurricanes can cause canopy gaps where trees are toppled or broken.

ENVIRONMENT

Environmental Description: Sites are often found along slopes, bluffs, or sheltered ravines above perennial streams in the region. This mesic habitat is confined to very limited, fire-sheltered areas within the natural ranges of *Pinus glabra* (east of the Mississippi River) (Kossuth and Michael 1990) and *Magnolia grandiflora* (Outcalt 1990). This system occurs in a variety of moist, non-wetland sites. Most common are lower slopes along streams and rivers in dissected terrain, but some examples occur on mesic flats between drier pine-dominated uplands and floodplains or on local high areas within bottomland terraces or nonriverine wet flats. There may be larger patches where side-drains join larger streams. *Climate:* The climate is warm temperate, humid. Most of the sites where this forest occurs can be influenced by hurricanes, wind and heavy rain. Average rainfall is 100-150 cm (40-60 inches) annually. *Soil/substrate/hydrology:* These sites have moderate to high fertility and moisture retention. Soils can be quite variable, ranging from coarse to loamy in surface texture. Soils are not saturated for any significant time during the growing season and seldom, if ever, are extremely dry. Soils developed from calcareous materials or rich alluvium may be basic; others are strongly acidic. Bluffs in southern Mississippi generally have loess soil, which is fine-textured. Richer and more mesic stands occur in more strongly concave and finer-textured areas.

DISTRIBUTION

***Geographic Range:** The range of this forest group is from southern South Carolina to central Florida, and west to eastern Texas.
Nations: US
States/Provinces: AL, FL, GA, LA, MS, SC, TX
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0369	*Fagus grandifolia - Magnolia grandiflora* Forest Alliance
A3115	*Quercus alba - Quercus nigra - Sabal minor* Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Beech-Magnolia Forest	Braun 1950	
><	Beech-Magnolia-Loblolly Slopes	Ajilvsgi 1979	
><	Floodplain Hardwood Pine Forest	Marks and Harcombe 1981	
><	Lower Slope Hardwood Pine Forest	Marks and Harcombe 1981	
=	Southern Mixed Hardwood Forest	Quarterman and Keever 1962	

AUTHORSHIP

***Primary Concept Source [if applicable]:** E.L. Braun (1950)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman
Acknowledgments [optional]: The work of E.L. Braun, E. Quarterman and C. Keever provided a foundation for the better understanding of these diverse southern upland hardwood forests.
Version Date: 12 May 2015

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1. Forest & Woodland
1.B.1.Na. Southeastern North American Forest & Woodland

G166. Southern Mesic Beech - Oak - Mixed Deciduous Forest

Type Concept Sentence: This vegetation consists of tall (25-32 m), productive and diverse forests primarily dominated by deciduous broad-leaved trees of the inner coastal plains of the southeastern United States; they occur in a variety of mesic fire-sheltered sites from near sea level to about 125 m (400 feet) in the loess hills and bluffs.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.1.Na.3. Southern Mesic Mixed Broadleaf Forest (M008)

Elcode: G166
***Scientific Name:** *Fagus grandifolia - Acer floridanum - Quercus alba* Forest Group
***Common (Translated Scientific) Name:** American Beech - Southern Sugar Maple - White Oak Forest Group
***Colloquial Name:** Southern Mesic Beech - Oak - Mixed Deciduous Forest

***Type Concept:** This group is composed of tall (25-32 m), productive and diverse forests primarily dominated by deciduous broad-leaved trees of the inner coastal plains of the southeastern United States. They occur from near sea level to about 125 m (400 feet) in the loess hills and bluffs. Examples of this group occur in a variety of mesic fire-sheltered sites, including lower slopes, bluffs and ravines, mesic flats, and local topographic high areas within bottomland terraces or wet flats. Stands are characteristically dominated by *Fagus grandifolia* in combination with *Acer floridanum* and/or *Quercus alba*. Some stands may exhibit codominance or perhaps dominance by *Quercus* spp., but the most mesic stands may lack oaks. If *Quercus* spp. are dominant, then a suite of herbs characteristic of mesic forests will be diagnostic. *Quercus rubra* will be important only north of 35°N latitude, and *Pinus taeda* conversely of greater importance to the south. Other hardwood species include *Acer rubrum, Fraxinus americana, Liquidambar styraciflua, Liriodendron tulipifera, Nyssa sylvatica, Magnolia acuminata* (of local distribution), and *Tilia americana*. Upland and bottomland oaks at the mid range of moisture tolerance are usually also present, particularly *Quercus alba*, but sometimes also *Quercus falcata, Quercus michauxii, Quercus nigra, Quercus pagoda*, and/or *Quercus shumardii*. *Pinus taeda* is sometimes present, but it is unclear if it is a natural component or has entered only as a result of past cutting. Some subcanopy components include *Carpinus caroliniana, Cornus florida, Diospyros virginiana, Ilex opaca, Magnolia macrophylla, Ostrya virginiana, Oxydendrum arboreum*, and *Ulmus alata*. Shrubs and woody vines include *Decumaria barbara, Rhododendron canescens, Smilax glauca, Toxicodendron radicans*, and *Vitis rotundifolia*. Important herbs include *Hexastylis arifolia, Mitchella repens*, and *Polystichum acrostichoides*.

***Diagnostic Characteristics:**

***Classification Comments:** The range of this group is defined as being north of the range of *Magnolia grandiflora* as mapped by Outcalt (1990) and *Pinus glabra* as mapped by Kossuth and Michael (1990), which excludes the warm temperate "beech-magnolia" forests to the south of its range. Some species that are excluded from the coastal plain farther south are common components farther north. In Maryland and the District of Columbia, the vegetation of this group can extend into the Piedmont, straddling the fall zone where the Coastal Plain and Piedmont meet. Besides the variation across this group's range, there are two significant gradients worthy of mention. Acidic and basic substrates have substantial floristic differences. Variants on upland slopes, nonriverine swamp islands, and high ridges in bottomlands are also noteworthy. Floristic differences may exist between these variants, but they are subtle and do not appear to be definitive at the group level, they may help to define alliances, for example.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G007	Southern Mesic Beech - Magnolia - Oak Forest	
G020	Appalachian-Central Interior Mesic Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Stands of this group have deciduous canopies and are composed of tall (20-35 m) trees.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Stands of this group are dominated by *Fagus grandifolia* or this species in combination with *Acer floridanum (= Acer barbatum)* (or *Acer saccharum*) and/or *Quercus alba*. The most characteristic feature of the vegetation in some examples may be *Fagus grandifolia*, but a variety of other hardwood species may also be found in the overstory, and *Fagus grandifolia* may not always be present. Some stands may be dominated by *Fagus grandifolia* and *Quercus alba*, others by *Quercus alba* or *Quercus pagoda* with other mesic hardwoods. Some stands may exhibit codominance by *Quercus* spp., the most notable being *Quercus alba, Quercus falcata, Quercus muehlenbergii, Quercus pagoda*, and *Quercus shumardii*, but the most mesic stands may lack oaks. *Quercus rubra* will be important only north of 35°N latitude, and *Pinus taeda* conversely of greater importance to the south. *Pinus taeda* may be common in some examples in the southern portion of the range and, depending on previous disturbance and site conditions, may be locally dominant. In addition, a variety of other hardwood species may also be found in the overstory, including *Acer rubrum, Fraxinus americana, Liquidambar styraciflua, Liriodendron tulipifera, Nyssa sylvatica, Magnolia acuminata* (of local distribution), and *Tilia americana*. Species of subcanopy trees, shrubs and vines can vary across the range of the group. Some subcanopy components (in addition to canopy species) include *Carpinus caroliniana, Cornus florida, Diospyros virginiana, Ilex opaca, Magnolia macrophylla, Morus rubra, Oxydendrum arboreum, Ostrya virginiana*, and *Ulmus alata*. Some typical shrubs include *Hamamelis virginiana, Rhododendron canescens, Stewartia malacodendron*, and *Symplocos tinctoria*. Within its range, *Sabal minor* may be a prominent shrub. Woody vines include *Decumaria barbara, Smilax glauca, Toxicodendron radicans*, and *Vitis rotundifolia*. Some stands may contain *Arundinaria gigantea*. Some typical herbs include *Hexastylis arifolia, Mitchella repens*, and *Polystichum acrostichoides*. Species richness may be fairly high in basic sites but is fairly low otherwise. This group is found north of the distribution of *Pinus glabra* and *Magnolia grandiflora*, which will be absent, or confined to lower strata at low cover values. In many cases, the loess bluffs provide habitat for plant species that are rare or absent from other parts of the coastal plain. Braun (1950) noted that the composition of forest changes from north to south along the bluffs.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: These are stable, generally fire-sheltered forests, with relatively low fire frequency and intensity. There is presumably some natural disturbance from the effects of windstorms and collapse of the fragile loess in Crowley's Ridge and loess bluff examples. Canopy dynamics are dominated by gap-phase regeneration on a fine scale.

ENVIRONMENT

Environmental Description: Examples of this group occur in a variety of mesic and moist (but non-wetland) sites that are naturally sheltered from frequent fire. These sites include lower slopes, bluffs and ravines along or near streams and rivers in dissected terrain, mesic flats between drier pine-dominated uplands and floodplains, and local topographic high areas within bottomland terraces or nonriverine wet flats. Bordering the northern portion of the eastern edge of the Mississippi River Alluvial Plain and on Crowley's Ridge, they occur on the lower sheltered portions of steep bluffs and hills composed of deep loess. The bluffs may extend to 150 m (500 feet) in elevation and from 30 to 60 m (100-200 feet) above the adjacent plain. They are often deeply eroded and very steep, with fertile topsoil and abundant moisture (Miller and Neiswender 1987). *Climate:* Cool temperate. *Soil/substrate/hydrology:* Stands of this group occur on coastal plain soils, which are deep, rich, and variable in texture. They are derived from alluvium, colluvium, and in some cases, wind-deposited loess; and rarely on shell deposits. The best and most fertile stands are found on finer-textured soils. Moisture regimes are mesic to moist, but these are upland not wetland communities.

DISTRIBUTION

***Geographic Range:** Vegetation of this group is found in the Southeastern Coastal Plain from Virginia south to coastal South Carolina and interior Georgia, and west to central Mississippi and including Crowley's Ridge in Arkansas and Missouri. Rarely, it occurs northward in the coastal plain to New Jersey. In Mississippi, it extends south to about 32°N latitude (where the Big Black River cuts through the loess bluffs). South of this area, and in southern Georgia and South Carolina, where *Magnolia grandiflora* and *Pinus glabra* become reliable canopy components, similar forests are placed in a different, warm temperate macrogroup and group.
Nations: US
States/Provinces: AL, AR, FL, GA, KY, MO, MS, NC, SC, TN, VA
USFS Ecoregions (2007) [optional]: 221D:PP, 231B:CC, 231E:CC, 231H:CC, 232A:CC, 232C:CC, 232H:CC, 232I:CC, 232J:CC, 234D:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3234	*Quercus alba - Carya tomentosa* Mesic Coastal Plain Forest Alliance
A3236	*Acer floridanum - Quercus shumardii - Fraxinus americana* Coastal Plain Forest Alliance
A3235	*Quercus shumardii - Quercus pagoda - Fraxinus americana* Coastal Plain Forest Alliance
A2059	*Fagus grandifolia - Quercus alba - Quercus nigra* Coastal Plain Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Mixed Mesophytic Forest (Mississippi Embayment Section Subtype)	Braun 1950	

AUTHORSHIP

***Primary Concept Source [if applicable]:** E.L. Braun (1950)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne

Acknowledgments [optional]:

Version Date: 12 May 2015

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USGS [U.S. Geological Survey]. 1992. National land cover dataset. U.S. Geological Survey, EROS Data Center, Sioux Falls, SD.

1.B.1.Nd. Madrean-Balconian Forest & Woodland

This division is composed of forests, woodlands, and savannas characterized by various species of conifers and deciduous and evergreen broad-leaved trees, usually oaks, junipers, and/or pines, that have a Madrean and/or Balconian distribution, in semi-arid to sub-humid, warm-temperate settings in montane areas of southern New Mexico, southeastern Arizona, western Texas, or northern and central Mexico and in lowland settings in central Texas.

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1. Forest & Woodland
1.B.1.Nd. Madrean-Balconian Forest & Woodland

M015. Balconian Forest & Woodland

Type Concept Sentence: These dry-mesic to dry hardwood and mixed forests and woodlands, dominated by *Quercus buckleyi, Quercus fusiformis*, and *Juniperus ashei*, are found in Texas, in parts of the Edwards Plateau west into the Stockton Plateau and north into the Arbuckle Mountains, as well as in part of south-central Oklahoma.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.1.Nd.3. Madrean-Balconian Forest & Woodland (D060)

Elcode: M015
***Scientific Name:** *Quercus buckleyi - Quercus fusiformis - Juniperus ashei* Forest & Woodland Macrogroup
***Common (Translated Scientific) Name:** Texas Red Oak - Texas Live Oak - Ashe's Juniper Forest & Woodland Macrogroup
***Colloquial Name:** Balconian Forest & Woodland

***Type Concept:** These dry-mesic to dry hardwood and mixed forests and woodlands are found in Texas, in parts of the Edwards Plateau, west into the Stockton Plateau and north into the Arbuckle Mountains as well as in parts of south-central Oklahoma. The physiognomic expression varies from closed-canopy stands and dense mottes (patches of forest where canopy cover approaches 100%) interspersed with grasslands to open savanna-like woodlands with scattered individuals or small groups of trees. *Quercus buckleyi* is present to dominant in the more dry-mesic stands, *Quercus fusiformis* in the drier ones. Other dominants vary regionally and include *Acer grandidentatum, Quercus laceyi, Quercus muehlenbergii*, and *Quercus sinuata*. In addition, *Juglans major* is also common in more mesic stands. Other diagnostic trees sometimes present include *Arbutus xalapensis, Celtis laevigata var. laevigata, Celtis laevigata var. reticulata, Fraxinus albicans, Prosopis glandulosa, Prunus serotina, Quercus marilandica, Quercus stellata, Quercus vaseyana*, and *Ulmus crassifolia*. Diagnostic shrubs may include *Aesculus pavia, Forestiera pubescens, Frangula caroliniana, Juniperus ashei, Lindera benzoin, Prunus mexicana*, and *Ungnadia speciosa*. Grasslands related to the drier phase of this vegetation tend to grade from shortgrass communities in the west to mixedgrass communities in the east.

***Diagnostic Characteristics:**

***Classification Comments:** Biotic and floristic regions centered on central Texas have been reported in several studies (Tharp 1939, Dice 1943, Blair 1950, Webster and Bahre 2001, McLaughlin 2007), but the vegetation of this region is a mixture of endemic, eastern, western and Great Plains components. The mixture of vegetation is distinct, and anchored by a few endemics, but many components are related to vegetation of other regions. As a result, this macrogroup is somewhat difficult to circumscribe. This macrogroup ranges in environment and composition from predominantly deciduous forests found on rocky upland slopes that are typically more mesic and less fire-prone than the surrounding uplands [see Balconian Dry-Mesic Hardwood Forest Group (G028)] to evergreen to mixed forests found on upper slopes and mesas that are typically drier and more fire-prone than the adjacent slopes and bottoms [see Balconian Dry Forest & Woodland Group (G126)]. Species endemic or near-endemic to this vegetation include *Clematis texensis, Fraxinus albicans, Quercus buckleyi, Quercus laceyi, Quercus sinuata var. breviloba*, and *Salvia penstemonoides*. Species generally ranging farther west include *Acer grandidentatum, Celtis laevigata var. reticulata, Diospyros texana, Juglans major, Juniperus ashei, Nolina texana, Opuntia engelmannii, Prosopis glandulosa, Quercus fusiformis, Quercus vaseyana, Rhus trilobata, Ungnadia speciosa*, and *Yucca elata*. Several studies suggest the presence of this deciduous forest and woodland vegetation (Van Auken et al. 1981, Gehlbach 1988, Riskind and Diamond 1988, Van Auken 1988). Southern mixedgrass grassland associations of Great Plains Mixedgrass & Fescue Prairie Macrogroup (M051) extend into the Edwards Plateau area, adjacent to open savannas of this macrogroup.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The more mesic component (G028) of this vegetation is primarily deciduous but has some evergreen components. In contrast, adjacent drier upland vegetation is primarily dominated by grasslands or evergreen woodlands. The structure is that of a short, open to closed forest. In closed-canopy examples, the shrub layer is often patchily well-developed and the ground flora is generally poorly developed. The drier component (G126) of this vegetation has a physiognomic expression that varies from dense mottes (patches of forest where canopy cover approaches 100%) interspersed with grasslands to open savanna-like woodlands with scattered individual or small groups of trees. Grasslands occur in small patches within more closed woodlands and in larger patches between mottes or in open savanna-like woodlands with scattered trees. Grasslands related to this group tend to grade from shortgrass communities in the west to mixedgrass communities in the east.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The dry-mesic to mesic component (G028) of this vegetation is characterized by an open to closed tree canopy that is floristically variable across the region. Common, but not necessarily dominant, components include *Juglans major, Juniperus ashei*, and *Quercus buckleyi*. Other canopy dominants vary regionally and may include *Acer grandidentatum, Quercus laceyi*, and *Quercus muehlenbergii*. Other diagnostic trees which are sometimes present include *Arbutus xalapensis, Celtis laevigata var. reticulata, Fraxinus albicans (= Fraxinus texensis), Prunus serotina*, and *Ulmus crassifolia*. Other trees that can occur in this group are *Quercus macrocarpa, Quercus sinuata var. breviloba*, and *Quercus stellata*. Diagnostic shrubs may include *Aesculus pavia, Cercis canadensis var. texensis, Forestiera pubescens, Frangula caroliniana (= Rhamnus caroliniana), Juniperus ashei, Lindera benzoin, Prunus mexicana*, and *Ungnadia speciosa*. Other shrubs include *Ageratina havanensis (= Eupatorium havanense), Diospyros texana, Garrya ovata ssp. lindheimeri (= Garrya lindheimeri), Ptelea trifoliata*, and *Viburnum rufidulum*.

Stands of the drier component (G126) of this vegetation are often dominated by *Quercus fusiformis*. Other canopy species may include *Fraxinus albicans, Juniperus ashei, Prosopis glandulosa, Quercus buckleyi, Quercus marilandica, Quercus sinuata, Quercus stellata, Quercus vaseyana*, and *Ulmus crassifolia*. Depending on soil characteristics, understories can contain various shrubs and forbs, including *Aesculus glabra var. arguta, Aloysia gratissima, Eysenhardtia texana, Forestiera pubescens, Stenaria nigricans (= Hedyotis nigricans), Liatris punctata var. mucronata (= Liatris mucronata), Monarda citriodora, Nolina texana, Opuntia engelmannii var. lindheimeri (= Opuntia lindheimeri), Cylindropuntia leptocaulis (= Opuntia leptocaulis), Plantago wrightiana, Rhus trilobata, Salvia texana, Sideroxylon lanuginosum, Stillingia texana, Symphyotrichum ericoides, Yucca elata*, and *Ziziphus obtusifolia var. obtusifolia*. Vegetation of grassy openings includes *Andropogon gerardii, Aristida oligantha, Aristida purpurea, Bothriochloa laguroides, Bouteloua curtipendula, Bouteloua hirsuta, Carex planostachys, Hilaria belangeri, Nassella leucotricha, Schizachyrium scoparium*, and *Sorghastrum nutans*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: The habitat for these forests and woodlands includes mesic to dry-mesic limestone slopes in dissected parts of the Edwards Plateau region of Texas and the Arbuckle Mountains of Oklahoma, as well as coarse soils underlain by metamorphic rocks and on fine-textured soils underlain by limestone. The habitat of the former (Edwards Plateau Dry-Mesic Hardwood Forest Group (G028)) is generally more mesic and less fire-prone than the surrounding landscape (Van Auken et al. 1981). The latter (Edwards Plateau Dry Forest & Woodland Group (G126)) occupies rolling uplands, upper slopes and mesatops. The climate of this region is generally subtropical-subhumid to subtropical-semiarid, with aridity increasing from east to west through the region, although local maxima occur in the southwestern part of the range where the Balcones Uplift rises abruptly from the lower South Texas Plains (Riskind and Diamond 1988).

DISTRIBUTION

***Geographic Range:** These woodlands and forests range from the Edwards Plateau of south-central Texas north into the Arbuckle Mountains of southern Oklahoma and west into the Stockton Plateau of Texas.
Nations: MX?, US
States/Provinces: OK, TX
USFS Ecoregions (2007) [optional]: 255A:CC, 315C:CP, 315D:CC, 315G:CP, 321B:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G126	Balconian Dry Forest & Woodland
G028	Balconian Dry-Mesic Hardwood Forest

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Canyons and Riparian Woodlands	Webster 2001	
<	Deciduous Woodland	Riskind and Diamond 1988	
>	Edwards Plateau Oak-Cedar	Tharp 1939	
<	Evergreen Woodland	Riskind and Diamond 1988	
<	Evergreen Woodlands	Van Auken 1988	
>	Juniper Woodland	Webster 2001	
>	Juniper Woodland	Webster and Bahre 2001	
<	North Slope Deciduous Forest	Van Auken 1988	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. Teague, in Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne and J. Teague
Acknowledgments [optional]:
Version Date: 15 Oct 2014

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Whitehouse, E. 1933. Plant succession on central Texas granite. Ecology 14:391-405.

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1. Forest & Woodland
1.B.1.Nd. Madrean-Balconian Forest & Woodland

G126. Balconian Dry Forest & Woodland

Type Concept Sentence: This mixed forest group occurs on upper slopes and mesas in the Edwards Plateau region of Texas and extends north discontinuously into north Texas and south-central Oklahoma. *Quercus fusiformis* is common and often dominates stands of this group which vary physiognomically from dense mottes (patches of forest where canopy cover approaches 100%) interspersed with grasslands to open savanna-like woodlands with scattered individual or small groups of trees.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.1.Nd.3. Balconian Forest & Woodland (M015)

Elcode: G126
***Scientific Name:** *Quercus fusiformis - Juniperus ashei* Dry Forest & Woodland Group
***Common (Translated Scientific) Name:** Texas Live Oak - Ashe's Juniper Dry Forest & Woodland Group
***Colloquial Name:** Balconian Dry Forest & Woodland

***Type Concept:** This upland mixed forest group occurs primarily on coarse- to fine-textured soils on upper slopes and mesas in the Edwards Plateau region of Texas and extends north discontinuously into north Texas and south-central Oklahoma. Physiognomic expression of this group varies from dense mottes (patches of forest where canopy cover approaches 100%) interspersed with grasslands to open savanna-like woodlands with scattered individual or small groups of trees. *Quercus fusiformis* is common and often dominates stands of this group. Other canopy species may include *Fraxinus albicans, Juniperus ashei, Pinus remota, Prosopis glandulosa, Quercus buckleyi, Quercus marilandica, Quercus sinuata, Quercus stellata, Quercus vaseyana*, and *Ulmus crassifolia*. Grasslands occur in small patches within more closed woodlands and in larger patches between mottes or in open savanna-like woodlands with scattered trees. Grasslands related to this group tend to grade from shortgrass communities in the west to mixedgrass communities to the east.

***Diagnostic Characteristics:**

***Classification Comments:** Biotic and floristic regions centered on central Texas have been reported in several studies (Tharp 1939, Dice 1943, Blair 1950, Webster and Bahre 2001, McLaughlin 2007), but the vegetation of this region is a mixture of endemic, eastern, western and Great Plains components. The mixture of vegetation is distinct, and anchored by a few endemics, but many components are related to vegetation of other regions. As a result, this group is somewhat difficult to circumscribe. This group generally represents the evergreen to mixed forests found on upper slopes and mesas that are typically drier and more fire-prone than the adjacent slopes and bottoms. It shares some species with Balconian Dry-Mesic Hardwood Forest Group (G028). Species endemic or near-endemic to this group and G028 include *Quercus buckleyi, Quercus sinuata var. breviloba*, and *Fraxinus albicans*. Species generally ranging farther west include *Quercus fusiformis, Quercus vaseyana, Celtis laevigata var. reticulata, Juniperus ashei, Prosopis glandulosa, Diospyros texana, Rhus trilobata, Opuntia engelmannii, Yucca elata*, and *Nolina texana*. Species ranging farther east include *Quercus stellata* and *Quercus marilandica*. Natural vegetation dominated by *Juniperus ashei* may be difficult to distinguish from ruderal vegetation dominated by *Juniperus ashei*.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G028	Balconian Dry-Mesic Hardwood Forest	
G191	Comanchian Oak - Juniper Scrub	
G192	Comanchian Mesquite - Mixed Scrub	
G803	Southeastern Granite Outcrop Pool	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Physiognomic expression of this group varies from dense mottes (patches of forest where canopy cover approaches 100%) interspersed with grasslands to open savanna-like woodlands with scattered individual or small groups of trees. Many stands are dominated by the evergreen oak *Quercus fusiformis*, but mixed stands are also common, as are stands dominated by the evergreen conifer *Juniperus ashei*. Grasslands occur in small patches within more closed woodlands and in larger patches between mottes or in open savanna-like woodlands with scattered trees. Grasslands related to this group tend to grade from shortgrass communities in the west to mixedgrass communities to the east.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Quercus fusiformis* often dominates stands of this group. Other canopy species may include *Fraxinus albicans (= Fraxinus texensis), Juniperus ashei, Pinus remota, Prosopis glandulosa, Quercus buckleyi, Quercus marilandica, Quercus sinuata, Quercus stellata, Quercus vaseyana*, and *Ulmus crassifolia*. Depending on soils characteristics, understories can contain various shrubs and forbs, including *Aesculus glabra var. arguta, Aloysia gratissima, Cercis canadensis var. texensis, Diospyros texana, Eysenhardtia texana, Forestiera pubescens, Stenaria nigricans (= Hedyotis nigricans), Juniperus ashei, Liatris punctata var. mucronata (= Liatris mucronata), Monarda citriodora, Nolina texana, Opuntia engelmannii var. lindheimeri (= Opuntia lindheimeri), Cylindropuntia leptocaulis (= Opuntia leptocaulis), Pinus remota, Plantago wrightiana, Rhus trilobata, Salvia texana, Sideroxylon lanuginosum, Stillingia texana, Symphyotrichum ericoides, Yucca elata*, and *Ziziphus obtusifolia var. obtusifolia*. Grassy openings include *Aristida oligantha, Aristida purpurea, Bothriochloa laguroides, Bouteloua curtipendula, Bouteloua hirsuta, Carex planostachys, Nassella leucotricha, Panicum virgatum, Schizachyrium scoparium*, and *Sorghastrum nutans*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: This upland mixed forest group occurs primarily on coarse soils underlain by metamorphic rocks and on fine-textured soils underlain by limestone. It occupies rolling uplands, upper slopes and mesatops in central Texas, extending north discontinuously into north Texas and south-central Oklahoma. The climate of this region is generally subtropical-subhumid to subtropical-semiarid, with aridity increasing from east to west through the region (Riskind and Diamond 1988).

DISTRIBUTION

***Geographic Range:** The geographic range of this group is centered in central Texas where it forms the matrix vegetation type of the Edwards Plateau, but ranges in a discontinuous manner north into south-central Oklahoma.
Nations: MX?, US
States/Provinces: OK, TX
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3212	*Juniperus ashei* Woodland Alliance
A3213	*Quercus buckleyi - Quercus sinuata var. breviloba - Quercus laceyi* Dry Forest & Woodland Alliance
A0477	*Quercus fusiformis - Juniperus ashei* Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	*Andropogon-Quercus-Juniperus*	Küchler 1964	
>	Edwards Plateau Oak-Cedar	Tharp 1939	
<	Edwards Plateau: Ashe Juniper Motte and Woodland (1101) [CES303.660.1]	Elliott 2011	
<	Edwards Plateau: Deciduous Oak / Evergreen Motte and Woodland (1103) [CES303.660.4]	Elliott 2011	
<	Edwards Plateau: Live Oak Motte and Woodland (1102) [CES303.660.2]	Elliott 2011	
<	Edwards Plateau: Oak / Hardwood Motte and Woodland (1104) [CES303.660.5]	Elliott 2011	
<	Edwards Plateau: Savanna Grassland (1107) [CES303.660.9]	Elliott 2011	
<	Evergreen Woodland	Riskind and Diamond 1988	
<	Evergreen Woodlands	Van Auken 1988	
>	Juniper Woodland	Webster and Bahre 2001	

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Llano Uplift: Live Oak Woodland (1602) [CES303.657.2]	Elliott 2011	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. Teague, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Teague
Acknowledgments [optional]:
Version Date: 07 May 2015

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Whitehouse, E. 1933. Plant succession on central Texas granite. Ecology 14:391-405.

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1. Forest & Woodland
1.B.1.Nd. Madrean-Balconian Forest & Woodland

G028. Balconian Dry-Mesic Hardwood Forest

Type Concept Sentence: This group includes deciduous forests of dry-mesic and mesic slopes and canyons from the Edwards and Stockton plateaus of Texas to the Crosstimbers and isolated mountains in south-central Oklahoma. Characteristic trees vary regionally and include *Acer grandidentatum, Arbutus xalapensis, Celtis laevigata var. reticulata, Fraxinus albicans, Juglans major, Prunus serotina var. eximia, Quercus buckleyi, Quercus laceyi, Quercus muehlenbergii*, and *Ulmus crassifolia*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.1.Nd.3. Balconian Forest & Woodland (M015)

Elcode: G028
***Scientific Name:** *Quercus buckleyi - Juglans major / Juniperus ashei* Dry-Mesic Forest Group
***Common (Translated Scientific) Name:** Texas Red Oak - Arizona Walnut / Ashe's Juniper Dry-Mesic Forest Group
***Colloquial Name:** Balconian Dry-Mesic Hardwood Forest

***Type Concept:** The range of this woodland and forest group is centered in the highly dissected southern and eastern sections of the Edwards Plateau of Texas but extends west into the Stockton Plateau of Texas and north and east into the Crosstimbers and to the Arbuckle Mountains and possibly other isolated mountains in south-central Oklahoma. It typically occurs on north- and northeast-facing, dry-mesic to mesic limestone slopes and canyon bottoms. The tree canopy is generally closed, deciduous, and floristically variable regionally. *Quercus buckleyi* is present in most stands and dominant in many. Other dominants vary regionally and include *Quercus laceyi, Quercus muehlenbergii, Ulmus crassifolia*, and *Acer grandidentatum*. *Juglans major* is common in more mesic stands. Other diagnostic trees sometimes present include *Arbutus xalapensis, Celtis laevigata var. reticulata, Fraxinus albicans*, and *Prunus serotina var. eximia*. Diagnostic shrubs may include *Aesculus pavia, Cercis canadensis var. texensis, Forestiera pubescens, Frangula caroliniana, Garrya ovata, Juniperus ashei, Lindera benzoin, Prunus mexicana, Ungnadia speciosa*, and *Viburnum rufidulum*.

***Diagnostic Characteristics:**

***Classification Comments:** Biotic and floristic regions centered on central Texas have been reported in several studies (Tharp 1939, Dice 1943, Blair 1950, Webster and Bahre 2001, McLaughlin 2007), but the vegetation of this region is a mixture of endemic, eastern, western and Great Plains components. The mixture of vegetation is distinct, and anchored by a few endemics, but many components are related to vegetation of other regions. As a result, this group is somewhat difficult to circumscribe. This group generally represents the predominantly deciduous forests found on rocky upland slopes that are typically more mesic and less fire-prone than the surrounding uplands, but species dominance varies across the range of the group. It shares some species with Balconian Dry Forest & Woodland Group (G126). Species endemic or near-endemic to this group and G126 include *Quercus buckleyi, Quercus laceyi, Fraxinus albicans, Salvia penstemonoides*, and *Clematis texensis*. Species generally ranging farther west include *Juglans major, Celtis laevigata var. reticulata, Ungnadia speciosa*, and *Acer grandidentatum*. Species ranging farther east include *Quercus muehlenbergii, Aesculus pavia, Prunus serotina, Frangula caroliniana*, and *Lindera benzoin*. Several studies suggest the presence of this deciduous forest and woodland group (Van Auken et al. 1981, Gehlbach 1988, Riskind and Diamond 1988, Van Auken 1988).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G126	Balconian Dry Forest & Woodland	
G601	Chinquapin Oak - Shumard Oak - Blue Ash Alkaline Forest & Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This vegetation is primarily deciduous but has some evergreen components. In contrast, adjacent upland vegetation is primarily dominated by grasslands or evergreen woodlands. The structure is that of a short, open to closed forest. The shrub layer is often patchily well-developed and the ground flora is generally poorly developed.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This forest group is characterized by an open to closed tree canopy that is floristically variable regionally. Common, but frequently not dominant, components include *Quercus buckleyi, Juniperus ashei*, and *Juglans major*. Canopy dominants vary regionally and include *Quercus laceyi, Quercus muehlenbergii*, and *Acer grandidentatum*. Other diagnostic trees sometimes present include *Prunus serotina, Arbutus xalapensis, Fraxinus albicans (= Fraxinus texensis), Ulmus crassifolia*, and *Celtis laevigata var. reticulata*. Other trees that can occur in this group are *Ulmus crassifolia, Quercus macrocarpa, Quercus stellata*, and *Quercus sinuata var. breviloba*. Diagnostic shrubs may include *Aesculus pavia, Cercis canadensis var. texensis, Forestiera pubescens, Frangula caroliniana (= Rhamnus caroliniana), Garrya ovata, Juniperus ashei, Lindera benzoin, Prunus mexicana, Ungnadia speciosa*, and *Viburnum rufidulum*. Other shrubs include *Ptelea trifoliata, Ageratina havanensis (= Eupatorium havanense), Garrya ovata ssp. lindheimeri (= Garrya lindheimeri), Diospyros texana*, and *Viburnum rufidulum*. Herbaceous cover is generally sparse.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: Vegetation of this group typically occurs on mesic to dry-mesic limestone slopes in dissected parts of the Edwards Plateau region of Texas and the Arbuckle Mountains of Oklahoma. These slopes are generally more mesic and less fire-prone than the surrounding landscape (Van Auken et al. 1981).

DISTRIBUTION

***Geographic Range:** The range of this woodland and forest group is centered in the Edwards Plateau of Texas but extends north into the Arbuckle Mountains in southern Oklahoma and west into the Stockton Plateau of Texas.
Nations: US
States/Provinces: OK, TX
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3214	*Acer grandidentatum - Quercus muehlenbergii - Juglans major* Forest & Woodland Alliance
A3215	*Quercus laceyi* Forest & Woodland Alliance
A0242	*Quercus buckleyi* Slope Forest & Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	*Andropogon-Quercus-Juniperus*	Küchler 1964	
>	Canyons and Riparian Woodlands	Webster 2001	
<	Deciduous Woodland	Riskind and Diamond 1988	

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Edwards Plateau Bigtooth Maple Mesic Canyon (not mapped) [CES303.038.1]	Elliott 2011	
<	Edwards Plateau Mixed Deciduous Mesic Canyon (not mapped) [CES303.038.2]	Elliott 2011	
>	Edwards Plateau Oak-Cedar	Tharp 1939	
<	Edwards Plateau: Oak / Ashe Juniper Slope Forest (903) [CES303.656.4]	Elliott 2011	
<	Edwards Plateau: Oak / Hardwood Slope Forest (904) [CES303.656.6]	Elliott 2011	
>	Juniper Woodland	Webster 2001	
<	North Slope Deciduous Forest	Van Auken 1988	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. Teague, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Teague

Acknowledgments [optional]:

Version Date: 07 May 2015

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1.B.2. Cool Temperate Forest & Woodland

Cool Temperate Forest & Woodland includes temperate deciduous forest and woodland, temperate needle-leaved forest and woodland, and temperate rainforest, dominated by broad-leaved or needle-leaved tree growth forms.

1.B.2.Na. Eastern North American Forest & Woodland

These eastern North American forests and woodlands are dominated by cold-deciduous broadleaf trees, sometimes mixed with conifers, with strong diagnostic tree species, including *Acer rubrum, Acer saccharum, Carya* spp. (especially *Carya cordiformis, Carya glabra, Carya ovata*), *Fagus grandifolia, Fraxinus americana, Liriodendron tulipifera, Quercus* spp. (especially *Quercus alba, Quercus rubra, Quercus velutina*), and *Tilia americana*.

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

M016. Southern & South-Central Oak - Pine Forest & Woodland

Type Concept Sentence: These fire-dependent oak-pine and oak-hardwood forests and woodlands are found in a broad band across the southeastern United States, from the upper Atlantic Coastal Plain and Piedmont of Virginia and the Carolinas, south and west to the Ozarks of Missouri and Arkansas, the West Gulf Coastal Plain, and the Post Oak Savanna region of east-central Texas. Typical hardwoods include *Quercus alba, Quercus coccinea, Quercus falcata, Quercus rubra, Quercus stellata*, and *Quercus velutina*, along with *Carya tomentosa, Carya glabra, Carya ovata, Carya pallida*, and other *Carya* spp. Pines include *Pinus echinata, Pinus taeda*, and *Pinus virginiana*.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.2.Na.1. Eastern North American Forest & Woodland (D008)

Elcode: M016
***Scientific Name:** *Quercus alba - Quercus falcata - Pinus echinata* Forest & Woodland Macrogroup
***Common (Translated Scientific) Name:** White Oak - Southern Red Oak - Shortleaf Pine Forest & Woodland Macrogroup
***Colloquial Name:** Southern & South-Central Oak - Pine Forest & Woodland

***Type Concept:** This wide-ranging vegetation type encompasses fire-dependent forests and woodlands found in a broad band across the southeastern United States and dominated by various combinations of *Quercus* species, *Pinus* species, and other hardwood trees. It occurs primarily in the unglaciated part of the Interior Low Plateaus, the Appalachian, Piedmont, Ozark-Ouachita, and upper coastal plain regions (north of the primary range of *Pinus palustris*), as well as to the west in eastern Oklahoma, southeastern Kansas, and the Inner Coastal Plain of central Texas. In many areas, this is the predominant natural upland vegetation of the landscape. Stands of these forests are dominated by combinations of upland *Quercus* spp., particularly *Quercus alba, Quercus coccinea, Quercus falcata, Quercus rubra, Quercus stellata*, and *Quercus velutina*, along with *Carya tomentosa, Carya glabra, Carya ovata, Carya pallida*, and other *Carya* spp. In some drier examples on more acidic substrates, *Quercus montana* is typical. Pines may be abundant or even dominant in some examples, including *Pinus echinata, Pinus palustris* (rarely), *Pinus taeda*, and *Pinus virginiana*. Fire-intolerant species such as *Acer rubrum, Liquidambar styraciflua, Liriodendron tulipifera*, and *Nyssa sylvatica* may be common in some examples. In the western part of the range, examples are dominated by short, stunted *Quercus stellata* and/or *Quercus marilandica* with *Carya texana*. These patches of forest and woodland are often interspersed with patches of tall- and midgrass prairie. On limestone-derived soils examples contain various combinations of *Fraxinus quadrangulata, Juniperus virginiana, Quercus muehlenbergii, Quercus pagoda*, and *Quercus shumardii*. Shrub and herb layer species vary considerably, depending on aspect, soil, and moisture relations. More open canopies and grass-dominated understories may have been more prevalent prior to the mid-twentieth century, when open grazing and surface fires were more common. Substrates also vary widely, including soils derived from felsic and mafic metamorphic rocks; sedimentary limestones, sandstones, and shales; as well as some coastal plain poorly consolidated sediments of silts and clays, as well as more rarely shell deposits or limesands. These soils range from calcareous to acidic; soils may be very shallow and well- to excessively well-drained in the dry expressions, and moderately well-drained in the submesic to dry-mesic ones. Examples may also occur on dense clay hardpans over mafic rocks. Examples can occur on a variety of topographic and landscape positions, including ridgetops and upper and midslopes.

***Diagnostic Characteristics:** These forests cover a broad range of floristics over a broad geographic range, and typically are fire-dependent. Typical hardwoods include *Quercus alba, Quercus coccinea, Quercus falcata, Quercus rubra, Quercus stellata*, and *Quercus velutina*, along with *Carya tomentosa, Carya glabra, Carya ovata, Carya pallida*, and other *Carya* spp. Pines include *Pinus echinata, Pinus taeda*, and *Pinus virginiana*. At the mafic/circumneutral end, they may contain *Quercus muehlenbergii*; at the acidic end, *Quercus montana*. Some examples contain *Pinus* species and some do not. Many, if not most, examples in the early 21st century landscape represent habitats altered and possibly degraded by the absence of fire.

***Classification Comments:** This type represents the bulk of what is often called the southern oak-hickory pine type (Küchler 1964), but also includes the unglaciated parts of his oak-hickory type. There is abundant variation among stands within this macrogroup, between dry and dry-mesic forests and also between those on acidic or circumneutral substrates. This variation will inform the limits of the different component groups and alliances, but a broadly similar canopy composition and similar dynamics tie them together at this broader level. In the Interior Low Plateaus, the range of this group is consistent with the non-coastal plain portion of the "Western Mesophytic" Forest region of Braun (1950), Keever (1971), and Greller (1988).

Examples with substantial *Pinus echinata* mainly occur in three general areas: the Appalachians (broadly defined to include the Cumberlands and Piedmont, particularly to the south); the East Gulf Coastal Plain north of the range of *Pinus palustris*; and the Ozark-Ouachita areas of Missouri and Arkansas. Stands found outside of the coastal plains in which *Pinus palustris* is a component are also included here. These were formerly included in Montane & Piedmont Longleaf Pine Woodland Group (G164). Examples in the Ozark-Ouachita area and the Upper Coastal Plain will lack *Pinus rigida, Pinus virginiana*, and *Quercus montana*.

~Cross Timbers & East-Central Texas Plains Oak Forest & Woodland Group (G017) is currently circumscribed at the group level, separate from somewhat similar vegetation occurring farther east that is also characterized by *Quercus stellata* and *Quercus marilandica*. This group represents the western edge of the eastern deciduous forests, and as such is lacking many of the eastern "dry-site" woody species, such as *Gaylussacia* spp., *Pinus echinata, Quercus alba, Quercus coccinea, Quercus falcata, Vaccinium pallidum*, and *Vaccinium stamineum*, among others, and by the presence of *Carya texana*. In addition, it represents a transition of forests to grasslands, and some evidence suggests this group once had a higher grass cover, linking it more closely with the Great Plains grasslands. Many factors are thought to have contributed to this increase in woody cover, primarily the imbalance in two main natural processes that helped maintain this grassland state: fire and grazing.

There is an overlap in species composition (including some of the key calcareous diagnostic species) between Chinquapin Oak - Shumard Oak - Blue Ash Alkaline Forest & Woodland Group (G601) and Northeastern Chinquapin Oak - Red-cedar Alkaline Forest & Woodland Group (G016), the full composition of species found in sites of the former shows stronger affinities with the south-central forests of M016.

The forests of Piedmont-Central Atlantic Coastal Plain Oak Forest Group (G165) have often been called "oak-hickory" (Braun 1950) or "oak-pine-hickory" (Küchler 1964, Greller 1989, Skeen et al. 1993). However, Monk et al. (1990) concluded there was insufficient abundance of *Carya* spp. to justify including this genus in the name of such forests "at a regional level." They do, however, acknowledge that "(t)here are many oak-hickory forest stands." There are fairly dramatic differences in the amount of pine present across the modern day Piedmont landscape, with it being especially prevalent in South Carolina, Georgia, and Alabama (USGS 1992). To some extent, the prevalence of pine in these southern portions of the region may represent natural conditions (Nelson 1957). It is possible that the more heavily mixed or pine-dominated forests of the southern Piedmont should be recognized as a different group, but distinguishing natural examples is difficult given a long history of land-use impacts and resulting vegetational changes in the region (Brender 1974). In addition, Skeen et al. (1993) assert that "the oak-hickory-pine designationmay be reflective of past land use and disturbance history and that the [current] steady-state typal forest of the southeastern Piedmont is in reality oak-hickory-yellow poplar."

This macrogroup also includes mixed evergreen-deciduous forests dominated by *Pinus taeda* and/or *Pinus echinata* in combination with a suite of dry- to dry-mesic-site hardwoods, including *Quercus alba, Quercus falcata*, and *Quercus stellata*, and the scrub oaks *Quercus incana, Quercus margarettae*, and *Quercus arkansana*. They are primarily found in the West Gulf Coastal Plain of Arkansas, Louisiana and Texas.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M008	Southern Mesic Mixed Broadleaf Forest	
M885	Southeastern Coastal Plain Evergreen Oak - Mixed Hardwood Forest	
M502	Appalachian-Northeastern Oak - Hardwood - Pine Forest & Woodland	
M012	Central Midwest Oak Forest, Woodland & Savanna	
M883	Appalachian-Interior-Northeastern Mesic Forest	
M882	Central Midwest Mesic Forest	
M509	Central Interior Acidic Scrub & Grassland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Physiognomies in this wide-ranging and variable vegetation type include forests and woodlands as well as savannas and barrens, which may be interspersed with patches of prairie on the western end of the range. The density of stands may vary from open to closed, depending on moisture regime, climate and management, particularly time since last fire, and average fire frequency over a period of several decades. More open stands are more likely to have a graminoid-dominated ground layer; otherwise the low-shrub stratum may be dense, with herbs correspondingly lower in cover. The density and diversity of the ground layer may vary from sparse to moderate in density in drier, acidic examples, to dense and diverse in more circumneutral examples as well as more mesic ones.

Stands of South-Central Interior Oak Forest & Woodland Group (G159) are moderately tall, closed-canopy upland forests under current conditions, but more open canopies and grass-dominated understories may have been more prevalent prior to the mid-twentieth century. Short, stunted *Quercus stellata* and/or *Quercus marilandica* characterize and dominate Southeastern Great Plains Post Oak - Blackjack Oak Forest & Woodland Group (G017). The physiognomy includes scattered trees with high herbaceous cover, open-canopied woodlands, and closed-canopied patches of trees interspersed with grasslands.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Stands of these forests are dominated by combinations of upland *Quercus* spp., particularly *Quercus alba, Quercus coccinea, Quercus falcata, Quercus rubra, Quercus stellata*, and *Quercus velutina*, along with *Carya tomentosa (= Carya alba), Carya glabra, Carya ovata, Carya pallida*, and other *Carya* spp. Piedmont mafic examples exhibit a pronounced abundance of *Carya* spp. relative to other Piedmont forests (Farrell and Ware 1991, Ware 1992). *Quercus alba* may also be present but not necessarily dominant, but will typically exhibit dominance in the submesic to dry-mesic examples, possibly with *Quercus velutina* or *Quercus falcata*. In addition, *Quercus coccinea, Quercus marilandica*, and *Quercus stellata* will also share dominance or be prominent in many of the dry examples. *Quercus muehlenbergii, Quercus pagoda*, and/or *Quercus shumardii* are typical of examples with high base status. Mesic hardwoods are typically absent, but may increase with lack of fire; they include *Acer floridanum (= Acer barbatum), Acer rubrum, Acer saccharum* (in more mesic examples), *Cercis canadensis, Cornus florida, Fagus grandifolia, Fraxinus americana, Gleditsia triacanthos, Gymnocladus dioicus, Juglans nigra, Juniperus virginiana var. virginiana, Kalmia latifolia, Liquidambar styraciflua, Liriodendron tulipifera, Ostrya virginiana, Oxydendrum arboreum, Styrax americanus, Vaccinium arboreum, Vaccinium pallidum, Vaccinium stamineum, Viburnum acerifolium, Ulmus americana, Ulmus serotina*, and *Vitis aestivalis*. East of the Mississippi River, in some drier examples on more acidic substrates, *Quercus montana (= Quercus prinus)* is typical, reflecting relations with similar Appalachian forest groups further to the east and north.

Pines may be abundant or even dominant in some examples, including *Pinus echinata, Pinus palustris* (rarely), *Pinus taeda*, and *Pinus virginiana*. The shrub layer of these pine-dominated examples may be well-developed, with *Gaylussacia baccata, Vaccinium arboreum, Vaccinium pallidum, Vaccinium stamineum*, or other acid-tolerant species being most characteristic. In more open stands, the understory is characterized by *Andropogon gerardii, Schizachyrium scoparium*, and other prairie graminoid elements. Herbs are usually sparse but may include *Pityopsis graminifolia* and *Tephrosia virginiana*. Fire-intolerant species such as *Acer rubrum, Liquidambar styraciflua, Liriodendron tulipifera*, and *Nyssa sylvatica* may be common in examples that lack recent fires.

In the West Gulf Coastal Plain, examples are dominated by *Pinus taeda* and/or *Pinus echinata* in combination with a suite of dry- to dry-mesic-site hardwoods, including *Quercus alba, Quercus falcata*, and *Quercus stellata*, and the scrub oaks *Quercus incana, Quercus margarettae*, and *Quercus arkansana*. This is the dominant upland vegetation of the West Gulf Coastal Plain, with an extension into central Texas, locally known as the "Bastrop Pines."

In the western part of the range, examples are dominated by short, stunted *Quercus stellata* and/or *Quercus marilandica* with *Carya texana*. These patches of forest and woodland are often interspersed with patches of tall- and midgrass prairie. Other component species may include *Carya cordiformis, Quercus fusiformis, Quercus prinoides, Ulmus alata*, and *Ulmus crassifolia* within their respective ranges. Small trees or shrubs such as *Callicarpa americana, Ilex decidua, Ilex vomitoria, Juniperus ashei, Juniperus virginiana, Prosopis glandulosa, Rhus* spp., *Sideroxylon lanuginosum, Smilax* spp., *Symphoricarpos orbiculatus*. *Toxicodendron radicans*, and *Vaccinium arboreum* may be present. The ground layer often contains species typical of the surrounding prairies, in particular *Schizachyrium scoparium*, but also including *Andropogon gerardii, Bothriochloa laguroides ssp. torreyana, Paspalum plicatulum* (to the south), *Sorghastrum nutans*, and *Sporobolus cryptandrus*.

On limestone-derived soils, various combinations of oaks, including *Quercus muehlenbergii, Quercus pagoda*, and *Quercus shumardii*, are dominant or may codominate with *Acer saccharum, Celtis* spp., *Cercis canadensis, Cotinus obovatus, Fraxinus americana, Fraxinus quadrangulata, Juniperus virginiana*, and *Ulmus alata*. Shrub and herb layer species vary considerably, depending on aspect, canopy closure, soils, and moisture relations.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Wind effects, drought, lightning, and occasional fires can influence the physiognomy and composition of stands of this vegetation. In successional examples of Piedmont-Central Atlantic Coastal Plain Oak Forest Group (G165), *Pinus* spp. (e.g., *Pinus echinata, Pinus taeda)* may be present to dominant in stands for a number of decades (Oosting 1942), with *Quercus* spp. and *Carya* spp. gradually invading the understory and then entering the canopy. In some areas, fire-intolerant species such as *Acer* spp., *Fagus grandifolia, Ilex opaca, Liquidambar styraciflua, Liriodendron tulipifera*, and *Nyssa sylvatica* are invading the understories of older stands on dry-mesic, acidic sites. When natural fires were more frequent, the forests presumably had less understory and shrub density and probably a grassy herb layer. Fire was probably once the most important natural dynamic process, but the almost universal elimination of fire in the Piedmont makes this difficult to tell. The xeric nature of sites with clay hardpans may have allowed fire to create open vegetation there while allowing forests to develop on more typical soils. Fire would have kept canopies open by limiting or slowing tree regeneration and would have promoted a more diverse, grass-dominated herb layer. Bison may have once been a significant influence in the pre-settlement and historic landscape as well.

On circumneutral sites, *Carya* spp. and *Fraxinus americana* often dominate the understory. There is a current tendency for *Quercus*-dominated stands to become invaded by more mesophytic and/or fire-intolerant tree species. Oak recruitment is decreasing or virtually absent in many of these forests, particularly the dry-mesic ones. This may be a result of the lengthening of fire-return times during the latter part of the twentieth century. In stands of Shortleaf Pine - Oak Forest & Woodland Group (G012), fire is clearly an important influence and may be the sole factor determining the relative dominance of pines versus hardwoods under natural conditions. An extensive hardwood component may partly be the result of lack of fire. Fires probably were frequent and of low intensity, or a mix of low and higher intensity. *Pinus echinata* is fairly resilient to fire once mature, while *Pinus virginiana* individuals are fairly susceptible to fire but well-adapted to establishing in areas opened by intense fire. *Pinus echinata* is a shade-intolerant species and does not survive or grow well without fire. *Dendroctonus frontalis* (southern pine beetle) outbreaks are an important factor in examples of this group, at least under present conditions. These beetle outbreaks can kill all the pines without creating the conditions for the pines to regenerate. Under current conditions, the understories are typically shrub- and small tree-dominated, with the typical species varying with aspect, soil, and moisture relations. More open and grass-dominated understories may have been more prevalent prior to the mid-twentieth century, when open grazing and surface fires were more common.

In examples of Cross Timbers & East-Central Texas Plains Oak Forest & Woodland Group (G017), drought, grazing, and fire are the primary natural processes. Overgrazing, lack of fire, and conversion to improved pasture or other agricultural uses have led to increased woody cover on most extant occurrences of this group and the invasion of some areas by problematic brush species such as *Juniperus virginiana var. virginiana* and *Prosopis glandulosa* within their respective ranges. These factors have also led to decreases in native grass cover allowing for annual grasses and forbs to invade.

ENVIRONMENT

Environmental Description: This is the matrix vegetation over much of its range, and occurs on ridges and gentle to moderately steep slopes. Soils are typically moderately to well-drained and more fertile than those associated with oak woodlands. This group encompasses a variety of associations ranging along a moisture gradient from submesic to dry. The submesic to dry-mesic expressions tend to be found on midslopes with northerly to easterly aspects; the dry expressions are found on southerly to westerly aspects and on broad ridges. Parent material can range from calcareous to acidic with very shallow, well- to excessively well-drained soils in the drier expressions and moderately well-drained soils in the submesic to dry-mesic ones.

Examples of Shortleaf Pine - Oak Forest & Woodland Group (G012) can occur on a variety of topographic and landscape positions, including ridgetops, upper and midslopes, as well as lower elevations (generally below 700 m [2300 feet]) in the Southern Appalachians such as mountain valleys, as well as on rolling uplands in the Upper East Gulf Coastal Plain. Examples occur on a variety of acidic soils or bedrock types. In the Ozark Highlands, this group was historically prominent only in the southeastern part, where sandstone-derived soils were common (USFS 1999), being limited in other areas by inadequate winter precipitation and non-conducive soils. In contrast, pine was "virtually ubiquitous in the historical forests of the Ouachitas" (USFS 1999). Wide variation in vegetation composition across this gradient is also strongly related to fire frequency and intensity (White and Lloyd 1998).

Examples of Chinquapin Oak - Shumard Oak - Blue Ash Alkaline Forest Group (G601) are associated with dry calcareous substrates such as limestone and dolomite. They occur on a variety of topographic and landscape positions, including ridgetops and upper and midslopes, or very rarely on the Atlantic Coastal Plain where erosion has exposed Tertiary-aged shell deposits or limesands. The soil moisture regime is dry to dry-mesic.

~Cross Timbers & East-Central Texas Plains Oak Forest & Woodland Group (G017) is located where the forests of the eastern U.S. transition into grasslands of the central U.S. Rainfall can be moderate, generally ranging from 66 to 110 cm (26-43 inches) per year and is somewhat erratic, therefore moisture is often limiting during part of the growing season. Its habitat consists of irregular plains and rugged scarps with primarily sandy to loamy soils that range from shallow to moderately deep.

~Western Gulf Coastal Plain Pine - Oak Forest & Woodland Group (G013) contain mixed evergreen-deciduous forests that are dominated by *Pinus taeda* and/or *Pinus echinata* in combination with a suite of dry- to dry-mesic-site hardwoods, including *Quercus alba, Quercus falcata*, and *Quercus stellata*, and the scrub oaks *Quercus incana, Quercus margarettae*, and *Quercus arkansana*. Examples are primarily found in the west gulf coastal plain of Arkansas, Louisiana and Texas.

DISTRIBUTION

***Geographic Range:** This vegetation is found over most of the southeastern United States, in of the coastal plains and adjacent interior regions, from the Piedmont and adjacent Atlantic Coastal Plain from Maryland to Alabama; the lower elevations of the Appalachians, westward through the unglaciated Interior Low Plateau (with northern limits in extreme southeastern Ohio, southern Indiana, and southern Illinois), and the Ozarks and Ouachitas of Arkansas, Missouri, southeastern Kansas and Oklahoma, and southward into Virginia, the Carolinas and the East Gulf Coastal Plain from Georgia to Mississippi, the West Gulf Coastal Plain and the Inner Coastal Plain of Texas.
Nations: US
States/Provinces: AL, AR, FL?, GA, IA?, IL, IN, KS, KY, LA, MD, MO, MS, NC, OH, OK, SC, TN, TX, VA
USFS Ecoregions (2007) [optional]: 221B:CC, 221D:CC, 221H:CC, 221J:CC, 223A:CC, 223B:CC, 223D:CC, 223E:CC, 223F:CC, 231A:CC, 231B:CC, 231C:CC, 231D:CC, 231E:CC, 231G:CC, 231H:CC, 231I:CC, 232C:CC, 232H:CC, 232I:CC, 232J:CC, 234A:CC, 234D:CC, 234E:CC, M221A:CC, M221B:CC, M221C:CC, M221D:CC, M223A:CC, M231A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: The concept of this macrogroup is generally a combination of the dominant forest vegetation of several of Braun's forest regions; the Western Mesophytic Forest Region, the Oak-Hickory Forest Region, the Oak-Chestnut Forest Region, and the Oak-Pine Forest Region.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G165	Piedmont-Central Atlantic Coastal Plain Oak Forest
G012	Shortleaf Pine - Oak Forest & Woodland
G159	South-Central Interior Oak Forest & Woodland
G651	South-Central Interior Oak Savanna & Barrens
G601	Chinquapin Oak - Shumard Oak - Blue Ash Alkaline Forest & Woodland
G017	Cross Timbers & East-Central Texas Plains Oak Forest & Woodland
G013	Western Gulf Coastal Plain Pine - Oak Forest & Woodland

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Chinquapin Oak - Ash - Red-cedar Forest Group	Faber-Langendoen and Menard 2006	This group includes forests further west in which *Juniperus ashei* is characteristic.
>	Deciduous Forest	Delcourt and Delcourt 2000	This concept is much broader, covering deciduous forests of the entire eastern United States.

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Deciduous Forest	Greller 1988	This concept is much broader, covering deciduous forests of the entire eastern United States.
><	Deciduous Forest Formation: Western Mesophytic Forest Region, Oak-Hickory Forest Region, Oak-Chestnut Forest Region, Oak-Pine Forest Region	Braun 1950	The concept of this macrogroup is generally a combination of the dominant forest vegetation of several of Braun's forest regions: the Western Mesophytic Forest Region, the Oak-Hickory Forest Region, the Oak-Chestnut Forest Region, and the Oak-Pine Forest
=	Dry Oak-Hickory Forest	Schafale and Weakley 1990	includes both their Coastal Plain and Piedmont manifestations.
=	Dry-Mesic Oak-Hickory Forest	Schafale and Weakley 1990	includes both their Coastal Plain and Piedmont manifestations.
><	Küchler 101 (oak-hickory pine; primarily the noncoastal plain and east of the Mississippi part)	Küchler 1985	The unglaciated part of Küchler 91 (oak-hickory forest) and primarily the non-coastal plain and east of the Mississippi part of 101 (oak-hickory pine).
><	Küchler 91 (oak-hickory forest; the unglaciated part)	Küchler 1985	The unglaciated part of Küchler 91 (oak-hickory forest) and primarily the non-coastal plain and east of the Mississippi part of 101 (oak-hickory pine).
<	Loblolly Pine-Southern Red Oak/*Callicarpa* Loamy Mesic Lower Slopes and Terraces Landtype Phase	Turner et al. 1999	
?	Mid Slope Oak Pine Forest	Marks and Harcombe 1981	
<	Mixed Hardwood - Loblolly Forest	Martin and Smith 1991	
<	Mixed Hardwood - Loblolly Forest	Martin and Smith 1993	
<	Oak - hickory savanna	Bruner 1931	
=	Oak-Hickory Forest	Bennett and Nelson 1991	
><	Oak-Hickory Forest Region, Southern Division Forest Prairie Transition	Braun 1950	Conceptually, Braun's types are vegetation regions, but the forested part of the region corresponds very closely to the group (G017) concept described here.
<	Oak-Hickory-Pine Forest Region	Küchler 1964	This concept covers the Piedmont and Upper Coastal Plain only.

Relationship to NVC	Supporting Concept Name	Short Citation	Note
><	Oak-Hickory-Pine Forests	Skeen et al. 1993	This concept covers the Piedmont and Upper Coastal Plain only.
<	Osage Savanna	Blair and Hubbell 1938	
?	Piedmont Flatwoods	Wharton 1978	
<	Shortleaf Pine - Oak: 76	Eyre 1980	
<	Shortleaf Pine / Oak - Hickory Forest	Martin and Smith 1993	
<	Shortleaf Pine / Oak - Hickory Forest	Martin and Smith 1991	
<	Shortleaf Pine-(Longleaf Pine)-Post Oak/*Callicarpa-Chasmanthium* Loamy Dry-Mesic Uplands Landtype Phase	Turner et al. 1999	
<	Shortleaf Pine-Post Oak/*Chasmanthium* Clayey Dry-Mesic Uplands Landtype Phase	Turner et al. 1999	
<	Shortleaf Pine-Post Oak/*Chasmanthium* Clayey Uplands Landtype Phase	Turner et al. 1999	
<	Shortleaf Pine-White Oak/*Callicarpa-Chasmanthium* Sandy/Loamy Dry-Mesic Uplands Landtype Phase	Turner et al. 1999	
<	White Oak-Loblolly Pine/*Callicarpa* Loamy Mesic Lower Slopes and Terraces Landtype Phase	Turner et al. 1999	
<	White Oak-Loblolly Pine/*Callicarpa* Loamy/Sandy Mesic Lower Slopes and Terraces Landtype Phase	Turner et al. 1999	
<	White Oak-Loblolly Pine/*Callicarpa* Loamy/Sandy Mesic Slopes Landtype Phase	Turner et al. 1999	

AUTHORSHIP

***Primary Concept Source [if applicable]:** E.L. Braun (1950)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne

Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by J. Teague, D. Faber-Langendoen, and A.S. Weakley.

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G165. Piedmont-Central Atlantic Coastal Plain Oak Forest

Type Concept Sentence: This vegetation encompasses both the prevailing upland oak and oak-hickory forests of the southern Piedmont as well as the more open vegetation of more limited areas where a particularly dense clay hardpan has developed over a range of typically mafic rocks, sometimes with interspersed areas of prairie- or glade-like herbaceous vegetation. Stands of these forests are dominated by combinations of upland *Quercus* spp., particularly *Quercus alba, Quercus coccinea, Quercus falcata, Quercus rubra, Quercus stellata*, and *Quercus velutina*, along with *Carya tomentosa, Carya glabra*, and other *Carya* spp.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.1. Southern & South-Central Oak - Pine Forest & Woodland (M016)

Elcode: G165
***Scientific Name:** *Quercus alba - Quercus falcata - Quercus nigra* Forest Group
***Common (Translated Scientific) Name:** White Oak - Southern Red Oak - Water Oak Forest Group
***Colloquial Name:** Piedmont-Central Atlantic Coastal Plain Oak Forest

***Type Concept:** Vegetation of this group encompasses both the prevailing upland oak and oak-hickory forests of the southern Piedmont, as well as the more open vegetation of more limited areas in the Piedmont where a particularly dense clay hardpan has developed over a range of typically mafic rocks, sometimes with interspersed areas of prairie- or glade-like herbaceous vegetation. In addition, it encompasses related oak-dominated forests of somewhat fire-sheltered dry to dry-mesic sites in the adjacent Mid-Atlantic and South Atlantic coastal plains from southeastern Virginia to Georgia. In general, high-quality and historic examples are typically dominated by combinations of upland *Quercus* spp., sometimes with *Pinus* spp. as a significant component, especially in the southern portions of the region. These forests occur in a variety of habitats and, under natural conditions, were the matrix vegetation type covering most of the landscape. Much of this group is currently composed of successional forests that have arisen after repeated cutting, clearing, and cultivation of original oak-hickory forests. Stands of these forests are dominated by combinations of upland *Quercus* spp., particularly *Quercus alba, Quercus coccinea, Quercus falcata, Quercus rubra, Quercus stellata*, and *Quercus velutina*, along with *Carya tomentosa, Carya glabra*, and other *Carya* spp. Other common tree species include *Acer rubrum, Liquidambar styraciflua, Liriodendron tulipifera, Pinus echinata, Pinus taeda*, and *Pinus virginiana*.

***Diagnostic Characteristics:** This group includes the *Quercus*-dominated upland matrix forests of the Piedmont, as well as the less extensive dry and dry-mesic forests of similar oak species of the adjacent Atlantic Coastal Plain, which tend to be on more topographically complex or fire-sheltered parts of the landscape. They are dominated by various combinations of upland broad-leaved deciduous *Quercus* spp., sometimes with *Pinus* spp. or *Carya* spp. as a significant component.

***Classification Comments:** Although these forests have often been called "oak-hickory" (Braun 1950) or "oak-pine-hickory" (Kuchler 1964, Greller 1989, Skeen et al. 1993), Monk et al. (1990) concluded there was insufficient abundance of *Carya* spp. to justify including this genus in the name of such forests. There are fairly dramatic differences in the amount of pine present across the modern day Piedmont landscape, with it being especially prevalent in South Carolina, Georgia, and Alabama (USGS 1992). To some extent, the prevalence of pine in these southern portions of the region may represent natural conditions (Nelson 1957). It is possible that the more heavily mixed or pine-dominated forests of the southern Piedmont should be recognized as a different group, but distinguishing natural examples is difficult given a long history of land-use impacts and resulting vegetational changes in the region (Brender 1974). In addition, Skeen et al. (1993) assert that "the oak-hickory-pine designation may be reflective of past land use and disturbance history and that the steady-state typal forest of the southeastern Piedmont is in reality oak-hickory-yellow poplar." There is some clear variation among associations within this group, between dry and dry-mesic forests and also between those on acidic or basic soils. These will inform the composition of the different alliances, but the similar canopy composition and similar dynamics tie them together, and those distinctions may best be made at the alliance and association level. Large areas once dominated by oak-hickory forests now have successional pine forest, and this will be found in other groups. In the coastal plain, there is a broad gradient in climate and species composition from north to south and west. Differences between coastal plain and Piedmont stands are sometimes fairly subtle, and species that differentiate them in one part of the range many not work in other parts. In particular, some species that are excluded from the coastal plain farther south are common components farther north, including *Quercus rubra*. These distinctions will also be worked out at the alliance and association levels.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G159	South-Central Interior Oak Forest & Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Stands are typically closed-canopy broad-leaved deciduous forests under current conditions, but prior to the mid-twentieth century, many examples exhibited somewhat open canopies and grassy ground layers.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Stands of this forest group are generally dominated by combinations of upland oaks, particularly *Quercus alba, Quercus coccinea, Quercus falcata, Quercus rubra, Quercus stellata*, and *Quercus velutina*, along with *Carya tomentosa (= Carya alba), Carya glabra*, and other *Carya* spp. In the northern and non-coastal part of its range, *Quercus rubra* and/or *Quercus montana (= Quercus prinus)* may be components, while in the southern part, evergreen species such as *Quercus hemisphaerica* or *Quercus nigra* may become more prominent. Other common tree species include *Acer rubrum, Liquidambar styraciflua, Liriodendron tulipifera, Pinus echinata, Pinus taeda*, and *Pinus virginiana*. In some mafic Piedmont examples on distinctly drier hardpan soils, stands may be open forests or woodlands of *Quercus stellata*, with *Quercus marilandica* as a characteristic associate. In addition, *Quercus alba, Carya tomentosa, Carya glabra, Carya pallida*, and *Fraxinus americana* may be canopy components. In particular, Piedmont mafic examples exhibit a pronounced abundance of hickory relative to other Piedmont forests (Farrell and Ware 1991, Ware 1992). If the canopy of drier examples is more open, this can, under certain conditions, lead to a more diverse and grassy herb layer than in most Piedmont forests. Some of these sites may have once supported open prairies or prairie savannas under a more frequent fire regime. In recent years, more shade-tolerant species appear to be increasing in many of these forests. In the northern part of the range, *Fagus grandifolia, Ilex opaca*, and *Nyssa sylvatica* are abundantly invading the understories of older oak forests on dry-mesic, acidic sites. On basic sites, *Carya* spp. and *Fraxinus americana* often dominate the understory. The invasion of oak forests by more mesophytic and/or fire-intolerant potential oak-replacement species is just one part of the story. In addition, oak recruitment is decreasing or virtually absent in many of these forests, particularly the dry-mesic ones. This may be a result of the lengthening of fire-return times during the latter part of the twentieth century. There is some variation in composition with aspect and degree of exposure to fire. *Pinus echinata* may be present in some stands, particularly on drier south- and west-facing slopes but is typically not dominant. *Pinus taeda* is sometimes present, but it is unclear if it is a natural component or has entered only as a result of past cutting.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Much of the Piedmont landscape is currently composed of successional forests that have arisen after repeated cutting, clearing, and cultivation of original oak-hickory forests. In successional forests, recovering from clearcutting or cultivation, *Pinus* spp. (e.g., *Pinus echinata, Pinus taeda)* dominate for a number of decades, with *Quercus* spp. and *Carya* spp. gradually invading the understory and then entering the canopy. A well-developed understory and shrub layer is generally present, with species varying with soil chemistry. The herb layer is variable in density and diversity, being sparse to, at most, moderate in density in drier, acidic examples, to rather dense in basic examples as well as more mesic ones. When natural fires were more frequent, the forests presumably had less understory and shrub density and probably a grassy herb layer. Fire was probably once the most important natural dynamic process, but the almost universal elimination of fire in the Piedmont makes this difficult to tell. The xeric nature of sites with clay hardpans may have allowed fire to create open vegetation there while allowing forests to develop on more typical soils. Fire would have kept canopies open by limiting or slowing tree regeneration and would have promoted a more diverse, grass-dominated herb layer. Bison may have once been a significant influence in the pre-settlement and historic landscape as well.

ENVIRONMENT

Environmental Description: These forests occur in a variety of habitats and, under natural conditions, were the matrix vegetation type covering most of the landscape. Much of this group is currently composed of successional forests that have arisen after repeated cutting, clearing, and cultivation of original oak-hickory forests. If the canopy of drier examples is more open, this can, under certain conditions, lead to a more diverse and grassy herb layer than in most Piedmont forests. Some of these sites may have once supported open prairies or prairie savannas under a more frequent fire regime. In recent years, more shade-tolerant species appear to be increasing in many of these forests.

DISTRIBUTION

***Geographic Range:** Vegetation of this group occurs primarily in the Piedmont from Maryland to Alabama. Some associations may extend into the adjacent Atlantic Coastal Plain.
Nations: US
States/Provinces: AL, FL?, GA, MD, NC, SC, VA
USFS Ecoregions (2007) [optional]: 231A:CC, 231B:CC, 231I:CC, 232H:CC, 232J:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.4.45b:C, 8.3.4.45c:C, 8.3.4.45g:C, 8.3.5.65k:C, 8.3.5.65l:C, 8.3.5.65m:C, 8.5.1.63e:C, 8.5.1.63h:C, 8.5.3.75f:C, 8.5.3.75h:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:** Numerous plots have been sampled in this group, and units similar to many of the associations have been found in a number of local studies. However, the details vary from one study to another.
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3295	*Quercus stellata - Quercus margarettae* Woodland Alliance
A3293	*Quercus rubra - Quercus alba - Carya* spp. Piedmont Forest Alliance
A3294	*Quercus stellata - Carya* spp. *- Pinus echinata* Piedmont Woodland Alliance
A3268	*Pinus echinata - Quercus stellata - Quercus marilandica* Piedmont Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Dry Oak--Hickory Forest	Schafale and Weakley 1990	includes both their Coastal Plain and Piedmont manifestations.
=	Dry-Mesic Oak--Hickory Forest	Schafale and Weakley 1990	includes both their Coastal Plain and Piedmont manifestations.
=	Oak-Hickory Forest	Bennett and Nelson 1991	
?	Piedmont Flatwoods	Wharton 1978	

AUTHORSHIP

***Primary Concept Source [if applicable]:** M.P. Schafale and A.S. Weakley (1990)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne

Acknowledgments [optional]: We have incorporated significant descriptive information developed or compiled by M. Schafale, G. Fleming, and K. Taverna.

Version Date: 04 May 2015

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EPA [Environmental Protection Agency]. 2004. Level III and IV Ecoregions of EPA Region 4. U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Western Ecology Division, Corvallis, OR. Scale 1:2,000,000.

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G012. Shortleaf Pine - Oak Forest & Woodland

Type Concept Sentence: This group encompasses forests and woodlands of the interior plateaus, Appalachians, Piedmont, Ozark-Ouachita, and upper coastal plain regions, north of the primary range of *Pinus palustris*, in which *Pinus echinata* dominates the canopy or is a significant component of it.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.1. Southern & South-Central Oak - Pine Forest & Woodland (M016)

Elcode: G012
***Scientific Name:** *Pinus echinata - Quercus falcata - Quercus stellata* Forest & Woodland Group
***Common (Translated Scientific) Name:** Shortleaf Pine - Southern Red Oak - Post Oak Forest & Woodland Group
***Colloquial Name:** Shortleaf Pine - Oak Forest & Woodland

***Type Concept:** This group encompasses forests and woodlands of the interior plateaus, Appalachians, Piedmont, Ozark-Ouachita, and upper coastal plain regions (north of the primary range of *Pinus palustris* in the coastal plains) in which *Pinus echinata* is the canopy dominant (or at least an important component). Examples can occur on a variety of topographic and landscape positions, including ridgetops, upper and midslopes, as well as lower elevations (generally below 700 m [2300 feet]) in the Southern Appalachians such as mountain valleys, as well as on rolling uplands in the Upper East Gulf Coastal Plain. Examples occur on a variety of acidic soils or bedrock types. Stands may be codominated by *Quercus* spp., *Carya* spp., and other hardwoods, with the varying proportion of pine versus hardwood depending on management (both commercial forestry and ecological management), particularly time since fire. Although examples of this group occur throughout this broad area, there is considerable local variation in their extent in the landscape and in their structure and composition. In more open stands (such as ones in naturally drier regions or ones which have experienced more recent/frequent fire), the understory is characterized by *Andropogon gerardii, Schizachyrium scoparium*, and other prairie graminoid elements. In the lower elevations of the Southern Appalachians, and under current conditions, stands are dominated by *Pinus echinata* or *Pinus virginiana*. *Pinus rigida* may sometimes be present. Stands found outside of the coastal plains in which *Pinus palustris* is a component are also included here. Hardwoods are sometimes abundant, especially dry-site oaks such as *Quercus falcata, Quercus montana, Quercus stellata*, and *Quercus coccinea*, but also *Carya glabra* and other hickories. The shrub layer may be well-developed, with *Vaccinium pallidum, Gaylussacia baccata*, or other acid-tolerant species being most characteristic. Herbs are usually sparse but may include *Pityopsis graminifolia* and *Tephrosia virginiana*. There is some regional variation in composition across the range of this group, with examples in the Ozark-Ouachita area and the upper coastal plain lacking *Pinus rigida, Pinus virginiana*, and *Quercus montana*. In the upper coastal plains, where fire is more frequent, stands of vegetation affiliated with this group may develop a relatively pure and open canopy of *Pinus echinata* with scattered overstory trees and an herbaceous-dominated understory, but such examples are rare on the modern landscape unless maintained by ecological management. More typical are examples in which *Quercus* spp., *Carya* spp., *Liquidambar styraciflua, Liriodendron tulipifera, Acer* spp., and *Nyssa sylvatica* have become prominent in the midstory and overstory and in which herbaceous patches are rare.

***Diagnostic Characteristics:** The cover of needle-leaved evergreen trees (*Pinus echinata* possibly with *Pinus rigida* and/or *Pinus virginiana* within their ranges) is variable, but typically is greater than 50%, with broad-leaved deciduous tree species *Quercus falcata, Quercus stellata*, and/or *Quercus montana* (within its range) singly or in combination varying greatly depending on management, but typically greater than 25% cover. Shrub diagnostics vary but typically include *Vaccinium* spp. and *Gaylussacia* spp. in combination with the above overstory dominants. In more open stands, native warm-season grasses including *Schizachyrium scoparium* will be dominant rather than shrubs.

***Classification Comments:** There is some regional variation in composition across the range of this group, with examples in the Ozark-Ouachita area and the Upper Coastal Plain lacking *Pinus rigida, Pinus virginiana*, and *Quercus montana*. Stands found outside of the coastal plains in which *Pinus palustris* is a component are also included here. These were formerly included in Montane &

Piedmont Longleaf Pine Woodland Group (G164). Examples of this group mainly occur in three general areas: the Appalachians (broadly defined to include the Cumberlands and Piedmont); the East Gulf Coastal Plain north of the range of *Pinus palustris*; and the Ozark-Ouachita areas of Missouri and Arkansas. In addition, any shortleaf pine-dominated or -codominated vegetation of the Interior Low Plateau (ILP), including examples in southern Indiana and the Tennessee portion of Land Between the Lakes, would also be included. Frost (1998) treats the ILP region in a different fire-return-interval class than the core range of this group, although local variation may overwhelm the broad regional differences. If more detailed information becomes available to document important ecological differences between these areas, it would improve our understanding of the dynamics and compositional variability. Vegetation in the Upper Gulf Coastal Plain west of the Mississippi River is accommodated in a different group.

A group of dry to xeric sand barren shortleaf pine/scrub oak-dominated associations are also placed here (e.g., *Quercus (incana, margarettae, arkansana) - (Pinus echinata) / Schizachyrium scoparium* Woodland (CEGL007972), *Quercus arkansana - Quercus incana / Selaginella arenicola ssp. riddellii* Woodland (CEGL003693), and some other related types). These were formerly placed in Southern Coastal Plain Dry Pine - Oak Forest Group (G155), which has been subsumed here. The addition of these types broadens the ecological amplitude of the group, and some of these may be placed in a different alliance (the others being mainly biogeographic in their primary identity).

There is vegetation which lies south of about 32°30'N latitude (about the latitude of Jackson, Mississippi, and within the general range of *Pinus palustris*) that may not be adequately represented in the NVC and Ecological Systems classifications. This area (which includes the Homochitto National Forest) is different from both the shortleaf pine-oak vegetation to the north and the longleaf pine-dominated vegetation to the east in the non-loessal coastal plain. It could be called "East Gulf Coastal Plain Mixed Pine (Oak) Forest." In stands of this type, all three pine species (*Pinus palustris, Pinus taeda*, and *Pinus echinata*) co-occur with oaks (e.g., *Quercus alba, Quercus falcata, Quercus pagoda, Quercus shumardii*) in a complex mosaic in gently to moderately rolling terrain. This is consistent with the ranges of Oak-Pine vegetation versus Longleaf-Loblolly-Slash Pines in Shantz and Zon (1924). More information is needed.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G162	Virginia Pine - Table Mountain Pine Woodland & Barrens	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Examples are dominated by needle-leaved evergreen trees, or a combination of needle-leaved evergreen and broad-leaved deciduous trees. The density of stands may vary from open to closed, depending on moisture regime, climate and management, particularly time since last fire, and average fire frequency over a period of several decades. More open stands are more likely to have a graminoid-dominated ground layer; otherwise the low-shrub stratum may be dense, with herbs correspondingly lower in cover.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Pinus echinata* is the canopy dominant (or at least an important component); stands may be codominated by *Quercus* spp., *Carya* spp., and other hardwoods. In more open stands, the understory is characterized by *Andropogon gerardii, Schizachyrium scoparium*, and other prairie graminoid elements. In the lower elevations of the Southern Appalachians, and under current conditions, stands are dominated by *Pinus echinata* or *Pinus virginiana*. *Pinus rigida* may sometimes be present. Some stands ("montane" or "Piedmont" longleaf) dominated by *Pinus palustris* are also included here. Hardwoods are sometimes abundant, especially dry-site oaks such as *Quercus falcata, Quercus montana (= Quercus prinus)*, and *Quercus coccinea*, but also *Carya glabra* and other hickories. The shrub layer may be well-developed, with *Vaccinium pallidum, Vaccinium arboreum, Vaccinium stamineum, Gaylussacia baccata*, or other acid-tolerant species most characteristic. Herbs are usually sparse but may include *Pityopsis graminifolia* and *Tephrosia virginiana*. There is some regional variation in composition across the range of this group, with examples in the Ozark-Ouachita area and the Upper Coastal Plain lacking *Pinus rigida, Pinus virginiana*, and *Quercus montana*. In the Upper Coastal Plain, where fire is more frequent, stands of vegetation affiliated with this group may develop a relatively pure and open canopy of *Pinus echinata* with scattered overstory trees and an herbaceous-dominated understory; such examples are rare on the current landscape. More typical are examples in which *Quercus* spp., *Carya* spp., *Liquidambar styraciflua, Liriodendron tulipifera, Acer* spp., and *Nyssa sylvatica* have become prominent in the midstory and overstory and in which herbaceous patches are rare.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Fire is clearly an important influence and may be the sole factor determining the occurrence of stands of this group rather than hardwood forests under natural conditions. Fires probably were frequent and of low intensity, or a mix of low and higher intensity. Within the range of *Pinus virginiana*, fire probably is important for determining the balance of the two pine species, the component of hardwoods, and the overall vegetation structure. *Pinus echinata* is fairly resilient to fire once mature, while *Pinus virginiana* individuals are fairly susceptible to fire but well-adapted to establishing in areas opened by intense fire. In the Upper Gulf Coastal Plain, the frequent presence of surface fire is important in order to support the reproduction of *Pinus echinata*, which is a shade-intolerant species and does not survive or grow well when fire-suppressed. Young shortleaf pines are generally slower growing and slower to dominate a site than *Pinus taeda* or many hardwood competitors, but they usually will endure competition longer. *Dendroctonus frontalis* (southern pine beetle) outbreaks are an important factor in examples of this group, at least under present conditions. These beetle outbreaks can kill all the pines without creating the conditions for the pines to regenerate. Effects of logging and past clearing as well as fire suppression make understanding of this group's natural character and dynamics difficult. An extensive hardwood component may partly be the result of fire suppression. In natural pine forests, logging may allow pines to regenerate or may change the composition to weedy hardwoods. It might alter canopy composition as well as structure. In the Ozarks and Ouachitas, fire frequency is 3-4 years mean fire interval (range=1-12 years) (Masters et al. 1995). Annual fire was common historically. Replacement and mixed severity fires are infrequent, every 100 to 1000 years. Stand-replacement fires occurred mostly under extreme drought conditions during the growing season. Other disturbance types include ice storms, wind events, and insect infestations. *Pinus echinata* can maintain dominance on most sites after it overtops competing vegetation, but in general, hardwoods cannot be eliminated from pine sites. On very good sites (i.e., with high site index), however, it may not outgrow competing species such as sweetgum and red maple (Lawson 1990).

ENVIRONMENT

Environmental Description: Examples can occur on a variety of topographic and landscape positions, including ridgetops, upper and midslopes, as well as lower elevations (generally below 700 m [2300 feet]) in the Southern Appalachians such as mountain valleys, as well as on rolling uplands in the Upper East Gulf Coastal Plain. Examples occur on a variety of acidic soils or bedrock types. In the Ozark Highlands, this group was historically prominent only in the southeastern part, where sandstone-derived soils were common (USFS 1999), being limited in other areas by inadequate winter precipitation and non-conducive soils. In contrast, pine was "virtually ubiquitous in the historical forests of the Ouachitas" (USFS 1999). In nearly all cases (at least in the Ouachitas), *Pinus echinata* occurs with a variable mixture of hardwood species. The exact composition of the hardwoods is much more closely related to aspect and topographic factors than is the pine component (Dale and Ware 1999). The belted character of the Upper Gulf Coastal Plain region, in the form of inner lowlands and cuestas and other low-ridge landforms (Bowman 1911, Fenneman 1938), the associated diversity of soil types, and differences in settlement history appear to account for the importance of shortleaf pine in the Gulf Coast region when compared to the Atlantic Coastal Plain (White and Lloyd 1998). Cuestas and other hills create strong environmental gradients which, coupled with soil characteristics, promote a variety of mixed pine and pine-hardwood vegetation in this region; local differences in topography, parent material, and exposure influence site characteristics, resulting in numerous different plant communities. This group primarily occupies the dry and dry-mesic portion of regional moisture gradients. Wide variation in vegetation composition across this gradient is also strongly related to fire frequency and intensity (White and Lloyd 1998).

DISTRIBUTION

***Geographic Range:** Examples of this group mainly occur in three general areas: the Appalachians (broadly defined to include the Cumberlands and Piedmont) from Alabama to Virginia and Kentucky; the East Gulf Coastal Plain generally north of the range of *Pinus palustris* from Georgia to Mississippi; and the Ozark-Ouachita areas of Arkansas, adjacent Oklahoma, and southeastern Missouri. In addition, any shortleaf pine-dominated or -codominated vegetation of the Interior Low Plateau, including examples in southern Indiana, the Knobs Region of Kentucky, and the Tennessee portion of Land Between the Lakes, is included. *Pinus echinata*-dominated or -codominated vegetation in the West Gulf Coastal Plain of Arkansas, Louisiana and Texas is accommodated in Western Gulf Coastal Plain Pine - Oak Forest & Woodland Group (G013).

In the Upper East Gulf Coastal Plain, this vegetation was the historical matrix in large areas of the region in Alabama and Mississippi, particularly between about 32°30'N latitude and about 35°N latitude. In southwestern Mississippi, this group is apparently dominant on the landscape west of 91°W longitude to the limits of the alluvial plain and northwest of a line running approximately from the intersection of 31°N latitude and 91°W longitude, northeastward to the city of Jackson, Mississippi, extending at least to about 34°N latitude. This is consistent with the ranges of oak-pine vegetation (generally equivalent to this group) versus longleaf-loblolly-slash pines in Shantz and Zon (1924).

Nations: US

States/Provinces: AL, AR, FL, GA, IN, KY, MO, MS, NC, OK, SC, TN, VA, WV?

USFS Ecoregions (2007) [optional]: 221H:CC, 221J:CC, 223A:CC, 223D:CC, 223E:CC, 231A:CC, 231B:CC, 231C:CC, 231D:CC, 231G:CC, 231H:CC, 231I:CC, M221A:CC, M221C:CC, M221D:CC, M223A:CC, M231A:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.5.65a:C, 8.3.5.65b:C, 8.3.5.65d:C, 8.3.5.65e:C, 8.3.5.65i:C, 8.3.6.74b:C, 8.3.6.74c:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3269	*Pinus echinata - Pinus pungens - Quercus montana* Appalachian Woodland Alliance
A3272	*Pinus palustris - Pinus echinata - Quercus montana* Interior Woodland Alliance
A3271	*Pinus echinata - Quercus stellata - Quercus velutina* Ozark-Ouachita Woodland Alliance
A3270	*Pinus echinata - Quercus falcata* Upper Coastal Plain Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-01-02	G164 Pinus palustris - Quercus prinus / Schizachyrium scoparium Woodland Group	G164 merged into G012.

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Shortleaf Pine - Oak: 76	Eyre 1980	

AUTHORSHIP

***Primary Concept Source [if applicable]:** F.H. Eyre (1980)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne
Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by A.S. Weakley, K.D. Patterson, T. Govus, and R. Evans.
Version Date: 04 May 2015

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G159. South-Central Interior Oak Forest & Woodland

Type Concept Sentence: These dry-mesic hardwood forests cover much of the landscape west of the Appalachians between about 34°N and 38°N latitude, including the unglaciated part of the Interior Low Plateau, the Upper East Gulf Coastal Plain and Crowley's Ridge, and the Ozarks and Ouachitas. Stands are dominated by *Quercus* species, including *Quercus alba, Quercus coccinea, Quercus falcata, Quercus marilandica, Quercus rubra, Quercus stellata*, and/or *Quercus velutina*, with *Carya* species also typically prominent.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.1. Southern & South-Central Oak - Pine Forest & Woodland (M016)

Elcode: G159
***Scientific Name:** *Quercus alba - Quercus falcata - Quercus rubra* Forest & Woodland Group
***Common (Translated Scientific) Name:** White Oak - Southern Red Oak - Northern Red Oak Forest & Woodland Group
***Colloquial Name:** South-Central Interior Oak Forest & Woodland

***Type Concept:** This group represents the dry-mesic hardwood forests that cover much of the landscape in a band of unglaciated terrain, between about 34°N latitude and 38°N latitude, extending west of the Appalachians, including the unglaciated part of the Interior Low Plateau, the Upper East Gulf Coastal Plain and Crowley's Ridge, and extending into the Ozarks and Ouachitas of Arkansas, Missouri and Oklahoma. A number of different *Quercus* species (including *Quercus alba, Quercus rubra, Quercus falcata, Quercus velutina* or *Quercus stellata, Quercus marilandica*, and *Quercus coccinea*) may dominate stands of this group, with *Carya* species also prominent, including *Carya tomentosa, Carya glabra, Carya ovata, Carya pallida*, and others. East of the Mississippi River, in some drier examples on more acidic substrates, *Quercus montana* is typical, reflecting relations with similar Appalachian forest groups further to the east. *Quercus alba* may also be present but not necessarily dominant, but will typically exhibit dominance in the submesic to dry-mesic examples, possibly with *Quercus falcata* and/or *Quercus velutina*. In addition, *Quercus coccinea, Quercus marilandica*, and/or *Quercus stellata* will also share dominance or be prominent in many of the drier examples. *Quercus muehlenbergii, Quercus pagoda*, and/or *Quercus shumardii* may appear in examples with high base status. Under current conditions, the understories are typically shrub- and small tree-dominated, with the typical species varying with aspect, soil, and moisture relations. More open canopies and grass-dominated understories may have been more prevalent prior to the mid-twentieth century, when open grazing and surface fires were more common. In the Interior Low Plateaus, the range of this group is generally consistent with the "Western Mesophytic" Forest region of Braun (1950), Keever (1971), and Greller (1988). Examples are typically found along ridgetops and slopes of various aspects. The floristic expression of different associations included in this group varies considerably with aspect and soil type. The associations range along a moisture gradient from submesic to dry. The submesic to dry-mesic expressions tend to be found on mid slopes with northerly to easterly aspects, and the dry expressions on southerly to westerly aspects and on narrow ridges. Parent material can range from calcareous to acidic with very shallow, well- to excessively well-drained soils in the dry expressions and moderately well-drained soils in the submesic to dry-mesic ones. The canopy closure of this group ranges from closed to somewhat open in the dry examples. On Crowley's Ridge, the vegetation is very distinctive from that of the adjacent alluvial plain, and the sites occur on distinct slopes that rise above the alluvial plain surface. Occurrences of this group generally comprise dry-mesic forests that occupy west-facing slopes and narrow, "finger" ridgetops in a highly dissected landscape. Historically, these examples may have been more open under conditions of more frequent fire. In the Ozarks and Ouachitas, soils are typically moderately to well-drained and more fertile than those associated with oak woodlands. Wind, drought, lightning, and occasional fires can influence vegetation of this group.

***Diagnostic Characteristics:** These are moderately tall, upland forests dominated by *Quercus* species, including *Quercus alba, Quercus coccinea, Quercus falcata, Quercus marilandica, Quercus rubra, Quercus stellata*, and/or *Quercus velutina*, with *Carya* species also typically prominent, found in the Interior Low Plateaus, and extending into the Ozarks and Ouachitas.

***Classification Comments:** Need to clarify range in the Upper East Gulf Coastal Plain (EPA 65, 74 in Alabama, Mississippi); also need to check the states of the associations and alliances.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G165	Piedmont-Central Atlantic Coastal Plain Oak Forest	
G017	Cross Timbers & East-Central Texas Plains Oak Forest & Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are moderately tall, closed-canopy forests at present, but more open canopies and grass-dominated understories may have been more prevalent prior to the mid-twentieth century. These are upland forests in unglaciated landscapes.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: A number of different *Quercus* species (including *Quercus alba, Quercus falcata, Quercus rubra, Quercus velutina* or *Quercus coccinea, Quercus marilandica*, and *Quercus stellata* in drier stands) may dominate stands of this group, with *Carya* species also prominent, including *Carya tomentosa (= Carya alba), Carya glabra, Carya ovata, Carya pallida*, and others. East of the Mississippi River, in some drier examples on more acidic substrates, *Quercus montana (= Quercus prinus)* is typical, reflecting relations with similar Appalachian forest groups further to the east. *Quercus alba* may also be present but not necessarily dominant, but will typically exhibit dominance in the submesic to dry-mesic examples, possibly with *Quercus velutina* or *Quercus falcata*. In addition, *Quercus stellata, Quercus marilandica*, and *Quercus coccinea* will also share dominance or be prominent in many of the dry examples. *Quercus muehlenbergii, Quercus pagoda*, and/or *Quercus shumardii* may appear in examples with high base status. Some other species which may be present include *Acer floridanum (= Acer barbatum), Acer saccharum* (in more mesic examples), *Cercis canadensis, Cornus florida, Fagus grandifolia, Fraxinus americana, Gleditsia triacanthos, Gymnocladus dioicus, Juglans nigra, Juniperus virginiana var. virginiana, Kalmia latifolia, Ostrya virginiana, Oxydendrum arboreum, Schizachyrium scoparium, Smilax* spp., *Styrax americanus, Ulmus americana, Ulmus serotina, Vaccinium arboreum, Vaccinium pallidum, Vaccinium stamineum*, other highbush *Vaccinium* species, *Viburnum acerifolium*, and *Vitis aestivalis*. Forbs of the Fabaceae (e.g., *Desmodium*) and Asteraceae (e.g., *Helianthus*) will be prominent in many examples. Under current conditions, the understories are typically shrub- and small tree-dominated, with the typical species varying with aspect, soil, and moisture relations. More open and grass-dominated understories may have been more prevalent prior to the mid-twentieth century, when open grazing and surface fires were more common.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Wind effects, drought, lightning, and occasional fires can influence the physiognomy and composition of stands of this group.

ENVIRONMENT

Environmental Description: *Soil/substrate/hydrology:* This is the matrix vegetation over much of its range, and occurs on dry-mesic to mesic, gentle to moderately steep slopes. Soils are typically moderately to well-drained and more fertile than those associated with oak woodlands. This group encompasses a variety of associations ranging along a moisture gradient from submesic to dry. The submesic to dry-mesic expressions tend to be found on mid slopes with northerly to easterly aspects; the dry expressions are found on southerly to westerly aspects and on broad ridges. Parent material can range from calcareous to acidic with very shallow, well- to excessively well-drained soils in the drier expressions and moderately well-drained soils in the submesic to dry-mesic ones. On Crowley's Ridge, loess soil is a characteristic and diagnostic component of the environment.

DISTRIBUTION

***Geographic Range:** Vegetation of this group extends across a band of unglaciated terrain between about 34°N latitude and 38°N latitude, extending west of the Appalachians, including parts of the Interior Low Plateaus (including southern Indiana and a small part of southeastern Ohio), also including the Upper East Gulf Coastal Plain and Crowley's Ridge, and extending into the Ozarks and Ouachitas of Arkansas, Missouri and Oklahoma.
Nations: US
States/Provinces: AL, AR, IL, IN, KS?, KY, LA, MO, MS, OH, OK, TN, WV
USFS Ecoregions (2007) [optional]: 223A:CC, 223B:CC, 223D:CC, 223E:CC, 223F:CC, 231C:CC, 231E:CC, 231G:CC, 234A:CC, 234D:CC, 234E:CC, M223A:CC, M231A:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.2.72a:C, 8.3.2.72b:C, 8.3.2.72c:C, 8.3.2.72d:C, 8.3.2.72e:C, 8.3.2.72f:C, 8.3.2.72g:C, 8.3.2.72h:C, 8.3.2.72i:C, 8.3.2.72j:C, 8.3.2.72k:C, 8.3.2.72l:C, 8.3.2.72m:C, 8.3.3.71a:C, 8.3.3.71b:C, 8.3.3.71c:C, 8.3.3.71d:C, 8.3.3.71e:C, 8.3.3.71f:C, 8.3.3.71g:C, 8.3.3.71h:C, 8.3.3.71i:C, 8.3.3.71j:C, 8.3.3.71k:C, 8.3.3.71l:C, 8.3.3.71n:C, 8.3.7.35d:C, 8.4.5.39a:C, 8.4.5.39b:C, 8.4.5.39c:C, 8.4.5.39d:C, 8.4.5.39e:C, 8.4.5.39f:C, 8.4.5.39g:C, 8.4.5.39h:C, 8.4.5.39i:C, 8.4.5.39j:C, 8.4.5.39k:C, 8.4.6.38a:C, 8.4.6.38b:C, 8.4.7.37a:C, 8.4.7.37b:C, 8.4.7.37c:C, 8.4.7.37d:C, 8.4.7.37e:C, 8.4.8.36a:C, 8.4.8.36b:C, 8.4.8.36c:C, 8.4.8.36d:C, 8.4.8.36e:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High

USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3291	*Quercus stellata - Quercus falcata - Quercus alba* Interior Low Plateau Woodland Alliance
A3288	*Quercus alba - Quercus falcata - Quercus stellata* Ozark-Ouachita Forest Alliance
A3290	*Quercus stellata - Quercus marilandica - Quercus alba* Ozark-Ouachita Woodland Alliance
A3292	*Quercus velutina - Carya* spp. Forest Alliance
A3289	*Quercus montana - Quercus falcata* Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Dry-mesic Loess/Glacial Till Forest	Nelson 2005	

AUTHORSHIP

***Primary Concept Source [if applicable]:** A.M. Greller (1988)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne

Acknowledgments [optional]:

Version Date: 04 May 2015

REFERENCES

***References [Required if used in text]:**

Braun, E. L. 1950. Deciduous forests of eastern North America. Hafner Press, New York. 596 pp.

Clark, G. T. 1974. A preliminary ecological study of Crowley's Ridge. Pages 213-241 in: Arkansas Department of Planning. Arkansas natural area plan. Arkansas Department of Planning. Little Rock. 248 pp.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, M. Russo, K. Schulz, K. Snow, J. Teague, and R. White. 2003-present. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, VA.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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Keever, C. 1971. A study of the mixed mesophytic, western mesophytic, and oak chestnut regions of the eastern deciduous forest, including a review of the vegetation and sites recommended as potential natural landmarks. National Park Service. 340 pp.

NatureServe Ecology - Southeastern United States. No date. Unpublished data. NatureServe, Durham, NC.

Nelson, P. 2005. The terrestrial natural communities of Missouri. Third edition. Missouri Natural Areas Committee, Department of Natural Resources and the Department of Conservation, Jefferson City, MO. 550 pp.

1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G651. South-Central Interior Oak Savanna & Barrens

Type Concept Sentence: This vegetation includes open woodlands dominated by *Quercus montana* with *Carya glabra, Pinus virginiana*, and *Quercus coccinea*; or by *Quercus stellata* and *Quercus marilandica*, found on shale and siltstone barrens and ridges in the Allegheny Plateau and Knobs region of Kentucky, or on clay soils derived from limestone in the Ridge and Valley of Georgia, or loessal soils on the Interior Low Plateau of Tennessee.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.1. Southern & South-Central Oak - Pine Forest & Woodland (M016)

Elcode: G651
***Scientific Name:** South-Central Interior Oak Savanna & Barrens Group
***Common (Translated Scientific) Name:** South-Central Interior Oak Savanna & Barrens Group
***Colloquial Name:** South-Central Interior Oak Savanna & Barrens

***Type Concept:** This vegetation includes two distinct assemblages of open woodlands. One is found on shale and siltstone barrens and ridges in the Allegheny Plateau and Knobs region of Kentucky, possibly ranging into Tennessee; the other is found on clay soils derived from limestone in the Ridge and Valley of Georgia, as well as on winter-wet, summer-dry loessal soils on the Interior Low Plateau (Western Highland Rim) of Tennessee. The canopies of the former are dominated by *Quercus montana*, with lesser coverage by *Amelanchier arborea, Carya glabra, Pinus virginiana, Quercus coccinea*, and *Quercus velutina*. Other species include the woody plants *Carya tomentosa, Cornus florida*, and *Vaccinium pallidum*, and the grasses and forbs *Aristida dichotoma, Aristida oligantha, Danthonia spicata, Dichanthelium linearifolium, Pityopsis graminifolia var. latifolia*, and *Potentilla canadensis*. Some examples may contain *Silene caroliniana*. The latter less acidic examples are dominated by *Quercus stellata* and *Quercus marilandica*, with a diverse ground layer containing a wide variety of native forbs and grasses. *Pinus echinata* may be present in some examples. Among the dominant grasses, *Schizachyrium scoparium* is most abundant, with *Andropogon gerardii* and *Sorghastrum nutans*; *Carex* spp., *Dichanthelium* spp. *Gymnopogon ambiguus, Panicum virgatum*, and *Sporobolus clandestinus* may also be present.

***Diagnostic Characteristics:** This group is defined to cover woodlands associated with shale and siltstone substrates dominated by *Quercus montana* in the Allegheny Plateau and Knobs region of Kentucky, as well as other woodlands associated with clay soils derived from limestone in the Ridge and Valley of Georgia and winter-wet, summer-dry loessal soils on the Interior Low Plateau (Western Highland Rim) of Tennessee. In this latter vegetation, *Quercus marilandica* and *Quercus stellata* are characteristic overstory dominants.

***Classification Comments:** There may be other undescribed associations that would be placed here, or associations currently in other groups that actually belong here. This concept is that of woodlands (i.e., the tree cover is thought to range from 25-60%), not "sparse woodlands" or "barrens" where tree cover is more typically 10-25%.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are open deciduous woodlands. Trees may be stunted and gnarled. Better quality examples will exhibit an open overstory with a sparse subcanopy and understory, over a ground layer containing a variety of native forbs and grasses.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: In one suite of these woodlands, found on shale and siltstone in Kentucky and Tennessee, canopies are dominated by *Quercus montana (= Quercus prinus)*, with lesser coverage by *Amelanchier arborea, Carya glabra, Pinus virginiana, Quercus coccinea*, and *Quercus velutina*. In this vegetation, other species include the woody plants *Carya tomentosa (= Carya alba), Cornus florida*, and *Vaccinium pallidum*, and the grasses and forbs *Aristida dichotoma, Aristida oligantha, Danthonia spicata, Dichanthelium linearifolium, Pityopsis graminifolia var. latifolia*, and *Potentilla canadensis*. Some examples may contain *Silene caroliniana* (*ssp. wherryi*, or possibly *ssp. pensylvanica*). In examples of a second suite of woodlands, found on clay or loessal soils in Georgia and Tennessee, the canopies are dominated by *Quercus stellata* and *Quercus marilandica*, with a diverse ground layer containing a wide variety of native forbs and grasses. *Pinus echinata* may be present in some examples. Among the dominant grasses, *Schizachyrium scoparium* is most abundant, with *Andropogon gerardii* and *Sorghastrum nutans* most characteristic; *Carex* spp., *Dichanthelium* spp. *Gymnopogon ambiguus, Panicum virgatum*, and *Sporobolus clandestinus* may also be present.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Presumably a combination of edaphic factors (dry, rocky soil or xerohydric soil) with historic grazing and fire operated to keep these sites open. Under current conditions, ecological management, including prescribed fire, may be necessary to maintain them in an open condition and maintain their ground layer vegetation.

ENVIRONMENT

Environmental Description: This group accommodates two suites of woodlands.Tthe first includes open woodlands of shale and siltstone barrens and ridges of the Allegheny Plateau and Knobs region of Kentucky; the other suite of woodlands are found over clay and loessal substrates over limestone-derived soils in the Ridge and Valley of Georgia, on winter-wet, summer-dry loessal soils in the Interior Low Plateau (Western Highland Rim) of Tennessee. There are possibly undescribed associations of related areas in these and adjacent regions.

DISTRIBUTION

***Geographic Range:** This vegetation is known from two distinct areas: the Allegheny Plateau and Knobs region of Kentucky (and possibly related areas of Tennessee); and the Ridge and Valley of Georgia and the Interior Low Plateau (Western Highland Rim) of Tennessee and possibly Kentucky. There may be undescribed associations in these and adjacent regions.
Nations: US
States/Provinces: AL, GA, KY, TN
USFS Ecoregions (2007) [optional]: 221Ea:CC?, 221Eb:CC?, 221Ej:CCC, 223Bd:CC, 223Eg:CCC, 231De:CCC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3315	*Quercus marilandica - Quercus stellata* Clay/Loess Woodland Alliance
A0622	*Quercus montana - Quercus coccinea* Shale Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen, in Faber-Langendoen et al. (2015)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne

Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by T. Govus, M. Evans, and M. Hines.

Version Date: 17 May 2016

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G601. Chinquapin Oak - Shumard Oak - Blue Ash Alkaline Forest & Woodland

Type Concept Sentence: This vegetation includes relatively dry calcareous forests and woodlands of temperate eastern North America, especially the unglaciated forest region of the south-central United States, in which various combinations of *Fraxinus quadrangulata, Juniperus virginiana, Quercus muehlenbergii*, and/or *Quercus shumardii* are characteristic.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Na.1. Southern & South-Central Oak - Pine Forest & Woodland (M016)

Elcode: G601

***Scientific Name:** *Quercus muehlenbergii - Quercus shumardii - Fraxinus quadrangulata* Forest & Woodland Group

***Common (Translated Scientific) Name:** Chinquapin Oak - Shumard Oak - Blue Ash Forest & Woodland Group

***Colloquial Name:** Chinquapin Oak - Shumard Oak - Blue Ash Alkaline Forest & Woodland

***Type Concept:** This group encompasses relatively dry calcareous forests and woodlands of temperate eastern North America, especially the unglaciated forest region of the south-central United States, in which various combinations of *Fraxinus quadrangulata, Juniperus virginiana, Quercus muehlenbergii*, and/or *Quercus shumardii* are characteristic. Examples can occur on a variety of topographic and landscape positions, including ridgetops and upper and midslopes, or rarely on the Atlantic Coastal Plain where erosion has exposed Tertiary-aged shell deposits or limesands. Droughts, fires, soil depth, and/or topographic position can determine the relative mixture of deciduous hardwood versus evergreen trees. In the Southern Ridge and Valley region, the Central Basin of Tennessee, the escarpment of the Cumberland Plateau and other related areas, these forests may cover large areas; elsewhere, they occur as relatively small inclusions within a forest matrix of other oak and pine species.

***Diagnostic Characteristics:** Tree canopy dominated by *Quercus muehlenbergii*, or containing *Quercus muehlenbergii* with some combination of *Acer saccharum, Carya ovata, Carya carolinae-septentrionalis, Cotinus obovatus, Fraxinus americana, Fraxinus quadrangulata, Juniperus virginiana, Quercus alba, Quercus shumardii, Quercus rubra*, and/or *Quercus velutina*; or open woodlands with *Juniperus virginiana* dominant and some combination of the above hardwoods. Soils or parent material are calcareous and relatively dry.

***Classification Comments:** This group has a fairly broad range but a restricted environmental setting. Tree species composition is not too variable, but shrub and herb composition is not well-described and may vary substantially across the range. Further review of overall composition is needed to solidify the concept. Old-field *Juniperus virginiana* woodlands are excluded and placed in Eastern North American Native Ruderal Forest Group (G030). Limestone substrates that are dry-mesic to mesic are placed within other groups because moisture and other factors outweigh the limestone influence, at least at the group level. For example, Nelson (2005) states that the Mesic Limestone-Dolomite Forest in Missouri shares many species with Mesic Loess/Glacial Till Forest.

Despite the overlap in some of the key calcareous diagnostic species between this group and Northeastern Chinquapin Oak - Red-cedar Alkaline Forest & Woodland Group (G016), the full composition of species found on these calcareous sites shows stronger affinities with the south-central forests of this macrogroup.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G028	Balconian Dry-Mesic Hardwood Forest	can have *Quercus muehlenbergii* but has other species not found in the range of this group.
G016	Northeastern Chinquapin Oak - Red-cedar Alkaline Forest & Woodland	is typically found in the glaciated Midwest and south-central regions of the eastern United States, but lacks the typical southern tree associates, such as *Quercus shumardii, Ulmus alata, Cotinus obovatus, Juniperus ashei*, etc.; *Fraxinus quadrangulata* is also less common in that type.
G179	Central Interior Alkaline Open Glade & Barrens	contains some similar associations but is characterized by very open canopies and well-developed graminoid cover in the herb layer.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group encompasses a range of physiognomies from closed-canopy forest to open woodland. Two major subgroupings of thin-soiled woodlands versus closed-canopy forests on somewhat deeper soils can be recognized.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Canopy dominants more-or-less throughout the range include *Quercus muehlenbergii* or *Quercus shumardii*, with other associates such as *Acer saccharum, Carya ovata, Carya carolinae-septentrionalis, Cotinus obovatus, Fraxinus americana, Fraxinus quadrangulata, Juniperus virginiana, Quercus shumardii, Quercus rubra*, and/or *Quercus velutina*. In addition, *Quercus alba* is a common associate; *Ilex opaca* is occasional. Other tree species characteristic in parts of the group's range include *Acer floridanum (= Acer barbatum), Acer leucoderme, Celtis* spp., *Fraxinus quadrangulata*, and *Ulmus alata*. *Cercis canadensis* is a characteristic tall shrub or subcanopy tree. The herb layer varies geographically and according to canopy closure.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**

***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The effects of droughts and fires are factors determining the relative mixture of deciduous hardwood versus evergreen trees in stands of this group.

ENVIRONMENT

Environmental Description: *Climate:* This group is found in the temperate portions of the eastern United States, mostly south of the glacial boundary. It tends to occur on portions of the landscape with warmer exposures. *Soil/substrate/hydrology:* These forests are associated with dry calcareous substrates such as limestone and dolomite. They occur on a variety of topographic and landscape positions, including ridgetops and upper and midslopes, or very rarely on the Atlantic Coastal Plain where erosion has exposed Tertiary-aged shell deposits or limesands. The soil moisture regime is dry to dry-mesic.

DISTRIBUTION

***Geographic Range:** This group is scattered over the south-central and eastern United States, from the Carolinas south to Alabama, and west to include the Interior Low Plateau, the Ozarks, and parts of Oklahoma and Texas.
Nations: US
States/Provinces: AL, AR, GA, IA?, IL, IN, KY, MO, NC, OK, TN, VA?
USFS Ecoregions (2007) [optional]: 221A:CC, 221H:CC, 221J:C?, 223A:CC, 223D:CC, 223E:CC, 223F:CC, 231A:CC, 231B:CC, 231E:CC, 231G:CC, 231H:CC, 232B:CC, 232F:CC, 251C:CC, 251E:CC, 255A:PP, M221C:CC, M221D:CC, M223A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE. This group is somewhat heterogeneous in structure but is supported by analyses of FIA plot data and has fairly clear geographical and ecological relationships.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3273	*Quercus muehlenbergii - Fraxinus quadrangulata - Juniperus virginiana* Woodland Alliance
A3276	*Quercus muehlenbergii - Carya* spp. - *Quercus sinuata* Forest Alliance
A3275	*Juniperus ashei* Ozark Woodland Alliance
A3274	*Fraxinus americana - Carya glabra - Juniperus virginiana* Piedmont-Appalachian Woodland Alliance
A2060	*Quercus muehlenbergii - Acer saccharum - Fraxinus americana* Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-12-18	G346 Quercus muehlenbergii - Quercus sinuata var. sinuata / Cornus drummondii Woodland Group	G346 merged into G601

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Chinquapin Oak - Ash - Red-cedar Forest Group	Faber-Langendoen and Menard 2006	This group includes forests further west in which

Relationship to NVC	Supporting Concept Name	Short Citation	Note
			Juniperus ashei is characteristic.

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen and S. Menard (2006)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne and D. Faber-Langendoen

Acknowledgments [optional]: We have incorporated significant descriptive information developed or compiled by J. Campbell and R. McCoy.

Version Date: 04 May 2015

REFERENCES

***References [Required if used in text]:**

Campbell, J. J. N. 1980a. Present and presettlement forest conditions in the Inner Bluegrass region of Kentucky. Ph.D. dissertation, University of Kentucky, Lexington. 109 pp. [Excerpts only]

Campbell, J. J. N. 1989b. Historical evidence of presettlement forest composition in the Inner Bluegrass of Kentucky. Pages 231-246 in: G. Rink and C. A. Budelsky, editors. Proceedings of the Seventh Central Hardwood Forest Conference, Southern Illinois University, Carbondale.

Campbell, J. J. N. 1996. Classification of forest, soil and land types on Daniel Boone National Forest. Technical report to Daniel Boone National Forest. The Nature Conservancy, Kentucky Chapter, Lexington, KY.

Campbell, J. J. N. 2010. Rebuilding the concept of Bluegrass woodland. The Lady-Slipper (newsletter of Kentucky Native Plant Society) 25:6-9.A

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Campbell, J. J. N., D. T. Towles, J. R. MacGregor, R. R. Cicerello, B. Palmer-Ball, Jr., M. E. Medley, and S. Olson. 1989. Cooperative inventory of endangered, threatened, sensitive, and rare species: Daniel Boone National Forest, Stanton Ranger District. Technical report by USDA Forest Service, The Nature Conservancy, Kentucky State Nature Preserves Commission and Kentucky Department of Fish & Wildlife Resources. Kentucky State Nature Preserves Commission, Frankfort, KY. 315 pp.

Campbell, J. J. N., and T. Simmons. 1999. Fire management plan for Mammoth Cave National Park. The Nature Conservancy, Kentucky Chapter, Lexington, KY.

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G017. Cross Timbers & East-Central Texas Plains Oak Forest & Woodland

Type Concept Sentence: This vegetation varies from open woodlands with scattered trees to dense forests with a dense and viney understory, and is found in Oklahoma, ranging north to southeastern Kansas, and south through central Texas to the Inner Coastal Plain. Short, stunted *Quercus stellata* and/or *Quercus marilandica* are characteristic and dominant, typically with *Carya texana*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.1. Southern & South-Central Oak - Pine Forest & Woodland (M016)

Elcode: G017
***Scientific Name:** *Quercus stellata - Quercus marilandica* Forest & Woodland Group
***Common (Translated Scientific) Name:** Post Oak - Blackjack Oak Forest & Woodland Group
***Colloquial Name:** Cross Timbers & East-Central Texas Plains Oak Forest & Woodland

***Type Concept:** This group consists of short, stunted woodlands and forests in eastern, central and western Oklahoma, ranging north to southeastern Kansas, and south through central Texas to the Inner Coastal Plain. The physiognomy of this vegetation varies from open woodlands with scattered trees to dense forests with a dense and viney understory. Canopy height is short (<15 m). This vegetation is located where the forests of the eastern U.S. transition into grasslands of the central U.S. Patches of forests and woodlands are often interspersed with patches of tall- and midgrass prairie. The area consists of irregular plains and rugged scarps with primarily sandy to loamy soils that range from shallow to moderately deep. Rainfall can be moderate, but somewhat erratic, therefore moisture is often limiting during part of the growing season. Short, stunted *Quercus stellata* and/or *Quercus marilandica* characterize and dominate this group. Another common canopy tree is *Carya texana*. Other component species may include *Carya cordiformis, Celtis laevigata var. reticulata, Quercus prinoides, Ulmus crassifolia, Ulmus alata, Quercus fusiformis, Quercus incana*, and *Quercus virginiana* within their respective ranges. The understory often contains species typical of the surrounding prairies, in particular *Schizachyrium scoparium*. Small trees or shrubs such as *Sideroxylon lanuginosum, Juniperus* spp., *Smilax* spp., and *Rhus* spp. may also be present. There is considerable variation in associated species in a broad transition from coastal plain to interior areas, and correspondingly from east to west. Drought, grazing, and fire are the primary natural processes that affect this group. With the disruption of these processes today, many examples of this vegetation trend more toward dense stunted forest than open woodland. Overgrazing and conversion to agriculture, along with fire suppression, have led to the invasion of some areas by problematic brush species such as *Juniperus virginiana* and *Juniperus ashei* and *Prosopis glandulosa* farther south in Texas and Oklahoma. It has also led to decreases in native grass cover allowing for annual grasses and forbs to invade.

***Diagnostic Characteristics:** Tree canopy strongly dominated by *Quercus stellata* and/or *Quercus marilandica* (>90% cover). Other associates may be *Carya texana, Carya cordiformis, Celtis laevigata var. reticulata, Quercus prinoides, Ulmus crassifolia, Ulmus alata, Quercus fusiformis, Quercus incana*, and *Quercus virginiana*, but lacking many eastern forest or shrub associates such as *Quercus falcata, Quercus alba, Quercus coccinea, Pinus echinata, Vaccinium pallidum, Vaccinium stamineum*, and *Gaylussacia* spp. This group only occurs in Kansas, Oklahoma and Texas.

***Classification Comments:** This group is currently circumscribed at the group level, separate from somewhat similar vegetation occurring farther east, that is also characterized by *Quercus stellata* and *Quercus marilandica*. It is differentiated from these forests by the lack of other "dry-site" eastern oaks, pines, and shrubs, such as *Quercus falcata, Quercus alba, Quercus coccinea, Pinus echinata, Vaccinium pallidum, Vaccinium stamineum, Gaylussacia* spp., among others. Even those forests and woodlands in the nearby Ouachita and Ozark mountains, though characterized by post oak and blackjack oak, have a flora more strongly associated with eastern forests. This group represents the western edge of the eastern deciduous forests, and as such is lacking many of the eastern woody species. In addition, it represents a transition of forests to grasslands, and some evidence suggests this group once had a higher grass cover, linking it more closely with the Great Plains grasslands. Many factors are thought to have contributed to this increase in woody cover, primarily the imbalance in two main natural processes that helped maintain this grassland state: fire and grazing. Because this vegetation is allied with the grasslands and was perhaps more so under natural conditions, and because many of the eastern species present in similar vegetation farther east are absent in this vegetation, it is currently circumscribed at the group level. Further investigation and review are necessary to determine if this is appropriate. Three or more alliances are expected to be needed, one north of the range of *Ulmus crassifolia* and one south, that also brings in some southeastern components such as *Ulmus alata, Ilex vomitoria, Callicarpa americana*, and *Vaccinium arboreum*, and then, perhaps one west of the range of these eastern shrubs and where western shrubs such as *Mahonia trifoliolata, Condalia hookeri, Colubrina texensis*, among others are more prominent. An alliance reflecting a mixture of *Quercus stellata* and *Quercus virginiana* may also be warranted in the southern limit of this vegetation.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G159	South-Central Interior Oak Forest & Woodland	
G179	Central Interior Alkaline Open Glade & Barrens	
G178	Central Interior Acidic Open Glade & Barrens	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Short, stunted *Quercus stellata* and/or *Quercus marilandica* characterize and dominate this group. The physiognomy of this vegetation includes scattered trees with high herbaceous cover, open-canopied woodlands, and closed-canopied patches of trees interspersed with grasslands. The expression of this varied physiognomy is thought to be related to environmental conditions such as geology, soils, hydrology, and topography and natural processes such as fire and grazing. The canopy of this vegetation is typically characterized by a low stature (<15 m).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This group is usually dominated or codominated by *Quercus stellata* and/or *Quercus marilandica*. Other canopy components may include *Carya texana, Carya cordiformis, Celtis laevigata var. reticulata, Quercus prinoides, Ulmus crassifolia, Ulmus alata, Quercus fusiformis, Quercus incana*, and *Quercus virginiana* within their respective ranges, but the canopy is typically low in species richness. Where light penetration allows the development of an herbaceous understory or in areas with reduced woody canopy, the ground flora contains species typical of the surrounding prairies, in particular *Schizachyrium scoparium*, but also including *Andropogon gerardii, Bothriochloa laguroides ssp. torreyana, Paspalum plicatulum* (to the south), *Sorghastrum nutans*, and *Sporobolus cryptandrus*. Species richness is typically higher in the herbaceous ground flora than in the canopy. Woody cover is generally thought to be higher today than historically, and shrubs may attain significant cover in the understory of some examples. Woody understory composition varies geographically and with soil type and may include, within their respective ranges, *Sideroxylon lanuginosum, Rhus* spp., *Smilax* spp., *Juniperus virginiana, Juniperus ashei, Ilex vomitoria* (sometimes with high cover), *Callicarpa americana, Vaccinium arboreum, Ilex decidua, Toxicodendron radicans, Prosopis glandulosa*, and *Symphoricarpos orbiculatus*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Drought, grazing, and fire are the primary natural processes that affect this group. Overgrazing, fire suppression and conversion to improved pasture or other agricultural uses have led to increased woody cover on most extant occurrences of this group and the invasion of some areas by problematic brush species such as *Juniperus virginiana var. virginiana* and *Prosopis glandulosa* within their respective ranges. These factors have also led to decreases in native grass cover allowing for annual grasses and forbs to invade.

ENVIRONMENT

Environmental Description: This vegetation is located where the forests of the eastern U.S. transition into grasslands of the central U.S. *Climate:* Rainfall can be moderate, generally ranging from 66 to 110 cm (26-43 inches) per year and is somewhat erratic, therefore moisture is often limiting during part of the growing season. *Soil/substrate/hydrology:* The area consists of irregular plains and rugged scarps with primarily sandy to loamy soils that range from shallow to moderately deep.

DISTRIBUTION

***Geographic Range:** This group forms a north-south band of vegetation on the eastern edge of the Great Plains. It ranges from the southeastern corner of Kansas to the Inner Coastal Plain of Texas.
Nations: US
States/Provinces: KS, OK, TX
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3216	*Quercus stellata - Quercus marilandica* Forest & Woodland Alliance
A3217	*Quercus stellata - Ulmus crassifolia* Forest & Woodland Alliance
A0668	*Quercus stellata - Quercus virginiana / Ilex vomitoria* Forest & Woodland Alliance
A3218	*Quercus stellata - Quercus marilandica / Rhus trilobata* Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Oak - hickory savanna	Bruner 1931	
><	Oak-Hickory Forest Region, Southern Division, Forest Prairie Transition	Braun 1950	Conceptually, Braun's types are vegetation regions, but the forested part of the region corresponds very closely to the group concept described here.
<	Osage Savanna	Blair and Hubbell 1938	

AUTHORSHIP

***Primary Concept Source [if applicable]:** E.L. Braun (1950)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Teague

Acknowledgments [optional]: S. Franklin

Version Date: 16 Apr 2013

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G013. Western Gulf Coastal Plain Pine - Oak Forest & Woodland

Type Concept Sentence: This vegetation is dominated by *Pinus taeda* and/or *Pinus echinata* in combination with a suite of dry- to dry-mesic-site hardwoods, including *Quercus alba, Quercus falcata*, and *Quercus stellata*, and the scrub oaks *Quercus arkansana, Quercus incana*, and *Quercus margarettae*. It is primarily found in the West Gulf Coastal Plain with an extension into central Texas, locally known as the "Bastrop Pines."

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.1. Southern & South-Central Oak - Pine Forest & Woodland (M016)

Elcode: G013
***Scientific Name:** *Pinus taeda - Pinus echinata - Quercus* spp. Forest & Woodland Group
***Common (Translated Scientific) Name:** Loblolly Pine - Shortleaf Pine - Oak species Forest & Woodland Group
***Colloquial Name:** Western Gulf Coastal Plain Pine - Oak Forest & Woodland

***Type Concept:** This forest group consists of vegetation typically dominated by *Pinus taeda* and/or *Pinus echinata* in combination with a suite of dry- to dry-mesic-site hardwood species, primarily *Quercus alba, Quercus falcata*, and *Quercus stellata*, but also the scrub oaks *Quercus incana, Quercus margarettae*, and *Quercus arkansana*. It is primarily found in the West Gulf Coastal Plain and Upper West Gulf Coastal Plain of southern Arkansas, northwestern Louisiana, and parts of eastern Texas, with an extension into central Texas, which is locally known as the "Bastrop Pines." The range of this type is predominantly north of the historic range of *Pinus palustris*, and was the historic matrix vegetation type for large portions of the Upper West Gulf Coastal Plain. Within this area, this type was historically present on nearly all upland sites in the region (except on the most edaphically limited sites, such as droughty sands, calcareous clays, and shallow soil barrens/rock outcrops). The upland sites on which the group is found are underlain by loamy to fine-textured soils of variable depths, and are found on ridgetops and adjacent sideslopes, with moderate fertility and moisture retention. In more limited areas of the West Gulf Coastal Plain (USFS Section 232F), stands are confined more typically to sideslopes and other less fire-prone locations not dominated by *Pinus palustris*. Other tree species that may occur include *Quercus velutina, Carya tomentosa, Carya texana, Crataegus* spp., and *Ostrya virginiana*. Typical shrubs include *Symplocos tinctoria, Morella cerifera, Vaccinium arboreum, Vaccinium elliottii, Viburnum acerifolium*, and *Viburnum dentatum*. Some typical grasses include *Chasmanthium sessiliflorum, Dichanthelium sphaerocarpon*, and *Schizachyrium scoparium*.

***Diagnostic Characteristics:** Tree: *Pinus taeda* (strong), *Pinus echinata* (moderate), *Quercus alba* (weak), *Quercus falcata* (moderate), and *Quercus stellata* (weak). *Pinus palustris* (weak), *Quercus margarettae, Quercus velutina* (weak), *Carya tomentosa, Carya texana* (moderate), *Crataegus* spp., and *Ostrya virginiana*. Shrub: *Symplocos tinctoria, Morella cerifera, Vaccinium arboreum, Vaccinium elliottii, Viburnum acerifolium*, and *Viburnum dentatum* (weak). Graminoids: *Chasmanthium sessiliflorum, Dichanthelium sphaerocarpon*, and *Schizachyrium scoparium* (all weak).

***Classification Comments:** The distribution of this vegetation group is primarily contained within the distribution of *Quercus falcata* (Burns and Honkala 1990b), and should not be found west of that area, with the one notable exception of the "Bastrop Pines" extension. There are issues related to vegetation which appears similar to this group but within the range of longleaf pine. Marks and Harcombe (1981) address this issue in relation to vegetation of the Big Thicket region of Texas, within the range of longleaf pine. Their "Upper Slope Pine Oak Forest" may represent successional vegetation which has developed under conditions of fire suppression on portions of the landscape which would have historically been occupied by longleaf pine-dominated vegetation. In contrast, their "Mid Slope Oak Pine Forest" may actually represent examples of this vegetation group which occur adjacent to longleaf pine-dominated uplands, but on lower slopes where fire is infrequent enough that longleaf pine is absent. More investigation of this question is needed.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The physiognomy and composition of stands of this vegetation may vary with environment (aspect, slope position) and with the effects of fire (whether anthropogenic or natural). Most stands will presently exhibit a more-or-less closed-canopy condition, but under historical conditions may very well have been open-canopy forests or woodlands. In the Upper West Gulf Coastal Plain, (primarily landward of the distribution of *Pinus palustris*), stands can occur on narrow ridgetops, which would be relatively more isolated from the effects of fire, and thereby exhibit greater natural dominance by hardwoods.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This forest group consists of vegetation typically dominated by *Pinus taeda* and/or *Pinus echinata* in combination with a host of dry- to dry-mesic-site hardwood species, primarily *Quercus alba, Quercus falcata*, and *Quercus stellata*. Stands on narrow ridgetops, which can be isolated from the effects of fire, may exhibit greater dominance by hardwoods. Most stands will presently exhibit a more-or-less closed canopy condition, but under historical conditions may very well have been open-canopy forests or woodlands. Other tree species that may occur include *Quercus velutina, Carya tomentosa (= Carya alba), Carya texana, Crataegus* spp., and *Ostrya virginiana*. Typical shrub species include *Symplocos tinctoria, Morella cerifera, Vaccinium arboreum, Vaccinium elliottii, Viburnum acerifolium*, and *Viburnum dentatum*. Some typical grasses include *Chasmanthium sessiliflorum, Dichanthelium sphaerocarpon*, and *Schizachyrium scoparium*. The importance of *Acer floridanum (= Acer barbatum), Acer leucoderme*, and *Liquidambar styraciflua* may increase with the absence of fire. There are no known "strong differential" herbaceous species or any local endemic or globally rare plant species, and overall this group may have supported relatively low levels of vascular plant species diversity. Examples in the "Bastrop Pines" extension are more likely to include *Quercus marilandica* as a dominant with *Quercus stellata*. This area is west of the ranges of the other component *Quercus* species.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: This vegetation has undergone major transformations since European settlement of the region, due to cycles of timber removal, heavy grazing, agricultural cropping, and conversion to plantations of improved *Pinus taeda*. The *Pinus taeda* of the

"Bastrop Pines" region is genetically different than strains to the east; it has much greater drought tolerance. It is possible that this area was one of the epicenters of early southern pine colonization of the coastal plain based on fossil pollen evidence.

ENVIRONMENT

Environmental Description: Stands on narrow ridgetops, which can be isolated from the effects of fire, may exhibit greater dominance by hardwoods. *Soil/substrate/hydrology:* In southern Arkansas, northwestern Louisiana, and parts of eastern Texas, this type was historically present on nearly all uplands in the region (except on the most edaphically limited sites, such as droughty sands, calcareous clays, and shallow soil barrens/rock outcrops). These upland sites are underlain by loamy to fine-textured soils of variable depths and are found on ridgetops and adjacent sideslopes, with moderate fertility and moisture retention. Within the range of *Pinus palustris*, vegetation of this group is apparently favored on relatively finer-textured soils, rather than coarser-textured ones. The "Bastrop Pines" extension of this group in central Texas is found on the Reclaw Formation (D. Diamond pers. comm. 2003).

DISTRIBUTION

***Geographic Range:** This vegetation is primarily found in the West Gulf Coastal Plain and Upper West Gulf Coastal Plain of southern Arkansas, northwestern Louisiana, and parts of eastern Texas, with an extension in central Texas (the "Bastrop Pines").
Nations: US
States/Provinces: AR, LA, TX
USFS Ecoregions (2007) [optional]: 231E:CC, 232F:CC, 234E:PP, 255C:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.7.35a:C, 8.3.7.35b:C, 8.3.7.35c:C, 8.3.7.35d:C, 8.3.7.35e:C, 8.3.7.35f:C, 8.3.7.35g:C, 8.3.7.35h:C, 8.3.8.33b:C, 8.3.8.33e:C, 8.3.8.33f:?, 8.4.8.36a:C, 9.5.1.34a:C, 9.5.1.34c:?
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3130	*Pinus taeda - Quercus alba / Viburnum* spp. Forest Alliance
A0386	*Quercus incana - Quercus arkansana - Pinus echinata* Woodland Alliance
A3129	*Pinus echinata - Pinus taeda - Quercus stellata* Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Loblolly Pine-Southern Red Oak/*Callicarpa* Loamy Mesic Lower Slopes and Terraces Landtype Phase	Turner et al. 1999	
?	Mid Slope Oak Pine Forest	Marks and Harcombe 1981	
<	Mixed Hardwood - Loblolly Forest	Martin and Smith 1991	
<	Mixed Hardwood - Loblolly Forest	Martin and Smith 1993	
><	Oak-Hickory-Pine Forests	Skeen et al. 1993	
<	Shortleaf Pine / Oak - Hickory Forest	Martin and Smith 1991	
<	Shortleaf Pine / Oak - Hickory Forest	Martin and Smith 1993	

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Shortleaf Pine-(Longleaf Pine)-Post Oak/*Callicarpa-Chasmanthium* Loamy Dry-Mesic Uplands Landtype Phase	Turner et al. 1999	
<	Shortleaf Pine-Post Oak/*Chasmanthium* Clayey Dry-Mesic Uplands Landtype Phase	Turner et al. 1999	
<	Shortleaf Pine-Post Oak/*Chasmanthium* Clayey Uplands Landtype Phase	Turner et al. 1999	
<	Shortleaf Pine-White Oak/*Callicarpa-Chasmanthium* Sandy/Loamy Dry-Mesic Uplands Landtype Phase	Turner et al. 1999	
<	White Oak-Loblolly Pine/*Callicarpa* Loamy Mesic Lower Slopes and Terraces Landtype Phase	Turner et al. 1999	
<	White Oak-Loblolly Pine/*Callicarpa* Loamy/Sandy Mesic Lower Slopes and Terraces Landtype Phase	Turner et al. 1999	
<	White Oak-Loblolly Pine/*Callicarpa* Loamy/Sandy Mesic Slopes Landtype Phase	Turner et al. 1999	

AUTHORSHIP

***Primary Concept Source [if applicable]:** P.L. Marks and P.A. Harcombe (1981)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne and J. Teague

Acknowledgments [optional]: P. Harcombe

Version Date: 25 Nov 2014

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

M502. Appalachian-Northeastern Oak - Hardwood - Pine Forest & Woodland

Type Concept Sentence: This northeastern macrogroup comprises forests characterized by a number of dry-site oak species (*Quercus coccinea, Quercus falcata, Quercus muehlenbergii, Quercus montana, Quercus velutina*) and pine species (*Pinus pungens, Pinus rigida, Pinus virginiana*) occurring on substrates ranging from acidic to substrates of high base status.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.2.Na.2. Eastern North American Forest & Woodland (D008)

Elcode: M502
***Scientific Name:** Appalachian-Northeastern Oak - Hardwood - Pine Forest & Woodland Macrogroup
***Common (Translated Scientific) Name:** Appalachian-Northeastern Oak - Hardwood - Pine Forest & Woodland Macrogroup
***Colloquial Name:** Appalachian-Northeastern Oak - Hardwood - Pine Forest & Woodland

***Type Concept:** This northeastern macrogroup comprises forests characterized by a number of dry-site oak and pine species occurring on a variety of well-drained substrates. Acidic parent materials of low fertility support forests dominated by *Quercus coccinea, Quercus falcata, Quercus muehlenbergii, Quercus montana, Quercus velutina*, as well as other hardwoods such as *Liriodendron tulipifera, Sassafras albidum*, and pines, including *Pinus rigida, Pinus pungens, Pinus strobus*, and *Pinus virginiana*, often overtopping a well-developed heath shrub layer comprising species of *Gaylussacia, Rhododendron, Vaccinium*, and others. Less acidic or high base status parent materials support many of the same oak species (*Quercus coccinea, Quercus falcata, Quercus muehlenbergii, Quercus montana, Quercus velutina*), in combination with a variety of hickory species (*Carya* spp.), *Betula alleghaniensis, Betula lenta*, and *Fagus grandifolia*. *Quercus muehlenbergii* is particularly characteristic of parent materials of higher base status. Vegetation of this macrogroup occurs on a variety of substrates, ranging from dry sandy soils supporting pine barrens and maritime scrub vegetation, to exposed bedrock and shale barrens.

***Diagnostic Characteristics:** Northeastern woodlands and forests with dominance by or importance of *Quercus coccinea, Quercus falcata, Quercus muehlenbergii, Quercus montana, Quercus velutina, Pinus pungens, Pinus rigida, Pinus virginiana*, and by the absence or unimportance of *Quercus bicolor, Quercus ellipsoidalis, Quercus macrocarpa, Quercus stellata, Pinus echinata*, or *Pinus taeda*.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M882	Central Midwest Mesic Forest	
M883	Appalachian-Interior-Northeastern Mesic Forest	
M012	Central Midwest Oak Forest, Woodland & Savanna	occurs to the west and is differentiated by *Quercus macrocarpa* and *Quercus ellipsoidalis*, and the absence or unimportance of *Quercus coccinea, Quercus velutina*, and *Quercus montana*.
M016	Southern & South-Central Oak - Pine Forest & Woodland	occurs farther south and, although it overlaps in species composition, generally lacks *Pinus strobus* and includes *Pinus echinata, Pinus taeda*, and *Quercus stellata* as characteristic species.
M505	Laurentian-Acadian Acidic Rocky Scrub & Grassland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Physiognomy of this vegetation ranges from closed forest to open woodland, with deciduous trees, needle-leaved trees, or a mixture of both. The shrub layer is often well-developed and characterized by heath shrubs in more infertile settings. Where this macrogroup occurs on the coast and on other highly exposed sites such as bedrock outcrops, steep slopes, and shale barrens, canopy trees may be stunted, gnarled, or wind-sheared. Tree canopies in coastal settings may also share dominance with tall shrubs and heavy vine cover.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Acidic parent materials of low fertility support forests dominated by *Quercus coccinea, Quercus falcata, Quercus montana (= Quercus prinus), Quercus velutina*, as well as other hardwoods such as *Liriodendron tulipifera, Nyssa sylvatica, Sassafras albidum*, and pines, including *Pinus pungens, Pinus rigida, Pinus strobus*, and *Pinus virginiana*, often overtopping a well-developed heath shrub layer comprising species of *Gaylussacia, Rhododendron, Vaccinium*, and others. *Castanea dentata* is an important understory component. The herbaceous layer may be poorly developed where tree or shrub canopies are dense; typical species include *Carex pensylvanica, Danthonia spicata, Deschampsia flexuosa, Gaultheria procumbens*, and others.

Less acidic or neutral parent materials support many of the same oak species as on acidic parent materials, in combination with *Carya* spp., *Betula alleghaniensis, Betula lenta, Fraxinus americana*, and *Fagus grandifolia*. Shrubs and understory tree species can include *Carpinus caroliniana, Cornus florida, Euonymus americanus, Hamamelis virginiana, Lindera benzoin, Oxydendrum arboreum, Viburnum acerifolium*; typical species of the herb layer include *Amphicarpaea bracteata, Arisaema triphyllum, Botrychium virginianum, Galium circaezans, Hexastylis arifolia, Hexastylis minor, Medeola virginiana, Mitchella repens, Parthenocissus quinquefolia, Polygonatum pubescens, Polystichum acrostichoides*, and *Thelypteris noveboracensis*.

Quercus muehlenbergii and *Acer saccharum* are particularly characteristic of parent materials of higher base status. Typical shrub species in this setting may include *Cercis canadensis, Viburnum prunifolium*, and *Viburnum rafinesqueanum*. The herbaceous layer is more species-rich than in infertile sites, and include mesophytic species such as *Actaea pachypoda, Adiantum pedatum, Aquilegia canadensis, Asclepias quadrifolia, Carex eburnea, Carex platyphylla, Dichanthelium boscii, Elymus hystrix, Hepatica nobilis*, and *Packera obovata*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: At moderate to low elevations, stands are naturally stable, uneven-aged forests, with canopy dynamics generally dominated by gap-phase regeneration. Wind or ice storms may create larger canopy openings. Fire occurred fairly frequently in pre-European-settlement times but much less so now. Higher-elevation examples may occur on exposed ridges where they are subject to frequent ice storms in the winter, windstorms in the summer, and high winds throughout the year. In pine barrens, fire is particularly important in arresting succession to hardwood dominance. Vegetation on highly exposed bedrock or very steep slopes may be edaphically controlled. In maritime situations, frequent storms, high winds, and salt spray impact physiognomy. Treefalls are common, causing canopy gaps and highly variable structure. Many of these forests were logged in early settlement, and when oaks were removed, their re-establishment was hampered by their slow growth in these exposed settings. They were replaced by fast-growing early-successional species with fruits and/or seeds that are either bird- or wind-dispersed. Heavy browsing by deer impact both the structure and composition of herbaceous and shrub layers, and can hamper tree regeneration. Outbreaks of southern pine beetle (*Dendroctonus frontalis*) can shift pine-dominated forests and woodlands to deciduous forest.

ENVIRONMENT

Environmental Description: A range of environmental settings support this vegetation. Soils may be deep to shallow to essentially lacking. Substrates may be well-drained bedrock, sand, loam, or shale talus; base status ranges from low to high. Topography ranges from steep slopes to well-drained sandplains, from low elevations (sea level) to high elevations (over 1220 m [4000 feet] in the Southern Blue Ridge). Base status of parent materials is an important gradient that separates the component groups of this macrogroup.

DISTRIBUTION

***Geographic Range:** This macrogroup ranges across temperate eastern North America, from Wisconsin and southern and south-central Canada east to the Atlantic Coast, and south to Alabama and Georgia. The western extent is defined more or less by the Appalachians but does not range into the Interior Low Plateau or Ozarks, ranging east to the Atlantic Coast north to southern Maine.
Nations: CA, US
States/Provinces: AL, CT, DC, DE, GA, IL?, IN, KY, MA, MD, ME, MI?, NC, NH, NJ, NS, NY, OH, ON, PA, QC, RI, SC, TN, VA, VT, WI, WV
USFS Ecoregions (2007) [optional]: 211E:CC, 211Fd:CCC, 221Ab:CCC, 221Ac:CCP, 221Af:CCC, 221Ai:CCC, 221Ak:CCC, 221Al:CCC, 221Bc:CCC, 221Dc:CCC, 232A:CC, 232Hc:CCC, M221Ac:CCC, M221Be:CCC, M221Db:CCC, M221Dd:CCC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G015	Appalachian Oak / Chestnut Forest
G016	Northeastern Chinquapin Oak - Red-cedar Alkaline Forest & Woodland
G650	Northeastern Oak - Hickory Forest & Woodland
G495	North Atlantic Maritime & Coastal Plain Forest
G161	Pitch Pine Barrens
G162	Virginia Pine - Table Mountain Pine Woodland & Barrens

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Appalachian Oak Forest	Küchler 1964	
=	Appalachian Oak section	Dyer 2006	
<	Black Oak: 110	Eyre 1980	
=	Chestnut Oak - American Chestnut Forest Group	Faber-Langendoen and Menard 2006	
>	Chinquapin Oak - Ash - Red-cedar Forest Group	Faber-Langendoen and Menard 2006	This group includes forests further west in which *Juniperus ashei* is characteristic.
=	Maritime pitch pine dune woodland	Edinger et al. 2002	
<	Northeastern Oak - Pine Forest	Küchler 1964	
<	Northern Red Oak: 55	Eyre 1980	
<	Oak - Chestnut Forest Region	Braun 1950	While a forest region is not equivalent to a forest group, the characterization of the major forest cover in this

Relationship to NVC	Supporting Concept Name	Short Citation	Note
			region fits the macrogroup concept in part
<	Oak - Hickory Forest	Küchler 1964	
>	Pitch Pine - Virginia Pine Forest Group	Faber-Langendoen and Menard 2006	
<	White Oak - Black Oak - Northern Red Oak: 52	Eyre 1980	
>	White Oak: 53	Eyre 1980	

AUTHORSHIP

***Primary Concept Source [if applicable]:** E.L. Braun (1950)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** L. Sneddon

Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by S.C. Gawler, M. Pyne, and D. Faber-Langendoen.

Version Date: 15 Oct 2014

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G015. Appalachian Oak / Chestnut Forest

Type Concept Sentence: This group comprises dry oak forests of the Appalachians from New England to Georgia, with typical oaks including *Quercus montana, Quercus alba, Quercus coccinea*, or *Quercus velutina*; *Castanea dentata* persists in the understory but was once a major canopy tree.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.2. Appalachian-Northeastern Oak - Hardwood - Pine Forest & Woodland (M502)

Elcode: G015
***Scientific Name:** *Quercus montana - Carya* spp. / *Castanea dentata* Forest Group
***Common (Translated Scientific) Name:** Chestnut Oak - Hickory species / American Chestnut Forest Group
***Colloquial Name:** Appalachian Oak / Chestnut Forest

***Type Concept:** This dry acidic Appalachian oak forest group includes mostly closed-canopy deciduous (oak) forests and mixed (oak-pine) forests with a variable mixture of dry-site oak and pine species. It is characterized by the occurrence of *Quercus montana* and/or other oaks, typically *Quercus alba, Quercus coccinea*, or *Quercus velutina*, often with sprouts of *Castanea dentata*. *Pinus strobus* or *Pinus virginiana* may be an important associate in some areas. Widespread hardwood associates include *Quercus rubra, Betula lenta, Carya glabra, Nyssa sylvatica*, and *Sassafras albidum*. Additional associated trees in parts of the group's range include *Halesia tetraptera var. monticola, Liriodendron tulipifera, Magnolia acuminata*, and *Oxydendrum arboreum*. Subcanopy, shrub, and herb layers vary, but in many cases a moderately well- to well-developed heath layer is present. Ericaceous shrubs are often common and include *Kalmia latifolia, Gaylussacia baccata, Gaylussacia frondosa, Gaylussacia ursina, Vaccinium pallidum, Vaccinium angustifolium, Vaccinium stamineum, Vaccinium arboreum, Vaccinium simulatum, Menziesia pilosa, Rhododendron calendulaceum*, and *Rhododendron prinophyllum*. This group is centered on the ranges of *Castanea dentata* and *Quercus montana*, ranging from central New England south through the Central Appalachian and Western Allegheny regions to the Cumberland Plateau and Southern Appalachians. The substrate is typically dry, acidic, and infertile. Elevation ranges from sea level (in the northern part of the range) to about 1500 m (in the Southern Appalachians).

***Diagnostic Characteristics:** Dominance of *Quercus montana* (or *Quercus alba* or *Quercus rubra* at higher elevations or at the northern range limit of *Quercus rubra*) or presence of *Castanea dentata* with *Quercus montana* also present (those species are differential for this group); or oak (and oak-pine) forests dominated by some combination of *Quercus montana, Quercus coccinea, Quercus velutina*, and *Castanea dentata* (totaling >20% Relative Importance Value), with other tree species including some combination of these diagnostics: *Oxydendrum arboreum, Carya glabra, Quercus alba, Quercus rubra, Betula lenta, Halesia tetraptera var. monticola, Nyssa sylvatica, Magnolia acuminata*, or *Sassafras albidum*. Diagnostic shrub species include several with ranges centered on the Central and Southern Appalachians, such as *Kalmia latifolia, Rhododendron calendulaceum, Gaylussacia ursina, Ilex montana, Galax urceolata*, and *Menziesia pilosa*. *Gaylussacia baccata, Vaccinium angustifolium, Vaccinium pallidum* are diagnostic at the northern end of the range.

***Classification Comments:** The distinctions between this group and North-Central Oak - Hickory Forest & Woodland Group (G649) and Northeastern Oak - Hickory Forest & Woodland Group (G650) can be challenging where the two overlap, especially since *Castanea dentata*, a key species for this group, is now absent or reduced over much of its range. This group encompasses somewhat drier forests with relatively infertile soils, in general, than G649 and G650. An outstanding question is the best placement for high-elevation red oak-dominated associations in the Central and Southern Appalachians (i.e., those attributed exclusively to Central and Southern Appalachian Montane Oak Forest (CES202.596)). Southern Appalachian geography led to their placement in this group, but they are more mesic than other associations herein and may be better placed in G649. When that description is written, we can compare associated woody and herbaceous species to determine the best placement, and revise this group description if they are removed.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G495	North Atlantic Maritime & Coastal Plain Forest	
G650	Northeastern Oak - Hickory Forest & Woodland	
G649	North-Central Oak - Hickory Forest & Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Mostly deciduous, closed-canopy forests. Examples of these forests at higher elevations or in xeric environments often feature stunted trees in the canopy, or a more interrupted canopy. Subcanopy, shrub, and herb layers vary, but in many cases a moderately well- to well-developed heath layer is present.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Canopy dominants include *Quercus montana (= Quercus prinus), Quercus rubra, Quercus velutina*, and/or *Quercus alba*. At higher elevations or northern range limits, *Quercus rubra* may be the sole dominant. *Castanea dentata* is often present, though not common, as sprouts and is diagnostic when it occurs with *Quercus montana*. Other oaks, including *Quercus coccinea* or *Quercus falcata*, are often present at relatively lower elevations. Many forests in this group have a pine component of *Pinus strobus, Pinus rigida, Pinus pungens*, or *Pinus virginiana*, or less often *Pinus echinata*. Ericaceous shrubs are often common and include *Kalmia latifolia, Gaylussacia* spp., *Vaccinium pallidum, Vaccinium angustifolium, Vaccinium stamineum, Vaccinium arboreum, Vaccinium simulatum, Menziesia pilosa, Rhododendron calendulaceum*, and *Rhododendron prinophyllum*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: At moderate to low elevations, stands are naturally stable, uneven-aged forests, with canopy dynamics generally dominated by gap-phase regeneration. Wind or ice storms may create larger canopy openings. Fire occurred fairly frequently in pre-European-settlement times, though there is some dispute whether most of the fires were natural or anthropogenic in origin (Abrams 1992, Delcourt and Delcourt 1997). Fires were usually low-intensity surface fires. Fire occurred even more frequently in post-European-settlement times, declining again in the 1900s. The dominant species are fairly fire-tolerant, making most fires non-catastrophic. Fire also can be expected to have a moderate effect on vegetation structure, producing a somewhat more open canopy and increased density of low-shrub layers than currently seen in most examples.

In the southern part of the group's range, higher-elevation examples may occur on exposed high ridges where they are subject to frequent ice storms in the winter, wind storms in the summer, and high winds throughout the year. This helps explain these forests' stunted appearance. In presettlement times, these forests are likely to have experienced lightning-caused fires every 40-60 years (Fleming et al. 2005). In some locations, fire exclusion and competing understory vegetation are a factor in poor oak regeneration, with replacement by more mesophytic species such as *Acer saccharum* (Fleming et al. 2005). Oak regeneration is also threatened by high levels of deer herbivory.

ENVIRONMENT

Environmental Description: This group occurs in temperate eastern North America, occurring on predominantly acidic substrates at a range of elevations from sea level (in the northern part of the range) to about 1500 m (in the Southern Appalachians). Topography and landscape position vary from rolling hills to steep slopes. The soils are coarse and infertile; they are typically shallow, on rocky slopes of acidic rock (shale, sandstone, other acidic igneous or metamorphic rock), but north of the glacial boundary may be on deep coarse glacial deposits as well as on shallow-to-bedrock soils.

DISTRIBUTION

***Geographic Range:** Central New England south through Pennsylvania and eastern Ohio, extending through West Virginia and Virginia, and south along the Cumberland Plateau and Southern Appalachians to northern Alabama and northeastern Georgia and extreme northwestern South Carolina.
Nations: CA, US
States/Provinces: AL, CT, DC, DE, GA, IL, IN, KY, MA, MD, ME, NC, NH, NJ, NY, OH, ON, PA, RI, SC, TN, VA, VT, WV
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A4128	*Pinus strobus - Quercus alba* Allegheny Forest & Woodland Alliance
A2080	*Pinus strobus - Quercus montana* Appalachian Forest Alliance
A0248	*Quercus montana - Quercus coccinea* Forest Alliance
A2048	*Quercus velutina - Quercus alba* Eastern Forest Alliance
A0224	*Castanea dentata* Forest Alliance
A0250	*Quercus montana - Quercus rubra* Forest Alliance
A3116	*Quercus rubra - Quercus alba* Montane Forest Alliance
A0624	*Quercus rubra - Quercus montana* Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Appalachian Oak section	Dyer 2006	
><	Chestnut - chestnut oak - yellow poplar	Shantz and Zon 1924	
=	Chestnut Oak - American Chestnut Forest Group	Faber-Langendoen and Menard 2006	
=	Chestnut oak forest	NYNHP 2013u	
>	Oak - Chestnut Forest Region	Braun 1950	While a forest region is not equivalent to a forest group, the characterization of the major forest cover in this region fits the group concept.
=	Oak / Heath Forest	Fleming and Patterson 2013	

AUTHORSHIP

***Primary Concept Source [if applicable]:** E.L. Braun (1950)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler and L.A. Sneddon
Acknowledgments [optional]: J. Vanderhorst and R. McCoy
Version Date: 06 May 2015

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G016. Northeastern Chinquapin Oak - Red-cedar Alkaline Forest & Woodland

Type Concept Sentence: This eastern U.S. group is made up of dry forests and woodlands that are more-or-less restricted to calcareous or circumneutral bedrock substrates, characterized by *Quercus muehlenbergii* and *Juniperus virginiana*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.2. Appalachian-Northeastern Oak - Hardwood - Pine Forest & Woodland (M502)

Elcode: G016
***Scientific Name:** *Quercus muehlenbergii - Fraxinus americana - Juniperus virginiana* Forest & Woodland Group
***Common (Translated Scientific) Name:** Chinquapin Oak - White Ash - Eastern Red-cedar Forest & Woodland Group
***Colloquial Name:** Northeastern Chinquapin Oak - Red-cedar Alkaline Forest & Woodland

***Type Concept:** This group encompasses relatively dry calcareous forests and woodlands of temperate eastern North America, in which *Quercus muehlenbergii* is associated with a variety of hardwoods and/or *Juniperus virginiana*. Examples can occur on a variety of topographic and landscape positions, including ridgetops and upper and midslopes. It also includes relatively dry, rich woodlands of traprock habitats in the Northeast. Droughts and fires are factors determining the relative mixture of deciduous hardwood versus evergreen trees. In the Southern Ridge and Valley region, the Central Basin of Tennessee and other related areas, these forests may cover large areas; elsewhere, they occur as relatively small inclusions within a forest matrix of other oak and pine species.

***Diagnostic Characteristics:** Tree canopy dominated by *Quercus muehlenbergii*, or containing *Quercus muehlenbergii* with some combination of *Acer saccharum, Quercus alba, Quercus rubra, Quercus velutina, Carya ovata, Fraxinus americana*, or *Juniperus virginiana*; or open woodlands with *Juniperus virginiana* dominant and the above hardwoods as associates. Soils or parent material are calcareous or enriched and relatively dry.

***Classification Comments:** This group has a fairly broad range but a restricted environmental setting. Tree species composition is not too variable, but shrub and herb composition is not well-described. Further review of overall composition is needed to solidify the concept. Old-field *Juniperus virginiana* woodlands are excluded and placed in Eastern North American Native Ruderal Forest Group (G030). This type is not in Maritime Canada (S. Basquill pers. comm. 2015).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G601	Chinquapin Oak - Shumard Oak - Blue Ash Alkaline Forest & Woodland	is typically found in the unglaciated Midwest and south-central regions of the eastern United States; southern tree associates, such as *Quercus shumardii, Ulmus alata, Cotinus obovatus, Juniperus ashei*, and other hardwoods are distinctive.
G655	Laurentian-Acadian Limestone Woodland	is characterized by *Quercus muehlenbergii* and *Juniperus virginiana*, but in association with northern conifers *Thuja occidentalis* and *Pinus banksiana*.
G179	Central Interior Alkaline Open Glade & Barrens	contains some similar associations but is characterized by very open canopies and well-developed graminoid cover in the herb layer.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group encompasses a range of physiognomies from closed-canopy forest to open woodland. Two major subgroupings of thin-soiled woodlands versus closed-canopy forests on somewhat deeper soils can be recognized.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Canopy dominants found more-or-less throughout the range include *Quercus muehlenbergii, Carya cordiformis, Carya ovalis, Acer saccharum, Juniperus virginiana*, and *Fraxinus americana*. *Quercus alba* is a common associate. Subcanopy trees and shrubs characteristic in parts of the group's range include *Ostrya virginiana, Viburnum prunifolium, Viburnum rafinesqueanum, Cercis canadensis*, and *Staphylea trifolia*. The herbaceous layer is generally species-rich and with indicators of high base status, including *Carex eburnea, Hepatica nobilis, Packera obovata, Carex platyphylla, Asclepias quadrifolia, Actaea pachypoda, Dichanthelium boscii, Elymus hystrix, Aquilegia canadensis*, and *Adiantum pedatum*. Traprock habitats of the Northeast support many fewer nutrient-demanding species, but are characterized by circumneutral species of dry habitats such as *Corydalis sempervirens, Krigia virginica*, and *Asclepias verticillata*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**

***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Droughts and fires are factors determining the relative mixture of deciduous hardwood versus evergreen trees.

ENVIRONMENT

Environmental Description: *Climate:* This group is found in the temperate portions of the eastern United States. It tends to occur on portions of the landscape with warmer exposures. *Soil/substrate/hydrology:* These forests are associated with dry calcareous substrates such as limestone and dolomite or on traprock. They occur on a variety of topographic and landscape positions, including ridgetops and upper and midslopes. The soil moisture regime is dry to dry-mesic.

DISTRIBUTION

***Geographic Range:** This group occurs across north-temperate eastern North America, from southern New England and New York west to Michigan, south to Georgia, and across to the central Midwest, but typically north of the Interior Low Plateau and Ozarks. This group may also occur in Canada.

Nations: CA, US

States/Provinces: AL?, CT, DC, DE?, GA, IL?, IN, KY, MA, MD, MI?, NC, NJ, NY, OH, ON, PA, RI, SC?, TN, VA, VT, WI, WV

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:** FIA plots and Natural Heritage inventories have been conducted in portions of the range, and some quantitative analysis has also been conducted in portions of the range, but comprehensive sampling and analysis still remain to be done.

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]: This group is somewhat heterogeneous in structure but is supported by analyses of FIA plot data and has fairly clear geographical and ecological relationships.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3106	*Quercus muehlenbergii* Appalachian Limestone Woodland Alliance
A3914	*Thuja occidentalis* Appalachian Limestone Cliff Woodland Alliance
A2047	*Quercus muehlenbergii - Acer saccharum - Tilia americana* Forest Alliance
A3107	*Juniperus virginiana - Fraxinus americana - Carya* spp. Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Chinquapin Oak - Ash - Red-cedar Forest Group	Faber-Langendoen and Menard 2006	This group includes forests further west in which *Juniperus ashei* is characteristic.

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Hickory - ash - red cedar woodland	Walz 1996	
>	Traprock glade/savanna	Walz 1996	

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen and S. Menard (2006)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler, D. Faber-Langendoen, L.A. Sneddon

Acknowledgments [optional]: J. Vanderhorst and R. McCoy

Version Date: 06 May 2015

REFERENCES

***References [Required if used in text]:**

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1. Forest & Woodland

1.B.2.Na. Eastern North American Forest & Woodland

G650. Northeastern Oak - Hickory Forest & Woodland

Type Concept Sentence: This group encompasses eastern U.S. dry-mesic, largely deciduous forests of intermediate fertility characterized by *Quercus alba, Quercus falcata, Quercus montana, Quercus rubra, Quercus velutina, Fagus grandifolia, Carya glabra, Carya ovata, Carya cordiformis, Carya tomentosa, Fraxinus americana*, and in the southern part of the range, *Liriodendron tulipifera*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Na.2. Appalachian-Northeastern Oak - Hardwood - Pine Forest & Woodland (M502)

Elcode: G650

***Scientific Name:** *Quercus alba - Quercus montana - Carya glabra* Forest & Woodland Group

***Common (Translated Scientific) Name:** White Oak - Chestnut Oak - Pignut Hickory Forest & Woodland Group

***Colloquial Name:** Northeastern Oak - Hickory Forest & Woodland

***Type Concept:** This group is found throughout the northeastern United States, south to Georgia. It is distinguished from other forested groups within the region by a dry-mesic to dry edaphic condition that is transitional between dry barrens and mesic hardwood forests. Forest cover can range from a dense to moderately open canopy of deciduous broadleaf trees (conifers never exceed 25%), and there is commonly a dense shrub layer. In most examples, this vegetation is overwhelmingly deciduous, and characterized by *Quercus alba, Quercus falcata, Quercus montana, Quercus rubra, Quercus velutina, Fagus grandifolia, Carya glabra, Carya ovata, Carya cordiformis, Carya tomentosa, Fraxinus americana*, and in the southern part of the range, *Liriodendron tulipifera*. One alliance of this group encompasses coastal plain oak-hickory forests of ancient inland dune ridges that are the remnants of former river terraces; these forests are dry, oak-dominated, and characterized by *Carya pallida*. Pines such as *Pinus rigida, Pinus echinata, Pinus virginiana* can contribute significant canopy cover in these settings.

***Diagnostic Characteristics:** These forests contain a dominant canopy of broad-leaved deciduous trees, with conifers consistently less than 25% cover. *Quercus alba* and *Quercus velutina*, either singly or in combination, are at least 50% relative cover of the overstory, or these two species have at least 20% relative cover, and the following species, singly or in combination have at least 30% relative cover: the moderately diagnostic species *Quercus montana, Quercus rubra*, any of the weakly diagnostic species of *Carya glabra, Carya ovata, Carya tomentosa, Cornus florida, Nyssa sylvatica*, and *Quercus coccinea*.

***Classification Comments:** The distinctions between this group and Appalachian Oak / Chestnut Forest Group (G015) can be challenging where the two overlap, especially since *Castanea dentata*, a key species for that group, is now absent or reduced over much of its range. Appalachian Oak / Chestnut Forest Group (G015) encompasses somewhat drier forests, in general, than this group. An outstanding question is the best placement for high-elevation red oak-dominated associations in the Southern Appalachians (i.e., those attributed exclusively to Central and Southern Appalachian Montane Oak Forest (CES202.596)). The Southern Appalachian geography led to their placement in Appalachian Oak / Chestnut Forest Group (G015), but they are more mesic than other associations herein and may be better placed here in Northeastern Oak - Hickory Forest & Woodland Group (G650). This type is not in Maritime Canada (S. Basquill pers. comm. 2015).

A variant of this group is found on sandy glacial and outwash deposits of Cape Cod, Massachusetts, and Long Island, New York, south to the coastal plain portions of New Jersey, Maryland and Virginia south to about the James River. *Quercus alba, Quercus montana, Quercus coccinea*, and *Quercus rubra* are typical, and *Ilex opaca* is sometimes present. In the northern half of the range, conditions can grade to dry-mesic, reflected in the local abundance of *Fagus grandifolia*. These forests occur on acidic, sandy to gravelly soils with a thick duff layer, often with an ericaceous shrub layer. From New Jersey south to Virginia, this variant also includes oak-beech/heath forests on steep slopes. In New Jersey, some sandy paleodune deposits of the coastal plain support open woodlands with *Quercus* and *Carya* species as the typical canopy dominants, with *Carex pensylvanica* dominating the ground cover.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G181	Central Midwest Oak Openings & Barrens	
G015	Appalachian Oak / Chestnut Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary:

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Forest cover can range from a dense to moderately open canopy of deciduous broadleaf trees (conifers never exceed 25% cover), and there is commonly a dense shrub layer. Fire-resistant oak species, in particular *Quercus alba, Quercus montana (= Quercus prinus), Quercus rubra*, and/or *Quercus velutina*, dominate the overstory. Hickories such as *Carya glabra, Carya ovata, Carya cordiformis*, and *Carya tomentosa (= Carya alba)* are characteristic associates. *Quercus coccinea* may be present in the northeast part of the range, but are generally less important than the other oak species. *Castanea dentata* was a prominent tree before chestnut blight eradicated it as a canopy constituent. Other common associates include *Prunus serotina, Sassafras albidum, Acer rubrum, Betula lenta*, and *Betula alleghaniensis*. Fire suppression may account for the more closed oak forest examples with the more mesic understory. It likely has allowed for other associates, such as *Acer saccharum, Acer rubrum, Celtis occidentalis, Liriodendron tulipifera, Ostrya virginiana, Fraxinus americana*, and *Juglans nigra*, to become more prevalent, especially in upland areas along floodplains. With a long history of human habitation, many of the forests are early- to mid-successional, where *Pinus strobus, Pinus virginiana*, or *Liriodendron tulipifera* may be dominant or codominant.

A variant of this group is found on sandy glacial and outwash deposits of Cape Cod, Massachusetts, and Long Island, New York, south to the coastal plain portions of Maryland and Virginia south to about the James River. *Quercus alba, Quercus montana, Quercus coccinea*, and *Quercus rubra* are typical, and *Ilex opaca* is sometimes present. In the northern half of the range, conditions can grade to dry-mesic, reflected in the local abundance of *Fagus grandifolia*. These forests occur on acidic, sandy to gravelly soils with a thick duff layer, often with an ericaceous shrub layer. From New Jersey south to Virginia, this variant also includes oak-beech/heath forests on steep slopes.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Fire combined with drought was an important natural process in this group, often occurring as surface fires. Fire suppression may account for the more closed oak forest examples with the more mesic understory. It likely has allowed for other associates, such as *Acer saccharum, Acer rubrum, Celtis occidentalis, Liriodendron tulipifera, Ostrya virginiana, Fraxinus americana*, and *Juglans nigra*, to become more prevalent, especially in upland areas along floodplains. With a long history of human habitation, many of the forests are early- to mid-successional, where *Pinus strobus, Pinus virginiana*, or *Liriodendron tulipifera* may be dominant or codominant.

ENVIRONMENT

Environmental Description: This type is found on dry-mesic to dry edaphic condition that is transitional between dry barrens and mesic hardwood forests.

DISTRIBUTION

***Geographic Range:** This group is found throughout the glaciated regions of the Northeast to southern Ontario, central and southern New York and south through Pennsylvania to Virginia. It does not extend to southernmost part of Virginia, except in the Ridge and Valley. The coastal plain variant ranges from sandy glacial and outwash deposits of Massachusetts and Long Island, New York, south to the coastal plain portions of Maryland and Virginia, south to about the James River, with historic occurrences (and possibly some extant remnants) in eastern Pennsylvania.
Nations: CA, US
States/Provinces: CT, DC, DE, GA, MA, MD, ME, NC, NH, NJ, NY, OH, ON, PA, QC, RI, SC, VA, VT, WV
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3113	*Quercus falcata - Carya pallida - Pinus* spp. Mid-Atlantic Paleodune Woodland Alliance
A2054	*Fagus grandifolia - Quercus rubra / Cornus florida* Forest Alliance
A2053	*Quercus alba - Carya* spp. - *Fraxinus americana* Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-07-23	G158 Quercus alba - Quercus rubra - Quercus velutina - Carya glabra Forest Group	G158 split into G649 & G650

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Black Oak: 110	Eyre 1980	
<	Northern Red Oak: 55	Eyre 1980	
><	Oak - Hardwoods Forest Cover Group	Windisch 2014a	
<	White Oak - Black Oak - Northern Red Oak: 52	Eyre 1980	
>	White Oak: 53	Eyre 1980	

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen, in Faber-Langendoen et al. (2012)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** D. Faber-Langendoen

Acknowledgments [optional]:

Version Date: 09 Oct 2013

REFERENCES

***References [Required if used in text]:**

Abrams, M. D. 1992. Fire and the development of oak forests. BioScience 42(5):346-353.

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1. Forest & Woodland

1.B.2.Na. Eastern North American Forest & Woodland

G495. North Atlantic Maritime & Coastal Plain Forest

Type Concept Sentence: This group encompasses maritime forests characterized by *Pinus rigida, Pinus taeda*, dry-site oaks such as *Quercus velutina, Quercus alba, Quercus falcata*, and *Quercus stellata*, and early-successional trees that often do not exceed 5 m in height due to intense winds and salt spray. It ranges from Atlantic Canada and southern Maine to northern Virginia and is restricted to coastal regions.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Na.2. Appalachian-Northeastern Oak - Hardwood - Pine Forest & Woodland (M502)

Elcode: G495

***Scientific Name:** *Pinus rigida - Quercus* spp. / *Morella pensylvanica* Forest Group

***Common (Translated Scientific) Name:** Pitch Pine - Oak species / Northern Bayberry Forest Group

***Colloquial Name:** North Atlantic Maritime & Coastal Plain Forest

***Type Concept:** This northern coastal and maritime forest group ranges from Atlantic Canada and southern Maine to northern Virginia and is restricted to the coastal plain at the southern end of the range, and in coastal regions. It occurs as forests and scrub forests on maritime sand dunes with little to no soil profile development and subjected to heavy winds, salt spray and coastal storms. It ranges inland and encompasses taller, more closed forests that are near the coast but generally sheltered from maritime influences, and to the interior coastal plain at the southern end of the distribution. The elevation range is narrow, from near sea level to 30 m on Cape Cod, Massachusetts, to 400 m on the inner coastal plain of the Delmarva peninsula. The group includes pine and pine-oak forests as well as deciduous forests comprised of native early-successional fruit-bearing tree species, as well as oaks, beech, and holly. These forests are characterized by variable height and canopy closure, ranging from closed-canopy forests, open woodlands to dense "scrub forest." The group is characterized by *Pinus rigida, Pinus taeda*, dry-site oaks such as *Quercus velutina, Quercus alba, Quercus falcata*, and *Quercus stellata*, and early-successional trees, most commonly *Prunus serotina*, but also including *Amelanchier* spp., *Sassafras albidum, Diospyros virginiana, Nyssa sylvatica*, and *Juniperus virginiana*. *Fagus grandifolia* and *Ilex opaca* are important in some areas. The shrub layer is characterized by *Morella pensylvanica*, with other associates including *Viburnum dentatum, Aronia* spp., *Gaylussacia baccata*, and *Vaccinium pallidum*. At the southern end of the range, *Morella cerifera* may be an important shrub component. Vines are usually abundant, including *Toxicodendron radicans, Smilax rotundifolia*, and *Parthenocissus quinquefolia*. At the northern end, in Atlantic Canada, the composition includes a more northern cool temperate flora.

***Diagnostic Characteristics:** The most characteristic and constant species of this group is the shrub *Morella pensylvanica*, which is not usually dominant, but is generally an indicator of coastal or maritime settings. Vines often contribute substantial canopy cover; typically these include *Toxicodendron radicans, Smilax rotundifolia*, and *Parthenocissus quinquefolia*. Some combination of *Pinus rigida, Pinus taeda, Quercus alba, Quercus velutina, Quercus stellata, Prunus serotina, Amelanchier* spp., with the presence of *Morella pensylvanica* is generally diagnostic of this group. *Quercus rubra* is nearly always absent, but *Quercus falcata* or *Quercus nigra* may be more characteristic at the southern portion of the range, as is *Morella cerifera* rather than *Morella pensylvanica*. *Quercus stellata* in a maritime setting is diagnostic of this group. Occurrence on coastal sand dunes and sandplains is diagnostic.

***Classification Comments:** This group is somewhat similar to Appalachian Oak / Chestnut Forest Group (G015) in its being characterized by dry-site oaks and pines, but that group occurs at generally higher elevations, is characterized by *Quercus montana* and *Quercus rubra* and by *Pinus strobus*, and is underlain by bedrock rather than sand. In Atlantic Canada, the maritime dune forest is usually dominated by *Picea glauca*, with *Morella pensylvanica, Rosa carolina*, and scattered *Ammophila breviligulata*, and *Juncus arcticus ssp. littoralis*. Dune forests dominated by *Pinus strobus*, and sometimes *Pinus resinosa* or even *Pinus banksiana* and *Quercus rubra*, occur along warmer parts of the coast and are generally rare. If there is no other spot for warmer deciduous/mixedwood dune forest, then ours will have to be placed within this concept. Atlantic Canada *Picea glauca* dune forest does not belong here (S. Basquill pers. comm. 2015).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G015	Appalachian Oak / Chestnut Forest	is superficially similar in tree species composition, but has a wider geographic range inland; forests are usually tall with a closed canopy.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The structure of this vegetation is highly variable, ranging from closed-canopy forest, to open woodland, to dense scrub forest. In general, however, these forests are short in stature, characterized by stunted, gnarled or wind-flagged trees. Where the canopy is closed, the shrub layer is usually very dense and dominated by vines; in more open canopies, the shrub layer is usually poorly developed.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Canopy dominants include *Pinus rigida* or *Pinus taeda, Quercus alba*, and *Quercus velutina*. *Quercus falcata* or *Quercus nigra* occur, usually at low cover, at the southern portion of the range. *Prunus serotina, Juniperus virginiana, Amelanchier* spp., and *Sassafras albidum* are often present. *Ilex opaca* may be present and, in one association, dominant; *Diospyros virginiana* is present in some areas. *Fagus grandifolia* is generally not present, but forms the canopy dominant occasionally on Long Island, New York, or Cape Cod, Massachusetts. *Morella pensylvanica* (sometimes *Morella cerifera* at the southern portion of the range) is generally present, though not usually dominant. Other shrubs may include *Aronia* spp. (sometimes forming part of the tree canopy), *Viburnum dentatum, Gaylussacia baccata, Rhus typhina, Rhus copallinum*, and *Rosa virginiana*. Vines are nearly always present, often forming impenetrable thickets in the understory. These include *Smilax rotundifolia, Smilax glauca, Toxicodendron radicans*, and *Parthenocissus quinquefolia*. In Atlantic Canada, the maritime dune forest is usually dominated by *Picea glauca*, with *Morella pensylvanica, Rosa carolina*, and scattered *Ammophila breviligulata*, and *Juncus arcticus ssp. littoralis (= Juncus balticus)*. Dune forests dominated by *Pinus strobus*, and sometimes *Pinus resinosa* or even *Pinus banksiana* and *Quercus rubra*, occur along warmer parts of the coast and are generally rare (S. Basquill pers. comm. 2015).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: These forests are exposed to high winds, salt spray, and coastal storms. Tree falls are common, causing canopy gaps and highly variable structure. Many of these forests were logged in early settlement, and when oaks were removed, their re-establishment was hampered by their slow growth in these exposed settings. They were replaced by fast-growing early-successional species with fruits and/or seeds that are either bird- or wind-dispersed.

ENVIRONMENT

Environmental Description: These forests occur on highly permeable sand of coastal dunes and sand flats. On the coastal plain of New Jersey and the Delmarva peninsula, elevations rarely exceed 3 m, but on glacially derived Long Island and Cape Cod, dune formations exhibit more variation in height, reaching up to 30 m in some areas. These forests also occur on headlands and bluffs where soils may have some minimal profile development, and occasionally they occur on rocky coasts in the northern portion of the range.

DISTRIBUTION

***Geographic Range:** This type extends from Atlantic Canada and southern coastal Maine southward along the Atlantic Coast to Chesapeake Bay in Virginia.
Nations: CA, US
States/Provinces: CT, DE, MA, MD, ME, NH, NJ, NS, NY, RI, VA
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: Quantitative analysis of plots was undertaken at individual national parks, but regional analysis is lacking. Plots have been taken throughout the range.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A4209	*Quercus velutina - Quercus falcata - Pinus rigida* Coastal Plain Forest Alliance
A0237	*Prunus serotina - Amelanchier* spp. - *Juniperus virginiana* Maritime Scrub Forest Alliance
A2032	*Quercus velutina - Fagus grandifolia - Ilex opaca* Maritime Forest Alliance
A3105	*Pinus rigida - Pinus taeda* Maritime Forest & Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
?	Maritime Forest, Dune Subtype, Deciduous Forest	Rawinski 1984b	
=	Maritime pitch pine dune woodland	Edinger et al. 2002	
?	Maritime woodland/forest	Enser and Lundgren 2006	
>	Mixed woodland	Higgins et al. 1971	Assateague Island
><	Oak-Mixed Shrub-Herb Forest	Greller 1977	
?	Pine Forest	McDonnell 1979	
?	Pine forest	Johnson 1985b	
=	Pitch Pine Dune Woodland	Clancy 1996	
?	Scrub Forest	McDonnell 1979	
?	Southern New England forest on dunes	Rawinski 1984a	
?	Sunken Forest	Art 1987	
>	Woodland community	Hill 1986	Assateague Island

AUTHORSHIP

***Primary Concept Source [if applicable]:** W.E. Martin (1959b)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** L.A. Sneddon and D. Faber-Langendoen

Acknowledgments [optional]: Tom Wentworth and Sean Basquill

Version Date: 06 Aug 2015

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G161. Pitch Pine Barrens

Type Concept Sentence: This group is characterized by *Pinus rigida*, and includes open eastern U.S. woodlands of dry, nutrient-poor sites that are influenced by periodic fire.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.2. Appalachian-Northeastern Oak - Hardwood - Pine Forest & Woodland (M502)

Elcode: G161
***Scientific Name:** *Pinus rigida* Barrens Group
***Common (Translated Scientific) Name:** Pitch Pine Barrens Group
***Colloquial Name:** Pitch Pine Barrens

***Type Concept:** This group encompasses woodlands dominated by *Pinus rigida*, or by *Pinus rigida* mixed with oak species, occurring on dry and nutrient-poor soils and mostly maintained by fire. *Quercus rubra, Pinus strobus*, and *Betula populifolia* are common associates in the north, while *Quercus stellata* is characteristic in the south. A tall-shrub layer of *Quercus ilicifolia, Quercus prinoides*, and, south of New England, *Quercus marilandica* are commonly present, although portions of some barrens (or occasionally the entire barrens) lack the scrub oak component. A well-developed low-shrub layer is typical, with lowbush *Vaccinium* spp., *Gaylussacia baccata*, and *Comptonia peregrina* characteristic. The main constituents of this group are the associations that characterize the pine barrens of sandy substrates in the northeastern United States; the group also contains associations in which *Pinus rigida* dominates thin-soiled rocky hilltops. Substrates are of two major types: (1) deep sandy soils of outwash plains, stabilized inland sand dunes, and glacial till; and (2) less commonly, thin-soiled outcrops of acidic bedrock along exposed low-elevation ridgelines and upper slopes. The soils are consequently coarse-textured, acidic, mostly well-drained to xeric, and low in nutrients. *Pinus rigida* is the usual dominant, and cover may range from closed-canopy forest to (more typically) open woodlands.

***Diagnostic Characteristics:** Trees usually include a component of individuals >5 m tall, or at least not with the dominant canopy <2 m tall; *Pinus rigida* strongly dominant (usually at least 50% of the canopy cover) in the tree layer; or *Pinus rigida* the dominant conifer and mixed with oak species (typically *Quercus coccinea, Quercus alba, Quercus velutina*).

***Classification Comments:** This group includes forests and woodlands, but not the dwarf pine plains that are characterized as shrublands. Species composition can be similar in the two groups, but structure and fire frequency, and some edaphic characters, separate them. The southern Ontario classification "Pitch Pine Acidic Treed Rock Barren Type (ON_SO_RBT3-1)" is placed with *Pinus rigida / Vaccinium* spp. - *Gaylussacia baccata* Woodland (CEGL005046). In Atlantic Canada, there is a northern analog of this on sandy outwash plains and thin glacial till. It occurs in warmer interior areas of Nova Scotia. Neither *Pinus rigida* or the southern oaks *Quercus ilicifolia* and *Quercus prinoides* are present. The vegetation is characterized by species such as *Corema conradii, Gaylussacia baccata, Hudsonia ericoides, Ilex glabra, Photinia* spp., and *Pinus* spp. (usually *Pinus resinosa* and *Pinus strobus*). *Quercus rubra* and *Prunus serotina* may be present. Either this group (G161) needs to be broadened or a new unit defined. Atlantic Canada also has coastal pine woodlands [see comments under Laurentian Subboreal Dry Jack Pine - Red Pine - Oak Woodland Group (G347)] (S. Basquill pers. comm. 2015).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G160	Great Lakes Pine Barrens	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The tree layer has a highly variable canopy, ranging from closed-canopy forest to scattered woodland canopy over shrubs. In most cases, canopy closure increases with time since major fire disturbance. The canopy layer may be strongly pine-dominated, or a pine-oak mix (very rarely without pine). A shrub layer of 1- to 2-m *Quercus ilicifolia* and/or *Quercus prinoides* is often present and may be dense. Where this shrub layer is not well-developed, a dwarf-shrub layer of *Vaccinium* spp. and/or *Gaylussacia* spp. may be extensive. Development of the herb layer varies with the cover of overtopping vegetation.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Pinus rigida* is the dominant and characteristic species of this group. *Quercus ilicifolia* and *Quercus prinoides* are typical shrubby oaks. Tree oaks include *Quercus alba, Quercus coccinea*, and *Quercus velutina*. Low shrubs are usually dominated by heaths and include *Vaccinium pallidum, Vaccinium angustifolium*, and *Gaylussacia baccata*. *Aronia melanocarpa (= Photinia melanocarpa)* and *Corema conradii* may be locally common. Characteristic herbs include *Carex pensylvanica, Piptatheropsis pungens (= Piptatherum pungens), Schizachyrium scoparium, Melampyrum lineare, Lysimachia quadriflora*, and *Baptisia tinctoria*. Most of the herb and shrub species can occur both on sandy and rock substrates. In Atlantic Canada, there is a northern analog of this on sandy outwash plains and thin glacial till. It occurs in warmer interior areas of Nova Scotia. Neither *Pinus rigida* or the southern oaks *Quercus ilicifolia* and *Quercus prinoides* are present. The vegetation is characterized by species such *Corema conradii, Gaylussacia baccata, Hudsonia ericoides, Ilex glabra, Photinia* spp., and *Pinus* spp. (usually *Pinus resinosa* and *Pinus strobus*). *Quercus rubra* and *Prunus serotina* may be present (S. Basquill pers. comm. 2015).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Pitch pine barrens on sandplains are highly dependent on fire to maintain pine dominance. Frequency of fire is an important determinant of community structure as well as composition. On rocky ridges and in exposed maritime settings, *Pinus rigida* may persist without frequent fire. The degree of serotiny in *Pinus rigida* cones varies across environmental settings, with those of sandy pine barrens generally having a higher incidence of serotiny than pitch pines of rocky outcrops or dune forests.

ENVIRONMENT

Environmental Description: *Climate:* This group is found in north temperate eastern United States and Atlantic Canada. *Soil/substrate/hydrology:* Substrates are of two major types: (1) deep sandy soils of outwash plains, stabilized sand dunes, and glacial till; and (2), less commonly, thin-soiled outcrops of acidic bedrock along exposed low-elevation ridgelines and upper slopes. South of Maryland, all occurrences are on acidic to mafic bedrock outcrops. The soils are in either case coarse-textured, acidic, mostly well-drained to xeric, and low in nutrients.

DISTRIBUTION

***Geographic Range:** This group occurs from Nova Scotia and southern Maine and New Hampshire south to Maryland and west to eastern Pennsylvania and New York, with outliers on higher-elevation rock outcrops in Virginia and North Carolina.
Nations: CA, US
States/Provinces: CT, DC, MA, MD, ME, NC, NH, NJ, NS, NY, ON, PA, QC, RI, VA, VT
USFS Ecoregions (2007) [optional]: 211E:CC, 211Fd:CCC, 221Ab:CCC, 221Ac:CCP, 221Af:CCC, 221Ai:CCC, 221Ak:CCC, 221Al:CCC, 221Bc:CCC, 221Dc:CCC, 232A:CC, 232Hc:CCC, M221Db:CCC, M221Dd:CCC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0809	*Pinus rigida* Dwarf-scrub Alliance
A0524	*Pinus rigida* Woodland Alliance
A3320	*Pinus rigida - Pinus echinata* Woodland Alliance
A3911	*Quercus ilicifolia* Sand Barrens Scrub Alliance
A0681	*Pinus rigida - Quercus alba - Quercus stellata* Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	*Pinetum rigidae*	Conard 1935	
<	Pine barren	Forman and Boerner 1981	
<	Pine barrens	Robichaud and Buell 1973	
<	Pine barrens formation	Harshberger 1916	
>	Pitch Pine - Virginia Pine Forest Group	Faber-Langendoen and Menard 2006	Their group includes both this group and Virginia Pine & Table Mountain Pine Woodland & Barrens Group (G162).
<	Pitch pine - scrub oak forest	Collins and Anderson 1994	

AUTHORSHIP

***Primary Concept Source [if applicable]:** D.S. Schweitzer and T.J. Rawinski (1988); J.W. Harshberger (1916)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler, L.A. Sneddon and D. Faber-Langendoen

Acknowledgments [optional]: Sean Basquill

Version Date: 17 Apr 2013

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G162. Virginia Pine - Table Mountain Pine Woodland & Barrens

Type Concept Sentence: This vegetation encompasses predominantly evergreen woodlands and forests dominated by *Pinus pungens*, often with *Pinus rigida* and/or *Pinus virginiana*, and occasionally *Tsuga caroliniana*, occupying very exposed, convex, rocky south- and west-facing slopes and related habitats in the Central Appalachians, Southern Ridge and Valley and Southern Blue Ridge, including distinctive shale barrens of low to mid elevations in the Central and Southern Appalachians.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.2. Appalachian-Northeastern Oak - Hardwood - Pine Forest & Woodland (M502)

Elcode: G162
***Scientific Name:** *Pinus virginiana - Pinus pungens - Pinus rigida* Woodland & Barrens Group
***Common (Translated Scientific) Name:** Virginia Pine - Table Mountain Pine - Pitch Pine Woodland & Barrens Group
***Colloquial Name:** Virginia Pine - Table Mountain Pine Woodland & Barrens

***Type Concept:** Vegetation of this group encompasses predominantly evergreen woodlands and forests occupying very exposed, convex, often rocky south- and west-facing slopes, ridge spurs, crests, and clifftops in the Central Appalachians, Southern Ridge and Valley and Southern Blue Ridge, as well as distinctive shale barrens of low to mid elevations in the Central and Southern Appalachians. They typically occur at moderate to upper elevations (450-1200 m [1500-4000 feet]), with the more southerly examples at the higher elevations. In the Southern Blue Ridge, this group is best developed above 700 m (2300 feet) in elevation, but some examples may be found at lower elevations. The underlying rock is acidic and sedimentary or metasedimentary (e.g., quartzites, sandstones and shales). The soils are very infertile, shallow and droughty. A thick, poorly decomposed duff layer, along with dead wood and highly volatile ericaceous shrubs, creates a strongly fire-prone habitat. Most examples are dominated by *Pinus pungens*, often with *Pinus rigida* and/or *Pinus virginiana*, and occasionally *Tsuga caroliniana*. The canopy is usually patchy to open, but areas of closed canopy may be present, especially where *Tsuga caroliniana* is prominent, or where fire has been absent. The shrub layer may be well-developed, with *Gaylussacia baccata, Vaccinium pallidum*, or other acid-tolerant species most characteristic. Herbs are usually sparse but may include *Pityopsis graminifolia* and *Tephrosia virginiana*. Fire is a very important ecological process in this group. Frequent, low-intensity fires coupled with periodic severe fires is one factor that determines the occurrence of this vegetation rather than hardwood forests under natural conditions. The pines may be able to maintain dominance due to edaphic conditions, such as very shallow soil or extreme exposure in some areas, which can produce sustained drought conditions, but most sites appear eventually to succeed to oak dominance in the absence of fire. Fire is also presumably a strong influence on vegetation structure, producing a more open woodland canopy structure and more herbaceous ground cover.

In floristically distinctive shale barrens examples, the exposed aspects, parent material with high levels of toxic metals, and lack of soil create extreme conditions for plant growth. Vegetation is mostly of a woodland physiognomy, but may include large open areas of sparse vegetation. The dominant trees are primarily *Quercus montana* and *Pinus virginiana*. On higher-pH shale barrens, which are less common, the primary trees include *Juniperus virginiana* and *Fraxinus americana*, but these are placed in a different group. Shale barrens endemics are diagnostic in the herb layer. The substrate includes areas of solid rock as well as unstable areas of shale scree, usually steeply sloped. The fully exposed areas are extremely dry. These barrens are high in endemic species.

***Diagnostic Characteristics:** Stands have an open to moderately dense canopy of *Pinus pungens*, often with *Pinus rigida* and/or *Pinus virginiana*. In addition, *Quercus montana* may be a component. In some cases, *Pinus pungens* may be absent and *Pinus virginiana* (in a setting other than ruderal reverting lands) will be the dominant. The understory may vary from open with grasses to densely shrubby with ericads. In addition, stands dominated by *Tsuga caroliniana* are included here.

***Classification Comments:** There may be some conceptual overlap with some associations in Shortleaf Pine - Oak Forest & Woodland Group (G012), particularly in terms of *Pinus virginiana* ingrowth into *Pinus echinata* stands following the decline of *Pinus echinata* due to impacts of southern pine beetle and lack of fire. Sites that would support this vegetation under a natural fire regime, but which have lost the pines by logging, southern pine beetle or senescence in the absence of fire, should probably be regarded as degraded examples of this type. However, they become virtually indistinguishable from related deciduous or mixed forests over time.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G012	Shortleaf Pine - Oak Forest & Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Vegetation is mostly of a woodland physiognomy, but may include large open areas of sparse vegetation. The canopy is usually patchy to open, but areas of closed canopy may be present. The understory and shrub layer may vary from open with grasses to densely shrubby; herbs are usually sparse.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Vegetation of this group generally consists of open forests or woodlands dominated by some combination of *Pinus virginiana* (or rarely *Pinus echinata*), with *Pinus rigida* or with *Pinus pungens*, or less commonly *Tsuga caroliniana*. In examples in which fire has not been present in a long time, *Quercus coccinea, Quercus montana (= Quercus prinus)*, or other oaks may be present and are sometimes abundant, as are *Acer rubrum* and *Nyssa sylvatica*. *Castanea dentata* may also have once been abundant. A dense heath shrub layer is almost always present. *Kalmia latifolia* is the most typical dominant shrub, but species of *Gaylussacia, Rhododendron*, and/or *Vaccinium* may be present to dominant. Herbs are usually sparse but probably were more abundant and shrubs less dense when fires occurred more frequently. Following long periods without fire, most stands have increased densities of *Kalmia latifolia* and *Quercus* spp. as well as *Acer rubrum* and *Pinus strobus* (Welch and Waldrup 2001).

In the more specific case of Central Appalachian shale barrens (which are included here and are of major conservation significance), stunted trees, including *Carya glabra, Pinus virginiana*, and *Quercus montana*, are common. They are strongly characterized by their open physiognomy and by a suite of uncommon and rare plants found almost exclusively in these habitats (Fleming et al. 2004). Endemic or near-endemic shale barren species include *Arabis serotina, Clematis albicoma, Clematis viticaulis* and also endemic to Virginia, *Eriogonum allenii, Oenothera argillicola, Packera antennariifolia*, and *Trifolium virginicum*. Other more-or-less widespread and characteristic herbaceous species of shale barrens include *Antennaria virginica, Blephilia ciliata, Brickellia eupatorioides var. eupatorioides, Carex pensylvanica, Danthonia spicata, Deschampsia flexuosa var. flexuosa, Erysimum capitatum var. capitatum, Helianthus laevigatus, Paronychia montana, Phlox subulata, Potentilla canadensis, Selaginella rupestris*, and *Schizachyrium scoparium*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Fire is apparently a very important process influencing the vegetation of this group (Harrod and White 1999). Pines may be able to maintain dominance due to shallow soils and extreme exposure in some areas, but most sites appear eventually to succeed to oak dominance in the absence of fire. Fire is also presumably a strong influence on vegetation structure, producing a more open woodland canopy structure and more herbaceous ground cover. Occurrence in highly exposed sites may make this vegetation more prone to ignition, but most fires probably spread from adjacent oak forests. Fires could be expected to show more extreme behavior than in oak forests under similar conditions, due to the flammability of the vegetation and the frequently dry, windy conditions and steep location. Both intense catastrophic fires and lower-intensity fires probably occurred naturally. Natural occurrences probably include both even-aged and uneven-aged canopies.

Outbreaks of southern pine beetle (*Dendroctonus frontalis*) are an important factor, at least under present conditions. Beetle outbreaks can kill the pines without creating the conditions for them to regenerate. Air pollutant stressors such as ozone and acid deposition are continuing to change the conditions that these stands respond to (O. Loucks pers. comm. 2013). If the pines are lost, the distinction between this vegetation and related oak-dominated forests and woodlands becomes blurred.

ENVIRONMENT

Environmental Description: Vegetation of this group encompasses predominantly evergreen woodlands and forests occupying very exposed, convex, often rocky south- and west-facing slopes, ridge spurs, crests, and clifftops in the Central Appalachians, Southern Ridge and Valley and Southern Blue Ridge, as well as distinctive shale barrens of the Central and Southern Appalachians at low to mid elevations. They typically occur at moderate to upper elevations (450-1200 m [1500-4000 feet]), with the more southerly examples at the higher elevations. In the Southern Blue Ridge, this group is best developed above 700 m (2300 feet) in elevation, but some examples may be found at lower elevations. The underlying rock is acidic and sedimentary or metasedimentary (e.g., quartzites, sandstones and shales). The soils are very infertile, shallow and droughty. A thick, poorly decomposed duff layer, along with dead wood and highly volatile ericaceous shrubs, creates a strongly fire-prone habitat.

In floristically distinctive shale barrens examples, the exposed aspects with very strong insolation, parent material with high levels of toxic metals, and lack of soil create extreme conditions for plant growth. The substrate includes areas of solid rock as well as unstable areas of shale scree, usually steeply sloped. The fully exposed areas are extremely dry. These barrens are high in endemic species.

DISTRIBUTION

***Geographic Range:** Vegetation of this group is centered on the Southern Blue Ridge, from northern Georgia and South Carolina north through Virginia, with outlying occurrences north through the Central Appalachians to the Northern Blue Ridge of south-central Pennsylvania and parts of Kentucky. The serpentine barrens portion is found from southern Pennsylvania south to Virginia and extreme eastern Tennessee. Application of the concept south of Virginia is uncertain.

Nations: US

States/Provinces: GA, KY, MD, NC, OH, PA, SC, TN, VA, WV

USFS Ecoregions (2007) [optional]: M221Ac:CCC, M221Be:CCC, M221D:CC

Omernik Ecoregions L3, L4 [optional]: 8.4.1.67c:C, 8.4.1.67d:C, 8.4.1.67h:C, 8.4.1.67i:C, 8.4.4.66a:C, 8.4.4.66c:C, 8.4.4.66d:C, 8.4.4.66e:C, 8.4.4.66g:C, 8.4.4.66k:C, 8.4.4.66l:C, 8.4.4.66m:C

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3312	*Pinus virginiana - Quercus montana* Acidic Shale Woodland Alliance
A3311	*Pinus rigida - Pinus virginiana - Quercus marilandica* Serpentine Woodland Alliance
A0677	*Pinus pungens - Pinus rigida - Quercus montana* Woodland Alliance
A0144	*Tsuga caroliniana* Woodland Alliance
A3313	*Pinus virginiana - Juniperus virginiana* Riverscour Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Pitch Pine - Virginia Pine Forest Group	Faber-Langendoen and Menard 2006	Their group includes both this group and Pitch Pine Barrens Group (G161).

AUTHORSHIP

***Primary Concept Source [if applicable]:** N.L. Turrill and E.R. Buckner (1995)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne

Acknowledgments [optional]:

Version Date: 04 May 2015

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1. Forest & Woodland

1.B.2.Na. Eastern North American Forest & Woodland

M883. Appalachian-Interior-Northeastern Mesic Forest

Type Concept Sentence:

OVERVIEW

***Hierarchy Level:** Macrogroup

***Placement in Hierarchy:** 1.B.2.Na.3. Eastern North American Forest & Woodland (D008)

Elcode: M883
***Scientific Name:** Appalachian-Interior-Northeastern Mesic Forest Macrogroup
***Common (Translated Scientific) Name:** Appalachian-Interior-Northeastern Mesic Forest Macrogroup
***Colloquial Name:** Appalachian-Interior-Northeastern Mesic Forest

***Type Concept:**

***Diagnostic Characteristics:**

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M008	Southern Mesic Mixed Broadleaf Forest	
M882	Central Midwest Mesic Forest	
M016	Southern & South-Central Oak - Pine Forest & Woodland	
M502	Appalachian-Northeastern Oak - Hardwood - Pine Forest & Woodland	
M012	Central Midwest Oak Forest, Woodland & Savanna	
M014	Laurentian-Acadian Mesic Hardwood - Conifer Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary:

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary:

***Floristics Table [Med - High Confidence]:**
***Number of Plots:** ***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description:

DISTRIBUTION

***Geographic Range:**
Nations: CA, US
States/Provinces: AL, CT, GA, IL, IN, KY, MA, MD, ME?, NC, NH, NJ, NY, OH, ON, PA, QC?, SC, TN, VA, VT, WV
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G020	Appalachian-Central Interior Mesic Forest
G742	Appalachian-Allegheny Northern Hardwood - Conifer Forest

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-12-05	M153 Acer saccharum - Tilia americana - Fagus grandifolia Forest Macrogroup	M153 split into M882 & M883

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:**

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:**

Acknowledgments [optional]:

Version Date:

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G020. Appalachian-Central Interior Mesic Forest

Type Concept Sentence: This group is composed of tall, productive and diverse forests primarily dominated by a diverse suite of deciduous broad-leaved trees of the unglaciated Appalachians, Piedmont, and Interior Low Plateau regions of the eastern United States. They are best developed on lower slopes and in sheltered landforms, typically with northern to eastern exposures.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.3. Appalachian-Interior-Northeastern Mesic Forest (M883)

Elcode: G020
***Scientific Name:** *Fagus grandifolia - Liriodendron tulipifera - Aesculus flava* Forest Group
***Common (Translated Scientific) Name:** American Beech - Tuliptree - Yellow Buckeye Forest Group
***Colloquial Name:** Appalachian-Central Interior Mesic Forest

***Type Concept:** This group is composed of tall, productive and diverse forests primarily dominated by a diverse suite of deciduous broad-leaved trees of the unglaciated Appalachians, Piedmont, and Interior Low Plateau regions of the eastern United States. They range from about 125 m (400 feet) elevation to generally 1375 m (4500 feet), and occasionally to 1525 m (5000 feet) in the Southern

Appalachians. They are best developed on lower slopes and in sheltered landforms, typically with northern to eastern exposures. Stands are most extensive, diverse and well-developed in the Central and Southern Appalachians, and in the Cumberland and Allegheny Plateaus. Examples in the Interior Low Plateau are somewhat less diverse in comparison, but are still the most diverse and productive forests in this particular region. The most typical and usually dominant forest tree species include *Liriodendron tulipifera, Prunus serotina, Acer saccharum, Tilia americana* (both *var. americana* and *var. heterophylla*, the latter being especially characteristic), and *Fagus grandifolia*. Other associates can include *Fraxinus americana, Juglans nigra*, and *Magnolia* spp. (e.g., *Magnolia acuminata, Magnolia tripetala, Magnolia macrophylla*). Stands are typically dominated by genera other than *Carya* and *Quercus*, although some species of these genera may be present, including *Carya cordiformis, Carya ovalis, Carya ovata, Quercus alba, Quercus muehlenbergii, Quercus pagoda, Quercus rubra*, and *Quercus shumardii*. A diverse herbaceous layer will contain species such as *Adiantum pedatum, Arisaema triphyllum, Galium* spp., *Osmorhiza claytonii, Podophyllum peltatum, Polygonatum biflorum, Trillium* spp., and *Viola* spp.

***Diagnostic Characteristics:** These are rich, productive forests in sheltered landforms, with diverse canopies, found in the Central and Southern Appalachians, the Cumberland and Allegheny plateaus, the Piedmont, and the Interior Low Plateau of the eastern United States. A well-developed herbaceous layer, often very dense and usually high in species richness, and with abundant spring ephemerals, is characteristic.

***Classification Comments:** There has been a long-standing discussion about how to delineate and subdivide the broad concept of mesic or "mesophytic" forests in eastern North America. This group encompasses these forests in the non-coastal plain, unglaciated eastern United States. It does not include related coastal plain forests, nor the related "beech-maple" and "maple-basswood" forests to the north of this group. Forests of the Piedmont and parts of the Interior Low Plateau are clearly less diverse than those of the core of the group's distribution, the Southern Appalachians and Cumberlands. This variation is best accommodated at the alliance and association level, and all are included in this broad group. In the Southern Appalachian region, this type is restricted to lower elevations. At higher elevations it transitions to Appalachian-Allegheny Northern Hardwood - Conifer Forest Group (G742).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G166	Southern Mesic Beech - Oak - Mixed Deciduous Forest	
G791	Ozark-Ouachita Mesic Forest	
G742	Appalachian-Allegheny Northern Hardwood - Conifer Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is composed of tall (25-50 m) broad-leaved deciduous trees forming a closed canopy. Stands are diverse and productive. Understory trees are common, and the shrub layer is of variable structure. The herbaceous layer is generally lush, composed of leafy forbs.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The most typical and usually dominant forest tree species include *Acer saccharum, Fagus grandifolia, Liriodendron tulipifera, Prunus serotina*, and *Tilia americana var. heterophylla*. Other associates can include *Fraxinus americana, Juglans nigra*, and *Magnolia acuminata*. *Tsuga canadensis* may be a component of some stands. Southern Appalachian examples will contain *Aesculus flava, Halesia tetraptera var. monticola*, and *Magnolia fraseri*. Some characteristic shrubs include *Calycanthus floridus, Clethra acuminata, Leucothoe fontanesiana, Hydrangea quercifolia, Rhododendron maximum, Staphylea trifolia*, and *Viburnum acerifolium*. A well-developed herbaceous layer, often very dense and usually high in species richness, and with abundant spring ephemerals, is characteristic. Ulrey (1999) listed *Actaea racemosa (= Cimicifuga racemosa), Caulophyllum thalictroides, Laportea canadensis, Osmorhiza claytonii, Sanguinaria canadensis*, and *Viola canadensis* as characteristic herbs in Southern Appalachian stands. Central Appalachian and Cumberland examples can contain *Actaea racemosa (= Cimicifuga racemosa), Adiantum pedatum, Arisaema triphyllum, Asarum canadense, Botrychium virginianum, Caulophyllum thalictroides, Claytonia virginica, Cryptotaenia canadensis, Dicentra canadensis, Dryopteris marginalis, Erythronium americanum, Galium triflorum, Geranium maculatum, Hepatica nobilis var. acuta, Hydrophyllum canadense, Hydrophyllum virginianum, Osmorhiza* spp., *Laportea canadensis, Prosartes lanuginosa, Sanguinaria canadensis, Sedum ternatum, Tiarella cordifolia, Trillium erectum, Trillium grandiflorum*, and many others.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: This group primarily naturally contains stable, uneven-aged forests, with canopy dynamics dominated by gap-phase regeneration on a fine scale. Occasional extreme wind or ice events may disturb larger patches. Natural fire dynamics are not well-known and fire probably only occurred in years that were extremely dry. Fires may have occurred at moderate frequency but were probably usually low enough in intensity to have only limited effects. Most of the component species are among the less fire-tolerant in the region.

ENVIRONMENT

Environmental Description: Stands of this group are best developed in somewhat protected landscape positions such as coves or lower slopes. *Soil/substrate/hydrology:* These high-diversity, predominately deciduous forests occur on a variety of soils and substrates across their broad range. In the Central Appalachians, Piedmont, and Interior Low Plateau, they are best developed on deep and enriched soils (in some cases due to, or enhanced by, the presence of limestone or related base-rich geology), in non-montane settings. In the Southern Appalachians, bedrock may be of virtually any type. Acidic rocks, such as felsic igneous and metamorphic rocks, support rich cove forests in a more limited range of sites than do basic rocks, such as mafic metamorphic rocks or marble. Soils may be rocky or fine-textured, and may be residual, alluvial, or colluvial.

DISTRIBUTION

***Geographic Range:** This group is found primarily in three areas in a broad band of unglaciated terrain in the eastern United States primarily between about 33°N and 38°N latitude, extending further north to about 42°N in southwestern New York. Its range includes the Appalachians and Piedmont (from southwestern New York south to Alabama, as well as the Allegheny and Cumberland plateaus, and the unglaciated Interior Low Plateau.
Nations: CA, US
States/Provinces: AL, GA, IL, IN, KY, MD, NC, NY, OH, PA, SC, TN, VA, WV
USFS Ecoregions (2007) [optional]: 211G:CC, 221E:CC, 221F:C?, 221H:CC, 223A:CC, 223D:CC, 223E:CC, 223F:CC, 231A:CC, 231C:CC, 231D:CC, 231E:CC, 231G:CC, 231I:CC, M221A:CC, M221B:CC, M221C:CC, M221D:CC, M223A:CC, M231A:CC
Omernik Ecoregions L3, L4 [optional]: 8.2.4.55d:C, 8.3.1.64a:C, 8.3.1.64b:C, 8.3.1.64c:C, 8.3.1.64d:C, 8.3.1.64e:C, 8.3.1.64f:C, 8.3.1.64g:C, 8.3.2.72a:C, 8.3.2.72b:C, 8.3.2.72c:C, 8.3.2.72d:C, 8.3.2.72e:C, 8.3.2.72f:C, 8.3.2.72h:C, 8.3.3.71a:C, 8.3.3.71b:C, 8.3.3.71c:C, 8.3.3.71d:C, 8.3.3.71e:C, 8.3.3.71f:C, 8.3.3.71g:C, 8.3.3.71h:C, 8.3.3.71i:C, 8.3.3.71j:C, 8.3.3.71k:C, 8.3.3.71l:C, 8.3.4.45a:C, 8.3.4.45b:C, 8.3.4.45c:C, 8.3.4.45d:C, 8.3.4.45e:C, 8.3.4.45f:C, 8.3.4.45g:C, 8.3.4.45h:C, 8.3.4.45i:C, 8.4.1.67a:C, 8.4.1.67b:C, 8.4.1.67c:C, 8.4.1.67d:C, 8.4.1.67f:C, 8.4.1.67g:C, 8.4.1.67h:C, 8.4.1.67i:C, 8.4.2.69a:C, 8.4.2.69b:C, 8.4.2.69c:C, 8.4.2.69d:C, 8.4.2.69e:C, 8.4.3.70a:C, 8.4.3.70b:C, 8.4.3.70c:C, 8.4.3.70d:C, 8.4.3.70e:C, 8.4.3.70f:C, 8.4.3.70g:C, 8.4.3.70h:C, 8.4.4.66a:C, 8.4.4.66b:C, 8.4.4.66c:C, 8.4.4.66d:C, 8.4.4.66e:C, 8.4.4.66f:C, 8.4.4.66g:C, 8.4.4.66i:C, 8.4.4.66j:C, 8.4.4.66k:C, 8.4.4.66l:C, 8.4.4.66m:C, 8.4.9.68a:C, 8.4.9.68b:C, 8.4.9.68c:C, 8.4.9.68d:C, 8.4.9.68e:C, 8.4.9.68f:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A2033	*Fagus grandifolia - Liriodendron tulipifera - Carya cordiformis* Forest Alliance
A3265	*Fagus grandifolia - Quercus rubra* Piedmont-Ridge and Valley Forest Alliance
A0235	*Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava* Forest Alliance
A3304	*Tsuga canadensis - Liriodendron tulipifera* Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
><	Beech - Sugar Maple: 60	Eyre 1980	
<	Cove Hardwoods Forest	Whittaker 1956	
<	Mesic Eutrophic (Cove) forests	Peet and Christensen 1980	
<	Rich mesophytic forest	Edinger et al. 2002	

AUTHORSHIP

***Primary Concept Source [if applicable]:** R.H. Whittaker (1956)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne and S. Gawler

Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by F. Gilliam and S. Franklin.

Version Date: 04 May 2015

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G742. Appalachian-Allegheny Northern Hardwood - Conifer Forest

Type Concept Sentence: This northern hardwood-conifer forest group occurs in the central and northeastern U.S., ranging from north-central New York and lower New England west to Lake Erie and south through the Central Appalachian region to the higher elevations of the Carolinas, on relatively cool, mesic sites.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.3. Appalachian-Interior-Northeastern Mesic Forest (M883)

Elcode: G742
***Scientific Name:** *Acer saccharum - Betula lenta - Quercus rubra* Forest Group
***Common (Translated Scientific) Name:** Sugar Maple - Sweet Birch - Northern Red Oak Forest Group
***Colloquial Name:** Appalachian-Allegheny Northern Hardwood - Conifer Forest

***Type Concept:** This forest group occurs in the central and northeastern U.S., ranging from extreme southern Ontario, north-central New York and lower New England west to Lake Erie and south to the higher elevations of the Carolinas, on relatively cool, mesic sites. Northern hardwoods such as *Acer rubrum, Acer saccharum, Betula alleghaniensis, Betula lenta, Fagus grandifolia, Fraxinus americana, Quercus rubra*, and *Tilia americana* are characteristic, either forming a deciduous canopy or mixed with *Tsuga canadensis* (or in some cases *Pinus strobus*). Other common and sometimes dominant trees include *Quercus* spp. (most commonly *Quercus rubra*, but also *Quercus alba, Quercus montana*), *Aesculus flava, Liriodendron tulipifera*, and *Prunus serotina*. It is of more limited extent and more ecologically constrained in the southern part of its range, in higher elevations of the northern parts of Virginia and West Virginia. This type is one of the matrix forest types in the northern part of the Central Interior and Appalachian Division. In general, this group is dominated by long-lived, mesic species that form multi-layered uneven-aged forests. Canopy dynamics are dominated by single and multiple disturbances, encouraging gap phase regeneration. Larger disturbances include windthrow, insect attack and ice storms. Although stand-replacing wind events are rare, small to medium blowdown events are more common.

***Diagnostic Characteristics:** Typical northern hardwoods such as *Acer saccharum, Betula lenta, Betula alleghaniensis, Fagus grandifolia*, and *Quercus rubra* are characteristic, either forming a deciduous canopy or mixed with *Tsuga canadensis* (or in some cases *Pinus strobus*), but also containing one or more Appalachian species, including *Aesculus flava, Liriodendron tulipifera*, and *Quercus montana*. Notably absent from this group are the Laurentian-Acadian species of *Picea rubens, Abies balsamea*, and *Betula papyrifera*, and *Thuja occidentalis* is very localized.

***Classification Comments:** Northward this group is replaced by Laurentian-Acadian Hemlock - White Pine - Hardwood Forest Group (G741) and Laurentian-Acadian Hardwood Forest Group (G743), which are in a different macrogroup, but conceptually the groups may overlap on the Allegheny Plateau and in central New England. The presence of any one of *Betula lenta, Liriodendron tulipifera, Quercus montana*, and other Appalachian tree species (to be determined) are diagnostic. Other diagnostic shrub and herb species need to be identified as approximate indicators for the northern limit of this group's range. Notably absent from this group are the Laurentian-Acadian species of *Picea rubens, Abies balsamea*, and *Betula papyrifera*, and *Thuja occidentalis* is very localized. This group may occur most typically at lower, warmer elevations in the High Allegheny Plateau region of northeastern Ohio, northern Pennsylvania and southern New York, as compared to G741 and G743. In the Central and Southern Appalachians, no distinction is made at the group level between hemlock-hardwood stands and hardwood stands, as hemlock is not as widespread, and stands are not as strongly hemlock-dominated as in the Laurentian-Acadian region (this pattern needs to be verified using USFS FIA tree plot data across G741, G742, and G743). The distinction is currently tracked at the alliance level. In the Southern Appalachian region, this type is restricted to higher elevations. There, at lower elevations it transitions to Appalachian-Central Interior Mesic Forest Group (G020).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G741	Laurentian-Acadian Hemlock - White Pine - Hardwood Forest	
G020	Appalachian-Central Interior Mesic Forest	
G743	Laurentian-Acadian Hardwood Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The canopy is characterized and often usually dominated by broad-leaved deciduous trees (northern hardwoods), but locally, stands may have a strong needle-leaved evergreen (conifer) component.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The canopy is characterized and often usually dominated by northern hardwoods, such as *Acer rubrum, Acer saccharum, Betula alleghaniensis, Betula lenta, Fagus grandifolia, Fraxinus americana, Quercus rubra*, and *Tilia americana*, either forming a deciduous canopy or mixed with *Tsuga canadensis* or *Pinus strobus*. *Tsuga canadensis* can dominate the canopy on cool/moist sites at higher elevations and in shaded coves, valley bottoms and riparian areas. Rarely, *Thuja occidentalis* may be present. Bottomlands and toeslopes may also contain *Fraxinus americana*, as well as *Platanus occidentalis* (Whitney 1990). Other common associates may include *Liriodendron tulipifera, Ostrya virginiana, Prunus serotina, Quercus alba, Quercus montana (= Quercus prinus)*, and *Magnolia acuminata*. The subcanopy and shrub layers are usually well-developed and may include *Viburnum lantanoides (= Viburnum alnifolium), Viburnum acerifolium, Hamamelis virginiana*, and *Cornus alternifolia*. Occasionally, *Rhododendron maximum* and sometimes *Kalmia latifolia* are present. Common herbaceous species include *Maianthemum canadense, Onoclea sensibilis, Huperzia lucidula (= Lycopodium lucidulum), Dryopteris carthusiana (= Dryopteris spinulosa), Oxalis montana*, and *Mitchella repens* (Lutz 1930, Braun 1950).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In general, this group is dominated by long-lived, mesic species that form multi-layered uneven-aged forests. Canopy dynamics are dominated by single and multiple disturbances encouraging gap phase regeneration (Abrams and Orwig 1996). Larger disturbances include windthrow, insect attack and ice storms. Although stand-replacing wind events are rare, small to medium blowdown events are more common and occur at greater frequency on the plateau and exposed sideslopes (Ruffner and Abrams 2003). This group is currently being devastated in large parts of its range by the hemlock woolly adelgid (*Adelges tsugae*). This sucking insect is continuing to cause close to 100% mortality as it spreads from the north into the southern United States. The insect will most likely cause canopy hemlocks to be replaced by other canopy trees. Historically, this group was probably only subject to occasional fires. Fires that did occur may have been catastrophic and may have led to even-aged stands of pine and hemlock. Fire suppression appears to have increased the extent of this group at the expense of oak-pine systems.

ENVIRONMENT

Environmental Description: *Soil/substrate/hydrology:* This group occurs predominantly on mesic sites over a broad range of topographic conditions, such as protected low and midslopes and valley bottoms, at elevations from 305 to 915 m (1000-3000 feet). Soils are usually neutral to acidic, and retain some moisture except during severe droughts. They are moderately well-drained to well-drained loamy or silty soils, and are rocky and usually deep in depressions among boulders. In riparian areas, stands are usually found along high-gradient (1-2%) streams. In the Central Appalachian center of its range, its ecological amplitude is somewhat broader, and it approaches matrix forest in some areas. At Shenandoah National Park, this group spans a broad range of environmental settings from steep west-facing slopes to south-facing gentle slopes.

DISTRIBUTION

***Geographic Range:** This group is found from central New England and north-central New York, south to higher elevations in North Carolina, and probably in adjacent eastern Kentucky.
Nations: CA, US
States/Provinces: CT, GA, KY, MA, MD, ME?, NC, NH, NJ, NY, OH?, PA, SC?, TN, VA, VT, WV
USFS Ecoregions (2007) [optional]: 211E:CC, 211Fc:CCC, 211G:CC, 221Aa:CCC, 221B:CC, 221D:CC, 221E:CC, 221F:CC, 222I:CC, M221A:CC, M221B:CC, M221C:CC, M221D:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0266	*Betula alleghaniensis - Aesculus flava* Forest Alliance
A3302	*Tsuga canadensis - Betula lenta - Betula alleghaniensis* Forest Alliance
A3301	*Acer saccharum - Fagus grandifolia - Tilia americana* Forest Alliance
A3303	*Quercus rubra - Acer saccharum - Betula lenta* Forest Alliance
A4126	*Acer saccharum - Tilia americana - Quercus rubra* Rocky Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-12-13	G163 Fagus grandifolia - Betula alleghaniensis - Tsuga canadensis - Pinus strobus Forest Group	G163 split into G741, G742, G743

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen, in Faber-Langendoen et al. (2012)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** D. Faber-Langendoen, S.C. Gawler, R. White, R. Evans, M. Pyne
Acknowledgments [optional]:
Version Date: 05 May 2015

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

M012. Central Midwest Oak Forest, Woodland & Savanna

Type Concept Sentence: This north-central oak - hardwood type, with closed forest to open savanna and barrens structure, is dominated by oak and hickory tree species within glaciated regions of the Midwest, from southern Minnesota to northern Missouri and east to western New York and southern Ontario. It is found on dry to dry-mesic sites on primarily glaciated sandy to loamy soils. Fire is critical to maintaining the oak species and the diverse herb and shrub layers.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.2.Na.4. Eastern North American Forest & Woodland (D008)

Elcode: M012
***Scientific Name:** *Quercus alba - Quercus macrocarpa - Carya ovata* Forest, Woodland & Savanna Macrogroup
***Common (Translated Scientific) Name:** White Oak - Bur Oak - Shagbark Hickory Forest, Woodland & Savanna Macrogroup
***Colloquial Name:** Central Midwest Oak Forest, Woodland & Savanna

***Type Concept:** The vegetation structure of this macrogroup ranges from open savanna or barrens, with at least 10% tree cover, to closed forest. Typical dominant oak species include *Quercus alba, Quercus ellipsoidalis, Quercus macrocarpa, Quercus rubra*, and/or *Quercus velutina*. In forest and woodland stands, hickories such as *Carya tomentosa, Carya cordiformis, Carya glabra*, and *Carya ovata* are characteristic associates. Forested stands can have a dense shrub understory. Most barrens and savanna examples have understories dominated by prairie graminoids such as *Andropogon gerardii, Hesperostipa spartea, Schizachyrium scoparium, Sorghastrum nutans*, and *Sporobolus heterolepis*, and can have a rich forb component. This fire-dependent type is transitional between dry prairies and mesic hardwood forests. This macrogroup is found throughout the glaciated regions of the Midwest, most typically in the tallgrass prairie border-central lowlands region. It can occur on glacial landscape features such as moraines, kettle-kame topography, and outwash plains. Soils are well-drained to excessively drained, with a loamy to sandy texture. Fire suppression leads to more closed-canopy forests and woodlands, and a more mesic understory, and eventually replacement of oak canopy with mesic hardwoods, such as *Acer saccharum* and *Acer rubrum*. Periodic strong winds and browsing also impact this type. Many of the stands have been cleared and converted to agriculture.

***Diagnostic Characteristics:** This macrogroup is found within glaciated regions of the Midwest on loamy to sandy soils. It includes forests, savannas, and barrens, with a tree canopy of 5 m or more and from 10-100% cover, dominated by oak species such as *Quercus alba, Quercus macrocarpa, Quercus rubra*, and *Quercus velutina*. Many forests are codominated by *Carya* spp. Savanna and barrens examples contain a graminoid layer dominated by *Andropogon gerardii* and *Schizachyrium scoparium* with diverse herbs. Eastern oaks are not present, including *Quercus coccinea* and *Quercus montana*.

***Classification Comments:** This type includes oak forests, savannas and barrens in the glaciated regions of the Midwest and adjacent Canada. Northeastern U.S., Appalachian and Ozarkian examples are included elsewhere.

Oak barrens are closely related to sand and gravel prairie and barrens, and oak savanna (oak openings) are closely related to loamy tallgrass prairie. Floristically, these stands may strongly resemble open prairie types, but their tree canopy structure places them here [see 1. Forest & Woodland Class (C01)]. This type is, to some degree, the drier counterpart to Central Midwest Mesic Forest Macrogroup (M882), North-Central Beech - Maple - Basswood Forest Group (G021), with which it shares a similar climate, but a very different disturbance regime and topo-edaphic characteristics.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M882	Central Midwest Mesic Forest	

Elcode	Scientific or Colloquial Name	Note
M883	Appalachian-Interior-Northeastern Mesic Forest	
M016	Southern & South-Central Oak - Pine Forest & Woodland	
M502	Appalachian-Northeastern Oak - Hardwood - Pine Forest & Woodland	
M159	Laurentian-Acadian Pine - Hardwood Forest & Woodland	
M054	Central Lowlands Tallgrass Prairie	
M509	Central Interior Acidic Scrub & Grassland	

Similar NVC Types General Comments [optional]: This macrogroup represents a transition from Central Lowlands Tallgrass Prairie Macrogroup (M054) to more mesic forests (Central Midwest Mesic Forest Macrogroup (M882), including maple-basswood forest and beech-maple forest). This macrogroup (M012) occurs primarily in the glaciated Midwest. Oak-dominated macrogroups also occur in the Appalachian and southeastern U.S. (Appalachian-Northeastern Oak - Hardwood - Pine Forest & Woodland Macrogroup (M502) and South-Central Oak - Hardwood & Pine Forest Macrogroup (M016)) but with other eastern and southern oak and/or pine associates.

VEGETATION

Physiognomy and Structure Summary: This macrogroup ranges from closed-canopy oak forests (60-100% cover) to open oak savannas and barrens typified by scattered trees (10-60% cover) over a continuous graminoid/shrub layer. Fire suppression in the region has allowed trees to establish more dense canopies.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Dominant tree species in forest and woodland examples of this macrogroup include *Quercus alba, Quercus rubra*, and/or *Quercus velutina*. Common associates include *Carya tomentosa (= Carya alba), Carya cordiformis, Carya glabra*, and *Carya ovata*. *Quercus macrocarpa* and *Quercus ellipsoidalis* may be common in these examples as well. Conifers (e.g., *Pinus banksiana, Pinus strobus*) occasionally occur but at less than 25% cover, and a dense shrub layer is common. In savanna and barrens examples, canopy cover of tree species ranges from 10 to 60%, and *Quercus macrocarpa* is the most common tree. Occasional associates include *Populus tremuloides* (northern portion of the range), *Quercus alba, Quercus bicolor*, and *Quercus stellata* (southern part of range). The understory is dominated by graminoids, including *Andropogon gerardii, Hesperostipa spartea (= Stipa spartea), Schizachyrium scoparium, Sorghastrum nutans*, and *Sporobolus heterolepis*. There can be a rich forb component (which may increase in dominance with more closed-canopy examples). Some common forb species include *Amorpha canescens, Antennaria* spp., *Calamagrostis canadensis* (in moist stands), *Carex* spp., *Lespedeza capitata, Ratibida pinnata, Silphium laciniatum*, and *Zizia aurea* (Curtis 1959, Anderson and Bowles 1999, Leach and Givnish 1999). Sandy oak barrens are dominated by *Quercus velutina*, with some *Quercus ellipsoidalis, Quercus macrocarpa*, and *Quercus alba*. *Pinus banksiana* can occur in the northern parts of the range. In the southern part of the range in central Illinois, sand savannas may be dominated by *Quercus marilandica* and *Quercus velutina*, with *Carya texana*. Common herbaceous species include *Ambrosia psilostachya, Amphicarpaea bracteata, Artemisia ludoviciana, Andropogon gerardii, Calamovilfa longifolia, Carex pensylvanica, Comandra umbellata, Hesperostipa spartea, Schizachyrium scoparium*, and *Sorghastrum nutans*. Fire is required to maintain the species composition and structure of this type. Fire suppression can increase the number of mesic tree and understory species and can increase the woody canopy cover in barrens and savanna examples.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Fire, especially in combination with drought, is extremely important in maintaining this macrogroup. Historically, fires in the landscape varied from annual to 30-year intervals depending on topography, soils and firebreaks (Grimm 1984,Leitner et al. 1991). The 1- to 5-year fire cycle maintained the savanna and barrens portions of this macrogroup and also prevented more mesic species from invading oak forests and woodlands (Curtis 1959). Mesic, loam savannas may have burned more frequently or intensely than sandy oak barrens. Fire suppression allows the oak trees to establish more dense canopies and, over time, replacement by mesic tree associates, such as *Acer saccharum, Acer rubrum, Celtis occidentalis, Ostrya virginiana*, and *Fraxinus americana*. Periodic, strong wind disturbances and browsing also impact this type as can drought alone and oak wilt. Much of this type has been converted to agriculture.

ENVIRONMENT

Environmental Description: This macrogroup occurs on rolling landscapes and many glacial features such as outwash plains, hills and ridges, rolling glacial moraines, kettle-kame topography, end moraine formations, and outwash plains. It can also occur on uplands within a prairie matrix and near floodplains. Soils range from almost pure sand to richer loams. Typical soils include well-drained to excessively drained Mollisols or Alfisols. Savanna and barrens examples have soils with low fertility, organic matter, and moisture-retention capacity. Factors which affect seasonal soil moisture are strongly related to variation in this type. Historically, the oak-hickory forests to savannas were quite extensive in the Midwest.

DISTRIBUTION

***Geographic Range:** This macrogroup is found throughout the glaciated regions of the Midwest to southern Ontario and western New York.
Nations: CA, US
States/Provinces: IA, IL, IN, KS, MI, MN, MO, ND, NE, NY, OH, OK, ON, QC?, WI
USFS Ecoregions (2007) [optional]: 212Ha:CCP, 212Hb:CCC, 212K:CP, 212Q:CP, 222I:CC, 222Ja:CCC, 222Jb:CCC, 222Jc:CCC, 222Je:CCC, 222Jf:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222K:CC, 222L:CC, 222M:CC, 222N:CC, 222R:CC, 222Ua:CCC, 222Ud:CCC, 222Ue:CCC, 251A:CC, 251B:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G181	Central Midwest Oak Openings & Barrens
G649	North-Central Oak - Hickory Forest & Woodland

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Black Oak: 110	Eyre 1980	Apart from its extension into the Ozarks, the concept of this cover is quite similar to the group concept.
<	Northern Red Oak: 55	Eyre 1980	The concept of this cover type is quite similar to the group concept, though the montane portions are excluded.
<	Oak Barrens	Curtis 1959	
<	Oak Openings	Curtis 1959	

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	White Oak - Black Oak - Northern Red Oak: 52	Eyre 1980	The concept of this cover type is quite similar to the group concept.
>	White Oak: 53	Eyre 1980	The concept of this cover type is more broad, especially southward that the group concept.

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.T. Curtis (1959); F.H. Eyre (1980)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.E. Menard and D. Faber-Langendoen

Acknowledgments [optional]:

Version Date: 15 Oct 2014

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G181. Central Midwest Oak Openings & Barrens

Type Concept Sentence: The deep-loam to sandy oak savanna (oak openings and oak barrens) occurs in the tallgrass prairie regions of the central United States, where scattered trees (10 to 30% cover) occur over a more-or-less continuous tallgrass prairie layer. Trees are *Populus tremuloides, Quercus alba, Quercus bicolor, Quercus macrocarpa*, and/or *Quercus stellata*, and dominant graminoids include *Andropogon gerardii, Schizachyrium scoparium, Sorghastrum nutans, Sporobolus heterolepis*, and/or *Hesperostipa spartea*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.4. Central Midwest Oak Forest, Woodland & Savanna (M012)

Elcode: G181
***Scientific Name:** *Quercus macrocarpa - Quercus velutina / Andropogon gerardii* Savanna & Barrens Group
***Common (Translated Scientific) Name:** Bur Oak - Black Oak / Big Bluestem Savanna & Barrens Group
***Colloquial Name:** Central Midwest Oak Openings & Barrens

***Type Concept:** The deep-soil oak savanna occurs in the northern, central and southern tallgrass prairie regions of the central United States, with extensions into southern Ontario and southeastern Manitoba, Canada. It was historically dominant in the northern glaciated regions of the Midwest with the largest concentration in the prairie-forest border ecoregion. It is typically found on rolling outwash plains, hills and ridges. Soils are typically moderately well- to well-drained deep loams. This savanna is typified by scattered trees, varying from 10 to 30% cover over a more-or-less continuous tallgrass prairie layer. *Quercus macrocarpa* is a common tree throughout the range. Other associates include *Populus tremuloides* (northern portion of the range), *Quercus alba, Quercus bicolor*, and *Quercus stellata*. The dominant herbaceous species are the graminoids *Andropogon gerardii, Schizachyrium scoparium, Sorghastrum nutans, Sporobolus heterolepis*, and *Hesperostipa spartea*. A rich forb component includes *Amorpha canescens, Antennaria* spp., *Calamagrostis canadensis* (in moist stands), *Carex* spp., *Lespedeza capitata, Ratibida pinnata, Silphium laciniatum*, and *Zizia aurea*, among many species. The shrub layer can be absent to prominent. Where shrubs are present, *Corylus* spp. tend to be dominant, accompanied by species such as *Cornus foemina, Rosa* spp., *Rubus allegheniensis*, and *Symphoricarpos occidentalis* (in the west). Historically, frequent fires maintained this savanna within its range and would have restricted tree canopies to 10-30% cover. Fire suppression in the region has allowed trees to establish more dense canopies. Periodic, strong wind disturbances and browsing also impact this type. Much of this type has also been converted to agriculture, or succeeded to forests because of the lack of fire, greatly reducing its area and range.

The sandy oak barrens occur on well-drained, coarse-textured sandy soils derived from glacial outwash, end moraine formations, or lakeplain dune systems in the north-central U.S. and parts of southern Ontario, Canada. Soils range from almost pure sand, to loamy sand, to sandy loam. The soils have low fertility, organic matter, and moisture-retention capacity. Factors which affect seasonal soil moisture are strongly related to variation in this type. The oak barrens is a scrubby, open-treed system dominated by graminoids and shrubs. Canopy structure varies from a dominant herbaceous ground layer with sparse, scattered "savanna" canopy (5-25%), through oak-dominated scrub, to a more closed woodland canopy (25-60%). The canopy layer is dominated by *Quercus velutina*, with some *Quercus ellipsoidalis, Quercus macrocarpa*, and *Quercus alba* (the latter more common eastward and in woodland conditions). Occasional *Pinus banksiana* can occur in the northern parts of the range. Species found in the herb layer include *Ambrosia psilostachya, Amphicarpaea bracteata, Artemisia ludoviciana, Andropogon gerardii, Calamovilfa longifolia, Carex pensylvanica, Carex* spp., *Comandra umbellata, Sorghastrum nutans, Hesperostipa spartea*, and *Schizachyrium scoparium*. Fire was an important factor in maintaining this community. Oak wilt and droughts also reduce tree cover.

***Diagnostic Characteristics:** A scattered canopy, typically 5-25% cover, dominated by either *Quercus macrocarpa* or *Quercus velutina*, with a strong graminoid layer of *Andropogon gerardii* and *Schizachyrium scoparium*, diverse herbs, and either deep loams or sandy-gravelly soils.

***Classification Comments:** Oak barrens are closely related to sand and gravel prairie and barrens, and oak savanna (oak openings) are closely related to loamy tallgrass prairie, suggesting that this group could be split into two. These oak openings and barrens are often treated with prairie. For an example of this approach, see Minnesota DNR (2005) which treats southern dry savanna (oak barrens) and southern dry prairie together, and mesic savanna and mesic prairie together, and does the same for northern prairie and savanna types. If we followed that approach, an alternative arrangement of this group would be to disperse it among the closely related prairie and sand barren types, as follows: Central Lowlands Tallgrass Prairie Macrogroup (M054) containing Northern Tallgrass Prairie Group (G075), Central Tallgrass Prairie Group (G333), and Southern Tallgrass Prairie Group (G334). However, in Curtis (1959, pp. 568-571), the most closely related type to the oak openings was the oak barrens and vice versa.

The oak barrens physiognomy is complex. Black oak woodland variants may occur in this group, but because *Quercus velutina* and *Quercus ellipsoidalis* can sprout after stems have been killed by fires, stands generally have a somewhat scrubby structure that can vary from 5-60% cover over time. Some stands may occur on fairly mesic sands. Similar complex physiognomies are found in

Laurentian-Acadian Pine - Hardwood Forest & Woodland Macrogroup (M159), including Great Lakes Pine Barrens Group (G160) and Pitch Pine Barrens Group (G161).

Our concept of oak barrens includes the "Eastern Sand Savanna" and "Northern Sand Savanna - oak only" types of Will-Wolf and Stearns (1999), but we treat their "Northern Sand Savanna - oak-pine" with Great Lakes Pine Barrens Group (G160). Our approach follows that of Curtis (1959).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G650	Northeastern Oak - Hickory Forest & Woodland	
G649	North-Central Oak - Hickory Forest & Woodland	
G329	Great Plains Bur Oak Forest & Woodland	
G333	Central Tallgrass Prairie	
G075	Northern Tallgrass Prairie	
G334	Southern Tallgrass Prairie	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The deep-soil oak savanna is typified by scattered trees over a continuous tallgrass prairie layer, comprised of both forbs and grasses. Fire suppression in the region has allowed trees to establish more dense canopies. The sandy oak barrens is a scrubby, open-treed system dominated by graminoids and shrubs. Canopy structure varies from a dominant herbaceous ground layer with sparse, scattered "savanna" canopy (5-25% cover), through oak-dominated scrub, to a more closed woodland canopy (25-60%). Leach and Givnish (1999) found that, in southern Wisconsin, oak savannas are forb-dominated, except on the sandiest or sunniest microsites.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Ground layer composition of this group is strongly related to the changes in texture from sandy to silty sites (Leach and Givnish 1999). The silty loam, deeper-soil savanna is typified by scattered trees, varying from 10 to 30% cover over a more-or-less continuous tallgrass prairie layer. *Quercus macrocarpa* is a common tree throughout the range. Other associates include *Populus tremuloides* (northern portion of the range), *Quercus alba, Quercus bicolor*, and *Quercus stellata*. The dominant herbaceous species are the graminoids, though a gradient from graminoid to forb may occur in relation to increasing canopy cover, that include *Andropogon gerardii, Schizachyrium scoparium, Sorghastrum nutans, Sporobolus heterolepis*, and *Hesperostipa spartea (= Stipa spartea)*. A rich forb component includes *Amorpha canescens, Antennaria* spp., *Calamagrostis canadensis* (in moist stands), *Carex* spp., *Lespedeza capitata, Ratibida pinnata, Silphium laciniatum*, and *Zizia aurea*. The shrub layer can be absent to prominent. Where shrubs are present, *Corylus* spp. tend to be dominant, accompanied by species such as *Cornus foemina, Rosa* spp., *Rubus allegheniensis*, and *Symphoricarpos occidentalis* (in the west). In the open tree layer, *Quercus macrocarpa* is the most common tree species and can range from 10-60% cover. The main herb layer is dominated by tallgrass prairie species such as *Andropogon gerardii, Calamagrostis canadensis*, and *Schizachyrium scoparium*, along with numerous forb species. (Curtis 1959, Anderson and Bowles 1999, Leach and Givnish 1999)

In the sandy oak barrens, the canopy layer is dominated by *Quercus velutina*, with some *Quercus ellipsoidalis, Quercus macrocarpa*, and *Quercus alba* (the latter more common eastward and in woodland conditions). Occasional *Pinus banksiana* can occur in the northern parts of the range. In the southern part of the range in central Illinois, sand savannas may be dominated by *Quercus marilandica* and *Quercus velutina*, with *Carya texana*. Species found in the herb layer include *Ambrosia psilostachya, Amphicarpaea bracteata, Artemisia ludoviciana, Andropogon gerardii, Calamovilfa longifolia, Carex pensylvanica, Carex* spp., *Comandra umbellata, Sorghastrum nutans, Hesperostipa spartea*, and *Schizachyrium scoparium*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Oak savanna: Historically, frequent fires maintained this savanna within its range and would have restricted tree canopies to 10-30% cover. Fire suppression in the region has allowed trees to establish more dense canopies. Periodic, strong wind disturbances and browsing also impact this type. Much of this type has also been converted to agriculture, or succeeded to forests because of the lack of fire, greatly reducing its area and range. Oak barrens: Fire was an important factor in maintaining this community. Oak wilt and droughts also reduce tree cover (Curtis 1959, Will-Wolf and Stearns 1999).

ENVIRONMENT

Environmental Description: Oak savannas are typically found on rolling outwash plains, hills and ridges. Soils are typically moderately well- to well-drained deep loams. Oak barrens occur on well-drained, coarse-textured sandy soils derived from glacial outwash, end moraine formations, or lakeplain dune systems. Soils range from almost pure sand, to loamy sand, to sandy loam. The soils have low fertility, organic matter, and moisture-retention capacity. Factors which affect seasonal soil moisture are strongly related to variation in this type.

DISTRIBUTION

***Geographic Range:** The oak savanna is found throughout the northern glaciated regions of the Midwest. Its main concentration, where it was likely the matrix type, is within the prairie-forest border of Minnesota, Wisconsin, Iowa, and Illinois. Conversion to agriculture and fire suppression have significantly impacted its range. The oak barrens are found in the north-central U.S. from North Dakota to western New York and westernmost Pennsylvania (mostly historic there) and into Ontario, Canada.
Nations: CA, US
States/Provinces: IA, IL, IN, MI, MN, MO, ND, NY, OH, ON, PA, WI
USFS Ecoregions (2007) [optional]: 212Ha:CCP, 212Hb:CCC, 212K:CP, 212Q:CP, 222I:CC, 222Ja:CCC, 222Jb:CCC, 222Jc:CCC, 222Je:CCC, 222Jf:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222K:CC, 222L:CC, 222M:CC, 222N:CC, 222R:CC, 222Ua:CCC, 222Ud:CCC, 222Ue:CCC, 251A:CC, 251B:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: This group concept may be somewhat heterogeneous in that it combines oak barrens and oak savannas (oak openings) together.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A1492	*Quercus velutina - Quercus ellipsoidalis* Wooded Grassland Alliance
A3256	*Quercus macrocarpa - Quercus alba* Wooded Grassland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Oak Barrens	Curtis 1959	
<	Oak Openings	Curtis 1959	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.T. Curtis (1959)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** D. Faber-Langendoen
Acknowledgments [optional]: R. Anderson
Version Date: 05 May 2015

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G649. North-Central Oak - Hickory Forest & Woodland

Type Concept Sentence: Deciduous or rarely mixed conifer-deciduous forests and woodlands found largely in the glaciated midwestern United States where mesic to dry-mesic forests are dominated by *Quercus alba, Quercus rubra*, and *Quercus velutina*, often with *Carya* spp. present to codominant.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.4. Central Midwest Oak Forest, Woodland & Savanna (M012)

Elcode: G649
***Scientific Name:** North-Central Oak - Hickory Forest & Woodland Group
***Common (Translated Scientific) Name:** North-Central Oak - Hickory Forest & Woodland Group
***Colloquial Name:** North-Central Oak - Hickory Forest & Woodland

***Type Concept:** This group is found throughout the glaciated regions of the Midwest, typically in gently rolling landscapes. Historically, this type was quite extensive in the Midwest and parts of the Northeast. It is distinguished from other forested groups within the region by a dry-mesic to dry edaphic condition that is transitional between dry prairies, oak barrens, or savannas and mesic hardwood forests, such as maple-basswood forests. Forest cover can range from a dense to moderately open canopy of deciduous broadleaf trees (conifers do not exceed 25% cover except in one variant in the Driftless Area), and there is commonly a dense shrub layer. Fire-resistant oak species, in particular *Quercus alba, Quercus rubra*, and/or *Quercus velutina*, dominate the overstory. Hickories such as *Carya glabra, Carya ovata, Carya cordiformis*, and *Carya tomentosa* are characteristic associates.

Quercus macrocarpa and *Quercus ellipsoidalis* may be common in some stands. Fire suppression may account for the more closed oak forest examples with the more mesic understory. It has allowed for other associates, such as *Acer saccharum, Acer rubrum, Celtis occidentalis, Ostrya virginiana*, and *Fraxinus americana*, to become more prevalent, especially in upland areas along floodplains. It can occur on uplands within the prairie matrix and near floodplains, or on rolling glacial moraines, among kettle-kame topography, and outwash plains. Soils are typically well-drained to excessively drained Mollisols or Alfisols that range from loamy to sandy in texture. Local areas of calcareous bedrock, or colluvial pockets, may support forests typical of richer soils.

***Diagnostic Characteristics:** These forests contain a dominant canopy of broad-leaved deciduous trees, with conifers consistently less than 25% cover, except in the Driftless Area. *Quercus alba* and *Quercus velutina*, either singly or in combination, are at least 50% relative cover of the overstory, or these two species have at least 20% relative cover, and the following species, singly or in combination have at least 30% relative cover: the moderately diagnostic species *Quercus rubra*, or any of the weakly diagnostic species of *Carya glabra, Carya ovata*, and *Carya tomentosa*. Where conifers are common, they are *Pinus strobus, Pinus resinosa*, or, in an unusual type found on steep slopes in river valleys, *Juniperus virginiana*.

***Classification Comments:** Originally this group included some examples from the northern Coastal Plain. Those were removed and this group became restricted to mostly the glaciated portions of the midwestern United States and adjacent Canada.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G181	Central Midwest Oak Openings & Barrens	
G015	Appalachian Oak / Chestnut Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Tree canopy can range from open to closed (25-100%) and is usually 10-20 m tall. Deciduous trees dominate the canopy and most examples are nearly 100% deciduous. Shrub cover varies but is often moderate to dense with the shrubs typically 1-4 m tall. Herbaceous cover also varies, often inversely with the total woody canopy cover.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Forest cover can range from a dense to moderately open canopy of deciduous broadleaf trees (conifers rarely exceed 25% cover), and there is commonly a dense shrub layer. Fire-resistant oak species, in particular *Quercus alba, Quercus rubra*, and/or *Quercus velutina*, dominate the overstory. Hickories such as *Carya glabra, Carya ovata, Carya cordiformis*, and *Carya tomentosa (= Carya alba)* are characteristic associates. *Quercus macrocarpa* and *Quercus ellipsoidalis* may be common. Fire suppression may account for the more closed oak forest examples with the more mesic understory. It likely has allowed for other associates, such as *Acer saccharum, Acer rubrum, Celtis occidentalis, Ostrya virginiana*, and *Fraxinus americana*, to become more prevalent, especially in upland areas along floodplains. Common native shrubs include *Corylus americana, Corylus cornuta, Cornus alternifolia, Cornus foemina, Hamamelis virginiana, Sassafras albidum, Viburnum acerifolium*, and *Zanthoxylum americanum*. The exotic shrubs *Rhamnus cathartica* and *Lonicera* spp. (*Lonicera x bella, Lonicera japonica, Lonicera morrowii, Lonicera tatarica*) can be very abundant in this group, and other exotic shrubs are often found near urban areas, including *Berberis thunbergii* and sometimes *Rosa multiflora* in the eastern portion of the group's range. A wide variety of herbaceous species can be common in examples of this group across its range, from prairie forbs and grasses (though these are rarely dominant) to forest herbs, sometimes including exotic or native invasive species. *Carex pensylvanica* is commonly present and can be dominant. Other species include *Amphicarpaea bracteata, Arisaema triphyllum, Circaea lutetiana, Desmodium* spp., *Maianthemum racemosum, Maianthemum stellatum*, and *Podophyllum peltatum*. Vines are common, especially *Parthenocissus quinquefolia, Toxicodendron radicans*, and *Vitis* spp.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Fire combined with drought was an important natural process in this group, often occurring as surface fires. Fire suppression may account for the more closed oak forest examples with the more mesic understory. It has allowed for other associates, such as *Acer saccharum, Acer rubrum, Celtis occidentalis, Ostrya virginiana*, and *Fraxinus americana*, to become more prevalent, especially in upland areas along floodplains. A lack of fire, especially in more open-canopied examples of this group, allows the proliferation of invasive understory species. The exotic shrubs *Rhamnus cathartica* and *Lonicera* spp. can be abundant in this group, particularly stands that have or had moderately open tree canopies.

ENVIRONMENT

Environmental Description: This group is found in glaciated regions of the Midwest, typically in gently rolling landscapes. It can occur on uplands within a tallgrass prairie matrix and near floodplains, or on rolling glacial moraines, among kettle-kame topography, and outwash plains. Soils are typically well-drained to excessively drained Mollisols or Alfisols that range from loamy to sandy in texture. A variant of this group, confined to the Driftless Area of southeastern Minnesota, southwestern Wisconsin, northeastern Iowa, and northwestern Illinois, occurs in an area not covered by the Wisconsin-age glaciers and sites there are often on steep slopes, sometimes with thin soil over bedrock. Local areas of calcareous bedrock or colluvial pockets may support forests typical of richer soils. Historically, this type was quite extensive in the Midwest. It is distinguished from other forested groups within the region by a dry-mesic to dry edaphic condition that is transitional between dry prairies, oak barrens, or savannas and mesic hardwood forests, such as maple-basswood forests.

DISTRIBUTION

***Geographic Range:** This group is found throughout the glaciated regions of the Midwest to southern Ontario, eastern Ohio, and possibly western West Virginia, and west into eastern Nebraska, Kansas, and Oklahoma. It does not extend to the Ozarks.
Nations: CA, US
States/Provinces: IA, IL, IN, KS, MI, MN, MO, NE, NY, OH, OK, ON, PA, QC, WI
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3326	*Quercus velutina - Quercus alba* North-Central Forest Alliance
A3323	*Quercus alba - Quercus rubra - Carya* spp. North-Central Forest Alliance
A3324	*Quercus alba - Quercus macrocarpa - Quercus bicolor* Woodland Alliance
A3237	*Pinus strobus - Quercus* spp. Driftless Forest & Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-07-23	G158 Quercus alba - Quercus rubra - Quercus velutina - Carya glabra Forest Group	G158 split into G649 & G650

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Black Oak: 110	Eyre 1980	Apart from its extension into the Ozarks, the concept of this cover is

Relationship to NVC	Supporting Concept Name	Short Citation	Note
			quite similar to the group concept.
<	Northern Red Oak: 55	Eyre 1980	The concept of this cover type is quite similar to the group concept, though the montane portions are excluded.
<	White Oak - Black Oak - Northern Red Oak: 52	Eyre 1980	The concept of this cover type is quite similar to the group concept.
>	White Oak: 53	Eyre 1980	The concept of this cover type is more broad, especially southward, than the group concept.

AUTHORSHIP

***Primary Concept Source [if applicable]:** F. H. Eyre (1980)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.E. Menard and J. Drake

Acknowledgments [optional]:

Version Date: 05 May 2015

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

M882. Central Midwest Mesic Forest

Type Concept Sentence: These hardwood forests are dominated by a mixture of *Acer saccharum, Fagus grandifolia, Quercus rubra*, and *Tilia americana* found on rich, mesic sites in the central hardwood region of the Midwest from Ohio to the Ozark/Ouachita regions and west into the eastern Great Plains.

OVERVIEW

***Hierarchy Level:** Macrogroup

***Placement in Hierarchy:** 1.B.2.Na.5. Eastern North American Forest & Woodland (D008)

Elcode: M882

***Scientific Name:** Central Midwest Mesic Forest Macrogroup
***Common (Translated Scientific) Name:** Central Midwest Mesic Forest Macrogroup
***Colloquial Name:** Central Midwest Mesic Forest

***Type Concept:** This macrogroup comprises forests characterized by a mostly closed canopy dominated a mixture of *Acer saccharum, Fagus grandifolia, Quercus rubra*, and *Tilia americana* (or in some cases *Acer floridanum* or *Acer nigrum*). Other common species include *Aesculus glabra, Carya cordiformis, Carya ovata, Celtis* spp., *Fraxinus americana, Juglans nigra, Quercus alba, Quercus muehlenbergii*, and *Ulmus rubra*. It occurs in the central hardwood region of the Midwest from western Ohio to the eastern Great Plains, and south into the Ozarks and Ouachitas on mesic, rich soils formed from glacial till or loess parent material. Examples in the Ozark region are often from base-rich substrates such as limestones and dolomites. Small-gap development and replacement due to wind or tree death are the most common natural dynamics. However, conversion to agriculture, logging, browsing, and grazing have greatly impacted this macrogroup. Once common in many areas, very few large stands remain intact across its range.

***Diagnostic Characteristics:** Mostly closed-canopy hardwood forests dominated by *Acer saccharum* and found within the central United States and Canada on mesic, rich soils.

***Classification Comments:** This macrogroup was originally part of Central Mesophytic Hardwood Forest Macrogroup (M153) which was split into this macrogroup (M882) and Appalachian-Interior-Northeastern Mesic Forest Macrogroup (M883).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M008	Southern Mesic Mixed Broadleaf Forest	
M883	Appalachian-Interior-Northeastern Mesic Forest	
M016	Southern & South-Central Oak - Pine Forest & Woodland	
M502	Appalachian-Northeastern Oak - Hardwood - Pine Forest & Woodland	
M012	Central Midwest Oak Forest, Woodland & Savanna	
M014	Laurentian-Acadian Mesic Hardwood - Conifer Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This macrogroup is composed of broad-leaved deciduous trees forming a closed canopy. Stands are diverse and productive. Understory trees are common with a variable shrub layer and a rich, diverse herbaceous layer.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Canopies are characterized by any mixture of *Acer saccharum, Fagus grandifolia, Quercus rubra*, and *Tilia americana* (or in some cases *Acer floridanum (= Acer barbatum)* or *Acer nigrum*). Associates include *Aesculus glabra, Carpinus caroliniana, Carya cordiformis, Carya ovata, Celtis* spp., *Fraxinus americana, Ostrya virginiana, Prunus serotina, Quercus alba, Quercus muehlenbergii*, and *Ulmus rubra*. *Acer saccharum* tends to be a dominant canopy species, although the dominance of *Acer saccharum* compared to other species can vary across the range of this macrogroup based on regional climate and microclimate. Shrubs and woody vines vary greatly with location but may include *Asimina triloba, Frangula caroliniana, Hamamelis virginiana, Hydrangea arborescens, Lindera benzoin, Symphoricarpos orbiculatus, Viburnum rufidulum*, and *Vitis aestivalis*. Understory herbaceous species are diverse and rich. Some typical species include *Actaea* spp., *Adiantum pedatum, Allium* spp., *Amphicarpaea bracteata, Anemone quinquefolia, Aplectrum hyemale, Aralia racemosa, Arisaema triphyllum, Asimina triloba, Aristolochia serpentaria, Asarum canadense, Brachyelytrum erectum, Cardamine concatenata, Caulophyllum* spp., *Chasmanthium latifolium, Circaea lutetiana ssp. canadensis, Collinsonia canadensis, Hepatica nobilis var. acuta, Iris cristata, Osmorhiza claytonii, Panax quinquefolius, Phryma leptostachya, Podophyllum peltatum, Polygonum virginianum, Polygonatum* spp., *Sanguinaria canadensis, Sanicula* spp., *Tiarella cordifolia, Trillium grandiflorum, Uvularia grandiflora*, and *Viola* spp.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: This macrogroup primarily naturally contains stable, uneven-aged forests, with canopy dynamics dominated by small-gap development and replacement due to tree death. Wind, ice events, and fire can impact this macrogroup over long return intervals and may disturb larger patches. The greatest impacts on this macrogroup are due to conversion to agriculture, logging, browsing, and grazing.

ENVIRONMENT

Environmental Description: This macrogroup occurs in various landscape settings, often on rolling uplands and valley slopes, typically with a northern or eastern aspect. It also can occur within bottoms, ravines and sinkhole basins. Soils are high-nutrient, rich loams, ranging from shallow to deep. In examples in the Ozark/Ouachita region, substrate is typically limestone or dolomite. Thick layers of humus and leaf litter can occur.

DISTRIBUTION

***Geographic Range:** This macrogroup ranges across the north temperate region of eastern North America from western Ohio to Minnesota and the Great Lakes south through the Ozarks and Ouachitas of Missouri, Arkansas and Oklahoma, and eastern Kansas and Nebraska.
Nations: CA, US
States/Provinces: AR, IA, IL, IN, KS, MI, MN, MO, NE, OH, OK, ON, QC, WI
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G791	Ozark-Ouachita Mesic Forest
G021	North-Central Beech - Maple - Basswood Forest

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-12-05	M153 Acer saccharum - Tilia americana - Fagus grandifolia Forest Macrogroup	M153 split into M882 & M883

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.E. Menard
Acknowledgments [optional]:
Version Date: 04 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G791. Ozark-Ouachita Mesic Forest

Type Concept Sentence: These diverse mesic forests are found in the Ozarks and Ouachitas. Examples contain a variable mixture of *Acer saccharum* (possibly *Acer floridanum* or *Acer nigrum*), *Aesculus glabra, Carya cordiformis, Carya ovata, Celtis* spp., *Fraxinus americana, Juglans nigra, Quercus alba, Quercus muehlenbergii, Quercus rubra, Tilia americana*, and *Ulmus rubra*. In this region, *Liriodendron tulipifera* is absent and *Fagus grandifolia* is rare.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.5. Central Midwest Mesic Forest (M882)

Elcode: G791
***Scientific Name:** *Acer saccharum - Carya cordiformis - Fraxinus americana* Forest Group
***Common (Translated Scientific) Name:** Sugar Maple - Bitternut Hickory - White Ash Forest Group
***Colloquial Name:** Ozark-Ouachita Mesic Forest

***Type Concept:** This Ozark-Ouachita mesic forest is dominated by a variable mixture of *Acer saccharum* (or possibly *Acer floridanum* or *Acer nigrum*), *Aesculus glabra, Carya cordiformis, Carya ovata, Celtis* spp., *Fraxinus americana, Juglans nigra, Quercus alba, Quercus muehlenbergii, Quercus rubra, Tilia americana*, and *Ulmus rubra*. Shrubs vary greatly with location but may include *Asimina triloba, Lindera benzoin*, and *Symphoricarpos orbiculatus*. This group includes forests of base-rich substrates (including soils derived from limestones and dolomites) found in the Ozarks and Ouachitas of the south-central United States. In this region, *Liriodendron tulipifera* is absent and *Fagus grandifolia* is rare.

***Diagnostic Characteristics:** This group is primarily defined on regional criteria, with the floristic corollary that *Liriodendron tulipifera* is absent and *Fagus grandifolia* is rare in this region (Beck 1990, Tubbs and Houston 1990) and therefore in the attributed stands. The absence of *Liriodendron tulipifera* and the presence of *Acer saccharum* (or in some cases either *Acer floridanum* or *Acer nigrum*), *Carya cordiformis*, and *Fraxinus americana* should be at least somewhat diagnostic.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G020	Appalachian-Central Interior Mesic Forest	
G021	North-Central Beech - Maple - Basswood Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group primarily naturally contains stable, uneven-aged forests, with canopy dynamics dominated by gap-phase regeneration on a fine scale. Occasional extreme wind or ice events may disturb larger patches. Natural fire dynamics are not well-known and fire probably only occurred in years that were extremely dry. Fires may have occurred at moderate frequency but were probably usually low enough in intensity to have only limited effects. Most of the component species are among the less fire-tolerant in the region. Stands are dominated by broad-leaved deciduous trees forming a closed canopy, and are diverse and productive. Understory trees are common, and the shrub layer is of variable structure. The herbaceous layer is generally lush, composed of leafy forbs.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Stands are dominated by a variable mixture of *Acer saccharum* (or in some cases *Acer floridanum (= Acer barbatum)* or *Acer nigrum*), *Aesculus glabra, Carya cordiformis, Carya ovata, Celtis* spp., *Fraxinus americana, Juglans nigra, Quercus alba, Quercus muehlenbergii, Quercus rubra, Tilia americana*, and *Ulmus rubra*. The subcanopy may include *Acer floridanum* or *Acer saccharum, Aesculus glabra, Asimina triloba, Euonymus americanus, Euonymus atropurpureus, Frangula caroliniana, Hydrangea arborescens, Ilex decidua, Lindera benzoin, Menispermum canadense*, and *Ostrya virginiana*. Shrubs and woody vines vary greatly with location but may include *Asimina triloba, Frangula caroliniana, Hamamelis virginiana, Hydrangea arborescens, Lindera benzoin, Symphoricarpos orbiculatus, Viburnum rufidulum*, and *Vitis aestivalis*. Characteristic herbs include *Actaea racemosa (= Cimicifuga racemosa), Amphicarpaea bracteata, Aplectrum hyemale, Aralia racemosa, Aristolochia serpentaria, Asarum canadense, Brachyelytrum erectum, Cardamine concatenata, Chasmanthium latifolium, Circaea lutetiana ssp. canadensis, Collinsonia canadensis, Cynoglossum virginianum, Desmodium nudiflorum, Dioscorea quaternata, Hepatica nobilis var. obtusa, Hybanthus concolor, Hydrastis canadensis, Iris cristata, Panax quinquefolius, Phryma leptostachya, Podophyllum peltatum, Polygonum virginianum, Sanguinaria canadensis, Solidago flexicaulis, Stylophorum diphyllum*, and *Uvularia grandiflora*. Numerous ferns may be found as well, including *Adiantum pedatum, Asplenium platyneuron, Dennstaedtia punctilobula, Deparia acrostichoides (= Athyrium thelypterioides), Diplazium pycnocarpon (= Athyrium pycnocarpon), Phegopteris hexagonoptera*, and *Polystichum acrostichoides*. Examples of this group are found in areas where *Liriodendron tulipifera* is absent and *Fagus grandifolia* is rare.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: This group primarily naturally contains stable, uneven-aged forests, with canopy dynamics dominated by gap-phase regeneration on a fine scale. Occasional extreme wind or ice events may disturb larger patches. Natural fire dynamics are not well-known and fire probably only occurred in years that were extremely dry. Fires may have occurred at moderate frequency but were probably usually low enough in intensity to have only limited effects. Most of the component species are among the less fire-tolerant in the region.

ENVIRONMENT

Environmental Description: Stands occur on gentle to moderately steep lower slopes in ravines, valleys, bases of bluffs, and sinkhole basins, generally with northern or eastern aspects. The soils are moderately well-drained and shallow to deep. The substrate is various types of bedrock (and colluvium derived from the bedrock), typically limestone or dolomite, but may also include sandstone material.

DISTRIBUTION

***Geographic Range:** This group is found in the Ozarks and Ouachitas of Arkansas, Missouri, and Oklahoma (and possibly Kansas). In this region, *Liriodendron tulipifera* is absent and *Fagus grandifolia* is rare (Beck 1990, Tubbs and Houston 1990).
Nations: US
States/Provinces: AR, KS?, MO, OK
USFS Ecoregions (2007) [optional]: 223A:CC, 231G:CC, M223A:CC, M231A:CC
Omernik Ecoregions L3, L4 [optional]: 8.4.5.39a:C, 8.4.5.39b:C, 8.4.5.39c:C, 8.4.5.39d:C, 8.4.5.39e:C, 8.4.5.39f:C, 8.4.5.39g:C, 8.4.5.39h:C, 8.4.5.39i:C, 8.4.5.39j:C, 8.4.5.39k:C, 8.4.6.38a:C, 8.4.6.38b:C, 8.4.7.37a:C, 8.4.7.37b:C, 8.4.7.37c:C, 8.4.7.37d:C, 8.4.8.36a:C, 8.4.8.36b:C, 8.4.8.36c:C, 8.4.8.36d:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3260	*Acer saccharum - Carya cordiformis - Fraxinus americana* Ozark-Ouachita Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Beech-Maple Cove Forest	Arkansas Department of Planning 1974	

AUTHORSHIP

***Primary Concept Source [if applicable]:** Arkansas Department of Planning (1974)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne

Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by T. Foti and D. Zollner.

Version Date: 04 May 2015

REFERENCES

***References [Required if used in text]:**

Arkansas Department of Planning. 1974. Arkansas natural area plan. State of Arkansas, Department of Planning, Little Rock. 248 pp.

Beck, D. E. 1990. Liriodendron tulipifera L. Yellow-poplar. Pages 406-416 in: R. M. Burns and B. H. Honkala, technical coordinators. Silvics of North America: Volume 2. Hardwoods. USDA Forest Service. Agriculture Handbook 654. Washington, DC.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Tubbs, C. H., and D. R. Houston. 1990. Fagus grandifolia Ehrh. American beech. Pages 325-332 in: R. M. Burns and B. H. Honkala, technical coordinators. Silvics of North America: Volume 2. Hardwoods. USDA Forest Service. Agriculture Handbook 654. Washington, DC.

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1. Forest & Woodland

1.B.2.Na. Eastern North American Forest & Woodland

G021. North-Central Beech - Maple - Basswood Forest

Type Concept Sentence: Stands occur throughout the central United States, reaching into southern Canada, on mesic, rich loam soils and are dominated by hardwood species with rich and diverse understories. *Acer saccharum, Fagus grandifolia, Quercus rubra*, and *Tilia americana* are the most common canopy species. Due to conversion to agriculture, logging, browsing and grazing, the range of this group has significantly decreased and very few large stands remain.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Na.5. Central Midwest Mesic Forest (M882)

Elcode: G021
***Scientific Name:** *Fagus grandifolia - Acer saccharum - Quercus* spp. Forest Group
***Common (Translated Scientific) Name:** American Beech - Sugar Maple - Oak species Forest Group
***Colloquial Name:** North-Central Beech - Maple - Basswood Forest

***Type Concept:** This group covers forests with dense canopies primarily dominated by *Acer saccharum*. *Fagus grandifolia* and *Tilia americana* often can codominate to dominate the canopy. *Quercus rubra* and *Ostrya virginiana* are common associates. Understories are rich with diverse herbaceous and shrub species. This group typically occurs on mesic, rich loam soils formed from glacial till or loess parent material. Examples of this group are found throughout the Midwest and southern Ontario ranging from eastern Kansas to northern Minnesota and east to central Ohio and St. Lawrence Lowlands in southern tip of Quebec. The primary natural dynamic affecting this group includes small gap development and replacement due to wind or tree death. However, the greatest impacts on this group are due to conversion to agriculture, logging, browsing, and grazing. Once common in many areas, very few large stands of this group remain intact across its range.

***Diagnostic Characteristics:** Mostly closed-canopy forests dominated by *Acer saccharum* with *Fagus grandifolia* and *Tilia americana* as likely codominants. Stands have rich, diverse understories and typically occur on mesic, rich loam soils.

***Classification Comments:** This group encompasses the beech-maple and maple-basswood forests of the Midwest. It includes Daubenmire's (1936) "Big Woods." Boundaries between this group and Laurentian-Acadian Hardwood Forest Group (G743) in the Midwest need to be clarified. Additional data from southern Ontario and Quebec are needed to better describe occurrences within that portion of the range of this group.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G791	Ozark-Ouachita Mesic Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Mostly closed-canopy forests with rich understory shrub and herb layers.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Canopies are characterized by any mixture of *Fagus grandifolia, Acer saccharum, Tilia americana*, and *Quercus rubra*. Associates include *Ostrya virginiana, Fraxinus americana, Carya cordiformis, Carpinus caroliniana, Acer nigrum*, and *Prunus serotina*. *Acer saccharum* tends to be the dominant canopy species, although the dominance of *Acer saccharum* compared to other species can vary across the range of this group based on regional climate and microclimate. *Fagus grandifolia* can dominate the canopy or codominate with *Acer saccharum* in parts of the range, especially across Ohio, southern Ontario, and southern Michigan. Understory herbaceous species and shrubs are diverse and rich. Typical species include *Anemone quinquefolia, Adiantum pedatum, Arisaema triphyllum, Osmorhiza claytonii, Polygonatum biflorum, Sanicula* spp., *Asarum canadense, Actaea pachypoda, Caulophyllum, Allium* spp., *Viola* spp., *Hepatica nobilis var. acuta, Sanguinaria canadensis, Polygonatum pubescens, Tiarella cordifolia*, and *Trillium grandiflorum*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Wind and fire can impact this group over long return intervals. Small-gap development and replacement due to tree death is more frequent than more catastrophic fire or wind. The greatest impacts on this group are due to conversion to agriculture, logging, browsing, and grazing.

ENVIRONMENT

Environmental Description: Mesic-moist to dry-mesic sites in various landscape settings, often on rolling uplands, valley slopes, and bottoms. These forests tend to occur north of the glacial boundary. Stands typically occur on high-nutrient, rich loam soils formed from glacial till or loess. Soils are generally well-drained with a mesic-moist to dry-mesic moisture regime. Thick layers of humus and leaf litter can occur.

DISTRIBUTION

***Geographic Range:** Across the north temperate region of eastern North America from Minnesota and the Great Lakes south through central Missouri and eastern Kansas and Nebraska and east across southern Canada to central Ohio.
Nations: CA, US
States/Provinces: IA, IL, IN, KS, MI, MN, MO, NE, OH, ON, QC, WI
USFS Ecoregions (2007) [optional]: 212Q:CC, 212Z:CP, 222H:CP, 222J:CC, 222K:CC, 222L:CC, 222M:CC, 222R:CC, 222U:CC, 251B:CC, 251D:CC, 251H:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0220	*Acer saccharum - Tilia americana - Quercus rubra* Forest Alliance
A3226	*Acer saccharum - Fagus grandifolia* Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** E.L. Braun (1950)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard
Acknowledgments [optional]: S. Franklin
Version Date: 04 May 2015

REFERENCES

***References [Required if used in text]:**

Barbour, M. G., and W. D. Billings, editors. 1988. North American terrestrial vegetation. Cambridge University Press, New York. 434 pp.

Braun, E. L. 1950. Deciduous forests of eastern North America. Hafner Press, New York. 596 pp.

Comer, P. J., D. A. Albert, H. A. Wells, B. L. Hart, J. B. Raab, D. L. Price, D. M. Kashian, R. A. Corner, and D. W. Schuen. 1995a. Michigan's native landscape, as interpreted from the General Land Office Surveys 1816-1856. Michigan Natural Features Inventory, Lansing, MI. 78 pp. plus digital map.

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Daubenmire, R. F. 1936. The "Big Woods" of Minnesota: Its structure and relation to climate, fire, and soils. Ecological Monographs 6(2):233-268.

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Gilliam, F. S., and M. R. Roberts, editors. 2003. The herbaceous layer in forests of Eastern North America. Oxford University Press, Inc., New York, NY.

Kost, M. A., D. A. Albert, J. G. Cohen, B. S. Slaughter, R. K. Schillo, C. R. Weber, and K. A. Chapman. 2007. Natural communities of Michigan: Classification and description. Report No. 2007-21, Michigan Natural Features Inventory, Lansing. 314 pp. [http://web4.msue.msu.edu/mnfi/reports/2007-21_Natural_Communites_of_Michigan_Classification_and_Description.pdf]

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

M159. Laurentian-Acadian Pine - Hardwood Forest & Woodland

Type Concept Sentence: These Laurentian-Acadian pine-oak forests have closed to open canopies dominated by pines (*Pinus banksiana, Pinus resinosa, Pinus strobus*) with a mix of oak species (*Quercus ellipsoidalis, Quercus rubra*) and other hardwoods, over an often heathy shrub layer. Sites typically occur on sandplains, outwash habitats, and coarse glacial deposits of sandy or loamy soils with dry to dry-mesic moisture conditions and occasional to frequent fires.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.2.Na.6. Eastern North American Forest & Woodland (D008)

Elcode: M159
***Scientific Name:** *Pinus strobus - Pinus banksiana - Quercus ellipsoidalis* Forest & Woodland Macrogroup
***Common (Translated Scientific) Name:** Eastern White Pine - Jack Pine - Northern Pin Oak Forest & Woodland Macrogroup
***Colloquial Name:** Laurentian-Acadian Pine - Hardwood Forest & Woodland

***Type Concept:** Stands of this Laurentian-Acadian macrogroup consist of a pine or oak overstory forming an open, patchy or continuous canopy with a variable understory. A combination of *Pinus strobus, Pinus banksiana, Pinus resinosa*, and (less commonly) *Picea mariana* are typical diagnostic overstory species. Common associates include the oaks *Quercus ellipsoidalis* and *Quercus rubra* along with a mix of other hardwoods, such as *Acer rubrum, Betula papyrifera, Populus grandidentata, Populus tremuloides, Thuja occidentalis*, and, less commonly, *Juniperus virginiana* which may dominate some examples on limestone habitats. The richness of the herbaceous layer is variable, but is typically moderately poor in closed-canopy stands and poor to rich in open stands. Stands may have a dominant cover of feathermosses and lichens. *Corylus cornuta* and *Corylus americana* are common tall shrubs; common low shrubs include *Vaccinium angustifolium* and *Vaccinium myrtilloides*. This macrogroup occurs from western Minnesota to the northern and western Great Lakes region, and into the northeastern United States, and possibly southeastern Canada. It occurs primarily on sandplains, outwash habitats, and coarse glacial deposits of sandy or loamy soils. Some examples occur on thin-soil limestone habitats such as bluffs adjacent to lakes, cliffs or talus and colluvial slopes. Fire is an important disturbance. Logging and forest management impact this macrogroup across its range.

***Diagnostic Characteristics:** Open to closed (10 to >80%) canopy cover typical of forests and pine barrens in the northern Midwest and Northeast U.S. (and possibly southeastern Canada), and dominated by pine species, in particular *Pinus strobus, Pinus banksiana* (mostly in the Great Lakes), *Pinus resinosa*, and (less commonly) *Picea mariana*. Hardwoods such as *Populus tremuloides, Quercus ellipsoidalis*, and *Quercus rubra* are common associates. Shrub layer often contains a heath component. *Thuja occidentalis, Pinus banksiana*, and *Larix laricina* are diagnostic in limestone woodlands.

***Classification Comments:** Overall composition of the macrogroup now includes all dry and dry-mesic pine-oak forests to open woodlands throughout the Laurentian-Acadian region, but it is unclear whether this macrogroup occurs in Canada; or, if so, whether it will be recognized as a distinct macrogroup, as the CNVC could treat these as edaphic expressions within Laurentian-Acadian Mesic Hardwood - Conifer Forest Macrogroup (M014). Two "subboreal" groups (G347 and G047, respectively) occur in this macrogroup; they have sufficient temperate influence to separate them from the core boreal forest types.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M014	Laurentian-Acadian Mesic Hardwood - Conifer Forest	occurs on more mesic soils and is dominated by conifers such as *Abies balsamea, Picea* spp., and *Tsuga canadensis* and mesic hardwood species such as *Acer saccharum* and *Betula alleghaniensis*.
M012	Central Midwest Oak Forest, Woodland & Savanna	
M495	Eastern North American Boreal Forest	represents the main boreal forest that occurs to the north of this macrogroup in Canada.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These sites range from closed-canopy conifer or conifer-hardwood forests to open woodlands and barrens ranging from >80% cover to as little as 10% cover. Shrub, herb, and nonvascular plants vary in cover but are limited by needle condition, dry conditions, and exposed bedrock. Fire suppression can lead to increased cover in barrens and woodland sites.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Pinus strobus* and *Pinus resinosa* are diagnostic overstory species. In the northwestern Great Lakes portion of the range, *Pinus banksiana* and *Picea mariana* can be dominant in dry forest and woodland sites. In dry-mesic northern forests, *Picea mariana, Picea glauca, Picea rubens*, and/or *Abies balsamea* can occur in the canopy. *Quercus rubra* or *Quercus ellipsoidalis* are common oak hardwood associates. Early-successional hardwoods such as *Acer rubrum, Betula papyrifera, Populus grandidentata*, and *Populus tremuloides* are often present and may codominate with the conifers and oaks in some stands. In limestone woodlands, the most abundant trees are *Thuja occidentalis* and *Pinus banksiana* with *Larix laricina* as a common associate. The understory ranges from moderate cover to extremely poor. Common tall shrubs include *Amelanchier* spp. and *Corylus cornuta*. Dwarf-shrubs can be very common, especially where gaps in the canopy occur in more closed-canopy examples and within barrens and woodland sites. Common species include ericaceous species such as *Gaultheria procumbens, Vaccinium angustifolium*, and *Vaccinium myrtilloides*. Less commonly *Dasiphora fruticosa ssp. floribunda* and *Juniperus horizontalis* occur on enriched sites. In closed-canopy sites with a moderate herb layer, common species include *Aralia nudicaulis, Chimaphila umbellata, Cornus canadensis, Epigaea repens, Eurybia macrophylla, Maianthemum canadense, Oryzopsis asperifolia, Pteridium aquilinum*, and *Trientalis borealis*. The predominant moss species are *Dicranum* spp. and *Pleurozium schreberi*. Characteristic herbs in Great Lakes barrens are dominated by grasses and sedges, including *Andropogon gerardii, Apocynum androsaemifolium, Carex pensylvanica*, and *Schizachyrium scoparium*. Grasses and sedges such as *Carex eburnea, Carex richardsonii, Carex scirpoidea, Clinopodium arkansanum, Schizachyrium scoparium*, and *Sporobolus heterolepis* also dominate the herbaceous layer in limestone woodlands.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Fire is an important natural disturbance, including occasional catastrophic and crown fires, which allow the regeneration of pines on these sites. A combination of surface fires every 20-30 years and severe crown fires every 100-150 years maintained presettlement *Pinus* spp. communities (Heinselman 1973, Whitney 1986, Frelich 1992). Logging and subsequent fires are also predominant in some examples of this type and may result in open bracken grasslands (Curtis 1959).

ENVIRONMENT

Environmental Description: This macrogroup occurs in a cool north temperate to sub-boreal climate on glaciated landscapes such as outwash plains, glacial lakeplains and river terraces. Substrates include sand and gravel deposits on flats, such as outwash sands, delta sands, eskers, kames, kame terraces, and dry lake sands. Sites occur on dry to dry-mesic thin to deep mineral soils ranging from dry sands to dry-mesic loams. Some sites can occur on rocky or bedrock soils (Curtis 1959).

DISTRIBUTION

***Geographic Range:** This macrogroup is found within the northern temperate (Laurentian-Acadian) areas of the U.S. and Canada. It ranges from western Minnesota into the northeastern United States and south-central and southeastern Canada. The more sub-boreal examples extend into northeastern Minnesota and northern New England, and may occur into southeastern Canada.
Nations: CA, US
States/Provinces: CT, DE, MA, MB?, MD, ME, MI, MN, NH, NJ, NS?, NY, OH, ON?, PA, QC?, RI, VT, WI
USFS Ecoregions (2007) [optional]: 211A:CP, 211B:CC, 211C:CC, 211D:CC, 211E:CC, 211J:CP, 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212Jb:CCC, 212Jc:CCC, 212Jo:CCC, 212Ka:CCC, 212Kb:CCC, 212La:CCC, 212Lb:CCC, 212Lc:CCC, 212Ld:CCC, 212Le:CCC, 212Ma:CCC, 212Mb:CCC, 212Na:CCC, 212Nb:CCC, 212Nc:CCC, 212Nd:CCC, 212Qa:CCC, 212Qb:CCC, 212Qc:CCC, 212Qd:CCC, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC, 212Sb:CCC, 212Sc:CCC, 212Sn:CCC, 212Sq:CCC, 212Ta:CCC, 212Tb:CCC, 212Tc:CCC, 212Te:CCC, 212Tf:CCC, 212Xa:CCC, 212Xb:CCC, 212Xc:CCC, 212Xd:CCC, 212Xe:CCC, 212Xf:CCC, 212Ya:CCC, 212Za:CCC, 212Zb:CCC, 212Zc:CCC, 221Ai:CCC, 221Al:CCC, 222I:CP, 222Ja:CCC, 222Jb:CCC, 222R:CC, 222Ud:CCC, 222Ue:CCC, M211A:CC, M211Bd:CCC, M211C:CP, M211D:CP
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G025	Laurentian-Acadian Pine - Oak Forest & Woodland
G347	Laurentian Subboreal Dry Jack Pine - Red Pine - Oak Woodland
G047	Laurentian Subboreal Dry-Mesic Pine - Black Spruce - Hardwood Forest
G160	Great Lakes Pine Barrens
G655	Laurentian-Acadian Limestone Woodland

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Northern dry forest	Curtis 1959	
<	Northern dry-mesic forest	Curtis 1959	
=	Northern forest - xeric	Curtis 1959	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.T. Curtis (1959)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard, S. Gawler, and D. Faber-Langendoen

Acknowledgments [optional]:

Version Date: 21 May 2015

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G025. Laurentian-Acadian Pine - Oak Forest & Woodland

Type Concept Sentence: This conifer - hardwood woodland is found across the northern Great Lakes and east to northern New England and Quebec, Canada. It is dominated by a combination of *Pinus strobus, Pinus banksiana*, and *Pinus resinosa* with northern hardwood species such as *Acer* spp., *Populus* spp., and *Quercus* spp. occurring as canopy associates or forming a subcanopy. Sites typically occur on coarse glacial deposits of sandy or loamy soils.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.6. Laurentian-Acadian Pine - Hardwood Forest & Woodland (M159)

Elcode: G025
***Scientific Name:** *Pinus strobus - Pinus banksiana - Quercus rubra* Forest & Woodland Group
***Common (Translated Scientific) Name:** Eastern White Pine - Jack Pine - Northern Red Oak Forest & Woodland Group
***Colloquial Name:** Laurentian-Acadian Pine - Oak Forest & Woodland

***Type Concept:** These dry-mesic to xeric pine forests are found across the northern Great Lakes and east to northern New England and Quebec. Typical occurrences are on coarse glacial deposits of sandy or loamy soils. Fire is an important natural disturbance. Stands are characterized by a pine overstory forming a patchy or continuous canopy, and a variable understory. A combination of *Pinus strobus, Pinus banksiana* (mostly in the Great Lakes region), and *Pinus resinosa* typically are the diagnostic overstory species. Hardwoods such as *Acer rubrum, Betula papyrifera, Populus grandidentata, Populus tremuloides, Quercus ellipsoidalis* (in the Great Lakes region), and *Quercus rubra* sometimes form a subcanopy; or *Quercus rubra* in particular may occasionally be an important canopy associate. The understory ranges from moderately herb- and shrub-rich to extremely poor. In the tall-shrub layer, the important species are *Amelanchier* spp. and *Corylus cornuta*. In the low-shrub layer, *Vaccinium angustifolium, Vaccinium myrtilloides, Diervilla lonicera, Gaultheria procumbens*, and *Linnaea borealis* are locally important. The herbaceous layer is variable, sometimes poorly developed and with more prominent cover of feathermosses and lichens, in other cases with an open herb layer, including *Aralia nudicaulis, Clintonia borealis, Cornus canadensis, Eurybia macrophylla, Maianthemum canadense, Pteridium aquilinum, Oryzopsis asperifolia, Streptopus lanceolatus*, and *Trientalis borealis*.

***Diagnostic Characteristics:** *Pinus strobus, Pinus banksiana* (mostly in the Great Lakes region), and *Pinus resinosa* typically are the diagnostic overstory species. Hardwoods such as *Acer rubrum, Betula papyrifera, Populus grandidentata, Populus tremuloides, Quercus ellipsoidalis*, and *Quercus rubra* sometimes form a subcanopy; *Quercus rubra* or *Quercus ellipsoidalis* may occasionally be important canopy associates. In the low-shrub layer, *Vaccinium* spp., *Gaultheria procumbens*, and *Linnaea borealis* are locally important. There can be a prominent cover of feathermosses and lichens.

***Classification Comments:** This group is related to Laurentian-Acadian Hemlock - White Pine - Hardwood Forest Group (G741) and is distinguished from it by the presence and relative importance of both *Pinus resinosa* and *Pinus strobus*, the absence of mesic hardwoods (*Acer saccharum, Fagus grandifolia*) or hemlock (*Tsuga canadensis*), and the setting on more xeric soils. It also contains subboreal associates such as *Pinus banksiana, Picea mariana, Abies balsamea, Vaccinium myrtilloides, Cornus canadensis*, etc., which may form their own alliance [see Minnesota DNR (2003), FDn12-43 red pine-white pine types]. The core concept of this group ranges from west-central Minnesota, across northern Wisconsin, Michigan, central Ontario, and into northern New York and central New England. Northeast Minnesota, northwest and upper-central Ontario, and into Quebec contain the more subboreal parts of the range. More data from examples in Canada are needed to better define examples of this group within that portion of its range.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G160	Great Lakes Pine Barrens	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These forests are characterized by a conifer or conifer-hardwood canopy that can range from quite closed (>80% cover) to occasionally more open (>60% cover). There may be a subcanopy, typically hardwoods. Shrub and herb layers are variable in cover but rarely extensive. Needle accumulation and dry conditions are factors in the limited understory growth. Lichens and mosses may be prominent in the ground layer.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Pinus strobus* and *Pinus resinosa* are the diagnostic overstory species. Mesic sites in the subboreal or Acadian region tend to include *Picea mariana, Picea glauca, Picea rubens*, and/or *Abies balsamea* in the canopy, while on dry sites, particularly in the Great Lakes region, *Pinus banksiana* may be diagnostic. Early-successional hardwoods such as *Acer rubrum, Betula papyrifera, Populus grandidentata*, and *Populus tremuloides* are often present and may codominate with the conifers in some stands. *Quercus rubra* or *Quercus ellipsoidalis* are common and can be diagnostic hardwood associates. In the central parts of its range, mesic sites may include *Acer saccharum, Fagus grandifolia*, and *Tsuga canadensis*. The understory ranges from moderately herb- and shrub-rich to extremely poor. In the tall-shrub layer, the important species are *Amelanchier* spp. and *Corylus cornuta*. In the low-shrub layer, *Vaccinium* spp., mainly *Vaccinium myrtilloides* and *Vaccinium angustifolium*, and *Gaultheria procumbens* are important, particularly where gaps in the canopy occur. The herbaceous layer is sometimes poorly represented in some of the drier sites, contributing only 11% of the ground cover in northeastern Minnesota, in contrast with more prominent cover of feathermosses. Where the herb layer is more substantial, common herbaceous species include *Pteridium aquilinum, Aralia* *nudicaulis, Oryzopsis asperifolia, Maianthemum canadense, Cornus canadensis, Chimaphila umbellata, Epigaea repens, Eurybia macrophylla*, and *Trientalis borealis*. The predominant moss species are *Dicranum* spp. and *Pleurozium schreberi*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Fire is an important natural disturbance. *Pinus resinosa* and *Pinus strobus* have extensive adaptations that make them well-suited to frequent surface fires and occasional crown fires. Reconstructions of the fire regime in *Pinus resinosa* and *Pinus strobus* stands indicate that a combination of surface fires every 20-30 years and severe crown fires every 100-150 years maintained presettlement *Pinus* spp. communities (Heinselman 1973, Whitney 1986, Frelich 1992). This group may be dependent on occasional catastrophic fires (with a moderately long fire-return interval) to allow regeneration of pines instead of gradual succession to other forest types.

ENVIRONMENT

Environmental Description: This group typically occurs on coarse glacial deposits of sandy or loamy soils in cool north-temperate to subboreal climatic regions. Fire is an important natural disturbance. These forests occur largely on dry to dry-mesic, deep mineral soil. The soil deposition history can be either glaciofluvial and morainal in nature. Substrates include sand and gravel deposits on flats, such as outwash sands, delta sands, eskers, kames, kame terraces, and dry lake sands. Soil depth ranges from 61-100 cm. The soil textures are most commonly coarse sand or coarse loam soils, as well as some fine sands and silts. These forests may also occur on upper hillslopes and low ridges, with shallow-to-bedrock soils.

DISTRIBUTION

***Geographic Range:** This group ranges from west-central Minnesota, across northern Wisconsin, Michigan, central Ontario, and into northern New York and central New England. Northward, the more subboreal parts include northeast Minnesota, northwest and upper-central Ontario, parts of Quebec and eastern Canada, and northern New England.
Nations: CA, US
States/Provinces: ME, MI, MN, NB, NH, NS?, NY, ON, QC?, VT, WI
USFS Ecoregions (2007) [optional]: 211A:CP, 211B:CC, 211C:CC, 211D:CC, 211E:CC, 211J:CP, 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212Jb:CCC, 212Jc:CCC, 212Jo:CCC, 212Ka:CCC, 212Kb:CCC, 212La:CCC, 212Lb:CCC, 212Lc:CCC, 212Ld:CCC, 212Le:CCC, 212Ma:CCC, 212Mb:CCC, 212Na:CCC, 212Nb:CCC, 212Nc:CCC, 212Nd:CCC, 212Qa:CCC, 212Qb:CCC, 212Qc:CCC, 212Qd:CCC, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC, 212Sb:CCC, 212Sc:CCC, 212Sn:CCC, 212Sq:CCC, 212Ta:CCC, 212Tb:CCC, 212Tc:CCC, 212Te:CCC, 212Tf:CCC, 212Xa:CCC, 212Xb:CCC, 212Xc:CCC, 212Xd:CCC, 212Xe:CCC, 212Xf:CCC, 212Ya:CCC, 212Za:CCC, 212Zb:CCC, 212Zc:CCC, 221Ai:CCC, 221Al:CCC, 222I:CP, 222Ja:CCC, 222Ud:CCC, 222Ue:CCC, M211A:CC, M211Bd:CCC, M211C:CP, M211D:CP
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3238	*Pinus banksiana - Pinus resinosa - Quercus ellipsoidalis* Forest & Woodland Alliance
A4127	*Pinus strobus - Pinus resinosa - Quercus rubra* Forest & Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-02-18	G628 Sub-Boreal Dry-Mesic Hardwood Forest Group	G628 merged into G025

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Northern dry forest	Curtis 1959	
<	Northern dry-mesic forest	Curtis 1959	
=	Northern forest - xeric	Curtis 1959	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.T. Curtis (1959)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard and S. Gawler

Acknowledgments [optional]:

Version Date: 22 Jan 2010

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***References [Required if used in text]:**

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1. Forest & Woodland

1.B.2.Na. Eastern North American Forest & Woodland

G347. Laurentian Subboreal Dry Jack Pine - Red Pine - Oak Woodland

Type Concept Sentence: This conifer woodland is found throughout the eastern southern or subboreal regions of eastern Canada, extending into the Upper Midwest and Northeast parts of the United States. It is dominated by *Pinus* spp., most frequently *Pinus banksiana*, and occurs on dry nutrient-poor sand plains and along rocky ridges, often adjacent to rivers and lakes, and along talus slopes.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.6. Laurentian-Acadian Pine - Hardwood Forest & Woodland (M159)

Elcode: G347
***Scientific Name:** *Pinus banksiana - Pinus resinosa - Quercus* spp. Subboreal Woodland Group
***Common (Translated Scientific) Name:** Jack Pine - Red Pine - Oak species Subboreal Woodland Group
***Colloquial Name:** Laurentian Subboreal Dry Jack Pine - Red Pine - Oak Woodland

***Type Concept:** This conifer woodland is found throughout the eastern southern or subboreal regions of eastern Canada, extending into the Upper Midwest and Northeast parts of the United States. It occurs on dry nutrient-poor sand plains and along rocky ridges, often adjacent to rivers and lakes, and along talus slopes. The canopy ranges from patchy to continuous and is dominated by a mix of primarily conifer and hardwood species. In some examples, canopy trees may be stunted. *Pinus banksiana* is the most frequent conifer species, although *Pinus resinosa, Pinus strobus, Picea mariana*, or *Picea glauca* can be common and may dominate some sites. Hardwood species vary in cover from 25-90% of the canopy. *Quercus ellipsoidalis* is a restricted dominant in the Midwest part of the range of this group, along with *Quercus macrocarpa* and *Quercus rubra*. More common are *Betula papyrifera, Betula populifolia*, and *Populus* spp. In areas of open bedrock, species typical of bedrock outcrops and shallow soils can be found and include *Danthonia spicata, Poa alsodes, Elymus trachycaulus, Maianthemum canadense, Schizachne purpurascens*, and *Oryzopsis asperifolia*. The nonvascular layer can be absent or present with up to 30% cover. In the open bedrock areas, this layer consists mainly of the lichens and mosses. Infrequent fire is the primary dynamic, with catastrophic fires occurring approximately every 150-200 years with surface fires every 50-200 years.

***Diagnostic Characteristics:** Examples of this group are characterized by their occurrence on bedrock or well-drained sands. They are typically mosaics of open bedrock or soil interspersed with scattered trees and shrubs and areas of denser tree canopies. Scattered trees and woodland areas are typically a mix of conifer and occasional hardwood species, most commonly *Pinus banksiana* and *Picea mariana*.

***Classification Comments:** The description of this type is drawn largely from the Great Lakes area, where the description and type probably work, but it needs to be improved for the Atlantic provinces.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G047	Laurentian Subboreal Dry-Mesic Pine - Black Spruce - Hardwood Forest	has some floristic overlap, but contains primarily closed-canopy forests occurring on deeper, more mesic soils.
G639	Central Boreal Dry Jack Pine Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Stands consist of mixed conifer species, occasionally with hardwood canopies that range from open to moderately dense. Many examples include a mosaic of exposed bedrock or soil and patches of shrubs or low vegetation and scattered trees that can be relatively open or occur in dense patches.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The canopy ranges from scattered trees to a moderately dense canopy. Stands are a mix of conifer species, occasionally with hardwood species. In some examples, canopy trees may be stunted. The conifers in most examples are dominated by *Pinus banksiana*. *Pinus resinosa, Pinus strobus, Picea mariana*, or *Picea glauca* can be common and may dominate some sites. Hardwood species vary in cover from 25-90% of the canopy. *Quercus ellipsoidalis* is a restricted dominant in the Midwest part of the range, with *Quercus macrocarpa* or *Quercus rubra, Betula papyrifera*, and *Populus* spp. occurring more commonly. Shrubs may be absent to dense and include *Amelanchier* spp., *Diervilla lonicera, Corylus cornuta, Viburnum rafinesqueanum, Juniperus communis, Prunus pensylvanica, Prunus virginiana, Salix bebbiana*, and *Vaccinium angustifolium*. Herbaceous species vary across the range of this type. Some typical species include *Danthonia spicata, Poa alsodes, Elymus trachycaulus (= Agropyron trachycaulum),* *Maianthemum canadense, Arctostaphylos uva-ursi, Corydalis sempervirens*, and *Schizachne purpurascens*. The nonvascular layer can be absent or present with up to 30% cover. In the open bedrock areas, this layer consists mainly of the lichens and mosses. Lichen species may include *Cladonia rangiferina* and *Cladonia arbuscula ssp. mitis (= Cladonia mitis)*. Mosses include *Dicranum* spp., *Pleurozium schreberi*, and *Polytrichum* spp.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Fire is the primary dynamic, with catastrophic fires occurring approximately every 150-200 years and surface fires every 50-200 years.

ENVIRONMENT

Environmental Description: Examples of this group occur on rocky ridgetops, high slopes, and terraces sometimes along rivers or lakeshores, including Great Lakes shorelines. These areas are dry, well-drained sites, often with exposed bedrock. Soils range from bare bedrock and talus slopes to rocky, shallow loams and deep sands. Those stands on bedrock may have occasional cracks in the underlying bedrock resulting in pockets of relatively deep (15-20 cm) soil. Bare rock (with crustose lichens) can cover up to 50% of the area.

DISTRIBUTION

***Geographic Range:** This group ranges in Canada from northwestern Ontario (possibly eastern Manitoba) to eastern Canada's Atlantic provinces and extending into the U.S. in northeastern Minnesota, Isle Royale, and near-coastal areas of Lake Superior shores in northern Wisconsin and Michigan.
Nations: CA, US
States/Provinces: LB?, MB?, MI, MN, NB, NF, ON, QC, WI
USFS Ecoregions (2007) [optional]: 211D:??, 211E:??, 212La:CCC, 212Lb:CC?, 212Lc:CCC, 212Ld:CC?, 212Le:CCC, 212Mb:CCC, 212Ra:CCC, 212Rd:CC?, 212Sb:CCC, 212Sc:CC?, 212Sn:CC?, 212Sq:CC?, 212Ya:CCC, M211:?
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3839	*Pinus banksiana - Pinus resinosa - Quercus ellipsoidalis* Subboreal Rocky Woodland Alliance
A3840	*Pinus banksiana - Pinus resinosa / Arctostaphylos uva-ursi* Subboreal Sand Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Northern Dry-Bedrock Pine (Oak) Woodland Class [FDn22]	Minnesota DNR 2003	
<	Northern Dry-Sand Pine Woodland Class [FDn12]	Minnesota DNR 2003	

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen, in Faber-Langendoen et al. (2012)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard and D. Faber-Langendoen

Acknowledgments [optional]: Ken Baldwin, Peter Uhlig, Claude Morneau, Sean Basquill, Mélanie Major

Version Date: 04 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Minnesota DNR [Minnesota Department of Natural Resources]. 2003. Field guide to the native plant communities of Minnesota: The Laurentian Mixed Forest Province. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. Minnesota Department of Natural Resources, St. Paul.

1\. Forest & Woodland

1.B.2.Na. Eastern North American Forest & Woodland

G047. Laurentian Subboreal Dry-Mesic Pine - Black Spruce - Hardwood Forest

Type Concept Sentence: This subboreal forest group is found on dry-mesic nutrient-poor soils from northwestern Ontario to eastern Canada, and southward in the U.S. in the northern parts of the Great Lakes region, with *Pinus banksiana, Pinus resinosa*, and *Picea mariana* characteristic overstory species, and *Pinus strobus* occasionally common.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Na.6. Laurentian-Acadian Pine - Hardwood Forest & Woodland (M159)

Elcode: G047

***Scientific Name:** *Pinus banksiana - Pinus resinosa - Picea mariana* Subboreal Forest Group

***Common (Translated Scientific) Name:** Jack Pine - Red Pine - Black Spruce Subboreal Forest Group

***Colloquial Name:** Laurentian Subboreal Dry-Mesic Pine - Black Spruce - Hardwood Forest

***Type Concept:** This subboreal forest group is found on dry-mesic nutrient-poor soils in a variety of topographic settings. It ranges from northwestern Ontario to eastern Canada, and southward into Minnesota, the Great Lakes region, and very locally into northwestern Maine. Soils are loamy to sandy, varying from nutrient-poor, thin soils over bedrock to deeper soils, sometimes sandy. Sites are typically dry-mesic. The dominant fire regime varies from 50-100 years. *Pinus banksiana, Pinus resinosa*, and *Picea mariana* are characteristic overstory species, with *Pinus strobus* occasionally common, over much of the range, but east of the Great Lakes, *Picea mariana* becomes increasingly dominant with *Abies balsamea* as an important associate. Canopy structure is mostly closed but can be partially open. Conifers typically dominate the canopy, but boreal hardwoods (*Populus tremuloides, Betula papyrifera*) may codominate. As time since fire increases, *Picea mariana* may dominate. Tree regeneration includes *Abies balsamea, Betula papyrifera, Populus tremuloides*, and *Picea mariana*. The shrub and field layers can be very open to somewhat dense (5-75% cover). Characteristic low-shrub and herb species include *Amelanchier* spp., *Vaccinium angustifolium, Diervilla lonicera, Cornus canadensis, Linnaea borealis, Doellingeria umbellata*, and *Eurybia macrophylla*. Older *Picea mariana* stands may be strongly dominated by feathermosses. Subboreal indicators need to be described.

***Diagnostic Characteristics:** *Pinus banksiana* and *Picea mariana* are characteristic overstory species, and hardwoods are typically less than 25% cover, and sub-boreal indicators are present, which are otherwise lacking in true boreal conditions. Tree regeneration of somewhat more moisture-preferring trees may be common, including *Abies balsamea, Betula papyrifera, Populus tremuloides*, and *Picea mariana*. Ground layer is not lichen-dominated and contains at least 5%, and as much as 75%, cover by herbs and shrubs, and feathermosses are common, up to 100% cover in some stands. Presence of temperate (sub-boreal) conditions needs to be described.

***Classification Comments:** In Quebec (C. Morneau pers. comm. 2009), *Picea mariana* is far more common than *Pinus banksiana* in the boreal forest. Secondly, forests composed of a mixture of *Picea mariana* and *Abies balsamea* with a feathermoss carpet on the ground are very common east of 74°W longitude and north of 48°N latitude where climate undergoes a maritime influence and where *Pinus banksiana* gradually becomes absent. *Picea mariana - Picea rubens / Rhododendron canadense / Cladonia* spp. Swamp Woodland (CEGL006421), in the present group, represents spruce-lichen woodlands at the boreal-temperate forest interface.

At this time, this group excludes xeric *Pinus banksiana* and *Picea mariana* stands, which are placed in their own group, Laurentian Subboreal Dry Jack Pine - Red Pine - Oak Woodland Group (G347), found on dry, poor sites, where there is a low density of *Pinus banksiana* trees resulting in a woodland condition. Lichens are dominant. Woodland physiognomy and lichen dominance distinguish that group from this group, which has more of a closed canopy and feathermosses and herbs are more abundant. See also Minnesota DNR (2003), which separates Northern Dry-Sand Pine Woodland (FDn12) and Northern Dry-Bedrock Pine-(Oak) Woodland (FDn22), and belong with G347, from the dry-mesic *Pinus banksiana* and *Picea mariana* Forests and Woodlands (FDn32 and FDn33), which belong with this group.

Placement of *Populus tremuloides - (Populus grandidentata)* Rocky Woodland (CEGL002487) in this group needs review.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G347	Laurentian Subboreal Dry Jack Pine - Red Pine - Oak Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The tree canopy is dominated by needle-leaved evergreen (conifer) trees, with broad-leaved deciduous trees a minor component. The canopy structure varies from partially open to closed. The shrub and herb layers can be very open to somewhat dense (5-75% cover).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Pinus banksiana* and *Picea mariana* are characteristic overstory species. In the Upper Great Lakes region, *Pinus banksiana* may intermix with *Pinus resinosa*. Canopy structure is mostly closed but can be partially open. Conifers typically dominate the canopy, but boreal hardwoods (*Populus tremuloides, Betula papyrifera*) may codominate. As time since fire increases, *Picea mariana* may dominate. Tree regeneration includes *Abies balsamea, Betula papyrifera, Populus tremuloides*, and *Picea mariana*. Characteristic low-shrub and herb species include *Amelanchier* spp., *Vaccinium angustifolium, Diervilla lonicera, Cornus canadensis, Linnaea borealis, Doellingeria umbellata (= Aster umbellatus)*, and *Eurybia macrophylla*. Older *Picea mariana* stands may be strongly dominated by feathermosses (Minnesota DNR 2003).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The dominant fire regime varies from 50-100 years.

ENVIRONMENT

Environmental Description: Soils are loamy to sandy, varying from nutrient-poor, thin soil over bedrock to deeper soils, sometimes sandy. Sites are typically on dry-mesic to dry sites, but not commonly found on xeric sandplains or bedrock sites.

DISTRIBUTION

***Geographic Range:** This group ranges from northwestern Ontario to eastern Canada, and southward into Minnesota, the Great Lakes region, and very locally into northwestern Maine.
Nations: CA, US
States/Provinces: LB, MB?, MI, MN, NB, NF, ON, QC, WI
USFS Ecoregions (2007) [optional]: 212La:CCC, 212Lb:CCC, 212Lc:CCC, 212Ld:CCC, 212Le:CCC, 212Mb:CCC, 212Na:CCC, 212Nb:CCC, 212Nd:CCC, 212Ra:CCC, 212Rd:CC?, 212Sb:CCC, 212Sc:CC?, 212Sn:CC?, 212Sq:CC?, 212Ya:CCC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3838	*Pinus banksiana - Picea mariana / Vaccinium* spp. Subboreal Forest Alliance
A4130	*Pinus resinosa - Pinus strobus* Subboreal Forest Alliance
A3837	*Populus tremuloides - Picea glauca* Subboreal Rocky Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
><	Black Spruce: 12	Eyre 1980	
<	Jack Pine - Black Spruce	Heinselman 1973	
<	Jack Pine - Fir, Black Spruce - Feathermoss	Heinselman 1973	
><	Jack Pine: 1	Eyre 1980	

AUTHORSHIP

***Primary Concept Source [if applicable]:** F.H. Eyre (1980)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard and D. Faber-Langendoen
Acknowledgments [optional]: Ken Baldwin, Peter Uhlig, Claude Morneau, Sean Basquill, Mélanie Major
Version Date: 08 Oct 2013

REFERENCES

***References [Required if used in text]:**

Comer, P. J., D. A. Albert, H. A. Wells, B. L. Hart, J. B. Raab, D. L. Price, D. M. Kashian, R. A. Corner, and D. W. Schuen. 1995a. Michigan's native landscape, as interpreted from the General Land Office Surveys 1816-1856. Michigan Natural Features Inventory, Lansing, MI. 78 pp. plus digital map.

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Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.
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Minnesota DNR [Minnesota Department of Natural Resources]. 2003. Field guide to the native plant communities of Minnesota: The Laurentian Mixed Forest Province. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. Minnesota Department of Natural Resources, St. Paul.
Morneau, Claude. Personal communication. Direction des inventaires forestiers, Ministère des Ressources naturelles et de la Faune, Québec.

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G160. Great Lakes Pine Barrens

Type Concept Sentence: These barrens occur within the western and northern Great Lakes regions and are characterized by open canopies typically dominated by *Pinus banksiana* with a graminoid understory, but *Pinus strobus, Pinus resinosa*, and *Quercus ellipsoidalis* also may occur as common overstory dominants. Sites occur on flat or gently glaciated landscapes such as outwash plains, glacial lakeplains, and sandy river terraces.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.6. Laurentian-Acadian Pine - Hardwood Forest & Woodland (M159)

Elcode: G160
***Scientific Name:** *Pinus banksiana - Quercus ellipsoidalis* Barrens Group
***Common (Translated Scientific) Name:** Jack Pine - Northern Pin Oak Barrens Group
***Colloquial Name:** Great Lakes Pine Barrens

***Type Concept:** These pine-oak barrens occur in the northern and western Great Lakes region. They occur primarily on sandplains/outwash habitats, with dry, frequent fires (every 10-50 years) and occasionally on Great Lakes dunes. Overstory is very open and savanna-like, with trees scattered or clumped. *Pinus banksiana* typically dominates the canopy, but *Pinus resinosa, Quercus ellipsoidalis*, and *Pinus strobus* also are common overstory dominants. The understory is often quite low in diversity and open. Prairie species are often present; *Schizachyrium scoparium* and *Andropogon gerardii* are common throughout much of the range of the group. Other common ground layer species include *Carex pensylvanica* and *Apocynum androsaemifolium*, species that are also common in forest edge or open woodlands. Typical dune species such as *Ammophila breviligulata* and *Juniperus horizontalis* are common on dune examples. Common shrub species include *Vaccinium angustifolium* and *Corylus americana*. Oak grubs may be common under frequent burning. Past logging practices in some areas also decreased the number of pines and created areas dominated by oak sprouts and scrubs.

***Diagnostic Characteristics:** Open to moderately dense canopy of pines such as *Pinus banksiana, Pinus resinosa*, and *Pinus strobus* mixed with *Quercus ellipsoidalis*. The understory typically is strongly graminoid-dominated and contains several tallgrass prairie species and dwarf-shrubs.

***Classification Comments:** This group covers the pine barrens within the western Great Lakes region. It is ecologically similar to Pitch Pine Barrens Group (G161) in the Northeast, but the ranges of the dominant tree species show little to no overlap. In addition Pitch Pine Barrens Group (G161) includes pitch pine forests, whereas this group currently excludes them. Review is needed of the placement of *Pinus banksiana - Quercus ellipsoidalis* forests found in the Great Lakes Pine Barren region. Laurentian-Acadian Pine - Oak Forest & Woodland Group (G025) may overlap somewhat with this group on dry-mesic sites, Great Lakes dune sites, or sites that may not have not burned for more than 50 years. Stands on Great Lakes dunes include Grand Sable and Sleeping Bear Dunes, Michigan.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G161	Pitch Pine Barrens	
G025	Laurentian-Acadian Pine - Oak Forest & Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Tree canopy cover is highly variable, ranging from open scrubby shrublands with few, scattered trees to moderately closed woodlands or forests, typically with a strong ground layer of graminoids, including prairie grasses and forbs. Fire suppression has led to increased canopy closure in many areas (Curtis 1959).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Dominant canopy species include *Pinus banksiana, Pinus resinosa, Quercus ellipsoidalis*, and *Pinus strobus*. In northern Wisconsin, extensive logging, fire suppression, and lack of seed source can decrease the cover of pine species (*Pinus* spp.) in some stands, and *Pinus resinosa* is now uncommon as a dominant. Prairie species such as *Schizachyrium scoparium* and *Andropogon gerardii* are common throughout much of the range of the group, although they can decrease in number and abundance from south to north within the range of this group. Other common ground layer species include *Carex pensylvanica* and *Apocynum androsaemifolium*, species that are also common in forest edge or open woodlands. Common shrub species include *Vaccinium angustifolium* and *Corylus americana*. Examples of this group on dunes can contain dune understory species such as *Juniperus horizontalis* and *Ammophila breviligulata* (Curtis 1959).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Catastrophic burns may create open bracken grasslands, though these may originate more typically from clearing of forests and subsequent fires on morainal substrates (Curtis 1959).

ENVIRONMENT

Environmental Description: This group occurs on flat or gently glaciated landscapes such as outwash plains, glacial lakeplains, and sandy river terraces. Soils are typically dry sands, but some stands can occur on rocky soils (Curtis 1959).

DISTRIBUTION

***Geographic Range:** Occurs throughout the northern and western Great Lakes region, from Minnesota to Michigan and Ontario.
Nations: CA, US
States/Provinces: IN, MI, MN, ON, WI
USFS Ecoregions (2007) [optional]: 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212He:CCC, 212Hg:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCP, 212J:CP, 212K:CC, 212L:CP, 212N:CC, 212Ra:CCC, 212Rb:CCP, 212Rc:CCP, 212Re:CCP, 212Sc:CCP, 212Sn:CCC, 212Sq:CCP, 212Tb:CCC, 212Tc:CCC, 212Te:CCC, 212X:CP, 222Ja:CCC, 222Jb:CCC, 222R:CC, 222Ud:CCC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A1499	*Pinus banksiana - Pinus* spp. - *Quercus* spp. Barrens Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.T. Curtis (1959)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard and D. Faber-Langendoen

Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by O. Loucks.

Version Date: 04 Oct 2013

REFERENCES

***References [Required if used in text]:**

Comer, P. J., D. A. Albert, H. A. Wells, B. L. Hart, J. B. Raab, D. L. Price, D. M. Kashian, R. A. Corner, and D. W. Schuen. 1995a. Michigan's native landscape, as interpreted from the General Land Office Surveys 1816-1856. Michigan Natural Features Inventory, Lansing, MI. 78 pp. plus digital map.

Comer, P. J., D. A. Albert, and M. Austin (cartography). 1998. Vegetation of Michigan circa 1800: An interpretation of the General Land Office Surveys 1816-1856. Michigan Natural Features Inventory, Lansing, MI. 2-map set, scale: 1:500,000.

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Wisconsin DNR [Wisconsin Department of Natural Resources]. 2009b. Natural communities of Wisconsin. Pine Barrens. Overview. Wisconsin Department of Natural Resources, Madison. [http://www.dnr.state.wi.us/org/land/er/communities/index.asp?mode=detail&Code=CTSAV006WI] (accessed October 2009).

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1. Forest & Woodland

1.B.2.Na. Eastern North American Forest & Woodland

G655. Laurentian-Acadian Limestone Woodland

Type Concept Sentence: This group is made up of woodlands on limestone substrates including pavement (alvar), lake bluffs, talus or colluvial slopes, in the northeastern U.S. west to Wisconsin, and in southeastern Canada.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Na.6. Laurentian-Acadian Pine - Hardwood Forest & Woodland (M159)

Elcode: G655
***Scientific Name:** Laurentian-Acadian Limestone Woodland Group
***Common (Translated Scientific) Name:** Laurentian-Acadian Limestone Woodland Group
***Colloquial Name:** Laurentian-Acadian Limestone Woodland

***Type Concept:** This group comprises forests and woodlands on thin-soil limestone habitats, including pavement (including those associated with alvars) bluffs adjacent to lakes, cliffs, or talus and colluvial slopes, and found in the eastern parts of the Laurentian-Acadian mixed forest region of southeastern Canada and northeastern United States. Physiognomy in this group varies from evergreen conifers to mainly deciduous hardwoods. The canopy is generally open woodland, but also includes closed forests occurring on limestone bluffs and cliffs. Dominants include the conifers *Thuja occidentalis* and, less commonly, *Juniperus virginiana* and *Pinus banksiana*. *Acer saccharum* and *Tilia americana* are common species in mesic limestone habitats, along with *Ostrya virginiana, Carya ovata*, and *Quercus rubra*. Drier habitats are characterized by *Quercus macrocarpa*. Other associates may include *Quercus muehlenbergii* and *Fraxinus americana*. Characteristic shrub and herb species need to be described. In savanna conditions, the most abundant trees are *Thuja occidentalis* and *Pinus banksiana*. There may be fairly diverse shrub and herb layers similar to the alvar grasslands and shrublands. Understory plants of this group include *Aquilegia canadensis, Carex eburnea, Cryptogramma stelleri, Cypripedium parviflorum, Cystopteris bulbifera, Dasiphora fruticosa ssp. floribunda, Packera paupercula*, and many others.

***Diagnostic Characteristics:** Deciduous or coniferous woodlands on limestone substrates, including alvar, cliffs, bluff, talus and colluvial slopes, ranging from northern New England west to Wisconsin and north to southeastern Canada.

***Classification Comments:** The description provided here is incomplete and needs a thorough revision. Type does not occur in Atlantic Canada (S. Basquill pers. comm. 2015).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G016	Northeastern Chinquapin Oak - Red-cedar Alkaline Forest & Woodland	occurs to the south.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Alvar savannas are distinguished by their partial canopy of trees (most commonly needleleaf evergreen, but some broadleaf deciduous); savannas have from 10 to 25% cover of trees at least 5 m tall. Cover of shrubs, herbs, and nonvascular plants, and the amount of exposed bedrock are variable in this group. Woodlands farther south are placed in other related limestone woodland groups [see Northeastern Chinkapin Oak - Red-cedar Forest & Woodland Group (G016)] (Reschke et al. 1999). Closed forests dominated by *Thuja occidentalis* occur on limestone bluffs in northern New England and on the Niagara Escarpment in Ontario.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: In savanna conditions, the most abundant trees are *Thuja occidentalis* and *Pinus banksiana*; *Larix laricina* is a common associate. Other trees may include *Acer saccharum, Ostrya virginiana, Pinus resinosa, Quercus muehlenbergii*, and *Tilia americana*. This group has fairly diverse shrub and herb layers. The most abundant shrubs are dwarf-shrubs (under 0.5 m tall), including *Dasiphora fruticosa ssp. floribunda* and *Juniperus horizontalis*. Characteristic herbs are similar to little bluestem alvar grassland, including *Carex eburnea, Carex richardsonii, Carex scirpoidea, Clinopodium arkansanum, Schizachyrium scoparium*, and *Sporobolus heterolepis*. Prominent forbs include *Aquilegia canadensis* and *Campanula rotundifolia*. Minor variants include the dominant tree *Carya ovata*; other characteristic trees include *Quercus macrocarpa, Fraxinus americana*, and *Ulmus thomasii*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Cool temperatures, drought, and fire are important factors maintaining this vegetation as open woodland. Droughts severe enough to kill up to 50% of woody vegetation have occurred in alvars in Ontario repeatedly in the last century (Catling 2014). *Thuja occidentalis* forests have achieved old-growth status on limestone bluffs in Vermont and on the Niagara Escarpment in Ontario. The trees are small and slow-growing, resulting in wood of greater strength than is usually seen in this species (Larson 2001).

ENVIRONMENT

Environmental Description: This group occurs on calcareous bedrock occurring as alvar (thin-soiled pavement), cliffs, lake bluffs, talus slopes, and colluvial slopes.

DISTRIBUTION

***Geographic Range:** This group is composed of forests and woodlands on thin-soil limestone habitats in the eastern parts of the Laurentian-Acadian mixed forest region of southeastern Canada and northeastern United States.
Nations: CA, US
States/Provinces: MI, NY, ON, QC?, VT, WI
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3299	*Quercus macrocarpa - Carya ovata* Northern Limestone Woodland Alliance
A3298	*Quercus muehlenbergii - Juniperus virginiana* Alvar Woodland Alliance
A3296	*Thuja occidentalis* Limestone Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Alvar woodland	Catling 2014	
>	Limestone bluff cedar - pine forest	Thompson and Sorenson 2000	
>	Temperate calcareous cliff	Thompson and Sorenson 2000	

AUTHORSHIP

***Primary Concept Source [if applicable]:** P.M. Catling and V.R. Brownell (1995)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** D. Faber-Langendoen and L.A. Sneddon
Acknowledgments [optional]: Sean Basquill
Version Date: 06 May 2015

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

M014. Laurentian-Acadian Mesic Hardwood - Conifer Forest

Type Concept Sentence: This macrogroup represents the mesic conifer - northern hardwoods of the eastern cool-temperate forests, ranging from the Upper Great Lakes region eastward to the Acadian region of southeastern Canada, to New York and Pennsylvania, and south along the Appalachians to northern North Carolina and eastern Tennessee; forests vary from pure hardwood dominance by *Acer saccharum, Betula alleghaniensis, Fagus grandifolia, Quercus rubra*, and *Tilia americana* to strong conifer dominance by *Pinus strobus* and *Tsuga canadensis* and (more eastward) *Picea rubens*.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.2.Na.7. Eastern North American Forest & Woodland (D008)

Elcode: M014
***Scientific Name:** *Acer saccharum - Betula alleghaniensis - Tsuga canadensis* Forest Macrogroup
***Common (Translated Scientific) Name:** Sugar Maple - Yellow Birch - Eastern Hemlock Forest Macrogroup
***Colloquial Name:** Laurentian-Acadian Mesic Hardwood - Conifer Forest

***Type Concept:** These northern temperate conifer-hardwoods forests form the landscape matrix over much of the glaciated north temperate region of eastern North America, and at higher elevations along the Central and Southern Appalachians, becoming especially prominent in cooler settings. The forests are dominated by "northern hardwoods" (*Acer saccharum, Betula alleghaniensis*, and *Tilia americana*, and in parts of the range, *Fagus grandifolia, Fraxinus americana*, and *Quercus rubra*) and/or by *Abies balsamea, Picea glauca, Picea rubens, Pinus strobus*, or *Tsuga canadensis*. The canopy may be deciduous, coniferous, or mixed. These forests are found on mesic to dry sites in various landscape settings, usually not both dry and highly exposed. Climate is cool-temperate to subboreal. Soils are highly variable, from high-nutrient soils developed over limestone to acidic, nutrient-poor glacial outwash soils. Soil moisture regime is most often mesic. Spruce- or hemlock-dominated forests may occur on moist sites.

***Diagnostic Characteristics:** This macrogroup contains a combination of the moderately diagnostic northern hardwood - conifer species of *Betula alleghaniensis, Tsuga canadensis, Pinus strobus, Picea rubens* (eastward), and *Thuja occidentalis*, and more widespread northern hardwood species, such as *Acer saccharum, Betula papyrifera, Fagus grandifolia, Fraxinus americana, Quercus rubra*, and *Tilia americana*. Occasionally *Picea glauca* and *Abies balsamea* are present; the latter species is a frequent canopy component in eastern areas. Southward, in the Appalachian region, species such as *Aesculus flava, Abies fraseri, Liriodendron tulipifera*, and *Quercus montana* may occur. Shrub and herb species need to be added to this list of diagnostic taxa.

***Classification Comments:** These forests are differentiated from other forest macrogroups in the range by the combination of northern hardwoods, white pine, spruce, fir, and/or hemlock, without significant presence of *Quercus* species other than *Quercus rubra* and without significant contribution of *Carya* species. Chapters in Barbour and Billings (2000) treat the red spruce - fir within the eastern deciduous forest region rather than boreal (following the treatment of Braun (1950)). Similarly, here we place all stands with *Picea rubens* with other cool-temperate types. We restrict the term "boreal" to forests that primarily or entirely lack temperate diagnostic species, which geographically corresponds largely to the North American forests within Bailey's (1997) subarctic "Tayga (boreal forest)" ecoregion. This macrogroup differs from Appalachian-Interior-Northeastern Mesic Forest Macrogroup (M883) by the lack of or low abundance of central mesophytic temperate forest taxa typical of Braun's (1950) Mixed Mesophytic region, such as *Magnolia* spp. and *Carya* [additional species needed here], and the presence or dominance of *Pinus strobus, Tsuga canadensis*, and *Picea rubens*. They differ from boreal forests in the absence or low abundance of boreal conifers (*Abies balsamea, Picea glauca, Picea mariana, Pinus banksiana*).

In Canada, consideration is being given as to whether northeastern mesic conifer (and mixedwood) forests will be separated from mesic northern hardwoods in the CNVC, and, if so, whether they should be differentiated at the macrogroup or submacrogroup level. If recognized, that conifer-mixedwood unit would define zonal vegetation in a low- to moderate-elevation region where the cool humid climate arises from prominent oceanic influences and abundant rainfall. One of the important things needing investigation is whether other humid northeastern temperate conifer/mixed forest (i.e., primarily Laurentian Subboreal Mesic Balsam Fir - Spruce - Hardwood Forest Group (G048)) would fall under this same macrogroup/submacrogroup (S. Basquill pers. comm. 2015).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M882	Central Midwest Mesic Forest	
M883	Appalachian-Interior-Northeastern Mesic Forest	
M159	Laurentian-Acadian Pine - Hardwood Forest & Woodland	
M495	Eastern North American Boreal Forest	is characterized by *Abies balsamea, Picea glauca, Pinus banksiana*, and *Picea mariana*, and absence of *Picea rubens* and absence or unimportance of northern hardwoods (e.g., *Fagus grandifolia, Acer saccharum, Betula alleghaniensis*).

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are mostly closed-canopy, uneven-aged forests, but may have patchy openings due to gap dynamics, primarily from windthrow (Tyrrell and Crow 1994a, 1994b). Forests on rocky substrates, more extreme sites, may have open or stunted canopies. Stands range from strong dominance by conifers to strong dominance by hardwoods. Some stands have a supercanopy of *Pinus strobus*. Shrub, sapling and ground layers vary from open to dense, often influenced by the pit-and-mound topography resulting from windthrows. Moss cover is patchy to continuous.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Dominant tree species include the typical conifers and hardwoods of *Acer saccharum, Betula alleghaniensis, Fagus grandifolia, Fraxinus americana, Picea glauca, Picea rubens, Pinus strobus, Tilia americana*, and *Tsuga canadensis*; *Abies balsamea* is occasional. *Acer rubrum, Betula papyrifera, Populus grandidentata*, and *Populus tremuloides* may be common. Other prominent canopy associates may include *Prunus serotina, Thuja occidentalis*, and *Quercus rubra*. Southward, in the Appalachians part of the range, *Liriodendron tulipifera* may also occur (Whittaker 1956). *Abies balsamea* and *Picea glauca* are uncommon associates. Canopy composition is dependent on a variety of factors, including geographic location, past disturbance, soils, slope, and aspect. Smaller trees that may form an understory include *Ostrya virginiana, Sorbus americana, Acer spicatum*, and *Acer pensylvanicum*. *Prunus pensylvanica* may also be common, especially in openings. The density and composition of shrub, herb, and bryophyte strata vary with geographic location and degree of past disturbance (i.e., canopy openings). Common shrub species include *Corylus cornuta, Diervilla lonicera, Dirca palustris, Hamamelis virginiana, Lonicera canadensis, Prunus virginiana*, and

Viburnum lantanoides. A diverse set of characteristic herbaceous species include *Actaea pachypoda, Actaea rubra, Allium tricoccum, Aralia nudicaulis, Arisaema triphyllum, Athyrium filix-femina, Clintonia borealis, Coptis trifolia, Cornus canadensis, Dryopteris campyloptera, Dryopteris carthusiana (= Dryopteris spinulosa), Gaultheria procumbens, Huperzia lucidula (= Lycopodium lucidulum), Lycopodium obscurum, Osmunda claytoniana, Oxalis montana, Maianthemum canadense, Medeola virginiana, Mitchella repens, Polygonatum pubescens, Polystichum acrostichoides, Streptopus lanceolatus (= Streptopus roseus), Trillium undulatum, Trientalis borealis, Uvularia sessilifolia*, and, in areas with a limestone or other more calcareous substrate, *Adiantum pedatum, Caulophyllum thalictroides*, and *Deparia acrostichoides (= Athyrium thelypterioides)*. The bryophyte layer is generally very well-developed, characterized by *Bazzania trilobata, Pleurozium schreberi, Dicranum* spp., and many others. These forests may also be invaded by non-native shrubs, including *Berberis* spp., *Lonicera morrowii, Lonicera tatarica, Frangula alnus, Rhamnus cathartica*, and others (Curtis 1959, Cohen et al. 2014).

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The natural disturbance regime is characterized by frequent, small windthrow gaps, which allow for gap-phase regeneration of the shade-tolerant canopy dominants. Large-diameter coarse woody debris provides nurse logs for regenerating tree canopy species, and tip-up mounds for plant establishment and regeneration (Canham 1988, 1990). Catastrophic windthrow occurred infrequently (return intervals of >500 years) with several generations of trees passing between large-scale, severe disturbance events (Canham and Loucks 1984, Frelich and Lorimer 1991a, Frelich 2002). As a result, these mesic northern forests historically dominated vast areas of mesic uplands of the Great Lakes and were multi-generational, with old-growth conditions lasting many centuries (Cohen 2005).Fire is not an important factor, although it has been shown to occur at long return intervals (>500 years) in the presettlement landscape. Forests at higher elevations are affected by wind disturbance, debris avalanches, ice loading, and lightning fire, and can be susceptible to large blowdowns where the soils are shallow. Insect defoliation and selective herbivory by white-tailed deer can alter the composition and structure and favor browse-tolerant species. In the northern part of the range, the spruce budworm occurs in periodic outbreaks (40-60 years) and causes significant defoliation and patchy blowdowns. Beech bark disease and emerald ash borer have locally killed canopy beech and American ash (Curtis 1959, Cohen et al. 2014).

Intensive and pervasive anthropogenic disturbance during the past 150 years has altered the extent, landscape pattern, natural processes, structure, and species composition of the mesic northern forest (Frelich 1995, Cohen 2005). In particular, old-growth and late-successional forests have been drastically reduced in acreage, or occur as remnant patches in a matrix of agricultural lands, early-successional forest, and young northern hardwoods (Leahy and Pregitzer 2003). Short-rotation timber management has replaced gap-phase dynamics as the dominant disturbance factor impacting structure and composition. Structural alterations include the reduction of large-diameter trees, snags, and coarse woody debris. Hemlock and white pine have declined in importance within these systems, and have been completely eliminated from many landscapes. Chronically high deer densities have limited tree recruitment and altered floral composition and structure (Frelich and Lorimer 1985, Alverson et al. 1988, Mladenoff and Stearns 1993, Alverson and Waller 1997, Rooney and Waller 2003, Cohen 2005).

ENVIRONMENT

Environmental Description: *Climate:* Climate is cool-temperate to sub-boreal. *Soil/substrate/hydrology:* The mesic northern forest is found chiefly on coarse-textured ground and end moraines, but also occurs commonly on silty/clayey lakeplains, thin glacial till over bedrock and medium-textured moraines. It also occurs locally on kettle-kame topography, moderately well-drained to well-drained sandy lakeplain and sand dunes. Sandy soils are especially common near the Great Lakes shorelines. Soils are highly variable, from high-nutrient soils developed over limestone to acidic, nutrient-poor glacial outwash soils. Soil moisture regime is most often mesic, but in the northern parts of this macrogroup's range, some pine-hardwood forests develop on more dry-mesic soils, while spruce- and hemlock-dominated stands may occur on somewhat poorly drained sites (Cohen et al. 2014). Southward, in the Appalachians region, this type is increasingly restricted to higher elevations, typically above 1230 m (4000 feet) (Whittaker 1956).

DISTRIBUTION

***Geographic Range:** This macrogroup is found across the north temperate region of eastern North America from Minnesota and the Great Lakes east across to the Acadian region of southern Canada to the Atlantic Provinces and south at increasingly high elevations in the red spruce-fir zones of the Southern Appalachians to North Carolina and eastern Tennessee.
Nations: CA, US
States/Provinces: CT, DE, MA, MD, ME, MI, MN, NB, NC, NH, NS, NY, ON, PA, QC, RI, VA, VT, WI, WV
USFS Ecoregions (2007) [optional]: 211A:CC, 211B:CC, 211C:CC, 211D:CC, 211E:CC, 211Fa:CCC, 211Fb:CCC, 211Fc:CCC, 211G:CC, 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212J:CC, 212K:CC, 212L:CC, 212Ma:CCC, 212N:CC, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC,

212Re:CCC, 212S:CC, 212T:CC, 212X:CC, 212Y:CC, 212Z:CC, 221Aa:CCC, 221Al:CCC, 221B:CC, 221D:CC, 221E:CC, 221F:CC, 222I:CC, 222Ja:CCC, 222Jf:CCC, 222L:CC, 222Ud:CC?, 222Ue:CCC, M211A:CC, M211B:CC, M211C:CC, M211D:CC, M221A:CC, M221B:CC, M221C:CC, M221D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G743	Laurentian-Acadian Hardwood Forest
G741	Laurentian-Acadian Hemlock - White Pine - Hardwood Forest
G048	Laurentian Subboreal Mesic Balsam Fir - Spruce - Hardwood Forest
G744	Northern Appalachian-Acadian Red Spruce - Fir - Hardwood Forest
G632	Central & Southern Appalachian Red Spruce - Fir - Hardwood Forest

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Balsam Fir: 5	Eyre 1980	
<	Dry-mesic northern hardwoods	Curtis 1959	
<	Fir-Birch	Heinselman 1996	
>	Hemlock - White Pine - Northern Hardwoods Region	Braun 1950	While a forest region is not equivalent to a forest group, the characterization of the major types in this region fits the group (G743) concept. Also see Nichols (1935) for an earlier treatment on which Braun based some of her descriptions.
<	Hemlock - white pine - northern hardwoods forests	Delcourt and Delcourt 2000	in Barbour and Billings (2000).
<	Mesic Northern Hardwoods	Curtis 1959	
<	Northern forest - mesic	Curtis 1959	
<	Northern hardwood forest	Flaccus 1972	
<	Northern hardwoods	Küchler 1964	
<	Northern hardwoods - fir forest	Küchler 1964	
<	Northern hardwoods - spruce forest	Küchler 1964	

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Red Spruce - Fir Forest Group	Faber-Langendoen and Menard 2006	
<	Spruce - fir forests	Delcourt and Delcourt 2000	in Barbour and Billings (2000).
<	Spruce-Fir Forest	Davis 1966	
>	Spruce-Fir-Cedar Forest	Albert and Comer 2008	
?	Zone 2: Northern hardwood - hemlock - white pine	Westveld 1956	
?	Zone :1 Spruce - fir - northern hardwoods	Westveld 1956	

AUTHORSHIP

***Primary Concept Source [if applicable]:** G.E. Nichols (1935); H.J. Oosting and W.D. Billings (1951)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Gawler, M. Pyne, S. Menard, L.A. Sneddon and D. Faber-Langendoen.

Acknowledgments [optional]: Josh Cohen provided many edits and made available text from his and other Michigan staff publications.

Version Date: 21 May 2015

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G743. Laurentian-Acadian Hardwood Forest

Type Concept Sentence: This group covers wet-mesic to dry-mesic forests around the northern Great Lakes, New England, and adjacent Canada dominated by some combination of northern hardwoods *Acer saccharum, Betula alleghaniensis, Fagus grandifolia, Fraxinus americana, Prunus serotina*, and *Tilia americana*, with presence of conifers, including *Tsuga canadensis* and *Pinus strobus*, or in the eastern part of the range, *Picea rubens*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.7. Laurentian-Acadian Mesic Hardwood - Conifer Forest (M014)

Elcode: G743
***Scientific Name:** *Fagus grandifolia - Acer saccharum - Betula alleghaniensis* Forest Group
***Common (Translated Scientific) Name:** American Beech - Sugar Maple - Yellow Birch Forest Group
***Colloquial Name:** Laurentian-Acadian Hardwood Forest

***Type Concept:** This group covers forests around the northern Great Lakes, New England, and adjacent Canada dominated by some combination of northern hardwoods *Acer saccharum, Betula alleghaniensis, Fagus grandifolia, Fraxinus americana, Prunus serotina*, and *Tilia americana*, with presence of conifers, including *Tsuga canadensis* and *Pinus strobus*, or in the eastern part of the range, *Picea rubens* and minor but frequent *Abies balsamea*. They are characteristic of mesic soils, ranging from dry-mesic to wet-mesic settings. Conifers contain <25% cover, and typically include *Tsuga canadensis* and *Pinus strobus*. Early-successional stages may be dominated by *Abies balsamea, Acer rubrum, Betula papyrifera*, or *Populus tremuloides*, often with *Pinus strobus*. With the exception of *Quercus rubra*, oaks are generally unimportant, and then usually on somewhat drier sites or sites with a relatively recent fire history.

***Diagnostic Characteristics:** Hardwood dominance (>75%), and typically closed-canopy forests in which *Acer saccharum, Betula alleghaniensis, Tilia americana, Fagus grandifolia*, and *Quercus rubra* (if in combination with any of those species) make up the dominant cover, except in successional areas where *Acer rubrum*, other *Betula* spp., and *Populus tremuloides* or *Populus grandidentata* may be dominant. *Pinus strobus* and *Tsuga canadensis* are common associates. Oaks other than *Quercus rubra* are uncommon and, over much of the range, absent. Diagnostic herbs include northern-affinity species such as *Aralia nudicaulis, Maianthemum canadense, Trientalis borealis*, and *Actaea rubra*.

***Classification Comments:** This group overlaps with both hemlock - white pine - northern hardwood stands, but has <25% conifer cover, and with lower-elevation red spruce - northern hardwoods stands. This group occurs across the Laurentian-Acadian region and may occur at higher, colder elevations in the central High Allegheny Plateau region. This group is primarily found in Province 212, Section M211, and Section 211E, and excluded from Section 222I. This group and Appalachian-Allegheny Northern Hardwood - Conifer Forest Group (G742) grade into one another in the High Allegheny Plateau (211F and 211G) of central New York and northern Pennsylvania; the absence of any one of *Betula lenta, Liriodendron tulipifera, Quercus montana*, and other Appalachian tree species (to be determined) are diagnostic. Other diagnostic shrub and herb species need to be identified. In that region of overlap, this group may be restricted to colder, higher elevations. In Atlantic Canada, the most thermophilic deciduous forests (only found in continentally warm, nutrient-rich areas of western New Brunswick) will be placed here. These forests are characterized by *Acer saccharum, Fraxinus americana*, and *Fraxinus pennsylvanica* with scattered *Tilia americana* and *Juglans cinerea*. Understory species include *Adiantum pedatum, Arisaema triphyllum, Asarum canadense, Cardamine maxima, Carex plantaginea, Caulophyllum thalictroides, Dryopteris goldieana, Erythronium americanum, Sanguinaria canadensis, Trillium erectum*, among others (S. Basquill pers. comm. 2015).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G742	Appalachian-Allegheny Northern Hardwood - Conifer Forest	grades into this group in the High Allegheny Plateau.
G741	Laurentian-Acadian Hemlock - White Pine - Hardwood Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Mostly closed-canopy forests with variable understory, shrub, and herb layers.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Canopies are characterized by any mixture of *Acer saccharum, Betula alleghaniensis, Fagus grandifolia, Fraxinus americana, Prunus serotina*, and *Tilia americana*, with occasional presence of *Tsuga canadensis*, and *Pinus strobus* (but conifers are <25% cover). *Acer rubrum, Betula papyrifera*, and *Populus tremuloides* may also be prominent components, especially following disturbance; *Prunus serotina* is important in some parts of the range, and *Picea rubens* may be a common associate, though not dominant, east of the Great Lakes. *Fraxinus nigra* can be common in wetter sites in the western half of the group's range. *Quercus rubra* is a frequent associate in drier or more nutrient-poor settings. Understory abundance and composition vary: typical woody species, where the understory is developed, include *Acer pensylvanicum, Rhododendron* spp., *Viburnum acerifolium*, and *Hamamelis virginiana*. Common species in the herb layer include *Aralia nudicaulis, Athyrium filix-femina, Gaultheria procumbens, Huperzia lucidula (= Lycopodium lucidulum), Lycopodium obscurum, Maianthemum canadense, Medeola virginiana, Polystichum acrostichoides, Streptopus lanceolatus (= Streptopus roseus), Trientalis borealis, Uvularia sessilifolia*, and, in areas with a limestone or other more calcareous substrate, *Adiantum pedatum, Caulophyllum thalictroides*, and *Deparia acrostichoides (= Athyrium thelypterioides)*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: These forests may be very long-lived in the absence of human disturbance. Fire is not an important factor, although it has been shown to occur at long return intervals in the presettlement landscape. Gap-phase replacement is the typical means of regeneration.

ENVIRONMENT

Environmental Description: Mesic sites in various landscape settings, usually not both dry and highly exposed. These forests tend to occupy a larger proportion of the landscape northward, especially north of the glacial boundary. *Climate:* Cool temperate to sub-boreal, but drier in the western edge of its range, where it may be more prone to fire. *Soil/substrate/hydrology:* Highly variable, from high-nutrient soils developed over alkaline, nutrient-rich soils to acidic, nutrient-poor soils developed over glacial till. Soil moisture regime is generally mesic, but ranges from dry-mesic to wet-mesic.

DISTRIBUTION

***Geographic Range:** Across the north temperate region of eastern North America from Minnesota and the Great Lakes east across southern Canada to the Atlantic Provinces and south to upstate New York and lower New England.
Nations: CA, US
States/Provinces: CT, MA, ME, MI, MN, NB, NH, NS, NY, ON, PA?, QC, VT, WI
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3224	*Acer saccharum - Fagus grandifolia - Betula alleghaniensis* Forest Alliance
A3225	*Betula papyrifera - Populus tremuloides - Acer rubrum* Forest Alliance
A3241	*Quercus rubra - Acer saccharum* Forest Alliance

Elcode	Scientific or Colloquial Name
A3240	*Acer saccharum - Tilia americana - Fraxinus americana* Forest Alliance
A3297	*Acer saccharum - Tilia americana* Limestone Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-12-13	G163 Fagus grandifolia - Betula alleghaniensis - Tsuga canadensis - Pinus strobus Forest Group	G163 split into G741, G742, G743

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Hemlock - White Pine - Northern Hardwoods Region	Braun 1950	While a forest region is not equivalent to a forest group, the characterization of the major types in this region fits the group concept. Also see Nichols (1935) for an earlier treatment on which Braun based some of her descriptions.
<	Northern Hardwood Forest Formation	Thompson and Sorenson 2000	
<	Northern forest - mesic	Curtis 1959	

AUTHORSHIP

***Primary Concept Source [if applicable]:** G.E. Nichols (1935)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Gawler, M. Pyne, S. Menard, L.A. Sneddon, D. Faber-Langendoen, and J. Drake

Acknowledgments [optional]: O. Loucks

Version Date: 05 May 2015

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G741. Laurentian-Acadian Hemlock - White Pine - Hardwood Forest

Type Concept Sentence: This conifer or mixed conifer-deciduous forest is found from the northeastern United States and maritime Canada to the western Great Lakes area. Stands have at least 25% cover by *Pinus strobus, Thuja occidentalis*, and *Tsuga canadensis* mixed with northern hardwoods such as *Acer saccharum, Betula alleghaniensis*, and *Fagus grandifolia* and are found on neutral to acidic upland soils.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.7. Laurentian-Acadian Mesic Hardwood - Conifer Forest (M014)

Elcode: G741
***Scientific Name:** *Tsuga canadensis - Pinus strobus - Betula alleghaniensis* Forest Group
***Common (Translated Scientific) Name:** Eastern Hemlock - Eastern White Pine - Yellow Birch Forest Group
***Colloquial Name:** Laurentian-Acadian Hemlock - White Pine - Hardwood Forest

***Type Concept:** This cool, moist to dry-mesic forest type ranges from the northeastern United States and maritime Canada west to the Great Lakes and central Wisconsin. Canopy dominants include *Pinus strobus, Thuja occidentalis*, and *Tsuga canadensis* (at least 25% cover), with or without hardwoods, including *Acer saccharum, Fagus grandifolia, Betula alleghaniensis*, and *Quercus rubra* in varying percentages. *Acer rubrum* is also quite common; *Betula lenta* may be common at the southern periphery of this group's range. *Picea rubens* and *Abies balsamea* are <25%. *Quercus velutina* and *Quercus alba* are largely absent from this group, particularly in the northeast, being more representative of groups in the Central Interior-Appalachian division to the south. This is a widespread, matrix forest type for the more temperate portions of this division. Gap replacement and infrequent fire are the major natural regeneration modes. These mesic forests usually occur on low-nutrient soils at low elevations, mostly less than 610 m (2000 feet).

***Diagnostic Characteristics:** Dominance of *Tsuga canadensis* (>25%), with varying mixtures of *Pinus strobus, Thuja occidentalis*, and other northern hardwood species, such as *Betula alleghaniensis, Acer saccharum, Fagus grandifolia*, and *Quercus rubra*, and the absence of any of the Appalachian species, including, *Aesculus flava, Betula lenta, Liriodendron tulipifera*, and *Quercus montana*. *Picea glauca, Picea rubens*, and *Abies balsamea* <25%.

***Classification Comments:** *Tsuga canadensis* is one useful tree used to separate this group from Laurentian-Acadian Pine - Oak Forest & Woodland Group (G025), although a suite of other mesic trees, herbs and shrubs could also be listed. Hemlock draws in USFS Section 222L (Baraboo) is considered an outlier of this group rather than an inclusion in the hardwood matrix, as they are very distinctive from the surrounding forest and have the northern representative flora. In the east, northern hardwoods such as *Betula alleghaniensis, Acer rubrum*, and *Fagus grandifolia* are common. This group and Appalachian-Allegheny Northern Hardwood - Conifer Forest Group (G742) grade into one another in the High Allegheny Plateau of central New York and northern Pennsylvania; the absence of any one of *Betula lenta, Liriodendron tulipifera, Quercus montana*, and other Appalachian tree species (to be determined) are diagnostic. The presence of *Picea glauca, Picea rubens*, and *Abies balsamea* are indicative of the Laurentian-Acadian northern hardwoods. Other diagnostic shrub and herb species need to be identified. In that region of overlap, this group may be restricted to colder, higher elevations.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G743	Laurentian-Acadian Hardwood Forest	
G742	Appalachian-Allegheny Northern Hardwood - Conifer Forest	grades into this group in the High Allegheny Plateau.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These forests typically have a moderately closed to dense tree canopy with at least 25% cover by conifers. There may be an open supercanopy of conifers above the main tree canopy, which can be deciduous or mixed conifer-deciduous. The shrub and herbaceous strata are usually sparse to moderate. Dominant shrubs range from tall shrubs (2-4 m) to dwarf-shrubs (<0.5 m).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Canopy dominants include *Pinus strobus, Thuja occidentalis*, and *Tsuga canadensis*, with *Betula alleghaniensis, Acer saccharum, Fagus grandifolia*, and *Quercus rubra* in varying percentages. *Acer rubrum* is also quite common; *Betula lenta* may be common at the southern periphery of this group's range. *Quercus velutina* and *Quercus alba* are essentially absent from this group, being more representative of groups in the Central Interior-Appalachian division to the south. Shrubs usually have sparse to moderate cover. Common shrubs include *Acer pensylvanicum, Acer spicatum*, and *Hamamelis virginiana*, while on sandy sites with shallow soils, ericaceous shrubs are more abundant, including *Gaylussacia baccata, Kalmia angustifolia, Vaccinium angustifolium*, and *Vaccinium myrtilloides*. Herbaceous species typically of northern forests are found in this mesic forest group. *Aralia nudicaulis, Clintonia borealis, Cornus canadensis, Dryopteris carthusiana, Eurybia macrophylla, Gaultheria procumbens, Lycopodium* spp., *Maianthemum canadense, Mitella nuda, Oclemena acuminata, Oryzopsis asperifolia*, and *Trientalis borealis* are typical. The presence of *Picea glauca, Picea rubens*, and *Abies balsamea* is indicative of the Laurentian-Acadian northern hardwoods.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Stand regeneration is usually a process of small canopy gaps formed by strong winds, ice storms, or disease which allows understory trees to grow into the canopy.

ENVIRONMENT

Environmental Description: *Climate:* Cool, moist climate. *Soil/substrate/hydrology:* The mesic to dry-mesic forests usually occur on low-nutrient soils at low elevations, mostly less than 610 m (2000 feet). Stands may occur on deep soil but shallow soil over bedrock, often sandy or gravelly, is not uncommon, either.

DISTRIBUTION

***Geographic Range:** Northern New England and maritime Canada west to the Great Lakes and north-central Wisconsin, extends northward to the sub-boreal region of Canada, and south to the central hardwoods and Central Appalachian region. Stands in the southern and western edges of this group's range are usually found in ravines or cool, mesic north- or east-facing slopes.
Nations: CA, US
States/Provinces: MA, ME, MI, NB, NH, NS, NY, ON, PA?, QC, VT, WI
USFS Ecoregions (2007) [optional]: 211A:CC, 211B:CC, 211C:CC, 211D:CC, 211E:CC, 211Fa:CCC, 211Fb:CCC, 211Fc:CCC, 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212J:CC, 212K:CC, 212L:CC, 212M:CC, 212N:CC, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC, 212S:CC, 212T:CC, 212X:CC, 212Y:CC, 212Z:CC, 221Al:CCC, 222Ja:CCC, 222Jf:CCC, 222L:CC, 222Ud:CC?, 222Ue:CCC, M211A:CC, M211B:CC, M211C:CC, M211D:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A4072	*Tsuga canadensis - Betula alleghaniensis - Acer saccharum* Forest Alliance
A3252	*Thuja occidentalis* Acidic Forest Alliance
A3251	*Pinus strobus - Tsuga canadensis* Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-12-13	G163 Fagus grandifolia - Betula alleghaniensis - Tsuga canadensis - Pinus strobus Forest Group	G163 split into G741, G742, G743

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** L. Sneddon, in Faber-Langendoen et al. (2012)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler, D. Faber-Langendoen, J. Drake

Acknowledgments [optional]: Sean Basquill

Version Date: 05 May 2015

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G048. Laurentian Subboreal Mesic Balsam Fir - Spruce - Hardwood Forest

Type Concept Sentence: This group represents the mesic eastern subboreal forest, ranging from northwestern Ontario to eastern Canada and extending into the U.S. in the northern Great Lakes region, dominated by *Picea glauca, Abies balsamea, Populus tremuloides*, and *Betula papyrifera*, with low abundance of northern hardwoods, such as *Acer saccharum, Betula alleghaniensis*, and *Tilia americana*, and a mix of shrubs, such as *Acer spicatum, Alnus viridis, Corylus cornuta, Diervilla lonicera*, and *Lonicera canadensis*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.7. Laurentian-Acadian Mesic Hardwood - Conifer Forest (M014)

Elcode: G048
***Scientific Name:** *Abies balsamea - Picea glauca - Acer spicatum* Subboreal Forest Group
***Common (Translated Scientific) Name:** Balsam Fir - White Spruce - Mountain Maple Subboreal Forest Group
***Colloquial Name:** Laurentian Subboreal Mesic Balsam Fir - Spruce - Hardwood Forest

***Type Concept:** This group represents the mesic eastern subboreal forest, ranging from northwestern Ontario to eastern Canada's Atlantic provinces and extending into the U.S. in northeastern Minnesota, Isle Royale, and near-coastal areas of Lake Superior shores in northern Wisconsin and Michigan. The low- to moderate-elevation forests are dominated by *Picea glauca* and/or *Abies balsamea*. *Picea mariana* may be present, along with occasional *Pinus banksiana*. Codominant boreal hardwoods include *Populus tremuloides* and *Betula papyrifera*. Northern hardwoods, such as *Acer saccharum* and *Tilia americana* are relatively minor. The shrub and herb layers are variable, decreasing as the percent conifer cover increases. Common shrub species include *Acer spicatum, Alnus viridis, Corylus cornuta, Diervilla lonicera*, and *Lonicera canadensis*. The moss layer ranges from discontinuous to continuous. These upland forests typically occur on loamy soils over bedrock in scoured bedrock uplands and loamy, rocky, or sandy soils on glacial moraines, till plains and outwash plains, and moisture conditions range from well-drained to somewhat poorly drained. Wetter sites may contain *Alnus incana ssp. rugosa, Calamagrostis canadensis*, and *Equisetum* spp. This is the matrix forest type in many parts of its range. This group may include earlier-successional patches, in which *Populus* spp. and *Betula* spp. are dominant or mixed with *Picea* and *Abies*, which will develop into spruce-fir forests. Blowdown with subsequent gap regeneration is the most frequent form of natural disturbance, with large-scale fires important at longer return intervals. Insect infestations, in particular by *Choristoneura fumiferana* (spruce budworm), also can impact this group. In Quebec and in northern New Brunswick, the vegetation type is usually a mixedwood forest with *Abies balsamea* and *Betula alleghaniensis* or *Acer rubrum*. It also occupies the lower shoulders of the boreal plateau in Cape Breton, Nova Scotia.

***Diagnostic Characteristics:** Dominance of either *Picea glauca* (western Laurentian region) or *Abies balsamea* (west and east); at least 20% conifer cover with any combination of *Betula papyrifera* or *Populus* spp. Earlier-successional stages may be dominated by *Betula* spp. or *Populus* spp. in the canopy with *Picea glauca* or *Abies balsamea* as seedlings or saplings. Northern hardwood and conifer species (*Acer rubrum, Acer saccharum, Betula alleghaniensis, Fagus grandifolia, Picea rubens, Tsuga canadensis, Tilia americana, Fraxinus americana, Populus grandidentata*) at least 10%, but never exceeding 50% relative dominance over the boreal hardwoods or conifers listed above. Additional diagnostic shrub and herb species should be added as they are identified.

***Classification Comments:** The transition zone from the Boreal Forest formation (where *Abies balsamea* is the dominant tree species) to the Cool Temperate Forest (where *Acer saccharum* is the dominant tree species) is difficult to untangle, but depends on the increasing abundance of northern hardwood tree species and more cool-temperate shrubs and herbs. Where these species occur with the boreal conifers, they are placed in 1.B.2 Cool Temperate Forest & Woodland Formation (F008). Forest associations typical of this transition zone are mixedwood associations dominated by *Betula alleghaniensis* or *Acer rubrum* and *Abies balsamea* or *Acer rubrum* and *Abies balsamea*. These associations are also currently placed in Cool Temperate Forest. In Quebec (C. Morneau pers. comm. 2009), the most northerly cool temperate transition zone extends between 47°N latitude and 49°N latitude, including Bas-St. Laurent and Gaspésie regions. The altitudinal toposequence in New Brunswick and the boreal plateau in Cape Breton is subalpine krummholz/woodland -- boreal *Abies balsamea* (*Picea glauca*) -- *Abies balsamea-Betula alleghaniensis* -- northern hardwoods (Sean Basquill pers. comm. 2015).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G632	Central & Southern Appalachian Red Spruce - Fir - Hardwood Forest	
G744	Northern Appalachian-Acadian Red Spruce - Fir - Hardwood Forest	

Elcode	Scientific or Colloquial Name	Note
G674	Atlantic Boreal Moist Balsam Fir - White Spruce Forest	
G638	Ontario-Québec Boreal Mesic Balsam Fir - Hardwood Forest	

Similar NVC Types General Comments [optional]: This group is subboreal, occurring north and west of the range of *Picea rubens*.

VEGETATION

Physiognomy and Structure Summary: These forests are mostly closed-canopy but may have patchy openings due to gap dynamics. Herbs are well-distributed but variable in the amount of cover depending on latitude and soil moisture. Moss cover is moderate to high.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: In the western Laurentian region, *Picea glauca* typically dominates on dry-mesic sites or is codominant with *Abies balsamea* on more mesic sites. In some mesic to wet-mesic examples, *Abies balsamea* dominates. Eastward the type is more often dominated by *Abies balsamea* and *Betula alleghaniensis* on richer sites, sometimes initiated by blow-down and mineral soil exposure, or stands are formed by heavy moose browsing. This group includes several successional stages, including earlier-successional patches in which *Populus* spp. and *Betula* spp. are dominant. Mid-successional stands often contain stands mixed with *Picea* and *Abies* that will develop into spruce-fir forests. The shrub and herb layers are variable, decreasing as the percent conifer cover increases. Common shrub species include *Acer spicatum, Corylus cornuta, Diervilla lonicera*, and *Lonicera canadensis*. The composition and density of the herbaceous layer can vary among associations and location. Typically, *Aralia nudicaulis, Eurybia macrophylla, Clintonia borealis*, and *Maianthemum canadense* are common understory species. The moss layer ranges from discontinuous to continuous. Wetter sites may contain *Alnus incana ssp. rugosa, Calamagrostis canadensis*, and *Equisetum* spp. Additional diagnostic shrub and herb species of this subboreal type will be added through further analyses.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: These forests are affected by windthrow, insect defoliation, and infrequent fires. Forests closer to the Great Lakes shorelines occur on shallower soils and are more likely to experience more serious windthrow and snap-off of larger trees. Mammalian herbivory also can impact forest stands. Selective herbivory by white-tailed deer and moose (*Alces americanus*) can alter the composition and structure and favor browse-tolerant species such as *Picea glauca*. These forests typically regenerate from gap-phase dynamics.

ENVIRONMENT

Environmental Description: These upland forests typically occur on loamy soils over bedrock in scoured bedrock uplands and loamy, rocky, or sandy soils on glacial moraines, till plains and outwash plains (Minnesota DNR 2003). Moisture conditions range from well-drained to somewhat poorly drained. Climate typically is characterized by cool, even temperatures, shorter growing season, and deep and sometimes severe winter snowfall. In the southern part of their range in the Great Lakes states, they occur along northern Great Lakes shorelines and on islands in Lake Superior. *Climate:* Cold temperate to boreal. *Soil/substrate/hydrology:* Soils are typically neutral to acidic, shallow sandy, sandy-loam, or loamy-sand. Some examples occur on heavier, mesic silty or clay loams that are more alkaline in nature. Along Great Lakes shorelines, these soils overlay limestone or volcanic bedrock.

DISTRIBUTION

***Geographic Range:** This group ranges in Canada from northwestern Ontario (possibly eastern Manitoba) to eastern Canada's Atlantic provinces and extending into the U.S. in northeastern Minnesota, Isle Royale, and near-coastal areas of Lake Superior shores in northern Wisconsin and Michigan. Its range westward is marked by a shift towards greater *Picea glauca* dominance and lower *Abies balsamea* dominance.
Nations: CA, US
States/Provinces: LB, MB?, MI, MN, NB?, NF, NS, ON, QC, WI

USFS Ecoregions (2007) [optional]: 212Kb:CCC, 212La:CCC, 212Lb:CCC, 212Lc:CCC, 212Ld:CCC, 212Le:CCC, 212Ra:CCC, 212Rd:CC?, 212Sb:CCC, 212Sc:CC?, 212Sn:CC?, 212Sq:CC?, 212Ya:CCC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3267	*Abies balsamea - Betula alleghaniensis - Populus tremuloides* Subboreal Forest Alliance
A3845	*Thuja occidentalis - Abies balsamea* Subboreal Forest Alliance
A3844	*Populus tremuloides - Betula papyrifera* Subboreal Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-02-18	G630 Hemi-Boreal Moist Fir - Northern Hardwood Forest Group [Provisional]	G630 subsumed into G629 (DFL 7-23-12); subsequently G629 merged into G048
2014-02-18	G629 Abies balsamea - Betula alleghaniensis - Populus tremuloides Sub-Boreal Forest Group	G629 merged into G048

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Balsam Fir: 5	Eyre 1980	
>	Boreal Forest	Curtis 1959	The bulk of Curtis's concept fits well with this type, but he also included stands further inland in Wisconsin, that appear to contain a large abundance of northern hardwoods.
>	Boreal Forest	Kost et al. 2007	
>	Boreal Forest	Wisconsin DNR 2009a	
<	Fir-Birch	Heinselman 1996	
<	White Spruce: 201	Eyre 1980	

AUTHORSHIP

***Primary Concept Source [if applicable]:** F.H. Eyre (1980)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** D. Faber-Langendoen
Acknowledgments [optional]: Ken Baldwin, Peter Uhlig, Claude Morneau, Sean Basquill, Mélanie Major
Version Date: 21 May 2015

REFERENCES

***References [Required if used in text]:**

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G744. Northern Appalachian-Acadian Red Spruce - Fir - Hardwood Forest

Type Concept Sentence: The vegetation is composed of red spruce-fir-hardwood forests and woodlands of northeastern North America where *Picea rubens* is generally dominant, and *Abies balsamea, Betula papyrifera, Betula alleghaniensis*, or *Populus* spp. are codominants, with characteristic shrubs including *Vaccinium angustifolium* and/or *Vaccinium myrtilloides, Viburnum lantanoides*, and *Viburnum nudum var. cassinoides*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.7. Laurentian-Acadian Mesic Hardwood - Conifer Forest (M014)

Elcode: G744
***Scientific Name:** *Picea rubens - Abies balsamea - Betula papyrifera* Forest Group
***Common (Translated Scientific) Name:** Red Spruce - Balsam Fir - Paper Birch Forest Group
***Colloquial Name:** Northern Appalachian-Acadian Red Spruce - Fir - Hardwood Forest

***Type Concept:** The vegetation comprises spruce-fir-hardwood forests and woodlands of northeastern North America within the range of *Picea rubens*, from the Acadian forests of southeastern Canada across northern New England and the Adirondacks and adjacent areas of New York and western Pennsylvania. Sites of this group occur in cool, mostly mesic settings on various glaciated landforms. Substrate geology also varies, although soils are generally acidic. They form the forest matrix in the coolest parts of this region, and they occur from sea level to treeline (below about 1370 m [4500 feet]). *Picea rubens* is generally present and often dominant. Following heavy disturbance from fire or timber harvesting, the canopy may be dominated by *Abies balsamea, Betula papyrifera*, or *Populus* spp. Typical canopy associates include *Betula alleghaniensis, Betula papyrifera, Thuja occidentalis*, and *Acer rubrum*. On less exposed sites in the southern part of this group's range, *Tsuga canadensis* may be an important canopy associate. Characteristic shrubs include *Vaccinium angustifolium* and/or *Vaccinium myrtilloides, Viburnum lantanoides*, and *Viburnum nudum var. cassinoides*. Characteristic herbs include *Clintonia borealis, Cornus canadensis, Mitchella repens, Oxalis montana, Trientalis borealis*, and *Trillium undulatum*. Ferns include *Dryopteris campyloptera, Dryopteris carthusiana*, and *Dryopteris intermedia*, among others. The bryophyte layer is generally very well-developed, characterized by *Bazzania trilobata, Pleurozium schreberi, Dicranum* spp., and many others. Moist sites may support *Sphagnum* spp. Mosses and liverworts grow densely on fallen logs, tree trunks, and the forest floor, giving these forests a distinctive carpeted appearance.

***Diagnostic Characteristics:** Dominance of *Picea rubens*; or presence of *Picea rubens* with dominance of other (native) *Picea* spp. (especially *Picea glauca*) or *Abies balsamea* or at least 50% conifer cover with at least 20% *Picea* spp. or *Abies balsamea* and with any combination of the moderately diagnostic species *Betula alleghaniensis, Betula papyrifera, Pinus strobus*, or *Thuja occidentalis*.

***Classification Comments:** Forests characterized by *Picea rubens* occupy a regional transition between eastern North America's cool temperate deciduous forest and southern parts of the eastern boreal forest. True boreal forests may also have *Abies balsamea*, but are characterized by *Picea mariana* or *Picea glauca* rather than *Picea rubens*. In turn *Picea rubens* often shares codominance with "northern hardwood" species such as *Betula alleghaniensis*. Older publications (e.g., Oosting and Billings 1951), and quite a few current publications directed at an amateur audience, refer to the red spruce - fir forests in the eastern United States as "boreal forest." Peinado et al. (1998) treat the *Picea rubens - Abies balsamea* stands as part of the eastern boreal (subalpine) but note that most of the plants also occur in the deciduous temperate forests of the eastern United States. Chapters in Barbour and Billings (2000) treat the red spruce - fir within the eastern deciduous forest region rather than boreal, following the treatment of Braun (1950). Here we place all stands with *Picea rubens* with other cool-temperate types. We restrict the term "boreal" to North American forests within Bailey's (1997) subarctic "Tayga (boreal forest)" ecoregion, and will continue to review this issue with Canadian partners. Sites with a history of fire may support a canopy of early-successional hardwoods (*Acer rubrum, Betula papyrifera*, and/ or *Populus* spp.), but even in these stands spruce and fir are typically dominant in the understory. In Atlantic Canada, high-elevation/coastal fir - red spruce stands (with minor red spruce) may be classified as part of Laurentian Subboreal Mesic Balsam Fir - Spruce - Hardwood Forest Group (G048). Seral pathways are an important consideration (S. Basquill pers. comm. 2015).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G632	Central & Southern Appalachian Red Spruce - Fir - Hardwood Forest	occurs in the Central and Southern Appalachian region.
G048	Laurentian Subboreal Mesic Balsam Fir - Spruce - Hardwood Forest	extends across the eastern boreal region of North America and into the upper Midwest Great Lakes states, especially Minnesota; it occurs north and west of the range of red spruce.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These forests are mostly closed-canopy but may have patchy and extensive openings, particularly in the aftermath of a spruce budworm (*Choristoneura fumiferana*) outbreak; forests on rocky substrates or more extreme sites have an open or stunted canopy. Shrub layers are patchy. Herbs are well-distributed but variable in the amount of cover, tending to be more extensive on mesic sites. In some areas, standing dead stems of *Abies balsamea* (depending on the location) are common, with extensive patches of *Abies* seedlings in canopy gaps.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Picea rubens* is generally present and often dominant, but the canopy may be dominated by *Abies balsamea*, particularly at higher elevations or on recently disturbed sites. Typical canopy associates include *Betula alleghaniensis* and *Betula papyrifera*. On less exposed sites, *Tsuga canadensis* may be an important canopy associate. Characteristic shrubs include *Vaccinium angustifolium* and/or *Vaccinium myrtilloides, Viburnum lantanoides*, and *Viburnum nudum var. cassinoides*. Characteristic herbs include *Clintonia borealis, Cornus canadensis, Mitchella repens, Oxalis montana, Trientalis borealis*, and *Trillium undulatum*. Ferns include *Dryopteris campyloptera, Dryopteris carthusiana*, and *Dryopteris intermedia*, among others. The bryophyte layer is generally very well-developed, characterized by *Bazzania trilobata, Pleurozium schreberi, Dicranum* spp., and many others. Mosses and liverworts grow densely on fallen logs, tree trunks, and the forest floor, giving these forests a distinctive carpeted appearance.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: These forests are affected by wind disturbance, debris avalanches, ice loading, insect outbreaks, and lightning-ignited fire. Periodic outbreaks of spruce budworm (*Choristoneura fumiferana*), which preferentially feeds on *Abies balsamea*, can convert large patches (hundreds to thousands of acres) into early-successional stands dominated by mixed conifers. Where soils are shallow, as they typically are, these forests are susceptible to large blowdowns. Across the range of the group, gap replacement is the most common pattern for canopy regeneration.

ENVIRONMENT

Environmental Description: Sites present a mesic character due to soil conditions, a landscape setting that leads to a cool, moist microclimate (cold-air drainage accumulation, frequent fog, etc.), or both. Sites occur across the spectrum from the immediate coastline to over 1000 m in elevation. *Climate:* Cool-temperate to sub-boreal. *Soil/substrate/hydrology:* Soils are generally shallow and rocky, with well-developed humus and A horizons. They are low in base saturation, relatively high in organic matter, and are acidic in reaction (pH 3-5). Spodosols and Inceptisols.

DISTRIBUTION

***Geographic Range:** Southeastern Ontario and southern Quebec east to the Atlantic, and south across western Pennsylvania, northern New York, and New England.
Nations: CA, US
States/Provinces: MA, ME, NB, NH, NS, NY, ON, PA, QC, VT
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: Many FIA plots, which held together as a group; much documentation in the literature.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3314	*Picea rubens / Vaccinium angustifolium* Northern Rocky Woodland Alliance
A0150	*Picea rubens - Abies balsamea* Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-12-20	G024 Picea rubens - Abies fraseri - Betula alleghaniensis Forest Group	G024 split into G744 and G632

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Red Spruce - Fir Forest Group	Faber-Langendoen and Menard 2006	

Relationship to NVC	Supporting Concept Name	Short Citation	Note
><	Spruce - Fir - Northern Hardwood Forest Formation	Thompson and Sorenson 2000	
<	Spruce-Fir Forest	Davis 1966	

AUTHORSHIP

***Primary Concept Source [if applicable]:** H.J. Oosting and W.D. Billings (1951)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler and D. Faber-Langendoen

Acknowledgments [optional]: Andy Cutko and Sean Basquill

Version Date: 05 May 2015

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1. Forest & Woodland
1.B.2.Na. Eastern North American Forest & Woodland

G632. Central & Southern Appalachian Red Spruce - Fir - Hardwood Forest

Type Concept Sentence: These are upland spruce-fir and spruce-fir-hardwood forests of eastern North America that occur in cool mesic settings at the highest elevations (often above 1370 m [4500 feet]), dominated by *Picea rubens* and/or *Abies fraseri*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Na.7. Laurentian-Acadian Mesic Hardwood - Conifer Forest (M014)

Elcode: G632
***Scientific Name:** *Picea rubens - Abies fraseri - Betula alleghaniensis* Forest Group
***Common (Translated Scientific) Name:** Red Spruce - Fraser Fir - Yellow Birch Forest Group
***Colloquial Name:** Central & Southern Appalachian Red Spruce - Fir - Hardwood Forest

***Type Concept:** These are upland spruce-fir forests and woodlands, or spruce-fir-hardwood forests of eastern North America. They are found within the range of *Picea rubens*, at progressively higher elevations from the Central to the Southern Appalachians. They occur in cool, mostly mesic settings on ridgetops and steep slopes with thin soils. Substrate geology also varies, although soils are generally acidic. At their southern extent, these forests occur only at the highest elevations (above 1370 m [4500 feet]). *Picea rubens* is generally present, and often dominant, but the canopy may be dominated by *Abies fraseri*. Typical canopy associates include *Betula alleghaniensis* and *Tsuga canadensis*. The density and composition of shrub and herbaceous strata vary with association and geographic location. Characteristic shrubs include *Acer spicatum, Rhododendron catawbiense, Rhododendron maximum, Vaccinium erythrocarpum*, and *Viburnum lantanoides*. Characteristic herbs rangewide include *Clintonia borealis, Dryopteris campyloptera, Mitchella repens, Oxalis montana*, and *Trillium undulatum*. The bryophyte layer is generally very well-developed, characterized by

Bazzania trilobata, Dicranum spp., *Pleurozium schreberi*, and many others. Mosses, liverworts, and lichens grow densely on fallen logs, tree trunks, and the forest floor, giving these forests a distinctive carpeted appearance.

***Diagnostic Characteristics:** Dominance of *Picea rubens*; or presence of *Picea rubens* with dominance of *Abies fraseri*; or dominance of *Abies fraseri*; and with any combination of the moderately diagnostic species *Betula alleghaniensis* or *Tsuga canadensis*. Characteristic shrubs include *Acer spicatum, Rhododendron catawbiense, Rhododendron maximum, Vaccinium erythrocarpum*, and *Viburnum lantanoides*. Characteristic herbs rangewide include *Clintonia borealis, Dryopteris campyloptera, Mitchella repens, Oxalis montana*, and *Trillium undulatum*. These shrub and herb species are not necessarily restricted to this habitat, and additional diagnostic shrub and herb species may need to be added.

***Classification Comments:** Forests characterized by *Picea rubens* occupy a regional transition between eastern North America's cool temperate deciduous forest and southern parts of the eastern boreal forest. True boreal forests may also have *Abies balsamea* but are characterized by *Picea mariana* or *Picea glauca* rather than *Picea rubens*. In turn *Picea rubens* often shares codominance with *Tsuga canadensis* or "northern hardwood" species such as *Betula alleghaniensis*. Older publications (e.g., Oosting and Billings 1951), and quite a few current publications directed at a general audience, refer to the red spruce - fir forests in the eastern United States as "boreal forest." Peinado et al. (1998) treat the montane *Picea rubens - Abies balsamea* stands as part of the eastern boreal (subalpine) but place the *Picea rubens - Abies balsamea* stands at lower elevations in the cool temperate with northern hardwoods types. Chapters in Barbour and Billings (2000) treat the red spruce - fir within the eastern deciduous forest region rather than boreal (following the treatment of Braun (1950)). Here we place all stands with *Picea rubens* with other cool temperate types. We restrict the term "boreal" to North American forests within Bailey's (1997) subarctic "Tayga (boreal forest)" ecoregion, and will continue to review this issue with Canadian partners.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G048	Laurentian Subboreal Mesic Balsam Fir - Spruce - Hardwood Forest	extends across the eastern boreal region of North America and into the upper Midwest Great Lakes states, especially Minnesota; it occurs north and west of the range of red spruce.
G744	Northern Appalachian-Acadian Red Spruce - Fir - Hardwood Forest	grades to this group northward and is dominated by *Picea rubens* and *Abies balsamea* (not *Abies fraseri*), forms large-patch to matrix forests in the Northern Appalachians, and does not contain a number of Southern Appalachian shrub and herb species.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These forests are mostly closed-canopy but may have patchy openings; forests on rocky substrates, more extreme sites, or disturbed by the balsam woolly adelgid (*Adelges piceae*) may have an open or stunted canopy. Shrub layers are patchy. Herbs are well-distributed but variable in the amount of cover, tending to be more extensive on more mesic sites. In some areas, standing dead stems of *Abies fraseri* (depending on the location) are common, with extensive patches of *Abies* seedlings in canopy gaps.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Picea rubens* is generally present, and often dominant, but the canopy may be dominated by *Abies fraseri*. Typical canopy associates include *Betula alleghaniensis* and *Sorbus americana*. The density and composition of shrub and herbaceous strata vary with association and geographic location. Characteristic shrubs include *Acer spicatum, Rhododendron catawbiense, Rhododendron maximum, Vaccinium erythrocarpum*, and *Viburnum lantanoides*. Characteristic herbs rangewide include *Clintonia borealis, Dryopteris campyloptera, Mitchella repens, Oxalis montana*, and *Trillium undulatum*. The bryophyte layer is generally very well-developed, characterized by *Bazzania trilobata, Dicranum* spp., *Pleurozium schreberi*, and many others. Mosses, liverworts, and lichens grow densely on fallen logs, tree trunks, and the forest floor, giving these forests a distinctive carpeted appearance.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: These forests are affected by wind disturbance, debris avalanches, ice loading, insect outbreaks, and lightning-ignited fire. Where soils are shallow, as they typically are, these forests are susceptible to large blowdowns. *Abies fraseri* has experienced large patchy dieback exacerbated by the balsam woolly adelgid (*Adelges piceae*). Across the range of the group, gap replacement is the most common pattern for canopy regeneration.

ENVIRONMENT

Environmental Description: Sites present a mesic character due to soil conditions, a landscape setting that leads to a cool, moist microclimate (cold-air drainage accumulation, frequent fog, etc.), or both. *Climate:* Cool temperate to sub-boreal. *Soil/substrate/hydrology:* Soils are generally shallow and rocky, with well-developed organic and A horizons. They are low in base saturation, relatively high in organic matter, and are acidic in reaction (pH 3-5). Spodosols and Inceptisols.

DISTRIBUTION

***Geographic Range:** This vegetation is restricted to a handful of higher-elevation sites in West Virginia, Virginia, western North Carolina, and eastern Tennessee.
Nations: US
States/Provinces: NC, TN, VA, WV
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0138	*Picea rubens - Betula alleghaniensis - Aesculus flava* Forest Alliance
A0136	*Picea rubens - Abies fraseri* Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-07-23	G024 Picea rubens - Abies fraseri - Betula alleghaniensis Forest Group	G024 split into G744 and G632

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Red Spruce - Fir Forest Group	Faber-Langendoen and Menard 2006	

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen, in Faber-Langendoen et al. (2012)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** D. Faber-Langendoen, M. Pyne, A. Cutko

Acknowledgments [optional]: A. Cutko

Version Date: 04 May 2015

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1.B.2.Ne. North American Great Plains Forest & Woodland

This division contains aspen, oak and mixed hardwood woodlands dominated by *Quercus macrocarpa, Populus tremuloides*, or *Betula papyrifera*, often with an understory dominated by prairie shrubs, grasses and forbs that are more tolerant of shade. It is found throughout the northern Great Plains, from central Kansas to the Canadian aspen parkland region.

1. Forest & Woodland
1.B.2.Ne. North American Great Plains Forest & Woodland

M151. Great Plains Forest & Woodland

Type Concept Sentence: This macrogroup contains aspen, oak, and mixed hardwood woodlands dominated by *Quercus macrocarpa, Populus tremuloides*, or *Betula papyrifera*, often with an understory dominated by prairie shrubs, grasses and forbs that are more tolerant of shade. It is found throughout northern Great Plains, from central Kansas to the Canadian aspen parkland region.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.2.Ne.1. North American Great Plains Forest & Woodland (D326)

Elcode: M151
***Scientific Name:** *Quercus macrocarpa - Populus tremuloides / Pascopyrum smithii* Forest & Woodland Macrogroup
***Common (Translated Scientific) Name:** Bur Oak - Quaking Aspen / Western Wheatgrass Forest Woodland Macrogroup
***Colloquial Name:** Great Plains Forest & Woodland

***Type Concept:** This macrogroup consists of aspen, oak and mixed hardwood woodlands found throughout much of the Great Plains, from central Kansas to the Canadian aspen parkland region. Deciduous trees dominate most stands. Trees are typically short to medium in height, and the canopy can vary from open to closed (10-100%). *Quercus macrocarpa* is common across much of eastern part of the range; *Populus tremuloides* and *Betula papyrifera* are most abundant northward, and scattered in the southern parts. *Fraxinus pennsylvanica* and *Ulmus americana* are abundant in ravines and draws in the central and southern parts of the range. The shrub stratum can be nearly absent but is typically moderate to dense. *Amelanchier alnifolia, Corylus* spp., *Elaeagnus commutata, Prunus americana, Prunus virginiana, Ribes* spp. (including *Ribes oxyacanthoides*), *Rosa* spp. (including *Rosa arkansana, Rosa woodsii*), *Salix* spp., *Shepherdia argentea, Symphoricarpos albus, Symphoricarpos occidentalis*, and small trees are common. The understory is typically dominated by shrubs, grasses and sedges more tolerant of shade, but may also be common in the surrounding prairies. Among these are *Andropogon gerardii, Calamagrostis canadensis, Festuca* spp., *Pascopyrum smithii, Sorghastrum nutans*, and *Sporobolus heterolepis*. Most stands occur on the landscape where water accumulates and where there is some protection from fire, i.e., in ravines, near rivers or ponds, or on mesic slopes. Northward, where the woodlands approach the boreal forests, trees are more common and this type is more widespread on the landscape. Stands occur on a variety of soils, though fine-textured soils are more common. Fire, drought, and grazing are important drivers of the system.

***Diagnostic Characteristics:** This macrogroup is distinguished from the grasslands adjacent to it across much of its range by having >10% tree cover. Trees are almost entirely broadleaf deciduous, dominated by *Quercus macrocarpa, Populus tremuloides*, and *Betula papyrifera*, rarely any other species. Absence of almost any other tree species is a diagnostic feature of this division. Ground layer varies from grass-dominated (mixed or tallgrass species) in more open and fire-maintained sites to shrub- and forb-dominated in more closely canopy sites.

***Classification Comments:** Where the northwestern Great Plains transition to mountains, this macrogroup may appear similar to early-successional stands of Rocky Mountain macrogroups at the lowest montane elevations where those occur. See classification comments at the division level (1.B.2.Ne North American Great Plains Forest & Woodland Division (D326)), many of which apply to this macrogroup. It's possible that Great Plains *Pinus ponderosa* types could be added to this macrogroup.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M028	Great Plains Flooded & Swamp Forest	can have a similar canopy composition to G145, especially. M028 is found on floodplains of perennial rivers and streams, while M151 is in dry ravines or hillsides.
M029	Central Hardwood Floodplain Forest	can have a similar composition to G145, especially. M029 is found on floodplains of perennial rivers and streams while M151 is in dry ravines or hillsides.
M051	Great Plains Mixedgrass & Fescue Prairie	can have a similar herbaceous and shrub composition but has <25% tree cover.
M054	Central Lowlands Tallgrass Prairie	can have a similar herbaceous and shrub composition but has <25% tree cover.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This macrogroup is dominated by deciduous trees, though the tree cover can vary from 10-100%. Trees are short to medium-tall (5-10 m tall). The shrub layer is usually moderate to dense with most shrubs 0.5-2 m tall. The herbaceous layer is also typically moderate to dense and dominated by a mix of graminoids, forbs and shrubs.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Quercus macrocarpa* is dominant in the eastern part of the range; *Populus tremuloides* and *Betula papyrifera* are abundant northward, especially in the aspen parkland regions, and more scattered in the southern parts. *Fraxinus pennsylvanica* and *Ulmus americana* are abundant in ravines and draws. Trees that can be locally common or abundant include *Juniperus scopulorum* in the western Great Plains, *Populus balsamifera* in the far northern Great Plains, and *Tilia americana* and *Juniperus virginiana* in the eastern Great Plains. The shrub stratum can be nearly absent but is typically moderate to dense. *Amelanchier alnifolia, Corylus* spp., *Elaeagnus commutata, Prunus americana, Prunus virginiana, Rosa* spp. (including *Rosa acicularis, Rosa arkansana, Rosa blanda, Rosa woodsii*), *Salix* spp., *Shepherdia argentea, Symphoricarpos albus, Symphoricarpos occidentalis*, and small trees are common. *Crataegus* spp., *Juniperus horizontalis*, and *Cornus sericea* can be locally common. The understory is typically dominated by low shrubs, grasses, sedges or forbs, some of which may be common in the surrounding prairies, particularly if woodlands are allowed to burn under natural fire regimes. Common grasses found in more open, fire-maintained stands include *Andropogon gerardii, Calamagrostis canadensis, Festuca* spp. (including *Festuca altaica*), *Pascopyrum smithii, Sorghastrum nutans*, and *Sporobolus heterolepis*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: This type occurs in a landscape where fire was historically common, in combination with periodic droughts. Fire restricts this type within much of its range, limiting the trees to protected places on the landscape. Fire was used by aboriginal peoples for maintaining open grassland. A reduction in fire frequency typically allows this woodland type to spread into surrounding prairies, though it also allows the tree canopy of established stands to close with a reduction in the prairie flora in the understory. In the northeastern Great Plains, conditions are more favorable for tree growth and fire is necessary to maintain this type. A significant reduction in fire frequency allows the woodlands to succeed to forests and the prairie plants are replaced by a forest understory.

Periodic drought and grazing also help maintain the open canopy of this type with intense grazing by bison, elk, and other grazers to limit woody regeneration. The combination of natural fire regimes and grazing pressures, especially in the northern part of the range, contributed to a dynamic natural landscape tension between parkland and prairie, with trees advancing in times of greater moisture and/or less grazing. Native wildlife (e.g., buffalo wallows) also created areas of exposed mineral soil that acted as seed beds for aspen, willow, etc. seedling establishment (Bird 1961).

ENVIRONMENT

Environmental Description: Across much of its range, stands occur on landscape positions that receive more water than the surrounding landscape, i.e., in ravines or canyons, near rivers and lakes, and on mesic, typically north-facing slopes. In the aspen parklands of the southern Canadian provinces, Montana, North Dakota and northwestern Minnesota, this type is common on flat or rolling topography. In these areas, the evapotranspiration rate and precipitation are more favorable to tree growth and trees are not as restricted to protected landscape positions. See Zoltai (1975) and Hogg (1994) regarding climatic balance between parkland and boreal forest in Canada. Stands can occur on a variety of soil textures but fine-textured soils are more common. The aspen woodlands in the parkland region are more mesic than stands found in the rest of the Great Plains and wet-mesic or even wet pockets are common.

DISTRIBUTION

***Geographic Range:** This type is found throughout the central and northern Great Plains from Kansas and Colorado north to southeastern Alberta, southern Saskatchewan, southwestern Manitoba, northern North Dakota and northwestern Minnesota. It may occur in Oklahoma.
Nations: CA, US
States/Provinces: AB, CO, IA, KS, MB, MN, MT, ND, NE, OK?, SD, SK, WY
USFS Ecoregions (2007) [optional]: 222N:CC, 251A:CP, 251B:CC, 251H:C?, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:C?, 331K:CC, 331L:CC, 331M:CP, 331N:CC, 332A:CC, 332B:CC, 332C:CC, 332D:CC, 332E:CC, 342F:CC, M331B:??, M331I:??, M334A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G329	Great Plains Bur Oak Forest & Woodland
G145	Great Plains Mesic Forest & Woodland
G146	Northeastern Great Plains Aspen Woodland
G328	Northwestern Great Plains Aspen Woodland

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake, D. Faber-Langendoen and K. Baldwin
Acknowledgments [optional]: Jeff Thorpe, Ken Baldwin, and Lorna Allen
Version Date: 08 Jan 2016

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1. Forest & Woodland
1.B.2.Ne. North American Great Plains Forest & Woodland

G329. Great Plains Bur Oak Forest & Woodland

Type Concept Sentence: This group is dominated by *Quercus macrocarpa* and is found in upland areas in the northern part of the Great Plains.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Ne.1. Great Plains Forest & Woodland (M151)

Elcode: G329
***Scientific Name:** *Quercus macrocarpa - Corylus* spp. / *Carex* spp. Forest & Woodland Group
***Common (Translated Scientific) Name:** Bur Oak - Hazelnut species / Sedge species Forest & Woodland Group
***Colloquial Name:** Great Plains Bur Oak Forest & Woodland

***Type Concept:** This group is dominated by *Quercus macrocarpa* and is found in upland areas in the northern part of the Great Plains. *Quercus muehlenbergii* can be abundant in the southeastern portion of the group's range. Other species, such as *Tilia americana* (not in the Dakotas), *Populus tremuloides, Juniperus virginiana*, and *Fraxinus* spp., may be present. The herbaceous layer can vary from sparsely to moderately vegetated and is composed of prairie grasses or woodland *Carex* spp. Shrub associates can include *Prunus virginiana, Corylus cornuta, Amelanchier alnifolia*, or *Symphoricarpos* spp. Historically, higher cover of grass species occurred as these stands were more open due to more frequent fires. Few good examples of this group likely remain because of past timber harvesting and heavy grazing. Where it occurs at elevations above 915 m (3000 feet), *Pinus ponderosa* woodlands are probably adjacent. It often occurs as small to large patches on buttes, escarpments, and in foothill zones, usually on northerly-facing slopes. It can also occur in ravines and river valleys, though not where flooding is regular. Farther east it can occur on rolling topography, usually in fire-protected areas.

***Diagnostic Characteristics:** This group is characterized by an open to moderately closed forest dominated by *Quercus macrocarpa*. It is found in the Western Great Plains on buttes, escarpments, and in foothill zones, while in the central Great Plains it tends to be in ravines and other low areas on the landscape.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G181	Central Midwest Oak Openings & Barrens	occurs to the east of the range of this group. It can be similar in structure, ranging from very open to slightly closed because of to fire suppression. Unlike G329, which occurs in patches across its range, G181 historically occurred as a matrix type across the eastern tallgrass region of the Great Plains.
G145	Great Plains Mesic Forest & Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is typified by moderately open to moderately closed woodlands. The understory can be sparse to moderately vegetated. Shrub and herbaceous cover vary widely from low to high cover, though high cover by one stratum is usually associated with low cover by the other. Most shrubs are 1-2 m tall and deciduous. The herbaceous stratum is dominated by prairie grasses or woodland sedges.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This group is typified by the predominance of *Quercus macrocarpa* constituting at least 10% of the vegetation cover in any given example. Other tree species, such as *Fraxinus pennsylvanica, Juniperus virginiana, Ostrya virginiana, Populus tremuloides*, and *Tilia americana*, may be also present. Understory vegetation can range from sparsely vegetated to more dense. Common shrubs include *Amelanchier alnifolia, Cornus drummondii, Corylus americana, Corylus cornuta, Prunus virginiana, Ribes* spp., and *Symphoricarpos occidentalis*. The herbaceous layer often exemplifies the surrounding prairie grassland vegetation with species such as *Andropogon gerardii, Elymus canadensis, Hesperostipa spartea, Nassella viridula, Panicum virgatum, Pascopyrum smithii, Sorghastrum nutans*, and *Schizachyrium scoparium*. Species typical of woodlands can be common in some stands, among them *Aralia nudicaulis, Carex pensylvanica, Galium* spp., *Maianthemum canadense, Maianthemum stellatum, Sanicula marilandica*, and *Thalictrum dioicum*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: This group is primarily driven by fire. Fire suppression within this group can lead to more closed canopies and a decrease in the cover of grass species in the understory. Grazing, conversion to agriculture, and past timber harvesting can impact this group. Overgrazing can also lead to a decrease in understory species, and timber harvesting can completely eliminate examples of this group.

ENVIRONMENT

Environmental Description: This group is found in upland areas that are protected from fire; sometimes these areas are also more mesic than the surrounding landscape due to receiving run-off from upslope. Often these are valleys or ravines but they can include hillslopes and escarpments. Sites may be in river or stream valleys but are high enough that they are not flooded except in exceptional years. Soils are predominately dry to mesic and can range from sands to loams.

DISTRIBUTION

***Geographic Range:** This group is found throughout the northern half of the Great Plains from Kansas and northern Missouri north and west to the southern Canadian Prairie Provinces and eastern Montana. In Wyoming, it occurs in the Bear Lodge Mountains and around Devils Tower National Monument. In North Dakota, it is most common in locally rough areas such as the Killdeer Mountains, Turtle Mountains, Pembina Hills, etc., and it may occur in the Pine Ridge region of Nebraska.
Nations: CA, US
States/Provinces: IA, KS, MB, MN, MO, MT, ND, NE, SD, SK, WY
USFS Ecoregions (2007) [optional]: 251B:CC, 251H:C?, 331C:CC, 331E:CC, 331F:CC, 331M:CP, 332B:CC, 332C:CC, 332D:CC, 332E:CC, M334A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A1505	*Quercus macrocarpa* / Mixedgrass Woodland Alliance
A0245	*Quercus macrocarpa* Forest Alliance
A0620	*Quercus macrocarpa / Corylus* spp. / Mixedgrass Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Aspen: 16	Eyre 1980	Rare but possible where it might be adjacent to Aspen Parklands.
<	Aspen: 217	Eyre 1980	
<	Bur Oak: 216	Eyre 1980	
>	Bur Oak: 236	Eyre 1980	
<	Bur Oak: 42	Eyre 1980	

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard and J. Drake

Acknowledgments [optional]:

Version Date: 07 May 2015

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***References [Required if used in text]:**

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Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Girard, M. M., H. Goetz, and A. J. Bjugstad. 1989. Native woodland habitat types of southwestern North Dakota. Research Paper RM-281. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 36 pp.

Tolstead, W. L. 1947. Woodlands in northwestern Nebraska. Ecology 28(2):180-188.

G145. Great Plains Mesic Forest & Woodland

Type Concept Sentence: This group is found in the northern Great Plains and has an open to closed tree canopy dominated by *Betula papyrifera, Fraxinus pennsylvanica, Populus tremuloides, Ulmus americana, Ulmus rubra*, and *Juniperus scopulorum* and sometimes the tall shrubs *Crataegus douglasii* and *Crataegus succulenta*. It is found in valleys, ravines, and mesic slopes.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Ne.1. Great Plains Forest & Woodland (M151)

Elcode: G145
***Scientific Name:** *Fraxinus pennsylvanica - Ulmus americana / Prunus* spp. Forest & Woodland Group
***Common (Translated Scientific) Name:** Green Ash - American Elm / Cherry species Forest & Woodland Group
***Colloquial Name:** Great Plains Mesic Forest & Woodland

***Type Concept:** This group is dominated by trees and/or shrubs in a largely grassland landscape. Cover of woody species is variable and can range from just over 10% to nearly 100%. This group occurs in a semi-arid climate, but sites are more mesic than the surrounding areas. In general, shrubs dominate stands that receive less moisture from surrounding areas (e.g., higher on the landscape, steeper slopes, coarser soil), while sites that receive more moisture are dominated by trees and shrubs. The herbaceous layer is variable but tends to be less prominent under heavier woody canopies with deep litter deposition. Dominant trees include *Betula papyrifera, Fraxinus pennsylvanica, Populus tremuloides, Ulmus americana, Ulmus rubra*, and, in the western Great Plains, *Juniperus scopulorum*. *Quercus macrocarpa* is common but not dominant except in some stands in canyons. Common shrubs are *Amelanchier alnifolia, Cornus sericea, Crataegus douglasii, Crataegus chrysocarpa, Crataegus succulenta, Dasiphora fruticosa ssp. floribunda, Elaeagnus commutata, Juniperus horizontalis, Prunus virginiana, Rhus* spp., *Rosa woodsii, Shepherdia argentea, Symphoricarpos occidentalis*, and *Toxicodendron rydbergii*. Common graminoids can include *Calamagrostis stricta, Carex* spp., *Pascopyrum smithii, Piptatheropsis micrantha, Pseudoroegneria spicata*, or *Schizachyrium scoparium*. *Festuca* spp. can be abundant in the northwestern Great Plains. Typical sites are upper river terraces, protected slopes (often north-facing), ravines, and draws. Stands of this group that occur on upper terraces and toeslopes in riparian areas are rarely flooded but have root access to groundwater. Soils range from shallow to deep and fine to sandy loams.

***Diagnostic Characteristics:** This group occurs in a landscape dominated by grasslands but is distinguished from them by having >25% tree and/or shrub cover. Stands are typically found in more mesic settings than surrounding grasslands but do not occur on regularly inundated or well-developed floodplains.

***Classification Comments:** The northern limit of the distribution of this group is near or overlaps with parts of Northeastern Great Plains Aspen Woodland Group (G146) and Northwestern Great Plains Aspen Woodland Group (G328). *Betula papyrifera* and *Populus tremuloides* can be dominant canopy species in all three groups but this group (G145) is found on slopes or in valleys, tends to have higher tree cover, and has less cover by prairie grasses in the understory.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G146	Northeastern Great Plains Aspen Woodland	
G329	Great Plains Bur Oak Forest & Woodland	
G328	Northwestern Great Plains Aspen Woodland	
G147	Great Plains Cottonwood - Green Ash Floodplain Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is characterized by having more than 10% cover by trees and/or shrubs. Cover of woody species is variable and can range from just over 25% to nearly 100%. In general, shrubs dominate stands that receive less moisture from surrounding areas (e.g., higher on the landscape, steeper slopes, coarser soil), while sites that receive more moisture are dominated by trees and shrubs. The herbaceous layer is variable but tends to be less prominent under heavier woody canopies with a deep litter layer.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This group is dominated by trees and/or shrubs. The herbaceous layer is variable but tends to be less prominent under heavier woody canopies. Dominant trees include *Betula papyrifera, Fraxinus pennsylvanica, Populus tremuloides, Ulmus americana, Ulmus rubra*, and, in the western Great Plains, *Juniperus scopulorum*. *Quercus macrocarpa* is common but not dominant except in some stands in canyons. *Acer negundo* is commonly present in portions of the northwestern Great Plains. Common shrubs are *Amelanchier alnifolia, Cornus sericea, Crataegus douglasii, Crataegus chrysocarpa, Crataegus succulenta, Dasiphora fruticosa ssp. floribunda, Elaeagnus commutata, Juniperus horizontalis, Prunus virginiana, Rhus* spp., *Rosa woodsii, Shepherdia argentea, Symphoricarpos occidentalis*, and *Toxicodendron rydbergii*. Common graminoids can include *Calamagrostis stricta, Carex* spp., *Pascopyrum smithii, Piptatheropsis micrantha (= Piptatherum micranthum), Pseudoroegneria spicata*, or *Schizachyrium scoparium*. *Festuca* spp. can be abundant in the northwestern Great Plains. Forbs, including a number that are more moisture-demanding than those in surrounding grasslands, may be prominent under more shaded conditions.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Fire, grazing, and hydrologic dynamics are the dominant factors affecting this group. It occurs in a landscape dominated by grasslands but is found in sites that have more moisture and less fire frequency than the surrounding grasslands. Even in the more mesic sites where this group occurs (ravines, riparian terraces, protected slopes), a decrease in moisture and/or an increase in fire frequency can result in transformation of the site to another group. Excessive grazing can have significant effects on the herbaceous component of this group, particularly by fostering invasion by exotic species, including *Euphorbia esula, Bromus inermis, Bromus arvensis, Poa pratensis*, and *Bromus tectorum*.

ENVIRONMENT

Environmental Description: This group occurs in a semi-arid climate, but sites are more mesic than the surrounding areas. Typical sites are upper river terraces, protected slopes (often north-facing), ravines, and draws. Stands of this group in riparian areas are rarely flooded but have root access to groundwater. Soils range from shallow to deep and fine to sandy loams.

DISTRIBUTION

***Geographic Range:** This group can be found from southern Saskatchewan, southwestern Manitoba, and possibly southeastern Alberta south through much of the northern Great Plains. It may extend into the lower foothills of the Rocky Mountains and the lower elevations of the Black Hills. It extends eastward to the eastern Dakotas and eastern Nebraska (excluding the Sandhills).
Nations: CA, US
States/Provinces: AB?, CO, MB, MT, ND, NE, SD, SK, WY
USFS Ecoregions (2007) [optional]: 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:C?, 331K:CC, 331L:CC, 331M:CP, 331N:CC, 332A:CC, 332B:CC, 332D:CC, 332E:CC, 342F:CC, M331B:??, M331I:??, M334A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3211	*Fraxinus pennsylvanica - Ulmus americana* Great Plains Forest Alliance
A3210	*Juniperus scopulorum - Juniperus virginiana* Woodland Alliance
A3209	*Betula papyrifera - Populus tremuloides - Quercus macrocarpa* Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Bur Oak: 216	Eyre 1980	
><	Bur Oak: 236	Eyre 1980	
<	Bur Oak: 42	Eyre 1980	
<	Cottonwood: 63	Eyre 1980	
<	Paper Birch: 18	Eyre 1980	
><	Rocky Mountain Juniper: 220	Eyre 1980	

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake
Acknowledgments [optional]: C. Lea
Version Date: 07 May 2015

REFERENCES

***References [Required if used in text]:**

Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.
Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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1. Forest & Woodland
1.B.2.Ne. North American Great Plains Forest & Woodland

G146. Northeastern Great Plains Aspen Woodland

Type Concept Sentence: This group is found on the northeastern border of the Great Plains and boreal forests and is characterized by a mosaic of tallgrass prairie, wet prairie, brush prairie, and aspen-oak woodlands dominated by *Populus tremuloides*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.2.Ne.1. Great Plains Forest & Woodland (M151)

Elcode: G146
***Scientific Name:** *Populus tremuloides - Quercus macrocarpa / Andropogon gerardii* Woodland Group
***Common (Translated Scientific) Name:** Quaking Aspen - Bur Oak / Big Bluestem Woodland Group
***Colloquial Name:** Northeastern Great Plains Aspen Woodland

***Type Concept:** This aspen-oak woodland group is found primarily on part of the Glacial Lake Agassiz plain in northwestern Minnesota, ranging into south-central Manitoba, Canada. Historically this group occurred in the context of a mosaic of tallgrass prairie, brush prairie and wetlands. It is dominated by *Populus tremuloides* with scattered *Quercus macrocarpa* and *Betula papyrifera*. Shrubs such as willows (*Salix* spp.) and hazelnuts (*Corylus* spp.) are also common. The dominant tallgrass species, at least in open, fire maintained sites, is *Andropogon gerardii* often associated with *Sorghastrum nutans, Calamagrostis* spp., and *Sporobolus heterolepis*. Calcareous glacial drift overlain with lacustrine soils ranging from loamy to gravelly is characteristic of the lakeplain within the range of this group. Fire is the most important natural dynamic in this group and helps maintain the open parkland or brush nature of this group. Wind and grazing are also important dynamics. Conversion to agriculture and fire suppression have decreased the range of this group and allowed more shrubs and trees to establish.

***Diagnostic Characteristics:** This woodland group is dominated by *Populus tremuloides* and *Quercus macrocarpa*, and often found as part of a complex of upland tallgrass prairie, brush prairie and wetlands. It occurs mostly in the Glacial Lake Agassiz plain in northwestern Minnesota into southern Canada.

***Classification Comments:** *Populus tremuloides*-dominated woodlands west of the Lake Agassiz plain, including the boundary areas in the Pembina Hills, are likely part of Great Plains Mesic Forest & Woodland Group (G145).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G328	Northwestern Great Plains Aspen Woodland	occurs farther west with an understory of more mixed grasses.
G145	Great Plains Mesic Forest & Woodland	occurs farther west and nearly always in ravines, valleys, or hilly terrain.
G075	Northern Tallgrass Prairie	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Trees are generally short in stature, reaching mature heights of 5-15 m tall. *Populus tremuloides* canopies are relatively diffuse, transmitting ample light for development of dense understory vegetation, including both shrub and herb layers. Herb layers are dominated by forbs, but also include a variety of shade-tolerant grasses and sedges. Stand structure also varies with site conditions; stands on sandy soils tend to be shorter and more open than those on fine-textured soils.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This group ranges from tallgrass prairie and wet prairie to shrub-dominated brush prairies and open woodlands. Woodlands are dominated by *Populus tremuloides* with *Quercus macrocarpa, Betula papyrifera, Populus grandidentata, Populus balsamifera*, and *Ulmus americana* as common associates. Prairie grasses occur throughout the components of this group. Prairie grass and forb species vary with changes in soil moisture along a gradient from wet-mesic to dry-mesic. *Andropogon gerardii* and *Sporobolus heterolepis* typically occur throughout examples of this group, at least on fire-maintained sites. On drier sites, *Schizachyrium scoparium* and *Koeleria macrantha* are also important. On wetter sites, *Spartina pectinata, Calamagrostis stricta ssp. inexpansa (= Calamagrostis inexpansa)*, and *Muhlenbergia richardsonis* are codominants. Typical shrubs include *Corylus americana, Corylus cornuta, Rosa* spp., *Rubus* spp., *Symphoricarpos occidentalis, Amelanchier* spp. (especially *Amelanchier alnifolia), Cornus foemina*, and *Viburnum* spp., and they may increase in the absence of fire.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: This group is primarily fire-maintained. Recurrent fires maintain the open nature of this group. Without common fires, stands may succeed to a more closed woodland or forest and may resemble an aspen forest.

ENVIRONMENT

Environmental Description: This group occurs in an ecotone between the semi-arid prairie west and semi-humid forested east on level to rolling terrain. Climate is typically cold and dry. Stands typically occur on coarse-textured outwash to lake-washed glacial till or in sandy lacustrine deposits. Soils vary from sandy clay loam to loamy fine sand and range from somewhat poorly drained to well-drained.

DISTRIBUTION

***Geographic Range:** This group is found primarily on part of the Glacial Lake Agassiz plain in northwestern Minnesota, ranging into southern Canada and eastern North Dakota.
Nations: CA, US
States/Provinces: MB, MN, ND
USFS Ecoregions (2007) [optional]: 222N:CC, 251A:PP
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3249	*Populus tremuloides - Populus balsamifera / Corylus americana* Forest Alliance
A3250	*Populus tremuloides / Corylus* spp. Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard and D. Faber-Langendoen
Acknowledgments [optional]: Jeff Thorpe, Ken Baldwin, Lorna Allen
Version Date: 15 Jan 2016

REFERENCES

***References [Required if used in text]:**

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, M. Russo, K. Schulz, K. Snow, J. Teague, and R. White. 2003-present. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, VA.

Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

MNNHP [Minnesota Natural Heritage Program]. 1993. Minnesota's native vegetation: A key to natural communities. Version 1.5. Minnesota Department of Natural Resources, Natural Heritage Program, St. Paul, MN. 110 pp.

Minnesota DNR [Minnesota Department of Natural Resources]. 2003. Field guide to the native plant communities of Minnesota: The Laurentian Mixed Forest Province. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. Minnesota Department of Natural Resources, St. Paul.

1.B.3. Temperate Flooded & Swamp Forest

Temperate Flooded & Swamp Forest is a tree-dominated wetland influenced by minerotrophic groundwater, either on mineral or organic (peat) soil, found in mid-latitudes of the globe.

1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest

This division includes swamp and floodplain forests and woodlands found in poorly-drained basins or along lakeshores and deciduous wet forests along small- to large-sized rivers (on a wide range of soil types), ranging across much of cool-temperate eastern North America.

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1. Forest & Woodland
1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest

M029. Central Hardwood Floodplain Forest

Type Concept Sentence: The macrogroup includes hardwood floodplain forests typically dominated by a combination of *Acer negundo, Acer saccharinum, Celtis laevigata, Celtis occidentalis, Fraxinus pennsylvanica, Liquidambar styraciflua, Platanus occidentalis, Populus deltoides*, and/or *Ulmus americana*. It occurs in the central, south-central, and north-central U.S. and extreme southern Ontario and Quebec in Canada.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.3.Na.1. Eastern North American-Great Plains Flooded & Swamp Forest (D011)

Elcode: M029
***Scientific Name:** *Acer saccharinum - Platanus occidentalis - Celtis* spp. Floodplain Forest Macrogroup
***Common (Translated Scientific) Name:** Silver Maple - American Sycamore - Hackberry species Floodplain Forest Macrogroup
***Colloquial Name:** Central Hardwood Floodplain Forest

***Type Concept:** This macrogroup encompasses north-temperate floodplain forests dominated by some combination of *Acer negundo, Acer saccharinum, Celtis laevigata, Celtis occidentalis, Fraxinus pennsylvanica, Liquidambar styraciflua, Platanus occidentalis, Populus deltoides*, and/or *Ulmus americana*. Associated trees include *Acer rubrum, Betula nigra*, and/or *Liriodendron tulipifera*. Common shrubs include *Asimina triloba, Carpinus caroliniana, Cornus amomum*, and *Viburnum* spp. Vines, including *Parthenocissus* spp., *Toxicodendron radicans*, and/or *Vitis* spp., are often abundant. The herb layer in the forested portions often features abundant spring ephemerals, giving way to a fern- or forb-dominated understory in many areas by mid-summer. This macrogroup occurs in eastern North America ranging from central Minnesota south to the Ozarks of Arkansas and Missouri east to New England and southern Canada. Some examples reach as far south as the plains of Alabama to Arkansas. Low-lying areas are underwater each spring; microtopography determines how long the various habitats are inundated. Reservoirs and conversion to agriculture have had a serious and negative effect on this macrogroup. Historically, drought, grazing, and fire influenced this macrogroup.

***Diagnostic Characteristics:** Deciduous forests with continuous or partial canopies in river floodplains. *Acer negundo, Acer saccharinum, Celtis laevigata, Celtis occidentalis, Fraxinus pennsylvanica, Platanus occidentalis, Populus deltoides*, and/or *Ulmus americana* are dominant. *Betula nigra, Liriodendron tulipifera*, and/or *Liquidambar styraciflua* are common associates in south-central examples.

***Classification Comments:** Silver Maple - Green Ash - Black Ash Floodplain Forest Group (G653) was moved to Laurentian-Acadian-North Atlantic Coastal Flooded & Swamp Forest Macrogroup (M504) per comments from Canadian ecologists. These are floodplain alliances with species that are more common in the central parts of the United States. Further review is needed to see if these northern expressions of *Acer saccharinum* flooded forests are outliers of this macrogroup or have enough northern associates to fit comfortably with other northern flooded and swamp forest types in M504. Eastern North American floodplain forests contain a diverse suite of dominant tree species with wide ranges, and they resist subdivision into neat groups and alliances. Some readjustment may be necessary. Further review is needed to ascertain if this is the correct way to separate these floodplain groups and alliances Into the appropriate macrogroups.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M151	Great Plains Forest & Woodland	
M504	Laurentian-Acadian-North Atlantic Coastal Flooded & Swamp Forest	occurs in the Laurentian-Acadian area of the U.S. and Canada to the north of this macrogroup, and includes both swamp and flooded forest types.
M028	Great Plains Flooded & Swamp Forest	
M154	Southern Great Plains Floodplain Forest & Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These forests have continuous or partial canopies and are often characterized by multi-stemmed trees as stems resprout after catastrophic disturbance. Vines may be abundant. Shrub cover varies; in many of these forests, it is sparse, giving a parklike appearance. Herb cover also varies, and herbs are either perennials that are disturbance-tolerant or annuals.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The most common trees in these forests through most of the range are *Acer negundo, Acer saccharinum, Celtis occidentalis, Fraxinus pennsylvanica, Platanus occidentalis, Populus deltoides*, and/or *Ulmus americana*. *Celtis laevigata* and/or *Liquidambar styraciflua* are important constituents in the southern and midwestern portions of the range. Associated tree species include *Acer rubrum, Betula nigra, Carya cordiformis, Carya illinoinensis*, and/or *Ulmus rubra*. In portions of the floodplain that are flooded for shorter durations, associates include *Acer saccharum, Carya ovata, Fraxinus americana, Juglans nigra, Prunus serotina, Quercus alba, Quercus macrocarpa*, and *Quercus rubra*. *Parthenocissus quinquefolia, Toxicodendron radicans*, and *Vitis* spp. are common vines. Characteristic shrubs include *Asimina triloba, Carpinus caroliniana, Cornus amomum, Cornus drummondii, Cornus foemina, Lindera benzoin*, and *Viburnum nudum*. Typical herbs vary somewhat with geography. Some common species include *Boehmeria cylindrica, Elymus virginicus, Impatiens capensis, Laportea canadensis, Matteuccia struthiopteris*, and *Verbesina alternifolia*. Spring ephemerals such as *Allium tricoccum, Claytonia* spp., *Erythronium americanum, Mertensia virginica*, and *Sanguinaria canadensis* may be abundant.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Flooding is the primary dynamic process, and many stands are flooded annually. Sediment accretion outpaces erosional processes in this macrogroup. Agriculture has converted much of this macrogroup to agricultural land, sometimes (particularly in the lower portions of the floodplain) involving adding drainage. Conversion to agriculture greatly reduced its abundance and continuity of occurrences (or fragmenting occurrences). Drought, grazing, and fire have all had historical influence. Reservoirs have had a serious and negative effect on vegetation that represents this macrogroup.

ENVIRONMENT

Environmental Description: This macrogroup is best expressed along medium to large rivers but may be found along low-gradient reaches of smaller rivers and streams where a flat floodplain develops. A variety of alluvial soil types may be found within the floodplain from very well-drained sandy substrates to very dense clays. It is this variety of substrates in combination with different flooding regimes that creates the mix of vegetation.

DISTRIBUTION

***Geographic Range:** This macrogroup is found across a large area of the northeastern, midwestern, and southeastern U.S. and southern Canada. It ranges from southern New England and Canada south and west through Minnesota and Iowa and south to the Interior Low Plateau of Ohio, Indiana, Illinois and Kentucky and the Ozarks of Arkansas and Missouri, and the Crosstimbers of Oklahoma. It extends south into the upper plains from Alabama to Arkansas.
Nations: CA, US
States/Provinces: AL, AR, CT, DE, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NB, NC, ND, NE, NH, NJ, NY, OH, OK, ON, PA, QC, SC, TN, TX, VA, VT, WI, WV
USFS Ecoregions (2007) [optional]: 222:C, 223:C, 231:C, 251:C, 255A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G652	Silver Maple - Green Ash - Sycamore Floodplain Forest
G673	Silver Maple - Sugarberry - Sweetgum Floodplain Forest

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard
Acknowledgments [optional]:
Version Date: 15 Oct 2014

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

G652. Silver Maple - Green Ash - Sycamore Floodplain Forest

Type Concept Sentence: The group includes hardwood floodplain forests in the central and north-central U.S. and extreme southern Ontario in Canada, and is typically dominated by *Acer saccharinum*, *Fraxinus pennsylvanica*, *Platanus occidentalis*, or *Acer rubrum*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.3.Na.1. Central Hardwood Floodplain Forest (M029)

Elcode: G652
***Scientific Name:** *Acer saccharinum - Fraxinus pennsylvanica - Platanus occidentalis* Floodplain Forest Group
***Common (Translated Scientific) Name:** Silver Maple - Green Ash - American Sycamore Floodplain Forest Group
***Colloquial Name:** Silver Maple - Green Ash - Sycamore Floodplain Forest

***Type Concept:** This group includes floodplain forests in the central and eastern United States and into southern Ontario, Canada. Stands are dominated by broad-leaved deciduous trees with a closed to moderately open canopy. Typical dominants include a combination of *Acer rubrum, Acer saccharinum, Acer saccharum, Fraxinus pennsylvanica, Platanus occidentalis, Populus deltoides*, and *Quercus macrocarpa*. This group occurs on sloping ridges, terraces, natural levees, or higher elevations that border rivers or streams. Examples occur on well-drained to poorly drained alluvial soils ranging from sands to clay. Sites are infrequently to frequently flooded.

***Diagnostic Characteristics:** Floodplain forests found across the central and eastern United States into southern Ontario and dominated by broad-leaved deciduous trees.

***Classification Comments:** The separation of this group with others to the north or south was determined partially by biogeography, with those alliances in the Laurentian-Acadian region contained within Silver Maple - Green Ash - Black Ash Floodplain Forest Group (G653) and those to the unglaciated south in Silver Maple - Sugarberry - Sweetgum Floodplain Forest Group (G673). Further review is needed to ascertain if this is the correct way to separate these floodplain groups and alliances. Also, there are some alliances in this group that occur on mesic terraces in floodplains and may better be treated as uplands in a mesic group.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G673	Silver Maple - Sugarberry - Sweetgum Floodplain Forest	is found to the south.
G653	Silver Maple - Green Ash - Black Ash Floodplain Forest	is found to the north.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These floodplain forests are dominated by broad-leaved deciduous trees that vary from small-statured (5-15 m tall) stands to taller (15-25 m) mature stands.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Stands are dominated by a combination of one or more of *Acer rubrum, Acer saccharinum, Acer saccharum, Fraxinus pennsylvanica, Platanus occidentalis, Populus deltoides*, and *Quercus macrocarpa*. Other common canopy species include *Acer negundo, Betula nigra, Carya* spp., *Celtis* spp., *Fagus grandifolia, Quercus bicolor*, and *Ulmus americana*. Commonly encountered understory species include *Arisaema dracontium, Boehmeria cylindrica, Carex* spp., *Cinna* spp., *Impatiens capensis, Leersia* spp., *Pilea pumila, Saururus cernuus, Symphyotrichum ontarionis (= Aster ontarionis), Toxicodendron radicans*, and *Uvularia sessilifolia*. Examples of this group can extend into and mix with adjacent communities, resulting in numerous transitional variants in understory species. Occurrences also may have a rather high percentage of standing dead trees, including remnant snags from earlier successional communities.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Flooding ranges from infrequent, short-duration to frequently flooded or saturated for a significant portion of the growing season. In some examples, water may be ponded for most of the year in shallow depressions. Riparian vegetation is constantly impacted in areas subjected to higher rates of flooding. Forests are early-, mid- or late-seral, depending on the age class of the trees and the associated species of the stand. Over time, a healthy riparian area can support all stages of development. Many examples of this group have been impacted by excessive browsing, grazing, and agricultural conversion.

ENVIRONMENT

Environmental Description: Stands of this group can occur on level to gently sloping ridges, terraces, natural levees, on newly formed sand bars, front-land ridges, low streambanks, overflow areas, and well-drained flats or higher elevations which border river floodplains or streams. They have level or nearly level soils that formed in water-deposited sandy, clayey or loamy sediments on floodplains of the rivers and streams. These soils are well-drained to poorly-drained.

DISTRIBUTION

***Geographic Range:** This group occurs across the central U.S., from north-central Minnesota to central Missouri and eastward to northwestern Pennsylvania (including the glaciated part of the Allegheny Plateau) and extreme southern Ontario. It possibly extends somewhat further northeastward. The core of its range is in Ecoprovinces 222 and 251 (Cleland et al. 2007).
Nations: CA, US
States/Provinces: IA, IL, IN, MN, MO, OH, ON, PA, WI
USFS Ecoregions (2007) [optional]: 222:C, 251:C
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3712	*Platanus occidentalis - Betula nigra* Floodplain Forest Alliance
A3713	*Quercus macrocarpa - Quercus bicolor* Mesic Floodplain Forest Alliance
A3708	*Acer rubrum - Fraxinus pennsylvanica* Floodplain Forest Alliance
A3710	*Acer saccharinum - Populus deltoides* Floodplain Forest Alliance
A3711	*Acer saccharum - Carya cordiformis* Mesic Floodplain Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-07-23	G139 Betula nigra - Platanus occidentalis - Salix spp. Riverscour Scrub Group	G040 split into G673, G652 & G653 (DFL 7-23-12)
2012-07-23	G040 Acer saccharinum - Fraxinus pennsylvanica - Platanus occidentalis Floodplain Group	G040 split into G673, G652 & G653

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al.

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** D. Faber-Langendoen and S.E. Menard
Acknowledgments [optional]:
Version Date: 19 May 2015

REFERENCES

***References [Required if used in text]:**

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Kost, M. A., D. A. Albert, J. G. Cohen, B. S. Slaughter, R. K. Schillo, C. R. Weber, and K. A. Chapman. 2007. Natural communities of Michigan: Classification and description. Report No. 2007-21, Michigan Natural Features Inventory, Lansing. 314 pp. [http://web4.msue.msu.edu/mnfi/reports/2007-21_Natural_Communites_of_Michigan_Classification_and_Description.pdf]

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1. Forest & Woodland
1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest

G673. Silver Maple - Sugarberry - Sweetgum Floodplain Forest

Type Concept Sentence: This complex and widespread group of floodplain forests is dominated by some combination of *Acer saccharinum, Betula nigra, Celtis laevigata, Fraxinus pennsylvanica, Liquidambar styraciflua, Liriodendron tulipifera, Platanus occidentalis*, and *Ulmus americana*. Stands are found in a broad band in the northeastern and middle parts of the eastern United States from southern New England and the Ontario lakeplains of New York south and west through the Interior Low Plateau of Ohio, Indiana, Illinois and Kentucky to the Ozarks of Arkansas and Missouri.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.3.Na.1. Central Hardwood Floodplain Forest (M029)

Elcode: G673
***Scientific Name:** *Acer saccharinum - Celtis laevigata - Liquidambar styraciflua* Floodplain Forest Group
***Common (Translated Scientific) Name:** Silver Maple - Sugarberry - Sweetgum Floodplain Forest Group
***Colloquial Name:** Silver Maple - Sugarberry - Sweetgum Floodplain Forest

***Type Concept:** Stands of these floodplain forests are dominated by some combination of *Acer saccharinum, Betula nigra, Celtis laevigata, Fraxinus pennsylvanica, Liquidambar styraciflua, Liriodendron tulipifera, Platanus occidentalis*, and *Ulmus americana*. Other species that may be present include *Acer negundo*. This complex and widespread group is found in a broad band in the northeastern and middle parts of the eastern United States from southern New England and the Ontario lakeplains of New York south and west through the Interior Low Plateau of Ohio, Indiana, Illinois and Kentucky to the Ozarks of Arkansas and Missouri.

***Diagnostic Characteristics:** Stands are dominated by some combination of *Acer saccharinum, Betula nigra, Celtis laevigata, Fraxinus pennsylvanica, Liquidambar styraciflua, Liriodendron tulipifera, Platanus occidentalis*, and *Ulmus americana*. They occur over a broad range broad band in the northeastern and middle parts of the eastern United States from southern New England and the Ontario lakeplains of New York south and west through the Interior Low Plateau of Ohio, Indiana, Illinois and Kentucky to the Ozarks of Arkansas and Missouri. Some associations range south into the upper plains from Alabama to Arkansas.

***Classification Comments:** This is a complex and widespread group of floodplain forests ranging from southern New England to the Ozarks. Eastern North American floodplain forests contain a diverse suite of dominant tree species with wide ranges, and they resist subdivision into neat groups and alliances. Some readjustment may be necessary. Some associations currently assigned to these alliances range south into the upper coastal plains from Alabama to Arkansas, and this may require review.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G652	Silver Maple - Green Ash - Sycamore Floodplain Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are typically closed-canopy forests, with canopy gaps occurring due to storm and flooding damage. There is usually a well-developed subcanopy as well. At topographically lower sites, the shrub layer is often sparse; on higher surfaces, it may be moderately dense. Vines are common.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Stands are dominated by some combination of *Acer saccharinum, Betula nigra, Celtis laevigata, Fraxinus pennsylvanica, Liquidambar styraciflua, Liriodendron tulipifera, Platanus occidentalis*, and *Ulmus americana*. Some characteristic and typical shrubs and small trees include *Alnus serrulata, Asimina triloba, Carpinus caroliniana, Cephalanthus occidentalis* (in wetter areas), *Cornus amomum, Ilex decidua, Leucothoe fontanesiana, Lindera benzoin, Physocarpus opulifolius, Viburnum prunifolium*, and others. In addition, *Arundinaria gigantea* may be present in some stands. Characteristic and typical forbs and graminoids may include *Ageratina altissima, Boehmeria cylindrica, Carex* spp., *Chasmanthium latifolium, Cryptotaenia canadensis, Dichanthelium clandestinum, Elymus virginicus, Impatiens capensis, Laportea canadensis, Leersia virginica, Pilea pumila, Polygonum virginianum, Rudbeckia laciniata, Verbesina alternifolia*, and many others, depending on biogeography and hydroperiod. Invasive introduced species such as *Alliaria petiolata, Glechoma hederacea, Humulus japonicus, Microstegium vimineum, Stellaria media*, and *Urtica dioica ssp. dioica* are often rampant.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: These forests occur on large river floodplains, where they occupy banks and first bottoms of major rivers with nutrient-rich silt loams, sand loams, and sands that are temporarily inundated, annually or less often, in major flood events.

DISTRIBUTION

***Geographic Range:** This group of floodplain forests is found across a broad band in the northeastern and middle parts of the eastern United States from southern New England and the Ontario lakeplains of New York south and west through Interior Low Plateau of Ohio, Indiana, Illinois and Kentucky to the Ozarks of Arkansas and Missouri, and the Crosstimbers of Oklahoma. Some associations range south into the upper coastal plains from Alabama to Arkansas.
Nations: CA, US
States/Provinces: AL, AR, DC, DE, GA, IL?, LA, MD, MO, MS, NC, NJ, OK, SC, TN, TX, VA
USFS Ecoregions (2007) [optional]: 211F:CC, 211G:CC, 211I:CC, 221A:CC, 221B:CC, 221D:CC, 221E:CC, 221H:CC, 221J:CC, 223A:CC, 223D:CC, 223E:CC, 223F:CC, 223G:CC, 231G:CC, 231H:CC, 232A:CC, 255A:CC, M221A:CC, M221B:CC, M221C:CC, M221D:CC, M223A:CC, M231A:CC
Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3699	*Betula nigra - Platanus occidentalis* Appalachian-Piedmont Floodplain Forest Alliance
A3697	*Acer saccharinum - Acer negundo* Appalachian-Piedmont Floodplain Forest Alliance
A3701	*Platanus occidentalis - Fraxinus pennsylvanica - Liriodendron tulipifera* Central Appalachian-Piedmont Floodplain Forest Alliance
A3698	*Betula nigra - Platanus occidentalis - Acer saccharinum* Ozark & West Gulf Riverfront Forest Alliance
A3700	*Fraxinus pennsylvanica - Platanus occidentalis - Acer saccharinum* Ozark-Ouachita Floodplain Forest Alliance
A3702	*Platanus occidentalis - Liquidambar styraciflua - Liriodendron tulipifera* Southern Appalachian Floodplain Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-07-23	G139 Betula nigra - Platanus occidentalis - Salix spp. Riverscour Scrub Group	G040 split into G673, G652 & G653 (DFL 7-23-12)
2012-07-23	G040 Acer saccharinum - Fraxinus pennsylvanica - Platanus occidentalis Floodplain Group	G040 split into G673, G652 & G653

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al.

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne
Acknowledgments [optional]:
Version Date: 19 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

1. Forest & Woodland
1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest

M503. Central Hardwood Swamp Forest

Type Concept Sentence: This swamp forest vegetation encompasses a variety of seepage, wet flatwood and depression, and lake or pond fringe forests (nonriverine) found in the eastern United States and adjacent Canada, primarily exclusive of the coastal plains, dominated by hardwood trees, including *Acer rubrum var. trilobum, Acer saccharinum, Betula nigra, Fagus grandifolia, Fraxinus pennsylvanica, Liriodendron tulipifera, Liquidambar styraciflua, Nyssa biflora, Nyssa sylvatica, Platanus occidentalis, Quercus alba, Quercus bicolor, Quercus lyrata, Quercus michauxii, Quercus palustris*, and *Quercus phellos*.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.3.Na.2. Eastern North American-Great Plains Flooded & Swamp Forest (D011)

Elcode: M503
***Scientific Name:** *Quercus palustris - Fraxinus pennsylvanica - Nyssa sylvatica* Swamp Forest Macrogroup
***Common (Translated Scientific) Name:** Pin Oak - Green Ash - Blackgum Swamp Forest Macrogroup
***Colloquial Name:** Central Hardwood Swamp Forest

***Type Concept:** These swamp forests include seepage, wet flatwood and depression, and lake or pond fringe forests (i.e., not associated with overbank flow from stream or river channels) found in the eastern United States and adjacent Canada, primarily exclusive of the coastal plains. Stands are dominated by hardwood trees, including *Acer rubrum var. trilobum, Acer saccharinum, Betula nigra, Fagus grandifolia, Fraxinus pennsylvanica, Liriodendron tulipifera, Liquidambar styraciflua, Nyssa biflora, Nyssa sylvatica, Platanus occidentalis, Quercus alba, Quercus bicolor, Quercus lyrata, Quercus michauxii, Quercus palustris*, and *Quercus phellos*. The collective range includes the northern glaciated midwestern United States ranging east into Lower New England, south into most of the south-central states, including the broad Appalachian region, the unglaciated Interior Low Plateau, and the Ouachitas and Ozarks. Examples of Central Interior-Appalachian Seepage Swamp Group (G044) generally occur where the substrate is saturated to the surface for extended periods during the growing season, but where surface water is seldom present for more than short periods of time. This includes streamhead swales or broad sandstone ridges where soils are sandy and saturated due to a combination of perched water table and seepage flow, as well as seepage-fed wetlands on gentle slopes, with substantial seepage flow which may be influenced by wildland fire, and along the bottom slopes of smaller valleys, as well as in the upper riparian zones of larger creeks, sometimes extending upslope along small ephemeral drainages. Examples of South-Central Flatwoods & Pond Forest Group (G654) are found in ponds, wet depressions, flats along small streams, and other related environments. Examples of Central Hardwood Flatwoods & Swamp Forest Group (G597) are found in ponds and depressions, and include various kinds of flatwoods (where soils often contain an impermeable clay layer or fragipan creating a shallow, perched water table, soils are poorly drained to very poorly drained, and surface water may be present for extended periods of time, rarely becoming dry).

***Diagnostic Characteristics:** These are generally nonriverine forested wetlands, characterized by hydrologic setting, which includes flat to depressional wetlands, as well as seepage swamps, ponds, flats along small streams, and other related environments. Stands are dominated by a diverse suite of primarily wetland *Quercus* species or other wetland deciduous hardwood trees that vary with biogeography and hydrology. Diagnostic species include *Acer rubrum var. trilobum, Fagus grandifolia, Fraxinus pennsylvanica, Liriodendron tulipifera, Liquidambar styraciflua, Nyssa biflora, Nyssa sylvatica, Platanus occidentalis, Quercus alba, Quercus bicolor, Quercus lyrata, Quercus michauxii, Quercus palustris*, and *Quercus phellos*.

***Classification Comments:** The floristic and hydrologic variation within this diverse macrogroup will be accommodated by the various component groups and alliances.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M504	Laurentian-Acadian-North Atlantic Coastal Flooded & Swamp Forest	
M302	Eastern North American Ruderal Flooded & Swamp Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Stands of this macrogroup are composed of broad-leaved deciduous trees. The canopy can range from moderate to dense. The density of shrubs and herbs varies based on the extent of canopy closure, hydrologic regime, and disturbance regime. In the current landscape, most are closed-canopy forests, but with greater fire frequencies they would have varied more in the past.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Stands are dominated by hardwood trees, typical of wet-mesic to wet conditions, including *Acer rubrum var. trilobum, Acer saccharinum, Betula nigra, Fagus grandifolia, Fraxinus pennsylvanica, Nyssa sylvatica, Liriodendron tulipifera, Liquidambar styraciflua, Nyssa biflora, Platanus occidentalis, Quercus alba, Quercus bicolor, Quercus lyrata, Quercus michauxii, Quercus palustris*, and *Quercus phellos*. Understories and ground layers vary with biogeography and hydrology, but some possible shrub components include *Alnus serrulata, Carpinus caroliniana, Cephalanthus occidentalis, Ilex opaca var. opaca* (central), *Eubotrys racemosa, Lyonia lucida, Vaccinium corymbosum*, and *Viburnum nudum*. The herb layer is quite variable. Forbs such as *Boehmeria cylindrica, Impatiens capensis, Rudbeckia laciniata*, and *Saururus cernuus* (central) are also often prominent with various wetland grasses, sedges, and rushes, including *Carex albolutescens, Carex intumescens, Carex joorii, Chasmanthium laxum, Cinna arundinacea*, and others. Large wetland ferns such as *Osmunda cinnamomea* and *Osmunda regalis var. spectabilis* are often prominent. Large *Smilax* tangles sometimes occur, and some examples have substantial amounts of *Sphagnum* spp. There is some floristic variation with latitude and elevation, with southern and lower-elevation associations containing *Magnolia virginiana* and/or *Nyssa biflora*, which are more typical of the coastal plain. In drier examples, *Quercus rubra, Quercus stellata*, and/or *Quercus velutina* may occur. Other species (in drier zones or phases) include *Campsis radicans, Cardamine bulbosa, Croton michauxii var. ellipticus (= Croton willdenowii), Danthonia spicata, Leersia virginica, Manfreda virginica, Gillenia stipulata (= Porteranthus stipulatus)*, and *Pycnanthemum tenuifolium*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In Central Interior-Appalachian Seepage Swamp Group (G044), the presence of seepage is the most important environmental factor. Long-term droughts will affect seepage flow and presumably have an impact on the vegetation. Canopy dynamics are not well-known and potentially may vary substantially over short distances in response to wetness. Wetness clearly limits recruitment of most tree and shrub seedlings to drier microsites in the wettest examples, and fire is also important in some examples. Long-term geomorphic processes may also be important. Headward erosion by small streams, or meandering by larger stream channels, sometimes drains seeps and eliminates the wetland vegetation. In north-central swamps and flatwoods (Central Flatwoods & Swamp Forest Group (G597)), water level dynamics are the most important factor, differentiating them from the surrounding uplands and differentiating the various components from one another. Most depressions and basins have a very limited watershed area, so water comes largely from rainfall. Variation in rainfall patterns will drive variation in duration of flooding, though most basins have an outlet that ultimately limits water depth. Fire is presumably naturally rare in these systems, although they would naturally be exposed to fires spreading from the surrounding uplands. Standing water and lack of continuous fuel would limit fires to the edges of ponds, with greater influence in flatwoods.

ENVIRONMENT

Environmental Description: This wooded wetland vegetation encompasses various primarily non-alluvial wetlands of the eastern and central United States. This diverse suite of communities includes types associated with ponds and depressions, as well as various kinds of flatwoods. Flatwoods often contain an impermeable clay layer or fragipan creating a shallow, perched water table, soils are poorly drained to very poorly drained, and surface water may be present for extended periods of time, rarely becoming dry. These wetlands result from topographic or edaphic circumstances that promote an enhanced hydroperiod at these sites, and this affects both the vegetation and the dynamics. Ponds and flatwoods have some features in common, and are united at this level, but will be discussed separately where this is necessary. Examples of Central Interior-Appalachian Seepage Swamp Group (G044) occur in small patches where relatively constant or seasonal seepage water creates wetland conditions. This seepage commonly occurs at the base of slopes on the edge of bottomlands or in headwaters of small streams. Examples also occur on gently sloping hillsides where impermeable soils and slope force shallow groundwater to the surface. The soils are seasonally to permanently saturated, but without substantial standing water. In north-central swamps and flatwoods (Central Flatwoods & Swamp Forest Group (G597)), soils are poorly drained to very poorly drained, and may have a dense clay hardpan or some other impermeable clay layer or fragipan that limits internal drainage and can create a shallow, perched water table. Some soils may be deep (100 cm or more), consisting of peat or muck. Rainwater accumulates in the basins and persists through the wet season, occasionally persisting all year. Some examples become dry, with drought possible during the summer and autumn months. These fluctuating moisture levels can lead to complexes of forest upland and wetland species.

DISTRIBUTION

***Geographic Range:** The collective range includes the northern glaciated midwestern United States and adjacent Canada, ranging east into Lower New England, south into most of the south-central states, including the broad Appalachian region, including the Piedmont, from Alabama to Kentucky, and the Ouachitas and Ozarks of Arkansas and Oklahoma.
Nations: CA, US
States/Provinces: AL, AR, CT, DC?, DE, GA, IA, IL, IN, KY, MA, MD, MI, MO, NC, NH, NJ, NY, OH, OK?, ON, PA, QC, RI, SC, TN, VA, WV
USFS Ecoregions (2007) [optional]: 211E:CC, 211F:CP, 221A:CC, 221B:CP, 221D:CC, 221F:CC, 221H:CC, 221J:CC, 222Jh:CCC, 222Ua:CCC, 222Ue:CC?, 223A:CC, 223D:CC, 223E:CC, 223F:CC, 223G:CC, 231A:CC, 231B:CC, 231C:CC, 231D:CC, 231H:CC, 231I:CC, M221A:CC, M221C:CC, M221D:CC, M223A:CC, M231A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G044	Central Interior-Appalachian Seepage Swamp
G654	South-Central Flatwoods & Pond Forest
G597	Central Hardwood Flatwoods & Swamp Forest
G667	Northeastern Forest Vernal Pool

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-07-23	M030 Northern & Central Swamp Forest Macrogroup	M030 split into Central (M503) & Northern (M504)

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen, in Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne
Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by S. Menard and S. Gawler.
Version Date: 15 Oct 2014

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Kost, M. A., D. A. Albert, J. G. Cohen, B. S. Slaughter, R. K. Schillo, C. R. Weber, and K. A. Chapman. 2007. Natural communities of Michigan: Classification and description. Report No. 2007-21, Michigan Natural Features Inventory, Lansing. 314 pp. [http://web4.msue.msu.edu/mnfi/reports/2007-21_Natural_Communites_of_Michigan_Classification_and_Description.pdf]

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Walz, Kathleen. Personal communication. Ecologist, New Jersey Natural Heritage Program, Office of Natural Lands Management, Trenton.

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1. Forest & Woodland
1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest

G654. South-Central Flatwoods & Pond Forest

Type Concept Sentence: These are primarily *Quercus*-dominated nonriverine wetland forests found in ponds, depressions, and flats along small streams, from Maryland south to Alabama and Georgia, and north and west to Kentucky, Missouri and possibly Oklahoma.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.3.Na.2. Central Hardwood Swamp Forest (M503)

Elcode: G654
***Scientific Name:** *Quercus lyrata - Quercus stellata - Nyssa sylvatica* Flatwoods & Pond Forest Group
***Common (Translated Scientific) Name:** Overcup Oak - Post Oak - Blackgum Flatwoods & Pond Forest Group
***Colloquial Name:** South-Central Flatwoods & Pond Forest

***Type Concept:** These primarily *Quercus*-dominated nonriverine wetland forests are found in ponds, wet depressions, flats along small streams, and other related environments from Maryland south to Alabama and Georgia, and north and west to Kentucky, Missouri and possibly Oklahoma. They encompass a variety of hydroperiods from longer (wetter) areas dominated by *Quercus lyrata* and *Quercus phellos*, to shorter mesic or seasonally wet environments dominated by *Quercus alba, Nyssa sylvatica*, and/or *Quercus stellata*. Other trees that may be present include *Betula nigra, Carya carolinae-septentrionalis, Fraxinus americana, Liquidambar styraciflua, Nyssa biflora, Quercus michauxii, Quercus oglethorpensis, Quercus shumardii*, and *Quercus similis*. Shrubs may include *Cephalanthus occidentalis* and *Lyonia lucida*. Herbs may include *Carex albolutescens, Carex intumescens, Carex joorii, Chasmanthium laxum, Cinna arundinacea, Croton michauxii var. ellipticus, Danthonia spicata, Pleopeltis polypodioides ssp. michauxiana, Zephyranthes atamasca*, and the moss *Climacium americanum*. The component associations are primarily from the Interior Low Plateau, southern Piedmont, Ridge and Valley/Cumberlands, and Ozarks, with some more peripheral occurrences in the northern Piedmont, mid-Atlantic Coastal Plain, and Ouachitas.

***Diagnostic Characteristics:** These nonriverine wetland forests occur in ponds, wet depressions, flats along small streams, and other related environments from Maryland south to Alabama and Georgia, and north and west to Kentucky, Missouri and possibly Oklahoma. They are primarily *Quercus*-dominated, with the dominant species varying by hydroperiod. Wetter (longer hydroperiod) areas are typically dominated by *Quercus lyrata* and *Quercus phellos*, with shorter mesic or seasonally wet environments being dominated by species such as *Quercus alba, Quercus stellata*, and/or *Nyssa sylvatica*.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are nonriverine wetland forests dominated by moderately tall trees. They have moderately closed canopies, and their shrub and herb layers vary in density and diversity depending on hydroperiod, which can vary from longer (wetter) to shorter (less wet). Longer hydroperiod areas tend to be more open and less diverse.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This vegetation encompasses a variety of hydroperiods from longer (wetter) areas dominated by *Quercus lyrata* and *Quercus phellos*, to shorter mesic or seasonally wet environments dominated by *Quercus alba, Nyssa sylvatica*, and/or *Quercus stellata*. Other trees that may be present include *Betula nigra, Carya carolinae-septentrionalis, Fraxinus americana, Liquidambar styraciflua, Nyssa biflora, Quercus michauxii, Quercus oglethorpensis, Quercus shumardii*, and *Quercus similis*. Shrubs may include *Cephalanthus occidentalis* and *Lyonia lucida*. Herbs may include *Carex albolutescens, Carex intumescens, Carex joorii, Chasmanthium laxum, Cinna arundinacea, Croton michauxii var. ellipticus (= Croton willdenowii), Danthonia spicata, Pleopeltis polypodioides ssp. michauxiana, Zephyranthes atamasca*, and the moss *Climacium americanum*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: These primarily *Quercus*-dominated nonriverine wetland forests encompass a variety of hydroperiods from longer (wetter) areas to shorter mesic or seasonally wet environments. The hydrology is driven by rainwater and groundwater, but not riverine flooding.

ENVIRONMENT

Environmental Description: These primarily nonriverine wetland forests are found in ponds, wet depressions, flats along small streams, and other related environments. They encompass a variety of hydroperiods from longer (wetter) to shorter mesic or seasonally wet environments.

DISTRIBUTION

***Geographic Range:** This vegetation ranges from Maryland south to Alabama and Georgia, and north and west to Kentucky, Missouri and possibly Oklahoma, primarily in the Interior Low Plateau, southern Piedmont, Ridge and Valley/Cumberlands, and Ozarks, with some more peripheral occurrences in the northern Piedmont, mid-Atlantic Coastal Plain, and Ouachitas.
Nations: US
States/Provinces: AL, AR, GA, KY, MD, MO, NC, OK?, SC, TN, VA
USFS Ecoregions (2007) [optional]: 221D:CP, 221H:CC, 221J:CC, 223A:CC, 223B:CC, 223D:CC, 223E:CC, 223F:CC, 223G:CC, 231A:CC, 231C:CC, 231D:CC, 231I:CC, 232H:PP, 232J:PP, M221C:PP, M223A:CC, M231A:PP
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3429	*Quercus phellos - Quercus lyrata - Quercus nigra* Interior Pond Forest Alliance
A3431	*Quercus stellata* Interior Flatwoods Forest Alliance
A3428	*Nyssa biflora* Interior Pond Forest Alliance
A3430	*Quercus phellos* Piedmont-Cumberland Wet Depression Forest Alliance
A1996	*Quercus alba - Nyssa sylvatica* Wet Depression Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-01-28	G169 Quercus bicolor - Quercus palustris - Liquidambar styraciflua Pond Forest Group	G169 & G170 first merged into a single flatwoods and pond unit, but then split into G597 (central flatwoods & pond, glaciated) and G654 (east-central flatwoods, unglaciated).

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen, in Faber-Langendoen et al. (2012)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne
Acknowledgments [optional]:
Version Date: 19 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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1. Forest & Woodland
1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest

G597. Central Hardwood Flatwoods & Swamp Forest

Type Concept Sentence: This is a diverse group of wooded wetland vegetation types encompassing primarily non-alluvial wetlands of the central to east-central United States and adjacent Canada, including depression swamps, ponds, and various kinds of flatwoods. Many examples are dominated by *Quercus bicolor, Quercus palustris*, or other oak species, or a mix of hardwoods, including *Acer rubrum, Fagus grandifolia, Fraxinus* spp., and *Ulmus americana*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.3.Na.2. Central Hardwood Swamp Forest (M503)

Elcode: G597
***Scientific Name:** *Acer rubrum - Quercus bicolor - Fagus grandifolia* Flatwoods & Swamp Forest Group
***Common (Translated Scientific) Name:** Red Maple - Swamp White Oak - American Beech Flatwoods & Swamp Forest Group
***Colloquial Name:** Central Hardwood Flatwoods & Swamp Forest

***Type Concept:** This wooded wetland vegetation group encompasses various primarily non-alluvial wetlands of the central to east-central United States. It is a diverse group, containing types associated with ponds and depressions, as well as various kinds of flatwoods. Ponded examples vary from open water to herb-, shrub-, or tree-dominated. The vegetation may be zoned, with an outer ring of trees, a more interior ring of shrubs, herbs and vines, and possibly a deeper central area with or without standing water year-round depending on precipitation. *Quercus* species, including *Quercus bicolor* and *Quercus palustris*, dominate the canopy in many examples of this group. In addition, *Acer rubrum, Acer saccharinum, Fraxinus pennsylvanica, Nyssa* spp., *Platanus occidentalis, Ulmus americana*, or a combination of these, may dominate. *Cephalanthus occidentalis* is a typical shrub component in areas with a longer hydroperiod. The herbaceous layer is widely variable depending on geography and hydroperiod. In flatwoods examples, across the upper Midwest and Lower New England, *Quercus bicolor* and/or *Quercus palustris* are the common oak species. South of the glaciated Midwest (e.g., in the Ozarks), *Quercus stellata* is more common. Drier examples of flatwoods across the range of this group may have *Acer rubrum, Fagus grandifolia, Nyssa sylvatica, Quercus alba, Quercus rubra*, and *Quercus velutina*. Understory shrub and herbaceous species vary with moisture level and canopy density. Flooding, drought, and fire can impact examples of this vegetation. Fire is particularly important in flatwoods examples found in the south-central United States.

These wetland features are the result of topographic or edaphic circumstances that promote an enhanced hydroperiod at these sites, and this affects the vegetation and dynamics of these communities. The depressional swamps and flatwoods associations are found throughout the northern glaciated Midwest into the south-central United States ranging east into Lower New England. Stands of both types occur on flat to gently sloping to undulating surfaces, as well as in shallow to deep basins of sinkholes or other isolated depressions on uplands, as well as poorly drained uplands; glaciated examples occur in depressions associated with glacial features such as tillplains, lakeplains or outwash plains. Soils are poorly drained to very poorly drained, and surface water may be present for extended periods of time, rarely becoming dry. Soils often contain an impermeable clay layer or fragipan creating a shallow, perched water table. Saturation can vary, with ponding common during wetter seasons, and drought possible during the summer and autumn months.

The typical hydrology is seasonally flooded, but the hydroperiod may be of greater or lesser length, depending on the depth of the basin or depression feature and the annual rainfall. Water depth may vary greatly on a seasonal basis and may be a meter deep or more in the winter in longer hydroperiod examples. Some examples become dry in the summer. Soils may be deep (100 cm or more), consisting of poorly drained mineral soil, as well as of peat or muck, with parent material of peat, muck or alluvium. Microtopography and fluctuating moisture levels can lead to complexes of forest upland and wetland species occurring within this group.

***Diagnostic Characteristics:** These are forested, more-or-less isolated flat to depressional wetland forests of the unglaciated and glaciated interior (central Midwest) of the eastern United States. Examples are typically dominated by wetland *Quercus* species or by other wetland deciduous hardwood trees, or by a combination of these.

***Classification Comments:** This group represents the merger of former Central Depression Pond Group (G169) and Central Flatwoods Group (G170), the independent existence of which can no longer be justified. Some of the landform features in which this vegetation is found have their geologic origin as a more-or-less complete karst collapse feature. Some of them may display this geologic origin in a more explicit manner, with definite walls and exposed limestone or dolomite at the surface ("sinkholes"). Others are more subtle and exist as more gentle depressions, with no exposed surface geology ("depression ponds"). Also included are associations from the sinkhole ponds of northern New Jersey (K. Walz pers. comm.) and ponds of the Ridge and Valley in Pennsylvania. These are very similar to Shenandoah sinkhole ponds of Virginia and are in Maryland as well. Southern Piedmont associations vary in relation to their underlying soil, geology, geography, and basin morphology. This variation is accounted for at the alliance and association levels. A few disjunct pond examples may occur in the Southern Blue Ridge because of similarity in topographic setting and general structure. They do, however, occur on different substrates (quartzite and sandstone) than any examples in the Piedmont. Their vegetation is different from other examples but not in having more montane flora. Their vegetation is no more different than most other pools are from each other. Most of the flatwoods and many swamp examples are found north of the glacial line in the Midwest and Lower New England. Those examples south of that range are relatively limited to broad, flat areas of the Interior Highlands.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G667	Northeastern Forest Vernal Pool	

Elcode	Scientific or Colloquial Name	Note
G044	Central Interior-Appalachian Seepage Swamp	includes seepage swamps.
G037	Coastal Plain Mixed Evergreen Swamp	of the coastal plains.
G038	Coastal Plain Hardwood Basin Swamp	of the coastal plains.
G599	Central Interior-Appalachian Open Depression Pond	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Stands of this group are composed of broad-leaved deciduous trees. The canopy can range from moderate to dense. The density of shrubs and herbs varies based on the extent of canopy closure, hydrologic regime, and disturbance regime.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The vegetation of this group consists of wetland forest stands dominated by wetland *Quercus* species, including *Quercus palustris* and *Quercus bicolor* as well as *Platanus occidentalis, Fraxinus pennsylvanica, Acer rubrum, Acer saccharinum*, or *Nyssa* spp., or a combination of these. *Cephalanthus occidentalis* is a typical shrub component. Examples that have been logged or cleared may be dominated by *Acer rubrum* or *Liquidambar styraciflua*. Lower strata are generally sparse in longer hydroperiod examples. Open ponds may have the same canopy species on the edges, but a few have *Nyssa sylvatica* or other wetland species. The lower strata are better developed in the open pools, with *Cephalanthus occidentalis, Eubotrys racemosa (= Leucothoe racemosa), Vaccinium* spp., or other wetland shrubs occurring as thickets along the edge or scattered in the interior. Large *Smilax* tangles sometimes occur. Herbs are usually still sparse or patchy but may include dense beds or scattered clumps of various graminoids or ferns. *Sphagnum* moss is sometimes extensive in parts of the pools. These isolated seasonal wetlands are often important breeding sites for amphibians.

In the flatwoods of the upper Midwest and Northeast, *Quercus palustris* and/or *Quercus bicolor* typically dominate the wetter portions and are often associated with *Acer rubrum*. In addition, *Quercus alba, Quercus rubra, Fagus grandifolia*, and *Acer saccharum* are common in the better-drained areas. *Fagus grandifolia* dominates in some areas across the Midwest and Northeast. South of the glaciated Midwest into the Interior Highlands, *Quercus phellos* and *Quercus stellata* are more common. *Quercus alba, Quercus rubra*, and/or *Quercus velutina* may occur in drier examples across the range of the group. Other possible canopy species include *Acer rubrum, Liquidambar styraciflua*, and *Nyssa sylvatica*. Understory shrub and herbaceous species vary with moisture level and canopy density. Stands with greater density of tree cover have less shrub and herbaceous cover, while those with moderate tree canopy cover tend to have a dense understory. Some common species include *Alnus* spp., *Carex* spp., *Cephalanthus occidentalis, Ilex* spp., and *Osmunda cinnamomea*. Other species (in drier zones or phases) include *Campsis radicans, Cardamine bulbosa, Croton michauxii var. ellipticus (= Croton willdenowii), Danthonia spicata, Leersia* spp., *Manfreda virginica, Gillenia stipulata (= Porteranthus stipulatus)*, and *Pycnanthemum tenuifolium*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The dynamics of water levels are the most important factor in these communities, differentiating them from the surrounding uplands and differentiating the various alliances and associations within the group. Most depressions and basins have a very limited watershed area, so water comes largely from rainfall. Variation in rainfall patterns will drive variation in duration of flooding, though most basins have an outlet that ultimately limits water depth. Fire is presumably naturally rare in these systems. Though they would naturally be exposed to fires in the surrounding uplands, standing water and lack of continuous fuel would limit fires to the edges of ponds, with greater influence in flatwoods. The migration of amphibians is presumably important as a dynamic process, as they concentrate in these areas for breeding. Ecosystem dynamics may be strongly affected by the suitability of surrounding uplands for amphibian adult habitat. Flooding and periodic drought can influence flatwoods examples; invasive shrubs are a problem in some areas. Very few flatwoods examples remain as almost all have been drained, tiled, and converted to agriculture.

ENVIRONMENT

Environmental Description: This group accommodates hardwood forests found in wet edaphic or topographic situations, ranging from upland flats to depressions. These are known respectively as swamps, flatwoods and ponds. They can all range in hydroperiod from short to long. Stands of this group occur in poorly drained, small, shallow to deeper basins, sinkholes, or gentle swales on flat to rolling upland sites, and occasionally in depressions on narrow, steeper ridgetops, sometimes associated with glacial features such as tillplains, lakeplains or outwash plains.

Soil/substrate/hydrology: Soils are poorly drained to very poorly drained, and have a dense clay hardpan or some other impermeable clay layer or fragipan that limits internal drainage and can create a shallow, perched water table. Some soils may be deep (100 cm or more), consisting of peat or muck, with parent material of peat, muck or alluvium. Rainwater accumulates in the basins and persists through the wet season, occasionally persisting all year. Some examples become dry, with drought possible during the summer and autumn months. These fluctuating moisture levels can lead to complexes of forest upland and wetland species occurring within this group, particularly in flatwoods. Only a few kinds of rock are known to form these depressions. Most examples occur on mafic rocks such as gabbro or diabase, but a few occur on slates or on mafic to felsic tuffs where a dense clay hardpan has formed. A few occur over bedrock of other kinds. Rock chemistry affects soil chemistry and influences variation in vegetation, but hydroperiod is a more important influence.

DISTRIBUTION

***Geographic Range:** The distribution of this group ranges from southern Minnesota, Wisconsin and Michigan across to southern Ontario and Lower New England, south to the Ozark-Ouachita region and east to Virginia.
Nations: CA, US
States/Provinces: AR, CT, DC?, DE, IA, IL, IN, KY, MA, MD, MI, MO, NH, NJ, NY, OH, ON, PA, QC, RI, TN, VA, WI, WV
USFS Ecoregions (2007) [optional]: 211E:CC, 211F:CP, 221A:CC, 221B:CP, 221F:CC, 221H:CC, 221J:CC, 222Jh:CPC, 222Ua:CCC, 222Ue:CC?, 223A:CC, 223D:CC, 223E:CC, 223F:CC, 223G:CC, 231B:CC, 231C:CC, 231D:CC, 231H:CC, M221A:CC, M223A:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.2.72a:C, 8.3.2.72c:C, 8.3.2.72h:C, 8.3.3.71e:C, 8.3.3.71f:C, 8.3.5.65e:C, 8.3.6.74b:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0230	*Quercus alba - Fagus grandifolia* Flatwoods & Swamp Forest Alliance
A0329	*Quercus palustris - Quercus bicolor* Flatwoods & Swamp Forest Alliance
A3408	*Quercus palustris - Quercus bicolor* Flooded & Swamp Forest Alliance
A3881	*Acer rubrum - Fraxinus* spp. - *Quercus bicolor* Swamp Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-01-28	G170 Quercus spp. - Acer rubrum - Fagus grandifolia Flatwoods Forest Group	G169 & G170 first merged into a single flatwoods and pond unit, but then split into G597 (central flatwoods & pond, glaciated) and G654 (east-central flatwoods, unglaciated).
2013-01-28	G169 Quercus bicolor - Quercus palustris - Liquidambar styraciflua Pond Forest Group	G169 & G170 first merged into a single flatwoods and pond unit, but then split into G597 (central flatwoods & pond, glaciated) and G654 (east-central flatwoods, unglaciated).

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Southern Hardwood Swamp	Kost et al. 2007	
<	Southern Wet-mesic Forest	Curtis 1959	
<	Wet-mesic Flatwoods	Kost et al. 2007	

AUTHORSHIP

***Primary Concept Source [if applicable]:** M. Pyne and S. Menard, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne, S. Menard and D. Faber-Langendoen

Acknowledgments [optional]:

Version Date: 19 Jan 2016

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***References [Required if used in text]:**

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Bryant, W. S., and M. E. Held. 2001. An ordination of the plant communities of the Jackson Purchase Region of Kentucky. Pages 11-18 in: Contributed Papers: Session I: Botany. Austin Peay State University, Clarksville, TN. [http://www.apsu.edu/field_biology/center/sym2001/botany.htm]

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1. Forest & Woodland

1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest

M504. Laurentian-Acadian-North Atlantic Coastal Flooded & Swamp Forest

Type Concept Sentence: This swamp forest macrogroup of the northeastern and north-central U.S. and southeastern Canada is characterized by a mixture of deciduous trees (*Acer rubrum, Betula alleghaniensis, Fraxinus nigra, Nyssa sylvatica, Ulmus americana*) and coniferous trees (*Chamaecyparis thyoides, Larix laricina, Picea rubens, Pinus strobus, Thuja occidentalis, Tsuga canadensis*) on organic or mineral soils spanning the pH spectrum from acidic to alkaline.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.3.Na.3. Eastern North American-Great Plains Flooded & Swamp Forest (D011)

Elcode: M504
***Scientific Name:** *Tsuga canadensis - Fraxinus nigra - Chamaecyparis thyoides* Flooded & Swamp Forest Macrogroup
***Common (Translated Scientific) Name:** Eastern Hemlock - Black Ash - Atlantic White-cedar Flooded & Swamp Forest Macrogroup
***Colloquial Name:** Laurentian-Acadian-North Atlantic Coastal Flooded & Swamp Forest

***Type Concept:** This swamp forest macrogroup ranges from temperate regions of northwest Ontario east to Atlantic Canada, and from central Minnesota east to northern New England. It includes deciduous and coniferous trees, including *Betula alleghaniensis, Fraxinus nigra, Larix laricina, Picea rubens, Pinus strobus, Thuja occidentalis*, and *Tsuga canadensis* to the north, and *Chamaecyparis thyoides* and *Nyssa sylvatica* to the south, with *Acer rubrum* usually present throughout the range and often strongly dominant in more successional stands. Occasionally, colder conditions favor *Abies balsamea, Picea glauca*, or *Picea mariana*, mixed with temperate trees, shrubs, and herbs. This macrogroup covers a wide pH range, and includes alkaline to circumneutral swamps and floodplains characterized by *Fraxinus nigra, Thuja occidentalis*, and *Ulmus americana* and acidic swamps characterized by *Chamaecyparis thyoides, Picea rubens*, and/or lacking *Thuja occidentalis* and *Fraxinus nigra*. Common shrubs may include *Clethra alnifolia, Gaylussacia dumosa, Ilex glabra, Eubotrys racemosa, Rhododendron viscosum* in the south; *Alnus incana, Ilex mucronata, Viburnum nudum var. cassinoides* in the north, with *Ilex verticillata* and *Vaccinium corymbosum* over much of the range. Ferns may be common, including *Dryopteris cristata, Osmunda cinnamomea, Onoclea sensibilis, Thelypteris palustris*, and others. Sedges and *Sphagnum* mosses are common. Hummock-and-hollow microtopography is characteristic, and trees are often primarily confined to hummocks, with more hydrophytic herbaceous vegetation in hollows. These swamps form in basin wetlands that remain saturated for all or nearly all of the growing season, and may have standing water seasonally. Some occur on gently sloping seepage lowlands, and even basin settings may have some seepage influence, especially near the periphery.

***Diagnostic Characteristics:** Saturated forests with prominent canopy trees including *Acer rubrum* and associates *Chamaecyparis thyoides* or *Pinus rigida* occurring on the Atlantic Coastal Plain from Virginia to southern New England, or *Acer rubrum, Betula alleghaniensis, Fraxinus nigra, Larix laricina, Picea rubens, Thuja occidentalis*, and *Tsuga canadensis* inland and to the north. The shrub and herbaceous layers have a significant component of hydrophytes (facultative to obligate wetland species). Ferns are prevalent within these swamp forests, including *Dryopteris cristata, Osmunda cinnamomea, Onoclea sensibilis, Thelypteris palustris*, and others.

***Classification Comments:** Some species, such as *Clethra alnifolia, Gaylussacia dumosa*, and *Ilex glabra*, have coastal plain affinities.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M503	Central Hardwood Swamp Forest	occurs to the south and west and is characterized by presence of *Liquidambar styraciflua, Liriodendron tulipifera, Quercus phellos*, and flatwoods species *Quercus palustris* and *Quercus bicolor* in addition to *Acer rubrum*; lacks northern conifers *Picea rubens, Thuja occidentalis*, and lacks *Chamaecyparis thyoides* or *Pinus rigida*.
M302	Eastern North American Ruderal Flooded & Swamp Forest	
M029	Central Hardwood Floodplain Forest	has floodplain trees such as *Acer saccharinum, Betula*

Elcode	Scientific or Colloquial Name	Note
		nigra, Quercus palustris, and *Platanus occidentalis*.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Deciduous, mixed, or coniferous canopy ranging from dense to partially open; shrub layer generally well-developed but can be sparse under dense canopy and where deer browse pressure is high. Hummock-and-hollow microtopography is characteristic, and mosses, especially species of *Sphagnum*, are common and usually abundant. Hummocks and decaying nurse logs provide critical substrate for plant establishment and growth.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Acer rubrum* is a relatively constant species throughout the range of these swamps. At the northern end of the range, canopy trees *Betula alleghaniensis, Larix laricina, Picea rubens, Pinus strobus*, and *Tsuga canadensis* are characteristic. *Nyssa sylvatica* can be more important toward the southern end of the range. Occasionally, colder conditions favor *Abies balsamea, Picea glauca*, or *Picea mariana*, mixed with temperate trees, shrubs, and herbs. Typical shrubs include *Alnus incana, Carpinus caroliniana, Cornus* spp., *Ilex verticillata, Lindera benzoin, Ilex mucronata (= Nemopanthus mucronatus), Ribes* spp., *Rubus pubescens, Salix* spp., *Vaccinium corymbosum*, and *Viburnum nudum var. cassinoides*. On the coastal plain, *Picea rubens* and *Larix laricina* are replaced by *Chamaecyparis thyoides* or *Pinus rigida*, with typical shrubs including *Clethra alnifolia, Gaylussacia dumosa, Ilex glabra, Eubotrys racemosa (= Leucothoe racemosa)*, and *Rhododendron viscosum*. Typical herbs across the range of acidic swamps include *Carex folliculata, Carex intumescens, Carex scabrata, Carex stricta, Chelone glabra, Dryopteris cristata, Onoclea sensibilis, Osmunda* spp., *Saxifraga pensylvanica*, and *Symplocarpus foetidus*, among others. Alkaline swamps are limited to the northern portion of the range of this macrogroup and are characterized by *Acer rubrum, Fraxinus nigra, Larix laricina, Thuja occidentalis*, and *Ulmus americana*, with shrubs including *Rhamnus alnifolia* and *Cornus sericea* in addition to the shrubs of northern acidic swamps. Herbaceous species of alkaline swamps include *Caltha palustris, Carex bromoides, Carex leptalea, Geum rivale, Impatiens capensis*, and *Packera aurea*, in addition to many of the acidic swamp species listed above.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: From Slaughter et al. (2007): "The primary natural processes structuring hardwood-conifer swamp are small-scale windthrow and dynamics of surface water and groundwater. Patchy windthrow is the dominant natural disturbance, creating small-scale canopy gaps (Forrester et al. 2005).

"Seedlings of several characteristic hardwood-conifer swamp canopy species (e.g., yellow birch, white pine, northern white-cedar, and hemlock) preferentially germinate and establish on root hummocks and/or decaying logs versus muck or litter-covered depressions (i.e., hollows) (Holcombe 1976, St. Hilaire and Leopold 1995, Rooney and Waller 1998, Allison and Ehrenfeld 1999, McGee 2001, Rooney et al. 2002). In comparison to hollows, hummocks and decaying logs have high moss cover, high moisture content, coarse substrate texture, and stable hydrology, characteristics which may favor the germination and establishment of small seeds with low nutrient reserves (Coffman 1978, St. Hilaire and Leopold 1995, McGee 2001).

"Groundwater and surface water dynamics also shape hardwood-conifer swamp structure and impact succession. Significant hydrological processes impacting hardwood-conifer swamp include groundwater seepage, water table fluctuation, seasonal inundation, and flooding events. "

Logging, especially of *Thuja occidentalis* and *Chamaecyparis thyoides*, has influenced the structure and dominance of this macrogroup. Regeneration of *Chamaecyparis thyoides* is stimulated by fire.

At the present time, excessive deer herbivory threatens the viability of hardwood-conifer swamp throughout its range. High white-tailed deer (*Odocoileus virginianus*) density is leading to considerable browse pressure on conifer seedlings and saplings throughout Michigan and the Great Lakes region (Frelich and Lorimer 1985, Mladenoff and Stearns 1993, Alverson and Waller 1997, Long et al. 1998, Rooney and Waller 1998, Rooney et al. 2002, Krueger and Peterson 2006). Deer browse also reduces frequency and cover of understory shrubs and herbs (Balgooyen and Waller 1995, Augustine and Frelich 1998, Rooney and Waller 2003, Kraft et al. 2004). The result of heavy deer browse is significant alteration of community structure consisting of impacts to all vegetative strata.

ENVIRONMENT

Environmental Description: From Slaughter et al. (2007): "Hardwood-conifer swamp occurs on a variety of landforms, including poorly-drained outwash channels and outwash plains and depressions on medium- to coarse-textured end moraines, ground moraines, and glacial lakeplains (Kost et al. 2007). The community occupies sites influenced by groundwater seepage, usually where the water table is at or near the soil surface. Hardwood-conifer swamp occurs on gently sloping to flat topography along headwater streams or in association with relatively inactive portions of floodplains of low order streams, where it forms backswamps or occurs in meander scars (Tepley et al. 2004). Shallow kettle depressions and the margins of large forested and non-forested peatlands may also support hardwood-conifer swamp, but the community is absent from areas where significant peat accumulation isolates the rooting zone from contact with mineral-rich groundwater." The type may also occur in floodplains. The substrate is either wet mineral soils or peat, and hummocky topography is present. The groundwater ranges from low to high base status.

DISTRIBUTION

***Geographic Range:** This macrogroup ranges from New England west to Minnesota, south along the Appalachian Mountains to Virginia, and east to the Atlantic Coastal Plain.
Nations: CA, US
States/Provinces: CT, DE, IL, IN, MA, MD, ME, MI, MN, NB, NH, NJ, NS, NY, OH, ON, PA, QC, RI, VA, VT, WI, WV
USFS Ecoregions (2007) [optional]: 211Aa:CCC, 211Ab:CCC, 211Ba:CCC, 211Bb:CCC, 211Ca:CCC, 211Cb:CCP, 211Da:CCC, 211Ea:CCC, 211Eb:CCP, 211Ec:CCC, 211Ed:CCC, 211Ee:CCC, 211Fb:CCC, 211G:CC, 211I:CC, 211Ja:CCP, 211Jb:CCP, 211Jc:CCP, 211Jd:CCC, 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212J:CC, 212L:CC, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC, 212Sb:CCC, 212Sc:CCC, 212Sn:CCC, 212Sq:CCC, 212Te:CCC, 212Ya:CCC, 212Z:CC, 221Ah:CCC, 221Ai:CCC, 221Ak:CCC, 221Al:CCC, 221B:CC, 221D:CC, 222Ib:CCC, 222Ic:CCC, 222Id:CCP, 222Ie:CCC, 222Ja:CCC, 222K:CC, 222L:CC, 222M:CC, 222Ua:CCC, 222Ud:CCC, 222Ue:CCC, 232A:CC, 232H:CC, M211Aa:CCP, M211Ab:CCC, M211Ac:CCP, M211Ad:CCP, M211Ae:CCC, M211Af:CCC, M211Ba:CCC, M211Bb:CCP, M211Bc:CCC, M211Ca:CCC, M211Cb:CCC, M211Da:CCC, M211Db:CCC, M211Dc:CCC, M211Dd:CCC, M211De:CCC, M221A:CC, M221B:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: Segregated reasonably well in the analyses of eastern U.S. FIA plots (Faber-Langendoen and Menard 2006).

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G653	Silver Maple - Green Ash - Black Ash Floodplain Forest
G039	Northern Atlantic Coastal Hardwood - Conifer Swamp
G045	Laurentian-Acadian-Appalachian Acidic Swamp
G046	Laurentian-Acadian-Appalachian Alkaline Swamp

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-07-23	M030 Northern & Central Swamp Forest Macrogroup	M030 split into Central (M503) & Northern (M504)

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
><	Atlantic white cedar wetland	Laderman 1989	
>	Northern White-Cedar - Hemlock - Red Spruce Conifer Swamp Group	Faber-Langendoen and Menard 2006	
><	Red maple swamp	Golet et al. 1993	
><	Spring swamp	National Wetlands Working Group 1988	

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** L. Sneddon and C. Lea

Acknowledgments [optional]: Sue Gawler authored two groups contributing to this description. Josh Cohen provided additional edits and the extended quoted text from Slaughter et al. (2007). Sean Basquill provided review comments.

Version Date: 05 Jun 2015

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1. Forest & Woodland
1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest

G653. Silver Maple - Green Ash - Black Ash Floodplain Forest

Type Concept Sentence: The group includes hardwood floodplain forests in the Laurentian-Acadian areas of the northeastern and midwestern U.S. and southern Canada, and is typically dominated by *Acer rubrum, Acer saccharinum, Acer saccharum, Fraxinus pennsylvanica, Tilia americana*, or *Ulmus americana*. Northward stands with *Picea glauca* or *Populus balsamifera* may occur.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.3.Na.3. Laurentian-Acadian-North Atlantic Coastal Flooded & Swamp Forest (M504)

Elcode: G653
***Scientific Name:** *Acer saccharinum - Fraxinus pennsylvanica - Fraxinus nigra* Floodplain Forest Group
***Common (Translated Scientific) Name:** Silver Maple - Green Ash - Black Ash Floodplain Forest Group
***Colloquial Name:** Silver Maple - Green Ash - Black Ash Floodplain Forest

***Type Concept:** This group occurs in the northeastern U.S. and temperate regions of eastern Canada, west to the upper Great Lakes region of Minnesota and Ontario. Forest canopy dominants can vary but typically are a combination of *Acer rubrum, Acer saccharinum, Acer saccharum, Fraxinus americana, Fraxinus nigra, Fraxinus pennsylvanica, Prunus serotina, Quercus rubra*, and *Ulmus americana*. Northward stands with *Picea glauca* or *Populus balsamifera* may occur. Shrub layer ranges from dense in patches to sparse. The herbaceous layer is typically diverse. Some common species include *Boehmeria cylindrica, Matteuccia struthiopteris*, and *Onoclea sensibilis*. It occurs along small and large rivers on slightly elevated alluvial terraces and active floodplains, along streams with small watersheds (<2 square miles), high-gradient or submontane portions of major rivers, and beside lakes. Soils range from alluvial sands to sand and alluvial loams to silt loams. Flooding occurs during spring runoff periods and during other peak floods.

***Diagnostic Characteristics:** Deciduous floodplain forests found dominated by *Acer rubrum, Acer saccharinum, Acer saccharum, Fraxinus pennsylvanica, Tilia americana*, or *Ulmus americana* with closed to somewhat open canopy and a rich, well-developed herb layer.

***Classification Comments:** The separation of this group with others to the south was determined partially by biogeography, with those alliances south of the Laurentian-Acadian region contained within Silver Maple - Green Ash - Sycamore Floodplain Forest

Group (G652). Further review is needed to ascertain if this is the correct way to separate these floodplain groups and alliances. Also, there are some alliances in this group that occur on mesic terraces in floodplains and may better be treated as uplands in a mesic group.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G652	Silver Maple - Green Ash - Sycamore Floodplain Forest	is found to the south.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Deciduous broad-leaved hardwood floodplain forests with closed to somewhat open canopy and a rich, well-developed herb layer.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Forest canopy dominants can vary but typically are a combination of *Acer rubrum, Acer saccharinum, Acer saccharum, Fraxinus americana, Fraxinus nigra, Fraxinus pennsylvanica, Prunus serotina, Quercus rubra*, and *Ulmus americana*. Northward stands with *Picea glauca* or *Populus balsamifera* may occur. Other common associations can include *Betula alleghaniensis, Carpinus caroliniana, Carya ovata, Fraxinus nigra, Juglans cinerea, Quercus bicolor, Quercus macrocarpa*, and *Pinus strobus*. Shrubs are occasional to locally dense and can include *Carpinus caroliniana, Cephalanthus occidentalis, Cornus* spp., *Corylus americana, Ilex verticillata, Lindera benzoin, Prunus virginiana, Vaccinium corymbosum*, and *Viburnum* spp. Vine species such as *Parthenocissus* spp., *Toxicodendron radicans*, and *Vitis* spp. can occur on some examples. The herbaceous layer is diverse and varies seasonally with spring ephemerals giving way to taller ferns, graminoids, and forbs. Some common species include *Ageratina altissima (= Eupatorium rugosum), Allium* spp., *Arisaema triphyllum, Asarum canadense, Asclepias incarnata, Athyrium filix-femina, Boehmeria cylindrica, Caulophyllum thalictroides, Carex* spp., *Cinna* spp., *Danthonia spicata, Elymus* spp., *Eupatorium* spp., *Galium* spp., *Impatiens capensis, Laportea canadensis, Lycopus uniflorus, Matteuccia struthiopteris, Onoclea sensibilis, Osmunda* spp., *Phalaris arundinacea, Pilea pumila, Sanguinaria canadensis*, and *Solidago* spp. Non-native and invasive species are often present.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Forests are flooded during spring runoff periods and during other peak floods.

ENVIRONMENT

Environmental Description: Stands occur along slightly elevated to higher alluvial terraces and active floodplains, streams with small watersheds (<2 square miles), high-gradient or submontane portions of major rivers. It often occurs as a linear band within terraces, backwaters, bars, and islands of minor rivers and smaller tributaries, creeks, and drainages. Soils are typically well-drained to imperfectly drained and range from alluvial sands to sand and alluvial loams to silt loams. Soils can be temporarily inundated during spring floods, although some examples tend to be more mesic and may be considered uplands rather than wetlands.

DISTRIBUTION

***Geographic Range:** This group occurs across the northern U.S., from northern Minnesota and southern Manitoba eastward to New England and from temperate regions of northwest Ontario to Atlantic Canada. It possibly extends somewhat further south in some parts of its range. The core of its range is in Ecoprovince 212 and extreme northern 251 (Cleland et al. 2007).
Nations: CA, US
States/Provinces: CT, MA, MB, MD, ME, MI, MN, NB, ND, NH, NJ, NS, ON, PA, QC, SD, VT, WI
USFS Ecoregions (2007) [optional]: 211:C, 212:C, 251A:CC, M211:C
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3715	*Acer saccharinum - Acer rubrum - Ulmus americana* Floodplain Forest Alliance
A3714	*Acer saccharum - Tilia americana* Mesic Floodplain Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-07-23	G139 Betula nigra - Platanus occidentalis - Salix spp. Riverscour Scrub Group	G040 split into G673, G652 & G653 (DFL 7-23-12)
2012-07-23	G040 Acer saccharinum - Fraxinus pennsylvanica - Platanus occidentalis Floodplain Group	G040 split into G673, G652 & G653

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al.

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.E. Menard and D. Faber-Langendoen

Acknowledgments [optional]: Sean Basquill

Version Date: 05 Jun 2015

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Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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1. Forest & Woodland

1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest

G039. Northern Atlantic Coastal Hardwood - Conifer Swamp

Type Concept Sentence: This group is made up of saturated, nutrient-poor swamp forests of the northern Atlantic Coastal Plain, characterized by *Chamaecyparis thyoides* or *Pinus rigida*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.3.Na.3. Laurentian-Acadian-North Atlantic Coastal Flooded & Swamp Forest (M504)

Elcode: G039
***Scientific Name:** *Chamaecyparis thyoides - Pinus rigida* Swamp Group
***Common (Translated Scientific) Name:** Atlantic White-cedar - Pitch Pine Swamp Group
***Colloquial Name:** Northern Atlantic Coastal Hardwood - Conifer Swamp

***Type Concept:** This group encompasses coniferous to mixed swamp forests and wetland pine barrens on the northern Atlantic Coastal Plain, generally from Massachusetts south to Virginia. They occur on sandy, acidic, and nutrient-poor soils, mostly in settings that remain saturated throughout the growing season, but sometimes in settings that are only seasonally saturated. The characteristic overstory tree is either *Chamaecyparis thyoides* or *Pinus rigida*, generally not together. *Acer rubrum* can be an important associate, especially with *Chamaecyparis*, where cutting or other anthropogenic disturbance has altered the vegetation composition. Associated shrubs and herbs indicative of the coastal plain setting include *Gaylussacia dumosa, Clethra alnifolia, Ilex glabra, Rhododendron viscosum, Eubotrys racemosa*, and *Carex striata*, as well as the more widespread *Vaccinium corymbosum, Gaylussacia baccata*, and *Chamaedaphne calyculata*. Fire has been an important ecological process in the vegetation of this group.

***Diagnostic Characteristics:** Tree canopy with at least 20% relative dominance by *Chamaecyparis thyoides* or *Pinus rigida* with wetland indicator species in the lower layers, and lacking species more characteristic of the central and southern Atlantic Coastal Plain such as *Quercus laurifolia, Quercus nigra, Quercus virginiana, Cliftonia monophylla, Fraxinus caroliniana, Gordonia lasianthus, Persea borbonia, Sabal palmetto, Pinus elliottii*; Virginia northward.

***Classification Comments:** In the 2006 analyses of FIA eastern forest plots, vegetation in this group was included within the former Coastal Plain Mixed Evergreen Swamp Forest Group (in what is now Southern Coastal Plain Evergreen Hardwood - Conifer Swamp Macrogroup (M032) in 1.B.3.Nb Southeastern North American Flooded & Swamp Forest Division (D062)). The vegetation in the present group was moved into former Northern & Central Swamp Forest Macrogroup (M030) and subsequently into Laurentian-Acadian-North Atlantic Coastal Flooded & Swamp Forest Macrogroup (M504) based on the absence of species more characteristic of the central and southern Atlantic Coastal Plain. The group concept needs to be expanded based on the component systems from CES203.520 and CES203.070.

In western Nova Scotia, in Atlantic Canada, swamps with the strongest expression of Atlantic Coastal Plain flora are deciduous,(usually *Acer rubrum*-dominated, but open conifer swamps of *Picea mariana, Larix laricina*, or *Thuja occidentalis* can support similar understory associates. The non-tree species in this description that are also found in these Atlantic Canada swamps include the shrubs *Chamaedaphne calyculata, Clethra alnifolia, Gaylussacia baccata, Gaylussacia dumosa, Ilex glabra, Vaccinium corymbosum*, and the herbs *Bartonia paniculata, Carex atlantica, Carex folliculata, Drosera* spp., *Glyceria striata, Lycopus virginicus, Mitchella repens, Osmunda cinnamomea, Osmunda regalis, Pogonia ophioglossoides, Sarracenia purpurea, Thelypteris palustris, Thelypteris simulata, Woodwardia areolata*, and *Woodwardia virginica*. Given the overstory species composition, these swamps may best be treated as an alliance within Laurentian-Acadian-Appalachian Acidic Swamp Group (G045).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G045	Laurentian-Acadian-Appalachian Acidic Swamp	occurs at similar latitudes and in similar acidic, nutrient-poor settings as this group, but is typically inland from the coastal plain and is not dominated by *Chamaecyparis thyoides* or *Pinus rigida*.
G037	Coastal Plain Mixed Evergreen Swamp	includes swamps dominated by *Chamaecyparis thyoides* but features associated or codominant species of more southern affinity (e.g., *Quercus laurifolia, Quercus nigra, Quercus virginiana, Cliftonia monophylla, Fraxinus caroliniana, Gordonia lasianthus, Persea borbonia,*

Elcode	Scientific or Colloquial Name	Note
		Sabal palmetto, Pinus elliottii).

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Forested, with full to partial canopies. Understory may be very sparse beneath dense *Chamaecyparis*, or have a well-developed shrub-graminoid layer where overstory trees are more scattered.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The most common overstory trees are *Chamaecyparis thyoides, Pinus rigida*, and *Acer rubrum*. *Nyssa sylvatica, Liquidambar styraciflua, Magnolia virginiana*, and *Ilex opaca* are less constant/important associates. Shrub and herb species include those indicative of the coastal plain setting, including *Gaylussacia dumosa, Clethra alnifolia, Ilex glabra, Rhododendron viscosum, Eubotrys racemosa (= Leucothoe racemosa), Woodwardia areolata*, and *Carex striata*, as well as the more widespread *Vaccinium corymbosum, Gaylussacia baccata, Gaylussacia frondosa* (less commonly), and *Chamaedaphne calyculata*. Other herbs include *Osmunda cinnamomea, Thelypteris palustris, Woodwardia virginica, Thelypteris simulata, Drosera* spp., *Sarracenia purpurea, Pogonia ophioglossoides, Mitchella repens, Carex striata, Carex collinsii, Carex atlantica, Chasmanthium laxum, Carex folliculata, Bartonia paniculata, Carex seorsa, Glyceria striata, Lycopus virginicus*, and *Osmunda regalis var. spectabilis*. *Sphagnum* spp., other nonvascular plants, and lichens may be common on exposed peat and rotting wood.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Coastal plain swamps undergo a number of natural disturbances, including wind storms and periodic fire. These processes remove part or all of the tree canopy; an open canopy is necessary for the establishment of the coniferous trees *Chamaecyparis thyoides* and *Pinus rigida*. When periodic disturbance is lacking, the vegetation succeeds to hardwood swamps characterized by *Acer rubrum* and *Nyssa sylvatica*. In pitch pine lowlands, hydrologic regime has the greatest effect on vegetation structure and composition (Zampella et al. 2001).

ENVIRONMENT

Environmental Description: Soils are sands or mucky peat over sand. Most remain saturated throughout the season, but some may be seasonally saturated. The coarse soils are acidic and nutrient-poor.

DISTRIBUTION

***Geographic Range:** Northern Atlantic Coastal Plain, from Massachusetts to southern Virginia (in the vicinity of the James River); occasional outliers northward near the coast or disjunct occurrences inland.
Nations: CA, US
States/Provinces: CT, DE, MA, MD, ME, NJ, NY, VA
USFS Ecoregions (2007) [optional]: 211Da:CCC, 221Ah:CCC, 221Ai:CCC, 221Ak:CCC, 221Al:CCC, 232A:CC, 232H:CC, M211Bc:CCC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3415	*Chamaecyparis thyoides* Mid-Atlantic Streamside Swamp Forest Alliance
A3400	*Chamaecyparis thyoides* Northern Peat Swamp Forest Alliance
A4211	*Pinus rigida* Scrub Swamp Alliance
A0580	*Pinus rigida* Swamp Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Broadleaf Swamp Forests	McCormick 1979	
<	Coastal Plain Atlantic White Cedar Swamp	NYNHP 2013w	
<	Pine Transition Forests	McCormick 1979	
<	Pitch Pine Lowland Forests	McCormick 1979	
<	Pitch pine lowland	Zampella et al. 1992	
<	Southern White Cedar Swamp Forests	McCormick 1979	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. McCormick (1979)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler and L.A. Sneddon

Acknowledgments [optional]:

Version Date: 19 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

McCormick, J. 1979. The vegetation of the New Jersey Pine Barrens. In: R. T. T. Formann, editor. Pine Barrens: Ecosystem and landscape. Academic Press, New York.

NYNHP [New York Natural Heritage Program]. 2013w. Online conservation guide for Coastal Plain Atlantic White Cedar Swamp. New York Natural Heritage Program, Albany, NY. [http://www.acris.nynhp.org/guide.php?id=9907]

Whittaker, R. H. 1979b. Vegetational relationships of the Pine Barrens. Pages 315-331 in: R. T. T. Forman. Pine Barrens: Ecosystems and landscape. Academy Press, New York.

Zampella, R. A., C. L. Dow, and J. F. Bunnell. 2001. Using reference sites and simple linear regression to estimate long-term water levels in coastal plain forests. Journal of the American Water Resources Association 37:1189-1201.

Zampella, R. A., G. Moore, and R. E. Good. 1992. Gradient analysis of pitch pine (Pinus rigida Mill.) lowland communities in the New Jersey Pinelands. Bulletin of the Torrey Botanical Club 119(3):253-261.

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1. Forest & Woodland
1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest

G045. Laurentian-Acadian-Appalachian Acidic Swamp

Type Concept Sentence: This group includes north-temperate acidic, nutrient-poor swamps of the northeastern U.S. and adjacent Canada, where *Acer rubrum* is the nearly constant and dominant tree species and the herbaceous and shrub layers tend to be fairly species-poor. Other codominants include deciduous trees *Fraxinus* spp., *Betula alleghaniensis*, or *Nyssa sylvatica*, or conifers *Tsuga canadensis* and *Picea rubens*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.3.Na.3. Laurentian-Acadian-North Atlantic Coastal Flooded & Swamp Forest (M504)

Elcode: G045
***Scientific Name:** *Acer rubrum - Picea rubens - Tsuga canadensis* Swamp Group
***Common (Translated Scientific) Name:** Red Maple - Red Spruce - Eastern Hemlock Swamp Group
***Colloquial Name:** Laurentian-Acadian-Appalachian Acidic Swamp

***Type Concept:** This group includes north-temperate acidic, nutrient-poor swamps of the northeastern U.S. and adjacent Canada, from southeastern Canada and New England to New York through the Central Appalachians south to Virginia and west to Ohio. They occur on mineral soils that are nutrient-poor; there may be an organic epipedon, and the substrate may be shallow to deep peat. Most are basin wetlands that remain saturated for all or nearly all of the growing season, and may have standing water seasonally. Some occur on gently sloping seepage lowlands, and even basin settings may have some seepage influence, especially near the periphery. *Acer rubrum* is a nearly constant and often dominant to codominant tree species. It may form a mostly deciduous canopy with *Fraxinus* spp., *Betula alleghaniensis*, or *Nyssa sylvatica*, or it may be mixed with conifers. *Tsuga canadensis* is the most widespread conifer in associations of this group. From central New England and New York north, *Picea rubens* is a characteristic associate (less commonly *Picea mariana*). *Larix laricina, Pinus strobus*, and *Abies balsamea* are occasional and in some places may be locally important. The herbaceous and shrub layers tend to be fairly species-poor. *Ilex mucronata, Viburnum nudum var. cassinoides, Ilex verticillata*, and *Vaccinium corymbosum* are typical shrubs through much of the range of this group, and *Rhododendron maximum* is often important in the central and southern portions of this group's range. Typical herbs include *Osmunda* spp., *Onoclea sensibilis, Dryopteris cristata, Carex folliculata, Carex intumescens, Carex stricta*, and *Carex scabrata*, among others. *Sphagnum* is an important component of the bryoid layer. In many swamps, species richness tends to be higher near the periphery where seepage waters influence the hydrology.

***Diagnostic Characteristics:** Tree growth form with any combination of *Picea rubens, Tsuga canadensis, Acer rubrum* (>20% Relative Importance Value), and other tree species are any combination of *Betula alleghaniensis, Abies balsamea, Ulmus americana, Pinus strobus* (>30% RIV); *Liquidambar styraciflua* absent or of minimal importance; wetland shrubs and herbs characterize the understory layers.

***Classification Comments:** Analyses of FIA plot data from the eastern U.S. combined this group and Laurentian-Acadian-Appalachian Alkaline Swamp Group (G046) into a Northern White-cedar - Hemlock - Red Spruce Conifer Swamp Group (Faber-Langendoen and Menard 2006). In review, this FIA group was split based on broad patterns of substrate pH, with this group housing the more acidic swamps and G046 housing the more alkaline swamps. Distribution of north-central midwestern acidic swamps (specifically *Larix laricina / Aronia melanocarpa / Sphagnum* spp. Swamp Forest (CEGL002472)), share characteristics of both alkaline and acidic swamps, and contain boreal elements. Perhaps CEGL002472 could be placed in Laurentian-Acadian-Appalachian Alkaline Swamp Group (G046).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G046	Laurentian-Acadian-Appalachian Alkaline Swamp	overlaps in range and can share many species but has a higher dominance by *Thuja occidentalis, Fraxinus nigra*, or *Larix laricina*.
G044	Central Interior-Appalachian Seepage Swamp	includes swamps south of the Central Appalachians that share some species with this group but whose overall floristics reflect a more southern affinity.
G039	Northern Atlantic Coastal Hardwood - Conifer Swamp	

Elcode	Scientific or Colloquial Name	Note
G552	Eastern North American Ruderal Flooded & Swamp Forest	
G809	Ontario-Québec Boreal Flooded & Rich Swamp Forest	
G810	Atlantic Boreal Flooded & Rich Swamp Forest	

Similar NVC Types General Comments [optional]: Boreal swamps such as those in North American Boreal Conifer Poor Swamp Macrogroup (M299) generally have *Picea mariana* as the most important conifer.

VEGETATION

Physiognomy and Structure Summary: Closed-canopy to patchy-canopy forests. The canopy can range from completely deciduous to completely coniferous; the most common expression is mixed. The shrub layer varies from sparse to well-developed depending on the canopy cover, but some shrub cover is typical. Herb cover likewise varies. The bryoid layer is often extensive.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Acer rubrum* is a nearly constant and dominant to codominant tree species. It may form a mostly deciduous canopy with *Fraxinus* spp., *Betula alleghaniensis*, or *Nyssa sylvatica*, or it may be mixed with conifers. Some swamps may be strongly conifer-dominated. *Tsuga canadensis* is the most widespread conifer in associations of this group. From central New England and New York north, *Picea rubens* is a characteristic associate (rarely *Picea mariana*). *Larix laricina, Pinus strobus*, and *Abies balsamea* are occasional. The herbaceous and shrub layers tend to be fairly species-poor. *Ilex verticillata, Kalmia angustifolia, Ilex mucronata (= Nemopanthus mucronatus), Vaccinium corymbosum*, and *Viburnum nudum var. cassinoides* are typical shrubs through much of the range of this group, and *Rhododendron maximum* is often important in the central and southern portions of this group's range. Typical herbs or creeping shrubs include *Dryopteris cristata, Osmunda* spp., *Onoclea sensibilis, Rubus pubescens, Saxifraga pensylvanica, Solidago uliginosa*, as well as the sedges *Carex folliculata, Carex intumescens, Carex stricta, Carex scabrata*, and *Carex trisperma*. *Sphagnum* is an important component of the bryoid layer.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: These swamps develop in depressions within the landscape where soils are poorly to very poorly drained. The soils remain saturated for most or all of the growing season, and in most of these swamps, standing water is present for at least part of the season. The pH is weakly to moderately acidic. Stands occur on nutrient-poor mineral soils, or on shallow to deep peat.

DISTRIBUTION

***Geographic Range:** This group ranges from New England and adjacent Canada west through New York to Ohio and south to western Virginia (the Central Appalachians region).
Nations: CA, US
States/Provinces: CT, IL, IN, MA, MD, ME, MI, MN, NB, NH, NJ, NY, OH, ON, PA, RI, VA, VT, WI, WV
USFS Ecoregions (2007) [optional]: 211A:CC, 211B:CC, 211C:CC, 211D:CC, 211E:CP, 211F:CC, 211G:CC, 211I:CC, 211J:CC, 221A:CC, 221B:CC, 221D:CC, 222I:CC, M211A:CC, M211B:CC, M211C:CC, M211D:CC, M221A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]: Segregated reasonably well in the analyses of eastern U.S. FIA plots (Faber-Langendoen and Menard 2006).

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3416	*Betula alleghaniensis - Tsuga canadensis* Swamp Forest Alliance
A3417	*Picea rubens* Central Appalachian Swamp Forest Alliance
A3706	*Acer rubrum - Fraxinus pennsylvanica* Northeastern Swamp Forest Alliance
A3418	*Picea rubens* Northern Appalachian Swamp Forest Alliance
A2058	*Acer rubrum - Nyssa sylvatica* Swamp Forest Alliance
A0653	*Acer rubrum* Swamp Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Northern White-Cedar - Hemlock - Red Spruce Conifer Swamp Group	Faber-Langendoen and Menard 2006	

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen and S. Menard (2006)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler and D. Faber-Langendoen
Acknowledgments [optional]:
Version Date: 05 Jun 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Faber-Langendoen, D., and S. Menard. 2006. A key to eastern forests of the United States: Macrogroups, groups, and alliances. September 15, 2006. NatureServe, Arlington, VA.

Golet, F. C., A. J. K. Calhoun, W. R. DeRagon, D. J. Lowry, and A. J. Gold. 1993. Ecology of red maple swamps in the glaciated Northeast: A community profile. USDI Fish & Wildlife Service, Washington, DC. 151 pp.

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1. Forest & Woodland
1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest

G046. Laurentian-Acadian-Appalachian Alkaline Swamp

Type Concept Sentence: These forested wetlands are dominated by *Thuja occidentalis* often with *Acer rubrum* or *Fraxinus nigra* and found on circumneutral to alkaline soils across the temperate regions of eastern to south-central Canada south into northern New England and the upper Midwest and down to the high plateau of the Allegheny Mountains.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.3.Na.3. Laurentian-Acadian-North Atlantic Coastal Flooded & Swamp Forest (M504)

Elcode: G046
***Scientific Name:** *Thuja occidentalis - Fraxinus nigra - Acer rubrum* Swamp Forest Group
***Common (Translated Scientific) Name:** Northern White-cedar - Black Ash - Red Maple Swamp Forest Group
***Colloquial Name:** Laurentian-Acadian-Appalachian Alkaline Swamp

***Type Concept:** These forested wetlands are found across the temperate regions of eastern to south-central Canada, southward from northern New England to the upper Midwest and down to the high plateau of the Allegheny Mountains. They occur in areas where circumneutral to alkaline pH and/or higher nutrient levels are associated with a rich flora. Examples of this group also occur within swales along the dunes of the Great Lakes. The substrate is typically mineral soil, but there may be extensive peat in examples occurring on the margins of peatland complexes. *Thuja occidentalis* is a diagnostic canopy species and may dominate the canopy or be mixed with other conifers or with deciduous trees, most commonly *Acer rubrum* or *Fraxinus nigra*. Some examples are strongly dominated by deciduous hardwoods, such as *Fraxinus nigra* (less often *Fraxinus americana*) and *Acer rubrum*. *Larix laricina*, a deciduous conifer, may dominate some stands within this group. Shrub species commonly occur and range in cover from sparse to dense depending on canopy cover. The herb layer tends to be more diverse than in acidic swamps and some examples may have extensive bryophytes. Examples of this group may occur on seepages, in a basin setting, or alluvial settings. A hummock-and-hollow topography is typical. Logging, especially of *Thuja occidentalis*, has influenced the structure and dominance of many examples of this group.

***Diagnostic Characteristics:** This type is distinguished by the poorly drained, circumneutral to alkaline conditions with a hummock-and-hollow topography, shallow to deep layer of peat (20+ cm) in combination with a mix of sphagnum, feathermosses and brown mosses, a variable tall-shrub layer of *Alnus incana, Ilex verticillata*, and *Vaccinium corymbosum*, with occasional ericaceous shrubs, and partial to closed tree canopies, ranging from pure conifer to deciduous, with dominants of *Thuja occidentalis, Acer rubrum*, and *Fraxinus nigra*. Other temperate species companions include *Tsuga canadensis, Picea rubens*, and *Betula alleghaniensis*.

***Classification Comments:** Analyses of FIA plot data from the eastern U.S. combined this group and Laurentian-Acadian-Appalachian Acidic Swamp Group (G045) into a Northern White-cedar - Hemlock - Red Spruce Conifer Swamp Group (Faber-Langendoen and Menard 2006). On review, this FIA group was split based on broad patterns of substrate pH, with this group (G046) housing the more alkaline swamps and G045 housing the more acidic swamps. *Thuja occidentalis* is a diagnostic here, but can also be diagnostic for boreal rich swamps, so further clarity is needed on the distinction between boreal rich swamps in Ontario-Québec Boreal Flooded & Rich Swamp Forest Group (G809) and Atlantic Boreal Flooded & Rich Swamp Forest Group (G810) and this type, but in this northern rich swamp type *Thuja occidentalis* often has companions of *Tsuga canadensis, Picea rubens, Betula alleghaniensis*, and *Acer rubrum*, which are not typically found in boreal rich swamps.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G045	Laurentian-Acadian-Appalachian Acidic Swamp	
G810	Atlantic Boreal Flooded & Rich Swamp Forest	
G809	Ontario-Québec Boreal Flooded & Rich Swamp Forest	

Similar NVC Types General Comments [optional]: Laurentian-Acadian-Appalachian Acidic Swamp Group (G045) overlaps in range and can share many species but has a consistent higher dominance by *Acer rubrum, Tsuga canadensis*, and *Picea rubens* and a stronger *Sphagnum* or woody peat layer. This group (G046) has a more alkaline substrate than G045, and understory and shrub species typically reflect this difference. Boreal swamps such as those in North American Boreal Conifer Poor Swamp Macrogroup (M299) generally have *Picea mariana* or *Larix laricina* as the most important conifer, and lack temperate hardwood and conifer associates.

VEGETATION

Physiognomy and Structure Summary: This group contains mostly closed-canopy to patchy-canopy forests. Many examples contain a hummock-and-hollow topography. Dominant species can range from completely deciduous to completely coniferous. The most common canopy structure is mixed. The shrub layer varies from sparse to well-developed depending on the canopy cover, but some shrub cover is typical. Herb cover likewise varies. The bryoid layer is often extensive.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The canopy layer varies from very open to moderately closed. Typical examples of this group are mixed conifer and deciduous with *Thuja occidentalis* being the most common conifer species and *Fraxinus nigra* the most common deciduous species. Typical stands contain a hummock-and-hollow topography with *Thuja occidentalis* dominating the hummocks and *Fraxinus nigra* common in the hollows. Some examples are dominated by conifers in addition to *Thuja occidentalis*, most commonly *Larix laricina*, although some examples may contain *Picea* spp. The density of shrubs varies with canopy closure. The most common are minerotrophic shrubs such as *Cornus sericea* and *Alnus incana*; *Rhamnus alnifolia* is a good indicator species. The herbaceous layer is typically more diverse than acidic swamps. It is characterized by *Carex* spp., *Linnaea borealis*, and *Lonicera* spp. An incomplete to dense moss layer occurs.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Tip-up mounds caused by blowdowns are common, in part because the very wet soils permit only shallow rooting by *Thuja occidentalis*. Logging, especially of *Thuja occidentalis*, has influenced the structure and dominance of this group. Acreage of hardwood-conifer swamp has been reduced by conversion of wetlands for agriculture and other human uses (Kost et al. 2007).

ENVIRONMENT

Environmental Description: Stands occur on level to gently sloping ground with wet, organic or mineral soil. Typical stands occur along the margins of peatlands, in drainage courses, shores of lakes and rivers above flooding level, or in shallow depressions. Some examples occur in swales within dunal areas of the Great Lakes. Stands occur on wet, saturated soils. Substrate is either wet mineral soils or well-decomposed peat, and hummocky topography is present. The groundwater is moderately minerotrophic and has circumneutral to alkaline pH.

DISTRIBUTION

***Geographic Range:** This group is located in northern New England and the Midwest, and southern regions of eastern and central Canada. It ranges into the southern Great Lakes and south-central Minnesota south to northern Illinois, Indiana, Ohio, and West Virginia. Examples are can be found along the high, flat plateau of the Allegheny Mountains.
Nations: CA, US
States/Provinces: CT, DE, IL, IN, MA, MD, ME, MI, MN, NB, NH, NJ, NY, OH, ON, PA, QC, RI, VT, WI, WV
USFS Ecoregions (2007) [optional]: 211Aa:CCC, 211Ab:CCC, 211Ba:CCC, 211Bb:CCC, 211Ca:CCC, 211Cb:CCP, 211Ea:CCC, 211Eb:CCP, 211Ec:CCC, 211Ed:CCC, 211Ee:CCC, 211Fb:CCC, 211Ja:CCP, 211Jb:CCP, 211Jc:CCP, 211Jd:CCC, 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212J:CC, 212L:CC, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC, 212Sb:CCC, 212Sc:CCC, 212Sn:CCC, 212Sq:CCC, 212Te:CCC, 212Ya:CCC, 212Z:CC, 222Ib:CCC, 222Ic:CCC, 222Id:CCP, 222Ie:CCC, 222Ja:CCC, 222K:CC, 222L:CC, 222M:CC, 222Ua:CCC, 222Ud:CCC, 222Ue:CCC, M211Aa:CCP, M211Ab:CCC, M211Ac:CCP, M211Ad:CCP, M211Ae:CCC, M211Af:CCC, M211Ba:CCC, M211Bb:CCP, M211Ca:CCC, M211Cb:CCC, M211Da:CCC, M211Db:CCC, M211Dc:CCC, M211Dd:CCC, M211De:CCC, M221B:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0347	*Fraxinus nigra - Acer rubrum* Swamp Forest Alliance
A3721	*Tsuga canadensis - Pinus strobus* Swamp Forest Alliance
A3720	*Thuja occidentalis - Acer rubrum - Larix laricina* Swamp Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** S.C. Gawler and S. Menard, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard and D. Faber-Langendoen

Acknowledgments [optional]: Sean Basquill

Version Date: 28 May 2013

REFERENCES

***References [Required if used in text]:**

Comer, P., and D. Albert. 1993. A survey of wooded dune and swale complexes in Michigan. Michigan Natural Features Inventory, Natural Heritage Program. Lansing, MI. 158 pp.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Faber-Langendoen, D., and S. Menard. 2006. A key to eastern forests of the United States: Macrogroups, groups, and alliances. September 15, 2006. NatureServe, Arlington, VA.

Kost, M. A., D. A. Albert, J. G. Cohen, B. S. Slaughter, R. K. Schillo, C. R. Weber, and K. A. Chapman. 2007. Natural communities of Michigan: Classification and description. Report No. 2007-21, Michigan Natural Features Inventory, Lansing. 314 pp. [http://web4.msue.msu.edu/mnfi/reports/2007-21_Natural_Communites_of_Michigan_Classification_and_Description.pdf]

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1. Forest & Woodland
1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest

M028. Great Plains Flooded & Swamp Forest

Type Concept Sentence: These deciduous forests and woodlands, dominated by *Populus deltoides, Fraxinus pennsylvanica*, and other hardwoods, are found along floodplains of permanent rivers in the prairie-dominated landscapes of the western and central Great Plains from southern Canada to northern Texas.

OVERVIEW

***Hierarchy Level:** Macrogroup

***Placement in Hierarchy:** 1.B.3.Na.4. Eastern North American-Great Plains Flooded & Swamp Forest (D011)

Elcode: M028

***Scientific Name:** *Populus deltoides - Fraxinus pennsylvanica / Salix* spp. Flooded & Swamp Forest Macrogroup
***Common (Translated Scientific) Name:** Eastern Cottonwood - Green Ash / Willow species Flooded & Swamp Forest
***Colloquial Name:** Great Plains Flooded & Swamp Forest

***Type Concept:** This macrogroup is composed of woodlands and forests found along large to small rivers in the western and central Great Plains from southern Canada to the Texas panhandle. *Populus deltoides* is the most common tree and may be nearly the only species in the overstory in some stands. Other common trees are *Acer negundo, Fraxinus pennsylvanica, Salix nigra, Salix amygdaloides*, and, in the southeastern portion of this macrogroup's range, *Celtis laevigata* and *Platanus occidentalis*. The shrub and herbaceous layers are much more diverse than the canopy across the range of this macrogroup with no single species common throughout. Typical shrubs include *Artemisia cana ssp. cana, Cornus* spp., *Salix* spp., and *Symphoricarpos occidentalis*. The herbaceous stratum is strongly influenced by surrounding upland Great Plains grasslands and often contains mid- and tallgrass species.

***Diagnostic Characteristics:** This macrogroup is dominated by trees and is found along large to small rivers in the Great Plains. Its range in the drier central and western Great Plains and the presence of more Great Plains flora in the understory help to distinguish it from floodplain macrogroups farther east.

***Classification Comments:** This macrogroup is often quite distinct from surrounding upland grassland or shrubland vegetation. Where small tributaries or draws join with medium or small rivers, this macrogroup could be adjacent to Great Plains Forest & Woodland Macrogroup (M151). This macrogroup (M028) is distinguished by being in floodplains where regular flooding occurs and often has *Populus deltoides* and/or *Salix* spp. as a dominant or significant component of the overstory and *Salix* spp. in the shrub layers.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M151	Great Plains Forest & Woodland	
M029	Central Hardwood Floodplain Forest	has more frequent and longer duration flooding, and few mixed grass or tallgrass prairie species in the understory; *Acer saccharinum, Celtis laevigata*, and *Platanus occidentalis* can be abundant.
M154	Southern Great Plains Floodplain Forest & Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Stands in this dynamic macrogroup can have a wide variety of physiognomies. The tree canopy, with trees >5 m, can be open to partly closed (10-60%) and the shrub and herbaceous strata can range from nearly absent to closed (<60%).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Populus deltoides* is the most common tree across the range of this macrogroup, and some stands may contain little else in the canopy. Several other tree species can be present to even dominant in some stands. These include *Acer negundo, Fraxinus pennsylvanica, Salix nigra, Salix amygdaloides*, and, in the southeastern portion of this macrogroup's range, *Celtis laevigata* and *Platanus occidentalis*. The shrub and herbaceous layers are much more diverse than the canopy across the range of this macrogroup. Typical shrubs include *Artemisia cana ssp. cana, Cornus drummondii, Cornus sericea, Salix interior, Salix exigua*, and *Symphoricarpos occidentalis*. *Prunus* spp. can occur, especially along drier edges of these floodplains. The herbaceous stratum is strongly influenced by surrounding upland Great Plains grasslands and often contains mid- and tallgrass species such as *Andropogon gerardii, Carex pellita, Pascopyrum smithii, Panicum virgatum, Schizachyrium scoparium, Spartina pectinata*, and *Sporobolus cryptandrus*. Portions of floodplains that retain water longer, typically in or adjacent to larger prairie rivers, can have pockets of marsh vegetation such as *Typha* spp., *Bolboschoenus fluviatilis (= Scirpus fluviatilis)*, and *Schoenoplectus tabernaemontani (= Scirpus* *validus)* in moderate to deep water and *Alisma* spp., *Phalaris arundinacea, Sagittaria latifolia*, and *Sparganium eurycarpum* in the shallowest areas (Weaver 1960). Where these pockets are large, they fall into a different macrogroup.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Periodic flooding is important in establishing and maintaining stands of this macrogroup. Flooding regime (frequency, severity, duration) is also important in shaping the understory composition and structure. Flooding regime is highly variable across the region and from year-to-year. In general, floods are most likely from late-fall to late-spring across the region. Streams in the north and west of the range of this macrogroup are more influenced by snowmelt and have more predictability of flow with spring maximum flow rates (Brown and Matthews 1995). Fire may spread from surrounding uplands, particularly where the understory has a significant herbaceous component.

ENVIRONMENT

Environmental Description: This macrogroup is found in floodplains and riparian settings along large to small rivers. Soils are primarily alluvial and range from sandy to clay. This macrogroup can occur in deep or shallow river valleys but slopes within stands are typically gentle or nonexistent.

Larger and broader river valleys may have a natural levee near the main channel, behind which a poorly drained backswamp can form. These riparian swamps do not flood as often and retain water from upland drainage, as well as from larger floods, so the hydrology is somewhat different than that on the levee or in floodplains with no levees. Backswamps in this macrogroup are not as wet as those associated with larger rivers to the east but larger and wetter occurrences can grade into Great Plains Marsh, Wet Meadow, Shrubland & Playa Macrogroup (M071) where the tree canopy is sparse or absent or into Central Hardwood Floodplain Forest Macrogroup (M029) where the swamps become more permanently wet.

Currently, many stands persist on rivers that have been dammed and where flooding is now largely absent.

DISTRIBUTION

***Geographic Range:** This macrogroup is found along permanent rivers throughout the western and central Great Plains from the southern Prairie Provinces of Canada to the panhandle of Texas and from the Rocky Mountains east to the eastern Dakotas, Nebraska and Kansas.
Nations: CA, US
States/Provinces: AB, CO, KS, MB, MT, ND, NE, NM, OK, SD, SK, TX, WY
USFS Ecoregions (2007) [optional]: 251B:CC, 251F:CP, 251H:CC, 315A:CC, 315B:CC, 315F:CC, 331B:CC, 331C:CC, 331D:CC, 331E:C?, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331K:CC, 331L:CC, 331M:CC, 331N:CC, 332A:CP, 332B:CC, 332C:CC, 332D:CC, 332E:CC, 332F:CC, 342A:CC, 342F:CC, M331F:??, M334A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G147	Great Plains Cottonwood - Green Ash Floodplain Forest

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Cottonwood - Willow: 235	Eyre 1980	
<	Cottonwood: 63	Eyre 1980	
<	Sugarberry - American Elm - Green Ash: 93	Eyre 1980	

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard, K. Kindscher, P. Comer, G. Kittel, in Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake

Acknowledgments [optional]:

Version Date: 15 Oct 2014

REFERENCES

***References [Required if used in text]:**

Brown, A. V., and W. J. Matthews. 1995. Stream ecosystems of the central United States. Pages 89-116 in: C. E. Cushing, K. W. Cummins, and G. W. Minnshall, editors. Ecosystems of the Worlds. Volume 22: River and Stream Ecosystems. Elsevier Science, Amsterdam.

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1. Forest & Woodland

1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest

G147. Great Plains Cottonwood - Green Ash Floodplain Forest

Type Concept Sentence: This group is found across the Great Plains on floodplains of medium to small rivers where an open to moderately closed tree canopy is dominated by *Populus deltoides* or sometimes *Fraxinus pennsylvanica*, often with *Acer negundo, Salix amygdaloides, Salix nigra*, and, in the southern portion of the group's range, *Celtis laevigata* and *Platanus occidentalis*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.3.Na.4. Great Plains Flooded & Swamp Forest (M028)

Elcode: G147

***Scientific Name:** *Populus deltoides - Fraxinus pennsylvanica / Pascopyrum smithii* Floodplain Forest Group

***Common (Translated Scientific) Name:** Eastern Cottonwood - Green Ash / Western Wheatgrass Floodplain Forest Group

***Colloquial Name:** Great Plains Cottonwood - Green Ash Floodplain Forest

***Type Concept:** This group is composed of woodlands and forests found along medium and small rivers in the western and central Great Plains from southern Canada to the Texas panhandle. *Populus deltoides* is the most common tree and may be nearly the only species in the overstory in some stands. Other common trees are *Fraxinus pennsylvanica, Salix nigra, Salix amygdaloides*, and, in the southeastern portion of this group's range, *Celtis laevigata* and *Platanus occidentalis*. The shrub and herbaceous layers are much more diverse than the canopy across the range of this group with no single species common throughout. Typical shrubs include

Artemisia cana ssp. cana, Cornus spp., *Salix* spp., and *Symphoricarpos occidentalis*. The herbaceous stratum is strongly influenced by surrounding upland Great Plains grasslands and often contains mid and tallgrass species.

***Diagnostic Characteristics:** This group is dominated by trees and is found along medium and small rivers in the Great Plains. Its range in the drier central and western Great Plains and the presence of more Great Plains flora in the understory help to distinguish it from floodplain groups farther east.

***Classification Comments:** This group can be similar to Southern Ash - Elm - Willow Floodplain Forest Group (G759) where their ranges adjoin in the central and eastern Great Plains. This group (G147) is found on smaller rivers with less extensive floodplains and tends to have more influence from Great Plains flora in the understory. However, both groups are typically dominated by *Populus deltoides* and both could occur on the same rivers, particularly the Missouri River and Arkansas River but also possibly the Platte River, Republican River, and Canadian River.

Where small tributaries or draws join with medium or small rivers, this group could be adjacent to Great Plains Mesic Forest & Woodland Group (G145). This group (G147) is distinguished by being in floodplains where regular flooding occurs and often has *Populus deltoides* and/or *Salix* spp. as a dominant or significant component of the overstory and *Salix* spp. in the shrub layers.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G145	Great Plains Mesic Forest & Woodland	
G337	Great Plains Riparian Wet Meadow & Shrubland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Stands in this dynamic group can have a wide variety of physiognomies. The tree canopy can be open to closed (>25%) and can range from short to tall (10-25 m). The shrub and herbaceous strata can range from nearly absent to dense.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Populus deltoides* is the most common tree across the range of this group, and some stands may contain little else in the canopy. The tree canopy is not very diverse. Other tree species that can be present to even dominant in some stand are *Acer negundo, Fraxinus pennsylvanica, Salix nigra, Salix amygdaloides*, and, in the southeastern portion of this group's range, *Celtis laevigata* and *Platanus occidentalis*. The shrub and herbaceous layers are much more diverse than the canopy across the range of this group. Typical shrubs include *Artemisia cana ssp. cana, Cornus drummondii, Cornus sericea, Salix interior, Salix exigua*, and *Symphoricarpos occidentalis*. *Prunus* spp. can occur, especially along drier edges of these floodplains. The herbaceous stratum is strongly influenced by surrounding upland Great Plains grasslands and often contains mid and tallgrass species such as *Andropogon gerardii, Carex pellita, Pascopyrum smithii, Panicum virgatum, Schizachyrium scoparium, Spartina pectinata*, and *Sporobolus cryptandrus*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Periodic flooding is important in establishing and maintaining stands of this group. Flooding regime (frequency, severity, duration) is also important in shaping the understory composition and structure. Scouring and deposition during flooding create areas of new bare mineral soil necessary for *Populus deltoides* regeneration. Fire may spread from surrounding uplands, particularly where the understory has a significant herbaceous component.

ENVIRONMENT

Environmental Description: This group is found in floodplains and riparian settings along medium and small rivers. Soils are primarily alluvial and range from sandy to clay. This group can occur in deep or shallow river valleys but slopes within stands of this group are typically gentle or nonexistent. Stands are flooded periodically but do not remain submerged for long periods.

DISTRIBUTION

***Geographic Range:** This group is found along permanent rivers throughout the western and central Great Plains from the southern Prairie Provinces of Canada to the panhandle of Texas and from the Rocky Mountains east to the eastern Dakotas, Nebraska and Kansas.
Nations: CA, US
States/Provinces: AB, CO, KS, MB, MT, ND, NE, NM, OK, SD, SK, TX, WY
USFS Ecoregions (2007) [optional]: 331B:CC, 331C:CC, 331D:C?, 331E:CC, 331F:CC, 331G:CC, 331H:C?, 331I:C?, 331K:CC, 331L:C?, 331M:CC, 331N:C?, 332A:CC, 332B:CC, 332C:CC, 332D:CC, 332E:CC, 332F:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3423	*Populus deltoides* Floodplain Forest Alliance
A0636	*Populus deltoides* Floodplain Woodland Alliance
A4131	*Fraxinus pennsylvanica - Ulmus americana - Populus deltoides* Floodplain Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Cottonwood - Willow: 235	Eyre 1980	
<	Cottonwood: 63	Eyre 1980	
<	Sugarberry - American Elm - Green Ash: 93	Eyre 1980	

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard, K. Kindscher, P. Comer, G. Kittel, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake
Acknowledgments [optional]:
Version Date: 19 May 2015

REFERENCES

***References [Required if used in text]:**
Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.
Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

1.B.3.Nb. Southeastern North American Flooded & Swamp Forest

These wetland forests occur in a variety of wetland settings, such as floodplain / riparian, isolated basins, and seepage slopes, centered in the Southeastern Coastal Plain of the United States.

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1. Forest & Woodland
1.B.3.Nb. Southeastern North American Flooded & Swamp Forest

M161. Pond-cypress Basin Swamp

Type Concept Sentence: This is a Southeastern Coastal Plain depression wetland forest or open woodland dominated by the deciduous conifer *Taxodium ascendens*, with shrubs or graminoid understory.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.3.Nb.1. Southeastern North American Flooded & Swamp Forest (D062)

Elcode: M161
***Scientific Name:** *Taxodium ascendens - Pinus elliottii* Swamp Macrogroup
***Common (Translated Scientific) Name:** Pond-cypress - Slash Pine Swamp Macrogroup
***Colloquial Name:** Pond-cypress Basin Swamp

***Type Concept:** This macrogroup consists of forested depression wetlands, typically dominated by *Taxodium ascendens*, with a characteristic and unique dome-shaped appearance in which trees in the center are generally taller than those around the sides. Examples are known from the Southeastern Coastal Plain of the Carolinas, Georgia, and Florida extending into southern Alabama, Mississippi and southeastern Louisiana. Examples occupy poorly drained, isolated depressions. Remaining examples are usually within a pineland landscape, but some occur in agricultural landscapes. The oldest and largest individual trees typically occupy the center of these domed wetlands, with smaller and younger individuals around the margins. Many Carolina bays have uniformly flat basins such that canopy trees do not have a domed aspect. Some examples are essentially permanently flooded, while others support water levels that vary substantially from year to year and over longer climatic cycles. The wettest sites have open water and floating-leaved aquatic vegetation, or marsh vegetation of tall graminoids. Drier sites often have an open canopy of *Taxodium ascendens*, with evergreen shrubs and often a dense, often fairly species-rich herbaceous layer beneath.

***Diagnostic Characteristics:** Wetland forest or woodland in depressions which are dominated by *Taxodium ascendens*. The vegetation of this macrogroup occurs in the warm-temperate climate region, and in the subtropical region of south Florida. Some examples on lakeshores and edges of large ponds have a canopy of *Taxodium distichum*. These are mostly at the very northern edge of the range in North Carolina and Virginia. These wetlands are not associated with rivers or creeks. Stringers and other examples which are not isolated have only very slowly flowing water.

***Classification Comments:** Flora of North America (FNA Editorial Committee 1993) and other more recent publications (Lickey and Walker 2002, Denny and Arnold 2007) consider *Taxodium ascendens* to be a variety of *Taxodium distichum*, the correct name then being *Taxodium distichum var. imbricarium* (Nuttall) Croom. Some intermediate individuals are found in cypress "stringers" and along small blackwater streams. Cypress "stringers" are more-or-less linear features that are parts of disconnected drainageways that can occur in the swales of ancient coastal topographies in a pine flatwoods landscape (e.g., CEGL007419). The vegetation of the cypress "stringers" is similar to the "dome swamps."

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M310	Southeastern North American Ruderal Flooded & Swamp Forest	
M067	Atlantic & Gulf Coastal Plain Wet Prairie & Marsh	includes herbaceous graminoid vegetation in coastal plain depressions,

Elcode	Scientific or Colloquial Name	Note
		which lack or have very sparse *Taxodium ascendens*.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This is a wetland forest or woodland dominated by the deciduous conifer *Taxodium ascendens*. In the wettest (semipermanently flooded) sites, there is open water and floating-leaved aquatic vegetation under the open canopy of *Taxodium ascendens*. In the sites which are flooded seasonally or for shorter durations, there is usually an evergreen shrub layer of *Ilex* or members of the heath plant family (Ericaceae), or they are dominated by wetland graminoids and forbs with shrubs scattered or confined to the periphery.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Taxodium ascendens* is the characteristic and dominant tree. Other woody species may include *Cephalanthus occidentalis, Clethra alnifolia, Hypericum chapmanii, Hypericum myrtifolium, Ilex amelanchier, Ilex cassine, Ilex coriacea, Ilex myrtifolia, Eubotrys racemosa (= Leucothoe racemosa), Liquidambar styraciflua, Lyonia lucida, Morella cerifera, Nyssa biflora*, *Pinus elliottii var. elliottii*, and *Styrax americanus* (Drew et al. 1998). Showy, characteristic herbaceous plants in the Carolinas include species of *Ludwigia, Solidago, Symphyotrichum*, and *Xyris* (Bennett and Nelson 1991), as well as *Agalinis linifolia, Boltonia asteroides, Coelorachis rugosa, Dichanthelium wrightianum, Lobelia boykinii, Lycopus amplectens, Pluchea rosea, Polygala cymosa, Rhexia aristosa, Rhynchospora careyana, Rhynchospora filifolia*, and *Scleria reticularis*; and in Florida include *Amphicarpum muehlenbergianum, Carex striata, Carex turgescens, Carex verrucosa, Coreopsis nudata, Lobelia floridana, Lycopus rubellus (= Lycopus angustifolius)*, and *Polygala cymosa*, plus many of those listed for the Carolinas. Many of these species extend westward on the Gulf Coastal Plain to southern Alabama, Mississippi, and southeastern Louisiana. Understory trees and shrubs in southern Florida include *Annona glabra, Chrysobalanus icaco*, and *Ficus aurea*. The wettest sites have open water and floating-leaved aquatic vegetation, or marsh vegetation of tall graminoids.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Variation in hydroperiod is the most important dynamic, causing rapid major changes in the herbaceous vegetation. Unlike the steeper-sided solution depressions, where many different hydroperiods are present within a short distance and vegetation zones simply shift, the flat-bottomed Carolina bays may experience drastic yearly changes in hydroperiod over their extent. The difference between a dry year when graminoids and forbs dominate, and a wet year when emergent sedges, such as *Rhynchospora careyana* dominate, often with floating *Utricularia radiata*, is striking and demands multiple years of inventory to capture a site's diversity. Many (probably most) plants persist in seedbanks for periods of years when conditions are not suitable. Fire is also an important process (Kurz and Wagner 1953, Ewel and Mitsch 1978), spreading into the bays from adjacent uplands when conditions are dry, and burning the vegetation along the shallow edges or even burning the vegetation completely throughout the depression. Fire prevents invasion by less water-tolerant trees during dry periods, and interacts with flooding to affect vegetational composition. Where fire no longer occurs, *Pinus taeda* often invades the ponds or bays. Fire may also be important in preventing buildup of organic matter on the soil surface.

ENVIRONMENT

Environmental Description: *Climate:* The climate is humid, warm-temperate. Average rainfall is 100-150 cm (40-60 inches). Hurricanes and other extreme rainfall events provide for an unpredictable hydrological regime. Rarely, as much as half of a year's rainfall can occur in one week. *Soil/substrate/hydrology:* This macrogroup occurs in isolated wetland depressions called Carolina bays in the Atlantic Coastal Plain. On the Gulf Coastal Plain, these depressions are called limesinks, cypress domes, or cypress ponds. Carolina bays are oriented, oval, shallow depressions with nearly flat bottoms, which range from North Carolina through South Carolina, and into adjacent Georgia. Most Carolina bays in the Outer Coastal Plain occur in sandy sediments and are filled with peat, while most Carolina bays in the Inner Coastal Plain occur in loamy sediments and have mineral soils with clay hardpans. These depressions hold water, due to a combination of rainfall and exposure of a high regional water table. Some are essentially permanently flooded. Others contain water well into the growing season in most years, but water levels vary substantially from year to year and over longer climatic cycles. In any event, it is important to note that pond-cypress swamps are primarily rainfall-fed and are not flooded from river overflow. Fire is an important natural influence during dry periods. Fires may burn out accumulated peat, changing the character of a depression.

DISTRIBUTION

***Geographic Range:** This macrogroup is found on the Southeastern Coastal Plain, from southeastern Virginia, through eastern North and South Carolina, and into Georgia, south Florida, southern Alabama, Mississippi and southeastern Louisiana. Occurrences are numerous and extensive in South Carolina.
Nations: US
States/Provinces: AL, FL, GA, LA, MS, NC, SC, VA
USFS Ecoregions (2007) [optional]: 232B:CC, 232C:CC, 232D:CC, 232G:CC, 232H:C?, 232I:CC, 232J:CC, 232K:CC, 232L:CC, 411A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G036	Pond-cypress Basin Swamp

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Cypress Savanna	Schafale and Weakley 1990	
<	Cypress Savanna	Edwards et al. 2013	
=	Cypress domes, heads, and islands	Christensen 2000	
=	Cypress pond and strand	Ewel 1990b	
<	Cypress-Gum Ponds	Edwards et al. 2013	
<	Pond Cypress Domes	Kurz and Wagner 1953	
<	Pond Cypress Pond	Bennett and Nelson 1991	
<	Pond Cypress Savanna	Bennett and Nelson 1991	
=	Pondcypress 100	Eyre 1980	

AUTHORSHIP

***Primary Concept Source [if applicable]:** H. Kurz and K.A. Wagner (1953)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman and R.K. Peet
Acknowledgments [optional]:
Version Date: 07 Oct 2015

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***References [Required if used in text]:**

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1. Forest & Woodland
1.B.3.Nb. Southeastern North American Flooded & Swamp Forest

G036. Pond-cypress Basin Swamp

Type Concept Sentence: This group consists of forested depression wetlands dominated by *Taxodium ascendens*, with a characteristic and unique dome-shaped appearance which occur within the flatwoods landscapes of the Southeastern Coastal Plain.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.3.Nb.1. Pond-cypress Basin Swamp (M161)

Elcode: G036
***Scientific Name:** *Taxodium ascendens / Ilex* spp. Basin Swamp Group

***Common (Translated Scientific) Name:** Pond-cypress / Holly species Basin Swamp Group
***Colloquial Name:** Pond-cypress Basin Swamp

***Type Concept:** This group consists of forested depression wetlands, typically dominated by *Taxodium ascendens*, with a characteristic and unique dome-shaped appearance in which trees in the center are generally taller than those around the sides. Examples are known from the Coastal Plain of the Carolinas, Georgia, and Florida extending into southern Alabama, Mississippi and Louisiana. Examples occupy poorly drained, isolated depressions which are usually within a pine flatwoods landscape. The oldest and largest individual trees typically occupy the center of these domed wetlands, with smaller and younger individuals around the margins. Many Carolina bays have uniformly flat basins such that canopy trees do not have a domed aspect. Some examples are essentially permanently flooded, while others support water levels that vary substantially from year to year and over longer climatic cycles. Vegetation includes a series of primarily herbaceous and woodland associations. The wettest sites have open water and floating-leaved aquatic vegetation, or marsh vegetation of tall graminoids (primarily sedges). Drier sites often have an open canopy of *Taxodium ascendens*, with evergreen shrubs and often a dense, often fairly species-rich herbaceous layer beneath.

***Diagnostic Characteristics:** Wetland forest or woodland dominated by *Taxodium ascendens*. The vegetation of this group occurs in the warm-temperate climate region, and in the subtropical region of south Florida.

***Classification Comments:** Publications since Kartesz (1999) show that *Taxodium ascendens* used as a nominal species is probably not actually a distinct species. Flora of North America (FNA Editorial Committee 1993) and other more recent publications (Lickey and Walker 2002, Denny and Arnold 2007) consider it to be a variety, the correct name being *Taxodium distichum var. imbricarium* (Nuttall) Croom. Some intermediate individuals are found in cypress "stringers" and along small blackwater streams. It is not clear if cypress "stringers" should be included here; these are more-or-less linear features that are parts of disconnected drainageways that arise in a pine flatwoods landscape (e.g., CEGL007419). The vegetation of the "stringers" is somewhat analogous to that of the edges of the true "dome swamps." This group includes the subtropical *Taxodium ascendens* ponds or savannas of the Big Cypress region of southwest Florida; they are included in *Taxodium ascendens / Annona glabra / Rhynchospora* spp. Subtropical Swamp Forest Alliance (A4085).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G002	Caribbean Lowland Swamp Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This is a wetland forest or woodland dominated by the deciduous conifer *Taxodium ascendens*. In the wettest (semipermanently flooded) sites, there is open water and floating-leaved aquatic vegetation under the canopy of *Taxodium ascendens*. In the sites which are flooded seasonally or for shorter durations, there is usually an evergreen shrub layer of *Ilex* or members of the heath plant family (Ericaceae), or they are dominated by graminoids and forbs with shrubs confined to the periphery. Carolina bays, if intact, also can have an elevated sand rim on the southeastern side of the basin, which supports a xerophytic flora quite unrelated to the moisture-dependent species within the bay.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Taxodium ascendens* is the characteristic tree dominant. Other woody species may include *Nyssa biflora, Pinus elliottii, Hypericum chapmanii, Hypericum myrtifolium, Ilex myrtifolia, Ilex coriacea, Ilex cassine, Ilex amelanchier, Eubotrys racemosa (= Leucothoe racemosa), Morella cerifera, Cephalanthus occidentalis, Liquidambar styraciflua, Clethra alnifolia, Lyonia lucida*, and *Styrax americanus* (Drew et al. 1998). Showy, characteristic herbaceous plants in the Carolinas include species of *Symphyotrichum, Xyris, Ludwigia*, and *Solidago* (Bennett and Nelson 1991), *Rhexia aristosa, Boltonia asteroides, Lobelia boykinii, Polygala cymosa, Rhynchospora careyana, Rhynchospora filifolia, Agalinis linifolia, Coelorachis rugosa, Dichanthelium wrightianum, Lycopus amplectens, Pluchea rosea*, and *Scleria reticularis*; and in Florida include *Lobelia floridana, Polygala cymosa, Coreopsis nudata, Lycopus rubellus (= Lycopus angustifolius), Amphicarpum muehlenbergianum, Carex striata, Carex verrucosa*, and *Carex turgescens*, plus many of those listed for the Carolinas. This same suite of species extends westward on the Gulf Coastal Plain, but with allowances for individual species distributions. The wettest sites have open water and floating-leaved aquatic vegetation, or marsh vegetation of tall graminoids.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Variation in hydroperiod is the most important dynamic, causing rapid major changes in the herbaceous vegetation. Unlike the steeper-sided solution depressions, where many different hydroperiods are present within a short distance and vegetation zones simply shift, the flat-bottomed Carolina bays may experience drastic yearly changes in hydroperiod over their extent. The difference between a dry year when graminoids and forbs dominate, and a wet year when emergent sedges, such as *Rhynchospora careyana* dominate, often with floating *Utricularia radiata*, is striking and demands multiple years of inventory to capture a site's diversity. Many (probably most) plants persist in seedbanks for periods of years when conditions are not suitable. Fire is also an important process, spreading into the bays from adjacent uplands when conditions are dry, and burning the vegetation along the shallow edges or even burning the vegetation completely throughout the depression. Fire prevents invasion by less water-tolerant trees during dry periods, and interacts with flooding to affect vegetation composition. Where fire no longer occurs, *Pinus taeda* often invades the ponds or bays. Fire may also be important in preventing buildup of organic matter on the soil surface.

ENVIRONMENT

Environmental Description: *Climate:* The climate is humid, warm temperate. Average rainfall is 100-150 cm (40-60 inches). Hurricanes and other extreme rainfall events provide for an unpredictable hydrological regime. Rarely, as much as half of a year's rainfall can occur in one week. *Soil/substrate/hydrology:* This group occurs in isolated wetland depressions called Carolina bays in the Atlantic Coastal Plain. On the Gulf Coastal Plain, these depressions are called limesinks, cypress domes, or cypress ponds. Carolina bays are oriented, oval, shallow depressions with nearly flat bottoms, which range from North Carolina through South Carolina, and into adjacent Georgia. Most Carolina bays in the Outer Coastal Plain occur in sandy sediments and are filled with peat, while most Carolina bays in the Inner Coastal Plain occur in loamy sediments and have mineral soils with clay hardpans. These depressions hold water, due to a combination of rainfall and exposure of a high regional water table. Some are essentially permanently flooded. Others contain water well into the growing season in most years, but water levels vary substantially from year to year and over longer climatic cycles. In any event, it is important to note that pond-cypress swamps are primarily rainfall-fed and are not flooded from river overflow. Fire is an important natural influence during dry periods. Fires may burn out accumulated peat, changing the character of a depression.

DISTRIBUTION

***Geographic Range:** This group is found on the Coastal Plain, from southeastern North Carolina, through South Carolina, and into Georgia, south Florida, and extending into Alabama, Mississippi and eastern Louisiana. Occurrences are numerous and extensive in South Carolina.
Nations: US
States/Provinces: AL, FL, GA, LA, MS, NC, SC
USFS Ecoregions (2007) [optional]: 232:C
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0652	*Taxodium distichum - Taxodium ascendens / Panicum hemitomon* Lakeshore Swamp Forest Alliance
A3341	*Taxodium ascendens / Carex striata* Swamp Forest Alliance
A3342	*Taxodium ascendens / Rhynchospora careyana - Panicum rigidulum* Swamp Forest Alliance
A3340	*Taxodium ascendens / Cyrilla racemiflora* Swamp Forest Alliance
A4085	*Taxodium ascendens / Annona glabra / Rhynchospora* spp. Subtropical Swamp Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Cypress Savanna	Edwards et al. 2013	
=	Cypress domes, heads, and islands	Christensen 2000	
=	Cypress pond and strand	Ewel 1990b	
<	Cypress-Gum Ponds	Edwards et al. 2013	
<	Depression Meadows	Bennett and Nelson 1991	
<	Non-Alluvial Swamp	Bennett and Nelson 1991	
<	Pond Cypress Domes	Kurz and Wagner 1953	
<	Pond Cypress Pond	Bennett and Nelson 1991	
<	Pond Cypress Savanna	Bennett and Nelson 1991	
=	Pondcypress: 100	Eyre 1980	

AUTHORSHIP

***Primary Concept Source [if applicable]:** H. Kurz and K.A. Wagner (1953)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman

Acknowledgments [optional]: B. Sorrie, K. Kirkman

Version Date: 07 Oct 2015

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1. Forest & Woodland
1.B.3.Nb. Southeastern North American Flooded & Swamp Forest

M033. Southern Coastal Plain Basin Swamp & Flatwoods

Type Concept Sentence: These are forests of poorly drained basins and wet flats in the coastal plains of the southeastern United States, including nonriverine wetland hardwood forests, dominated by some combination of *Quercus* species and *Nyssa* species, with *Liquidambar styraciflua, Taxodium distichum*, and other trees and shrubs that can tolerate wet conditions.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.3.Nb.2. Southeastern North American Flooded & Swamp Forest (D062)

Elcode: M033
***Scientific Name:** *Nyssa biflora - Quercus michauxii - Taxodium distichum* Basin Swamp & Flatwoods Macrogroup
***Common (Translated Scientific) Name:** Swamp Tupelo - Swamp Chestnut Oak - Bald-cypress Basin Swamp & Flatwoods Macrogroup
***Colloquial Name:** Southern Coastal Plain Basin Swamp & Flatwoods

***Type Concept:** These are forests of poorly drained basins and wet flats in the coastal plains of the southeastern United States, including nonriverine wetland hardwood forests, dominated by some combination of *Quercus* species and *Nyssa* species, with *Chamaecyparis thyoides, Liquidambar styraciflua, Pinus serotina, Pinus taeda, Taxodium distichum*, and other trees that tolerate wetland conditions. Basin swamps (G038) tend to experience longer periods of saturation and their dominant flora reflects this, with the *Quercus* species including *Quercus laurifolia, Quercus michauxii*, and *Quercus phellos*, with *Nyssa biflora, Nyssa ogeche*, and/or *Nyssa sylvatica*. Wet flatwoods (G130) vary more in their hydroperiod and the associated species sort along this moisture gradient, with more mesic zones including *Quercus alba, Quercus falcata, Quercus michauxii, Quercus nigra, Quercus pagoda*, and *Quercus shumardii*, with *Quercus laurifolia* and *Quercus phellos* in wetter zones. Other woody species that may occur in basin swamps (G038) include *Acer rubrum var. trilobum, Fraxinus profunda, Liriodendron tulipifera*, and *Populus heterophylla*. Typical species in the moderate to dense understory include *Clethra alnifolia, Cyrilla racemiflora, Ilex opaca var. opaca, Lyonia lucida, Magnolia virginiana, Persea palustris*, and *Smilax laurifolia*. Vines are conspicuous components, with important species including *Parthenocissus quinquefolia, Smilax smallii, Toxicodendron radicans, Vitis rotundifolia*, and *Vitis aestivalis*. Herbaceous species in basin swamps are more limited due to the extended hydroperiods, and may include *Carex* spp., *Sphagnum* spp., *Woodwardia areolata*, and *Woodwardia virginica*. Flatwoods may be more diverse, and their ground layers can include *Agrimonia rostellata, Aristolochia serpentaria, Botrychium virginianum, Carex cherokeensis, Chasmanthium sessiliflorum, Clematis virginiana, Clitoria mariana, Dichanthelium boscii, Dioscorea villosa, Elephantopus carolinianus, Elephantopus tomentosus, Geum canadense, Galium circaezans,* *Passiflora lutea, Phryma leptostachya, Podophyllum peltatum, Ruellia caroliniensis, Sanicula canadensis, Scleria oligantha, Smallanthus uvedalius*, and *Spigelia marilandica*. The environment for this vegetation encompasses two more-or-less distinct habitats types. Basin swamps (G038) occupy large, seasonally inundated nonriverine basins with peaty substrates, as well as less well-defined broad interfluvial flats and smaller areas near headwater streams in the coastal plains. These flatter areas may have some conceptual overlap with wet flatwoods (G130) in terms of their environment. Wet flatwoods (G130) occur in flat terrain where soils are seasonally to nearly semipermanently saturated because of low relief, poor soil drainage, and the seasonally high water table. The hydrology is dominated by groundwater seepage, rainfall and sheetflow. Overbank and tidal flooding, if they occur, have little to no influence on the vegetation. The available soil moisture fluctuates widely throughout the growing season, from saturated to very dry, a condition sometimes referred to as xerohydric or hydroxeric. The largest areas are on broad interfluvial flats; examples also occur on sites above modern floodplains but with poor internal drainage: nonriverine Pleistocene high terraces, as well as in broad, low flats, in small to large depressions, and along small, ill-defined drainages.

***Diagnostic Characteristics:** The combination of the suite of canopy species with nonriverine hydrology helps distinguish this vegetation from related riverine/floodplain vegetation. Examples of this vegetation have generally closed canopies dominated by deciduous trees, particularly *Nyssa* and *Taxodium* in the case of hardwood basin swamps (G038), and *Quercus* and *Pinus* species in the case of pine and hardwood wet flatwoods, but the shrub strata may have a significant broad-leaved evergreen component. The hydrology is nonriverine, with water coming from rainwater and groundwater rather than from overbank flooding. The environmental settings include depressions and wet flats.

***Classification Comments:** Two groups constitute this macrogroup: basin swamps, Coastal Plain Hardwood Basin Swamp Group (G038), and wet flatwoods, Hardwood - Loblolly Pine Nonriverine Wet Flatwoods Group (G130). The "wet flatwoods" are wetter than dry or mesic flatwoods but not as wet as "basin swamps." This vegetation is also referred to as "nonriverine wet hardwood forest" (Schafale and Weakley 1990). In some examples, *Pinus taeda* may attain greater dominance in relation to hardwoods either due to management (preferential removal of the *Quercus* component) or to other stochastic events (fire, windstorm).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M031	Southern Coastal Plain Floodplain Forest	
M310	Southeastern North American Ruderal Flooded & Swamp Forest	
M032	Southern Coastal Plain Evergreen Hardwood - Conifer Swamp	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are generally closed-canopy forests dominated by deciduous trees, particularly *Nyssa* and *Taxodium* in the case of hardwood basin swamps (G038), and *Quercus* and *Pinus* species in the case of pine and hardwood wet flatwoods, but the shrub strata may have a significant broad-leaved evergreen component. Basin swamps (G038) are dominated by broad-leaved deciduous hardwoods with needle-leaved deciduous conifers (*Taxodium* spp.). Wet flatwoods (G130) have generally closed canopies dominated by broad-leaved deciduous trees, particularly *Quercus* species.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Examples of this vegetation are primarily dominated by deciduous hardwood trees, including *Quercus* species and *Nyssa* species, with *Chamaecyparis thyoides, Liquidambar styraciflua, Pinus serotina, Pinus taeda, Taxodium distichum*, and other trees that tolerate wetland conditions. Basin swamps (G038) tend to experience longer periods of saturation and their dominant flora reflects this, with the *Quercus* species including *Quercus laurifolia, Quercus michauxii*, and *Quercus phellos*, with *Nyssa biflora, Nyssa ogeche*, and/or *Nyssa sylvatica*. Wet flatwoods (G130) vary more in their hydroperiod and the associated species sort along this moisture gradient, with more mesic zones including *Quercus alba, Quercus falcata, Quercus michauxii, Quercus nigra, Quercus pagoda*, and *Quercus shumardii*, with *Quercus laurifolia* and *Quercus phellos* in wetter zones. Other woody species that may occur in basin swamps (G038) include *Acer rubrum var. trilobum, Fraxinus profunda, Liriodendron tulipifera*, and *Populus heterophylla*. Typical species in the moderate to dense understory include *Clethra alnifolia, Cyrilla racemiflora, Ilex opaca var. opaca, Lyonia lucida, Magnolia virginiana, Persea palustris*, and *Smilax laurifolia*. Vines are conspicuous components, with important species including *Parthenocissus quinquefolia, Smilax smallii, Toxicodendron radicans, Vitis rotundifolia*, and *Vitis aestivalis*. *Parthenocissus quinquefolia* and *Toxicodendron radicans* may cover the ground, as well as being represented by high-climbing individuals. Herbaceous species in basin swamps are more limited due to the extended hydroperiods, and may include

Carex spp., *Sphagnum* spp., *Woodwardia areolata*, and *Woodwardia virginica*. Flatwoods may be more diverse, and their ground layers can include *Agrimonia rostellata, Aristolochia serpentaria, Botrychium virginianum, Carex cherokeensis, Chasmanthium sessiliflorum, Clematis virginiana, Clitoria mariana, Dichanthelium boscii, Dioscorea villosa, Elephantopus carolinianus, Elephantopus tomentosus, Geum canadense, Galium circaezans, Passiflora lutea, Phryma leptostachya, Podophyllum peltatum, Ruellia caroliniensis, Sanicula canadensis, Scleria oligantha, Smallanthus uvedalius*, and *Spigelia marilandica*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In basin swamps (G038), the predominant ecological processes are related to soil texture and moisture and disturbance history. These wetlands hold standing water for variable periods after rainfall events. In the wetter *Taxodium*- and *Nyssa*-dominated vegetation, fire is probably of little ecological significance because the vegetation is not flammable. Without fire as a major factor, most communities probably occur naturally as old-growth multi-aged forests dominated by gap-phase regeneration. Hurricanes may create larger canopy gaps occasionally. Examples in drowned river valleys are subject to influence by rising sea level and can be expected to evolve into tidal swamp systems, sometimes fairly quickly. Some of the sites where this vegetation is found today were formerly occupied by stands of *Chamaecyparis thyoides*. These depended on fire for regeneration of the canopy. The occurrence of fires on the time scale of several decades to a century or more may have determined the mosaic of *Chamaecyparis* forests versus other vegetation types. Some areas may once have been canebrakes, with dominance of *Arundinaria* determined by more frequent fire. Similarly, in wet oak-dominated flatwoods (G130), fire is probably of little ecological significance because the vegetation is not particularly flammable. There is some uncertainty about the role of fire, and low-intensity surface fires may have been ecologically important in some examples. The fire regime in dry and mesic flatwoods may be characterized as medium- to long-interval, low-intensity, and high-severity; and in wetter flatwoods as short-interval, low-intensity, and low-severity (D. Zollner pers. comm. 2006).

ENVIRONMENT

Environmental Description: The environment for this vegetation encompasses two more-or-less distinct habitats types. Basin swamps (G038) occupy large, seasonally inundated nonriverine basins with peaty substrates, as well as less well-defined broad interfluvial flats and smaller areas near headwater streams in the coastal plains. These flatter areas may have some conceptual overlap with wet flatwoods (G130) in terms of their environment. Wet flatwoods (G130) occur in flat terrain where soils are seasonally to nearly semipermanently saturated because of low relief, poor soil drainage, and the seasonally high water table. The hydrology is dominated by groundwater seepage, rainfall and sheetflow. Overbank and tidal flooding, if they occur, have little to no influence on the vegetation. The available soil moisture fluctuates widely throughout the growing season, from saturated to very dry, a condition sometimes referred to as xerohydric or hydroxeric. The largest areas are on broad interfluvial flats; examples also occur on sites above modern floodplains but with poor internal drainage: nonriverine Pleistocene high terraces, as well as in broad, low flats, in small to large depressions, and along small, ill-defined drainages (locally known as "slashes" in Louisiana). Some examples found near small drainageways have hydrology that is not influenced by overbank flooding. Soils may be loamy to clayey, shallow to deep.

DISTRIBUTION

***Geographic Range:** The vegetation of this macrogroup is most abundant in the Atlantic and Gulf coastal plains from southeastern Virginia to Texas, extending down the Florida peninsula; it also extends north along the coast to Long Island, New York, and north in the interior to Arkansas, southeastern Oklahoma, and the Missouri "bootheel."
Nations: US
States/Provinces: AL, AR, DE, FL, GA, LA, MD, MO, MS, NC, NJ, NY, OK, PA, SC, TX, VA
USFS Ecoregions (2007) [optional]: 231Bb:CCC, 231E:CC, 232F:CC, 232La:CCC, 234Ad:CCC, 234E:C?
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G038	Coastal Plain Hardwood Basin Swamp
G130	Hardwood - Loblolly Pine Nonriverine Wet Flatwoods

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
><	Basin Swamp	FNAI 1990	
?	Flatland Hardwood Forest	Marks and Harcombe 1981	
=	Nonriverine Wet Hardwood Forest	Schafale and Weakley 1990	

AUTHORSHIP

***Primary Concept Source [if applicable]:** M.P. Schafale and A.S. Weakley (1990)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne

Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by M.P. Schafale and A.S. Weakley.

Version Date: 15 Oct 2014

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G038. Coastal Plain Hardwood Basin Swamp

Type Concept Sentence: These are forests which occur in poorly drained basins and wet flats in the Southern Coastal Plain, dominated by some combination of *Nyssa biflora*, occasionally *Nyssa ogeche* and/or *Nyssa sylvatica*, and *Taxodium distichum*. Several *Quercus* species more tolerant of wet conditions (such as *Quercus laurifolia, Quercus michauxii*, and *Quercus phellos*) may be present.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.3.Nb.2. Southern Coastal Plain Basin Swamp & Flatwoods (M033)

Elcode: G038
***Scientific Name:** *Nyssa biflora - Nyssa ogeche - Taxodium distichum* Basin Swamp Group
***Common (Translated Scientific) Name:** Swamp Tupelo - Ogeechee Tupelo - Bald-cypress Basin Swamp Group
***Colloquial Name:** Coastal Plain Hardwood Basin Swamp

***Type Concept:** Forests in this group occur in poorly drained basins and wet flats in the Southern Coastal Plain. Canopy dominants are some combination of *Nyssa biflora*, occasionally *Nyssa ogeche* and/or *Nyssa sylvatica*, and *Taxodium distichum*. Several *Quercus* species more tolerant of wet conditions (such as *Quercus laurifolia, Quercus michauxii*, and *Quercus phellos*) may be present. Other woody species that may occur are *Acer rubrum var. trilobum, Chamaecyparis thyoides, Fraxinus profunda, Liquidambar styraciflua, Liriodendron tulipifera, Pinus serotina, Pinus taeda, Populus heterophylla*, and *Taxodium ascendens*. Typical species in the moderate to dense understory include *Acer rubrum, Clethra alnifolia, Cyrilla racemiflora, Ilex opaca var. opaca, Lyonia lucida, Magnolia virginiana, Persea palustris*, and *Smilax laurifolia*. The herbaceous layer may be sparse to dense, and species include *Carex* spp., *Woodwardia areolata, Woodwardia virginica*, and *Sphagnum* spp. Vines are conspicuous components. Stands occur on poorly drained basins and flats with organic or mineral soils that are saturated by rainfall and seasonal high water tables, but without the influence of river or tidal flooding (although they may be physically proximal to small streams). Stands may be difficult to distinguish from some other wetland forests based purely on canopy composition.

***Diagnostic Characteristics:** Stands have generally closed canopies dominated by deciduous trees, particularly *Nyssa* and *Taxodium*, but the shrub strata may have a broad-leaved evergreen component. Southern stands with a high cover of *Chamaecyparis thyoides* typically are placed here, depending on hydrology. The hydrology is nonriverine, with water coming from rainwater and groundwater rather than from overbank flooding. The environmental settings include depressions and wet flats.

***Classification Comments:** It is not clear if this group should include associations that have characteristics such as "very wet forests along mucky small streams in sandy terrain...flooded occasionally by stream water, but is primarily kept saturated by seepage input" or have "floodplain edges...that are very rarely flooded by alluvial waters, but which receive regular seepage from adjacent upland slopes"? CEGL004734, CEGL004427 and CEGL004679 have been placed in G038; CEGL004631 is placed into Hardwood - Loblolly Pine Nonriverine Wet Flatwoods Group (G130). This group was formerly called "Atlantic Maritime Conifer & Hardwood Swamp Group" (Faber-Langendoen and Menard 2006).

The combination of the suite of canopy species with nonriverine hydrology distinguishes vegetation of this group from related riverine/floodplain vegetation. There are differences in nutrient dynamics and other ecosystem process as well. The overall flora is usually distinct and reflects these differences in nutrient status. The invertebrate fauna is likely very distinct. Fire frequency is also an important difference between Coastal Plain Mixed Evergreen Swamp Group (G037) and Coastal Plain Hardwood Basin Swamp Group (G038), namely that fire is frequent in this group. It is unclear if fire frequency determines the difference in vegetation or if the different flammability of the vegetation determines the fire regime.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G597	Central Hardwood Flatwoods & Swamp Forest	
G553	Southeastern Native Ruderal Flooded & Swamp Forest	
G130	Hardwood - Loblolly Pine Nonriverine Wet Flatwoods	is related but with a shorter hydroperiod, the associations being primarily *Quercus*-dominated.
G037	Coastal Plain Mixed Evergreen Swamp	

Similar NVC Types General Comments [optional]: The vegetation of this group (G038) is distinguished from Coastal Plain Mixed Evergreen Swamp Group (G037) by the canopy dominants and the lack of both *Pinus serotina* and evergreen broadleaf hardwoods as major canopy components. This group of "nonriverine swamps and wet hardwood forests" (G038) would be expected to have a longer hydroperiod (i.e., more extended wet conditions) when compared to "hardwood flatwoods" of Hardwood - Loblolly Pine Nonriverine Wet Flatwoods Group (G130).

VEGETATION

Physiognomy and Structure Summary: Stands of this group are wetland forests with generally closed canopies and the characteristic presence or dominance of broad-leaved deciduous hardwoods (*Nyssa* and *Quercus* spp.), and needle-leaved deciduous conifers (*Taxodium* spp.). Understory shrubs are mixed broadleaved-evergreen and broad-leaved deciduous shrubs. The herb layer varies from sparse to dense.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Canopy dominants are some combination of *Nyssa biflora*, occasionally *Nyssa ogeche* and/or *Nyssa sylvatica*, and *Taxodium distichum*. *Quercus* species, when present, include *Quercus laurifolia, Quercus michauxii*, and *Quercus phellos*, which are tolerant of longer periods of saturation. Other woody species that may occur are *Acer rubrum var. trilobum, Chamaecyparis thyoides, Fraxinus profunda, Liquidambar styraciflua, Liriodendron tulipifera, Pinus serotina, Pinus taeda, Populus heterophylla*, and *Taxodium ascendens*. Typical species in the moderate to dense understory include *Acer rubrum, Clethra alnifolia, Cyrilla racemiflora, Ilex opaca var. opaca, Lyonia lucida, Magnolia virginiana, Persea palustris*, and *Smilax laurifolia*. Herbaceous species include *Carex* spp., *Woodwardia areolata, Woodwardia virginica*, and *Sphagnum* spp. The woody vines *Parthenocissus quinquefolia* and *Toxicodendron radicans* are conspicuous components. Other important woody vines include *Smilax smallii, Vitis aestivalis*, and *Vitis rotundifolia*.

Within its range, *Nyssa ogeche* may be a component. In general, at least in the Carolinas, the lower strata of stands tend to have affinities with broad-leaved evergreen types ("pocosin" or "baygall" communities) rather than with the flora of river floodplain systems to which the canopy components are related. The combination of hardwood/deciduous canopy dominants and nonriverine hydrology distinguishes this vegetation group from floodplain wetland forests. Stands with a high cover of *Chamaecyparis thyoides* formerly occupied much of the acreage of this group, but are now very rare.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The predominant ecological processes affecting this vegetation are related to soil texture and moisture and disturbance history. These are wetlands that hold standing water for variable periods during the year after rainfall events. In the wetter *Taxodium*- and *Nyssa*-dominated vegetation of this group, fire is probably of little ecological significance because the vegetation is not flammable. Without fire as a major factor, most communities probably occur naturally as old-growth multi-aged forests dominated by gap-phase regeneration. Hurricanes may create larger canopy gaps occasionally. Examples in drowned river valleys are subject to influence by rising sea level and can be expected to evolve into tidal swamp systems, sometimes fairly quickly. Some of the sites where this vegetation is found today were formerly occupied by stands of *Chamaecyparis thyoides*. These depended on fire for regeneration of the canopy. The occurrence of fires on the time scale of several decades to a century or more may have determined the mosaic of *Chamaecyparis* forests versus other vegetation types. Some areas may once have been canebrakes, with dominance of *Arundinaria* determined by more frequent fire.

ENVIRONMENT

Environmental Description: Vegetation of this group is found in at least two different habitat types. One group of associations occupies large, seasonally inundated nonriverine basins with peaty substrates, from southeastern Virginia to Texas. These "depression" basins do not receive overbank flooding. Natural fire is infrequent in these examples and varies from a minor to a significant influence on vegetational composition and structure. Under certain conditions (e.g., during a drought), a fire could be a catastrophic replacement event. A separate set of associations is found in flat areas of the outer Atlantic Coastal Plain from southeastern Virginia to Texas, in areas where soils are seasonally to nearly semipermanently saturated because of low relief, poor soil drainage, and seasonal high water table. The largest areas are on broad interfluvial flats. Smaller areas may be found near small headwater streams in the coastal plains. Despite being proximal to these small streams, their hydrology is dominated by groundwater seepage, rainfall and sheetflow. Overbank and tidal flooding, if they occur, have little to no influence on the vegetation. Soils may be loamy to clayey, shallow to deep. A distinctive small subset has soils with limestone near the surface, influencing soil chemistry.

DISTRIBUTION

***Geographic Range:** Vegetation of this group ranges from Long Island, New York, to southeastern Virginia, continuing to Mississippi, extending down the Florida peninsula, and possibly to Texas, and may occur in Arkansas and the Missouri "bootheel." The northern range limit needs further investigation.
Nations: US
States/Provinces: AL, AR?, DE, FL, GA, LA, MD, MO, MS, NC, NJ, NY, PA, SC, TN, TX?, VA
USFS Ecoregions (2007) [optional]: 221A:CC, 231E:CC, 231H:CP, 232A:CC, 232B:CC, 232C:CC, 232D:CC, 232E:CC, 232F:CC, 232G:CC, 232H:CC, 232I:CC, 232J:CC, 232K:CC, 232L:CC, 234A:CC, 234C:CC, 234D:CC, 234E:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.5.65a:C, 8.3.5.65b:C, 8.3.5.65f:C, 8.3.5.65h:C, 8.3.5.65o:C, 8.3.7.35a:C, 8.3.7.35b:C, 8.3.7.35c:C, 8.3.7.35d:C, 8.3.7.35e:C, 8.3.7.35f:C, 8.3.8.33a:C, 8.5.1.63b:C, 8.5.1.63c:C, 8.5.1.63e:C, 8.5.1.63h:C, 8.5.3.75a:C, 8.5.3.75d:C, 8.5.3.75e:C, 8.5.3.75f:C, 8.5.3.75g:C, 8.5.3.75j:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3636	*Nyssa biflora - Nyssa ogeche* Depressional Swamp Forest Alliance
A0320	*Crataegus aestivalis - Crataegus opaca - Crataegus rufula* Swamp Forest Alliance
A3637	*Liquidambar styraciflua - Acer rubrum / Morella cerifera* Mid-Atlantic Swamp Forest Alliance
A3635	*Nyssa biflora* Swamp Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
><	Basin Swamp	FNAI 1990	
<	Coastal Plain Small Stream Swamp	Schafale and Weakley 1990	
<	Nonriverine Swamp Forest	Schafale and Weakley 1990	

AUTHORSHIP

***Primary Concept Source [if applicable]:** M.P. Schafale and A.S. Weakley (1990)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne and D. Faber-Langendoen
Acknowledgments [optional]:

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1. Forest & Woodland
1.B.3.Nb. Southeastern North American Flooded & Swamp Forest

G130. Hardwood - Loblolly Pine Nonriverine Wet Flatwoods

Type Concept Sentence: These are nonriverine wetland hardwood-pine flatwood forests of the Atlantic and Gulf coastal plains and the Mississippi River Alluvial Plain, primarily dominated by *Quercus* spp., including primarily *Quercus laurifolia, Quercus michauxii, Quercus nigra, Quercus pagoda*, and *Quercus phellos*, and also with a variety of other hardwoods. In addition, *Pinus glabra* and/or *Pinus taeda* may be codominant or dominant in some examples, particularly in the Gulf Coastal Plain.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.3.Nb.2. Southern Coastal Plain Basin Swamp & Flatwoods (M033)

Elcode: G130
***Scientific Name:** *Quercus laurifolia - Quercus phellos - Pinus taeda* Wet Flatwoods Group
***Common (Translated Scientific) Name:** Laurel Oak - Willow Oak - Loblolly Pine Wet Flatwoods Group
***Colloquial Name:** Hardwood - Loblolly Pine Nonriverine Wet Flatwoods

***Type Concept:** These are nonriverine wetland hardwood or pine-hardwood forests and woodlands of the Atlantic and Gulf coastal plains and the Mississippi River Alluvial Plain, ranging from southeastern Virginia to Texas. Stands occur in a variety of flat, wet habitats and are most frequently dominated by *Quercus* spp. (including *Quercus laurifolia, Quercus phellos, Quercus pagoda, Quercus similis*, and *Quercus stellata*). In the Atlantic Coastal Plain, *Quercus michauxii, Quercus nigra*, and *Quercus virginiana* are important components, In addition, particularly in the Gulf Coastal Plain, *Pinus taeda* is dominant or codominant. *Pinus glabra* may be present within its range. Other hardwoods, including *Fraxinus pennsylvanica, Nyssa biflora*, and *Ulmus americana*, may be present as well. *Acer rubrum* and *Liquidambar styraciflua*, which are often increased by timber removal or other soil disturbance, may be prominent in some examples. *Sabal minor* is abundant in the lower strata of some stands within its range. In the Mississippi River Alluvial Plain, which is outside of the typical range of pine, hardwoods are the sole dominants. These communities are generally known as "flatwoods," and are found on a variety of sites which are generally flat to very gently sloping, primarily Pleistocene terraces. These sites typically have poor internal drainage, often from strata in the soil that limit permeability (claypans, hardpans, etc.). This limited permeability of the soil contributes to shallowly perched water tables during portions of the year when precipitation is greatest and evapotranspiration is lowest. Conversely, during the dry season, there is very little available water, leading to seasonal droughtiness. The hydrologic regime is primarily influenced by rainwater (and groundwater in included depressions), rather than overbank flooding. In some cases the flatwoods are within the current floodplain, but the hydrology, soils and vegetation are dominated by flatwoods, rather than floodplain, characteristics. Soil moisture fluctuates widely throughout the growing season, partly as a result of included impermeable layers. Hydrologic conditions vary from saturated to very dry, a condition sometimes referred to as xerohydric or hydroxeric. Soils are primarily mineral but may have some organic matter or muck. In some areas (e.g., in the youngest Pleistocene terraces in the Upper West Gulf Coastal Plain of Arkansas), the local topography is a complex of ridges and swales, often in close proximity to one another. Ridges are typically drier than swales, which may hold water for varying periods of time. Within both ridges and swales, there is vegetation variability relating to soil texture and moisture and disturbance history. As a result of dry (xeric) conditions during the dry season (summer-fall), most sites with these communities burned frequently, and the characteristic physiognomy was woodland. In today's landscapes, with reduced fire, most occurrences are forested.

***Diagnostic Characteristics:** The hydrology is nonriverine, with water coming from rainwater and (in depressions) groundwater rather than from overbank flooding. The environmental setting is wet flats with included depressions. Frequently burned sites have a woodland physiognomy, while most examples today are forested from lack of fire.

***Classification Comments:** This group encompasses a range of hydroperiods, as is traditional for the vegetation commonly called "flatwoods." It is drier than basin swamps, which can occur in similar topography, and wetter than mesic or upland groups. The placement and classification of vegetation commonly called "flatwoods" depend on the length of the hydroperiod. Forests in this group represent this hydrologic variation, which helps define the component alliances. Some other flatwoods included in this group are wetter than most flatwoods but not as wet as basin swamps. The relative abundance and ecological role of *Pinus taeda* in examples of this group is dependent on its importance in the particular region. In the West Gulf Coastal Plain, *Pinus taeda* (with some *Pinus echinata*) may be a primary dominant in stands of this group. The description of NVC associations in this group is probably incomplete, and more information is needed. On the lower terraces of the East Gulf Coastal Plain, the most western parts of the region contain flatwoods vegetation dominated primarily by *Quercus* spp., whereas in the more central part of the region (sometimes called the "Louisiana Florida Parishes Spruce Pine Flatwoods Forest"), the vegetation is dominated by a mixture of hardwoods with *Pinus glabra* and *Pinus taeda*. Characteristic hardwoods include *Magnolia grandiflora, Quercus laurifolia, Quercus michauxii, Quercus nigra, Quercus pagoda*, and *Quercus virginiana*. Some important understory trees and shrubs include *Crataegus opaca* and *Sabal minor* (which may often be very abundant or dominant), with *Arundinaria tecta* (Smith 1996b).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G038	Coastal Plain Hardwood Basin Swamp	represents wetter nonriverine hardwood vegetation, including "basin swamps."
G144	Great Plains Shortgrass Prairie	is related vegetation in the interior regions.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Stands have generally closed canopies, and are dominated by broad-leaved deciduous trees, particularly *Quercus* species, with *Pinus taeda* sometimes abundant or dominant in the West Gulf Coastal Plain and in altered or disturbed examples elsewhere. The lower strata may have a broad-leaved evergreen or deciduous shrub component. Characteristics include flat topography on coastal plain terraces or high Mississippi River Alluvial Plain terraces, a perched or seasonal high water table (sometimes also with dry periods), a lack of overland flooding, and dominance by wetland hardwoods and/or pines that are shared with river floodplain communities.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Examples of this vegetation are most frequently dominated by *Quercus* spp., including *Quercus laurifolia, Quercus phellos, Quercus pagoda, Quercus similis*, and *Quercus stellata*. In the Atlantic Coastal Plain, *Quercus michauxii, Quercus nigra*, and *Quercus virginiana* are important components. In addition, particularly in the Gulf Coastal Plain, *Pinus taeda* is dominant or codominant. *Pinus glabra* may be present within its range. Other hardwoods, including *Fraxinus pennsylvanica, Nyssa biflora*, and *Ulmus americana*, may be present as well. *Acer rubrum* and *Liquidambar styraciflua*, which are often increased by timber removal or other soil disturbance, may be prominent in some examples. *Sabal minor* is abundant in the lower strata of some stands within its range. Shrub and understory species may include *Clethra alnifolia, Crataegus aestivalis, Crataegus crus-galli, Crataegus marshallii, Diospyros virginiana, Hypericum hypericoides, Ilex opaca var. opaca, Ilex verticillata, Morella cerifera, Rhapidophyllum hystrix, Rhododendron viscosum, Sabal minor, Sabal palmetto, Serenoa repens, Vaccinium elliottii, Vaccinium formosum, Vaccinium fuscatum, Vaccinium virgatum, Viburnum dentatum*, and *Viburnum nudum var. nudum*. Woody vines include *Nekemias arborea (= Ampelopsis arborea), Berchemia scandens, Bignonia capreolata, Campsis radicans, Gelsemium sempervirens, Parthenocissus quinquefolia, Smilax bona-nox, Smilax glauca, Smilax rotundifolia, Toxicodendron radicans*, and *Vitis rotundifolia*. The herbaceous layer may be dense with grass and sedge species such as *Carex cherokeensis, Carex debilis var. debilis, Carex flaccosperma, Carex glaucescens, Carex intumescens, Carex seorsa, Chasmanthium laxum, Chasmanthium nitidum, Dichanthelium aciculare, Dichanthelium commutatum, Dichanthelium scoparium, Leersia* spp., *Rhynchospora caduca, Rhynchospora inexpansa, Scleria* *oligantha*, and *Scleria triglomerata*. Ferns may also be prominent, with scattered colonies and individuals of *Osmunda cinnamomea, Osmunda regalis var. spectabilis, Woodwardia areolata*, and *Woodwardia virginica*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In these communities, because soils are seasonally very dry, fire was originally ecologically significant. In today's landscapes, fire has been greatly reduced, leading to changes in community composition and structure. Canopy dynamics are usually driven by small gaps, but hurricanes may occasionally create large canopy gaps. Examples in drowned river valleys are subject to influence by rising sea level and can be expected to evolve into tidal swamp systems, sometimes fairly quickly. Low-intensity surface fires were ecologically important in inland examples. The fire regime in drier flatwoods may be characterized as short- to medium-interval, low-intensity, medium- to high-severity; and in wetter flatwoods as short-interval, low-intensity, low-severity (D. Zollner pers. comm. 2006). Some, such as the wet hardwood flats of North Carolina, apparently were non-flammable enough that fire had negligible influence. In Arkansas, there are two distinct landscapes in which these flatwoods play a prominent role. One of these is the Mississippi River Alluvial Plain, where there are Pleistocene valley train terraces formed by glacial outwash that were occupied principally by oak-dominated flatwoods. There are similar Pleistocene terraces in the Upper West Gulf Coastal Plain, but these were not formed from glacial outwash, by high waterflows at the same time. Those were dominated by *Pinus taeda* with hardwoods becoming more important in the wetter areas. Each of these distinctive areas occupies about a million acres, so they represented major portions of the pre-settlement landscape.

ENVIRONMENT

Environmental Description: Vegetation of this group occurs on flat areas, typically terraces of Pleistocene age of the Atlantic and Gulf coastal plains and the Mississippi River Alluvial Plain, from southeastern Virginia to Texas, and in the interior north to Arkansas, Oklahoma, and the Missouri "bootheel," in areas where soils seasonally vary from saturated to extremely dry because of low relief, poor internal and external soil drainage, seasonally high water table, and impervious layers that result in limited soil moisture during the dry season. Soil moisture fluctuates widely throughout the growing season, from saturated to very dry, a condition sometimes referred to as xerohydric or hydroxeric. The hydrology is dominated by rainfall and sheetflow, with groundwater seepage in depressions and at the boundaries of terraces. Overbank flooding has little to no influence on the vegetation. The largest areas are on broad interfluvial flats. Some examples of this environment include sites above modern floodplains but with poor internal drainage, including nonriverine Pleistocene high terraces, as well as broad, low flats, small to large depressions, and areas along small, ill-defined drainages (locally known as "slashes" in Louisiana). In Louisiana, some soils on which this vegetation is found include the Gilbert and Calhoun series which support "Wet Hardwood Flatwoods" (LNHP 2004). In Arkansas, Calhoun soils are sometimes associated with flatwoods. Fire was originally a very important influence on vegetation composition and structure in these seasonally dry examples, but today is often of limited importance. Fire was a negligible influence in others, such as the hardwood flats of North Carolina.

DISTRIBUTION

***Geographic Range:** Vegetation of this group is found in the Atlantic and Gulf coastal plains from southeastern Virginia to Texas, extending down the Florida peninsula, and west to Arkansas, southeastern Oklahoma, and the Missouri "bootheel." It is abundant in the Embayed Region of northeastern North Carolina and southeastern Virginia (south of the James River), and widespread in the West Gulf Coastal Plain.
Nations: US
States/Provinces: AL?, AR, FL?, GA, LA, MO?, MS, NC, OK, SC, TX, VA
USFS Ecoregions (2007) [optional]: 231Ec:CCC, 231Ef:CCC, 231G:CP, 231H:CP, 231Ib:CCC, 231Ic:CCC, 231If:CCC, 232B:CC, 232Ca:CCC, 232Cb:CCC, 232D:CC, 232E:CC, 232Fa:CCC, 232Fb:CCC, 232Fe:CCC, 232G:CC, 232H:CC, 232Ib:CCC, 232Je:CCC, 232Jg:CCC, 232K:CC, 232La:CCC, 234Da:CC?
Omernik Ecoregions L3, L4 [optional]: 8.3.5.65a:C, 8.3.5.65b:C, 8.3.5.65f:C, 8.3.5.65h:C, 8.3.5.65o:C, 8.3.7.35a:C, 8.3.7.35b:C, 8.3.7.35c:C, 8.3.7.35d:C, 8.3.7.35e:C, 8.3.7.35f:C, 8.3.8.33a:C, 8.5.1.63b:C, 8.5.1.63c:C, 8.5.1.63e:C, 8.5.1.63h:C, 8.5.2.73c:?, 8.5.3.75a:C, 8.5.3.75d:C, 8.5.3.75e:C, 8.5.3.75f:C, 8.5.3.75g:C, 8.5.3.75j:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A4189	*Quercus laurifolia - Quercus phellos - Quercus michauxii* Atlantic Coastal Plain Wet Flatwoods Forest Alliance
A3443	*Quercus michauxii - Quercus pagoda* Wet Flatwoods Forest Alliance
A3445	*Quercus stellata - Quercus falcata* Wet Flatwoods Forest Alliance
A3440	*Quercus michauxii - Liquidambar styraciflua - Platanus occidentalis* West Gulf Coastal Plain Wet Forest Alliance
A4190	*Pinus taeda - Quercus laurifolia - Quercus phellos* West Gulf Coastal Plain Wet Flatwoods Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
?	Flatland Hardwood Forest	Marks and Harcombe 1981	
>	IIA10e. Nonriverine Wet Hardwood Forest	Allard 1990	
>	Nonriverine Wet Hardwood Forest	Schafale and Weakley 1990	
?	Willow Oak - Water Oak - Diamondleaf (Laurel) Oak: 88	Eyre 1980	

AUTHORSHIP

***Primary Concept Source [if applicable]:** M.P. Schafale and A.S. Weakley (1990)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne
Acknowledgments [optional]: We have incorporated information from T. Foti relative to the West Gulf Coastal Plain.
Version Date: 13 May 2015

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1. Forest & Woodland
1.B.3.Nb. Southeastern North American Flooded & Swamp Forest

M032. Southern Coastal Plain Evergreen Hardwood - Conifer Swamp

Type Concept Sentence: These often-extensive Southeastern Coastal Plain wetland evergreen forests and woodlands are dominated by evergreen trees and evergreen shrubs and occur on saturated organic soils (including peat) and sandy wet mineral soils which may be high in peat content.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.3.Nb.3. Southeastern North American Flooded & Swamp Forest (D062)

Elcode: M032
***Scientific Name:** *Magnolia virginiana - Persea palustris - Pinus serotina* Swamp Forest Macrogroup
***Common (Translated Scientific) Name:** Sweetbay - Swamp Bay - Pond Pine Swamp Forest Macrogroup
***Colloquial Name:** Southern Coastal Plain Evergreen Hardwood - Conifer Swamp

***Type Concept:** This macrogroup is found in the Southeastern Coastal Plain from southeastern Virginia to eastern Texas. It occurs on poorly drained, organic soil flats and seepage-fed wetlands in dissected coastal plain landscapes. It may also occur in poorly developed upland drainages and small headwater streambottoms, as well as on toeslopes. These areas are saturated by rainfall and seasonally high water tables without influence of river or tidal flooding. The vegetation is characterized by an overstory that generally includes some combination of *Acer rubrum, Liriodendron tulipifera, Magnolia virginiana, Nyssa sylvatica, Nyssa biflora, Persea palustris*, and *Pinus serotina*, although there is some variation according to latitude. Some associations may contain *Chamaecyparis thyoides*, but this species is not diagnostic of this macrogroup. Understory vegetation throughout the region consistently supports the vine *Smilax laurifolia*, and there may be ferns such as *Osmunda cinnamomea, Osmunda regalis var. spectabilis, Woodwardia areolata*, and *Woodwardia virginica*. Soils may be wet sands or mixtures of organic (peaty) and mineral soils, which are often extremely nutrient-poor. When these communities are associated with streams, they tend to be low-gradient, with narrow, often braided channels and diffuse drainage patterns.

***Diagnostic Characteristics:** This macrogroup contains floristically and structurally diverse wetland forests with open to closed canopies. The broad-leaved evergreen tree growth form is more dominant here than in other related types (i.e., Coastal Plain Hardwood Basin Swamp Group (G038), Nonriverine Wet Oak Flatwoods Group (G130)), although not all examples will be so dominated. Other codominant growth forms include broad-leaved evergreen shrubs and evergreen needle-leaved trees. The component characteristic taxa are tolerant of groundwater seepage, but not long-hydroperiod flooding by deep water. Dominant taxa are typically strongly restricted to wetlands of the Southeastern Coastal Plain. Hydrology includes wet flats and gentle slopes, with groundwater rather than overbank flooding being the source of the water.

***Classification Comments:** Some closely related southern *Chamaecyparis thyoides* vegetation also is included in this macrogroup. Tree and tall-shrub pocosins are included here, but low-shrub and herb pocosins are treated in Southeastern Coastal Pocosin & Shrub Bog Group (G186) in Southeastern Coastal Bog & Fen Macrogroup (M065). Baygall wetlands are included here.

Some authors have treated *Persea palustris* (of wetlands) and *Persea borbonia* (of coastal uplands) as one taxon under a broadly conceived *Persea borbonia*. We recognize the two distinct taxa, following recent authors (Godfrey 1988, Kartesz 1999, Weakley 2008).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M033	Southern Coastal Plain Basin Swamp & Flatwoods	is not dominated by broad-leaved evergreen trees or shrubs.
M310	Southeastern North American Ruderal Flooded & Swamp Forest	
M031	Southern Coastal Plain Floodplain Forest	
M065	Southeastern Coastal Bog & Fen	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Stands of this macrogroup are wetland forests with generally closed canopies and the characteristic presence or dominance of several broad-leaved evergreen tree species. In some cases the hydrology is strongly influenced by groundwater seepage, but many examples are ombrotrophic, rain fed wetlands.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The vegetation of this macrogroup is dominated by woody plants, primarily trees. An open to closed canopy is usually present and consists of a mixture of acidic-tolerant wetland trees such as *Acer rubrum, Liriodendron tulipifera, Magnolia virginiana, Nyssa sylvatica, Nyssa biflora, Persea palustris*, and *Pinus serotina*. Some associations may contain *Chamaecyparis thyoides*, but this species is not diagnostic of this macrogroup. There is generally a dense shrub layer that is dominated by species shared with pocosins or baygalls, such as *Arundinaria tecta (= Arundinaria gigantea ssp. tecta), Clethra alnifolia, Cliftonia monophylla, Cyrilla racemiflora, Ilex glabra, Leucothoe axillaris, Lyonia ligustrina*, and *Lyonia lucida*, but includes some species which occur in other saturated wetlands, such as *Morella caroliniensis, Persea palustris, Toxicodendron vernix*, and *Viburnum nudum*. The vine *Smilax laurifolia* may be abundant. The herb layer, if well-developed at all, generally consists of large wetland ferns, such as *Osmunda cinnamomea, Osmunda regalis var. spectabilis, Woodwardia virginica*, and *Woodwardia areolata*, with *Carex* spp. There is some variation according to latitude, with southerly examples generally consisting of broad-leaved evergreen forests, while more northerly examples support more mixed evergreen-deciduous forests. In addition, broad-leaved evergreen species are especially pronounced in the shrub layer of southern examples.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The evergreen seepage-influenced vegetation types included here are quite heterogeneous in composition and in the role of fire, as well as extensive in geographic range. The streamhead seepages of the sandhills of the Carolinas, Georgia, Florida, and southern Virginia are distinctive in being strongly fire-dominated, having *Pinus* spp. as a major canopy dominant, and having many shrubs typical of pocosins. A second set of associations ranging from South Carolina through the Gulf Coastal Plain has vegetation that suggests less influence by fire, including hardwood canopies and shrub layers of broad-leaved evergreen shrubs of saturated habitats. A third set, from a wider variety of topographic settings throughout the region, has hardwood canopies and shrub and herb layers with less peatland affinities, more closely related to floodplain communities. Their flora suggests a minor role for fire. Fire is important, but the fire regime appears to be somewhat variable or unclear, because some of the characteristic trees are fire-intolerant (e.g., *Magnolia*), while others are fire-dependent (*Pinus serotina*). Fire frequency is lengthened by the wetness of the soil. This vegetation occurs in landscapes that had frequent fire under natural conditions, but the wetness sometimes limited fire spread, creating a less frequent fire-return interval. Natural fire intensity varies among alliances and associations, with some readily producing intense fire when they burn, while others probably experiencing only low-intensity fires because of low flammability. *Persea palustris* is suffering the effects of a beetle-borne fungus which is killing these trees in stands of this vegetation as well as upland maritime forests. This fungus (*Ophiostoma* sp.) is carried by the redbay ambrosia beetle (*Xyleborus glabratus*), introduced from Asia.

ENVIRONMENT

Environmental Description: This vegetation is found on coastal plain terrain on sites saturated by seepage of shallow groundwater. Seasonal to permanent saturation combined with wildland fire of only moderate to low frequency and woody vegetation are the unifying characteristics of this macrogroup. Often, a small stream drains the site, but overbank flooding is a negligible influence. Some examples are on wet flats, some are in bottoms of ravines, but some are on sideslopes or flats at the base of slopes. Most examples are in sandy areas where rapid soil drainage in the surrounding landscape supplies the seepage. Soils within the macrogroup itself are generally mucky sands or clay, or deeper organic soils.

DISTRIBUTION

***Geographic Range:** This vegetation ranges from southeastern Virginia to eastern Texas, extending into central Florida and north in the interior to southern Arkansas and extreme southeastern Oklahoma.
Nations: US
States/Provinces: AL, AR, FL, GA, LA, MS, NC, OK, SC, TX, VA
USFS Ecoregions (2007) [optional]: 231E:CC, 231H:CC, 232B:CC, 232C:CC, 232D:CC, 232F:CC, 232G:CC, 232H:CC, 232I:CC, 232Ja:CCC, 232K:CC, 232L:CC, 234A:CC, 234C:CP, 234E:CP
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G037	Coastal Plain Mixed Evergreen Swamp

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Atlantic White-Cedar 97	Eyre 1980	
<	Atlantic white cedar swamp forest	Christensen 2000	
=	Bay Swamp	Ewel 1990b	
<	Bay forests, bayheads, and baygalls	Christensen 2000	
=	Hardwood flats and warm temperate peatlands of the coastal plain	Brinson and Malvarez 2002	
><	Pocosins	Christensen 2000	
<	Pond Pine 98	Eyre 1980	
<	Slash Pine - Hardwood 85	Eyre 1980	
<	Sweetbay - Swamp Tupelo - Redbay 104	Eyre 1980	
<	Wetland Baygall Shrub Thicket	Marks and Harcombe 1981	

AUTHORSHIP

***Primary Concept Source [if applicable]:** K.C. Ewel (1990b)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman, R.K. Peet and M. Pyne
Acknowledgments [optional]:
Version Date: 15 Oct 2014

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Frost, C. C. 1987. Historical overview of Atlantic white cedar in the Carolinas. Pages 257-263 in: A. D. Laderman, editor. Atlantic white cedar wetlands. Westview Press, Boulder, CO. 401 pp.
Hoagland, B. 2000. The vegetation of Oklahoma: A classification for landscape mapping and conservation planning. The Southwestern Naturalist 45(4):385-420.
Marks, P. L., and P. A. Harcombe. 1981. Forest vegetation of the Big Thicket, southeast Texas. Ecological Monographs 51:287-305.
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1. Forest & Woodland
1.B.3.Nb. Southeastern North American Flooded & Swamp Forest

G037. Coastal Plain Mixed Evergreen Swamp

Type Concept Sentence: These mixed evergreen and deciduous forests of *Acer rubrum, Liriodendron tulipifera, Magnolia virginiana, Nyssa biflora, Nyssa sylvatica, Persea palustris*, and *Pinus serotina*, are found on poorly drained, organic soil flats and seepage-fed wetlands in dissected coastal plain landscapes from southeastern Virginia to eastern Texas.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.3.Nb.3. Southern Coastal Plain Evergreen Hardwood - Conifer Swamp (M032)

Elcode: G037
***Scientific Name:** *Magnolia virginiana - Gordonia lasianthus - Pinus serotina* Swamp Forest Group
***Common (Translated Scientific) Name:** Sweetbay - Loblolly-bay - Pond Pine Swamp Forest Group
***Colloquial Name:** Coastal Plain Mixed Evergreen Swamp

***Type Concept:** This group is found in the southern coastal plain region from southeastern Virginia to eastern Texas. It occurs on poorly drained, organic soil flats and seepage-fed wetlands in dissected coastal plain landscapes. It may also occur in poorly developed upland drainages and small headwater streambottoms, as well as on toeslopes. These areas are saturated by rainfall and seasonally high water tables without influence of river or tidal flooding. The vegetation is characterized by an overstory that generally includes some combination of *Acer rubrum, Liriodendron tulipifera, Magnolia virginiana, Nyssa biflora, Nyssa sylvatica, Persea palustris*, and *Pinus serotina*, although there is some variation according to latitude. Some associations may contain *Chamaecyparis thyoides*, but this species is not diagnostic of this group. Understory vegetation throughout the region consistently supports the vine *Smilax laurifolia* and there may be ferns, such as *Osmunda cinnamomea, Osmunda regalis var. spectabilis, Woodwardia virginica*, and *Woodwardia areolata*. Soils may be wet sands or mixtures of organic (peaty) and mineral soils, which are nutrient-poor. When these communities are associated with streams, they tend to be low-gradient, with narrow, often braided channels and diffuse drainage patterns. Fire is important, but the fire regime appears to be somewhat variable or unclear, because some of the characteristic trees are fire-intolerant (e.g., *Magnolia*), while others are fire-dependent (*Pinus serotina*). Fire-return interval is lengthened by the wetness of the soil.

***Diagnostic Characteristics:** This group contains floristically and structurally diverse wetland forests with open to closed canopies. The broad-leaved evergreen tree growth form is more dominant here than in other related types (i.e., Coastal Plain Hardwood Basin Swamp Group (G038), Nonriverine Wet Oak Flatwoods Group (G130)), although not all examples will be so dominated. Other codominant growth forms include broad-leaved deciduous trees and evergreen needle-leaved trees. The component characteristic taxa are tolerant of groundwater seepage, but not long-hydroperiod flooding by deep water. Dominant taxa are typically strongly restricted to wetlands of the Southeast Coastal Plain. Hydrology includes wet flats and gentle slopes, with groundwater rather than overbank flooding being the source of the water.

***Classification Comments:** Some closely related southern *Chamaecyparis thyoides*- and *Arundinaria*-dominated associations also fit into this group. Tree and tall shrub pocosins are included here, but low shrub and herb pocosins are treated in Southeastern Coastal Pocosin & Shrub Bog Group (G186). Baygalls are treated here.

Some authors have treated *Persea palustris* (of wetlands) and *Persea borbonia* (of uplands) as one taxon under a broadly conceived *Persea borbonia*. We recognize the two distinct taxa, following Godfrey (1988), Kartesz (1999) and Weakley (2008).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G597	Central Hardwood Flatwoods & Swamp Forest	
G039	Northern Atlantic Coastal Hardwood - Conifer Swamp	
G038	Coastal Plain Hardwood Basin Swamp	
G553	Southeastern Native Ruderal Flooded & Swamp Forest	
G776	Atlantic & Gulf Coastal Plain Shrub Swamp	

Similar NVC Types General Comments [optional]: See Southeastern Coastal Pocosin & Shrub Bog Group (G186), the pocosin shrublands, where some associations are floristically similar to this group.

VEGETATION

Physiognomy and Structure Summary: Stands of this group are wetland forests with generally closed canopies and the characteristic presence or dominance of several broad-leaved evergreen tree species. The distinctive hydrology is strongly influenced by groundwater seepage.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The vegetation of this group is dominated by woody plants, primarily trees. An open to closed canopy is usually present and consists of a mixture of acidic-tolerant wetland trees such as *Acer rubrum, Liriodendron tulipifera, Magnolia virginiana, Nyssa biflora, Nyssa sylvatica, Persea palustris*, and *Pinus serotina*. Some associations may contain *Chamaecyparis thyoides*, but this species is not diagnostic of this group. There is generally a dense shrub layer that is dominated by species shared with pocosins or baygalls, such as *Arundinaria tecta (= Arundinaria gigantea ssp. tecta), Clethra alnifolia, Cliftonia monophylla, Cyrilla racemiflora, Ilex glabra, Leucothoe axillaris, Lyonia ligustrina*, and *Lyonia lucida*, but includes some species which occur in other saturated wetlands, such as *Morella caroliniensis, Persea palustris, Toxicodendron vernix*, and *Viburnum nudum*. The vine *Smilax laurifolia* may be abundant. The herb layer, if well-developed at all, generally consists of large wetland ferns, such as *Osmunda cinnamomea, Osmunda regalis var. spectabilis, Woodwardia virginica*, and *Woodwardia areolata*, with *Carex* spp. There is some variation according to latitude, with southerly examples generally consisting of broad-leaved evergreen forests, while more northerly examples support more mixed evergreen-deciduous forests. In addition, broad-leaved evergreen species are especially pronounced in the shrub layer of southern examples.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The evergreen seepage-influenced vegetation types included here are quite heterogeneous in composition and in the role of fire, as well as extensive in geographic range. The streamhead seepages of the Fall-line Sandhills region of North Carolina and northern South Carolina (EPA 65c), as well as related areas of Georgia, Florida, and southern Virginia are distinctive in being strongly fire-dominated, having *Pinus* spp. as a major canopy dominant, and having a flora consisting largely of pocosin species. A second set of associations ranging from South Carolina through the Gulf Coastal Plain has vegetation that suggests less influence by fire, including hardwood canopies and shrub layers that are primarily evergreen shrubs of saturated habitats, that share some other wetland species. A third set, from a wider variety of topographic settings throughout the region, has hardwood canopies and shrub and herb layers with less peatland affinities, more closely related to floodplain communities. Their flora suggests a minor role for fire. Fire is important, but the fire regime appears to be somewhat variable or unclear, because some of the characteristic trees are fire-intolerant (e.g., *Magnolia*), while others are fire-dependent (*Pinus serotina*). Fire frequency is lengthened by the wetness of the soil. This vegetation occurs in landscapes that had frequent fire under natural conditions, but the wetness sometimes limited fire spread, creating a less frequent fire-return interval. Natural fire intensity varies among alliances and associations, with some readily producing intense fire when they burn, while others probably experiencing only low-intensity fires because of low flammability. *Persea palustris* is suffering the effects of a beetle-borne fungus which is killing these trees in stands of this vegetation as well as upland maritime forests. This fungus (*Ophiostoma* sp.) is carried by the redbay ambrosia beetle (*Xyleborus glabratus*), introduced from Asia.

ENVIRONMENT

Environmental Description: This vegetation is found on coastal plain terrain on sites saturated by seepage of shallow groundwater. Seasonal to permanent saturation combined with wildland fire of only moderate to low frequency and woody vegetation are the unifying characteristics of this group. Often, a small stream drains the site, but overbank flooding is a negligible influence. Some examples are on wet flats, some are in bottoms of ravines, but some are on sideslopes or flats at the base of slopes. Most examples are in sandy areas where rapid soil drainage in the surrounding landscape supplies the seepage. Soils within the group itself are generally mucky sands or clay, or deeper organic soils.

DISTRIBUTION

***Geographic Range:** This vegetation ranges from southeastern Virginia to eastern Texas, extending into central Florida and north in the interior to southern Arkansas and extreme southeastern Oklahoma.
Nations: US
States/Provinces: AL, AR, FL, GA, LA, MD, MS, NC, OK, SC, TX, VA
USFS Ecoregions (2007) [optional]: 231E:CC, 231H:CC, 232B:CC, 232C:CC, 232D:CC, 232F:CC, 232G:CC, 232H:CC, 232I:CC, 232Ja:CCC, 232K:CC, 232L:CC, 234A:CC, 234C:CP, 234E:CP
Omernik Ecoregions L3, L4 [optional]: 8.3.5.65b:C, 8.3.5.65c:C, 8.3.5.65d:C, 8.3.5.65f:C, 8.3.5.65g:C, 8.3.5.65h:C, 8.3.5.65k:C, 8.3.5.65l:C, 8.3.5.65m:C, 8.3.5.65o:C, 8.3.5.65p:C, 8.3.5.65q:C, 8.3.6.74a:C, 8.3.6.74c:C, 8.3.7.35a:C, 8.3.7.35b:C, 8.3.7.35c:C, 8.3.7.35d:C, 8.3.7.35e:C, 8.3.7.35f:C, 8.3.7.35g:C, 8.3.7.35h:C, 8.5.1.63b:C, 8.5.1.63c:C, 8.5.1.63e:C, 8.5.1.63h:C, 8.5.1.63n:C, 8.5.3.75a:C, 8.5.3.75b:C, 8.5.3.75c:C, 8.5.3.75d:C, 8.5.3.75e:C, 8.5.3.75f:C, 8.5.3.75g:C, 8.5.3.75h:C, 8.5.3.75i:C, 8.5.3.75j:C, 8.5.3.75l:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:** At least in North Carolina, a moderate amount of plot data exists for this group. The difficulty of working in the vegetation of many examples leads to them being undersampled in local studies, and the data are probably not a good representation of their variation. Some associations have been borne out in local analyses, but it is unknown whether any comprehensive analysis that covers any significant part of the range of this group exists (M. Schafale pers. comm. 2012).

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0060	*Magnolia virginiana - Persea palustris* Swamp Forest Alliance

Elcode	Scientific or Colloquial Name
A0058	*Cliftonia monophylla* Baygall Swamp Forest Alliance
A3350	*Sabal palmetto - Quercus virginiana - Magnolia virginiana* Swamp Forest Alliance
A0581	*Pinus serotina* Swamp Woodland Alliance
A0196	*Chamaecyparis thyoides* Swamp Forest Alliance
A0378	*Magnolia virginiana - Nyssa biflora - Quercus laurifolia* Swamp Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Bay Swamp	Ewel 1990b	
<	Bay-Gallberry Holly Bogs	Ajilvsgi 1979	
<	Baygall	FNAI 1990	
<	Wetland Baygall Shrub Thicket	Marks and Harcombe 1981	

AUTHORSHIP

***Primary Concept Source [if applicable]:** K.C. Ewel (1990b)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman and M. Pyne

Acknowledgments [optional]:

Version Date: 13 May 2015

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***References [Required if used in text]:**

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Frost, C. C. 1987. Historical overview of Atlantic white cedar in the Carolinas. Pages 257-263 in: A. D. Laderman, editor. Atlantic white cedar wetlands. Westview Press, Boulder, CO. 401 pp.

Godfrey, R. K. 1988. Trees, shrubs, and woody vines of northern Florida and adjacent Georgia and Alabama. University of Georgia Press, Athens. 734 pp.

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1. Forest & Woodland
1.B.3.Nb. Southeastern North American Flooded & Swamp Forest

M031. Southern Coastal Plain Floodplain Forest

Type Concept Sentence: These floodplain forests are found in the southern United States, in the Atlantic and Gulf coastal plains from Delaware to Texas and in adjacent interior provinces, north to southern Illinois, western Kentucky and southeastern Missouri. There are three broad combinations of dominant species that collectively constitute the vegetation of this macrogroup: bald-cypress - tupelo forests, oak - sweetgum forests, and ash - elm - willow forests.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.3.Nb.4. Southeastern North American Flooded & Swamp Forest (D062)

Elcode: M031
***Scientific Name:** *Quercus michauxii - Taxodium distichum - Carya illinoinensis* Southern Floodplain Forest Macrogroup
***Common (Translated Scientific) Name:** Swamp Chestnut Oak - Bald-cypress - Pecan Southern Floodplain Forest Macrogroup
***Colloquial Name:** Southern Coastal Plain Floodplain Forest

***Type Concept:** These floodplain forests are found in the southern United States, in the Atlantic and Gulf coastal plains from Delaware to Texas and in adjacent interior provinces, north to southeastern Missouri, southern Illinois, southern Indiana, and western Kentucky. There are three broad combinations of dominant species that collectively constitute the vegetation of this macrogroup: bald-cypress - tupelo forests (G033), oak - sweetgum forests (G034), and ash - elm - willow forests (G759). The dominant species in stands of floodplain forest primarily vary with hydroperiod, with species sorting on a rough gradient from wet to mesic. Bald-cypress - tupelo forests (G033) are primarily dominated by *Taxodium distichum* (occasionally *Taxodium ascendens*) with *Nyssa aquatica* (occasionally *Nyssa biflora*). Oak - sweetgum forests (G034) are dominated by *Liquidambar styraciflua, Quercus* spp., and *Ulmus* spp. There is also some floristic variation based on hydrology; shorter- hydroperiod examples will contain *Quercus michauxii, Quercus pagoda*, and *Quercus shumardii*, and longer-hydroperiod ones will have *Nyssa biflora, Quercus laurifolia, Quercus lyrata*, and *Quercus phellos*. Other dominant species include *Acer negundo, Celtis laevigata, Fraxinus pennsylvanica*, and *Platanus occidentalis*. Ash - elm - willow forests (G759) are typically dominated by *Fraxinus pennsylvanica, Populus deltoides, Salix caroliniana, Salix nigra*, and *Ulmus americana*. Except in the very wet examples, understory, shrub and herb layers are generally well-developed and woody vines are also prominent. Vines such as *Nekemias arborea, Berchemia scandens, Campsis radicans, Parthenocissus quinquefolia*, and *Vitis* spp., may be conspicuous. *Arundinaria gigantea* is a common understory component in these forests on natural levees and higher point bars, and may become dominant after thinning or removal of the overstory. These are communities of streams and rivers of all orders and sizes, including some tidal forests. Stands are typically flooded for periods of up to 3 months, but not during the growing season. Stands are known from low bottomlands, depressions, sloughs and abandoned channel segments, as well as from elevated features such as riverfronts, point bars, natural levees, high bottomlands, ridges, and upper terraces. This floristic and ecological variation is accounted for at the group and alliance levels. Some examples of these forests are known as "blackwater" and others as "brownwater."

***Diagnostic Characteristics:** These are all floodplain forests of the southern United States, dominated by a variety of distinctive species which are found only, or primarily, in stands of this macrogroup. Probably the most strongly diagnostic species include *Acer rubrum var. drummondii, Carya aquatica, Fraxinus profunda, Gleditsia aquatica, Nyssa aquatica, Nyssa biflora, Planera aquatica*, and *Taxodium distichum* (in longer hydroperiod examples), and *Carpinus caroliniana, Liquidambar styraciflua, Platanus occidentalis, Populus deltoides, Quercus laurifolia, Quercus lyrata, Quercus michauxii, Quercus nigra, Quercus phellos, Quercus pagoda, Quercus shumardii*, and *Quercus texana* (in shorter hydroperiod examples).

***Classification Comments:** Some embedded patches of smaller trees, including *Cornus foemina, Forestiera acuminata, Itea virginica*, and *Planera aquatica*, are also included here, as are patches of *Cephalanthus occidentalis*, which can range in lifeform from small tree to shrub. These are usually smaller-patch features imbedded within larger-patch (and taller stature) floodplain forests of various types. The basis of the distinction among the groups in this macrogroup is floristic and broadly ecological rather than purely hydrologic. Isolated wetlands such as depression ponds dominated by *Taxodium* are placed in nonriverine groups. Forests dominated by *Fagus grandifolia* with or without *Magnolia grandiflora* belong in mesic groups, whether they are clearly in uplands or in upland-floodplain transition areas.

Along the western edge of the range of Southern Coastal Plain Floodplain Forest Macrogroup (M031) in Texas and Oklahoma, it transitions into the single group in Southern Great Plains Floodplain Forest & Woodland Macrogroup (M154), i.e., Southeastern Great Plains Floodplain Forest Group (G784). While there is some floristic overlap between these two macrogroups, M154 lacks many of the eastern species characteristic of M031.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M310	Southeastern North American Ruderal Flooded & Swamp Forest	contains exotic tree species and generalist native tree species on strongly human disturbed sites.
M154	Southern Great Plains Floodplain Forest & Woodland	
M032	Southern Coastal Plain Evergreen Hardwood - Conifer Swamp	
M033	Southern Coastal Plain Basin Swamp & Flatwoods	is found in nonriverine settings and shares some species.
M036	Interior Warm & Cool Desert Riparian Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are most typically closed-canopy flooded, riverine, and bottomland forests (and more rarely woodlands) dominated by a combination of tall broad-leaved deciduous trees and a needle-leaved deciduous tree (*Taxodium*). The understory is also quite variable. Shrubs and herbaceous plants can be virtually absent to dense. Vines are common.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The dominant species in stands of floodplain forest primarily vary with hydroperiod, with species sorting on a rough gradient from wet to mesic. Bald-cypress - tupelo forests (G033) are primarily dominated by *Taxodium distichum* (occasionally *Taxodium ascendens*) with *Nyssa aquatica* (occasionally *Nyssa biflora*). Oak - sweetgum forests (G034) are dominated by *Liquidambar styraciflua, Quercus* spp., and *Ulmus* spp. There is also some floristic variation based on hydrology; shorter-hydroperiod examples will contain *Quercus michauxii, Quercus pagoda, Quercus shumardii*, and *Quercus texana* and longer-hydroperiod ones will have *Nyssa biflora, Quercus laurifolia, Quercus lyrata*, and *Quercus phellos*. Other dominant species include *Acer negundo, Celtis laevigata, Fraxinus pennsylvanica*, and *Platanus occidentalis*. Ash - elm - willow forests (G759) are typically dominated by *Fraxinus pennsylvanica, Populus deltoides, Salix caroliniana, Salix nigra*, and *Ulmus americana*.

Some other trees which may be associated with stands of this group include *Acer rubrum var. drummondii, Carya aquatica, Fraxinus pennsylvanica, Gleditsia aquatica, Salix nigra*, and other trees tolerant of flooding. Some inclusions are dominated by small trees or large shrubs, including *Carpinus caroliniana, Cephalanthus occidentalis, Cornus foemina, Decodon verticillatus, Forestiera acuminata, Ilex decidua, Ilex opaca var. opaca, Itea virginica, Planera aquatica*, and *Viburnum dentatum*. Except in the very wet examples, understory, shrub and herb layers are generally well-developed and woody vines are also prominent. Vines such as *Nekemias arborea (= Ampelopsis arborea), Berchemia scandens, Campsis radicans, Parthenocissus quinquefolia, Smilax bona-nox,* *Toxicodendron radicans*, and *Vitis* spp., may be conspicuous. The perennial graminoid bamboo *Arundinaria gigantea (= ssp. gigantea)* is a common understory component in these forests on natural levees and higher point bars, and may become dominant after thinning or removal of the overstory. Some other examples have very diverse herbaceous layers, including *Bidens aristosa, Carex cherokeensis, Carex debilis, Carex digitalis, Carex joorii, Chasmanthium latifolium, Geum canadense, Glyceria striata, Leersia virginica*, and *Polygonum hydropiperoides*. Terrestrial herbs in wetter examples are usually limited due to long hydroperiods, and are often only found on elevated logs and stumps, but can include *Boehmeria cylindrica, Carex decomposita, Carex grayi, Carex intumescens, Carex joorii, Carex lupulina, Commelina virginica, Leersia lenticularis, Onoclea sensibilis*, and *Saururus cernuus*. Aquatic and floating herbs include *Ceratophyllum* spp., *Elodea* spp., *Lemna minor, Ludwigia peploides, Potamogeton* spp., and *Sagittaria lancifolia*.

Floodplain forests, at least in the Southern Appalachian region, are much more prone to invasion from exotics than are uplands, with average cover of 22% (Brown and Peet 2003). Matthews et al. (2011) note the following exotics are common in Piedmont floodplain forests: shrubs *Ligustrum sinense, Lonicera japonica*; and herbs *Glechoma hederacea, Microstegium vimineum, Murdannia keisak*. Additional information is needed on the typical exotics found in this macrogroup. See Southeastern North American Ruderal Flooded & Swamp Forest Macrogroup (M310) for a summary of exotic species that may also occur in this type.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Flooding is an important ecological factor in examples of this macrogroup, and the length of the flooding may be the most important factor distinguishing this vegetation. In addition to disturbance, floods bring nutrient input, deposit sediment, exclude non-flood-tolerant species and disperse plant seeds. Flooding is most common in the winter but may occur in other seasons. The small flows, low gradient, and binding of sediment by vegetation limit channel shifts and sediment movement, but floods may cause local disturbance by scouring. Flood waters may have significant energy in higher-gradient systems, but scouring and reworking of sediment rarely affect more than small patches. Most of these forests would exist naturally as multi-aged old-growth forests driven by gap-phase regeneration.

Most of these forests exist naturally as multi-aged old-growth forests driven by gap-phase regeneration. Windthrow is probably the most important cause of gaps, as wind disturbance is perhaps more important than in uplands because of frequently wet soils, less dense soils, and more shallow-rooted trees.

Fire does not appear to be a dominant factor in this floodplain vegetation, and it is not very flammable. Fire is probably more important in small stream examples than in larger river ones, because distances to uplands are short and stream channels and sloughs are smaller and less effective as firebreaks. However, most of the vegetation is not very flammable and usually will not carry fire. However, historical references to canebrakes dominated by *Arundinaria gigantea* suggest that at least in some portions of stands, fire may have once been more of a factor. Examples often have limited herbaceous layers, making fire less important, even during extended dry periods.

Some tidal examples are included in Bald-cypress - Tupelo Floodplain Forest Group (G033); these are affected by diurnal tidal flooding or by storm tides. In these cases, infrequent intrusion of saltier water, which is stressful or fatal to many of the plant species, is an important periodic disturbance created by storms. Natural fire is not frequent in these tidal examples, but may sometimes be important in determining the boundary between tidal swamps and tidal marshes. The tidal forest examples generally appear to be in a shifting relationship with adjacent tidal freshwater marshes. Many of these tidal marshes have standing dead trees in them, suggesting they recently were swamps. But some marshes are being invaded with trees and may be turning into swamps. Rising sea level is causing more inland swamps to develop tidal characteristics and causing some stands to turn into marshes. In areas not too strongly affected by salt intrusion, drowning by rising sea level, or fire, the communities can be expected to exist as old-growth, multi-aged forests.

Southern ash - elm - willow floodplain forests (G759) are subject to frequent disturbances, including flooding, erosion, and deposition of sediment. This leads to a physiognomically diverse group. Stands that have recently been subjected to severe flooding may be relatively open. Most stands have moderate to closed tree canopies, though.

Matthews et al. (2011), in their summary of historic changes to Piedmont floodplain forests, capture much of what has occurred across the range of this type; namely, that these forests occur in a highly fragmented landscape, where the natural hydrologic regime has been altered by anthropogenic activities for hundreds of years, where a long history of selective tree harvesting has reduced the abundance of certain species; and where non-native invasive species are increasingly common. Finally, they note that, in the Piedmont, extensive sediment deposition occurred following European agriculture on the uplands during the period 1700-1940.

ENVIRONMENT

Environmental Description: This vegetation occurs on and near streams and rivers of all orders and sizes, including tidal forests. Sites include floodplains and terraces affected by river flooding and on emergent bars and banks within channels. Depositional landforms, including levees, sloughs, ridges, terraces, and abandoned channel segments may be present within stands. The substrate is primarily alluvium. Soils are usually sandy to loamy, but include local clayey and gravelly areas. Soils are generally fertile. Alluvial soils may be as important a factor as ongoing flooding in differentiating this vegetation from that of adjacent uplands. Emergent and vegetated bars of gravel to cobbles occur occasionally but are generally not extensive or as distinctive as they are on larger rivers. Floods are generally of short duration, and wetness is a major influence, especially within channels and where water is ponded in local depressions. The geologic substrate may be of any kind, but areas on Triassic sediments tend to have large floodplain systems even on fairly small streams.

Tidally influenced examples occur in lower reaches of river floodplains and along estuary shorelines, in places regularly or irregularly flooded by lunar or wind tides. The water has little salt content, due to distance from the ocean and/or strong freshwater input. Soils may be mineral or organic. Soils are generally permanently saturated even when the tide is low. The transition of the hydrology to flood dominance rather than tidal dominance may be very gradual.

Blackwater examples occur in floodplains of small streams of the coastal plain that carry little mineral sediment. These streams have their headwaters in sandy portions of the coastal plain. The water is usually strongly stained by tannins but has little suspended clay and is not turbid. Depositional landforms may be absent or may be present in limited variety and of small size. Soils are generally sandy in drier portions of the floodplain, mucky in wetter portions, or may be uniform organic soils. Soils are usually strongly acidic, but spring-fed rivers may have calcareous water and non-acidic soils. Flooding ranges from semipermanent in the wettest floodplains to intermittent and short in higher-gradient streams. Some small blackwater streams have most of their flow from sandhill seepage and have limited fluctuation in water levels.

In contrast, brownwater or redwater river examples occur in floodplains of medium to small coastal plain rivers that carry significant mineral sediment. These rivers have their headwaters in the Piedmont, Blue Ridge, Interior Plateaus, or in portions of the coastal plain where fine-textured sediment predominates. The water generally carries substantial amounts of silt, clay, and sometimes sand. Depositional landforms such as point bars, natural levees, backswamps, and ridge-and-swale systems (scrollwork) are well-developed and form patterns of significant variation in flooding duration and nutrient input. Soil texture varies from sandy to clayey. Soils are generally fertile and not strongly acidic. Flooding ranges from semipermanent in the wettest areas to intermittent and short on the higher portions of the floodplain. The highest terraces may no longer flood at all and will be occupied by upland vegetation.

DISTRIBUTION

***Geographic Range:** These deciduous floodplain or swamp forests are found throughout the Atlantic Coastal Plain from Delaware, New Jersey, and Virginia south to southeastern Georgia, in the Gulf Coastal Plain from Georgia to Texas, in portions of the adjacent Piedmont and interior regions from Alabama and Tennessee to southern Virginia, as well as in the Mississippi River Alluvial Plain and adjacent Upper East Gulf Coastal Plain from southeastern Missouri, southern Illinois, southern Indiana, and Kentucky south to Mississippi and Louisiana. There is also one association in the Ouachitas of Arkansas and Oklahoma. Some of the ash - elm - willow floodplain forest associations (G759) are more northerly, ranging to New York and Connecticut, but these are close to the ocean (i.e., tidally-influenced).

Nations: US

States/Provinces: AL, AR, CT, DC, DE, FL, GA, IL, IN, KY, LA, MA, MD, MO, MS, NC, NJ, NY, OK, PA?, SC, TN, TX, VA, WV

USFS Ecoregions (2007) [optional]: 231A:CC, 231B:CC, 231H:CC, 231I:CC, 232A:CC, 232B:CC, 232C:CC, 232D:CC, 232E:CC, 232G:CC, 232H:CC, 232I:CC, 232J:CC, 232K:CC, 232L:CC, 234A:CC, 234C:CC, 234D:CC, 234E:CC, 255Ad:CCC, 255Af:CCC, 255Ba:CCC, 255Ca:CCC, 255Cc:CCC, 255Cd:CCC, 255Ea:CCC, 255Eb:CCC, 255Ec:CCC, 255Ed:CCC, 255Ee:CCC, 315Cb:CPP, 315Ed:CCC, 315Ga:CCC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G034	Oak - Sweetgum Floodplain Forest
G759	Southern Ash - Elm - Willow Floodplain Forest
G033	Bald-cypress - Tupelo Floodplain Forest

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Black Willow: 95	Eyre 1980	
<	Floodplain Hardwood Forest	Marks and Harcombe 1981	
<	Floodplain Hardwood Pine Forest	Marks and Harcombe 1981	
>	Southern Floodplain Forests	Sharitz and Mitsch 1993	
<	Swamp Cypress Tupelo Forest	Marks and Harcombe 1981	

AUTHORSHIP

***Primary Concept Source [if applicable]:** R.R. Sharitz and W.J. Mitsch (1993)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne and J. Teague

Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by J. Teague.

Version Date: 15 Jun 2015

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1. Forest & Woodland
1.B.3.Nb. Southeastern North American Flooded & Swamp Forest

G034. Oak - Sweetgum Floodplain Forest

Type Concept Sentence: This vegetation is dominated by members of the genus *Quercus*, including *Quercus laurifolia, Quercus lyrata, Quercus michauxii, Quercus nigra, Quercus pagoda, Quercus phellos, Quercus shumardii*, and *Quercus texana*, along with *Carpinus caroliniana, Liquidambar styraciflua, Nyssa biflora, Ulmus* spp., and other trees tolerant of flooding and wet conditions, being generally known as bottomland hardwood forests. It is found primarily in the Atlantic and Gulf coastal plains, as well as the Mississippi River Alluvial Plain and adjacent Upper East Gulf Coastal Plain, and the adjacent southern Piedmont.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.3.Nb.4. Southern Coastal Plain Floodplain Forest (M031)

Elcode: G034
***Scientific Name:** *Quercus michauxii - Quercus laurifolia - Liquidambar styraciflua* Floodplain Forest Group
***Common (Translated Scientific) Name:** Swamp Chestnut Oak - Laurel Oak - Sweetgum Floodplain Forest Group
***Colloquial Name:** Oak - Sweetgum Floodplain Forest

***Type Concept:** This wetland forest group is a very broad one, in its environmental amplitude, its floristic diversity, and its biogeographic range. It is primarily affiliated with the Atlantic and Gulf coastal plains from Virginia to Texas, and the Mississippi River Alluvial Plain and adjacent Upper East Gulf Coastal Plain from Illinois, Missouri and Kentucky south to Mississippi and Louisiana, but it also includes wetland, swamp, and riparian forests of the southern Piedmont from Virginia to Alabama. This group primarily encompasses vegetation dominated by members of the genus *Quercus*, along with *Liquidambar styraciflua, Ulmus* spp., and other trees, being generally known as bottomland hardwood forests. It primarily encompasses communities of streams and rivers of all orders and sizes, as well as some forests of isolated wetlands, including depression ponds. This group includes forests known as "blackwater" as well as "brownwater" examples. Some characteristic components of blackwater forests include *Nyssa biflora*, as well as *Quercus laurifolia, Quercus lyrata, Quercus nigra, Pinus taeda*, and *Magnolia virginiana* in higher portions of the floodplain. *Nyssa aquatica* is generally scarce or absent. Brownwater examples are also likely to contain *Platanus occidentalis, Celtis laevigata, Fraxinus pennsylvanica, Acer negundo*, and others. These stands also may include *Quercus laurifolia, Quercus michauxii, Quercus pagoda*, and sometimes *Liquidambar styraciflua*. There is also some floristic variation between shorter and longer hydroperiod examples. *Quercus michauxii, Quercus pagoda*, and *Quercus shumardii* are characteristic of shorter hydroperiod examples, and *Quercus laurifolia, Quercus lyrata, Quercus phellos*, and *Nyssa biflora* of longer hydroperiod ones.

Except in the very wet examples, understory, shrub and herb layers are generally well-developed and woody vines are also prominent. *Arundinaria gigantea* is a common understory component in these forests on natural levees and higher point bars, and may become dominant after thinning or removal of the overstory. Sandbars dominated by *Salix* spp. and/or *Populus* spp. may have an open-canopy (woodland) structure.

Most vegetation placed here is associated with rivers and streams, but some are referred to as "flatwoods." It includes riverfront vegetation, which is generally temporarily (but rarely seasonally) flooded, on point bars and natural levees adjacent to the river that formed them, as well as high bottomlands, some low bottomlands, as well as levees, ridges, terraces, and some sloughs and abandoned channel segments. These features are large and well-defined in larger river systems, but the forests of smaller floodplains and bottomlands are not differentiated by these depositional landforms, because these features are small and flooding regimes are variable. The hydrologic regime and the hydroperiod are also highly diverse in this group of forests.

***Diagnostic Characteristics:** Examples are most typically closed-canopy forests found in bottomlands or floodplains. Characteristic trees include *Liquidambar styraciflua, Nyssa biflora, Quercus laurifolia, Quercus lyrata, Quercus michauxii, Quercus nigra, Quercus pagoda, Quercus phellos, Quercus shumardii*, and *Quercus texana*, along with *Carpinus caroliniana, Liquidambar styraciflua, Ulmus* spp., and other trees tolerant of flooding and wet conditions. Typical shrubs include *Ilex decidua* and *Arundinaria gigantea*.

***Classification Comments:** This group does not include associations and alliances dominated by *Taxodium distichum, Taxodium ascendens*, and *Nyssa aquatica*. These are generally known as "bald-cypress - tupelo forests" and are accommodated in a different group. Forests dominated by *Fagus grandifolia* with or without *Magnolia grandiflora* belong in mesic groups, whether they are clearly in uplands or in upland-floodplain transition areas. There may be floristic overlap in terms of the composition of individual stands of this group (G034) and those of Southern Ash - Elm - Willow Floodplain Forest Group (G759), but stands of G034 will typically be dominated by *Liquidambar - Quercus* and tend to occur in less frequently disturbed habitats. Both are in Southern Coastal Plain Floodplain Forest Macrogroup (M031).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G007	Southern Mesic Beech - Magnolia - Oak Forest	
G033	Bald-cypress - Tupelo Floodplain Forest	
G553	Southeastern Native Ruderal Flooded & Swamp Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Examples are most typically closed-canopy flooded and bottomland forests, dominated by tall trees.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Characteristic canopy tree species are *Liquidambar styraciflua* and a variety of *Quercus* spp., including *Quercus laurifolia, Quercus lyrata, Quercus michauxii, Quercus nigra, Quercus pagoda, Quercus phellos, Quercus shumardii, Quercus texana*, and others, which vary in their hydrological tolerance. The forest canopy will also usually contain a mix of mesophytic and widespread species such as *Acer rubrum, Liquidambar styraciflua*, and *Liriodendron tulipifera*, along with characteristic alluvial and bottomland species such as *Acer negundo, Acer saccharinum, Betula nigra, Carya illinoinensis, Celtis laevigata, Fraxinus pennsylvanica, Gleditsia triacanthos, Platanus occidentalis, Populus deltoides, Salix nigra*, and *Ulmus americana*. *Quercus virginiana* may be present within its range. *Ulmus crassifolia* may be more commonly found west of the Mississippi River. Some small trees and shrubs include *Carpinus caroliniana, Cornus florida, Ilex decidua, Ilex opaca var. opaca*, and *Viburnum dentatum*. Southern stands may contain *Sabal minor*. The perennial graminoid bamboo *Arundinaria gigantea (= ssp. gigantea)* may dominate the shrub stratum of some forests, such as on natural levees and higher point bars, or it may form non-forested stands called "canebrakes." Vines are common, including *Nekemias arborea (= Ampelopsis arborea), Berchemia scandens, Campsis radicans, Smilax bona-nox, Toxicodendron radicans*, and *Vitis rotundifolia*. *Fagus grandifolia* may be present in drier portions, mixed with the other species, but stands in which it is dominant are probably accommodated in mesic upland groups. Successional areas are often strongly dominated by *Pinus taeda* with *Liquidambar styraciflua* and/or *Liriodendron tulipifera*, but with a natural understory composition. Lower strata in the forests may be either primarily of mesophytic species shared with moist uplands systems, or a mix of mesophytic and bottomland species. *Nyssa aquatica* is generally scarce or absent. Higher portions of the floodplain have forests with combinations of a small set of wetland oaks and other species, including *Liquidambar styraciflua, Magnolia virginiana, Pinus taeda, Quercus laurifolia, Quercus lyrata, Quercus nigra*, and other species. Herbs in wetter examples may include *Boehmeria cylindrica, Commelina virginica, Leersia lenticularis*, and *Onoclea sensibilis*. Some other examples have very diverse herbaceous layers, including *Bidens* *aristosa, Carex cherokeensis, Carex debilis, Carex digitalis, Carex joorii, Chasmanthium latifolium, Geum canadense, Glyceria striata, Leersia virginica*, and *Polygonum hydropiperoides*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Flooding is an important ecological factor in examples of this group and may be the most important factor separating this vegetation from that of adjacent uplands. In addition to disturbance, floods bring moisture and nutrient input, deposit sediment, exclude non-flood-tolerant species and disperse plant seeds. It is unclear how important aquatic fauna are when the system is flooded, but they may be important. The small flows, low gradient, and binding of sediment by vegetation limit channel shifts and sediment movement, but floods may cause local disturbance by scouring. Small rivers and streams, with small watersheds, have shorter and more variable flooding regimes than larger rivers. Floods tend to be of short duration and unpredictably variable as to season and depth. Flood waters may have significant energy in higher-gradient systems, but scouring and reworking of sediment rarely affect more than small patches. They are important in maintaining the small non-forested patches.

Most of these forests exist naturally as multi-aged old-growth forests driven by gap-phase regeneration. Windthrow is probably the most important cause of gaps, as wind disturbance is perhaps more important than in uplands because of frequently wet soils, less dense soils, and more shallow-rooted trees.

Fire does not appear to be a dominant factor, and most floodplain vegetation is not very flammable. Fire is probably more important in small stream examples than in larger river ones, because distances to uplands are short and because stream channels and sloughs are smaller and less effective as firebreaks. However, most of the vegetation is not very flammable and usually will not carry fire. However, historical references to canebrakes dominated by *Arundinaria gigantea* suggest that fire may have once been more possible and more important in at least some portions of stands.

Stands of this group with a shorter hydroperiod are subject to greater disturbance effects than those with longer hydroperiods. A variety of direct and indirect modern human influences have affected all stands. Many larger rivers have been dammed, and power generation and regulation of waterflow create unnatural flood regimes. Extensive erosion of uplands, caused by many years of poor agricultural practices, transported large amounts of sediment into floodplains. River bottoms were the focus of agriculture among Native Americans, so some members of this group have a long history of human clearing. A number of exotic plant species have invaded floodplains as well.

ENVIRONMENT

Environmental Description: This group occurs near streams and small rivers, on floodplains and terraces affected by river flooding and on emergent bars and banks within channels. Depositional landforms, including levees, sloughs, ridges, terraces, and abandoned channel segments may be present within stands. The substrate is primarily alluvium. Soils are usually sandy to loamy, but include local clayey and gravelly areas. Soils are generally fertile. The presence of alluvial soils may be as important a factor as ongoing flooding in differentiating these systems from adjacent uplands. Emergent and vegetated bars composed of material ranging from gravel to cobbles occur occasionally but are generally not extensive or as distinctive as they are on larger rivers. Floods are generally of short duration, and wetness is a major influence only within channels and where water is ponded in local depressions. The geologic substrate may be of any kind, but areas on Triassic sediments tend to have large floodplain systems even on fairly small streams.

Blackwater examples occur in floodplains of small streams of the coastal plain that carry little mineral sediment. These streams have their headwaters in sandy portions of the coastal plain. The water is usually strongly stained by tannins but has little suspended clay and is not turbid. Depositional landforms may be absent or may be present in limited variety and of small size. Soils are generally sandy in drier portions of the floodplain, mucky in wetter portions, or may be uniform organic soils. Soils are usually strongly acidic, but spring-fed rivers may have calcareous water and non-acidic soils. Flooding ranges from semipermanent in the wettest floodplains to intermittent and short in higher-gradient streams. Some small blackwater streams have most of their flow from sandhill seepage and have limited fluctuation in water levels.

In contrast, brownwater or redwater river examples occur in floodplains of medium to small coastal plain rivers that carry significant mineral sediment. These rivers have their headwaters in the Piedmont, Blue Ridge, Interior Plateaus, or in portions of the coastal plain where fine-textured sediment predominates. The water generally carries substantial amounts of silt, clay, and sometimes sand. Depositional landforms such as point bars, natural levees, backswamps, and ridge-and-swale systems (scrollwork) are well-developed and form patterns of significant variation in flooding duration and nutrient input. Soil texture varies from sandy to clayey. Soils are generally fertile and not strongly acidic. Flooding ranges from semipermanent in the wettest areas to intermittent and short on the higher portions of the floodplain. The highest terraces may no longer flood at all and will be occupied by upland vegetation.

DISTRIBUTION

***Geographic Range:** This group is found throughout the Atlantic Coastal Plain, from southeastern Virginia to southeastern Georgia, in the Gulf Coastal Plain from Georgia to Texas, in the Mississippi Alluvial Plain and adjacent Upper East Gulf Coastal Plain from Missouri, extreme southern Illinois and western Kentucky south to Mississippi and Louisiana, and in the Piedmont from Alabama to southern Virginia. The northern boundary in Virginia is roughly the watershed of the James River.
Nations: US
States/Provinces: AL, AR, FL, GA, IL, KY, LA, MD, MO, MS, NC, OK, SC, TN, TX, VA, WV
USFS Ecoregions (2007) [optional]: 231A:CC, 231E:CC, 231G:CC, 231H:CC, 231I:CC, 232B:CC, 232C:CC, 232D:CC, 232E:CC, 232F:CC, 232G:CC, 232H:CC, 232I:CC, 232J:CC, 232L:CC, 234A:CC, 234C:CC, 234D:CC, 234E:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.2.72a:C, 8.3.5.65b:C, 8.3.5.65c:C, 8.3.5.65d:C, 8.3.5.65e:C, 8.3.5.65i:C, 8.3.5.65j:C, 8.3.5.65k:C, 8.3.5.65l:C, 8.3.5.65m:C, 8.3.5.65p:C, 8.3.5.65q:C, 8.3.5.65r:C, 8.3.6.74a:C, 8.3.6.74b:C, 8.3.7.35a:C, 8.3.7.35c:C, 8.3.7.35d:C, 8.3.7.35e:C, 8.3.7.35f:C, 8.3.7.35g:C, 8.3.7.35h:C, 8.3.8.33a:C, 8.5.1.63a:C, 8.5.1.63b:C, 8.5.1.63c:C, 8.5.1.63d:C, 8.5.1.63e:C, 8.5.1.63g:C, 8.5.1.63h:C, 8.5.1.63n:C, 8.5.2.73a:C, 8.5.2.73b:C, 8.5.2.73c:C, 8.5.2.73d:C, 8.5.2.73f:C, 8.5.2.73g:C, 8.5.2.73h:C, 8.5.2.73i:C, 8.5.2.73k:C, 8.5.2.73l:C, 8.5.2.73m:C, 8.5.2.73n:C, 8.5.3.75a:C, 8.5.3.75b:C, 8.5.3.75f:C, 8.5.3.75h:C, 8.5.3.75i:C, 8.5.3.75j:C, 9.5.1.34a:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3634	*Quercus virginiana - Quercus pagoda - Quercus nigra* Coastal Plain Swamp Forest Alliance
A3628	*Quercus laurifolia - Quercus phellos - Pinus taeda* Coastal Plain Riparian Forest Alliance
A3627	*Quercus laurifolia - Liquidambar styraciflua - Nyssa biflora* Coastal Plain Floodplain Forest Alliance
A3631	*Quercus michauxii - Quercus pagoda* Coastal Plain Floodplain Forest Alliance
A3632	*Quercus phellos - Quercus nigra* Coastal Plain Floodplain Forest Alliance
A3630	*Quercus michauxii - Carya laciniosa - Liquidambar styraciflua* Interior Floodplain Forest Alliance
A3629	*Quercus lyrata - Quercus phellos - Carya aquatica* Swamp Forest Alliance
A3626	*Liriodendron tulipifera - Quercus alba - Liquidambar styraciflua* Piedmont Floodplain Forest Alliance
A3633	*Quercus phellos* Piedmont Floodplain Forest Alliance
A3625	*Liquidambar styraciflua - Fraxinus pennsylvanica - Acer rubrum* Flooded & Swamp Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Bottomland Forest	FNAI 1990	
<	Floodplain Forest	FNAI 1990	
<	Floodplain Hardwood Pine Forest	Marks and Harcombe 1981	
<	Floodplain Swamp	FNAI 1990	
>	Southern Floodplain Forests	Sharitz and Mitsch 1993	

AUTHORSHIP

***Primary Concept Source [if applicable]:** R.R. Sharitz and W.J. Mitsch (1993)

Relationship to NVC	**Name Used in Source**	**Short Citation**	**Note**

***Author of Description:** M. Pyne
Acknowledgments [optional]:
Version Date: 13 May 2015

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1. Forest & Woodland
1.B.3.Nb. Southeastern North American Flooded & Swamp Forest

G759. Southern Ash - Elm - Willow Floodplain Forest

Type Concept Sentence: These deciduous floodplain or swamp forests are found primarily in the coastal plains of the southeastern United States, and are typically dominated by some combination of *Fraxinus pennsylvanica, Populus deltoides, Salix caroliniana, Salix nigra*, and *Ulmus americana*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.3.Nb.4. Southern Coastal Plain Floodplain Forest (M031)

Elcode: G759
***Scientific Name:** *Fraxinus pennsylvanica - Ulmus americana - Salix nigra* Floodplain Forest Group
***Common (Translated Scientific) Name:** Green Ash - American Elm - Black Willow Floodplain Forest Group
***Colloquial Name:** Southern Ash - Elm - Willow Floodplain Forest

***Type Concept:** This group is composed of deciduous floodplain or swamp forests found primarily in the coastal plains of the southeastern United States. These forests are typically dominated by some combination of *Fraxinus pennsylvanica, Populus deltoides, Salix caroliniana, Salix nigra*, and *Ulmus americana*. In addition, some examples contain or are codominated by *Acer negundo, Betula nigra, Liquidambar styraciflua*, and/or *Platanus occidentalis*. The composition and physiognomy of the shrub and herbaceous layers are quite variable due to the broad geographic area in which this group occurs, as well as the dynamics of the frequent disturbances. Common shrubs include *Cornus drummondii, Ilex vomitoria, Lindera benzoin, Smilax* spp., and *Toxicodendron radicans*. Sites are typically on sandbars, riverfronts, and levees of rivers and small streams, though some examples occur on the edges of lakes, and one alliance occurs primarily in the swales of Atlantic coastal dunes.

***Diagnostic Characteristics:** This group is typically dominated by some combination of *Fraxinus pennsylvanica, Populus deltoides, Salix caroliniana, Salix nigra*, and *Ulmus americana*. These stands are found primarily in the coastal plains of the southeastern United States, and occur on sandy to sandy loam soils and usually on riverfronts or levees or sometimes on sands along the edges of lakes. Sites are subject to frequent seasonal or temporary flooding.

***Classification Comments:** There may be floristic overlap in terms of the composition of individual stands of this group (G759) and those of Oak - Sweetgum Floodplain Forest Group (G034), but stands of G759 will typically not be dominated by *Liquidambar - Quercus* and tend to occur in more frequently disturbed habitats. Both are in Southern Coastal Plain Floodplain Forest Macrogroup (M031).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These forests are subject to frequent disturbances, including flooding, erosion, and deposition of sediment. This leads to a physiognomically diverse group. Stands that have recently been subjected to severe flooding may be relatively open. Most stands have moderate to closed tree canopies, though. The understory is also quite variable. Shrubs and herbaceous plants can be virtually absent to dense. Vines are common.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The forests of this group are typically dominated by some combination of *Fraxinus pennsylvanica, Populus deltoides, Salix caroliniana, Salix nigra*, and *Ulmus americana*. In addition, some examples contain or are codominated by *Acer negundo, Betula nigra, Liquidambar styraciflua*, or *Platanus occidentalis*. The composition and physiognomy of the shrub and herbaceous layers are quite variable due to the broad geographic area in which this group occurs and the frequent disturbances. Common shrubs include *Cornus drummondii, Ilex vomitoria, Lindera benzoin, Smilax* spp., and *Toxicodendron radicans*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Flooding, seasonal or after heavy rains, is a critical part of the typical dynamics of this group.

ENVIRONMENT

Environmental Description: *Soil/substrate/hydrology:* Soils are usually coarse- to medium-textured alluvium (sands to sandy loams). Water levels vary throughout the year with flooding typical at some point during the year.

DISTRIBUTION

***Geographic Range:** This group is composed of deciduous floodplain or swamp forests found primarily along rivers and streams in the coastal plains of the mid-Atlantic and southeastern United States primarily from Delaware south to Florida and west to Texas. Some associations are more northerly, ranging to New York and Connecticut, but these are close to the ocean and are tidally-influenced.
Nations: US
States/Provinces: AL, AR, CT, DC, DE, FL, GA, KY, LA, MA, MD, MS, NC, NJ, NY, OK?, PA?, SC, TN, TX, VA

USFS Ecoregions (2007) [optional]: 221A:CC, 231E:CC, 231G:CC, 231H:CC, 232A:CC, 232B:CC, 232C:CC, 232D:CC, 232E:CC, 232F:CC, 232G:CC, 232H:CC, 232I:CC, 232J:CC, 232K:CC, 232L:CC, 234A:CC, 234C:CC, 234D:CC, 234E:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3421	*Populus deltoides - Salix nigra - Salix caroliniana* Coastal Plain Floodplain Forest Alliance
A1914	*Salix caroliniana - Salix nigra* Coastal Plain Swamp Forest Alliance
A3707	*Fraxinus pennsylvanica - Platanus occidentalis - Ulmus americana* Coastal Plain Floodplain Forest Alliance
A3705	*Fraxinus pennsylvanica - Acer rubrum - Juniperus virginiana var. silicicola* Tidal Floodplain Forest Alliance
A3709	*Ulmus americana - Ulmus crassifolia - Celtis laevigata* West Gulf Coastal Plain Floodplain Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-04-04	G041 Populus deltoides - Salix nigra Floodplain Forest Group	G041 reworked and replaced by G759 and other groups

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Black Willow: 95	Eyre 1980	

AUTHORSHIP

***Primary Concept Source [if applicable]:** M. Pyne, D. Faber-Langendoen et al. (2013)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne
Acknowledgments [optional]:
Version Date: 13 May 2015

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Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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1. Forest & Woodland
1.B.3.Nb. Southeastern North American Flooded & Swamp Forest

G033. Bald-cypress - Tupelo Floodplain Forest

Type Concept Sentence: Dominant and characteristic trees are *Taxodium distichum* (occasionally *Taxodium ascendens*) and *Nyssa aquatica* (and occasionally *Nyssa biflora*). This vegetation is primarily found in the Atlantic and Gulf coastal plains, the adjacent Piedmont and interior regions, and the Mississippi River Alluvial Plain and adjacent Upper East Gulf Coastal Plain, and west into the coastal plains of Louisiana and Texas.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.3.Nb.4. Southern Coastal Plain Floodplain Forest (M031)

Elcode: G033
***Scientific Name:** *Taxodium distichum - Nyssa aquatica* Floodplain Forest Group
***Common (Translated Scientific) Name:** Bald-cypress - Water Tupelo Floodplain Forest Group
***Colloquial Name:** Bald-cypress - Tupelo Floodplain Forest

***Type Concept:** This wetland forest group is primarily affiliated with the Atlantic and Gulf coastal plains from southeastern Virginia (rarely north into the Chesapeake Bay) to Texas, portions of the adjacent Piedmont and interior regions, and the Mississippi River Alluvial Plain and adjacent Upper East Gulf Coastal Plain from southern Illinois, western Kentucky and southeastern Missouri, south to the Gulf of Mexico, and west in the coastal plains of Louisiana and Texas. Dominant and characteristic trees are *Taxodium distichum* (and occasionally *Taxodium ascendens*) and *Nyssa aquatica* (and occasionally *Nyssa biflora*). These are generally known as "Bald-Cypress - Tupelo Forests." Both *Taxodium distichum* and *Nyssa aquatica* are primarily, if not entirely, found in the coastal plains. Their ranges are not entirely congruent, with *Nyssa aquatica* being more limited. So, vegetation may be dominated by either or both of these characteristic species (and occasionally including *Taxodium ascendens* and/or *Nyssa biflora* as noted above). Also included here are embedded patches of smaller trees, including *Forestiera acuminata, Itea virginica*, and *Planera aquatica*, as well as *Cephalanthus occidentalis*, which can range in lifeform from small tree to shrub. These are usually smaller-patch features embedded within larger-patch (and taller stature) bald-cypress - tupelo forests. The basis of this group is floristic rather than purely hydrologic. This group primarily encompasses communities of streams and rivers of all orders and sizes, including some (or most) tidal forests. Stands are typically flooded for periods of up to 3 months, but not during the growing season. Stands are mainly from low bottomlands, depressions, sloughs and abandoned channel segments, and are not typically affiliated with elevated features such as riverfronts, point bars, natural levees, high bottomlands, levees, ridges, and upper terraces. This group includes forests known as "blackwater" as well as "brownwater" examples, as well as several tidally flooded associations. Isolated wetlands such as depression ponds dominated by *Taxodium* are excluded.

***Diagnostic Characteristics:** These are riverine forests (and more rarely woodlands) dominated by a combination of broad-leaved deciduous trees and a needle-leaved deciduous tree (*Taxodium*). Examples may be tidally or non-tidally flooded, in "blackwater" and "brownwater" situations. Characteristic trees include *Acer rubrum var. drummondii, Carya aquatica, Fraxinus profunda, Gleditsia aquatica, Nyssa aquatica, Nyssa biflora, Planera aquatica*, and *Taxodium distichum*. Some shrubs include *Cephalanthus occidentalis, Decodon verticillatus, Forestiera acuminata, Itea virginica*, and *Planera aquatica*. Characteristic forbs and graminoids include *Boehmeria cylindrica, Carex decomposita, Carex grayi, Carex intumescens, Carex joorii, Carex lupulina*, other *Carex* spp., and *Saururus cernuus*. Aquatic and floating forbs include *Ceratophyllum* spp., *Elodea* spp., *Lemna minor, Ludwigia peploides, Potamogeton* spp., and *Sagittaria lancifolia*.

***Classification Comments:** This group includes associations and alliances dominated by *Taxodium distichum, Taxodium ascendens*, and *Nyssa aquatica*, typically in riverine settings. These are generally known as "Bald-Cypress - Tupelo Forests"; this is in contrast to bottomland hardwood forests (oak-sweetgum) which are accommodated in a different group. Both *Taxodium distichum* and *Nyssa aquatica* are primarily, if not entirely, found in the coastal plains. Their ranges are not entirely congruent, with *Nyssa aquatica* being more limited. So, associations accommodated here may be dominated by either or both of these characteristic species (and occasionally including *Taxodium ascendens* and/or *Nyssa biflora* as noted above). These are associations that are generally of a longer hydroperiod than those in Oak - Sweetgum Floodplain Forest Group (G034), but some in that group are of a long hydroperiod as well. Also included here are some embedded patches of smaller trees including *Cornus foemina, Forestiera acuminata, Itea virginica*, and *Planera aquatica*, as well as *Cephalanthus occidentalis*, which can range in lifeform from small tree to shrub. These are usually smaller-patch features imbedded within larger-patch (and taller stature) bald-cypress - tupelo forests. The basis of the distinction between these two groups is floristic and broadly ecological rather than purely hydrologic. This group primarily encompasses communities of streams and rivers of all orders and sizes, including some (or most) tidal forests. Isolated wetlands such as depression ponds dominated by *Taxodium* are placed in nonriverine groups.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G553	Southeastern Native Ruderal Flooded & Swamp Forest	
G034	Oak - Sweetgum Floodplain Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are flooded riverine forests composed of tall trees, mostly broad-leaved deciduous trees and one needle-leaved deciduous tree (*Taxodium*).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Stands of this group are primarily tall-statured forests dominated by *Taxodium distichum* (and occasionally *Taxodium ascendens*) and/or *Nyssa aquatica* (and occasionally *Nyssa biflora*). The ranges of *Taxodium distichum* and *Nyssa aquatica* are not entirely congruent, with *Nyssa aquatica* being more limited. Therefore, in some parts of the range of the group, one of these characteristic species may not be present. Some other trees which may be associated with stands of this group include *Acer rubrum var. drummondii, Carya aquatica, Fraxinus pennsylvanica, Gleditsia aquatica, Salix nigra*, and other trees tolerant of flooding. Associations dominated by *Quercus* spp. are included in a different group. Also included here are some associations dominated by smaller trees, including *Forestiera acuminata, Itea virginica*, and *Planera aquatica*, as well as *Cephalanthus occidentalis*, which can range in lifeform from small tree to shrub. *Cornus foemina* and *Decodon verticillatus* may also be present. Terrestrial herbs are usually limited due to long hydroperiods, and are often only found on elevated logs and stumps, but can include *Boehmeria cylindrica, Carex decomposita, Carex grayi, Carex intumescens, Carex joorii, Carex lupulina*, and *Saururus cernuus*. Aquatic and floating herbs include *Ceratophyllum* spp., *Elodea* spp., *Lemna minor, Ludwigia peploides, Potamogeton* spp., and *Sagittaria lancifolia*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Flooding is an important ecological factor in examples of this group, and the length of the flooding may be the most important factor separating this vegetation from that of other wetland groups. In addition to disturbance, floods bring nutrient input, deposit sediment, exclude non-flood-tolerant species and disperse plant seeds. Flooding is most common in the winter but may occur in other seasons. The small flows, low gradient, and binding of sediment by vegetation limit channel shifts and sediment movement, but floods may cause local disturbance by scouring. Flood waters may have significant energy in higher-gradient systems, but scouring and reworking of sediment rarely affect more than small patches. Most of these forests would exist naturally as multi-aged old-growth forests driven by gap-phase regeneration. Windthrow is probably the most important cause of gaps, as wind disturbance is perhaps more important than in uplands because of frequently wet soils, less dense soils, and more shallow-rooted trees.

Fire does not appear to be a dominant factor, and most floodplain vegetation in this group is not very flammable. Fire is probably more important in small stream examples than in larger river ones, because distances to uplands are short and stream channels and sloughs are smaller and less effective as firebreaks. Stands of this group often have limited herbaceous layers, making fire less of an important factor, even during extended dry periods.

Some examples are affected by diurnal tidal flooding or by storm tides. In these cases, infrequent intrusion of saltier water, which is stressful or fatal to many of the plant species, is an important periodic disturbance created by storms. Natural fire is not frequent in these tidal examples, but may sometimes be important in determining the boundary between tidal swamps and tidal marshes. The tidal forest examples generally appear to be in a shifting relationship with adjacent tidal freshwater marshes. Many of these tidal marshes have standing dead trees in them, suggesting they recently were swamps. But some marshes are being invaded with trees and may be turning into swamps. Rising sea level is causing more inland swamps to develop tidal characteristics and causing some stands to turn into marshes. In areas not too strongly affected by salt intrusion, drowning by rising sea level, or fire, the communities can be expected to exist as old-growth, multi-aged forests.

The associations in this group are generally of a longer hydroperiod than those in Oak - Sweetgum Floodplain Forest Group (G034), but some in that group are of a long hydroperiod as well. Stands of this group, because of their longer hydroperiod, have been subject to more indirect disturbance effects than others, but they are still subject to a variety of indirect modern human influences. Many larger rivers have been dammed, and power generation and regulation of waterflow create unnatural flood regimes. Extensive erosion of uplands, caused by many years of poor agricultural practices, transported large amounts of sediment into floodplains. River bottoms were the focus of agriculture among Native Americans, so some members of this group have a long history of human clearing. A number of exotic plant species have invaded floodplains as well. Isolated wetlands such as depression ponds dominated by *Taxodium* are for the time being placed in nonriverine groups.

ENVIRONMENT

Environmental Description: Stands of this group are found on streams and rivers of all orders and sizes, including some (or most) tidal forests. The elements included are mainly from low bottomlands, depressions, sloughs and abandoned channel segments, and are not typically affiliated with elevated features such as riverfronts, point bars, natural levees, high bottomlands, levees, ridges, and upper terraces. Wetness is a major influence, especially within channels and where water is ponded in local depressions. Tidally influenced examples occur in lower reaches of river floodplains and along estuary shorelines, in places regularly or irregularly flooded by lunar or wind tides. The water has little salt content, due to distance from the ocean and/or strong freshwater input. Soils may be mineral or organic. Soils are generally permanently saturated even when the tide is low. The transition of the hydrology to flood dominance rather than tidal dominance may be very gradual.

DISTRIBUTION

***Geographic Range:** This wetland forest group is primarily affiliated with the Atlantic and Gulf coastal plains from southeastern Virginia (rarely north into the Chesapeake Bay) to Texas, portions of the adjacent Piedmont and interior regions, and the Mississippi River Alluvial Plain and adjacent Upper East Gulf Coastal Plain from southern Illinois and Indiana, western Kentucky (including areas along the Ohio River (EPA Ecoregion 72a)) and southeastern Missouri, south to the Gulf of Mexico, and west to the coastal plains of Louisiana and Texas. There is also one association in the Ouachitas of Arkansas and Oklahoma.
Nations: US
States/Provinces: AL, AR, DE, FL, GA, IL, IN, KY, LA, MD, MO, MS, NC, NY, OK, SC, TN, TX, VA
USFS Ecoregions (2007) [optional]: 231A:CC, 231B:CC, 231I:CC, 232B:CC, 232C:CC, 232D:CC, 232E:CC, 232G:CC, 232H:CC, 232I:CC, 232J:CC, 232K:CC, 232L:CC, 234A:CC, 234C:CC, 234D:CC, 234E:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.2.72a:C, 8.3.4.45b:C, 8.3.4.45c:C, 8.3.4.45f:C, 8.3.4.45g:C, 8.3.4.45h:C, 8.3.4.45i:C, 8.3.5.65c:?, 8.3.5.65d:?, 8.3.5.65f:C, 8.3.5.65g:C, 8.3.5.65h:C, 8.3.5.65k:C, 8.3.5.65o:C, 8.3.5.65p:C, 8.3.7.35b:C, 8.3.7.35g:C, 8.3.8.33f:C, 8.5.1.63b:C, 8.5.1.63c:C, 8.5.1.63e:C, 8.5.1.63g:C, 8.5.1.63h:C, 8.5.1.63n:C, 8.5.2.73a:C, 8.5.2.73b:C, 8.5.2.73c:C, 8.5.2.73d:C, 8.5.2.73f:C, 8.5.2.73i:C, 8.5.2.73m:C, 8.5.2.73n:C, 8.5.3.75a:C, 8.5.3.75b:C, 8.5.3.75c:C, 8.5.3.75d:C, 8.5.3.75e:?, 8.5.3.75g:?, 8.5.3.75i:C, 8.5.3.75j:C, 9.5.1.34c:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3596	*Taxodium distichum* Nonriverine Swamp Forest Alliance
A0344	*Fraxinus caroliniana* Swamp Forest Alliance
A0323	*Nyssa biflora - Nyssa aquatica* Floodplain Forest Alliance
A3592	*Acer rubrum - Gleditsia aquatica - Fraxinus profunda* Swamp Forest Alliance
A3595	*Taxodium distichum - Nyssa biflora* Tidal Swamp Forest Alliance
A3594	*Taxodium distichum - Nyssa aquatica - Nyssa biflora* Floodplain Forest Alliance
A0345	*Nyssa aquatica* Swamp Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
><	Bottomland Forest	FNAI 1990	
><	Floodplain Forest	FNAI 1990	
<	Floodplain Hardwood Forest	Marks and Harcombe 1981	
><	Floodplain Swamp	FNAI 1990	
<	Swamp Cypress Tupelo Forest	Marks and Harcombe 1981	

AUTHORSHIP

***Primary Concept Source [if applicable]:** R.R. Sharitz and W.J. Mitsch (1993)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne

Acknowledgments [optional]:

Version Date: 13 May 2015

REFERENCES

***References [Required if used in text]:**

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Marks, P. L., and P. A. Harcombe. 1981. Forest vegetation of the Big Thicket, southeast Texas. Ecological Monographs 51:287-305.

Sharitz, R. R., and W. J. Mitsch. 1993. Southern floodplain forests. Pages 311-372 in: W. H. Martin, S. G. Boyce, and A. C. Echternacht, editors. Biodiversity of the southeastern United States: Lowland terrestrial communities. John Wiley and Sons, New York.

Wharton, C. H., W. M. Kitchens, E. C. Pendleton, and T. W. Sipe. 1982. The ecology of bottomland hardwood swamps of the Southeast: A community profile. U.S. Fish and Wildlife Service, Office of Biological Services. FWS/OBS-81/37. Washington, DC.

M154. Southern Great Plains Floodplain Forest & Woodland

Type Concept Sentence: These floodplain and riparian forests and woodlands are found in the southern Great Plains of the U.S. (south-central and north-central Texas extending into Oklahoma). Characteristic species include those occurring at the southwestern extent of their range (*Acer negundo, Carya illinoinensis, Celtis laevigata var. laevigata, Cornus drummondii, Fraxinus pennsylvanica, Juglans nigra, Platanus occidentalis, Quercus macrocarpa, Quercus shumardii, Salix nigra, Sideroxylon lanuginosum, Taxodium distichum*, and *Ulmus americana*) and the southeastern extent of their range (*Celtis laevigata var. reticulata, Juglans major, Juglans microcarpa, Prosopis glandulosa*, and *Quercus fusiformis*).

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.3.Nb.5. Southeastern North American Flooded & Swamp Forest (D062)

Elcode: M154
***Scientific Name:** *Carya illinoinensis - Celtis laevigata - Quercus macrocarpa* Floodplain Forest & Woodland Macrogroup
***Common (Translated Scientific) Name:** Pecan - Sugarberry - Bur Oak Floodplain Forest & Woodland Macrogroup
***Colloquial Name:** Southern Great Plains Floodplain Forest & Woodland

***Type Concept:** This macrogroup covers floodplain and riparian vegetation ranging from closed-canopy forests of tall stature in the eastern part of its range to open, short-statured woodlands in the western part of its range. Species composition also varies across the east-west range of this macrogroup, but this concept is based on a core set of characteristic species, including *Carya illinoinensis, Celtis laevigata var. laevigata, Celtis laevigata var. reticulata, Cephalanthus occidentalis, Cornus drummondii, Elymus virginicus, Justicia americana, Panicum virgatum, Platanus occidentalis, Populus deltoides, Salix nigra, Sapindus saponaria var. drummondii, Sideroxylon lanuginosum, Taxodium distichum, Tripsacum dactyloides*, and *Ulmus crassifolia*. Other characteristic species in eastern examples include *Acer negundo, Callicarpa americana, Diospyros virginiana, Forestiera acuminata, Fraxinus pennsylvanica, Gleditsia triacanthos, Ilex decidua, Juglans nigra, Juniperus virginiana, Quercus macrocarpa, Quercus shumardii, Ulmus americana*, and *Viburnum rufidulum*. Other characteristic species in western examples include *Diospyros texana, Fraxinus albicans, Juglans microcarpa, Juniperus ashei, Muhlenbergia lindheimeri, Nassella leucotricha, Prosopis glandulosa, Prunus rivularis, Quercus fusiformis*, and *Ungnadia speciosa*. This vegetation is found in the floodplains of medium and larger rivers, as well as along small and intermittent streams of the East Central Texas Plains, Texas Blackland Prairie, Crosstimbers, and Edwards Plateau ecoregions, extending peripherally into adjacent ecoregions. Environmental processes include alluvial sedimentation and erosion associated with perennial and intermittent streams and rivers. It occurs on large and small floodplains, especially in the eastern (and wetter) parts of its range, and on narrow riparian corridors of intermittent streams becoming particularly dry and flashy in the western parts of the range. Periodic, intermediate flooding and deposition (every 5-25 years) dominate the formation and maintenance of examples along better establish floodplains. Further west, in the drier parts of the Edwards Plateau (including the Stockton Plateau) of Texas, examples are open to closed-canopy, low-statured woodlands and shrublands in scoured, rocky riparian settings. These riparian settings are typically intermittently flooded but may be subirrigated.

***Diagnostic Characteristics:** This macrogroup covers floodplain and riparian vegetation ranging from closed-canopy forests of tall stature in the eastern part of its range to open, short-statured woodlands/shrublands in the western part of its range. Species composition also varies across this east-west range, but this concept is based on a core set of characteristic species, including the trees *Carya illinoinensis, Celtis laevigata var. laevigata, Celtis laevigata var. reticulata, Platanus occidentalis, Populus deltoides, Salix nigra, Sapindus saponaria var. drummondii, Sideroxylon lanuginosum, Taxodium distichum*, and *Ulmus crassifolia*, shrubs *Cephalanthus occidentalis, Cornus drummondii*, and grasses and forbs *Elymus virginicus, Justicia americana, Panicum virgatum*, and *Tripsacum dactyloides*.

***Classification Comments:** Vegetation in this macrogroup varies across an east-west gradient, with eastern components sharing similarities with vegetation occurring farther east, and western components sharing species with vegetation farther west. The macrogroup is described on a core set of species, but these species also range in importance across an east-west gradient. Further information is needed to better describe the macrogroup and its groups. Southeastern Great Plains Floodplain Forest Group (G784) is distinctive from groups in Southern Coastal Plain Floodplain Forest Macrogroup (M031) at least in part by the lack of species found in the groups of M031 (e.g., *Nyssa* spp.), and the presence of *Quercus macrocarpa, Sapindus saponaria var. drummondii*, and *Ulmus crassifolia*, and the eastern extensions of the range of *Celtis laevigata var. reticulata*.

There are two groups (in two different macrogroups, in two divisions) which may need to be more clearly distinguished from one another floristically and (as much as is possible) biogeographically. These are Southeastern Great Plains Floodplain Forest Group (G784) in Southern Great Plains Floodplain Forest & Woodland Macrogroup (M154); and Great Plains Cottonwood - Green Ash Floodplain Forest Group (G147) in Great Plains Flooded & Swamp Forest Macrogroup (M028). The first of these is in 1.B.3.Nb Southeastern North American Flooded & Swamp Forest Division (D062), the latter one in 1.B.3.Na Eastern North American-Great Plains Flooded & Swamp Forest Division (D011). One problem area is Oklahoma, where G784 and G147 overlap.

Several associations in *Carya illinoinensis - Ulmus crassifolia - Celtis laevigata* Floodplain Forest Alliance (A3679) extend this group into Arkansas, Kansas, and Louisiana which is beyond the conceptual boundary of this group and macrogroup. This is peripheral to the core geographic distribution of this group, i.e., the East Central Texas Plains, Texas Blackland Prairie regions, Crosstimbers, and Edwards Plateau ecoregions centered on Texas. More information is needed to determine if the vegetation in Arkansas, Kansas, and Louisiana represents a new association that would be better classified elsewhere.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M029	Central Hardwood Floodplain Forest	
M028	Great Plains Flooded & Swamp Forest	
M310	Southeastern North American Ruderal Flooded & Swamp Forest	
M031	Southern Coastal Plain Floodplain Forest	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This macrogroup covers floodplain and riparian vegetation ranging from closed-canopy forests of tall stature in the eastern part of its range to open, short-statured woodlands/shrublands in the western part of its range. Depending on the degree of soil development, herbaceous species may occur as clumps or as a continuous herbaceous layer, and may be quite high, especially in situations where shrub cover is low.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Species composition varies across the east-west range of this macrogroup, but its concept is based on a core set of characteristic species, including the trees *Carya illinoinensis, Celtis laevigata var. laevigata, Celtis laevigata var. reticulata, Platanus occidentalis, Populus deltoides, Salix nigra, Sapindus saponaria var. drummondii (= Sapindus drummondii), Sideroxylon lanuginosum, Taxodium distichum*, and *Ulmus crassifolia*, shrubs *Cephalanthus occidentalis, Cornus drummondii, Amorpha fruticosa*, and grasses and forbs *Andropogon glomeratus, Elymus virginicus, Justicia americana, Panicum virgatum, Tripsacum dactyloides*, and *Verbesina virginica*. Associates of these characteristic species vary across an east-west gradient, with eastern components sharing similarities with vegetation occurring farther east, and western components sharing species with vegetation farther west. Other characteristic species in eastern examples include the trees *Acer negundo, Fraxinus pennsylvanica, Gleditsia triacanthos, Juglans nigra, Quercus macrocarpa, Quercus shumardii*, and *Ulmus americana*, shrubs *Callicarpa americana, Diospyros virginiana, Forestiera acuminata, Ilex decidua, Juniperus virginiana*, and *Viburnum rufidulum*, and vines *Nekemias arborea (= Ampelopsis arborea), Berchemia scandens, Campsis radicans, Parthenocissus quinquefolia*, and *Vitis* spp., and grasses and forbs *Carex* sp., *Chasmanthium latifolium, Chasmanthium sessiliflorum, Clematis pitcheri, Galium* spp., *Geum canadense, Sanicula canadensis*, and *Symphyotrichum drummondii var. texanum*. Other characteristic species in western examples include the trees *Fraxinus albicans (= Fraxinus texensis), Juglans microcarpa, Prosopis glandulosa*, and *Quercus fusiformis*, shrubs *Diospyros texana, Juniperus ashei, Prunus rivularis*, and *Ungnadia speciosa*, vines *Ampelopsis cordata*, and *Parthenocissus heptaphylla*, and grasses and forbs *Cladium mariscus ssp. jamaicense, Eleocharis* spp., *Hydrocotyle* spp., *Muhlenbergia lindheimeri, Nassella leucotricha*, and *Setaria scheelei*. Herbaceous species of the adjacent uplands may also be present, including *Bothriochloa barbinodis (= var. barbinodis), Bouteloua curtipendula, Indigofera lindheimeriana, Leptochloa dubia*, and *Schizachyrium scoparium var. scoparium (= Schizachyrium scoparium ssp. neomexicanum)*.

Along the eastern and northeastern margins of the range of this macrogroup, some stands belonging to more eastern groups may exhibit dominance by eastern taxa such as *Quercus alba, Quercus lyrata, Quercus phellos*, and *Quercus pagoda*; the environment becomes generally and correspondingly drier from east to west with communities containing these moister representatives being constrained to riverbanks and floodplains. Representatives of this macrogroup may vary in the openness of the habitat and physiognomy. There may be an open canopy resulting from flood events and rare fire events. Along the Red River and a few of its tributaries, thin bands of riparian vegetation occurring on sandy floodplain terraces, bluffs and sandbars are significantly different in species composition from riparian communities elsewhere in the region. Occurrences may include *Acer saccharinum* (which probably does not occur in any other basin in Texas), *Juniperus virginiana, Populus deltoides*, and *Salix* spp. (especially *Salix exigua*).

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In eastern examples, periodic and intermediate flooding are the most significant processes, and are expected every 5 to 25 years. Grazing and conversion to agriculture can significantly impact this vegetation, and can lead to its degradation or extirpation. Fire occurs infrequently relative to surrounding systems. Fuels tend to stay moister due to shady conditions and low topographic position. Other disturbances include ice storms/blowdowns, which are capable of setting back small to large patches, as well as beaver pond flooding, which, even though a small-patch event, is expected to cycle throughout the forest over the long term, perhaps at a scale of hundreds or thousands of years. Overgrazing and/or overbrowsing may influence recruitment of overstory species and composition of the understory and herbaceous layers.

ENVIRONMENT

Environmental Description: Some examples of this type occupy relatively broad flats at low topographic positions, along large streams where alluvial deposition dominates, as well as on medium to very small, intermittent to ephemeral drainages, minor intermittent streams, and tributaries. Species composition of these forests are variable and are thought to be dependent on soil and geologic substrates. Some examples may be influenced by fire. Others occur on flashy streams, or frequently inundated floodplains where flooding, rather than fire, is the dominant process. Fuels are variable, and fire-return interval is partially determined by that of the adjacent and surrounding matrix upland vegetation, where consistent fuels are present. The "riparian" components are driven primarily by erosional processes and are affiliated with smaller, higher-gradient streams that may occur on limestone cobbles or flat-bedded limestone of streambeds that are typically intermittently flooded but may be subirrigated by shallow groundwater. "Floodplain terrace" components are driven primarily by depositional processes and are affiliated with larger, lower-gradient rivers and streams. This vegetation is ubiquitous (in appropriate habitats) in the East Central Texas Plains, Texas Blackland Prairie Regions, Crosstimbers, and Edwards Plateau (Level 3 Ecoregions 33, 32, 29 and 30, respectively, *sensu* Griffith et al. (2004)).

DISTRIBUTION

***Geographic Range:** This macrogroup encompasses the floodplain vegetation along large and small rivers in north and south-central Texas in the Edwards Plateau, Texas Blackland Prairies, and East Central Texas Plains ecoregions, and extending peripherally into adjacent ecoregions. The type occurs in portions of the floodplains and tributaries of the Red, Trinity, San Jacinto, Brazos, Colorado, Guadalupe, San Antonio, Nueces, and Lavaca rivers, as well as along minor streams and tributaries in the Colorado, Rio Grande, Guadalupe, San Antonio, and Nueces river drainage basins in the western Edwards and Stockton plateaus of Texas.
Nations: US
States/Provinces: OK, TX
USFS Ecoregions (2007) [optional]: 255B:CC, 255C:CC, 255D:CC, 255E:CC, 315C:CC, 315D:CC, 315E:CP, 315G:CC, 321B:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G784	Southeastern Great Plains Floodplain Forest

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Sawgrass - Willow	Webster 1950	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. Teague, in Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Teague and M. Pyne

Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by J. Teague, D. Diamond, and L. Elliott.

Version Date: 15 Jun 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Griffith, G. E., S. A. Bryce, J. M. Omernik, J. A. Comstock, A. C. Rogers, B. Harrison, S. L. Hatch, and D. Bezanson. 2004. Ecoregions of Texas (two-sided color poster with map, descriptive text, summary tables, and photographs). U.S. Geological Survey, Reston, VA. Scale 1:2,500,000.

Hoagland, B. W. 2008. Vegetation of Oklahoma In: K. S. Johnson and K. V. Luza, editors. Earth Sciences and Mineral Resources of Oklahoma. Oklahoma Geological Survey Educational Publication #9. Norman. [http://www.biosurvey.ou.edu/download/publications/HoaglandOGS08.pdf]

Keys, J. E., Jr., C. A. Carpenter, S. L. Hooks, F. G. Koenig, W. H. McNab, W. E. Russell, and M-L. Smith. 1995. Ecological units of the eastern United States - first approximation (map and booklet of map unit tables). Presentation scale 1:3,500,000, colored. USDA Forest Service, Atlanta, GA.

Webster, G. L. 1950. Observations on the vegetation and summer flora of the Stockton Plateau in northeastern Terrell County, TX. Texas Journal of Science 1950(2):234-242.

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1. Forest & Woodland
1.B.3.Nb. Southeastern North American Flooded & Swamp Forest

G784. Southeastern Great Plains Floodplain Forest

Type Concept Sentence: These floodplain and riparian forests and woodlands are found in the southern Great Plains of the U.S. (south-central and north-central Texas extending into Oklahoma). Characteristic species include those occurring at the southwestern extent of their range (*Acer negundo, Carya illinoinensis, Celtis laevigata var. laevigata, Cornus drummondii, Fraxinus pennsylvanica, Juglans nigra, Platanus occidentalis, Quercus macrocarpa, Quercus shumardii, Salix nigra, Sideroxylon lanuginosum, Taxodium distichum*, and *Ulmus americana*) and the southeastern extent of their range (*Celtis laevigata var. reticulata, Juglans major, Juglans microcarpa, Prosopis glandulosa*, and *Quercus fusiformis*).

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.3.Nb.5. Southern Great Plains Floodplain Forest & Woodland (M154)

Elcode: G784

***Scientific Name:** Southeastern Great Plains Floodplain Forest Group

***Common (Translated Scientific) Name:** Southeastern Great Plains Floodplain Forest Group

***Colloquial Name:** Southeastern Great Plains Floodplain Forest

***Type Concept:** This is currently the sole group in Southern Great Plains Floodplain Forest & Woodland Macrogroup (M154). It covers floodplain and riparian vegetation ranging from closed-canopy forests of tall stature in the eastern part of its range to open, short-statured woodlands in the western part of its range. Species composition also varies across the east-west range of this group, but this concept is based on a core set of characteristic species, including *Carya illinoinensis, Celtis laevigata var. laevigata, Celtis* *laevigata var. reticulata, Cephalanthus occidentalis, Cornus drummondii, Elymus virginicus, Justicia americana, Panicum virgatum, Platanus occidentalis, Populus deltoides, Salix nigra, Sapindus saponaria var. drummondii, Sideroxylon lanuginosum, Taxodium distichum, Tripsacum dactyloides*, and *Ulmus crassifolia*. Other characteristic species in eastern examples include *Acer negundo, Callicarpa americana, Diospyros virginiana, Forestiera acuminata, Fraxinus pennsylvanica, Gleditsia triacanthos, Ilex decidua, Juglans nigra, Juniperus virginiana, Quercus macrocarpa, Quercus shumardii, Ulmus americana*, and *Viburnum rufidulum*. Other characteristic species in western examples include *Diospyros texana, Fraxinus albicans, Juglans microcarpa, Juniperus ashei, Muhlenbergia lindheimeri, Nassella leucotricha, Prosopis glandulosa, Prunus rivularis, Quercus fusiformis*, and *Ungnadia speciosa*. This vegetation is found in the floodplains of medium and larger rivers, as well as along small and intermittent streams of the East Central Texas Plains, Texas Blackland Prairie, Crosstimbers, and Edwards Plateau ecoregions, extending peripherally into adjacent ecoregions. Environmental processes include alluvial sedimentation and erosion associated with perennial and intermittent streams and rivers. It occurs on large and small floodplains, especially in the eastern (and wetter) parts of its range, and on narrow riparian corridors of intermittent streams becoming particularly dry and flashy in the western parts of the range. Periodic, intermediate flooding and deposition (every 5-25 years) dominate the formation and maintenance of examples along better establish floodplains. Further west, in the drier parts of the Edwards Plateau (including the Stockton Plateau) of Texas, examples are open to closed-canopy, low-statured woodlands and shrublands in scoured, rocky riparian settings. These riparian settings are typically intermittently flooded but may be subirrigated.

***Diagnostic Characteristics:** This group covers floodplain and riparian vegetation ranging from closed-canopy forests of tall stature in the eastern part of its range to open, short-statured woodlands/shrublands in the western part of its range. Species composition also varies across this east-west range, but this concept is based on a core set of characteristic species, including the trees *Carya illinoinensis, Celtis laevigata var. laevigata, Celtis laevigata var. reticulata, Platanus occidentalis, Populus deltoides, Salix nigra, Sapindus saponaria var. drummondii, Sideroxylon lanuginosum, Taxodium distichum*, and *Ulmus crassifolia*, shrubs, *Cephalanthus occidentalis, Cornus drummondii*, and grasses and forbs *Elymus virginicus, Justicia americana, Panicum virgatum*, and *Tripsacum dactyloides*.

***Classification Comments:** There are two groups (in two different macrogroups, in two divisions) which may need to be more clearly distinguished from one another floristically and (as much as is possible) biogeographically. These are Southeastern Great Plains Floodplain Forest Group (G784) in Southern Great Plains Floodplain Forest & Woodland Macrogroup (M154); and Great Plains Cottonwood - Green Ash Floodplain Forest Group (G147) in Great Plains Flooded & Swamp Forest Macrogroup (M028). The first of these is in 1.B.3.Nb Southeastern North American Flooded & Swamp Forest Division (D062), the latter one in 1.B.3.Na Eastern North American-Great Plains Flooded & Swamp Forest Division (D011). One problem area is Oklahoma, where G784 and G147 overlap. Several associations in *Carya illinoinensis - Ulmus crassifolia - Celtis laevigata* Floodplain Forest Alliance (A3679) extend this group into Arkansas, Kansas, and Louisiana which is beyond the conceptual boundary of this group and macrogroup. This is peripheral to the core geographic distribution of this group, i.e., the East Central Texas Plains, Texas Blackland Prairie, Crosstimbers, and Edwards Plateau ecoregions centered on Texas. More information is needed to determine if the vegetation in Arkansas, Kansas, and Louisiana represents a new association that would be better classified elsewhere.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group covers floodplain and riparian vegetation ranging from closed-canopy forests of tall stature in the eastern part of its range to open, short-statured woodlands/shrublands in the western part of its range. Depending on the degree of soil development, herbaceous species may occur as clumps or as a continuous herbaceous layer, and may be quite high, especially in situations where shrub cover is low.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Species composition varies across the east-west range of this group, but its concept is based on a core set of characteristic species, including the trees *Carya illinoinensis, Celtis laevigata var. laevigata, Celtis laevigata var. reticulata, Platanus occidentalis, Populus deltoides, Salix nigra, Sapindus saponaria var. drummondii (= Sapindus drummondii), Sideroxylon lanuginosum, Taxodium distichum*, and *Ulmus crassifolia*, shrubs *Cephalanthus occidentalis, Cornus drummondii, Amorpha fruticosa*, and grasses and forbs *Andropogon glomeratus, Elymus virginicus, Justicia americana, Panicum virgatum, Tripsacum dactyloides*, and *Verbesina virginica*. Associates of these characteristic species vary across an east-west gradient, with eastern components sharing similarities with vegetation occurring farther east, and western components sharing species with vegetation farther west. Other characteristic species in eastern examples include the trees *Acer negundo, Fraxinus pennsylvanica, Gleditsia triacanthos, Juglans nigra, Quercus macrocarpa, Quercus shumardii*, and *Ulmus americana*, shrubs *Callicarpa americana, Diospyros virginiana, Forestiera acuminata, Ilex decidua, Juniperus virginiana*, and *Viburnum rufidulum*, and vines *Nekemias arborea (= Ampelopsis arborea), Berchemia scandens, Campsis radicans, Parthenocissus quinquefolia*, and *Vitis* spp., and grasses and forbs *Carex* sp., *Chasmanthium latifolium, Chasmanthium sessiliflorum, Clematis pitcheri, Galium* spp., *Geum canadense, Sanicula canadensis*, and *Symphyotrichum drummondii var. texanum*. Other characteristic species in western examples include the trees *Fraxinus albicans (= Fraxinus texensis), Juglans microcarpa, Prosopis glandulosa, Prunus serotina var. eximia* and *Quercus fusiformis*, shrubs *Diospyros texana, Juniperus ashei, Prunus rivularis*, and *Ungnadia speciosa*, vines *Ampelopsis cordata*, and *Parthenocissus heptaphylla*, and grasses and forbs *Cladium mariscus ssp. jamaicense, Eleocharis* spp., *Hydrocotyle* spp., *Muhlenbergia lindheimeri, Nassella leucotricha*, and *Setaria scheelei*. Herbaceous species of the adjacent uplands may also be present, including *Bothriochloa barbinodis (= var. barbinodis), Bouteloua curtipendula, Indigofera lindheimeriana, Leptochloa dubia*, and *Schizachyrium scoparium var. scoparium (= Schizachyrium scoparium ssp. neomexicanum)*.

Along the eastern and northeastern margins of the range of this group, some stands belonging to more eastern groups may exhibit dominance by eastern taxa such as *Quercus alba, Quercus lyrata, Quercus phellos*, and *Quercus pagoda*; the environment becomes generally and correspondingly drier from east to west with communities containing these moister representatives being constrained to riverbanks and floodplains. Representatives of this group may vary in the openness of the habitat and physiognomy. There may be an open canopy resulting from flood events and rare fire events. Along the Red River and a few of its tributaries, thin bands of riparian vegetation occurring on sandy floodplain terraces, bluffs and sandbars are significantly different in species composition from riparian communities elsewhere in the region. Occurrences may include *Acer saccharinum* (which probably does not occur in any other basin in Texas), *Juniperus virginiana, Populus deltoides*, and *Salix* spp. (especially *Salix exigua*).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In eastern examples, periodic and intermediate flooding are the most significant processes, and are expected every 5 to 25 years. Grazing and conversion to agriculture can significantly impact this vegetation, and can lead to its degradation or extirpation. Fire occurs infrequently relative to surrounding systems. Fuels tend to stay moister due to shady conditions and low topographic position. Other disturbances include ice storms/blowdowns, which are capable of setting back small to large patches, as well as beaver pond flooding, which, even though a small-patch event, is expected to cycle throughout the forest over the long term, perhaps at a scale of hundreds or thousands of years. Overgrazing and/or overbrowsing may influence recruitment of overstory species and composition of the understory and herbaceous layers.

ENVIRONMENT

Environmental Description: Some examples of this type occupy relatively broad flats at low topographic positions, along large streams where alluvial deposition dominates, as well as on medium to very small, intermittent to ephemeral drainages, minor intermittent streams, and tributaries. Species composition of these forests is variable and is thought to be dependent on soil and geologic substrates. Some examples may be influenced by fire. Others occur on flashy streams, or frequently inundated floodplains where flooding, rather than fire, is the dominant process. Fuels are variable, and fire-return interval is partially determined by that of the adjacent and surrounding matrix upland vegetation, where consistent fuels are present. The "riparian" components are driven primarily by erosional processes and are affiliated with smaller, higher-gradient streams that may occur on limestone cobbles or flat-bedded limestone of streambeds that are typically intermittently flooded but may be subirrigated by shallow groundwater. "Floodplain terrace" components are driven primarily by depositional processes and are affiliated with larger, lower-gradient rivers and streams. This vegetation is ubiquitous (in appropriate habitats) in the East Central Texas Plains, Texas Blackland Prairie, Crosstimbers, and Edwards Plateau ecoregions (Level 3 Ecoregions 33, 32, 29 and 30, respectively, *sensu* Griffith et al. (2004)).

DISTRIBUTION

***Geographic Range:** This group encompasses the floodplain vegetation along large and small rivers in north and south-central Texas in the Edwards Plateau, Texas Blackland Prairies, and East Central Texas Plains ecoregions, and extending peripherally into adjacent ecoregions. The type occurs in portions of the floodplains and tributaries of the Red, Trinity, San Jacinto, Brazos, Colorado, Guadalupe, San Antonio, Nueces, and Lavaca rivers, as well as along minor streams and tributaries in the Colorado, Rio Grande, Guadalupe, San Antonio, and Nueces river drainage basins in the western Edwards and Stockton plateaus of Texas.

Nations: US
States/Provinces: AR, KS, LA, OK, TX
USFS Ecoregions (2007) [optional]: 255B:CC, 255C:CC, 255D:CC, 255E:CC, 315C:CC, 315D:CC, 315E:CC, 315G:CC, 321B:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A2018	*Platanus occidentalis - Juglans major - Salix nigra* Floodplain Woodland Alliance
A3681	*Taxodium distichum - Platanus occidentalis* Edwards Plateau Floodplain Forest Alliance
A3680	*Fraxinus pennsylvanica - Carya illinoinensis - Quercus macrocarpa* Great Plains Floodplain Forest Alliance
A3682	*Platanus occidentalis - Populus deltoides - Salix nigra* Great Plains Floodplain Forest Alliance
A3679	*Carya illinoinensis - Ulmus crassifolia - Celtis laevigata* Floodplain Forest Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-11-06	G172 Juglans microcarpa - Chilopsis linearis - Brickellia laciniata Riparian Woodland Group	G171 & G172 merged into G784
2014-11-06	G171 Quercus macrocarpa - Carya illinoinensis - Ulmus crassifolia Forest Group	G171 & G172 merged into G784

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. Teague, in Faber-Langendoen et al. (2015)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Teague
Acknowledgments [optional]:
Version Date: 15 Jun 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Griffith, G. E., S. A. Bryce, J. M. Omernik, J. A. Comstock, A. C. Rogers, B. Harrison, S. L. Hatch, and D. Bezanson. 2004. Ecoregions of Texas (two-sided color poster with map, descriptive text, summary tables, and photographs). U.S. Geological Survey, Reston, VA. Scale 1:2,500,000.

1.B.3.Nd. Western North American Interior Flooded Forest

This lowland riparian forest and woodland type is dominated by broad-leaved deciduous trees (cottonwoods, sycamores, and hackberries) and palms that occur along perennial and intermittent rivers, springs and oases of the California Central Valley, Southwest U.S. deserts, and the Tamaulipan region of south Texas and adjacent Mexico.

1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest

M036. Interior Warm & Cool Desert Riparian Forest

Type Concept Sentence: This macrogroup covers warm and cold climate riparian and wetland forested vegetation of the southwestern deserts and western interior U.S., including the Tamaulipan area of southern Texas. Some of the dominant trees species of this highly diverse macrogroup include *Vachellia farnesiana, Celtis laevigata, Ebenopsis ebano, Juglans major, Platanus racemosa, Platanus wrightii, Populus deltoides ssp. wislizeni, Populus deltoides ssp. monilifera, Populus fremontii, Prosopis glandulosa, Salix laevigata*, and *Salix gooddingii*. This macrogroup also includes oases dominated by evergreen palms *Washingtonia filifera* or *Sabal mexicana*.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.3.Nd.2. Western North American Interior Flooded Forest (D013)

Elcode: M036
***Scientific Name:** Interior Warm & Cool Desert Riparian Forest Macrogroup
***Common (Translated Scientific) Name:** Interior Warm & Cool Desert Riparian Forest Macrogroup
***Colloquial Name:** Interior Warm & Cool Desert Riparian Forest

***Type Concept:** This macrogroup is of riparian, floodplain, seep and oases dominated by trees. Dominant include *Vachellia farnesiana, Acer negundo, Celtis laevigata, Celtis ehrenbergiana, Cordia boissieri, Diospyros texana, Ebenopsis ebano, Ehretia anacua, Fraxinus velutina, Haematoxylum brasiletto, Juglans major, Leucaena pulverulenta, Parkinsonia aculeata, Platanus racemosa, Platanus wrightii, Populus deltoides ssp. wislizeni, Populus deltoides ssp. monilifera, Populus fremontii, Prosopis glandulosa, Quercus lobata, Sabal mexicana, Salix amygdaloides, Salix gooddingii, Salix laevigata, Sapindus saponaria, Sideroxylon celastrinum, Tecoma stans, Ulmus crassifolia*, and *Washingtonia filifera*. It occurs from sea level to 2300 m (7500 feet) along foothill and mountain canyons and valleys where riparian corridors follow stream courses and spring-fed depressions along canyon waterways and tectonic faultlines. Most of the dominant woody species found in this macrogroup are phreatophytes and require the presence of a seasonally shallow water table. This macrogroup occurs from Central Valley of California south and east through the Sonoran and Chihuahuan deserts to the Rio Grande River, north into valleys of the lower Colorado Plateau, the San Luis Valley of Colorado and east into the western Great Plains and the Tamaulipan region of southern Texas. The Tamaulipan area is floristically variable with some components better classified with subtropical vegetation and others with temperate vegetation, so it is a transitional zone and is included within this macrogroup because of shared habitat, dynamics, physiognomic structure and tree genera.

***Diagnostic Characteristics:** Diagnostic tree species trees include *Cordia boissieri, Diospyros texana, Ebenopsis ebano, Ehretia anacua, Juglans major, Leucaena pulverulenta, Parkinsonia aculeata, Platanus racemosa, Platanus wrightii, Populus deltoides ssp. wislizeni, Populus fremontii, Sabal mexicana, Salix laevigata, Ulmus crassifolia*, and *Washingtonia filifera*.

***Classification Comments:** Currently within the NVC there are no subtropical groups, so for the present time this warm-climate riparian macrogroup appears to be the best placement of Tamaulipan Riparian Scrub Forest Group (G549). G549 is related to Warm Desert Lowland Freshwater Marsh, Wet Meadow & Shrubland Macrogroup (M076) (J. Evens pers. comm. 2014). In addition, the Tamaulipan area is floristically variable with some components better classified with subtropical vegetation and others with temperate vegetation, so it is a transitional zone. These groups share common habitat, dynamics, physiognomy, and tree genera and all three include endemic palm species. This macrogroup was expanded to include the cool desert range of *Populus fremontii* in Nevada and Utah as well as part of the range of *Populus deltoides ssp. monilifera* that occurs within the interior west and western edge of the Great Plains, skirting around the southern Rocky Mountains, but not into the Great Plains proper.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M031	Southern Coastal Plain Floodplain Forest	is most closely related to G171.

Elcode	Scientific or Colloquial Name	Note
M034	Rocky Mountain-Great Basin Montane Riparian & Swamp Forest	
M298	Interior West Ruderal Flooded & Swamp Forest & Woodland	
M076	Warm Desert Lowland Freshwater Marsh, Wet Meadow & Shrubland	is a shrub and herb wetland, whereas this type is tree-dominated.

Similar NVC Types General Comments [optional]: Trees in this M036 often occur at low cover in the shrubland stands of Warm Desert Lowland Freshwater Marsh, Wet Meadow & Shrubland Macrogroup (M076). Also, M076 shares many ecological and floristic characteristics with M036. The distinction of forest versus shrubland at the class level for riparian associations needs further evaluation.

VEGETATION

Physiognomy and Structure Summary: Open to closed forests of tall and scrubby-height cold-deciduous and broad-leaved evergreen trees, often occurring in multiple layers.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The vegetation is primarily treed with varying height and canopy closure. Dominant tree species include *Vachellia farnesiana (= Acacia farnesiana), Acer macrophyllum, Acer negundo, Alnus rhombifolia, Alnus rubra, Celtis laevigata var. reticulata, Celtis ehrenbergiana (= Celtis pallida), Cephalanthus occidentalis, Cordia boissieri, Diospyros texana, Ebenopsis ebano, Ehretia anacua, Fraxinus velutina, Haematoxylum brasiletto, Juglans major, Leucaena pulverulenta, Parkinsonia aculeata, Platanus racemosa, Platanus wrightii, Populus deltoides ssp. wislizeni, Populus deltoides ssp. monilifera, Populus fremontii, Prosopis glandulosa, Pseudotsuga menziesii, Quercus agrifolia, Quercus lobata, Sabal mexicana, Salix gooddingii, Salix laevigata, Salix nigra, Sapindus saponaria, Taxodium mucronatum, Tecoma stans, Ulmus crassifolia*, and *Washingtonia filifera*. Floristic information was compiled from Brown (1982a), Barbour and Major (1988), MacMahon (1988), Szaro (1989), Dick-Peddie (1993), Holland and Keil (1995), Sawyer and Keeler-Wolf (1995), Muldavin et al. (2000a), Barbour et al. (2007), and Sawyer et al. (2009).

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Vegetation is dependent upon at least temporary annual rise in the water table with annual or periodic flooding and associated sediment scour for growth and reproduction (especially for cottonwood and willow species). Permanent subsurface water is required to maintain many of the dominant phreatophytic species and the palm species (*Washingtonia filifera* and *Sabal mexicana*). Palm groves were once common in the lower Rio Grande Valley 130 km (80 miles) from the Gulf of Mexico, but have since largely been converted to agriculture (Clover 1937, Everitt et al. 1996a, Tremblay et al. 2005).

ENVIRONMENT

Environmental Description: This macrogroup consists of riparian corridors along perennial, intermittent and temporarily flooded streams, and arroyos (ramaderos). Stands may occur on isolated springs as well as within-channel spring-fed depressions. Soils are typically coarse alluvial to loam, silt loam or clay loam and are usually somewhat deeper than soils of the surrounding landscape; and some stands occur on serpentine soils. Elevation ranges from sea level up to 2300 m (7500 feet). Environmental information was compiled from several sources: Brown (1982a), Barbour and Major (1988), Barbour et al. (2007), MacMahon (1988), Szaro (1989), Dick-Peddie (1993), Holland and Keil (1995), Sawyer and Keeler-Wolf (1995), Muldavin et al. (2000a), and Sawyer et al. (2009).

DISTRIBUTION

***Geographic Range:** This macrogroup occurs from Oregon's southern Coast Ranges, California's Central Valley, the foothills of the Sierra Nevada east into the Sonoran, Mojave, western Great Plains and Tamaulipan regions of Texas and Mexico.
Nations: MX, US
States/Provinces: AZ, CA, CO, MXBC, MXBS, MXCH, MXCO, MXNU, MXSO, MXTM, NM, NV, OR, TX, UT
USFS Ecoregions (2007) [optional]: 261B:??, 262A:CC, 263A:??, 322A:PP, M261A:CC, M261B:CC, M261C:CC, M261D:CC, M261E:CC, M261F:CC, M261G:CC

Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: Tamaulipan area is considered floristically transitional with some components better classified with subtropical vegetation and others with temperate vegetation. While the macrogroup shares common habitat, dynamics, physiognomy and some tree genera, the floristic overlap between the Tamaulipan and other groups within this macrogroup is very limited. G549 has similarities to shrub and herb wetlands in Warm Desert Lowland Freshwater Shrubland, Meadow & Marsh Macrogroup (M076), and distinctiveness of these two macrogroups needs review.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G549	Tamaulipan Riparian Scrub Forest
G797	Western Interior Riparian Forest & Woodland

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	California Riparian Deciduous Forests and Woodland - 223.3	Brown et al. 1998	
>	Sonoran Riparian Oasis Forest - 224.4	Brown et al. 1998	
>	Southwestern Riparian Deciduous Forests and Woodland - 223.2	Brown et al. 1998	
>	Tamaulipan Interior Swamp and Riparian Forest - 224.3	Brown et al. 1998	

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** G. Kittel, P. Comer, T. Keeler-Wolf, J. Teague
Acknowledgments [optional]:
Version Date: 11 May 2015

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1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest

G549. Tamaulipan Riparian Scrub Forest

Type Concept Sentence: This scrub forest group occurs in mesic environments, including riparian areas and floodplains, in the Tamaulipan region of southern Texas and northeastern Mexico.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.3.Nd.2. Interior Warm & Cool Desert Riparian Forest (M036)

Elcode: G549
***Scientific Name:** *Sabal mexicana - Ebenopsis ebano - Ulmus crassifolia* Tamaulipan Riparian Scrub Group
***Common (Translated Scientific) Name:** Rio Grande Palmetto - Texas Ebony - Cedar Elm Tamaulipan Riparian Scrub Group
***Colloquial Name:** Tamaulipan Riparian Scrub Forest

***Type Concept:** As currently circumscribed, this scrub forest group occurs in mesic environments including riparian areas and floodplains in the Tamaulipan region of southern Texas and northeastern Mexico. Stands are a unique mix of species from southeastern North America and subtropical Central America and may be dominated by *Celtis laevigata, Cordia boissieri, Diospyros texana, Ebenopsis ebano, Ehretia anacua, Fraxinus berlandieriana, Leucaena pulverulenta, Parkinsonia aculeata, Sabal mexicana,* *Sideroxylon celastrinum, Ulmus crassifolia*, and many other riparian plants. Other species may include *Salix nigra, Taxodium mucronatum, Prosopis glandulosa*, and *Celtis ehrenbergiana*. In the shrublands, the dense shrub canopy is a mix of species often including *Vachellia farnesiana, Celtis ehrenbergiana, Haematoxylum brasiletto, Prosopis glandulosa*, or *Tecoma stans*. The highly variable understory is dependent on canopy density and may include dense shrub or herbaceous layers dominated by neotropical species. Dominance of the herbaceous layer by invasive exotic grasses (e.g., *Pennisetum ciliare* and *Urochloa maxima*) is becoming more common.

***Diagnostic Characteristics:**

***Classification Comments:** This group is a placeholder for wet-mesic, primarily forested vegetation in the Tamaulipan region of Texas and adjacent Mexico. As described, it may be better classified in a forest and woodland division. It is floristically variable, and some components may be better classified with related subtropical vegetation and others with related temperate or desert vegetation. Its placement in Interior Warm & Cool Desert Riparian Forest Macrogroup (M036) should be reviewed when more information about related subtropical vegetation is available.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: As currently circumscribed, this vegetation includes low woodlands, forests and shrublands. This vegetation is reported to have been as tall as 21 m historically (Jahrsdoerfer and Leslie 1988).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Stands are a unique mix of species from southeastern North America and subtropical Central America and may be dominated by *Cordia boissieri, Diospyros texana, Ebenopsis ebano, Ehretia anacua, Fraxinus berlandieriana, Leucaena pulverulenta, Parkinsonia aculeata, Phaulothamnus spinescens, Sabal mexicana, Sideroxylon celastrinum, Ulmus crassifolia*, and many other riparian plants. Other species may include *Salix nigra, Taxodium mucronatum, Prosopis glandulosa*, and *Celtis ehrenbergiana (= Celtis pallida)*. In these scrublands, the dense tall-shrub/short-tree canopy is a mix of species often including *Vachellia farnesiana (= Acacia farnesiana), Celtis ehrenbergiana, Condalia hookeri, Haematoxylum brasiletto, Prosopis glandulosa*, or *Tecoma stans*. The highly variable understory is dependent on canopy density and may include dense shrub or herbaceous layers dominated by neotropical species. Dominance of the herbaceous layer by invasive exotic grasses (e.g., *Pennisetum ciliare* and *Urochloa maxima*) is becoming more common.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Palm groves were once common in the lower Rio Grande Valley 80 miles from the Gulf of Mexico, but have since largely been converted to agriculture (Clover 1937, Everitt et al. 1996, Tremblay et al. 2005). Hydrologic regimes associated with the natural processes of the Rio Grande delta were important ecological processes for this group. This vegetation has been highly impacted by clearing, overgrazing, disruption of natural processes, and invasive species.

ENVIRONMENT

Environmental Description: This vegetation occurs in wet-mesic environments including riverbanks, floodplains, arroyos (ramaderos), and deltaic deposits that are temporarily to intermittently flooded (or were historically) and are dry during parts of the year. Soils are typically loams, silt loams, or clay loams and are somewhat deeper than those of the surrounding landscape. This vegetation is thought to have been once widespread, and now reduced to less than 90% of its former range through clearing for agriculture and hydrological alterations.

DISTRIBUTION

***Geographic Range:** This group occurs in the central and southern part of the Tamaulipan region of Texas and Mexico.
Nations: MX, US
States/Provinces: MXCO, MXNU, MXTM, TX
USFS Ecoregions (2007) [optional]: 315A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3841	*Vachellia farnesiana - Celtis ehrenbergiana* Riparian Scrub Alliance
A3842	*Celtis laevigata - Ulmus crassifolia / Urvillea ulmacea* Tamaulipan Riparian Scrub Alliance
A0041	*Ebenopsis ebano - Sabal mexicana / Cardiospermum corindum* Riparian Scrub Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
><	Chihuahuan Thorn Forest	Jahrsdoerfer and Leslie 1988	
<	Deciduous floodplain hardwood forest	Diamond 1998	
<	Evergreen low forest	Diamond 1998	
<	Hackberry-huisache Association	McLendon 1991	
<	Huisache-prickly pear Association	McLendon 1991	
?	Mesquite-granjeno Association	McLendon 1991	
<	Mid-Delta Thorn Forest	Jahrsdoerfer and Leslie 1988	
<	Mid-Valley Riparian Woodland	Jahrsdoerfer and Leslie 1988	
<	Ramadero	Jahrsdoerfer and Leslie 1988	
<	Southwestern Subtropical Upland Forests	Diamond 1998	
=	Timber of the Rio Grande Valley below Rio Grande City	Bray 1901	
<	Upper Valley Flood Forest	Jahrsdoerfer and Leslie 1988	

AUTHORSHIP

***Primary Concept Source [if applicable]:** W.L. Bray (1901)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Teague
Acknowledgments [optional]:
Version Date: 10 Jun 2015

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***References [Required if used in text]:**

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Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]
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Tremblay, T. A., W. A. White, and J. A. Raney. 2005. Native woodland loss during the mid-1900s in Cameron County, Texas. The Southwestern Naturalist 50(4):479-482.

1.B.5. Boreal Flooded & Swamp Forest

Boreal Flooded & Swamp Forest is a tree-dominated wetland influenced by minerotrophic groundwater (rarely ombrotrophic), either on mineral or organic (peat) soil, found in northern, high latitudes of North America and Eurasia, with extended cold winters and short mild summers.

1.B.5.Na. North American Boreal Flooded & Swamp Forest

This division includes conifer-treed poor peat swamps and broad-leaved cold-deciduous (hardwood) riparian forests and rich swamps of the boreal region of North America, characterized by *Abies balsamea, Fraxinus nigra, Larix laricina, Picea mariana, Populus balsamifera*, and *Thuja occidentalis*.

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1. Forest & Woodland
1.B.5.Na. North American Boreal Flooded & Swamp Forest

M299. North American Boreal Conifer Poor Swamp

Type Concept Sentence: This boreal swamp type is found across the North American boreal region, from Alaska to Newfoundland, including poor to intermediate swamp forests, primarily on peatland soils, dominated by *Picea mariana, Larix laricina, Abies balsamea*, and/or *Betula papyrifera*.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 1.B.5.Na.1. North American Boreal Flooded & Swamp Forest (D016)

Elcode: M299
***Scientific Name:** North American Boreal Conifer Poor Swamp Macrogroup
***Common (Translated Scientific) Name:** North American Boreal Conifer Poor Swamp Macrogroup
***Colloquial Name:** North American Boreal Conifer Poor Swamp

***Type Concept:** Boreal poor to intermediate swamp forests and woodlands develop on wet soils with permanent or semipermanent water tables at or near the soil surface, where the flow rate, subsurface depth and chemistry of groundwater determine site moisture and nutrient characteristics. These treed wetlands are common on the boreal landscape, occurring at scales ranging from small discrete patches in landscape depressions to extensive wetland complexes over large areas of level, poorly drained terrain. They usually occur on organic soils composed of sphagnum or graminoid peat. Regional west to east differences in nutrient levels: *Picea mariana* is dominant or codominant in nutrient-poor and intermediate peatlands, while *Larix laricina* occurs with *Picea mariana* across all regions in treed wetlands that are moderately well-supplied with nutrients (intermediate). In eastern Canada, *Abies balsamea* and *Betula papyrifera* also occur in intermediate wetlands; in western Canada, *Picea glauca* can be present. Several understory shrub, herb, moss and lichen species are indicative of relative moisture and nutrient status in these forests and woodlands. The poor swamps have a set of widely distributed characteristic species, such as *Ledum groenlandicum, Maianthemum trifolium, Chamaedaphne calyculata, Rubus chamaemorus, Kalmia polifolia*, and *Vaccinium oxycoccos*. Other species are regionally distributed: *Vaccinium vitis-idaea* is the primary *Vaccinium* species in western and northern Canadian poor swamps, while *Vaccinium myrtilloides* and *Vaccinium angustifolium* fill that role in eastern Canada; *Kalmia angustifolia* is an important heath component in eastern Canada.

***Diagnostic Characteristics:** This macrogroup is characterized by open stands of *Picea mariana, Larix laricina, Abies balsamea*, and/or *Betula papyrifera* on saturated peatland soils

***Classification Comments:** Terminology for wooded weakly minerotrophic wetlands is challenging. In the USNVC, poor swamps is the typical term, encompassing what are sometimes called wooded poor fens. Adding to the challenge is that thresholds for tree heights in poor swamp conditions are more often set at 2 m and 10 m. For that reason, we set a variable range of height thresholds for poor swamps at 5-10 m, with >10% cover, and we rely on a combination of vegetation structure, ecology, and floristics to help make the distinction between treed bogs and poor swamps. Types <5 m in height, on peat soils, and lacking minerotrophic indicators are treated as treed bogs and poor fens in the bog and fen formation. The short or stunted tree cover is variable. This is consistent with a number of treatments that place treed bogs with open bogs, separate from swamps. For example, Harris et al. (1996) and Rydin and Jeglum (2006) use 10 m as the cutoff for swamps versus bogs and fens, and 2 m to distinguish treed bogs from open bogs. The CNVC and USNVC more often use 5 m and 10%. Rydin and Jeglum (2006, Table 1.2) provide a key to the vegetation types based on those thresholds. Further description of this type is available from the CNVC Technical Committee [see cnvc-cnvc.ca].

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M496	West-Central North American Boreal Forest & Woodland	
M877	North American Boreal & Subboreal Alkaline Fen	
M876	North American Boreal & Subboreal Bog & Acidic Fen	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This macrogroup is dominated by needle-leaved evergreen trees with an open woodland canopy. These poor swamps are 5-10 m in height with >10% canopy cover.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Regional west to east differences in nutrient levels: *Picea mariana* is dominant or codominant in nutrient-poor and intermediate peatlands, while *Larix laricina* occurs with *Picea mariana* across all regions in treed wetlands that are moderately well-supplied with nutrients (intermediate). In eastern Canada, *Abies balsamea* and *Betula papyrifera* also occur in intermediate wetlands; in western Canada, *Picea glauca* can be present. Several understory shrub, herb, moss and lichen species are indicative of relative moisture and nutrient status in these forests and woodlands. The poor swamps have a set of widely distributed characteristic species, such as *Ledum groenlandicum, Maianthemum trifolium, Chamaedaphne calyculata, Rubus chamaemorus, Kalmia polifolia*, and *Vaccinium oxycoccos*. Other species are regionally distributed: *Vaccinium vitis-idaea* is the primary *Vaccinium* species in western and northern Canadian poor swamps, while *Vaccinium myrtilloides* and *Vaccinium angustifolium* fill that role in eastern Canada; *Kalmia angustifolia* is an important heath component in eastern Canada. In Alaska, this type includes acidic swamps. *Picea mariana* is the dominant overstory species in an open canopy (30-50% canopy cover). Other overstory associates may include *Larix laricina, Picea glauca*, or, in the subboreal Rocky Mountain region, *Picea glauca x engelmannii* (hybrid white spruce). Shrubs may include *Andromeda polifolia, Betula nana, Empetrum nigrum, Vaccinium vitis-idaea, Vaccinium uliginosum, Chamaedaphne calyculata, Rubus chamaemorus, Alnus incana ssp. tenuifolia, Betula nana*, and *Ledum groenlandicum*. Characteristic herbaceous species include *Carex aquatilis, Carex pluriflora, Eriophorum angustifolium, Equisetum* spp., and *Petasites frigidus*. Moss cover is high; typical species include *Aulacomnium palustre, Tomentypnum nitens, Pleurozium schreberi, Sphagnum* spp., and

Hylocomium splendens, among others. Well-developed bogs may have a significant lichen component in the ground layer composed largely of *Cladonia* spp.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Acidic swamps are in contact with weakly minerotrophic water, typically in peatland soils. An abundance of woody material in swamps provides another important distinction in that the peat is primarily composed of both decomposing woody material (shrub and tree) and *Sphagnum*- or sedge-dominated peats (National Wetlands Working Group 1998).

ENVIRONMENT

Environmental Description: This type often occurs as part of a larger wetland complex, where there is an adequate flow of near-surface groundwater, often along peatland edges or inactive floodplain channels. Trees root on microsites that are elevated above the water table. Soils are saturated and may be made up of well-decomposed woody peat or fine-textured mineral deposits. Stands occur on wet soils with permanent or semipermanent water tables at or near the soil surface, where the flow rate, subsurface depth and chemistry of groundwater determine site moisture and nutrient characteristics. These treed wetlands are common on the boreal landscape, occurring at scales ranging from small discrete patches in landscape depressions to extensive wetland complexes over large areas of level, poorly drained terrain. They usually occur on organic soils composed of sphagnum or graminoid peat.

DISTRIBUTION

***Geographic Range:** This macrogroup is found from eastern Canada, including the maritime region, extending south into the most northern parts of northern New England (Maine, New Hampshire, Vermont, and parts of New York) and westward into Quebec, Ontario and northern regions of the Great Lakes region (including northern Minnesota, Wisconsin and Michigan), extending through Manitoba, Saskatchewan, northwestern Alberta, northern British Columbia and boreal Alaska.
Nations: CA, US
States/Provinces: AB, AK, BC, MB, ME, MI, MN, NB, NH, NS, NY, ON, PE?, VT, WI, YT
USFS Ecoregions (2007) [optional]: 211A:CC, 211B:CC, 211C:CC, 211D:CC, 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212K:CC, 212L:CC, 212M:CC, 212N:CC, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC, M211A:CC, M211B:CC, M211C:CC, M211D:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G807	Atlantic Boreal Black Spruce - Balsam Fir Poor Swamp
G051	Eastern Boreal Balsam Fir - Black Spruce Intermediate-Rich Swamp
G050	Eastern Boreal Black Spruce - Tamarack Poor Swamp & Bog
G806	Ontario-Québec Boreal Black Spruce Poor Swamp
G843	West-Central Boreal Black Spruce - Tamarack Poor Swamp
G546	Alaskan-Yukon Boreal Black Spruce Wet Forest

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2011-04-08	M038 Central & Eastern Boreal Flooded & Swamp Forest Macrogroup	M038 split into M299 & M300

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Fpn Northern Forest Rich Peatland System	Minnesota DNR 2003	
>	I.A.2.f - Black spruce (open)	Viereck et al. 1992	
>	I.A.2.h - Black spruce-tamarack (open)	Viereck et al. 1992	
>	I.A.3.d - Black spruce (woodland)	Viereck et al. 1992	
>	II.B.1.f. - Closed tall shrub swamp	Viereck et al. 1992	
>	II.B.2.f - Open tall shrub swamp	Viereck et al. 1992	

AUTHORSHIP

***Primary Concept Source [if applicable]:** K. Baldwin and CNVC Technical Committee

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** D. Meidinger, D. Faber-Langendoen, K. Baldwin, G. Kittel

Acknowledgments [optional]:

Version Date: 29 Mar 2017

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1. Forest & Woodland
1.B.5.Na. North American Boreal Flooded & Swamp Forest

G051. Eastern Boreal Balsam Fir - Black Spruce Intermediate-Rich Swamp

Type Concept Sentence: These floodplain forests are found in parts of the eastern boreal regions of Canada, extending to the extreme northern portions of the eastern U.S.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.5.Na.1. North American Boreal Conifer Poor Swamp (M299)

Elcode: G051
***Scientific Name:** *Picea mariana - Abies balsamea / Alnus incana* Swamp Group
***Common (Translated Scientific) Name:** Black Spruce - Balsam Fir / Gray Alder Swamp Group
***Colloquial Name:** Eastern Boreal Balsam Fir - Black Spruce Intermediate-Rich Swamp

***Type Concept:** This is a moderately to richly minerotrophic forested peatland found across the eastern boreal and sub-boreal regions of Canada, extending southward to the northern Great Lakes region and parts of the glaciated northeastern United States. Stands are typically found in glacial lakeplains, poorly drained basins, and kettleholes, with level, wet, poorly drained organic soils, and a shallow to thick layer of moderately decomposed peat. The pH typically exceeds 5.5. Trees form a partial to full cover over most or all of the peatland. Dominant trees include *Picea mariana, Abies balsamea, Larix laricina, Betula papyrifera*, and, less commonly, *Picea glauca* and *Thuja occidentalis*, either solely or in combination. Tall shrubs, especially *Alnus incana* and regenerating tree species, may form an open to dense, almost impenetrable layer. Other tall shrubs include *Acer spicatum, Cornus sericea, Sorbus americana, Sorbus decora, Salix* spp., *Nemopanthus mucronatus*, and *Viburnum nudum var. cassinoides* (in Quebec) Low shrubs and herbs are common in the understory. A sparse to moderately well-developed low-shrub layer contains ericaceous species such as *Ledum groenlandicum, Gaultheria hispidula, Vaccinium angustifolium*, and *Vaccinium myrtilloides*, but also includes minerotrophic species, such as *Lonicera canadensis* and *Ribes* spp., as well as *Linnaea borealis*. The diverse herb layer includes the sedges *Carex disperma, Carex leptalea, Carex trisperma*, and the forbs *Clintonia borealis, Coptis trifolia, Cornus canadensis, Equisetum* spp., *Lycopodium annotinum, Maianthemum canadense, Maianthemum trifolium, Oxalis montana, Rubus pubescens*, and *Trientalis borealis*. Fern species, including *Osmunda cinnamomea, Osmunda claytoniana, Gymnocarpium dryopteris*, and *Dryopteris* spp., can be abundant in richer stands. Mosses range from partial mats of sphagnum (especially *Sphagnum fuscum, Sphagnum girgensohnii, Sphagnum magellanicum*) and feathermosses (*Hylocomium splendens, Pleurozium schreberi*, and *Ptilium crista-castrensis*), especially on hummocks, to brown moss species, especially in hollows.

***Diagnostic Characteristics:** This type is distinguished by the poorly drained, more alkaline (intermediate to rich) conditions with a shallow to deep layer of peat (20+ cm) in combination with a mix of sphagnum, feathermosses and brown mosses, occasional dense thickets of *Alnus incana*, and partial to closed canopy dominated by *Picea mariana, Abies balsamea, Larix laricina*, and *Betula papyrifera*. The role of *Thuja occidentalis* is under review.

***Classification Comments:** At this time, the concept of this group includes both boreal and sub-boreal conifer swamps, but it is not clear how far southward this group extends in the Laurentian-Acadian region, especially in eastern Canada and New England, or eastward into the Atlantic boreal region. Although this is a rich swamp type, its boreal characteristics appear to make it more acidic than Laurentian-Acadian-Allegheny Alkaline Swamp Group (G046), and thus somewhat similar to Northern Conifer & Hardwood Acidic Swamp Group (G045). Some *Picea rubens* swamps may be difficult to place, as they can share codominance with *Picea mariana* swamps throughout the sub-boreal region, but it may be that all such stands are placed in G046. Similarly, it is not clear whether northern examples of *Thuja occidentalis* swamps belong here (especially *Thuja occidentalis - (Picea mariana, Abies balsamea) / Alnus incana* Forest (CEGL002456)). Laurentian-Acadian-Allegheny Alkaline Swamp Group (G046) is found in the central and southern parts of the Laurentian-Acadian region and may overlap this group, including in northern and central Minnesota, central and southern Ontario, and southern Quebec. That group more often contains northern hardwood and conifer species, such as *Acer rubrum, Betula alleghaniensis, Fraxinus nigra*, and *Tsuga canadensis*, along with diagnostic shrubs, such as *Ilex verticillata, Vaccinium corymbosum*, and *Photinia melanocarpa*. *Thuja occidentalis* and, more rarely, *Larix laricina* may also be found, along with

Picea rubens. Eastern Boreal Black Spruce - Tamarack Poor Swamp Group (G050) overlaps in concept with this type, but lacks the minerotrophic indicators and often has a very continuous layer of sphagnum. Separation of an Atlantic boreal swamp group is under review.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Trees form partial to full cover over most or all of the peatland. Tall shrubs may form an open to thick, almost impenetrable layer. A sparse to moderately well-developed low-shrub layer contains both ericaceous and non-ericaceous shrubs. A wide diversity of herbs are present. Mosses range from partial mats of *Sphagnum* spp. and feathermosses (especially *Pleurozium schreberi*), particularly on hummocks, to brown moss species, especially in hollows.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Trees form a partial to full cover over most or all of the peatland. Dominant trees include *Abies balsamea, Picea mariana, Larix laricina, Betula papyrifera*, and, less commonly, *Picea glauca*, either solely or in combination. Tall shrubs, especially *Alnus incana*, may form an open to thick, almost impenetrable layer. Other tall shrubs include *Acer spicatum, Cornus sericea, Sorbus americana, Sorbus decora, Salix* spp., *Nemopanthus mucronatus*, and *Viburnum nudum var. cassinoides*. Low shrubs and herbs are common in the understory. A sparse to moderately well-developed low-shrub layer contains ericaceous species such as *Ledum groenlandicum, Gaultheria hispidula, Vaccinium angustifolium*, and *Vaccinium myrtilloides*, but also includes minerotrophic species, such as *Lonicera canadensis* and *Ribes* spp., as well as *Linnaea borealis*. The diverse herb layer includes the sedges *Carex disperma, Carex leptalea, Carex trisperma*, and the forbs *Clintonia borealis, Cornus canadensis, Equisetum* spp., *Coptis trifolia, Lycopodium annotinum, Maianthemum canadense, Maianthemum trifolium, Oxalis montana, Rubus pubescens*, and *Trientalis borealis*. Fern species can be abundant in richer stands. Mosses range from partial mats of sphagnum (especially *Sphagnum fuscum, Sphagnum girgensohnii, Sphagnum magellanicum*) and feathermosses (*Hylocomium splendens, Pleurozium schreberi*, and *Ptilium crista-castrensis*), especially on hummocks, to brown moss species, especially in hollows.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: Stands are intermediate to rich in minerals and moderate to high pH. The pH typically exceeds 5.5 (Minnesota DNR 2003). Stands are typically found in glacial lakeplains, poorly drained basins, and kettleholes, with level, wet, poorly drained organic soils, and a shallow to thick layer of peat. The peat is moderately decomposed (hemic). During high water levels, pools may form on the peat surface, but undulating topography and low hummocks at the base of trees provide substrates that remain dry and aerated enough to support trees and shrubs (Minnesota DNR 2003).

DISTRIBUTION

***Geographic Range:** This group is found in eastern Canada (excluding Atlantic Canada), extending into the most northern parts of northern New England (Maine, New Hampshire, Vermont, and parts of New York) and the Great Lakes region (particularly in northern Minnesota, Wisconsin and Michigan). Separation of an Atlantic boreal region type is under review.
Nations: CA, US
States/Provinces: MB, ME, MI, MN, NB, NH, NS, NY, ON, PE?, VT, WI

USFS Ecoregions (2007) [optional]: 211A:CC, 211B:CC, 211C:CC, 211D:CC, 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212K:CC, 212L:CC, 212M:CC, 212N:CC, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC, M211A:CC, M211B:CC, M211C:CC, M211D:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Fpn Northern Forest Rich Peatland System	Minnesota DNR 2003	

AUTHORSHIP

***Primary Concept Source [if applicable]:** Minnesota Department of Natural Resources (2003)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** D. Faber-Langendoen and S. Menard
Acknowledgments [optional]: K. Baldwin
Version Date: 08 Oct 2013

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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1. Forest & Woodland
1.B.5.Na. North American Boreal Flooded & Swamp Forest

G050. Eastern Boreal Black Spruce - Tamarack Poor Swamp & Bog

Type Concept Sentence: This is a forested acidic (poor swamp and bog) peatland found across the eastern boreal (and sub-boreal) regions of Canada, extending southward to the northern Great Lakes region and parts of the northeastern United States.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.5.Na.1. North American Boreal Conifer Poor Swamp (M299)

Elcode: G050
***Scientific Name:** *Picea mariana - Larix laricina / Ledum groenlandicum* Swamp & Bog Group
***Common (Translated Scientific) Name:** Black Spruce - Tamarack / Bog Labrador-tea Swamp & Bog Group
***Colloquial Name:** Eastern Boreal Black Spruce - Tamarack Poor Swamp & Bog

***Type Concept:** This is a poor acidic forested peatland (poor swamp and forested bog) found across the eastern boreal and sub-boreal regions of Canada, extending southward to the northern Great Lakes region and parts of the northeastern United States. The group is primarily moderately to weakly minerotrophic (similar to poor fen), and even approaching ombrotrophic (bog) conditions. They are typically found in poorly drained basins or kettleholes, with level, wet, poorly drained organic soils, and a shallow to thick layer of peat that reduces contact with groundwater. Trees form a partial to full cover over most or all of the peatland. Stunted to well-developed *Picea mariana* is the dominant canopy species. Other common trees include *Larix laricina, Abies balsamea*, and *Pinus banksiana*. Heaths and sedges are common in the understory. A sparse to moderately well-developed low-shrub layer contains mostly ericaceous species such as *Chamaedaphne calyculata, Ledum groenlandicum, Gaultheria hispidula, Vaccinium* spp., and *Kalmia* spp. Mosses commonly include *Sphagnum* spp., *Pleurozium schreberi*, and *Dicranum polysetum*.

***Diagnostic Characteristics:** This type is distinguished by the poorly drained, acidic environmental conditions with a shallow to deep layer of peat (20+ cm) in combination with a dense sphagnum mat, an open to dense ericaceous shrub layer, and partial to closed canopy dominated by tree-size (>6 m height) *Picea mariana*.

***Classification Comments:** An Atlantic boreal swamp group may be recognized separately from this group, but is still under review. Eastern North American Boreal Acidic Bog & Fen Group (G748) (scrub/herb bogs and poor fens) is associated with this group in peatland areas where flat to raised peats create stronger ombrotrophic conditions, but has trees >2 m with <10% cover. Eastern Boreal Balsam Fir - Black Spruce Intermediate-Rich Swamp Group (G051) has stronger minerotrophic influence, with pH typically >5.5. Laurentian-Acadian-Allegheny Alkaline Swamp Group (G046) is found in the Laurentian-Acadian region and may overlap this group, including in northern Minnesota, central Ontario, and Quebec, but it is distinguished by a suite of northern temperate species, including *Acer rubrum, Betula alleghaniensis*, and *Tsuga canadensis*, along with diagnostic shrubs, such as *Ilex verticillata, Nemopanthus mucronatus, Viburnum nudum var. cassinoides, Vaccinium corymbosum*, and *Photinia melanocarpa*. *Thuja occidentalis* and *Picea rubens* are other more typical northern temperate conifers.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Partially to closed-canopy forests typify this group. Subcanopy, shrub, and herb layers vary in density and species richness, but a moderately well- to well-developed heath layer and dense sphagnum mat is common. Shallow to deep peat occurs on the majority of sites.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Stunted to well-developed *Picea mariana* is the dominant canopy species. Other common trees include *Larix laricina, Abies balsamea*, and *Pinus banksiana*. The tall-shrub layer is typically sparse to absent, and where present may include *Alnus incana*, in addition to saplings of the dominant tree species. Heaths and sedges are common in the understory. A sparse to moderately well-developed low-shrub layer contains mostly ericaceous species such as *Chamaedaphne calyculata, Ledum groenlandicum, Gaultheria hispidula, Vaccinium angustifolium, Vaccinium myrtilloides, Vaccinium oxycoccos, Kalmia angustifolia*, and *Kalmia polifolia*. Herbs are typically sparse but can be dense in some examples. Common herbaceous species include *Maianthemum trifolium, Cornus canadensis, Carex trisperma, Carex disperma*, and *Rubus chamaemorus*. There is a strong sphagnum layer, including *Sphagnum angustifolium, Sphagnum capillifolium, Sphagnum fuscum, Sphagnum girgensohnii*, and *Sphagnum* *magellanicum*. Other mosses include *Pleurozium schreberi* and *Dicranum polysetum*. The lichen *Cladina rangiferina* can also be common on the upper dry part of the sphagnum mat.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: This group occurs on level, wet sites with organic soils or in kettlehole basins and other types of depressions. Sites are acidic and typically poorly to very poorly drained. Peat accumulation ranges from shallow to very deep. *Climate:* Boreal to cool temperate(hemi-boreal). *Soil/substrate/hydrology:* Poorly to very poorly drained organic, acidic soils typify this group.

DISTRIBUTION

***Geographic Range:** This acidic forested peatland group is found in eastern Canada, extending into the most northern parts of northern New England (Maine, New Hampshire, Vermont, and parts of New York) and the Great Lakes region (particularly in northern Minnesota, Wisconsin and Michigan). Extension into the Atlantic boreal region is under review.
Nations: CA, US
States/Provinces: MB, ME, MI, MN, NB, NH, NS, NY, ON, PE?, VT, WI
USFS Ecoregions (2007) [optional]: 211A:CC, 211B:CC, 211C:CC, 211D:CC, 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212K:CC, 212L:CC, 212M:CC, 212N:CC, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC, M211A:CC, M211B:CC, M211C:CC, M211D:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	APn81 Northern Poor Conifer Swamp	Minnesota DNR 2003	
<	Apn80 Black Spruce Bog	Minnesota DNR 2003	
><	Muskeg	Kost et al. 2007	

Relationship to NVC	Supporting Concept Name	Short Citation	Note
><	Poor Conifer Swamp	Kost et al. 2007	

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard and D. Faber-Langendoen, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard and D. Faber-Langendoen

Acknowledgments [optional]: K. Baldwin

Version Date: 10 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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Harris, A. G., S. C. McMurray, P. W. C. Uhlig, J. K. Jeglum, R. F. Foster, and G. D. Racey. 1996. Field guide to the wetland ecosystem classification for northwestern Ontario. Ontario Ministry of Natural Resources, Northwest Science and Technology, Thunder Bay, Ontario. Field guide FG-01. 74 pp. plus appendix.

Kost, M. A., D. A. Albert, J. G. Cohen, B. S. Slaughter, R. K. Schillo, C. R. Weber, and K. A. Chapman. 2007. Natural communities of Michigan: Classification and description. Report No. 2007-21, Michigan Natural Features Inventory, Lansing. 314 pp. [http://web4.msue.msu.edu/mnfi/reports/2007-21_Natural_Communites_of_Michigan_Classification_and_Description.pdf]

Minnesota DNR [Minnesota Department of Natural Resources]. 2003. Field guide to the native plant communities of Minnesota: The Laurentian Mixed Forest Province. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. Minnesota Department of Natural Resources, St. Paul.

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1. Forest & Woodland

1.B.5.Na. North American Boreal Flooded & Swamp Forest

M300. North American Boreal Flooded & Rich Swamp Forest

Type Concept Sentence: This type is found across the North American boreal region, from Alaska to Newfoundland, including rich floodplain and rich swamp forests.

OVERVIEW

***Hierarchy Level:** Macrogroup

***Placement in Hierarchy:** 1.B.5.Na.2. North American Boreal Flooded & Swamp Forest (D016)

Elcode: M300

***Scientific Name:** North American Boreal Flooded & Rich Swamp Forest Macrogroup

***Common (Translated Scientific) Name:** North American Boreal Flooded & Rich Swamp Forest Macrogroup

***Colloquial Name:** North American Boreal Flooded & Rich Swamp Forest

***Type Concept:** Boreal rich swamp and floodplain forests develop on wet soils where the interaction of climate and landscape results in permanent or semipermanent water tables at or near to the soil surface, but where water, nutrient and temperature regimes lie within the range required for tree establishment and growth. These wet forests are of two main types in boreal North America: (1) forests and woodlands that are strongly influenced by permanently high water tables where the flow rate, subsurface depth and alkaline chemistry of groundwater determine site moisture and nutrient characteristics, and (2) forests and woodlands on sites that do not have permanent water tables at or near the soil surface, but that may be seasonally flooded for short periods during the growing season; soils are freely drained such that anoxic conditions are quickly relieved after subsidence of floodwaters. The first case describes rich swamps. In the second case, flood ecosystems develop alongside waterbodies that periodically overflow their banks or where subsurface water tables are within the rooting zone for part of the growing season. These conditions do not usually cover extensive areas and typically occur on fine-textured mineral soils beside flood-prone rivers or lakes.

Across all regions of the North American boreal, *Larix laricina* occurs with *Picea mariana* across all regions in treed wetlands that are moderately well-supplied with nutrients (intermediate to rich). In eastern Canada, *Abies balsamea* and *Betula papyrifera* also occur in intermediate wetlands; in western Canada, *Picea glauca* can be present. On nutrient-rich sites (rich swamps or flooded sites) with primarily mineral soils and where water tables draw down during the growing season, broad-leaved deciduous trees often dominate. *Populus balsamifera, Populus tremuloides, Betula papyrifera*, and *Picea glauca* are common across all regions. In Alberta, Saskatchewan and Manitoba, *Acer negundo* may also be an important constituent. East of the Manitoba-Ontario border, *Fraxinus nigra, Thuja occidentalis*, and *Abies balsamea* are prevalent. In Alaska, *Populus balsamifera ssp. balsamifera* is the dominant deciduous tree in floodplains in the continental boreal region, while *Populus balsamifera ssp. trichocarpa* is dominant in the subboreal region. *Picea glauca* may be codominant in mid-seral stages and becomes dominant in late-seral stages. *Picea x lutzii* replaces *Picea glauca* in the transitional region between the subboreal and temperate biomes.

The moss flora of rich swamps (rich wooded fens) is dominated by brown mosses (e.g., *Tomentypnum nitens, Aulacomnium palustre*). Rich swamps with standing and flowing water and higher nutrient status support *Salix* spp. and *Betula* spp. shrubs as well as a higher diversity of sedges (especially *Carex* spp.) and grasses (especially *Calamagrostis canadensis*). *Cornus sericea* and, especially in eastern Canada, *Alnus incana* are important shrub species on nutrient-rich sites. The understories of hardwood swamps on moist, rich sites are typically vigorous and species-rich because of high light levels beneath the transmissive canopies of these small-leaved broadleaf trees. In Alaska, *Alnus viridis ssp. sinuata* occurs more commonly in the subboreal, while *Alnus viridis ssp. fruticosa* is more common to the north in the continental boreal. *Alnus incana ssp. tenuifolia* occurs on poorly drained floodplain terraces in both boreal regions. *Salix alaxensis* is the most common willow across both the subboreal and boreal regions. Other common willows include *Salix pulchra* and *Salix barclayi* (subboreal only).

***Diagnostic Characteristics:** Tall trees often with tall shrubs and a strong bryophyte layer along with flooded or saturated soils rich in nutrients.

***Classification Comments:** The concept for this macrogroup was developed by the CNVC Technical Committee (Ken Baldwin, chair), and a full description of the type is available on their website (cnvc-cnvc.ca).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M496	West-Central North American Boreal Forest & Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is represented by a mixed mosaic of forest and woodland vegetation composed of needle-leaved evergreen trees and broad-leaved deciduous trees.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Canadian National Vegetation Classification (CNVC) recognizes regional west to east differences. Across all regions of the North American boreal, *Larix laricina* occurs with *Picea mariana* across all regions in treed wetlands that are moderately well-supplied with nutrients (intermediate to rich). In eastern Canada, *Abies balsamea* and *Betula papyrifera* also occur in intermediate wetlands; in western Canada and Alaska, *Picea glauca* can be present. On nutrient-rich sites (rich swamps or flooded sites) with primarily mineral soils and where water tables draw down during the growing season, broad-leaved deciduous trees often dominate. *Populus balsamifera, Populus tremuloides, Betula papyrifera*, and *Picea glauca* are common across all regions. In Alberta, Saskatchewan and Manitoba, *Acer negundo* may also be an important constituent. East of the Manitoba-Ontario border, *Fraxinus nigra, Thuja occidentalis*, and *Abies balsamea* are prevalent. In Alaska, *Populus balsamifera ssp. balsamifera* is the dominant deciduous tree in floodplains in the continental boreal region, while *Populus balsamifera ssp. trichocarpa* is dominant in the subboreal region. *Picea glauca* may be codominant in mid-seral stages and becomes dominant in late-seral stages. *Picea x lutzii* replaces *Picea glauca* in the transitional region between the subboreal and temperate biomes.

Several understory shrub, herb, moss and lichen species are indicative of relative moisture and nutrient status in these forests and woodlands. The moss flora of rich swamps (rich wooded fens) is dominated by brown mosses (e.g., *Tomentypnum nitens, Aulacomnium palustre*). Rich swamps with standing and flowing water and higher nutrient status support *Salix* spp. and *Betula* spp. shrubs as well as a higher diversity of sedges (especially *Carex* spp.) and grasses (especially *Calamagrostis canadensis*). *Cornus sericea (= Cornus stolonifera)* and, especially in eastern Canada, *Alnus incana* are important shrub species on nutrient-rich sites. The understories of hardwood swamps on moist, rich sites are typically vigorous and species-rich because of high light levels beneath the transmissive canopies of these small-leaved broadleaf trees. In Alaska, *Alnus viridis ssp. sinuata* occurs more commonly in the subboreal, while *Alnus viridis ssp. fruticosa* is more common to the north in the continental boreal. *Alnus incana ssp. tenuifolia* occurs on poorly drained floodplain terraces in both boreal regions. *Salix alaxensis* is the most common willow across both the subboreal and boreal regions. Other common willows include *Salix pulchra* and *Salix barclayi* (subboreal only). The composition of the herbaceous layer is diverse and varies by substrate type. Common herbaceous species may include *Calamagrostis canadensis, Equisetum arvense, Chamerion angustifolium, Aconitum delphiniifolium, Hedysarum alpinum*, and *Rubus arcticus*. *Hylocomium splendens* is the dominant moss in late-seral stands.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: High water table or seasonal flooding determines and maintains these swamps.

ENVIRONMENT

Environmental Description: These wet forests are of two main types in boreal North America: (1) forests and woodlands that are strongly influenced by permanently high water tables where the flow rate, subsurface depth and alkaline chemistry of groundwater determine site moisture and nutrient characteristics, and (2) forests and woodlands on sites that do not have permanent water tables at or near the soil surface, but that may be seasonally flooded for short periods during the growing season; soils are freely drained such that anoxic conditions are quickly relieved after subsidence of floodwaters. The first case describes rich swamps.

DISTRIBUTION

***Geographic Range:** This type is found across the North American boreal region, from Alaska to Newfoundland.
Nations: CA, US
States/Provinces: AB, AK, MB, ON, SK
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G810	Atlantic Boreal Flooded & Rich Swamp Forest
G052	Eastern Boreal Hardwood Floodplain & Swamp
G809	Ontario-Québec Boreal Flooded & Rich Swamp Forest
G844	West-Central Boreal Flooded & Rich Swamp
G548	Alaskan-Yukon Boreal Flooded & Rich Swamp

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2011-04-08	M038 Central & Eastern Boreal Flooded & Swamp Forest Macrogroup	M038 split into M299 & M300

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al.

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** D. Faber-Langendoen and G. Kittel
Acknowledgments [optional]:
Version Date: 29 Mar 2017

REFERENCES

***References [Required if used in text]:**
Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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1. Forest & Woodland
1.B.5.Na. North American Boreal Flooded & Swamp Forest

G052. Eastern Boreal Hardwood Floodplain & Swamp [Proposed (Submitted)]

Type Concept Sentence: These floodplain forests are found in parts of the eastern boreal regions of Canada, extending to the extreme northern portions of the eastern U.S. The group includes floodplain forests dominated by trees such as *Populus balsamifera* and *Fraxinus nigra*. *Acer saccharinum* is absent. *Populus tremuloides, Ulmus americana, Betula papyrifera*, and *Abies balsamea* are common associates.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 1.B.5.Na.2. North American Boreal Flooded & Rich Swamp Forest (M300)

Elcode: G052
***Scientific Name:** *Populus balsamifera - Fraxinus nigra - Abies balsamea* Flooded & Swamp Forest Group
***Common (Translated Scientific) Name:** Balsam Poplar - Black Ash - Balsam Fir Flooded & Swamp Forest Group
***Colloquial Name:** Eastern Boreal Hardwood Floodplain & Swamp

***Type Concept:** These floodplain forests are found in parts of the eastern boreal regions of Canada, extending to the extreme northern portions of the eastern U.S. They are found along medium-sized rivers, in areas not strongly influenced by ice-scour (i.e., depositional), where topography and process have resulted in a complex of upland and wetland alluvial vegetation. The group includes floodplain forests dominated by trees such as *Populus balsamifera* and *Fraxinus nigra*. *Acer saccharinum* is absent. *Populus tremuloides, Ulmus americana, Betula papyrifera*, and *Abies balsamea* are common associates; occasionally, *Thuja occidentalis* and *Picea glauca* may be present, but with low abundance. Shrubs, including *Alnus incana, Acer spicatum, Corylus cornuta*, and *Cornus sericea*, may be abundant. Ferns are common in the herb layer, including *Athyrium filix-femina, Dryopteris* spp., *Gymnocarpium dryopteris, Onoclea sensibilis*, and, occasionally, *Matteuccia struthiopteris*; other common herbs include *Rubus pubescens, Mitella nuda, Aralia nudicaulis, Circaea* spp., *Galium triflorum*, and *Calamagrostis canadensis*. Most areas are flooded each spring; microtopography determines how long the various microhabitats are inundated.

***Diagnostic Characteristics:** Floodplain or lakeplain setting with dominance by some combination of *Populus balsamifera, Populus tremuloides*, and *Fraxinus nigra*; *Acer saccharinum* is absent.

***Classification Comments:** This type extends westward to southeastern Manitoba. Riparian vegetation in the central and western boreal is different. This type is not well-documented in the U.S. because boreal conditions in Canada are different than sub-boreal conditions in the U.S.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Partial-canopy to closed-canopy forest. Trees may not reach great age as a result of the regular hydrologic disturbance. The shrub and herb layers vary in extent.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The group includes floodplain forests dominated by trees such as *Populus balsamifera* and *Fraxinus nigra*. *Acer saccharinum* is absent. *Populus tremuloides, Ulmus americana, Betula papyrifera*, and *Abies balsamea* are common associates; occasionally, *Thuja occidentalis* and *Picea glauca* may be present, but with low abundance. Shrubs, including *Alnus incana, Acer spicatum, Corylus cornuta*, and *Cornus sericea*, may be abundant. Ferns are common in the herb layer, including *Athyrium filix-femina, Dryopteris* spp., *Gymnocarpium dryopteris, Onoclea sensibilis*, and, occasionally, *Matteuccia struthiopteris*; other common herbs include *Rubus pubescens, Mitella nuda, Aralia nudicaulis, Circaea* spp., *Galium triflorum*, and *Calamagrostis canadensis*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: *Climate:* Boreal. *Soil/substrate/hydrology:* These forests develop on fine-textured alluvial soils along larger rivers and in some glacial lakeplains. They are generally flooded each spring, but the soils do not necessarily remain saturated throughout the growing season.

DISTRIBUTION

***Geographic Range:**
Nations: CA, US
States/Provinces: ME, MI, MN, NB, NH, NY, ON, QC, SK?, VT
USFS Ecoregions (2007) [optional]: 212J:CP, 212L:CP, 212M:CP, 212N:CP, 212R:CP, 212S:CP, 212T:CP, 212X:CP, 212Y:CP, 222N:CC, M211A:CC, M211B:CP
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Proposed (Submitted)
USNVC Confidence Comments [optional]: Canadian information would improve the delineation and description of this group.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Balsam Poplar Floodplain Forest	Gawler and Cutko 2010	
<	Northwestern Wet Aspen Forest	Minnesota DNR 2003	description based on 15 plots.

AUTHORSHIP

***Primary Concept Source [if applicable]:** S.C. Gawler and A. Cutko (2010)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler and K. Baldwin
Acknowledgments [optional]: K. Baldwin
Version Date: 08 Oct 2013

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Gawler, S. C., and A. Cutko. 2010. Natural landscapes of Maine: A classification of vegetated natural communities and ecosystems. Maine Natural Areas Program, Department of Conservation, Augusta.

Minnesota DNR [Minnesota Department of Natural Resources]. 2003. Field guide to the native plant communities of Minnesota: The Laurentian Mixed Forest Province. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. Minnesota Department of Natural Resources, St. Paul.

2. SHRUB & HERB VEGETATION

Grasslands, shrublands, open tree savannas, marshes, bogs and fens dominated by broadly mesomorphic (including scleromorphic) shrub and herb growth forms (including *broad-leaved, needle-leaved*, and *sclerophyllous shrubs*, and *forb* and *graminoid herbs*) with an irregular horizontal canopy structure, mesomorphic trees typically <10% cover (but tropical tree savannas typically <40%), tropical to boreal and subalpine climates, and wet to dry substrate conditions.

2.A. Tropical Grassland, Savanna & Shrubland

Tropical Grassland, Savanna & Shrubland is dominated by mesomorphic grasses and shrubs, with or without scattered trees (but trees typically <40% cover), ranging from tropical coastal to inland lowland and montane grasslands and shrublands. Stands are found in warm tropical continental climates, typically from the equator to about 23°N and S latitude, with low or pronounced rainfall seasonality, with either one or two short dry seasons, or one long dry season, but frost virtually absent.

2.A.1. Tropical Lowland Grassland, Savanna & Shrubland

Tropical Lowland Grassland, Savanna & Shrubland is characterized by a ground layer with a more-or-less continuous grass or graminoid layer, or mixed forb layer that may have up to 80-90% shrub cover and/or typically <40% tree cover, and <8 m tall. Shrubs are predominantly broad-leaved evergreen and deciduous, but sclerophyllous growth forms are also included. Stands are found in warm tropical continental climates, with low or pronounced rainfall seasonality, with either one or two short dry seasons, or one long dry season.

2.A.1.Ea. Caribbean-Mesoamerican Lowland Grassland, Savanna & Shrubland

2. Shrub & Herb Vegetation
2.A.1.Ea. Caribbean-Mesoamerican Lowland Grassland, Savanna & Shrubland

M671. Caribbean Dry Scrub

Type Concept Sentence: This dry scrub macrogroup, found in the Florida Keys and most of the Caribbean islands, varies widely in floristic composition across its distribution but has a broadly similar set of ecological factors, including highly seasonal precipitation and limiting substrate conditions, such as ultramafic soils, exposed limestone, dogtooth limestone, or coastal rock pavements, limestone terraces, and boulderfields exposed to wind and salt spray. The vegetation is typically open, with a low-statured canopy formed by small trees and shrubs, where often cacti are dominant or codominant. Floristic diversity is relatively low and endemism levels are very high.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.A.1.Ea.1. Caribbean-Mesoamerican Lowland Grassland, Savanna & Shrubland (D094)

Elcode: M671
***Scientific Name:** *Pithecellobium unguis-cati - Opuntia* spp. - *Agave* spp. Scrub Macrogroup
***Common (Translated Scientific) Name:** Catclaw Blackbead - Prickly-pear species - Agave species Scrub Macrogroup
***Colloquial Name:** Caribbean Dry Scrub

***Type Concept:** This macrogroup encompass tropical and subtropical dry scrub distributed in the Florida Keys and most of the Caribbean islands. The physiognomy of the vegetation types included is varied: from an open, primarily herbaceous community with scattered shrubs and columnar and tree-shaped cacti, to a mixed evergreen, drought-deciduous scrub (stunted trees, shrubs and low palms) with succulents, which can be dense and varying in height from 0.4 to 4 m. Stands of serpentine scrubs that alternate with small grassy clearings also occur, as well as sand savannas. Common plant growth forms include evergreen sclerophyllous and microphyllous shrubs, small or arborescent cacti, plants in rosettes (such as agaves and terrestrial bromeliads), semi-deciduous shrubs, and emergent palms. The ecology is characterized by a dry season of 2-6 months and occurs on limiting substrate conditions related to the presence of ultramafic soils, exposed limestone, dogtooth limestone, or rocky areas of Key Largo limestone with little soil or leaf litter. Most commonly these environmental characteristics are present in coastal areas; however, inland communities can occur growing on ferrallitic soils, which are derived from serpentine in isolated locations in the lowlands. Habitat diversity in this edaphoxerophylous system is spatially very heterogeneous and patchy. Given that this type develops under limiting environmental factors, variation in the dry season period, topography, and substrate determines the specific characteristics of the vegetation communities in this macrogroup since all of these factors have great importance as determinants of variation in water availability and physiological adaptations.

***Diagnostic Characteristics:** Stands are characterized by an overstory of scattered shrubs (*Cordia* spp. *Erithalis fruticosa*), stunted trees (*Eugenia, Bursera, Thouinia, Coccoloba* spp.) or short-statured palms (*Coccothrinax* spp.), and herbaceous communities with grasses or sedges codominated by *Agave* spp. and small or columnar cacti (*Melocactus, Opuntia, Harrisia, Pilosocereus*). The canopy layer varies from very open to closed depending on the site conditions.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The physiognomy of the vegetation types included is varied: from an open, primarily herbaceous community with scattered shrubs in the Florida Keys, to a mixed evergreen, drought-deciduous scrub of stunted trees, shrubs, low palms, and succulents, which can be dense and varying in height from 0.4 to 4 m with scattered emergent trees or palms; the latter physiognomy is more common of the communities in the Caribbean islands. Stands of serpentine scrubs that alternate with small grassy clearings also occur in Cuba and Puerto Rico. The macrogroup includes edaphic savannas growing on silica sands that support short grass and sedge savanna with palms and sometimes with pines (WWF and IUCN 1997). In the scrub community types, common plant growth forms include evergreen sclerophyllous and microphyllous shrubs, small or arborescent cacti, plants in rosettes (such as agaves and terrestrial bromeliads), semi-deciduous shrubs, and emergent palms. The scrub physiognomy is determined by a combination of low rainfall, which may be less than 700 mm per year (WWF and IUCN 1997) and the harsh conditions imposed by the substrate.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: In the Florida Keys the cactus barren community pertaining to this macrogroup consists of a wide variety of herbaceous and succulent species which characteristically includes cacti, agaves, stunted trees, and several rare herbs. These frequently occur with grasses and sedges, such as *Leptochloa dubia, Paspalidium chapmanii*, and *Cyperus elegans* (Avery 1982, as cited in FNAI 2010a). Spiny species, particularly the rare *Opuntia triacantha*, are characteristic but their abundance is variable. Other spiny species include *Agave decipiens, Acanthocereus tetragonus*, and *Opuntia stricta*. Scattered clumps of stunted trees may be present, including *Bursera simaruba, Conocarpus erectus, Eugenia foetida*, and *Pithecellobium unguis-cati* (Avery 1982, as cited in FNAI 2010a). Diagnostic species vary across the Caribbean islands; the Cuban scrub on limestone substrate is dominated by the shrubs *Auerodendron cubense, Coccothrinax munizii, Cordia leucosebestena, Eugenia cowellii, Jacquinia berteroi, Picrodendron macrocarpum, Polygala guantanamana, Randia spinifex*, and cacti and succulents *Agave albescens, Consolea macracantha, Dendrocereus nudiflorus, Harrisia fernowii, Melocactus acunae*, and *Pilosocereus brooksianus* (Huggins et al. 2007), while this type in Puerto Rico features endemic *Harrisia portoricensis*, and shrubs *Croton discolor, Croton betulinus, Erithalis fruticosa, Plumeria obtusa*, and *Reynosia uncinata* (Rojas-Sandoval and Melendez-Ackerman 2012b, Medina et al. 2014).

In the Lesser Antilles typical species of the mixed cactus scrub on limestone pavement include *Agave karatto, Capparis cynophallophora, Capparis indica, Clerodendrum aculeatum, Haematoxylon campechianum, Leucaena leucocephala, Pilosocereus royenii, Pisonia aculeata, Pisonia subcordata*, and *Pithecellobium unguis-cati* (Areces-Mallea et al. 1999). In Bahamas, when the limestone pavement community occurs right above the water table and there is more moisture available, characteristic species include *Sideroxylon americanum (= Bumelia americana), Bursera simaruba, Cephalocereus* sp., *Cladium mariscus ssp. jamaicense, Coccoloba northropiae, Coccoloba tenuifolia, Guettarda scabra, Manilkara jaimiqui ssp. emarginata (= Manilkara bahamensis), Pithecellobium bahamense, Psidium longipes, Randia aculeata, Stigmaphyllon sagraeanum*, and *Tabebuia bahamensis* (Areces-Mallea et al. 1999). On serpentine derived soils present in Puerto Rico and Cuba, characteristic species include *Comocladia dodonaea, Croton lucidus, Pictetia aculeata, Pilosocereus royenii, Plumeria alba, Thouinia striata var. portoricensis* and evergreen trees *Acrosynanthus minor, Annona bullata, Antirhea abbreviata, Antirhea orbicularis, Byrsonima bucheri, Exostema purpureum, Hemithrinax savannarum, Jacquinia shaferi, Myrtus cabanesensis, Neobracea valenzuelana, Phyllanthus comosus, Phyllanthus orbicularis, Rondeletia camarioca, Spirotecoma apiculata*, and *Tabebuia linearis*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The natural process giving rise to cactus barrens in the Florida Keys is not known, but since they occur on sites where the thin layer of organic soil over limestone bedrock is missing, they may have formed by soil erosion following destruction of the plant cover by fire, storm, or artificial clearing. The edaphic shortgrass savannas have been characterized in Cuba as a natural community (*Schizachyrium tenerum, Leptocoryphium lanatum, Byrsonima*) by Fiala and Herrera (1988) but other studies (Borhidi 1988) state that the original vegetation of these soil types is a thorny scrub/woodland consisting of endemic palms and trees which has been converted long ago to open palm grasslands, and used intensively as pastures. Thus, Caribbean Moist Shortgrass Savanna Group (G465), included in this macrogroup, should be considered a seral stage resulting from the past intense disturbance of the thorny scrub referred to by Borhidi (1988).

ENVIRONMENT

Environmental Description: *Climate:* At sea level, temperatures in February, which is often the coolest and driest month, rarely fall to 12°C. Rainy seasons are usually warmer, but temperature maxima rarely reach 33°C. Overall averages at sea level are mostly in the range 25-27°C. Annual precipitation ranges from 600 to 1500 mm for the distribution range of this macrogroup and the dry season is usually limited to one period that can last for 2-6 months, or divided into two periods together lasting up to 8 months. The main dry period is usually between January and April; there may be a second dry period in more southerly latitudes in July to September.

Soil/substrate/hydrology: The limestone substrate has low water-retention capacity, and rainfall leaches easily after accumulating in cracks and crevices of variable depth. The underlying calcareous rock is prone to erosion in the presence of water acidified with CO_2 from the atmosphere or contributed by root respiration and decomposition of organic matter in the litter layer (Lugo et al. 2001 cited in Medina et al. 2014). The major nutrient sources in these areas are probably cations adsorbed by the clay accumulated in cracks and crevices, and deposited on the bottom of the depressions (Medina et al. 2014). The macrogroup includes edaphic savannas growing on silica sands and in seasonal conditions that result in actual drought during periods of low rainfall and physiological drought due to impeded drainage and waterlogging during periods of high rainfall. These savannas are level and usually have topsoils of silica sands with impervious subsoil horizons. They occur in Cuba, Jamaica, Puerto Rico and Trinidad and are renowned for their local floristic diversity in contrast to savannas derived from removal of the woodlands and periodical fire and grazing. (WWF and IUCN 1997).

DISTRIBUTION

***Geographic Range:** This macrogroup is distributed in the Florida Keys and most of the islands of the Greater and Lesser Antilles.
Nations: BS, CU, DO, HT, JM, PR, TT, US, VI, XC, XD
States/Provinces: FL
USFS Ecoregions (2007) [optional]: 411A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G485	Caribbean Coastal Cactus Scrub
G479	Caribbean Karstic Dry Scrub
G463	Caribbean Serpentine Dry Scrub
G465	Caribbean Moist Shortgrass Savanna

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-05-10	M295 Caribbean Serpentine Dry Forest Macrogroup	M295 concept covered by M671
2013-05-10	M670 Antillean Mixed Evergreen & Deciduous Shrubland Macrogroup	M670 concept covered by M671
2013-05-10	M288 Caribbean Thorn Woodland Macrogroup	M288 is redundant with M671

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse, in Faber-Langendoen et al. (2015)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse
Acknowledgments [optional]:
Version Date: 13 Apr 2015

REFERENCES

***References [Required if used in text]:**

Areces-Mallea, A. E., A. S. Weakley, X. Li, R. G. Sayre, J. D. Parrish, C. V. Tipton, and T. Boucher. 1999. A guide to Caribbean vegetation types: Preliminary classification system and descriptions. The Nature Conservancy, Arlington, VA. 166 pp.
Borhidi, A. 1988. Vegetation dynamics of the savannization process on Cuba. Vegetatio 77:177-183.
FNAI [Florida Natural Areas Inventory]. 2010a. Guide to the natural communities of Florida: 2010 edition. Florida Natural Areas Inventory, Tallahassee, FL. 228 pp.
Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]
Fiala, K., and R. Herrera. 1988. Living and dead belowground biomass and its distribution in some savanna communities in Cuba. Folia Geobotanica et Phytotaxonomica 23(2):113-224.
Huggins, A. E., S. Keel, P. Kramer, F. Núñez, S. Schill, R. Jeo, A. Chatwin, K. Thurlow, M. McPherson, M. Libby, R. Tingey, M. Palmer, and R. Seybert. 2007. Biodiversity conservation assessment of the insular Caribbean using the Caribbean Decision Support System, Technical Report, The Nature Conservancy.
Medina, E., E. H. Helmer, E. Meléndez-Ackerman, and H. Marcano-Vega. 2014. Natural vegetation groups and canopy chemical markers in a dry subtropical forest on calcareous substrate: The vegetation of Mona Island, Puerto Rico. Caribbean Naturalist 13:1-15.
Rojas-Sandoval, J., and E. Melendez-Ackerman. 2012b. Factors affecting establishment success of the endangered Caribbean cactus Harrisia portoricensis (Cactaceae). International Journal of Tropical Biology 60 (2):867-879.
WWF and IUCN [World Wildlife Fund and The World Conservation Union]. 1997. Centres of Plant Diversity. A guide and strategy for their conservation. Volume 3. IUCN Publications Unit. Cambridge, U.K.

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2. Shrub & Herb Vegetation
2.A.1.Ea. Caribbean-Mesoamerican Lowland Grassland, Savanna & Shrubland

G485. Caribbean Coastal Cactus Scrub

Type Concept Sentence: This Caribbean coastal open cactus- and grass-dominated scrub with scattered shrubs and small trees occurs on dry rocky limestone sites with sparse or thin soils which are prone to drought.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.A.1.Ea.1. Caribbean Dry Scrub (M671)

Elcode: G485
***Scientific Name:** *Opuntia* spp. - *Paspalidium chapmanii* Caribbean Coastal Cactus Scrub Group
***Common (Translated Scientific) Name:** Prickly-pear species - Chapman's Bristlegrass Caribbean Coastal Cactus Scrub Group
***Colloquial Name:** Caribbean Coastal Cactus Scrub

***Type Concept:** This group occurs either on sandy or rocky substrates, along the Caribbean coasts, or higher in areas of low rainfall. Few species of thorny trees and shrubs form an open canopy with a maximum height of 5 m, and the herb (mainly grasses) layer and cacti are conspicuous. Vegetation cover by annual plants varies due to large quantitative and seasonal rain fluctuations. Cacti are codominant; columnar and tree-shaped cacti are common. Microphyllous shrubs, small succulent trees, plants in rosettes (such as agaves and terrestrial bromeliads) or evergreen and semi-deciduous shrubs can also be present. In Puerto Rico, the cactus scrub is associated with limestone pavements. In the Bahamas, this type occurs on limestone pavements with sinkholes and "dogtooth" terrain above the water table. In many areas, this vegetation has an open aspect. Species vary across the Antilles, Bahamas, and the Florida Keys, but common plants include *Agave* spp., *Croton flavens, Dendrocereus nudiflorus, Eugenia* spp., *Leptochloa dubia, Opuntia* spp., *Paspalidium chapmanii, Pilosocereus brooksianus*, and *Stenocereus* spp.

***Diagnostic Characteristics:**

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Few species of thorny trees and shrubs form an open canopy with a maximum height of 5 m, and the herb (mainly grasses) layer is conspicuous. Vegetation cover by annual plants varies due to large quantitative and seasonal rain fluctuations. Cacti are codominant; columnar and tree-shaped cacti are common. Microphyllous shrubs, small succulent trees, plants in rosettes (such as agaves and terrestrial bromeliads) or evergreen and semi-deciduous shrubs can also be present. In many areas, this vegetation has an open aspect, and is primarily herbaceous (FNAI 2010a).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The following list of species is diagnostic for this group: *Agave albescens, Agave missionum, Bourreria cumanensis, Caesalpinia* spp., *Capparis* spp., *Cercidium* sp., *Consolea macracantha, Cordia* spp., *Cylindropuntia hystrix, Dendrocereus nudiflorus, Erithalis fruticosa, Gochnatia* sp., *Guaiacum officinale, Guettarda* sp., *Jacquinia armillaris (= Jacquinia arborea), Lantana involucrata, Melocactus acunae, Opuntia militaris, Opuntia dillenii, Opuntia triacantha, Pilosocereus brooksianus, Plumeria alba, Rhodocactus cubensis, Stenocereus fimbriatus (= Stenocereus hystrix, = Ritterocereus hystrix)*, and *Stenocereus griseus (= Ritterocereus griseus, = Ritterocereus deficiens)*. In Puerto Rico, the Lesser Antilles, and Bahamas, the following species are typical: *Calliandra purpurea, Chrysobalanus icaco, Coccoloba* spp., *Comocladia dodonaea, Croton flavens, Eugenia xerophytica, Manilkara jaimiqui ssp. emarginata (= Manilkara bahamensis), Melocactus intortus, Oplonia spinosa, Pilosocereus royenii, Psidium longipes, Stenocereus fimbriatus, Stigmaphyllon sagraeanum*, and *Tabebuia bahamensis* (Huggins et al. 2007). In the Florida Keys, characteristic species include *Acanthocereus tetragonus, Cienfuegosia yucatanensis, Cyperus elegans, Evolvulus convolvuloides, Indigofera oxycarpa (= Indigofera mucronata var. keyensis), Jacquemontia pentanthos, Leptochloa dubia, Opuntia stricta, Opuntia triacantha*, and *Paspalidium chapmanii* (FNAI 2010a).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Drought occurs from lack of rain and from the rapid drainage of the rocky substrate. Drought keeps the dominance of woody plants low and favors grasses, such as *Paspalidium chapmanii* and *Leptochloa dubia*. Some sites have probably been subject to soil erosion from fire or coastal storm surge, exposing the rocky substrate (FNAI 2010a). The cactus moth (*Cactoblastis cactorum*) is a threat to all the *Opuntia* which occur in Caribbean Coastal Cactus Scrub. It is native to South America, but has spread in coastal areas of the Caribbean and southern United States.

ENVIRONMENT

Environmental Description: *Climate:* This group occurs in coastal areas, especially areas of rainshadows created by mountains and in areas of extreme temperatures. Xeric areas generally have low and highly seasonal precipitation with a range of 800-1000 mm annual precipitation, with great variation between years. The rainy season is from May through November. The driest months are February and March. Overall temperature averages at sea level are mostly in the range of 25-27°C. Annual precipitation ranges from 600 to 1500 mm for the distribution range of this group. The dry season is usually limited to one period that can last for 2-6 months, or divided into two periods together lasting up to 8 months. The main dry period is usually between January and April; there may be a second dry period in more southerly latitudes in July to September.

Soil/substrate/hydrology: This group occurs either on sandy or rocky substrates, along the Caribbean coasts, or higher in areas of low rainfall. The limestone substrate has low water-retention capacity, and rainfall leaches easily after accumulating in cracks and crevices of variable depth. Other substrates where communities of this group develop also exhibit actual drought during periods of low rainfall and physiological drought due to impeded drainage and waterlogging during periods of high rainfall. In Puerto Rico, the cactus scrub is associated with limestone pavements. In the Bahamas, this type occurs on limestone pavements with sinkholes and "dogtooth" terrain above the water table. In the Florida Keys, it is associated with rocky areas of limestone with thin soils.

DISTRIBUTION

***Geographic Range:** This group occurs in coastal areas of the Caribbean, including south Florida, the Bahamas, and the Antilles.
Nations: BS, CU, DO, HT, JM, PR, TT, US, VI, XC, XD
States/Provinces: FL
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-05-17	G468 Caribbean Coastal Thorn Scrub Group	G468 is redundant with G485

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
?	Cactus scrub	Beard 1955	
?	Keys Cactus Barren	FNAI 2010a	
<	Puerto Rico land cover type 49, Dry cactus grassland and shrubland	Gould et al. 2008	
<	Puerto Rico land cover type 9, Lowland dry cactus shrubland	Gould et al. 2008	
?	Succulent extremely xeromorphic evergreen shrubland Formation	Areces-Mallea et al. 1999	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse and C. Nordman, in Faber-Langendoen et al. (2016)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse and C. Nordman
Acknowledgments [optional]:
Version Date: 08 Feb 2016

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International Institute of Tropical Forestry. No date. Maps of vegetation and land cover in Puerto Rico. [in press]
Josse, C., G. Navarro, P. Comer, R. Evans, D. Faber-Langendoen, M. Fellows, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological systems of Latin America and the Caribbean: A working classification of terrestrial systems. NatureServe, Arlington, VA.

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2. Shrub & Herb Vegetation
2.A.1.Ea. Caribbean-Mesoamerican Lowland Grassland, Savanna & Shrubland

G463. Caribbean Serpentine Dry Scrub

Type Concept Sentence: This dry scrub has many endemic plant species and genera, and occurs on serpentine soils in Cuba and southwestern Puerto Rico.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.A.1.Ea.1. Caribbean Dry Scrub (M671)

Elcode: G463
***Scientific Name:** Caribbean Serpentine Dry Scrub Group
***Common (Translated Scientific) Name:** Caribbean Serpentine Dry Scrub Group
***Colloquial Name:** Caribbean Serpentine Dry Scrub

***Type Concept:** This group occurs in gently rolling flatlands or hills up to 450 m elevation. Despite the great variation in substrate, climate, and species composition, the physiognomy of the serpentine scrub is very constant throughout its distribution. It occurs on ferrallitic soils, which are derived from serpentine in isolated locations in the case of Cuba's Cajalbana hills and Holguin area. In Cuba, 5% of the soils are serpentine, and these sites support a third of Cuba's endemic flora. It also occurs in Puerto Rico, especially in the southwest of the island. Examples are dominated by stands of dense, thorny 2- to 4-m high shrubland with emergent palms and evergreen microphyllous trees. The proportion of microphylls and spiny elements is very high, with the exception of cacti which are not common in this type of vegetation. Many plants hyperaccumulate nickel. Stands of serpentine scrubs that alternate with small grassy clearings also occur, except for the more humid, higher elevation communities which are dominated by microphylls and do not present grassy clearings. These often develop into dwarf-grass savannas after grazing or human interference.

***Diagnostic Characteristics:**

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Vegetation is open and dominated by small leaved (microphyllous) and thorny plants. Plants have reduced growth forms, microphylly, stenophylly, sclerophylly, spiny leaves and thorny stems (Iturralde 2001). Due to the plant physiology imposed by the limiting factors of soils derived from serpentines, these communities represent a drier degree than a community living in the same climatic conditions but on non-serpentine rock. Adaptations include xeromorphism or pseudo-xeromorphism, reduced productivity, reduced structure, and advantage of sclerophyllous evergreen shrubs over deciduous trees/shrubs.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The following list of species is diagnostic for this group: *Acrosynanthus minor, Annona bullata, Antirhea abbreviata, Antirhea orbicularis, Byrsonima bucheri, Coccoloba* spp., *Coccothrinax fragrans, Coccothrinax* spp., *Copernicia* spp., *Exostema purpureum, Hemithrinax rivularis var. rivularis, Hemithrinax rivularis var. savannarum (= Hemithrinax savannarum), Ipomoea cordatotriloba (= Ipomoea carolina), Jacaranda cowellii, Jacquinia shaferi, Myrtus cabanesensis, Neobracea valenzuelana, Paepalanthus brittonii, Passiflora cubensis, Phyllanthus comosus, Phyllanthus orbicularis, Pilosocereus royenii, Rondeletia camarioca, Sideroxylon cubense (= Dipholis cubensis), Spirotecoma apiculata, Tabebuia lepidota, Tabebuia linearis, Thouinia striata var. portoricensis, Zanthoxylum dumosum*, and many other very restricted endemics. Grasses include *Aristida neglecta, Aristida refracta, Aristida vilfifolia, Imperata brasiliensis, Schizachyrium multinervosum (= Andropogon multinervosus)*, and *Schizachyrium sanguineum var. hirtiflorum (= Andropogon hirtiflorus)*. Trees (with some palms) include *Acrocomia crispa (= Gastrococos crispa), Byrsonima crassifolia, Coccothrinax* spp., and *Copernicia* spp. In examples in Puerto Rico, common shrubs on serpentine include *Bursera simaruba* (which may be dominant), *Comocladia dodonaea, Croton lucidus, Pictetia aculeata, Pilosocereus royenii, Plumeria alba*, and *Thouinia striata var. portoricensis* (Cedeño-Maldonado and Breckon 1996, Huggins et al. 2007). There are many plants endemic to serpentine.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: On serpentine soils derived from ultramafic rock in Cuba, there are 131 nickel-hyperaccumulating plant species, and 24 endemic genera of plants (Borhidi 2001).

ENVIRONMENT

Environmental Description: *Climate:* Annual precipitation ranges from 1000-1900 mm, with one or two dry seasons annually. *Soil/substrate/hydrology:* Occurs on serpentine soils on isolated sites occurring on the coastal zone and up to lower montane places. In Cuba, 5% of the soils are serpentine, and these sites support a third of Cuba's endemic flora (Iturralde 2001). In southwestern Puerto Rico, especially the Susua area (Gould et al. 2008) it occurs on serpentine soils of the Nipe and Rosario series (Miller and Lugo 2009).

DISTRIBUTION

***Geographic Range:** This group occurs on areas of serpentine on the islands of Cuba, and Puerto Rico (especially in the southwest).
Nations: CU, PR
States/Provinces:
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low - Poorly Documented
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-05-14	G481 Caribbean Serpentine Thorn Evergreen Scrub Group	G481 is covered by G463
2013-05-14	G480 Caribbean Serpentine Semi-Dry Evergreen Scrub Group	G480 is covered by G463

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
?	Arid lowland serpentine shrubwoods	Borhidi 1991	
?	Lowland/submontane serpentine shrubland Formation	Areces-Mallea et al. 1999	
?	Montane serpentine shrubland Formation	Areces-Mallea et al. 1999	
?	Puerto Rico land cover type 18, Dry and moist serpentine woodland and shrubland	Gould et al. 2008	
?	Thorn woodland	Beard 1955	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse and C. Nordman, in Faber-Langendoen et al. (2016)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse and C. Nordman

Acknowledgments [optional]:

Version Date: 04 Feb 2016

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***References [Required if used in text]:**

Areces-Mallea, A. E., A. S. Weakley, X. Li, R. G. Sayre, J. D. Parrish, C. V. Tipton, and T. Boucher. 1999. A guide to Caribbean vegetation types: Preliminary classification system and descriptions. The Nature Conservancy, Arlington, VA. 166 pp.

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2.A.3. Tropical Scrub & Herb Coastal Vegetation

Tropical Scrub & Herb Coastal Vegetation is found in tropical coastal habitats, including beaches, bluffs and dunes, where wind and water are major drivers of the vegetation, from the equator to 23°N and S latitude. It is dominated by prostrate perennials on the beach and foredune, and graminoids and scrub on backdunes and bluffs.

2.A.3.Ee. Caribbean-Mesoamerican Dune & Coastal Grassland & Shrubland

2. Shrub & Herb Vegetation
2.A.3.Ee. Caribbean-Mesoamerican Dune & Coastal Grassland & Shrubland

M700. Caribbean-Mesoamerican Coastal Dune & Beach

Type Concept Sentence: This macrogroup encompasses vegetation of the beach, foredune and rock pavement of the shorelines of the Caribbean islands, extreme southern peninsular Florida, the Florida Keys, and south Florida mangrove islands.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.A.3.Ee.1. Caribbean-Mesoamerican Dune & Coastal Grassland & Shrubland (D254)

Elcode: M700
***Scientific Name:** *Sporobolus virginicus - Ipomoea pes-caprae - Suriana maritima* Coastal Dune & Beach Vegetation Macrogroup
***Common (Translated Scientific) Name:** Seashore Dropseed - Bayhops - Bay-cedar Coastal Dune & Beach Vegetation Macrogroup
***Colloquial Name:** Caribbean-Mesoamerican Coastal Dune & Beach

***Type Concept:** This macrogroup covers the gradient from the upper beach to landward features found on sand-covered shorelines, including shorelines of coastal lagoons, as well as supra-tidal coastal rock pavement and salt spray cliffs. Sand beach vegetation closest to the intertidal zone - the upper beach, comprise mostly annual nitro-halophytes occupying accumulations of drift material and sands rich in nitrogenous organic matter. In the Caribbean coasts, ephemeral growth of *Blutaparon vermiculare, Cakile lanceolata, Cyperus* spp., *Diodia serrulata, Fimbristylis cymosa, Kyllinga* spp., and *Lepidium virginicum* is characteristic, accompanied by patches of *Heliotropium curassavicum* and *Sesuvium portulacastrum*, mostly limited to small depressions. Locally, *Ipomoea pes-caprae, Alternanthera maritima, Remirea maritima*, and other upper beach and foredune species may invade the pioneer foreshore and lower backshore zone. Perennial vines such as *Canavalia rosea* and *Ipomoea pes-caprae* are generally more characteristic of tropical beaches than of temperate ones.

This beach vegetation includes the southernmost of its kind along the mainland Atlantic Coast of North America. Its southerly location distinguishes it from other types, primarily due to the prevalence of the tropical flora it supports. Dunes and foredunes of the tropical portion of the Florida peninsula are distinguished by the presence of *Canavalia rosea* on the upper beach, and *Scaevola plumieri, Suriana maritima, Chamaesyce mesembrianthemifolia*, and occasional shrubs of *Coccoloba uvifera* among *Uniola paniculata*, a perennial rhizomatous grass, whose stems trap the sand grains blown off the beach, building up the dune by growing upward to keep pace with sand burial. Besides southern Florida, the tropical distribution of this type of grassy sea-oat dunes includes the sandy beaches of the Gulf of Mexico north of the Yucatan Peninsula, Cuba, and the Bahamas.

More stable beach ridges, foredunes and primary dunes of the Antilles and the Caribbean coast of South America are colonized by low, usually leaf-succulent shrubs and subshrubs, many of them of pantropical, tropical American or cosmopolitan distribution. The communities formed are fairly constant throughout the tropics and characteristic dominants include *Argusia gnaphalodes, Batis maritima, Borrichia* spp., *Nolana galapagensis, Scaevola plumieri, Suriana maritima*, and *Uniola paniculata*. Low chenopod shrubs such as *Atriplex peruviana, Salicornia "virginica"* s.l. (*Salicornia "fruticosa"* s.l.) are also typically present.

The macrogroup also includes shrub thickets, known in Florida as coastal berms, found on long narrow storm-deposited ridges of loose sediment formed by a mixture of coarse shell fragments, pieces of coralline algae, and other coastal debris. These ridges parallel the shore and may be found in low-energy coastlines in south Florida and the Florida Keys, on the seaward edge or landward edge of the mangroves or further inland depending on the height of the storm surge that formed them. Similar shoreline thicket communities occur in several of the Caribbean islands on locations with mangroves and similar storm dynamics. These thickets are dominated by shrubs and herbs accompanied by small trees, all of tropical floristic affinity. Rock pavement and coastal cliffs are dominated by *Rachicallis americana* and *Borrichia arborescens* that occur in supra-tidal pavement areas.

***Diagnostic Characteristics:** The beach environment of this macrogroup is primarily upland, with some wet patches fed by groundwater. The vegetation may be sparse or patchy in its cover. The rocky or shifting substrate (of sand in most cases) largely limits the vegetation to pioneering, salt-tolerant, succulent annuals or perennial vines. Perennial vines are generally more characteristic of tropical beaches than of temperate ones.

***Classification Comments:** Due to the shared occurrence of *Canavalia rosea, Uniola paniculata*, and other beach grasses further north in Florida and Texas and up to the coast of Virginia, the boundary between the tropical Caribbean communities of south Florida and the south temperate ones is poorly distinguished. Some of the dominant shrubs also occur in tropical salt marsh communities. Borhidi (1991) separates the sandy shoreline vegetation into a separate class from the rocky shoreline vegetation. Here we make that distinction at the group level.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The dynamic disturbance regimes largely limit the vegetation of sandy beaches and dunes to pioneering, salt-tolerant, succulent annuals and perennial vines, which are more prevalent in these tropical examples, as compared to more northerly and temperate ones. The stands of vegetation are generally low in stature (with some clumps of taller grasses) and have sparse to patchy cover. The landward communities of coastal berms and more stable dunes form a short-statured forest or scrub ranging in height from 0.5 to 3 m, and whose structure and composition are variable depending on height and time since the last storm event.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The main components of the upper beach communities are very constant throughout the tropics, comprising, in particular, the creeping *Ipomoea pes-caprae* and *Canavalia rosea*. Specifically, tropical American elements include *Alternanthera ficoidea, Batis maritima, Capraria biflora, Heliotropium curassavicum*, and *Tephrosia cinerea (= var. littoralis)*. *Ipomoea pes-caprae*, the grass *Sporobolus virginicus*, and various succulents are among the principal dominants.

Beach ridges, foredunes and primary dunes of the Caribbean coasts are colonized by dense scrubs dominated by the succulent subshrub *Argusia gnaphalodes (= Tournefortia gnaphalodes)* and the succulent shrub *Suriana maritima* with *Chamaesyce mesembrianthemifolia (= Euphorbia mesembrianthemifolia)*, often accompanied by *Blutaparon vermiculare, Cyperus* spp., *Erigeron* spp., *Opuntia* spp., *Sesuvium portulacastrum, Stemodia maritima, Talinum paniculatum*, and occasional, *Borrichia arborescens, Scaevola plumieri, Spilanthes urens*, and *Turnera ulmifolia*. These communities are typical of stabilized sites where there is a continuous supply of sand brought by the trade winds. In the Caribbean coasts, ephemeral growth of *Blutaparon vermiculare (= Philoxerus vermicularis), Cakile lanceolata, Cyperus* spp., *Diodia serrulata (= Diodia maritima), Fimbristylis cymosa (= Fimbristylis spathacea), Kyllinga* spp., and *Lepidium virginicum* is characteristic, accompanied by patches of *Heliotropium curassavicum* and *Sesuvium portulacastrum*, mostly limited to small depressions. Locally, *Ipomoea pes-caprae, Alternanthera maritima, Remirea maritima*, and other upper beach and foredune species may invade the pioneer foreshore and lower backshore zone. Perennial vines such as *Canavalia rosea* and *Ipomoea pes-caprae* are generally more characteristic of tropical beaches than of temperate ones.

In southeastern Florida the most stable berms may share some tree species with rockland hammocks, but generally have a greater proportion of shrubs and herbs (Ross et al. 1992, as cited in FNAI 2010a). Tree species may include *Bursera simaruba, Casasia clusiifolia (= Genipa clusiifolia), Coccoloba uvifera, Coccothrinax argentata, Drypetes diversifolia, Guapira discolor*, and *Metopium toxiferum*. Characteristic tall shrub and short tree species include *Eugenia foetida, Pithecellobium keyense, Randia aculeata, Sideroxylon celastrinum*, and *Ximenia americana*. Short shrubs and herbs include *Hymenocallis latifolia, Lantana involucrata*, and *Rivina humilis* (Ross et al. 1992, Kruer 1992, as cited in FNAI 2010a). The sparsely vegetated coastal rocky cliffs and pavement are characterized by *Borrichia arborescens, Conocarpus erectus, Erithalis fruticosa, Lithophila muscoides, Opuntia dillenii, Rachicallis americana, Sesuvium maritimum, Sesuvium portulacastrum, Strumpfia maritima*, and *Trianthema portulacastrum*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Plants on the foredune are regularly exposed to salt spray and sand burial from onshore winds. Plants on the upper beach are subject to these stresses plus occasional inundation by seasonal or storm tides and periodic destruction by waves. The plants of the beach dune community are adapted to either withstand these stresses or to rapidly re-colonize from seed or vegetative parts following destruction. Fertilization from piles of seaweed washed up by storms helps to speed plant growth and the re-colonization process. Once a new foredune ridge blocks salt spray and plant cover inhibits sand movement, inland herbaceous and eventually woody species can begin to replace the coastal pioneer species of the beach dune community in the backdune area. The southeast coast of Florida has some of the highest wave energy along the entire Atlantic Coastal Plain (Tanner 1960). The coastal berm is deposited by storm waves along low-energy coasts. Their distance inland depends on the height of the storm surge. Tall berms may be the product of repeated storm deposition. Excavation of one berm in the Florida Keys revealed several layers of buried soils, evidence for burial by repeated storms at relatively long intervals (Kruer 1992, as cited in FNAI 2010a). Coastal berms that are deposited far enough inland and remain long-undisturbed may in time succeed to maritime hammock (FNAI 2010a). Fires are rare to non-existent in this scrub community. In south Florida, invasion by exotics, including *Casuarina equisetifolia, Schinus terebinthifolius, Scaevola sericea var. sericea, Thespesia populnea*, and *Colubrina asiatica*, following storm disturbance is an ongoing threat to this community.

ENVIRONMENT

Environmental Description: This macrogroup is found on reliefs constituted either by dunes, onshore wind-carried sand deposits arranged in cordons of ridges parallel to the coast, or by beach-ridges, wave and longshore drift-carried sand deposits, also often organized in successive parallel berms produced by the progradation of the beach. Beach dune may be distinguished from coastal grassland by its position above the immediate shoreline and by the dominance of grasses, such as *Uniola* and *Panicum*, that are tolerant of being buried in sand. It differs from coastal berm in its position facing the open ocean on a sandy coast rather than on a storm-deposited shell ridge on a mangrove-dominated shoreline. The sparsely vegetated coastal cliffs, rocky outcrops, dogtooth limestone, and boulderfields are supra-tidal and exposed to winds and salt spray. *Climate*: The climate is tropical to subtropical, with frosts being extremely rare events.

DISTRIBUTION

***Geographic Range:** This system occurs in the Caribbean islands, extreme southern peninsular Florida, the Florida Keys, and Mexico.
Nations: BR, BS?, CO, CR, CU, GT, HN, MX, NI, PA, PR, US, VE, XB, XC
States/Provinces: FL, TX
USFS Ecoregions (2007) [optional]: 255D:CC, 411A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G127	Caribbean Coastal Beach & Dune
G467	Caribbean Coastal Rocky Shore & Cliff

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-09-03	M858 Neotropical Dune Vegetation Macrogroup	M858 concept covered by M700

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	*Ipomoea-Mallotonietea*	Borhidi 1991	Herbaceous and shrubby vegetation of tropical sandy shores.
<	*Sesuvio-Rachicallietea*	Borhidi 1991	Halophytic vegetation of the supratidal rocky shores of the Caribbean.

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse, in Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne and C. Josse

Acknowledgments [optional]:

Version Date: 08 Jan 2015

REFERENCES

***References [Required if used in text]:**

Barbour, M. G., M. Rejmanek, A. F. Johnson, and B. M. Pavlik. 1987. Beach vegetation and plant distribution patterns along the northern Gulf of Mexico. Phytocoenologia 15:201-234.

Borhidi, A. 1991. Phytogeography and vegetation ecology of Cuba. Akademiai Kiado. Budapest, Hungary. 858 pp. plus color plates and map by A. Borhidi and O. Muniz (1970) inside of back cover.

FNAI [Florida Natural Areas Inventory]. 2010a. Guide to the natural communities of Florida: 2010 edition. Florida Natural Areas Inventory, Tallahassee, FL. 228 pp.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Johnson, A. F., and M. G. Barbour. 1990. Dunes and maritime forests. Pages 429-480 in: R. L. Myers and J. J. Ewel, editors. Ecosystems of Florida. University of Central Florida Press, Orlando.

Tanner, W. F. 1960. Florida coastal classification. Gulf Coast Association of Geological Societies Transactions 10:259-266.

WNHP [Washington Natural Heritage Program]. 2011. Ecological integrity assessments for the ecological systems of Washington. Version: 2.22.2011. Washington Natural Heritage Program, Department of Natural Resources, Olympia. [http://www1.dnr.wa.gov/nhp/refdesk/communities/eia_list.html] (accessed September 9, 2013).

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2. Shrub & Herb Vegetation

2.A.3.Ee. Caribbean-Mesoamerican Dune & Coastal Grassland & Shrubland

G127. Caribbean Coastal Beach & Dune

Type Concept Sentence: This group consists of Caribbean, south Florida and Bahamas sparse vegetation of the beach strand line, transitional dune, and stabilized coastal dunes with grasses, herbs and low shrubs.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.A.3.Ee.1. Caribbean-Mesoamerican Coastal Dune & Beach (M700)

Elcode: G127

***Scientific Name:** *Scaevola plumieri - Suriana maritima - Ipomoea pes-caprae* Caribbean Coastal Beach & Dune Group

***Common (Translated Scientific) Name:** Gull-feed - Bay-cedar - Bayhops Caribbean Coastal Beach & Dune Group
***Colloquial Name:** Caribbean Coastal Beach & Dune

***Type Concept:** This group consists of Caribbean, south Florida and Bahamas sparse vegetation of the beach strand line, transitional dune, and stabilized coastal dunes with grasses, herbs and low shrubs. In the Caribbean islands, it occurs also in hard-packed sand areas behind sand beaches. Dunes are uncommon on Caribbean islands; open beaches are common. The process of sand movement due to the forces of wind and water is part of the natural dynamics of beach ecosystems. This includes transport of sand along the coast, and movement of sand by wind or water between the dunes, beach and subtidal areas. The following list of species is diagnostic for this group: *Ambrosia hispida, Argusia gnaphalodes, Borrichia arborescens, Cakile lanceolata, Calotropis procera, Canavalia rosea, Cassia lineata, Cenchrus echinatus, Chamaesyce blodgettii, Chamaesyce dioica, Chamaesyce mesembrianthemifolia, Chrysobalanus icaco, Coccoloba uvifera, Croton punctatus, Cyperus planifolius, Egletes prostrata, Heliotropium nanum, Heterostachys ritteriana, Hippomane mancinella, Ipomoea pes-caprae, Iva imbricata, Lycium tweedianum, Opuntia caracassana, Piscidia piscipula, Pithecellobium keyense, Portulaca pilosa, Scaevola plumieri, Sesuvium portulacastrum, Spartina patens, Sporobolus virginicus, Tournefortia volubilis, Tribulus zeyheri*, and *Turnera diffusa*.

***Diagnostic Characteristics:** The beach environment of this group is primarily upland above the normal high tide line, with some wet patches fed by groundwater. The beach vegetation may be very sparse, but slightly higher areas and dunes may be sparse or patchy and grass-dominated in its cover. The shifting substrate (of sand, small pebbles or shell fragments) largely limits the vegetation to pioneering, salt-tolerant, succulent annuals, grasses, perennial vines, and a few shrubs. Perennial vines such as *Ipomoea pes-caprae* are generally more characteristic of tropical beaches than of temperate ones.

***Classification Comments:** This group includes vegetation of carbonate sand beaches of the Florida Keys and south Florida mangrove islands (after Johnson and Barbour 1990). Should the beaches of southern Texas and southern Florida be placed with other neotropical beaches? Are there species that reliably distinguish neotropical beaches from tropical beaches in Hawai'i and the Pacific? Should south Texas beach systems be placed here with those of southern Florida? There are presumably a number of vegetation types which would be components of this group that are as yet undescribed. It may not be possible (nor necessary) to distinguish these tropical beaches of the United States from beaches of the Caribbean. If this group is to be maintained, should it be "Tropical Mainland North America" Beach? Where to draw the line among beaches of the mainland Gulf and Caribbean coasts from Texas to Yucatan and beyond?

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The dynamic disturbance regimes largely limit the vegetation to pioneering, salt-tolerant, succulent annuals and perennial vines, which are more prevalent in these tropical examples in contrast to more northerly and temperate ones. The stands of vegetation are generally low in stature (with some clumps of taller grasses) and sparse to patchy in their cover.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This group consists of the beach strand line, transitional dune, and stabilized coastal dunes with grasses and herbs. In the Caribbean islands, it occurs also in hard-packed sand areas behind sand beaches. Dunes are uncommon on Caribbean islands; open beaches are common. The following list of species is diagnostic for this group: *Ambrosia hispida, Argusia gnaphalodes (= Mallotonia gnaphalodes, = Tournefortia gnaphalodes), Borrichia arborescens, Cakile lanceolata, Calotropis procera, Canavalia rosea (= Canavalia maritima), Cassia lineata, Cenchrus echinatus, Chamaesyce blodgettii (= Euphorbia blodgettii), Chamaesyce dioica, Chamaesyce mesembrianthemifolia (= Euphorbia buxifolia), Chrysobalanus icaco, Coccoloba uvifera, Croton punctatus, Cyperus planifolius, Egletes prostrata, Heliotropium nanum, Heterostachys ritteriana, Hippomane mancinella, Ipomoea pes-caprae, Iva imbricata, Lycium tweedianum (= Lycium nodosum), Opuntia caracassana, Piscidia piscipula, Pithecellobium keyense, Portulaca pilosa, Scaevola plumieri, Sesuvium portulacastrum, Spartina patens, Sporobolus virginicus, Tournefortia volubilis, Tribulus zeyheri*, and *Turnera diffusa*. Along the Caribbean coast of Mexico and Central America, plants include *Acoelorraphe wrightii, Bromus* sp., *Clitoria falcata (= Clitoria rubiginosa), Crotalaria retusa, Dactyloctenium aegyptium, Dodonaea* sp., *Hibiscus tiliaceus, Hymenocallis* *littoralis, Manicaria* sp., *Mimosa pudica, Morinda citrifolia, Phyllanthus acidus, Sphagneticola trilobata (= Wedelia trilobata), Stachytarpheta jamaicensis*, and *Tridax procumbens*. On isolated dunes there are short trees or shrubs of *Conocarpus erectus, Prosopis juliflora*, and *Acacia tortuosa*. *Cocos nucifera* is a common introduced palm, and the introduced tree *Casuarina equisetifolia* has been planted along the coast in Florida, the Bahamas, and the Caribbean. Other invasive exotic plants in coastal strand in south Florida include *Colubrina asiatica, Cupaniopsis anacardioides, Neyraudia reynaudiana, Scaevola sericea var. taccada (= Scaevola taccada)*, and *Schinus terebinthifolius* (FNAI 2010a).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The process of sand movement due to the forces of wind and water is part of the natural dynamics of beach ecosystems. This includes transport of sand along the coast, and movement of sand by wind or water between the dunes, beach and subtidal areas. If not restricted by infrastructure or engineered hard structures, beaches and dunes can migrate as coastlines change over time in response to the action of wind and water (Defeo et al. 2009). Coastal engineering such as seawalls and other hard structures are among the threats to the natural dynamics of the beach (Defeo et al. 2009). Dunes are best developed along the Atlantic Coast of Florida; many beaches in the Caribbean lack dunes. Plants on the foredune are regularly exposed to salt spray and sand burial from onshore winds. Plants on the upper beach are subject to these stresses plus occasional inundation by seasonal or storm tides and periodic destruction by waves. The plants of the beach dune community are adapted to either withstand these stresses or to rapidly re-colonize from seed or vegetative parts following destruction. Fertilization from piles of seaweed washed up by storms helps to speed plant growth and the re-colonization process. Once a new foredune ridge blocks salt spray and plant cover inhibits sand movement, inland herbaceous and eventually woody species can begin to replace the coastal pioneer species of the beach dune community in the backdune area. The coastal berm is deposited by storm waves along low-energy coasts. Their distance inland depends on the height of the storm surge. Tall berms may be the product of repeated storm deposition. Excavation of one berm in the Florida Keys revealed several layers of buried soils, evidence of burial by repeated storms at relatively long intervals (Kruer 1992, as cited in FNAI 2010a).

ENVIRONMENT

Environmental Description: *Climate:* The climate is tropical or subtropical, and these sites have onshore winds. The Caribbean shores are subject to hurricanes. Frosts are rare events in coastal areas of south Texas and south Florida.

Soil/substrate/hydrology: The communities within this group are found on reliefs constituted either by dunes, onshore wind-carried sand deposits arranged in cordons of ridges parallel to the coast, or by beach-ridges, wave and longshore drift-carried sand deposits, also often organized in successive parallel berms produced by the progradation of the beach. Dunes are best developed along the Atlantic Coast of Florida; many beaches in the Caribbean lack dunes. Beach dune may be distinguished from coastal grassland by its position above the immediate shoreline and by the dominance of burial-tolerant grasses such as *Uniola paniculata* and *Panicum amarum* in Florida, the Bahamas, and Cuba. It differs from coastal berm in its position facing the open ocean on a sandy coast rather than on a storm-deposited shell ridge on a mangrove-dominated shoreline.

DISTRIBUTION

***Geographic Range:** The range of this group includes the shorelines of the Caribbean, Bahamas, and including south Texas and south Florida.
Nations: BS?, BZ, CO, CR, CU, DO, GT, HN, HT, JM, MX, NI, PA, PR, US, VE, VI, XB, XC
States/Provinces: FL, TX
USFS Ecoregions (2007) [optional]: 255D:CC, 411A:CC
Omernik Ecoregions L3, L4 [optional]: 8.5.3.75b:C, 8.5.3.75d:C, 15.4.1.76c:C, 15.4.1.76d:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-10-14	G466 Caribbean Marine Beach & Foredune Group	G466 is redundant with G127 and should not have been created.

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Dune	Johnson and Barbour 1990	
?	Dunes with sparse vegetation Formation	Areces-Mallea et al. 1999	
?	Littoral Subzone, dune ecosystem	Dansereau 1966	
?	Puerto Rico land cover type 59, Fine to coarse sandy beaches, mixed sand and gravel beaches	Gould et al. 2008	
?	Strand vegetation Formation	Areces-Mallea et al. 1999	

AUTHORSHIP

***Primary Concept Source [if applicable]:** M.G. Barbour M. Rejmanek, A. F. Johnson, and B. M. Pavlik (1987)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne, C. Josse and C. Nordman

Acknowledgments [optional]:

Version Date: 03 Feb 2016

REFERENCES

***References [Required if used in text]:**

Areces-Mallea, A. E., A. S. Weakley, X. Li, R. G. Sayre, J. D. Parrish, C. V. Tipton, and T. Boucher. 1999. A guide to Caribbean vegetation types: Preliminary classification system and descriptions. The Nature Conservancy, Arlington, VA. 166 pp.

Barbour, M. G., M. Rejmanek, A. F. Johnson, and B. M. Pavlik. 1987. Beach vegetation and plant distribution patterns along the northern Gulf of Mexico. Phytocoenologia 15:201-234.

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Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Gould, W. A., C. Alarcón, B. Fevold, M. E. Jiménez, S. Martinuzzi, G. Potts, M. Quiñones, M. Solórzano, and E. Ventosa. 2008. The Puerto Rico Gap Analysis Project. Volume 1: Land cover, vertebrate species distributions, and land stewardship. General Technical Report IITF-GTR-39. USDA Forest Service, International Institute of Tropical Forestry, Río Piedras, PR. 165 pp.

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Tanner, W. F. 1960. Florida coastal classification. Gulf Coast Association of Geological Societies Transactions 10:259-266.

2. Shrub & Herb Vegetation
2.A.3.Ee. Caribbean-Mesoamerican Dune & Coastal Grassland & Shrubland

G467. Caribbean Coastal Rocky Shore & Cliff

Type Concept Sentence: This group includes sparsely vegetated Caribbean coastal cliffs, rock outcrops, and coastal boulderfields exposed to wind and salt spray.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.A.3.Ee.1. Caribbean-Mesoamerican Coastal Dune & Beach (M700)

Elcode: G467
***Scientific Name:** *Sesuvium portulacastrum* Caribbean Coastal Rocky Shore & Cliff Group
***Common (Translated Scientific) Name:** Shoreline Sea-purslane Caribbean Coastal Rocky Shore & Cliff Group
***Colloquial Name:** Caribbean Coastal Rocky Shore & Cliff

***Type Concept:** This group includes sparsely vegetated Caribbean coastal cliffs, rock outcrops, and coastal boulderfields exposed to wind and salt spray. The vegetation is dominated by low herbaceous plants and low shrubs. There are many areas of bare rock. The characteristic and diagnostic plants in the Greater Antilles are slightly different than those along the coast of Belize, but *Sesuvium portulacastrum* is characteristic both in the Greater Antilles and in coastal areas of Belize.

***Diagnostic Characteristics:**

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The vegetation is dominated by low herbaceous plants and low shrubs. There are many chasmophytes, plants which grow in cracks in rock.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The vegetation is dominated by low herbaceous plants and low shrubs. There are many areas of bare rock. This group includes sparsely vegetated coastal cliffs, rock outcrops, and coastal boulderfields exposed to wind and salt spray. The following list of species is diagnostic for this group in the Greater Antilles: *Borrichia arborescens, Conocarpus erectus, Erithalis fruticosa, Lithophila muscoides, Opuntia dillenii, Rachicallis americana, Sesuvium maritimum, Sesuvium portulacastrum, Strumpfia maritima*, and *Trianthema portulacastrum*. Examples of this group on mainland karst (especially along the coast of Belize, and Quintana Roo, Mexico) include the species *Coccoloba uvifera, Dactyloctenium aegyptium, Gomphrena* spp., *Hymenocallis littoralis (= Pancratium littorale), Jacquinia armillaris (= Jacquinia arborea), Neea psychotrioides, Phyla nodiflora (= Lippia nodiflora), Sesuvium portulacastrum, Stachytarpheta jamaicensis*, and *Tridax procumbens*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: These sites are prone to sea breezes, salt spray, and in some cases seasonal high tides or storm surge. Many plants grow in cracks in the rock. Limestone areas are well-drained. Plants survive in dry conditions.

ENVIRONMENT

Environmental Description: *Climate:* The climate is subtropical to tropical. These coastal sites have sea breezes.
Soil/substrate/hydrology: Rocky shores vary from steep cliffs to gentle slopes. On low, flat islands of the Caribbean the predominant formations are highly dissected platforms of gray rock that transition from being exposed to salt spray to being awash with high tides. This group describes the landward edge of the cliffs or coastal pavement that is only seldomly reached by spring tides. Most rocky shores are the remains of ancient coral reefs filled in by pieces of calcareous material from marine life. The resulting limestone is well-drained and highly soluble, forming a pitted, gouged terrace or pavement exposed to wind and salt-spray.

DISTRIBUTION

***Geographic Range:** This group occurs in coastal areas of the Caribbean.
Nations: BZ, CU, DO, JM, MX, PR, US, VI, XC
States/Provinces: FL, MXQU
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
?	Littoral Subzone, Rocky shore	Dansereau 1966	
=	Puerto Rico land cover type 57, Rocky cliffs and shelves	Gould et al. 2008	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse and C. Nordman, in Faber-Langendoen et al. (2016)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse and C. Nordman
Acknowledgments [optional]:
Version Date: 08 Feb 2016

REFERENCES

***References [Required if used in text]:**

Areces-Mallea, A. E., A. S. Weakley, X. Li, R. G. Sayre, J. D. Parrish, C. V. Tipton, and T. Boucher. 1999. A guide to Caribbean vegetation types: Preliminary classification system and descriptions. The Nature Conservancy, Arlington, VA. 166 pp.
Borhidi, A. 1991. Phytogeography and vegetation ecology of Cuba. Akademiai Kiado. Budapest, Hungary. 858 pp. plus color plates and map by A. Borhidi and O. Muniz (1970) inside of back cover.
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2.B. Temperate & Boreal Grassland & Shrubland

Temperate & Boreal Grassland & Shrubland is dominated by mesomorphic grasses and shrubs, with or without scattered trees (and trees typically <10% cover), ranging from temperate coastal to inland lowland and montane grasslands and shrublands, with a strongly seasonal climate and at least some frost to extended cold seasons.

2.B.2. Temperate Grassland & Shrubland

Temperate Grassland, Meadow & Shrubland is dominated by perennial grasses, forbs and shrubs typical of moderately dry to moist habitats, and is found in the mid-latitude regions of all continents (23° to 55°N and S), varying from large open grassland landscapes to droughty hillside meadows in forested landscapes.

2.B.2.Nb. Central North American Grassland & Shrubland

This division is found in the central plains of North America, and is dominated by grassland vegetation commonly referred to as shortgrass, mixedgrass and tallgrass prairie, interspersed with evergreen and deciduous shrublands. The vegetation occurs on either glaciated or non-glaciated substrates, rolling to rugged topography, and fine-textured to coarse-textured soils, and natural disturbances include grazing and fire.

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland

M054. Central Lowlands Tallgrass Prairie

Type Concept Sentence: This Great Plains tallgrass prairie macrogroup is dominated by a suite of tall and mid-height grasses and forbs, including the grasses *Andropogon gerardii, Panicum virgatum, Schizachyrium scoparium, Sorghastrum nutans, Sporobolus heterolepis*, and *Tripsacum dactyloides*. It is found over a range of moisture conditions on glaciated and unglaciated soils from Texas to Manitoba. Because of the relatively moist climate, the type is dependent on fire for maintenance of species richness and suppression of woody plant encroachment.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.B.2.Nb.1. Central North American Grassland & Shrubland (D023)

Elcode: M054
***Scientific Name:** *Andropogon gerardii - Sorghastrum nutans - Liatris spicata* Tallgrass Prairie Macrogroup
***Common (Translated Scientific) Name:** Big Bluestem - Indiangrass - Dense Blazingstar Tallgrass Prairie Macrogroup

***Colloquial Name:** Central Lowlands Tallgrass Prairie

***Type Concept:** This macrogroup encompasses tallgrass prairie grasslands occurring on glacial features and flat to rolling landscapes across North America from Texas to Manitoba where fire regularly occurs. It includes perennial grassland species and associated forb species across its range. Predominant grass species include *Andropogon gerardii, Panicum virgatum, Schizachyrium scoparium*, and *Sorghastrum nutans*. Northern mesic sites may also include *Sporobolus heterolepis* and *Muhlenbergia richardsonis*. Drier, rocky sites contain *Bouteloua curtipendula* and *Hesperostipa spartea*. Southward, dominants may also include *Tripsacum dactyloides* and *Paspalum plicatulum*. A wide diversity of forbs are present and even dominant, including *Achillea* spp., *Echinacea* spp., *Helianthus* spp., *Liatris* spp., *Lobelia spicata, Ratibida pinnata, Silphium* spp., *Solidago* spp., and *Symphyotrichum* spp. Woody species are rare but rockier sites may contain scattered trees tolerant of droughty conditions and periodic fire, such as *Quercus macrocarpa* and *Pinus banksiana*. A wide variety of forbs can contribute to the vegetation cover. Species composition varies geographically. Grazing and fire influenced species composition and distribution of this macrogroup historically, but a substantial reduction in fire frequency has allowed woody plants or other grasses to become dominant in many examples. Poor grazing practices can lead to soil erosion and invasion by cool-season grasses such as *Bromus inermis* and *Poa pratensis*. Much of this macrogroup has been converted to agriculture and very few unaltered examples persist in the current, highly fragmented landscape.

***Diagnostic Characteristics:** Tallgrass prairie typically dominated by the grasses *Andropogon gerardii, Panicum virgatum, Schizachyrium scoparium*, and *Sorghastrum nutans* with <10% tree and <25% shrub cover. Northward, mid-height associates include *Sporobolus heterolepis* and *Muhlenbergia richardsonis* along with native C-3 graminoids, such as *Carex* spp., *Dichanthelium* spp., and *Hesperostipa spartea*. Southward, dominants may also include *Tripsacum dactyloides* and *Paspalum plicatulum*. A suite of diagnostic forbs needs to be developed, including *Achillea* spp., *Echinacea* spp., *Helianthus* spp., *Liatris* spp., *Lobelia spicata, Ratibida pinnata, Silphium* spp., *Solidago* spp., and *Symphyotrichum* spp.

***Classification Comments:** This macrogroup (M054) includes sandy and rocky prairies in the northern and central Midwest but does not include the Sandhills or sand prairies in the western Great Plains, including states such as the Dakotas, Kansas or Nebraska. Those are covered by Great Plains Sand Grassland & Shrubland Macrogroup (M052).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M012	Central Midwest Oak Forest, Woodland & Savanna	can be very similar in its savanna portion but has >10% tree cover.
M151	Great Plains Forest & Woodland	
M051	Great Plains Mixedgrass & Fescue Prairie	
M052	Great Plains Sand Grassland & Shrubland	can also be found on sand but tends to be dominated by *Andropogon hallii* and *Calamovilfa longifolia* and not *Andropogon gerardii, Sorghastrum nutans*, and *Panicum virgatum*. It is generally found further west than the sand/gravel portion of M012.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Tallgrass prairie is characterized by perennial C-4 grasses with flowering culms that reach heights of 2 m (6 feet) or more when they mature in late summer. Tallgrass prairie has the greatest number of native plant species of any of the mid-continent North American prairies. The very tall grasses are accompanied by numerous shorter grasses and many perennial forbs. Some stands are dominated by forbs (Woodward 2008).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Andropogon gerardii* is the characteristic tall sod-forming grass, with *Sorghastrum nutans*. *Schizachyrium scoparium* and *Sporobolus heterolepis* are common mid- to tall-sized bunchgrass associates. *Bouteloua curtipendula* is an important short bunchgrass on sandy or gravelly soils, or in Texas hay meadows occurring on deep clays. On wetter sites *Calamagrostis canadensis, Calamagrostis stricta, Panicum virgatum*, and *Spartina pectinata* can be abundant. Southward, dominants may also include *Tripsacum dactyloides* and *Paspalum plicatulum*. Forbs are very common and a wide variety can be found across the range of this macrogroup. Among these are *Achillea* spp., *Echinacea* spp., *Helianthus* spp., *Liatris* spp., *Lobelia spicata, Ratibida pinnata, Silphium* spp., *Solidago* spp., and *Symphyotrichum* spp. (Woodward 2008). An example of the diversity of forbs found in tallgrass prairie in central Illinois include the following: A suite of diagnostic forbs, ranking among dominants in Illinois prairies, would include *Comandra umbellata, Eryngium yuccifolium, Euphorbia corollata, Fragaria virginiana, Helianthus grosseserratus, Helianthus pauciflorus (= Helianthus rigidus), Liatris pycnostachya, Liatris spicata, Oligoneuron rigidum, Parthenium integrifolium, Phlox pilosa, Ratibida pinnata, Silphium laciniatum, Silphium integrifolium, Silphium terebinthinaceum*, and *Symphyotrichum ericoides* (J. Taft pers. comm. 2014). Scattered shrubs include *Amorpha canescens, Ceanothus americanus, Corylus americana*, and *Rosa carolina*. The actinorhizal shrub *Ceanothus americanus* has been shown to structure mesic tallgrass prairie (Taft and Dawson 2011).

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Disturbance is necessary to maintain and rejuvenate stands of this macrogroup, because climatic conditions are suitable for the growth of trees and/or shrubs. Historically, fire, grazing, and periodic drought prevented woody species from displacing grassland vegetation and also provided a variety of conditions across the landscape fostering species richness (Anderson 1990b). The fire-return interval in the Central Tallgrass Prairie region has been estimated at 3-5 years (Wright and Bailey 1982b). This return interval, combined with the patchy nature of burned versus unburned areas affected by fires, are sufficient to suppress the expansion of woody species and promote a diverse assemblage of herbaceous species (Risser 1990). In Illinois, maximum species diversity is maintained by frequent fire (every 1-2 years) (Bowles and Jones 2013), but in other parts of the region, such frequent fires may lead to strong dominance by grasses. The dominant grasses also exhibit a compensatory growth response to clipping and/or burning, which could be in response to a nutrient flush (particularly in the form of potash) that follows a burn (Ehrenreich 1959). The removal of litter/mulch by fire also increases the exposed soil surface, allowing more light to reach the ground.

While shrub thickets locally are (were) part of the tallgrass prairie ecosystem, the widespread expansion of shrubs largely is an artifact of an altered fire regime resulting in reduced fire frequency and is one of the greatest management concerns and threats to biodiversity in the region of the tallgrass prairie (e.g., Briggs et al. 2005, Taft and Kron 2014).

ENVIRONMENT

Environmental Description: The climate of the bulk of the range of this macrogroup is interior continental, characterized by cold winters and hot summers. Mean January minimum temperatures range from below 0°F near the Canadian border to approximately 45°F on the Texas coast. Mean July maximum temperatures range from approximately 80°F near the Canadian border to 95°F in eastern Texas. Annual precipitation ranges from under 50 cm (20 inches) in the north to approximately 127 cm (50 inches) on the Gulf coast (PRISM Climate Group 2014). Late-spring and early-summer months have the most rain and, in the north, snowmelt adds to available moisture. Tallgrass prairie often grows on unconsolidated parent materials derived from glacial deposits and loess of Pleistocene age. Soils range from deep Mollisol and sandy/gravelly soils to thin, rocky soils. Grasslands on blackland Vertisols and sandy clay loam Alfisols in Texas and Gulf coastal prairies are also included in this macrogroup. The most common single soil type is Mollisols, which have deep horizons containing much humus from decaying plant material that often produces a dark blackish brown coloration. The deep roots of the grass and capillary action bring calcium carbonate up into the subsoil (B-horizon) and raise the pH to neutral or slightly basic levels. Distinct carbonate nodules do not usually form. True chernozems have formed in this part of the biome. A major exception to the characteristically deep soils occurs in the Flint Hills in eastern Kansas and Osage Hills in western Oklahoma, where rocky soils cover limestone in places. Shallow-soil prairies over limestone also occur commonly in western Missouri (Nelson 2005) and locally in northern Illinois (including gravel substrates). Prairies on deep sand deposits are present at several locations in the northern half of Illinois (Gleason 1910, Ebinger et al. 2006).

DISTRIBUTION

***Geographic Range:** Tallgrass prairie occurs in a band from southern Manitoba, Canada, south to the Gulf coast of Texas and includes the Prairie Peninsula, where annual precipitation is considerably more than 50 cm (20 inches) a year. Tallgrass prairie may once have covered 150,000 square km (400,000 square miles). Most prairie has long since vanished under the plow. Large tracts are uncommon; many reserves are less than 0.08 square km (20 acres) in size. Important remnants occur in the Loess Hills of western Iowa, the Prairie Coteau in eastern South Dakota, the Flint Hills in Kansas, Osage Hills in Oklahoma, Osage Plains in Kansas, and the Fort Worth Prairie in Oklahoma and Texas (Woodward 2008).

Nations: CA, MX?, US
States/Provinces: AR, IA, IL, IN, KS, LA, MB, MI, MN, MO, ND, NE, OH, OK, ON, SD, TX, WI
USFS Ecoregions (2007) [optional]: 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCP, 212Hi:CCC, 212Hk:CCC, 212Hm:CCP, 212K:CP, 212M:CP, 212N:CP, 212Tb:CCC, 222H:CC, 222Ja:CCC, 222Jb:CCC, 222Jc:CCC, 222Je:CCC, 222Jf:CCP, 222Jg:CCC, 222Jh:CCC, 222Ji:CCP, 222K:CC, 222L:CC, 222M:CC, 222N:CC, 222R:CP, 222Ua:CCC, 222Ud:CCP, 222Ue:CCP, 223A:CC, 223G:CC, 232E:CC, 251A:CC, 251B:CC, 251C:CC, 251D:CC, 251E:CC, 251F:CC, 251H:CC, 255A:CC, 255B:CC, 255C:CC, 255D:CC, 255E:CC, 315E:CC, 332B:CC, 332C:CC, 332D:CC, 332E:CC, 332F:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G335	Blackland & Coastal Tallgrass Prairie
G334	Southern Tallgrass Prairie
G333	Central Tallgrass Prairie
G075	Northern Tallgrass Prairie
G151	Sand & Gravel Tallgrass Prairie

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Blackland Prairie (*Andropogon-Stipa*): 76	Küchler 1964	Küchler types 74, 76 and 77 are included in this macrogroup.
<	Bluestem Prairie (601)	Shiflet 1994	Equivalent to M054 from North Dakota to Kansas and possibly into eastern Oklahoma.
<	Bluestem Prairie (710)	Shiflet 1994	Equivalent to M054 in the Osage Hills of Oklahoma (southern Flint Hills).
<	Bluestem Prairie (*Andropogon-Panicum-Sorghastrum*): 74	Küchler 1964	Küchler types 74, 76 and 77 are included in this macrogroup.
<	Bluestem-Sacahuista Prairie (711)	Shiflet 1994	
<	Bluestem-Sacahuista Prairie (*Andropogon-Spartina*): 77	Küchler 1964	Küchler types 74, 76 and 77 are included in this macrogroup.

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Coastal Prairie	Barbour and Billings 2000	Coastal Prairie and Tallgrass Prairie equal M054.
<	Dry-mesic Prairie	Curtis 1959	
<	Flint Hills Tallgrass Prairie	Lauver et al. 1999	
<	Little Bluestem-Indiangrass-Texas Wintergrass (717)	Shiflet 1994	
<	Mesic Prairie	Curtis 1959	
=	Prairie	Weaver and Fitzpatrick 1934	Simply called "true prairie," the authors provide one of the first detailed tallgrass prairie descriptions across the central region.
<	Tallgrass Prairie	Barbour and Billings 2000	Coastal Prairie and Tallgrass Prairie equal M054.
=	True and Upper Coastal Prairie grassland	Diamond and Smeins 1988	
<	Wet-mesic Prairie	Curtis 1959	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.E. Weaver and T.J. Fitzpatrick (1934)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard, J. Drake, D. Faber-Langendoen, B. Hoagland, D. Diamond

Acknowledgments [optional]:

Version Date: 15 Oct 2014

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland

G335. Blackland & Coastal Tallgrass Prairie

Type Concept Sentence: This prairie group ranges from the outer Gulf Coastal Plain of Louisiana and Texas, through central Texas to southern Oklahoma. It is characterized by grasslands, though some examples on xeric sandy soils may have greater cover of forbs. Microtopography often influences dominance patterns of characteristic grasses such as *Andropogon gerardii, Panicum virgatum, Paspalum plicatulum, Schizachyrium scoparium, Sorghastrum nutans, Sporobolus silveanus, Triplasis purpurea*, and *Tripsacum dactyloides*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nb.1. Central Lowlands Tallgrass Prairie (M054)

Elcode: G335
***Scientific Name:** *Schizachyrium scoparium - Bifora americana - Paspalum plicatulum* Tallgrass Prairie Group
***Common (Translated Scientific) Name:** Little Bluestem - Prairie Bishop - Brownseed Crowngrass Tallgrass Prairie Group
***Colloquial Name:** Blackland & Coastal Tallgrass Prairie

***Type Concept:** This perennial grassland prairie group encompasses alliances and associations related to blackland prairies of Texas and Oklahoma, grasslands on sands of central Texas, as well as non-saline tallgrass prairie vegetation ranging along the coast of Louisiana and Texas. In the blackland areas, soils are typically dark alkaline Vertisols over calcareous parent material interspersed with patches of acidic, sandy loam Alfisols and Mollisols. In the coastal prairies, this vegetation occurs on Vertisols and Alfisols which have developed over Pleistocene terraces flanking the Gulf Coast. This group also encompasses grasslands occurring on deep sandy soils (Entisols) in two settings: older Eocene strata, and younger Pleistocene terraces flanking rivers. Terrain in this group is often characterized by gilgai, ridge-and-swale, or mound-and-intermound mima mound microtopography, and the vegetation encompasses both upland and small-scale wetland plant communities. Both of these components are typically dominated by perennial grasses such as *Andropogon gerardii, Panicum virgatum, Schizachyrium scoparium, Sorghastrum nutans, Sporobolus* *silveanus, Triplasis purpurea*, and *Tripsacum dactyloides*. In addition, *Paspalum plicatulum* is a possible dominant in the coastal stands. Disturbed examples of coastal stands may be dominated by *Andropogon glomeratus*.

***Diagnostic Characteristics:** This group is characterized by a tall to medium-tall, more-or-less continuous graminoid layer dominated or codominated by perennial grasses such as *Andropogon gerardii, Panicum virgatum, Schizachyrium scoparium, Sorghastrum nutans, Sporobolus silveanus, Triplasis purpurea*, and *Tripsacum dactyloides*. Soils are typically deep and may be Alfisols, Mollisols, or Vertisols.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The vegetation of this group is herbaceous, prairie vegetation on deep soils. Some components may be an upland/wetland mosaic.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Both the ridge/mound and swale/intermound components are typically dominated by perennial grasses such as *Andropogon gerardii, Panicum virgatum, Schizachyrium scoparium, Sorghastrum nutans, Sporobolus silveanus*, and *Tripsacum dactyloides*. In addition, *Paspalum plicatulum* is a possible dominant in the coastal stands. Disturbed occurrences of the coastal prairie may be dominated by *Andropogon glomeratus*. In the blackland prairies, *Andropogon gerardii* is a more likely associate on Mollisols. *Tripsacum dactyloides* and *Panicum virgatum* are common associates on Vertisols, especially on the gilgai microtopography. Heavy grazing has allowed species such as *Bouteloua dactyloides (= Buchloe dactyloides)* and *Bouteloua rigidiseta* to invade. Grasses of deep sandy soils are characterized by *Aristida desmantha, Dichanthelium* spp., *Schizachyrium scoparium*, and *Triplasis purpurea* but forbs, lichens and dry-site ferns, such as *Brazoria truncata, Cladonia* spp., *Cnidoscolus texanus, Froelichia floridana, Gaillardia amblyodon, Lechea mucronata, Monarda punctata, Polanisia erosa, Rhynchosia americana, Selaginella arenicola ssp. riddellii, Stylisma pickeringii, Tephrosia lindheimeri, Tetragonotheca repanda, Zornia bracteata*, may be more characteristic of these areas than grasses.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Fire and grazing constitute the major natural dynamics influencing the blackland prairie. Infrequent, but intense, fires prevent woody species from establishing. Fire suppression and overgrazing have allowed woody species to invade. Heavy grazing has also altered the floristic composition by allowing species such as *Bouteloua dactyloides* and *Bouteloua rigidiseta* to invade. Stands of this group are matrix in the case of the coastal Louisiana and Texas component, and large patch in the case of the blackland component. Some estimates state that 99% of Texas-Louisiana coastal prairie has been lost through conversion to other uses and environmental degradation due to the interruption of important ecological processes, such as fire, needed to maintain it. In the absence of regular fire, this vegetation will be invaded by woody shrubs and trees.

ENVIRONMENT

Environmental Description: Prairies on deep sandy soils in this group are found primarily on the Carrizo geologic formation, but also on other Eocene strata such as Queen City and Sparta. The combination of these very droughty soils with low levels of rainfall create extreme edaphic conditions and a locally unique environment which supports a number of endemic plant taxa. It is found on high topographic positions, and this, along with rapidly draining soils, results in conditions that only briefly retain surface moisture. The coastal prairie is generally coincident with the distribution of the Pleistocene Beaumont and Lissie formations in Texas (Prairie and

Intermediate allogroups in Louisiana). It is usually found on level to gently rolling landscapes, with slopes generally less than 5%. Microtopography plays an important role in local variation, with ridges, swales, mounds, depressions, mima (or pimple) mounds, and gilgai leading to a mosaic of drier and wetter plant communities. Typical soils are non-saline Vertisols, Alfisols, and (less extensively) Mollisols (Diamond and Smeins 1984, Smeins et al. 1992). Vertisols are often characterized by gilgai, resulting from shrink-swell attributes of the montmorillonitic clays of which they are composed. Historically, rivers and streams dissected this vegetation type, breaking it into large compartments with species composition shifting across the range. A moisture gradient occurs from northeast (average 120 cm/year) to southwest (average 100 cm/year) across the range of the coastal prairie component of this group (Diamond and Smeins 1984). Texas blackland prairie examples are typified by the presence of dark alkaline Vertisol soils over calcareous parent material interspersed with patches of acidic, sandy loam Alfisols and Mollisols. Microtopography such as gilgai and mima mounds can occur and are important microhabitats that lead to a high degree of plant diversity. The main belt of the Texas blackland prairie is divided into Vertisol, Alfisol and Mollisol regions. The Vertisol region is characterized by the presence of dark clay alkaline soils over limestone marl parent material, while the Eastern Marginal prairies are characterized by variously textured Alfisols over sandstone parent material. Alkaline clay and clay loam Mollisols are found on the Austin Chalk formation on fragmented Cretaceous limestone. Two outlier prairies, the Fayette Prairie (EPA 32b) and San Antonio Prairie (EPA 33c), are underlain by both Vertisols and Alfisols. Each variation in soil texture and pH supports its characteristic community.

DISTRIBUTION

***Geographic Range:** This group ranges from the outer Gulf Coastal Plain of Louisiana and Texas through central Texas to southern Oklahoma.
Nations: US
States/Provinces: LA, OK, TX
USFS Ecoregions (2007) [optional]: 232E:CC, 255B:CC, 255C:CC, 255D:CC, 315E:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.8.33a:C, 8.3.8.33b:C, 8.3.8.33c:C, 8.3.8.33d:C, 8.3.8.33f:C, 9.4.7.32a:C, 9.4.7.32b:C, 9.5.1.34a:C, 9.5.1.34b:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A4059	*Schizachyrium scoparium - Paspalum plicatulum - Schizachyrium tenerum* Grassland Alliance
A4062	*Schizachyrium scoparium - Liatris elegans var. carizzana* Sandy Grassland Alliance
A4060	*Panicum virgatum - Tripsacum dactyloides* Grassland Alliance
A4063	*Schizachyrium scoparium - Sorghastrum nutans - Andropogon gerardii* Grassland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-02-07	G065 Mixedgrass Mesic Grassland Group	G064 & G065 reworked to form G333 & G335
2013-02-07	G064 Mixedgrass Dry Grassland Group	G064 & G065 reworked to form G333 & G335

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	*Schizachyrium-Sorghastrum-Andropogon* community type	Diamond and Smeins 1988	
<	*Schizachyrium-Sorghastrum-Andropogon* community type	Diamond and Smeins 1985	

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Blackland Prairie (*Andropogon-Stipa*): 76	Küchler 1964	
<	Bluestem - Sacahuista Prairie (711)	Shiflet 1994	
<	Bluestem-Sacahuista Prairie (*Andropogon-Spartina*): 77	Küchler 1964	
<	Little Bluestem - Indiangrass - Texas Wintergrass (717)	Shiflet 1994	
<	Little Bluestem-Big Bluestem-Indiangrass Association	Diamond and Smeins 1990	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. Teague and M. Pyne, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Teague and M. Pyne

Acknowledgments [optional]:

Version Date: 07 May 2015

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2. Shrub & Herb Vegetation

2.B.2.Nb. Central North American Grassland & Shrubland

G334. Southern Tallgrass Prairie

Type Concept Sentence: This group occurs in the southeastern Great Plains from Kansas and southwestern Missouri to central Texas on thin or rocky soils where the tallgrasses *Andropogon gerardii, Panicum virgatum*, and *Sorghastrum nutans* dominate or codominate, usually with *Schizachyrium scoparium* and species typical of southern prairies such as *Bothriochloa laguroides, Dichanthelium* spp., *Stenaria nigricans*, and *Liatris punctata var. mucronata*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nb.1. Central Lowlands Tallgrass Prairie (M054)

Elcode: G334
***Scientific Name:** *Andropogon gerardii - Sorghastrum nutans - Schizachyrium scoparium* Tallgrass Prairie Group
***Common (Translated Scientific) Name:** Big Bluestem - Indiangrass - Little Bluestem Tallgrass Prairie Group
***Colloquial Name:** Southern Tallgrass Prairie

***Type Concept:** This group is found primarily within the Flint Hills and Osage Plains of Kansas and Oklahoma ranging into the Arkansas River Valley region of Arkansas and Oklahoma and the undissected portions of the Springfield Plateau region of Arkansas, Oklahoma and Missouri. Small patches can be found in the Ozarks of Missouri and the Arbuckle Mountains of Oklahoma. In southern Oklahoma and Texas, this is the primary natural group of the "Grand Prairie" or "Fort Worth Prairie," ranging south into the Lampasas Cutplain of Texas. It is distinguished from Central Tallgrass Prairie Group (G333) by having more species with southwestern geographic affinities and the presence of a thin or rocky soil layer over limestone beds ranging to more acidic substrates, although some areas of deeper soil are found within the region, especially on lower slopes, draws and terraces. Because of the presence of the rocky substrate close to the surface and the rolling topography, this area is relatively unsuitable for agriculture. The Flint Hills contain one of the largest remaining, relatively intact pieces of tallgrass prairie. The vegetation in this group is typified by tallgrass species such as *Andropogon gerardii, Panicum virgatum, Schizachyrium scoparium*, and *Sorghastrum nutans* forming a dense cover. A moderate to high density of forb species also occurs. Species composition varies geographically, with *Oligoneuron rigidum, Liatris punctata, Symphyotrichum ericoides, Lespedeza capitata*, and *Viola pedatifida* occurring in some localities. Areas of deeper soil, especially lower slopes along draws, slopes and terraces, can include *Baptisia alba var. macrophylla, Liatris pycnostachya*, and *Vernonia missurica*. Shrub and tree species are relatively infrequent and, if present, constitute less than 10% cover in the area. The combined effect of droughty soils, reduced precipitation, and prevailing level topography create conditions highly conducive to the ignition and spread of fires. Although many of the native common plant species still occur, grazing does impact this region. Poor grazing practices can lead to soil erosion and invasion by cool-season grasses such as *Bromus inermis* within its range.

***Diagnostic Characteristics:** This tallgrass group is found on thinner, rocky soils throughout the unglaciated regions of the southeastern Great Plains.

***Classification Comments:** This group is distinguished from Central Tallgrass Prairie Group (G333) by having more species with southwestern geographic affinities and the presence of a thin soil layer over limestone beds ranging to more acidic substrates.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G181	Central Midwest Oak Openings & Barrens	
G333	Central Tallgrass Prairie	has some similar dominant species but occurs on deeper, richer soils.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The vegetation is characterized by a dense layer of tall grasses interspersed with forbs.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Tallgrass species such as *Andropogon gerardii, Panicum virgatum, Schizachyrium scoparium*, and *Sorghastrum nutans* predominate this group and often form a dense cover. Forb species such as *Oligoneuron rigidum (= Solidago rigida), Liatris punctata, Symphyotrichum ericoides, Lespedeza capitata*, and *Viola pedatifida* can also occur. In those areas of deeper soils, *Baptisia alba var. macrophylla, Liatris pycnostachya*, and *Vernonia missurica* can also occur within their range. Tree and shrub species are relatively infrequent and constitute less than 10% cover. Some other plant species which can occur include *Andropogon ternarius, Aristida dichotoma, Bouteloua curtipendula, Bouteloua eriopoda, Bouteloua gracilis, Bouteloua hirsuta, Calamagrostis canadensis, Coreopsis grandiflora, Croton michauxii var. ellipticus (= Croton willdenowii), Danthonia spicata, Helianthus grosseserratus, Mentzelia oligosperma, Rudbeckia missouriensis, Silene regia*, and *Tradescantia bracteata*. Other possible forb species, especially in examples in the Arkansas River Valley and Springfield Plateau, include *Helianthus mollis, Rudbeckia subtomentosa, Silphium laciniatum, Symphyotrichum* spp., *Solidago* spp., *Camassia scilloides, Echinacea pallida, Callirhoe digitata, Asclepias hirtella, Eryngium yuccifolium, Delphinium carolinianum, Castilleja coccinea, Calopogon oklahomensis, Buchnera americana, Dodecatheon meadia, Amorpha canescens, Tephrosia virginiana, Orbexilum pedunculatum, Baptisia alba, Baptisia bracteata, Liatris pycnostachya*, and *Liatris squarrosa var. hirsuta (= Liatris hirsuta)*. Examples in the Arkansas Valley and Springfield Plateau can have wetter areas that support a rich diversity of rushes and sedges, including *Carex opaca, Carex oklahomensis, Carex buxbaumii, Carex scoparia, Carex conjuncta, Carex davisii, Carex arkansana, Eleocharis tenuis var. verrucosa, Eleocharis wolfii*, and *Rhynchospora macrostachya*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Fire and grazing are the prevalent dynamic processes in examples of this group. Overgrazing can lead to soil erosion and invasion of cool-season grasses. Fire suppression can lead to increased cover of woody species.

ENVIRONMENT

Environmental Description: This group is typified by the thin or rocky soil layer over limestone beds or acidic substrates such as chert or granite, although areas of deeper soils are possible along lower slopes, draws and terraces. The topography is rolling and mostly unsuitable for agriculture. The combined effect of droughty soils, reduced precipitation, and prevailing level topography create conditions highly conducive to the ignition and spread of fires.

DISTRIBUTION

***Geographic Range:** This group is found primarily within the Flint Hills and Osage Plains of Kansas and Oklahoma ranging east into the Arkansas River Valley and Springfield Plateau of Arkansas, Oklahoma and Missouri and south into the Lampasas Cutplain of Texas. Small patches can be found in the Ozarks of Missouri and the Arbuckle Mountains of Oklahoma.
Nations: US
States/Provinces: AR, KS, MO, OK
USFS Ecoregions (2007) [optional]: 223A:CC, 251E:CC, 251F:CC, 251H:CC, 255A:CC, 255E:CC, 332E:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.2.72d:P, 8.3.2.72f:C, 8.4.5.39a:C, 8.4.5.39k:?, 9.2.3.47d:C, 9.2.3.47f:C, 9.2.4.40b:P, 9.2.4.40c:C, 9.2.4.40d:C, 9.4.2.27d:P, 9.4.2.27i:C, 9.4.2.27o:P, 9.4.4.28a:C, 9.4.5.29a:C, 9.4.5.29b:C, 9.4.5.29c:C, 9.4.5.29d:C, 9.4.5.29e:C, 9.4.5.29h:C, 9.4.5.29i:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A4045	*Andropogon gerardii - Sorghastrum nutans - Helianthus* spp. Southern Grassland Alliance
A4046	*Schizachyrium scoparium - Echinacea pallida* Southern Grassland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Flint Hills Tallgrass Prairie	Lauver et al. 1999	

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard and K. Kindscher

Acknowledgments [optional]:

Version Date: 07 May 2015

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2. Shrub & Herb Vegetation

2.B.2.Nb. Central North American Grassland & Shrubland

G333. Central Tallgrass Prairie

Type Concept Sentence: This group is found in the midwestern United States as tallgrass prairies, typically with abundant *Andropogon gerardii, Panicum virgatum*, and *Sorghastrum nutans*, and a variety of midgrasses and forbs on deep, rich soils.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Nb.1. Central Lowlands Tallgrass Prairie (M054)

Elcode: G333

***Scientific Name:** *Andropogon gerardii - Sorghastrum nutans - Hesperostipa spartea* Tallgrass Prairie Group

***Common (Translated Scientific) Name:** Big Bluestem - Indiangrass - Porcupine Grass Tallgrass Prairie Group

***Colloquial Name:** Central Tallgrass Prairie

***Type Concept:** This group is found primarily in the central Midwestern states from northwestern Indiana to eastern Nebraska and northeastern Kansas. Dominant species are tallgrasses 1-2 m tall or tallgrasses mixed with midgrasses approximately 1 m tall. Vegetation cover is high except for the growing season after a fire. *Andropogon gerardii, Panicum virgatum*, and *Sorghastrum nutans* are typical tallgrasses while *Bouteloua curtipendula, Schizachyrium scoparium*, and *Sporobolus heterolepis* are typical midgrasses. A wide variety of forbs contribute to the vegetation cover. Trees and shrubs are widely scattered or absent in high-quality examples of this group. These tallgrass prairies occur on flat to rolling landscapes with deep, rich Mollisol soils. Fire is critical to maintain sites. A substantial reduction in fire frequency will allow woody plants or other grasses to become dominant and change the vegetation community. The great majority of sites where this group existed in the past have been converted to agricultural uses or succeeded to woodlands or shrublands due to a lack of fire.

***Diagnostic Characteristics:** This prairie group is characterized by moderate to dense herbaceous vegetation dominated by tallgrass species (1-2 m tall) and with a diverse forb component occurring in deep, rich soils. Shrubs and trees have <10% cover except in two unusual native shrub associations within this group where *Cornus drummondii, Corylus americana*, or *Malus ioensis* are codominant to dominant.

***Classification Comments:** This group shares some dominant species, physiognomic, and environmental characteristics with tallgrass groups to the north and south, i.e., Northern Tallgrass Prairie Group (G075) and Southern Tallgrass Prairie Group (G334), respectively. Modal concepts for each tallgrass prairie group have noticeable differences, but classifying stands where their ranges overlap or adjoin could be difficult. Stands in Central Tallgrass Prairie Group (G333) tend to have more fertile and deeper soils. Overall floristics of Central Midwest Oak Openings & Barrens Group (G181), particularly stands on richer soils, can be similar to G333, but the savanna physiognomy (>10% tree cover) of the former group is a useful and obvious diagnostic.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G181	Central Midwest Oak Openings & Barrens	Stands on richer soil can be floristically similar but have a savanna physiognomy (>10% tree cover) which is a good diagnostic.
G334	Southern Tallgrass Prairie	typically shares dominant grass species, but sites usually on poorer, rockier soil.
G133	Central Great Plains Mixedgrass Prairie	
G075	Northern Tallgrass Prairie	typically shares dominant grass species but sites are on poorer soils with shorter growing season and thus tend to be less diverse.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Stands in this tallgrass prairie have moderate to dense cover by herbaceous species. Dominant grasses are typically 1-2 m tall though they can be taller under ideal conditions. Woody cover is generally low unless fire has been absent from a site for several years but patches of moderate to heavy shrub cover can occur within this prairie group. Immediately after a fire, the cover and height of herbaceous and shrub vegetation are reduced but these tend to recover in 1-2 growing seasons.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This group is characterized, and usually dominated by, tallgrass species, notably *Andropogon gerardii, Panicum virgatum*, and *Sorghastrum nutans*. Midgrasses are very common and can be as dominant or more dominant than the taller species at some sites, especially those with coarser soils or on south- or west-facing slopes. Typical midgrasses are *Bouteloua curtipendula, Schizachyrium scoparium*, and *Sporobolus heterolepis*. High-quality sites have a diversity of forbs, though none is common on all or most sites. The list of common forbs that may be found includes *Amorpha canescens, Echinacea purpurea, Helianthus* spp., *Liatris* spp., *Lobelia spicata, Ratibida pinnata, Solidago* spp., and *Symphyotrichum* spp.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Disturbance is necessary to maintain and rejuvenate stands of this group. The climate and soils that support it will also support trees and/or shrubs. Historically, fire and/or grazing prevented woody species from taking over sites and also reduced litter from previous years' growth. Fire was a frequent event in tallgrass prairies. The fire-return interval for a given site in the Central Tallgrass Prairie region has been estimated to be 3-5 years (Wright and Bailey 1982b). This level of fire frequency prevents woody species from becoming established, prevents litter from accumulating, and allows a diverse assemblage of herbaceous species to grow. In addition to removing woody species, burning and/or clipping reduces litter and increases productivity for many native species in tallgrass prairie, including dominant grasses (Ehrenreich 1959). Without the removal of litter, these tallgrass prairies tend to experience a reduction in forb cover.

ENVIRONMENT

Environmental Description: *Soil/substrate/hydrology:* This group is characterized by deep, rich Mollisols, usually over 1 m deep. Soils can range from wet-mesic to dry-mesic and are not flooded or saturated regularly.

DISTRIBUTION

***Geographic Range:** This group covered much of the presettlement landscape in USFS Ecoregions 251C and 251D (Cleland et al. 2007) which include eastern Nebraska, southern Iowa, northeastern Kansas, northern Missouri, central Illinois, and parts of northwestern Indiana. Smaller examples of this group extended further into all of those states and into many adjacent states.
Nations: CA, US
States/Provinces: AR, IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, OK, ON, SD?, WI
USFS Ecoregions (2007) [optional]: 222H:CC, 222J:CC, 222K:CC, 222L:CC, 222M:CC, 223G:CC, 251B:CC, 251C:CC, 251D:CC, 251E:CC, 251F:CC, 332C:CC, 332D:CC, 332F:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A4058	*Schizachyrium scoparium - Bouteloua curtipendula - Sorghastrum nutans* Central Bedrock Grassland Alliance
A4208	*Corylus americana - Malus ioensis - Ceanothus americanus* Central Shrubland Alliance
A4057	*Andropogon gerardii - Sorghastrum nutans - Coreopsis palmata* Central Grassland Alliance
A4047	*Schizachyrium scoparium - Sorghastrum nutans - Bouteloua curtipendula* Central Sand & Gravel Grassland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2015-06-05	G151 Schizachyrium scoparium - Bouteloua spp. - Andropogon gerardii Sand & Gravel Tallgrass Prairie Group	G151 merged into G333

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Dry-mesic Prairie	Curtis 1959	
<	Mesic Prairie	Curtis 1959	
<	Wet-mesic Prairie	Curtis 1959	

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake

Acknowledgments [optional]:

Version Date: 07 May 2015

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2. Shrub & Herb Vegetation

2.B.2.Nb. Central North American Grassland & Shrubland

G075. Northern Tallgrass Prairie

Type Concept Sentence: This group is dominated by tallgrass species such as *Andropogon gerardii, Sorghastrum nutans*, and *Panicum virgatum*, and key diagnostics include *Muhlenbergia richardsonis, Hesperostipa spartea*, and *Sporobolus heterolepis*. It is found primarily in the Northern Tallgrass ecoregion ranging along the Red River basin in Minnesota and the Dakotas to Lake Manitoba in Canada and south into northwestern Iowa.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Nb.1. Central Lowlands Tallgrass Prairie (M054)

Elcode: G075

***Scientific Name:** *Andropogon gerardii - Sporobolus heterolepis - Hesperostipa spartea* Tallgrass Prairie Group

***Common (Translated Scientific) Name:** Big Bluestem - Prairie Dropseed - Porcupine Grass Tallgrass Prairie Group

***Colloquial Name:** Northern Tallgrass Prairie

***Type Concept:** This northern tallgrass prairie group is found on mesic sites from northwestern Iowa in the United States northward through Minnesota and the Dakotas to southeastern Manitoba, Canada. It is dominated by tallgrass species such as *Andropogon gerardii, Panicum virgatum*, and *Sorghastrum nutans*. Key diagnostics include *Hesperostipa spartea, Muhlenbergia richardsonis*, and *Sporobolus heterolepis*. The soils in this region are only moderately rich and deep. Where this group occurs on well-drained, drier soils, it grades into Northeastern Great Plains Aspen Woodland Group (G146) to the north and east. Grazing and fire influenced species composition and distribution of this group historically, but much of it has been converted to agriculture and very few unaltered examples persist in the modern, highly fragmented landscape.

***Diagnostic Characteristics:** Key grass diagnostics include *Hesperostipa spartea, Muhlenbergia richardsonis*, and *Sporobolus heterolepis*. Additional forb diagnostics should be identified. Common dominants include *Andropogon gerardii, Panicum virgatum*, and *Sorghastrum nutans*. This type is restricted to thinner and less nutrient-rich soils as compared to Central Great Plains Tallgrass Prairie Group (G333).

***Classification Comments:** Greater clarity on the distinctions between this group and Central Tallgrass Prairie Group (G333) is needed. Consult Diamond and Smeins (1988) for diagnostic species.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G181	Central Midwest Oak Openings & Barrens	
G146	Northeastern Great Plains Aspen Woodland	
G333	Central Tallgrass Prairie	

Similar NVC Types General Comments [optional]: This group grades into Northeastern Great Plains Aspen Woodland Group (G146) on well-drained, drier soils to the north and east. It is similar in dominant species and structure to Central Tallgrass Prairie Group (G333); however, the thinner soils associated with the region where this group occurs decrease the species diversity.

VEGETATION

Physiognomy and Structure Summary: The vegetation is characterized by a dense layer of tall grasses interspersed with forbs.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Tallgrass species such as *Andropogon gerardii, Panicum virgatum*, and *Sorghastrum nutans* are dominant this group. Other grasses include *Hesperostipa spartea (= Stipa spartea), Muhlenbergia richardsonis, Schizachyrium scoparium*, and *Sporobolus heterolepis*. Forbs can be abundant and often have high local diversity, but more information is needed on typical species. Some common forbs include *Amorpha canescens, Solidago canadensis*, and *Symphyotrichum ericoides (= Aster ericoides)*. Woody vegetation is rare, but clumps of trees and tall brush can often be found along the boundary between wetlands and this group. *Calamagrostis canadensis, Calamagrostis stricta*, and *Spartina pectinata* can occur in wet-mesic versions of this group. *Muhlenbergia richardsonis* may be a diagnostic, less dominant species of the northern tallgrass prairie (Diamond and Smeins 1988).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Grazing and fire influenced species composition and distribution of this group historically, but much of it has been converted to agriculture and very few unaltered examples persist in the modern, highly fragmented landscape.

ENVIRONMENT

Environmental Description: This group occurs on soils that are black, friable, and organic-rich but are not as rich nor deep as grasslands to the south. They range from somewhat poorly drained to well-drained. During the warm season, soils can be intermittently dry for long periods. *Climate:* The annual temperature where this group typically occurs is around 2.5°C with mean summer temperatures of 16°C and mean winter temperatures of -12.5°C. Mean annual precipitation typically ranges from 450-700 mm.

DISTRIBUTION

***Geographic Range:** This group is found in the United States and Canada from northwestern Iowa, northward along the Red River basin and Prairie Coteau in Minnesota and the Dakotas to Lake Manitoba in southeastern Manitoba.
Nations: CA, US
States/Provinces: IA, MB, MN, ND, SD
USFS Ecoregions (2007) [optional]: 222N:CC, 251A:CC, 251B:CC, 251H:C?, 332B:CC, 332D:CC
Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A4019	*Schizachyrium scoparium - Bouteloua curtipendula* Northern Grassland Alliance
A4018	*Andropogon gerardii - Sporobolus heterolepis - Muhlenbergia richardsonis* Northern Grassland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	*Andropogon-Stipa-Sporobolous*	Diamond and Smeins 1988	

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard and D. Faber-Langendoen

Acknowledgments [optional]: B. Hoagland

Version Date: 25 Aug 2015

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland

G151. Sand & Gravel Tallgrass Prairie

Type Concept Sentence:

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nb.1. Central Lowlands Tallgrass Prairie (M054)

Elcode: G151
***Scientific Name:** *Schizachyrium scoparium - Bouteloua* spp. - *Andropogon gerardii* Sand & Gravel Tallgrass Prairie Group
***Common (Translated Scientific) Name:** Little Bluestem - Grama species - Big Bluestem Sand & Gravel Tallgrass Prairie Group
***Colloquial Name:** Sand & Gravel Tallgrass Prairie

***Type Concept:** This group is found in the northern Midwest, particularly in Minnesota, Wisconsin, Michigan, and possibly ranging into Ontario, Canada. It is often found on glacial features such as kames, eskers, moraines, lakeplains (though excluding the Great Lakes lakeplain) and sandplains, and along eolian dunes. In contrast to the deeper, richer soils supporting other tallgrass systems in the region, the underlying soils in this group tend to be more shallow, sandy, rocky, and/or gravelly outwash soils. Organic content is significantly lower. Grassland species such as *Schizachyrium scoparium, Andropogon gerardii*, and *Bouteloua* spp., varying in cover from sparse to moderately dense, dominate this group. *Hesperostipa spartea* and *Sporobolus heterolepis* are also common components. Woody species more tolerant of droughty conditions may be found in some examples. The most common trees are *Pinus banksiana, Quercus ellipsoidalis, Quercus macrocarpa*, and *Populus tremuloides*. Fire and drought are the major dynamics influencing this group. If fire and periodic drought are not present, woody species begin to invade, especially in the eastern parts of the distribution. Wind can also play a role, especially on examples found on sandplains and/or eolian dunes.

***Diagnostic Characteristics:** This tallgrass group is restricted to shallow sandy, rocky, and/or gravelly soils compared to Central Great Plains Tallgrass Prairie Group (G333) and Northern Great Plains Tallgrass Prairie Group (G075). It is found throughout the central Midwest.

***Classification Comments:** This group has some similar dominant species to both Northern Great Plains Tallgrass Prairie Group (G075) and Central Great Plains Tallgrass Prairie Group (G333) but is found on shallow sandy, rocky, and/or gravelly soils compared to the deeper, richer soils found with other tallgrass groups. Likewise, many examples contain *Bouteloua* spp. and other graminoids more commonly found on drier soils. This group refers to sandy and rocky prairies in the northern Midwest and does not include the Sandhills or sand prairies in the western Great Plains, including states such as the Dakotas, Kansas or Nebraska. Those are covered by Great Plains Sand Grassland Group (G068).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The vegetation is characterized by a sparse to moderately dense layer of tall grasses. Some examples of this group may contain scattered woody species tolerant of the droughty conditions.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Grassland species such as *Schizachyrium scoparium, Andropogon gerardii*, and *Bouteloua* spp., varying in cover from sparse to moderately dense, dominate this group. *Hesperostipa spartea* and *Sporobolus heterolepis* are also common components. Woody species more tolerant of droughty conditions may be found in some examples. The most common trees are *Pinus banksiana, Quercus ellipsoidalis, Quercus macrocarpa*, and *Populus tremuloides*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Fire and drought are the major dynamics influencing this group. If fire and periodic drought are not present, woody species begin to invade, especially in the eastern parts of the distribution. Wind can also play a role, especially on examples found on sandplains and/or eolian dunes.

ENVIRONMENT

Environmental Description: This group is often found on glacial features such as kames, eskers, moraines, lakeplains (though excluding the Great Lakes lakeplain) and sandplains, and along eolian dunes. In contrast to the deeper, richer soils supporting other tallgrass groups in the region, the underlying soils in this group tend to be more shallow, sandy, rocky, and/or gravelly outwash soils. Organic content is significantly lower.

DISTRIBUTION

***Geographic Range:** This group is found in the northern Midwest possibly ranging into Ontario, Canada.
Nations: CA, US
States/Provinces: IA, IL, IN, MI, MN, MO, ND, ON?, SD, WI
USFS Ecoregions (2007) [optional]: 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCP, 212Hi:CCC, 212Hk:CCC, 212Hm:CCP, 212K:CP, 212M:CP, 212N:CP, 212Tb:CCC, 222Ja:CCC, 222Jb:CCC, 222Jc:CCC, 222Je:CCC, 222Jf:CCP, 222Jg:CCC, 222Jh:CCC, 222Ji:CCP, 222K:CC, 222L:CC, 222M:CC, 222N:CC, 222R:CP, 222Ua:CCC, 222Ud:CCP, 222Ue:CCP, 251A:CC, 251B:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard
Acknowledgments [optional]:
Version Date: 17 Dec 2010

REFERENCES

***References [Required if used in text]:**

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Thompson, J. W. 1940. Relic prairie areas in central Wisconsin. Ecological Monographs 10(4):685-717.

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland

M051. Great Plains Mixedgrass & Fescue Prairie

Type Concept Sentence: The macrogroup is dominated by mixed grasses and scattered to moderately dense shrubs. It is found from northern Texas to southern Alberta across to southwest in the region between the tallgrass prairies to the east and the shortgrass prairies to the west. It occurs on both glaciated and non-glaciated substrates on a wide variety of landforms, and natural disturbances include grazing and fire.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.B.2.Nb.2. Central North American Grassland & Shrubland (D023)

Elcode: M051
***Scientific Name:** *Hesperostipa comata - Pascopyrum smithii - Festuca hallii* Grassland Macrogroup
***Common (Translated Scientific) Name:** Needle-and-Thread - Western Wheatgrass - Plains Rough Fescue Grassland Macrogroup
***Colloquial Name:** Great Plains Mixedgrass & Fescue Prairie

***Type Concept:** The macrogroup is dominated by mixed grasses and scattered to moderately dense shrubs. It is found from northern Texas to southern Alberta. The most common graminoid species occurring across the range of the macrogroup include *Hesperostipa comata* and *Pascopyrum smithii*. Northern examples are typically dominated by *Festuca* spp., especially *Festuca hallii*, in combination with *Bouteloua gracilis, Hesperostipa curtiseta, Koeleria macrantha, Pascopyrum smithii, Poa pratensis*, and *Symphoricarpos occidentalis*. Southern examples are more likely to be dominated by species such as *Aristida purpurea, Bothriochloa laguroides ssp. torreyana, Bouteloua curtipendula, Schizachyrium scoparium*, and *Sporobolus cryptandrus*. The most mesic sites can have abundant tallgrasses, especially *Andropogon gerardii, Panicum virgatum*, and *Sorghastrum nutans*. Other common associated species include *Bouteloua gracilis, Bouteloua dactyloides, Carex filifolia, Carex inops ssp. heliophila, Calamovilfa longifolia, Elymus lanceolatus, Festuca idahoensis, Hesperostipa curtiseta, Hesperostipa neomexicana, Koeleria macrantha, Muhlenbergia montana, Nassella leucotricha, Nassella viridula, Pseudoroegneria spicata, Sorghastrum nutans*, and *Sporobolus compositus*. Common forb species tend to be somewhat restricted but may include *Achillea millefolium, Ambrosia psilostachya, Amphiachyris dracunculoides, Artemisia ludoviciana, Cerastium arvense, Dalea purpurea, Echinacea angustifolia, Galium boreale, Hymenopappus scabiosaeus, Liatris punctata, Lygodesmia juncea, Pediomelum linearifolium*, and *Symphyotrichum falcatum*. Woody species can occur and include *Amelanchier alnifolia, Artemisia cana, Dasiphora fruticosa ssp. floribunda, Juniperus horizontalis, Prosopis glandulosa, Prunus virginiana, Rhus trilobata, Rosa arkansana*, and *Symphoricarpos occidentalis*. Isolated patches of *Quercus macrocarpa* also can occur. Some examples may range into shrub-steppe. Grazing and fire are important dynamic processes in this macrogroup and can significantly influence the distribution and dominance of species within it. Fire suppression and overgrazing within the region has enabled the invasion of both exotics and some shrub species such as *Juniperus virginiana* and *Prosopis glandulosa*. These factors have also allowed for the establishment of *Pinus ponderosa* in the northwestern parts of the range. Conversion to agriculture likewise has decreased the range of this macrogroup. This type is found in regions centered between the shortgrass prairies in the western Great Plains and the tallgrass prairies in the eastern Great Plains. It occurs on both glaciated and non-glaciated substrates on a wide variety of landforms. The distribution, species richness and productivity of plant species is controlled by environmental conditions, in particular soil moisture and topography. Soils range from fine-textured loams to sandy or gravelly soils. Northern examples of this macrogroup contain significant areas of solonetzic soils, characterized by a subsoil hardpan layer with a high proportion of sodium and may also be clay, silty clay, or loam. The relative dominance of the various grass and forb species within different associations in the macrogroup also can strongly depend on the degree of natural or human disturbance. Because of its proximity to other prairie types, this macrogroup contains elements from both shortgrass and tallgrass prairies, which combine to form the mixedgrass prairie throughout its range.

***Diagnostic Characteristics:** This macrogroup is dominated by medium-tall graminoids and, in addition to a suite of diagnostic mixedgrass species, also contains elements from both the shortgrass prairies to the west and the tallgrass prairies to the east. The most common species present across the range of the group include *Hesperostipa comata* and *Pascopyrum smithii*. Drier sites may be codominated by shortgrass species such as *Bouteloua gracilis* and *Koeleria macrantha*. Northern sites in the Dakotas, Montana, and Canada are typically dominated by *Festuca* spp., especially *Festuca hallii*, and *Hesperostipa curtiseta*.

***Classification Comments:** A significant portion of the range of this macrogroup occurs in Canada. The rough fescue (*Festuca hallii*) in the north, where it extends into the aspen parkland, may be distinct enough to recognize as a separate macrogroup, but diagnostic species beyond rough fescue are needed (perhaps *Hesperostipa curtiseta*). More information about occurrences in Canada will help refine the definition of the northern range of this macrogroup. Characteristic codominants of fescue grassland include *Bouteloua gracilis, Hesperostipa curtiseta, Pascopyrum smithii, Poa pratensis, Symphoricarpos occidentalis*, as well as *Koeleria macrantha*.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M151	Great Plains Forest & Woodland	
M054	Central Lowlands Tallgrass Prairie	
M052	Great Plains Sand Grassland & Shrubland	
M053	Western Great Plains Shortgrass Prairie	
M498	Great Plains Ruderal Grassland & Shrubland	
M115	Great Plains Badlands Vegetation	

Similar NVC Types General Comments [optional]: This macrogroup (M051) occurs between Western Great Plains Shortgrass Prairie Macrogroup (M053) to the west and Central Lowlands Tallgrass Prairie Macrogroup (M054) to the east and typically contains elements of each.

VEGETATION

Physiognomy and Structure Summary: This macrogroup is characterized by a dense to sparse mixture of mixedgrass species, along with tall and short grasses interspersed with forbs and short shrubs. Some examples may contain considerable leaf litter, bare soil and rock.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The most common graminoid species occurring across the range of the macrogroup include of *Hesperostipa comata (= Stipa comata)* and *Pascopyrum smithii*. Other common species include *Bouteloua curtipendula, Bouteloua gracilis, Bothriochloa laguroides ssp. torreyana, Bouteloua dactyloides, Carex filifolia, Carex inops ssp. heliophila, Elymus lanceolatus, Pseudoroegneria spicata, Schizachyrium scoparium, Sorghastrum nutans, Sporobolus compositus, Sporobolus cryptandrus*, and *Sporobolus heterolepis*. Northern examples in Montana, the Dakotas, and Canada (the fescue grasslands) are typically dominated by *Festuca* spp. with the most common species being *Festuca hallii (= Festuca altaica ssp. hallii)*, typically in combination with *Bouteloua gracilis, Hesperostipa curtiseta (= Stipa curtiseta), Koeleria macrantha, Pascopyrum smithii, Poa pratensis*, and *Symphoricarpos occidentalis* (Kupsch et al. 2012). Southern examples are more likely to be dominated by species such as *Aristida purpurea, Bothriochloa laguroides ssp. torreyana, Bouteloua curtipendula, Schizachyrium scoparium*, and *Sporobolus cryptandrus*.

Common forb species include *Ambrosia psilostachya, Amphiachyris dracunculoides, Artemisia frigida, Dalea purpurea, Echinacea angustifolia, Lygodesmia juncea, Opuntia polyacantha*, and *Sphaeralcea coccinea*. Woody species can occur in many examples. Some common species include *Amelanchier alnifolia, Artemisia cana, Dasiphora fruticosa ssp. floribunda, Juniperus horizontalis, Prosopis glandulosa, Prunus virginiana, Rhus trilobata, Rosa arkansana*, and *Symphoricarpos occidentalis*. *Elaeagnus commutata* shrublands are common in the northern fescue grasslands. Isolated patches of *Quercus macrocarpa* also can occur. Some examples may range into shrub-steppe. Species composition and abundance can shift dramatically with overgrazing.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Fire, grazing, and drought are the primary processes occurring within the macrogroup. The diversity in this mixedgrass prairie likely reflects both the short- and long-term responses of the vegetation to these often concurrent disturbance regimes (Collins and Barber 1985). Fire is not as common as in more fertile, well-watered tallgrass prairies further east but is still important. Fire-return intervals in the central Great Plains have been estimated at 15-25 years (LANDFIRE 2007a) but fires burn patchily across the landscape, consuming vegetation in some areas and missing others. This combined with the differential responses of species to burning results in greater diversity across the landscape (Wright 1974). Grazing by native ungulates, primarily bison (*Bos bison*) and small mammals, principally prairie dogs (*Cynomys* spp.) added a further degree of patchy disturbance to the mixedgrass prairie (Whicker and Detling 1988, Weltzin et al. 1997). Long-term precipitation variance affects diversity of the mixedgrass prairie, creating conditions more favorable to shortgrass species during droughts while allowing mixedgrass species to spread during wetter years (Albertson and Tomanek 1965).

ENVIRONMENT

Environmental Description: This macrogroup occurs on a wide variety of landforms and soils. Climate and growing season length for the region in which it occurs are intermediate to the shortgrass regions to the west and southwest and the tallgrass regions to the east. Soils range from loams, clay loams, silty clays, and clays to more coarse-textured sandy or gravelly soils. The northern fescue grasslands in Alberta are dominated by dark brown chernozemic soils on a level to undulating plain. Parent materials are dominated by glacial till. The climate is cold, continental (mean daily temperature of 3.8°C, total precipitation 38 cm) with few chinooks, compared to the somewhat warmer and moist climate of the mixedgrass prairies in southern Alberta (mean daily temperature 4.5-5.0°C and total precipitation 34-42 cm) (Kupsch et al. 2012). Some examples may include an impermeable or slowly permeable subsoil claypan layer. Other northern soils may be solonetzic and characterized by a subsoil hardpan layer with an excess of sodium (Adams et al. 2013).

DISTRIBUTION

***Geographic Range:** This macrogroup is found in the central Great Plains, ranging from Manitoba, Saskatchewan and Alberta, Canada, south into northern Texas and northeastern New Mexico. Fescue grasslands are found in Alberta, Saskatchewan, Montana, and possibly North Dakota.
Nations: CA, US
States/Provinces: AB, CO, KS, MB, MT, ND, NE, NM, OK, SD, SK, TX, WY
USFS Ecoregions (2007) [optional]: 223A:??, 251A:CC, 251B:CC, 251E:CP, 251F:CC, 251H:CC, 255A:??, 315A:CC, 315B:CC, 315F:CC, 315H:CC, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 331K:CC, 331L:CC, 331M:CC, 331N:CC, 332A:CP, 332B:CC, 332C:CC, 332D:CC, 332E:CC, 332F:CC, 342A:CP, 342F:CC, 342G:CC, M313A:CP, M313B:CC, M331A:CC, M331B:CC, M331D:CP, M331F:CC, M331G:CC, M331I:CC, M331J:C?, M332B:CC, M332D:CC, M332E:CC, M332F:CP, M333B:CC, M333C:CC, M334A:CC, M341A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G133	Central Great Plains Mixedgrass Prairie
G331	Northern Great Plains Dry Mixedgrass Prairie
G141	Northern Great Plains Mesic Mixedgrass Prairie
G332	Northern Great Plains Rough Fescue Prairie

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Blue Grama - Western Wheatgrass (704)	Shiflet 1994	
>	Bluestem - Grama (709)	Shiflet 1994	
<	Bluestem - Grama Prairie (604)	Shiflet 1994	
<	Bluestem Prairie (601)	Shiflet 1994	
<	Bluestem Prairie (710)	Shiflet 1994	
<	Eastern Redcedar: 46	Eyre 1980	Only on really degraded sites.
><	Fescue Grassland (613)	Shiflet 1994	
<	Wheatgrass (610)	Shiflet 1994	
><	Wheatgrass - Bluestem - Needlegrass (606)	Shiflet 1994	
<	Wheatgrass - Grama (609)	Shiflet 1994	
<	Wheatgrass - Grama - Needlegrass (608)	Shiflet 1994	
<	Wheatgrass - Needlegrass (607)	Shiflet 1994	
><	Wheatgrass - Saltgrass - Grama (615)	Shiflet 1994	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.E. Weaver and F.W. Albertson (1956); R.T. Coupland (1961)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard, K. Kindscher, L. Elliott, D. Faber-Langendoen

Acknowledgments [optional]:

Version Date: 20 Nov 2015

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland

G133. Central Great Plains Mixedgrass Prairie

Type Concept Sentence: This group occurs in the central Great Plains where grasslands are dominated by *Bouteloua curtipendula, Pascopyrum smithii*, and *Schizachyrium scoparium*, often with tallgrass or shortgrass species present to codominant.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Nb.2. Great Plains Mixedgrass & Fescue Prairie (M051)

Elcode: G133
***Scientific Name:** *Schizachyrium scoparium - Bouteloua curtipendula - Pascopyrum smithii* Mixedgrass Prairie Group
***Common (Translated Scientific) Name:** Little Bluestem - Sideoats Grama - Western Wheatgrass Mixedgrass Prairie Group
***Colloquial Name:** Central Great Plains Mixedgrass Prairie

***Type Concept:** This mixedgrass prairie group ranges from South Dakota into the Rolling Plains and the western Edwards Plateau of Texas. The loessal regions in west-central Kansas and central Nebraska, the Red Hills region of south-central Kansas and northern Oklahoma are all located within this group. Because of its proximity to other ecoregions, this group contains elements from both shortgrass and tallgrass prairies, which combine to form the mixedgrass prairie group throughout its range. The distribution, species richness and productivity of plant species within the mixedgrass group is controlled primarily by environmental conditions, in particular soil moisture and topography. Grazing and fire are important dynamic processes in this group. The relative dominance of the various grass and forb species within different associations in the group also can strongly depend on the degree of natural or human disturbance. This group can contain grass species such as *Andropogon gerardii, Hesperostipa comata*, and *Sporobolus heterolepis*, although the majority of the associations within the region are dominated by *Pascopyrum smithii* or *Schizachyrium scoparium*, often with substantial *Bouteloua gracilis* or *Bouteloua curtipendula*. *Muhlenbergia reverchonii* can be a dominant in the southern part of the group's range. Numerous forb and sedge species (*Carex* spp.) can also occur within the mixedgrass group in the western Great Plains. *Bouteloua dactyloides* and *Yucca glauca* can be common in drier or overgrazed areas. Some common forb species include *Ambrosia psilostachya, Echinacea angustifolia*, and *Lygodesmia juncea*. Oak species such as *Quercus macrocarpa* can occur also in areas protected from fire due to topographic position, which may resemble an oak savanna, and fire suppression may result in a closed canopy and expansion of bur oak beyond sheltered areas. Likewise, within the mixedgrass prairie, small seeps may occur, especially during the wettest years. Although these are not considered a separate group, the suppression of fire within the region has enabled the invasion of both exotics and some shrub species such as *Juniperus virginiana* and also allowed for the establishment of *Pinus ponderosa* in the northwestern parts of the range.

***Diagnostic Characteristics:** This group contains elements from both shortgrass prairies to the west and tallgrass prairies to the north and east, which combine to form the mixedgrass prairie group throughout its range. Dominance by some combination of *Schizachyrium scoparium, Bouteloua curtipendula*, and *Bouteloua gracilis* in the central Great Plains is characteristic.

***Classification Comments:** This group was originally split into a dry group and a mesic group. It was combined into one group as the difference between mesic and dry appeared more appropriately separated at the alliance level.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G144	Great Plains Shortgrass Prairie	
G141	Northern Great Plains Mesic Mixedgrass Prairie	
G068	Great Plains Sand Grassland	
G333	Central Tallgrass Prairie	

Similar NVC Types General Comments [optional]: This group contains elements from both Great Plains Shortgrass Prairie Group (G144) and Central Tallgrass Prairie Group (G333). It is similar in structure and contains some similar species to both Northern Great Plains Mesic Mixedgrass Prairie Group (G141) and Northern Great Plains Dry Mixedgrass Prairie Group (G331).

VEGETATION

Physiognomy and Structure Summary: The vegetation is characterized by a dense to sparse mixture of tall, mid, and short grasses interspersed with forbs. Woody vegetation is uncommon in most examples but can become common in the prolonged absence of fire, especially in the wetter, eastern part of this group's range.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This group typically contains mixedgrass species such as *Pascopyrum smithii, Bouteloua curtipendula, Schizachyrium scoparium, Hesperostipa comata, Sporobolus heterolepis*, and *Bouteloua gracilis*. Some tallgrass species may be common, such as *Andropogon gerardii, Sorghastrum nutans*, and *Panicum virgatum*. *Bouteloua dactyloides (= Buchloe dactyloides)* can become common on overgrazed sites. Common forb species include *Ambrosia psilostachya, Echinacea angustifolia*, and

Lygodesmia juncea. Scattered patches of trees, often *Juniperus virginiana* and *Quercus macrocarpa* but also *Pinus ponderosa* in the northwest, and shrubs, typically *Artemisia filifolia* (on sandier soils), *Gutierrezia sarothrae, Prosopis glandulosa* (in the south), *Prunus virginiana*, and *Yucca glauca*, occur in some stands and these can increase in the prolonged absence of fire.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Fire and grazing are the primary processes occurring within the group. The diversity in this mixedgrass group likely reflects both the short- and long-term responses of the vegetation to these often concurrent disturbance regimes. Fire suppression and overgrazing can lead to the invasion of woody species such as *Juniperus virginiana* and *Pinus ponderosa*. Likewise, fire suppression may lead to a more closed canopy of *Quercus macrocarpa*.

ENVIRONMENT

Environmental Description: Topographic and soil characteristics also vary across the range of this group. It is often characterized by rolling to extremely hilly landscapes with soils developed from loess, shale, limestone, or sandstone parent material. Mollisol soils are most prevalent and range from silt loams and silty clay loams with sandy loams possible on the western edge of the range. The Red Hills region of Kansas and Oklahoma, which contains examples of this group, contains somewhat unique soil characteristics and has developed from a diversity of sources including red shale, red clay, sandy shale, siltstone, or sandstone. These soils have developed a characteristic reddish color from the primary material. They can consist of silt, loam, or clay and can have textures ranging from fine sandy loam to a more clayey surface.

DISTRIBUTION

***Geographic Range:** This group is found throughout the central and southern areas of the Western Great Plains ranging from southern South Dakota and possibly southern North Dakota into Texas with a few occurrences in the tallgrass-dominated landscapes of western Iowa, eastern Nebraska, and northwestern Missouri.
Nations: CA, US
States/Provinces: CO, IA, KS, ND, NE, NM, OK, SD, TX
USFS Ecoregions (2007) [optional]: 223A:??, 251A:CP, 251B:CC, 251E:CP, 251F:CC, 251H:CC, 255A:??, 315F:CC, 331B:CC, 331C:CC, 331E:CC, 331F:CC, 331H:CC, 331I:CC, 331M:CP, 332B:CC, 332C:CC, 332D:CC, 332E:CC, 332F:CC
Omernik Ecoregions L3, L4 [optional]: 9.4.2.27d:C, 9.4.2.27g:C, 9.4.2.27h:C, 9.4.2.27i:C, 9.4.2.27k:C, 9.4.2.27l:C, 9.4.2.27n:C, 9.4.2.27o:C, 9.4.2.27r:C, 9.4.3.26a:C, 9.4.3.26c:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A4042	*Schizachyrium scoparium - Bouteloua curtipendula* Central Great Plains Grassland Alliance
A4038	*Rhus trilobata* Great Plains Shrubland Alliance
A4039	*Pascopyrum smithii - Bouteloua gracilis* Great Plains Grassland Alliance
A4040	*Muhlenbergia reverchonii* Grassland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Blue Grama - Western Wheatgrass (704)	Shiflet 1994	
>	Bluestem - Grama (709)	Shiflet 1994	
<	Bluestem - Grama Prairie (604)	Shiflet 1994	
<	Eastern Redcedar: 46	Eyre 1980	Only on really degraded sites.

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard, K. Kindscher, D. Faber-Langendoen and J. Drake

Acknowledgments [optional]: B. Hoagland

Version Date: 07 May 2015

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***References [Required if used in text]:**

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Weaver, J. E., and W. E. Bruner. 1948. Prairies and pastures of the dissected loess plains of central Nebraska. Ecological Monographs 18(4):507-549.

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2. Shrub & Herb Vegetation

2.B.2.Nb. Central North American Grassland & Shrubland

M158. Great Plains Comanchian Scrub & Open Vegetation

Type Concept Sentence: This scrub woodland and shrubland vegetation is found in the High, Rolling, and Red Bed plains of Texas and Oklahoma ranging south into parts of the Edwards Plateau and marginally in the Chihuahuan Desert regions of Texas and possibly adjacent Mexico, as well as the Southwestern Tablelands. Occurrences on dry, rocky sites typically include evergreen junipers and oaks such as *Juniperus ashei, Juniperus monosperma, Juniperus pinchotii, Quercus fusiformis, Quercus havardii, Quercus mohriana*, and *Quercus sinuata*, as well as *Prosopis glandulosa var. glandulosa, Buddleja racemosa, Dalea formosa*, and *Mimosa borealis* in some examples.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.B.2.Nb.5. Central North American Grassland & Shrubland (D023)

Elcode: M158
***Scientific Name:** *Juniperus ashei - Juniperus pinchotii - Quercus mohriana* Scrub & Open Vegetation Macrogroup
***Common (Translated Scientific) Name:** Ashe's Juniper - Pinchot's Juniper - Mohr Oak Scrub & Open Vegetation Macrogroup
***Colloquial Name:** Great Plains Comanchian Scrub & Open Vegetation

***Type Concept:** This scrub woodland vegetation is found in the High, Rolling, and Red Bed plains of Texas and Oklahoma ranging south into parts of the Edwards Plateau and Chihuahuan Desert regions of Texas, as well as the Southwestern Tablelands. Occurrences on dry, rocky sites typically include evergreen junipers and oaks such as *Juniperus ashei, Juniperus monosperma, Juniperus pinchotii, Quercus fusiformis, Quercus havardii, Quercus mohriana*, and *Quercus sinuata*, as well as *Prosopis glandulosa var. glandulosa* in some examples. Other woody species include *Buddleja racemosa, Cercocarpus montanus, Dalea formosa, Gutierrezia sarothrae, Mimosa borealis, Rhus lanceolata*, and *Rhus trilobata*. On deeper alluvial soils, *Prosopis glandulosa* may dominate, with species such as *Mahonia trifoliolata, Sideroxylon lanuginosum*, and *Ziziphus obtusifolia* also commonly encountered. Characteristic graminoids include *Aristida purpurea, Bouteloua curtipendula, Bouteloua gracilis, Bouteloua hirsuta, Bouteloua dactyloides, Pleuraphis mutica*, and *Schizachyrium scoparium*. Forbs, including species such as *Artemisia ludoviciana, Calylophus* sp., *Chaetopappa ericoides, Croton monanthogynus, Indigofera miniata, Krameria lanceolata, Melampodium leucanthum, Rhynchosia senna*, and *Ruellia nudiflora*, may also be present. The canopy is less than 6 m in height, and may be open with a grassy or rocky understory, or may form dense low patches or mottes interspersed with grasslands and rock outcrops. Bare ground is often conspicuous, and herbaceous cover, where present, is usually dominated by mid to short grasses and forbs. This vegetation occupies dry, rocky sites on mesas and escarpment breaks over a variety of geologic strata, including sandstones, shales, limestone and basalt. Alternatively, *Prosopis glandulosa*-dominated occurrences may occupy deeper, alluvial soils, often along drainages or topographic lows. Soils are variable in depth, and this vegetation can occur where there is little soil development.

***Diagnostic Characteristics:** These are *Quercus* and *Juniperus* scrub woodlands and shrublands, as well as *Prosopis glandulosa var. glandulosa* woodlands in the southwestern Great Plains and adjacent areas. This does not include vegetation characterized by *Prosopis glandulosa var. glandulosa* occurring in southern Texas.

***Classification Comments:** Comanchian Oak - Juniper Scrub Group (G191) represents oak and juniper scrub woodlands and shrublands in the southwestern Great Plains and adjacent areas. It overlaps some with Madrean Pinyon - Juniper Woodland Group (G200) in Madrean Lowland Evergreen Woodland Macrogroup (M010) and Balconian Dry Forest & Woodland Group (G126) in Balconian Forest & Woodland Macrogroup (M015). These relationships should be examined. Due to the reproductive nature of some of the dominant species, it often exhibits patch dominance by a single species. Classification of this group as well as Comanchian Mesquite - Mixed Scrub Group (G192) is further complicated because they may be difficult to distinguish from compositionally and structurally similar ruderal vegetation. G192 as described does not include vegetation characterized by *Prosopis glandulosa var. glandulosa* occurring in southern Texas.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]: Comanchian Oak - Juniper Scrub Group (G191) has some overlap with Madrean Pinyon - Juniper Woodland Group (G200) in Madrean Lowland Evergreen Woodland Macrogroup (M010) and Balconian Dry Forest & Woodland Group (G126) in Balconian Forest & Woodland Macrogroup (M015). These relationships should be examined.

VEGETATION

Physiognomy and Structure Summary: Physiognomic expression varies from open, short, stunted woodlands, less than 6 m in height, to low dense shrublands. Many stands are dominated by evergreen oaks and junipers, but deciduous shrubs are also common. Some examples are dominated by *Prosopis glandulosa var. glandulosa*, in which the small size of the leaflets allows light to reach the ground even through more closed canopies.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Examples are dominated by evergreen junipers and oaks such as *Juniperus ashei, Juniperus monosperma, Juniperus pinchotii, Juniperus scopulorum, Quercus fusiformis, Quercus havardii, Quercus mohriana*, and *Quercus sinuata*, as well as *Prosopis glandulosa var. glandulosa* in some examples. Other woody species include *Acacia greggii, Aloysia gratissima, Buddleja racemosa, Cercocarpus montanus, Dalea formosa, Gutierrezia sarothrae, Mahonia trifoliolata, Mimosa borealis, Prosopis glandulosa, Rhus lanceolata, Rhus trilobata, Sapindus saponaria var. drummondii*, and *Ungnadia speciosa*. In addition, *Yucca glauca* and *Opuntia* spp. may be present. On deeper alluvial soils, *Prosopis glandulosa* may dominate, with species such as *Mahonia trifoliolata, Sideroxylon lanuginosum*, and *Ziziphus obtusifolia* also commonly encountered. Field layer cover is variable but often sparse. Characteristic graminoids, when present, include *Aristida purpurea, Bouteloua curtipendula, Bouteloua gracilis, Bouteloua hirsuta, Bouteloua dactyloides (= Buchloe dactyloides), Nassella leucotricha, Pleuraphis mutica, Schizachyrium scoparium*, and *Sporobolus vaginiflorus*. Forbs, including species such as *Artemisia ludoviciana, Calylophus* sp., *Chaetopappa ericoides, Croton monanthogynus, Indigofera miniata, Krameria lanceolata, Melampodium leucanthum, Mimosa* spp., *Rhynchosia senna*, and *Ruellia nudiflora*, may also be present. Additional forbs characteristic of open vegetation of rock outcrops are *Lesquerella gordonii, Lesquerella ovalifolia, Sedum nuttallianum*, and *Sedum pulchellum*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: Examples of Comanchian Oak - Juniper Scrub Group (G191) occupy dry, rocky sites on mesas and escarpment breaks over a variety of geologic strata, including sandstones, shales, limestone and basalt. Soils are variable and this vegetation can occur where there is little soil development. Comanchian Mesquite - Mixed Scrub Group (G192) occurs on a variety of soil types but is best developed on bottomland soils (L. Elliott pers. comm., D. Diamond. pers. comm.).

DISTRIBUTION

***Geographic Range:** This scrub woodland vegetation is found in the High, Rolling, and Red Bed plains of Texas and Oklahoma ranging south into parts of the Edwards Plateau and marginally in the Chihuahuan Desert regions of Texas and possibly adjacent Mexico, as well as the Southwestern Tablelands.
Nations: MX?, US
States/Provinces: MXCH?, MXCO?, NM?, OK, TX
USFS Ecoregions (2007) [optional]: 315B:CC, 315C:CC, 315D:CC, 315F:CC, 315G:CC, 321A:CP, 321B:CC, 332F:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G598	Comanchian Barrens & Glade
G191	Comanchian Oak - Juniper Scrub
G192	Comanchian Mesquite - Mixed Scrub

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	*Prosopis glandulosa* Shrubland Alliance	Hoagland 2000	
><	Ashe Juniper - Redberry (Pinchot) Juniper: 66	Eyre 1980	
><	Live Oak - Mesquite Savanna	Tharp 1939	
><	Mesquite - Grassland	Tharp 1939	
><	Mesquite Grassland	Hoagland 2008	
><	Mesquite Plains	Blair and Hubbell 1938	
><	Mohrs (Shin) Oak: 67	Eyre 1980	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. Teague, in Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne and J. Teague

Acknowledgments [optional]:

Version Date: 07 May 2015

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***References [Required if used in text]:**

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2. Shrub & Herb Vegetation

2.B.2.Nb. Central North American Grassland & Shrubland

G598. Comanchian Barrens & Glade

Type Concept Sentence: This specialized limestone or granitic glade vegetation is dominated by low forbs, annual grasses, and succulents and is found in inland (non-coastal plain) parts of Texas and adjacent Oklahoma, including the Edwards Plateau, Lampasas Cutplain, Blackland Prairie, Crosstimbers, and isolated locations in the South Texas Plains. Some characteristic plants include *Lesquerella gordonii, Lesquerella ovalifolia, Schizachyrium scoparium, Sedum nuttallianum, Sedum pulchellum*, and *Sporobolus vaginiflorus*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nb.5. Great Plains Comanchian Scrub & Open Vegetation (M158)

Elcode: G598
***Scientific Name:** *Sedum nuttallianum - Lesquerella gordonii - Sporobolus vaginiflorus* Glade Vegetation Group
***Common (Translated Scientific) Name:** Yellow Stonecrop - Gordon's Bladderpod - Poverty Dropseed Glade Vegetation Group
***Colloquial Name:** Comanchian Barrens & Glade

***Type Concept:** This group accommodates specialized glade vegetation, frequently dominated by low forbs, annual grasses, and succulents, found on limestones and granitic materials in inland (non-coastal plain) parts of Texas and adjacent Oklahoma, including the Edwards Plateau, Lampasas Cutplain, Blackland Prairie, Crosstimbers, and isolated locations in the South Texas Plains. This vegetation may occur as large to small patches, embedded in a matrix of woodlands, open forests, or perennial grass-dominated prairies. Some characteristic plants include *Lesquerella gordonii, Lesquerella ovalifolia, Schizachyrium scoparium, Sedum nuttallianum, Sedum pulchellum*, and *Sporobolus vaginiflorus* (*var. ozarkanus* and *var. vaginiflorus*).

***Diagnostic Characteristics:** These are glades found on shallow soils over limestones, dolomites, and related substrates, as well as granitic materials, which are dominated by low forbs, annual grasses, and succulents. There may be intercalated patches of dry upland and seasonally wet (or saturated) vegetation.

***Classification Comments:** This group has been developed to accommodate elements that are not comfortably placed in either the "northern and central" glade group nor in the "southern coastal plain" glade group. Two of the four associations placed in this group were provisionally placed in a proposed group that mainly contained Appalachian associations on metamorphic rock; in contrast, these two associations (CEGL004729 and CEGL004874) are found in Texas and Oklahoma on limestone. The four associations (CEGL004396, CEGL004729, CEGL004874, and CEGL004917) placed here are all in one alliance. It may require subdivision as more information becomes available. Three associations (CEGL004729, CEGL004874, and CEGL004917) are restricted to limestones, and CEGL004396 is restricted to massive granites in south-central Texas. Some associations within this group are broadly described to include vegetation that occupies small shallow depressions in the rock substrate (limestone and granitic) that are seasonally moist and support obligate wetland plants such as *Isoetes lithophila* in granitic settings.

Characteristics of this group may overlap with that of Great Plains Cliff, Scree & Rock Vegetation Group (G567), and review is needed to clarify the respective limits of the two concepts.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G179	Central Interior Alkaline Open Glade & Barrens	
G584	Southeastern Coastal Plain Barrens & Glade	
G567	Great Plains Cliff, Scree & Rock Vegetation	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These glades are mosaics of patches of low-statured vegetation, including low forbs, annual grasses, and succulents. At some sites, the vegetated areas may be limited to cracks or depressions in the limestone or granitic bedrock where soil has developed and accumulated. There may be intercalated patches of dry upland and seasonally wet (or saturated) vegetation.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The vegetation is typically dominated by low forbs, annual grasses, and succulents. Some characteristic plants on carbonate strata include *Lesquerella gordonii, Lesquerella ovalifolia, Schizachyrium scoparium, Sedum nuttallianum, Sedum pulchellum*, and *Sporobolus vaginiflorus* (*var. ozarkanus* and *var. vaginiflorus*). *Nostoc commune* (a cyanobacterium) is also common. At some sites, the vegetated areas may be limited to cracks or depressions in the limestone bedrock where soil has developed and accumulated. Some of the depressions hold moisture for longer periods than the surrounding landscape, providing for the establishment of a diversity of spring annuals. The dominance of the vegetation has a strong seasonal aspect. In central and western Oklahoma, examples are dominated by members of the genus *Lesquerella*, including *Lesquerella gordonii* and *Lesquerella ovalifolia*.

Some associates include *Bouteloua curtipendula, Bouteloua hirsuta, Croton monanthogynus, Mentzelia oligosperma, Oenothera macrocarpa (= Oenothera missouriensis)*, and *Opuntia humifusa* (Hoagland 2000).

On granitic materials in south-central Texas, sites contain large expanses of exposed granite surfaces, with scattered soil-filled depressions, crevices, gravel areas, and shallow pools. The vegetation is dominated by annuals and species adapted to drought conditions. Bare rock is occupied by scattered patches of crustose and foliose lichens, mosses, and several ferns and fern allies, including *Cheilanthes lindheimeri, Cheilanthes tomentosa, Pellaea ternifolia, Selaginella arenicola ssp. riddellii, Selaginella peruviana*, and *Woodsia obtusa ssp. occidentalis*. Typical species that occur in areas where shallow sand or gravel accumulate include *Aphanostephus skirrhobasis, Campanula reverchonii, Helenium amarum, Hypericum gentianoides, Plantago wrightiana, Sedum nuttallianum, Phemeranthus parviflorus (= Talinum parviflorum)*. Areas with deeper soils are dominated by *Schizachyrium scoparium* occurring with other grasses such as *Aristida purpurea, Bouteloua curtipendula*, and *Bouteloua hirsuta*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In the Edwards Plateau of Texas, processes controlling this group are unclear; however, erosion likely plays a major role. Erosion may be exacerbated in some situations by removal of biomass through overgrazing. Erosion mediates the occurrence of this group through its effects on soil depth. As is true for all communities, there is a gradient from moister representatives in the east to drier ones in the west.

ENVIRONMENT

Environmental Description: These glades and barrens are found in xeric, rocky sites. Substrates are diverse, including limestone rock and related substrates, including sandy and gravelly soils, as well as granitic strata in south-central Texas. In the Edwards Plateau of Texas, this glade vegetation is primarily found on hard-bedded limestone such as the Edwards Formation, and igneous bedrock of the Llano Uplift, but may also occur in smaller patches on soft-bedded limestone strata such as the Glen Rose and Cow Creek formations. This vegetation occurs as distinct and mappable patches on limestone and granite; however, it also occurs in smaller patches in a mosaic with savanna and woodland vegetation dominated by perennial grasses, shrubs, and trees. The vegetation may be of very low stature, and plants may occur at low cover. Some of the dominant taxa (e.g., annual grasses) may not be evident at all times of the year.

Soil/substrate/hydrology: Stands are found in xeric sites on limestone rock and related substrates, including sandy and gravelly soils, as well on massive granitic materials in south-central Texas.

DISTRIBUTION

***Geographic Range:** This group is found in inland (non-coastal plain) parts of Texas and adjacent Oklahoma, including the Edwards Plateau, Lampasas Cutplain, Blackland Prairie, Crosstimbers, and isolated locations in the South Texas Plains. Although some occurrences are small (less than 1 ha), others are more extensive. This vegetation is fairly wide-ranging across the eastern Edwards Plateau and Lampasas Cutplain of Texas. Although residential development of this ridgetop habitat has destroyed numerous examples in urban areas, those in more remote settings face few, if any, threats. Some of the largest and most diverse examples are located on Federal land where chances of development are slim.

There are a few *Sedum pulchellum*-dominated/codominated glades in the Edwards Plateau, including one reported site in Bell County. In addition, however, there may be a few on Fort Hood Military Reservation and perhaps a site or two remaining in Travis County (J. Singhurst pers. comm. 2010). In northeast Texas, there are *Sedum pulchellum - Centaurium texense - Paronychia virginica - Nostoc* glades. There is a high probability of *Lesquerella (gordonii, ovalifolia) - Schizachyrium scoparium* Grassland (CEGL004917) being in the Rolling Plains of Texas, but it is doubtful it would occur in the Edwards Plateau.

Nations: US
States/Provinces: OK, TX
USFS Ecoregions (2007) [optional]: 255A:CC, 255E:CP, 315B:CC, 315C:CC, 315D:CC, 315F:CP, 331B:PP, 332F:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]: There may be undescribed associations that belong in this concept, for example "*Sedum pulchellum-Centaurium texense-Paronychia virginica-Nostoc* glades" in northeast Texas (J. Singhurst pers. comm. 2010).

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3308	*Sedum* spp. - *Schizachyrium scoparium* Comanchian Open Grassland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	*Lesquerella (gordonii, ovalifolia) - Schizachyrium scoparium* herbaceous association	Hoagland 2000	
<	Llano Uplift Acidic Glade (not mapped) [CES303.657.3]	Elliott 2011	

AUTHORSHIP

***Primary Concept Source [if applicable]:** M. Pyne and J. Teague, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne and J. Teague

Acknowledgments [optional]: We have incorporated information developed by J. Singhurst and B. Hoagland.

Version Date: 07 May 2015

REFERENCES

***References [Required if used in text]:**

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Weakley, Alan, PhD. Personal communication. Curator, UNC Herbarium, University of North Carolina, Chapel Hill. Formerly Chief Ecologist, NatureServe, Southeast Region, Durham, NC.

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2. Shrub & Herb Vegetation

2.B.2.Nb. Central North American Grassland & Shrubland

G191. Comanchian Oak - Juniper Scrub

Type Concept Sentence: This scrub woodland group occurs on dry, rocky sites on mesas and escarpment breaks in the Rolling Plains, Red Bed Plains, Edwards Plateau and Stockton Plateau regions of the south-central U.S. Characteristic and dominant woody shrubs include *Buddleja racemosa, Juniperus ashei, Juniperus monosperma, Juniperus pinchotii, Quercus mohriana*, and *Quercus sinuata*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nb.5. Great Plains Comanchian Scrub & Open Vegetation (M158)

Elcode: G191
***Scientific Name:** *Quercus mohriana - Quercus sinuata - Juniperus pinchotii* Scrub Group
***Common (Translated Scientific) Name:** Mohr Oak - Bastard Oak - Pinchot's Juniper Scrub Group
***Colloquial Name:** Comanchian Oak - Juniper Scrub

***Type Concept:** The range of this scrub woodland group is centered on the Rolling and Red Bed plains of Texas and Oklahoma and the Edwards and Stockton plateaus of Texas. It may also range into the High Plains, Chihuahuan Desert and Southwestern Tablelands. It occupies dry, rocky sites on mesas and escarpment breaks over a variety of geologic strata including sandstones, shales, limestone and basalt. Soils are variable and this vegetation can occur where there is little soil development. The canopy is less than 6 m in height, and may be open with a grassy or rocky understory, or may form dense low patches or mottes interspersed with grasslands, rock outcrops and woodlands. Characteristic and dominant woody species include evergreen oaks and junipers such as *Quercus mohriana, Quercus sinuata, Juniperus pinchotii*, and *Juniperus ashei*. Other woody species that may be present include *Buddleja racemosa, Cercocarpus montanus, Diospyros texana, Eysenhardtia texana, Gutierrezia sarothrae, Juniperus monosperma, Quercus havardii, Rhus trilobata*, and *Rhus virens*. Bare ground is often conspicuous, and herbaceous cover, where present, is usually dominated by mid- to short grasses. Characteristic graminoids include *Aristida purpurea, Bouteloua curtipendula, Bouteloua gracilis, Bouteloua hirsuta, Pleuraphis mutica*, and *Schizachyrium scoparium*. Forbs, including species such as *Artemisia ludoviciana, Calylophus* sp., *Chaetopappa ericoides, Krameria lanceolata*, and *Melampodium leucanthum*, may also be present.

***Diagnostic Characteristics:** This scrub woodland group occurs on dry, rocky sites on mesas and escarpment breaks in the High Plains, Rolling Plains, Red Bed Plains, Edwards Plateau and Stockton Plateau regions of the south-central U.S. It is characterized by evergreen shrubs and scrubby short-statured trees such as *Buddleja racemosa, Juniperus ashei, Juniperus monosperma, Juniperus pinchotii, Quercus mohriana*, and *Quercus sinuata*.

***Classification Comments:** This group represents oak and juniper scrub woodlands and shrublands in the southwestern Great Plains and adjacent areas. Its separation from Comanchian Mesquite - Mixed Scrub Group (G192) is based on the dominance of evergreen versus deciduous shrubs and short-statured trees, a distinction that may be better made at the alliance level. Classification of this group is hindered by the paucity of USNVC classification information for the association level. It overlaps some with Madrean Pinyon - Juniper Woodland Group (G200) and Balconian Dry Forest & Woodland Group (G126), and this vegetation may be better classified there. The classification distinction between low-statured woodlands and shrublands with some scattered scrubby trees is difficult in this region with shallow soils and limited rainfall. Due to the reproductive nature of some of the dominant species, it often exhibits patch dominance by a single species. Classification of this group is further complicated because it may be difficult to distinguish from compositionally and structurally similar ruderal vegetation.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G200	Madrean Pinyon - Juniper Woodland	
G126	Balconian Dry Forest & Woodland	
G192	Comanchian Mesquite - Mixed Scrub	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Physiognomic expression of this group varies from open stunted woodlands, less than 6 m in height, to low dense shrublands. Many stands are dominated by evergreen oaks and junipers, but deciduous shrubs are also common. Bare ground is common and woody cover is interspersed with grasslands and rock outcrops.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Characteristic and dominant woody species include evergreen oaks and junipers such as *Quercus mohriana, Quercus sinuata, Juniperus pinchotii*, and *Juniperus ashei*. Other woody species that may be present include *Buddleja racemosa, Cercocarpus montanus, Condalia hookeri, Diospyros texana, Eysenhardtia texana, Forestiera pubescens, Gutierrezia sarothrae, Juniperus monosperma, Mahonia trifoliolata, Quercus havardii, Quercus vaseyana, Rhus microphylla, Rhus trilobata, Rhus virens*, and *Ungnadia speciosa*. Bare ground is often conspicuous, and herbaceous cover, where present, is usually dominated by mid- to short grasses. Herbaceous cover includes *Aristida purpurea, Bouteloua curtipendula, Bouteloua gracilis, Bouteloua hirsuta, Bouteloua dactyloides (= Buchloe dactyloides), Pleuraphis mutica, Schizachyrium scoparium, Artemisia ludoviciana, Calylophus hartwegii, Calylophus berlandieri, Krameria lanceolata*, and *Melampodium leucanthum*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: This upland scrub woodland and shrubland group occupies dry, rocky sites on mesas and escarpment breaks over a variety of geologic strata including sandstones, shales, limestone and basalt. Soils are variable and this vegetation can occur where there is little soil development.

DISTRIBUTION

***Geographic Range:** The range of this scrub woodland group is centered on the Rolling and Red Bed plains of Texas and Oklahoma and the Edwards and Stockton plateaus of Texas. It may also range into the High Plains, Chihuahuan Desert and Southwestern Tablelands.
Nations: MX?, US
States/Provinces: MXCH?, MXCO?, NM?, OK, TX
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3246	*Juniperus pinchotii - Quercus mohriana* Scrub & Woodland Alliance
A4116	*Quercus sinuata var. breviloba* Scrub Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
><	*Juniperus sabinoides* Formation	Bray 1901	
><	*Quercus breviloba* Formation	Bray 1901	
><	Ashe Juniper - Redberry (Pinchot) Juniper: 66	Eyre 1980	
<	Edwards Plateau: Shin Oak Shrubland (1206) [CES303.041.8]	Elliott 2011	
<	Edwards Plateau: Shin Oak Slope Shrubland (1226) [CES303.041.18]	Elliott 2011	
><	Live Oak - Mesquite Savanna	Tharp 1939	
><	Mohrs (Shin) Oak: 67	Eyre 1980	
<	Rolling Plains: Breaks Evergreen Shrubland (2105)	Elliott 2012	
><	Xerophytic Forest Formation of the Mountain Slopes of the Trans Pecos	Bray 1901	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. Teague, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Teague

Acknowledgments [optional]:

Version Date: 07 May 2015

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***References [Required if used in text]:**

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Tharp, B. C. 1939. The vegetation of Texas. Texas Academy of Science, Nontechnical Publication Series, Austin.

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2. Shrub & Herb Vegetation

2.B.2.Nb. Central North American Grassland & Shrubland

G192. Comanchian Mesquite - Mixed Scrub

Type Concept Sentence: This Comanchian scrub woodland group is dominated or codominated by *Prosopis glandulosa var. glandulosa, Dalea formosa*, and *Mimosa borealis* and is known from the rolling plains of Texas and Oklahoma, the Edwards Plateau as well as the Chihuahuan Desert regions of Texas.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Nb.5. Great Plains Comanchian Scrub & Open Vegetation (M158)

Elcode: G192
***Scientific Name:** *Prosopis glandulosa var. glandulosa - Ziziphus obtusifolia* Scrub Group
***Common (Translated Scientific) Name:** Honey Mesquite - Lotebush Scrub Group
***Colloquial Name:** Comanchian Mesquite - Mixed Scrub

***Type Concept:** This scrub woodland group ranges from the High, Rolling, and Red Bed plains of Texas and Oklahoma south into parts of the Edwards Plateau and Chihuahuan Desert regions of Texas. The open to closed canopy is dominated or codominated by *Prosopis glandulosa var. glandulosa* or low-statured shrubs such as *Dalea formosa* and *Mimosa borealis*. Associated species can include *Ziziphus obtusifolia, Quercus fusiformis, Sideroxylon lanuginosum, Aloysia gratissima, Mahonia trifoliolata, Yucca glauca, Opuntia* spp., *Acacia greggii, Mimosa* spp., *Rhus lanceolata, Nassella leucotricha, Bouteloua curtipendula, Bouteloua gracilis, Bouteloua hirsuta, Bouteloua dactyloides, Schizachyrium scoparium, Ruellia nudiflora, Croton monanthogynus, Rhynchosia senna*, and *Indigofera miniata*.

***Diagnostic Characteristics:** Deciduous scrubby woodlands and shrublands in the High Plains, Rolling Plains, Red Bed Plains, Edwards Plateau and Stockton Plateau regions of the south-central U.S.

***Classification Comments:** Classification of this group is complicated because it may be difficult to distinguish from compositionally and structurally similar ruderal vegetation. This group as described does not include vegetation characterized by *Prosopis glandulosa var. glandulosa* occurring in southern Texas. Vegetation in this group is poorly described and classification of this group is hindered by the paucity of USNVC classification information at the association level. Its separation from Comanchian Oak - Juniper Scrub Group (G191) is based on the dominance of evergreen versus deciduous shrubs and short-statured trees, a distinction that may be better made at the alliance level. The relationship of this vegetation to that included in *Prosopis glandulosa* Shortgrass Prairie Ruderal Scrub Alliance (A3952) in Great Plains Shortgrass Prairie Group (G144) needs further reconciliation.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G126	Balconian Dry Forest & Woodland	
G191	Comanchian Oak - Juniper Scrub	
G144	Great Plains Shortgrass Prairie	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The physiognomy of this group ranges from an open short woodland to a shrubland. Due to the small size of the leaflets, light can reach the floor even through more closed canopies of *Prosopis glandulosa*.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The canopy of this group is dominated by *Prosopis glandulosa var. glandulosa* or low-statured shrubs such as *Dalea formosa* and *Mimosa borealis*. Other canopy components may include *Quercus fusiformis, Ziziphus obtusifolia*, and *Sideroxylon lanuginosum*. The understory may contain a variety of dry-xeric shrubs, including *Acacia greggii, Aloysia gratissima, Mahonia trifoliolata, Mimosa* spp., *Opuntia* spp., *Rhus lanceolata*, and *Yucca glauca*. The herbaceous layer is typically continuous and dominated by graminoids such as *Bouteloua curtipendula, Bouteloua gracilis, Bouteloua hirsuta, Bouteloua dactyloides (= Buchloe dactyloides), Nassella leucotricha*, and *Schizachyrium scoparium*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: This group occurs on a variety of soil types but is well-developed on coarse soils.

DISTRIBUTION

***Geographic Range:** This scrub woodland group ranges from the High, Rolling, and Red Bed plains of Texas and Oklahoma south into parts of the Edwards Plateau and Chihuahuan Desert regions of Texas.
Nations: MX?, US
States/Provinces: MXCH?, MXCO?, NM?, OK, TX
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A4113	*Dalea formosa* Dwarf-shrubland Alliance
A3247	*Prosopis glandulosa* Scrub Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	*Prosopis glandulosa* Shrubland Alliance	Hoagland 2000	
><	Live Oak - Mesquite Savanna	Tharp 1939	
><	Mesquite (southern type): 68	Eyre 1980	
><	Mesquite - Buffalo Grass	Küchler 1964	
><	Mesquite - Grassland	Tharp 1939	
><	Mesquite Grassland	Hoagland 2008	
><	Mesquite Plains	Blair and Hubbell 1938	
><	Mesquite Savanna	Küchler 1964	
<	Rolling Plains: Breaks Deciduous Shrubland (2106)	Elliott 2012	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. Teague, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Teague
Acknowledgments [optional]:
Version Date: 08 May 2015

REFERENCES

***References [Required if used in text]:**

Blair, W. F., and T. H. Hubbell. 1938. The biotic districts of Oklahoma. The American Midland Naturalist 20:425-454.

Elliott, L. 2012. Draft descriptions of systems, mapping subsystems, and vegetation types for Phases V. Unpublished documents. Texas Parks and Wildlife Ecological Systems Classification and Mapping Project. Texas Natural History Survey, The Nature Conservancy of Texas, San Antonio.

Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Hoagland, B. 2000. The vegetation of Oklahoma: A classification for landscape mapping and conservation planning. The Southwestern Naturalist 45(4):385-420.

Hoagland, B. W. 2008. Vegetation of Oklahoma In: K. S. Johnson and K. V. Luza, editors. Earth Sciences and Mineral Resources of Oklahoma. Oklahoma Geological Survey Educational Publication #9. Norman. [http://www.biosurvey.ou.edu/download/publications/HoaglandOGS08.pdf]

Küchler, A. W. 1964. Potential natural vegetation of the conterminous United States. American Geographic Society Special Publication 36. New York, NY. 116 pp.

Tharp, B. C. 1939. The vegetation of Texas. Texas Academy of Science, Nontechnical Publication Series, Austin.

2.B.2.Nc. Eastern North American Grassland & Shrubland

This division consists of open grasslands and shrublands in the northern and central regions of eastern Canada and the United States. Vegetation occurs on a variety of soil types and depth, with acidic to basic pH, that range in depth from deep loams to exposed rock. Vegetation types are colloquially known as alvars, balds, barrens, flatrocks, and glades, and often contain a prairie-like flora, but with distinctive eastern elements.

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2. Shrub & Herb Vegetation
2.B.2.Nc. Eastern North American Grassland & Shrubland

M506. Appalachian Rocky Felsic & Mafic Scrub & Grassland

Type Concept Sentence: This vegetation macrogroup encompasses a variety of grass- and shrub-dominated communities, sometimes with scattered and/or stunted trees. This concept includes communities colloquially called balds, barrens, rock outcrops, and granitic flatrocks. Vegetation of this macrogroup is found in the Appalachian and Piedmont regions of the eastern United States with outliers in adjacent Canada.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.B.2.Nc.1. Eastern North American Grassland & Shrubland (D024)

Elcode: M506
***Scientific Name:** *Rhododendron catawbiense / Saxifraga michauxii - Danthonia compressa* Felsic & Mafic Scrub & Grassland Macrogroup
***Common (Translated Scientific) Name:** Catawba Rosebay / Michaux's Saxifrage - Flattened Oatgrass Felsic & Mafic Scrub & Grassland Macrogroup
***Colloquial Name:** Appalachian Rocky Felsic & Mafic Scrub & Grassland

***Type Concept:** This vegetation macrogroup encompasses a variety of grass- and shrub-dominated communities, sometimes with scattered and/or stunted trees, known colloquially as balds, barrens, flatrocks, rock outcrops, rocky domes, and rocky summits. They are found in the Appalachian and Piedmont regions of the eastern United States (with outliers in adjacent Canada), from higher to lower elevations. A suite of species tolerant of dry and rocky conditions are characteristic. At lower elevations this includes *Danthonia spicata, Dichanthelium* spp., and *Schizachyrium scoparium*, with trees including *Pinus virginiana, Quercus montana, Quercus stellata*, and/or *Quercus velutina*. At higher elevations this includes *Carex pensylvanica, Danthonia compressa, Huperzia selago, Minuartia groenlandica, Sibbaldiopsis tridentata*, and *Trichophorum cespitosum*. Shrubs may include *Kalmia latifolia, Rhododendron catawbiense*, and *Vaccinium corymbosum*. Appalachian oak barrens are dominated by grasses and shrubs, typically with scattered trees, including *Juniperus virginiana var. virginiana, Quercus marilandica, Quercus montana, Quercus stellata*, and/or *Quercus velutina* found on rocky substrates of a range of soil chemistries in the broadly-conceived Appalachian region. Appalachian balds may be dominated by shrubs or by graminoids and low forbs, and are found on higher peaks in the Southern Appalachians. The most characteristic species are *Carex pensylvanica, Danthonia compressa, Rhododendron catawbiense*, and *Sibbaldiopsis* *tridentata*. Granitic domes, flatrocks, and associated solution pools are found in the southern Piedmont of the United States. This vegetation is dominated by *Croton michauxii var. ellipticus, Minuartia glabra, Packera tomentosa, Schizachyrium scoparium*, and *Phemeranthus* spp., with *Diamorpha smallii* having high cover in some examples. The pools are distinctive and contain *Amphianthus pusillus*.

***Diagnostic Characteristics:** This macrogroup includes a variety of grass- and shrub-dominated communities, sometimes with scattered and/or stunted trees, found in the Appalachian and Piedmont regions of the eastern United States. This concept includes communities colloquially called balds, barrens, rock outcrops, and granitic flatrocks. It contains a diverse suite of physiognomies, including scattered trees over grasses and shrubs, to open grasslands, dense shrublands, and patchy herbaceous vegetation on rocky outcrops.

***Classification Comments:** This is a diverse macrogroup. Choosing a set of nominals for the scientific name was a challenge. There is not a nominal to represent the Piedmont flatrock component. Although many of the species listed do occur in Massachusetts, there are enough southern species that don't get to Massachusetts, and for those related occurrences, Laurentian-Acadian Acidic Rocky Scrub & Grassland Macrogroup (M505) fits better.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M505	Laurentian-Acadian Acidic Rocky Scrub & Grassland	is the related, but more northern and rocky type.
M509	Central Interior Acidic Scrub & Grassland	
M508	Central Interior Calcareous Scrub & Grassland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This macrogroup contains a diverse suite of physiognomies, including scattered trees over grasses and shrubs, to open grasslands, dense shrublands, and patchy herbaceous vegetation on rocky outcrops.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: A suite of species tolerant of dry and rocky conditions are generally characteristic of this vegetation. At lower elevations this includes *Danthonia spicata, Dichanthelium* spp., and *Schizachyrium scoparium*, with trees including *Pinus virginiana, Quercus montana (= Quercus prinus), Quercus stellata*, and/or *Quercus velutina*. At higher elevations this includes *Carex pensylvanica, Danthonia compressa, Huperzia selago, Minuartia groenlandica, Sibbaldiopsis tridentata*, and *Trichophorum cespitosum*. Shrubs may include *Kalmia latifolia, Rhododendron catawbiense*, and *Vaccinium corymbosum*. Appalachian oak barrens are dominated by grasses and shrubs, typically with scattered trees, including *Juniperus virginiana var. virginiana, Quercus marilandica, Quercus montana, Quercus stellata*, and/or *Quercus velutina*, found on rocky substrates of a range of soil chemistries in the broadly-conceived Appalachian region. Possible dominant graminoids include *Andropogon virginicus, Carex pensylvanica, Danthonia spicata, Deschampsia flexuosa, Elymus hystrix (= Hystrix patula), Piptochaetium avenaceum, Schizachyrium scoparium*, and *Sporobolus compositus*. Some other characteristic plants include *Cheilanthes lanosa, Phacelia dubia, Phlox subulata, Polygonatum biflorum, Polygonum scandens var. cristatum, Tradescantia virginiana*, and *Woodsia obtusa*. In more felsic examples, lichens (*Cladonia* spp.) and mosses are prominent on exposed rock. Appalachian balds may be dominated by shrubs or by graminoids and low forbs, and are found on higher peaks in the Southern Appalachians. The most characteristic species are *Carex pensylvanica, Danthonia compressa, Rhododendron catawbiense*, and *Sibbaldiopsis tridentata*. Granitic domes, flatrocks, and associated solution pools are found in the southern Piedmont of the United States. This vegetation is dominated by *Croton michauxii var. ellipticus (= Croton willdenowii), Minuartia glabra, Packera tomentosa, Schizachyrium scoparium*, and *Phemeranthus (= Talinum)* spp., with *Diamorpha smallii* having high cover in some examples. The pools are distinctive and contain *Amphianthus pusillus*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: These grass- and shrub-dominated communities, sometimes with scattered and or stunted trees, are known colloquially as balds, barrens, flatrocks, rock outcrops, rocky domes, and rocky summits.

DISTRIBUTION

***Geographic Range:** This vegetation is found from the northeastern U.S. south through the Central and Southern Appalachians, Cumberland Plateau, and Piedmont south to Georgia and Alabama, and includes an outlier in southern Ontario, Canada.
Nations: CA, US
States/Provinces: AL, CT, GA, KY, MA, MD, ME, NC, NH, NJ, NY, ON, PA, QC, RI?, SC, TN, VA, VT, WV
USFS Ecoregions (2007) [optional]: 221A:CC, 221D:CC, 231Aa:CCC, 231Af:CCC, 231Ic:CCC, 232A:CC, 232I:CC, M221Dc:CCC, M221Dd:CCC
Omernik Ecoregions L3, L4 [optional]: 8.3.4.45b:C, 8.3.4.45f:C, 8.4.4.66i:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G658	Southern Appalachian Shrub Bald
G657	Southern Appalachian Grass Bald
G180	Appalachian Mafic Glade
G670	Central & Southern Appalachian Rocky Outcrop
G789	North-Central Appalachian Acidic Scrub & Grassland
G671	Piedmont Dome & Flatrock Vegetation

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-07-24	M163 Eastern North American Prairie & Barrens Macrogroup	M163 split into M505, M506, M507, M508, M509
2012-07-24	M122 Appalachian & Laurentian Rocky Scrub & Meadow Macrogroup	M122 split into M505 & M506

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** M. Pyne, in Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne

Acknowledgments [optional]:
Version Date: 06 Jan 2016

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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2. Shrub & Herb Vegetation
2.B.2.Nc. Eastern North American Grassland & Shrubland

G658. Southern Appalachian Shrub Bald

Type Concept Sentence: These dense shrubland communities are frequently dominated by *Rhododendron catawbiense*, but substantial examples are also dominated by *Alnus viridis ssp. crispa, Kalmia latifolia, Rhododendron carolinianum*, or mixtures of these and other shrubs. They are found in the highest elevational zone of the Southern Appalachians, generally above 1524 m (5000 feet) but occasionally to 1220 m (4000 feet), and at slightly lower elevations at its northern limit in Virginia and West Virginia, and in the Cumberland Mountains along the Virginia-Kentucky border.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nc.1. Appalachian Rocky Felsic & Mafic Scrub & Grassland (M506)

Elcode: G658
***Scientific Name:** *Rhododendron catawbiense - Pieris floribunda - Alnus viridis ssp. crispa* Southern Appalachian Shrub Bald Group
***Common (Translated Scientific) Name:** Catawba Rosebay - Mountain Fetterbush - Mountain Alder Southern Appalachian Shrub Bald Group
***Colloquial Name:** Southern Appalachian Shrub Bald

***Type Concept:** These dense shrubland communities are found in the highest elevational zone of the Southern Appalachians, generally above 1524 m (5000 feet) but occasionally to 1220 m (4000 feet), and at slightly lower elevations at its northern limit in Virginia and West Virginia, and in the Cumberland Mountains along the Virginia-Kentucky border. The vegetation consists of dense shrubby areas most often dominated by *Rhododendron catawbiense*, but substantial examples are also dominated by *Rhododendron carolinianum, Kalmia latifolia*, or a mixture of shrubs. One large (and unusual) example dominated by *Alnus viridis ssp. crispa* is also included. Heath balds may contain sparse stunted trees barely larger than the shrub canopy. This combination of high-elevation, non-wetland sites and dense shrub vegetation without appreciable rock outcrop conceptually distinguishes this group from all others in the Southern Appalachians. However, the widespread areas of degraded spruce-fir with grass and/or shrub cover and the invasion of balds by trees blur the distinction somewhat.

***Diagnostic Characteristics:** These are dense shrubland communities, dominated by *Rhododendron catawbiense* as well as by *Alnus viridis ssp. crispa, Kalmia latifolia, Rhododendron carolinianum*, or mixtures of these and other shrubs, and found at the highest elevations of the Southern Appalachians.

***Classification Comments:** Grassy balds and heath balds differ in a number of ways and are often recognized as distinct entities. This vegetation occurs in settings similar to Central & Southern Appalachian Rocky Outcrop Group (G670) and the relationship among these is acknowledged by their placement together in Appalachian Rocky Felsic & Mafic Scrub & Grassland Macrogroup (M506).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G670	Central & Southern Appalachian Rocky Outcrop	
G657	Southern Appalachian Grass Bald	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are dense shrubland communities found at the highest elevations of the Southern Appalachians.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Examples of this vegetation consist of dense shrubs, particularly *Rhododendron catawbiense*, but substantial examples are also dominated by *Kalmia latifolia, Rhododendron carolinianum*, or a mixture of other shrubs, including *Corylus cornuta, Gaylussacia baccata, Leiophyllum buxifolium, Pieris floribunda, Prunus pensylvanica, Sorbus americana*, and *Vaccinium corymbosum*. One large example, dominated by *Alnus viridis ssp. crispa*, is also included here. Large areas have also become dominated by *Rubus allegheniensis*, possibly with other brambles (*Rubus canadensis, Rubus idaeus ssp. strigosus*) and by mixtures of native grasses with exotic pasture grasses (e.g., *Phleum pratense*). Heath balds may contain sparse stunted trees barely larger than the shrub canopy.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The dynamics that created and maintain this vegetation are the subject of a yet unresolved debate. In particular, the relationship between shrub balds and grassy balds is not fully understood. Some interpretations suggest that shrub balds are simply degraded grassy balds, but the situation may be more complicated. On the one hand, most grassy bald occurrences show a strong tendency to succeed to shrub or forest vegetation under present conditions, suggesting that some important maintenance process has been lost. Grazing by native herbivores (elk and bison) and periodic fire have both been suggested as natural mechanisms to keep out woody vegetation. Exposure to wind, snow, ice, and heavy rainfall also retard succession to forest. The presence of shade-intolerant disjunct herb species in some suggests even greater age. Some areas of the spruce-fir system degraded by a combination of logging, slash fires, and grazing resemble grassy or shrub balds, but most do not. The universal cattle grazing in grassy balds by early settlers has further obscured their original character and evidence of processes. Heath balds are more widely regarded as being created or maintained by fire. However, heavy organic accumulations in the soil suggest great age for some. Most show a very limited tendency to succeed to forest, suggesting that the dense shrub layer is highly competitive and that only infrequent fire would be needed to maintain them. As with the grassy balds, spruce-fir forests which burned in historical times do not usually develop vegetation identical to heath balds.

ENVIRONMENT

Environmental Description: This vegetation generally occurs at elevations above 1524 m (5000 feet) but may range as low as 1220 m (4000 feet) in the Southern Blue Ridge. It is also of limited extent above 1035 m (3400 feet) in the Cumberland Mountains along the Virginia-Kentucky border. It occurs on broad ridgetops and narrow spur ridges. Elevation and orographic effects (winds cooling as they rise to create increased condensation) make the climate cool and wet, with heavy moisture input from fog as well as high rainfall. Convex slopes and exposure to wind offset the moisture input to some extent. Concentration of air pollutants has been implicated as an important anthropogenic stress in this elevational range in recent years. Soils range from shallow and rocky to fairly deep residual soils. Any kind of bedrock may be present, but most sites have erosion-resistant felsic igneous or metamorphic rocks, with slate and quartzite particularly frequent. The sites that support balds are not obviously different from similar sites that support spruce-fir forests, so the origin of these communities continues to be a subject of some debate. Fire may be an important factor in some examples, whereas grazing and/or exposure to the elements promote the maintenance of others.

DISTRIBUTION

***Geographic Range:** This group ranges from the Balsam Mountains and Great Smoky Mountains of North Carolina and Tennessee northward to Virginia and West Virginia. It is also of limited extent in the Cumberland Mountains along the Virginia-Kentucky border. The current status in Georgia is open to question and it was apparently never extensive in any case.
Nations: US
States/Provinces: GA, KY, NC, SC?, TN, VA, WV
USFS Ecoregions (2007) [optional]: M221Dc:CCC, M221Dd:CCC
Omernik Ecoregions L3, L4 [optional]: 8.4.4.66i:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0744	*Rhododendron catawbiense - Rhododendron carolinianum - Kalmia latifolia* Shrub Bald Alliance
A0929	*Alnus viridis ssp. crispa* Shrub Bald Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-07-24	G057 Rhododendron catawbiense - Pieris floribunda - Danthonia compressa Grass & Shrub Bald Group	G057 split into G658 & G657

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al.

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne
Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by M.P. Schafale and C.W. Nordman.
Version Date: 04 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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2. Shrub & Herb Vegetation
2.B.2.Nc. Eastern North American Grassland & Shrubland

G657. Southern Appalachian Grass Bald

Type Concept Sentence: These are densely vegetated herbaceous communities dominated by *Danthonia compressa* or *Carex* spp. found in the highest elevational zone of the Southern Appalachians, generally above 1524 m (5000 feet) but occasionally to 1220 m (4000 feet), and at slightly lower elevations at its northern limit in Virginia and West Virginia.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nc.1. Appalachian Rocky Felsic & Mafic Scrub & Grassland (M506)

Elcode: G657
***Scientific Name:** *Carex pensylvanica - Danthonia compressa - Sibbaldiopsis tridentata* Southern Appalachian Grass Bald Group

***Common (Translated Scientific) Name:** Pennsylvania Sedge - Flattened Oatgrass - Shrubby Fivefingers Southern Appalachian Grass Bald Group
***Colloquial Name:** Southern Appalachian Grass Bald

***Type Concept:** These densely vegetated herbaceous communities are found in the highest elevational zone of the Southern Appalachians, generally above 1524 m (5000 feet) but occasionally to 1220 m (4000 feet), and at slightly lower elevations at its northern limit in Virginia and West Virginia. The vegetation consists of dense herbaceous cover characteristically dominated by *Danthonia compressa* or *Carex* spp. Extensive areas have become dominated by *Rubus allegheniensis* and by mixtures of native grasses and exotic pasture grasses. Most examples of grassy balds have some invading shrubs and trees, often dense enough to threaten the herbaceous vegetation. The combination of high-elevation, non-wetland sites and dense herbaceous vegetation without appreciable rock outcrop conceptually distinguish this group from all others in the Southern Appalachians. However, the widespread areas of degraded spruce-fir with grass and/or shrub cover and the invasion of grassy balds by trees blur the distinction somewhat.

***Diagnostic Characteristics:** These are densely vegetated herbaceous communities found in the highest elevational zone of the Southern Appalachians, generally above 1524 m (5000 feet) but occasionally to 1220 m (4000 feet). The vegetation is characteristically dominated by *Danthonia compressa* and/or *Carex* spp. with many characteristic forbs.

***Classification Comments:** Grassy balds and heath balds differ in a number of ways and are often recognized as distinct entities. This vegetation occurs in settings similar to Central & Southern Appalachian Rocky Outcrop Group (G670) and the relationship among these is acknowledged by their placement together in Appalachian Rocky Felsic & Mafic Scrub & Grassland Macrogroup (M506).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G670	Central & Southern Appalachian Rocky Outcrop	
G658	Southern Appalachian Shrub Bald	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Examples of this vegetation consist of dense herbaceous cover dominated by grasses or sedges.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Examples of this vegetation consist of dense herbaceous cover dominated by grasses or sedges. These grassy balds are characteristically dominated by *Danthonia compressa, Carex pensylvanica*, or other *Carex* spp. with many characteristic forbs including *Minuartia groenlandica, Paronychia argyrocoma, Saxifraga michauxii, Solidago glomerata, Solidago rugosa ssp. aspera, Sibbaldiopsis tridentata*, and others. Large areas have also become dominated by *Rubus allegheniensis*, possibly with other brambles (*Rubus canadensis, Rubus idaeus ssp. strigosus*) and by mixtures of native grasses with exotic pasture grasses (e.g., *Phleum pratense*). Most examples of grassy balds have some invading shrubs and trees, often dense enough to threaten the herbaceous vegetation.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The dynamics that created and maintain this vegetation are the subject of a yet unresolved debate. Most grassy bald occurrences show a strong tendency to succeed to shrub or forest vegetation under present conditions, suggesting that some important maintenance process has been lost. Grazing by native herbivores (elk and bison) and periodic fire have both been suggested as natural mechanisms to keep out woody vegetation. Exposure to wind, snow, ice, and heavy rainfall also retard succession to shrubland or forest. Others have suggested that all grassy balds are of anthropogenic origin and were never ecologically stable. The most definitive grassy balds have been documented as present at the time of the first European settlement, making documentation of their origin impossible. The presence of shade-intolerant disjunct herb species in some suggests even greater age. Some areas of the spruce-fir system degraded by a combination of logging, slash fires, and grazing resemble grassy balds, but most do not. The universal cattle grazing in grassy balds by early settlers has further obscured their original character and evidence of processes. Heath balds are more widely regarded as being created or maintained by fire. However, heavy organic accumulations in the soil suggest great age for some. Most show very limited tendency to succeed to forest, suggesting that the dense shrub layer is highly competitive and that only infrequent fire would be needed to maintain them. As with the grassy balds, spruce-fir forests burned in historical times do not usually develop vegetation identical to heath balds.

ENVIRONMENT

Environmental Description: This vegetation generally occurs at elevations above 1524 m (5000 feet) but may range as low as 1220 m (4000 feet) in the Southern Blue Ridge. It is also of limited extent above 1035 m (3400 feet) in the Cumberland Mountains along the Virginia-Kentucky border. It occurs on broad ridgetops and narrow spur ridges. Elevation and orographic effects (winds cooling as they rise to create increased condensation) make the climate cool and wet, with heavy moisture input from fog as well as high rainfall. Convex slopes and exposure to wind offset the moisture input to some extent. Concentration of air pollutants has been implicated as an important anthropogenic stress in this elevational range in recent years. Soils range from shallow and rocky to fairly deep residual soils. Any kind of bedrock may be present, but most sites have erosion-resistant felsic igneous or metamorphic rocks, with slate and quartzite particularly frequent. The sites that support balds are not obviously different from similar sites that support spruce-fir forests, so the origin of these communities continues to be a subject of some debate. Fire may be an important factor in some examples, whereas grazing and/or exposure to the elements promote the maintenance of others.

DISTRIBUTION

***Geographic Range:** This group ranges from the Balsam Mountains and Great Smoky Mountains of North Carolina and Tennessee northward to Virginia and West Virginia. The current status in Georgia is open to question and it was apparently never extensive in any case.
Nations: US
States/Provinces: GA?, NC, TN, VA
USFS Ecoregions (2007) [optional]: M221Dc:CCC, M221Dd:CCC
Omernik Ecoregions L3, L4 [optional]: 8.4.4.66i:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0930	*Rubus allegheniensis - Rubus canadensis* Shrubland Alliance
A2026	*Carex pensylvanica - Danthonia compressa - Hypericum mitchellianum* Grass Bald Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-07-24	G057 Rhododendron catawbiense - Pieris floribunda - Danthonia compressa Grass & Shrub Bald Group	G057 split into G658 & G657

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al.

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne

Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by M.P. Schafale and C.W. Nordman.

Version Date: 04 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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2. Shrub & Herb Vegetation
2.B.2.Nc. Eastern North American Grassland & Shrubland

G180. Appalachian Mafic Glade

Type Concept Sentence: These are grasslands of *Schizachyrium scoparium* with scattered, stunted trees of *Cercis canadensis, Fraxinus americana, Juniperus virginiana var. virginiana, Pinus rigida, Pinus virginiana, Quercus alba, Quercus marilandica, Quercus stellata*, and *Ulmus alata*; *Packera paupercula* and *Packera plattensis* are characteristic forbs which occur on these shallow soils and outcrops of mafic and ultramafic bedrock substrates in the Piedmont and Blue Ridge.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nc.1. Appalachian Rocky Felsic & Mafic Scrub & Grassland (M506)

Elcode: G180
***Scientific Name:** *Schizachyrium scoparium - Packera paupercula - Packera plattensis* Appalachian Mafic Glade Group
***Common (Translated Scientific) Name:** Little Bluestem - Balsam Groundsel - Prairie Groundsel Appalachian Mafic Glade Group
***Colloquial Name:** Appalachian Mafic Glade

***Type Concept:** This group consists of vegetation associated with shallow soils over predominantly mafic and ultramafic bedrock substrates in the Piedmont and Blue Ridge, usually with significant areas of rock outcrop. Bedrock includes a variety of igneous and metamorphic rock types such as greenstone, shale, diabase, serpentine, and amphibolite. These areas on gentle to moderate slopes support a patchy mosaic of open woodland and grassy herbaceous vegetation sometimes with a predominant woody short-shrub community present. Shallow soils impede tree growth and help to distinguish this group from forests. The vegetation is structurally intermediate between other rock outcrop groups and forests. The unusual and extreme soil chemistry determines the special flora of the type. Most examples are open woodlands with *Pinus rigida, Pinus virginiana, Juniperus virginiana var. virginiana*, and/or *Quercus alba, Quercus marilandica*, and *Quercus stellata* in the often stunted canopy. Trees can include *Fraxinus americana, Ulmus alata*, and *Cercis canadensis* on basic soil examples. Shrubs may be dense, with species determined by soil chemistry. The herb layer is usually fairly dense and may be dominated by grasses or by a mix of grasses and forbs, both in treeless areas and beneath open canopies. The forbs include species characteristic of other rock outcrops and grassland species, with a smaller number of forest species present. Plant species richness may be fairly high. Extreme edaphic conditions lead to locally xerophytic growing conditions that contribute to relatively open canopies and a ground cover dominated by prairie grasses and a variety of forbs. Disjunct species from drier regions and some endemic plant taxa are often present.

***Diagnostic Characteristics:** Occurrences of this group are on mafic and ultramafic substrates. The bedrock includes a variety of igneous and metamorphic rock types such as greenstone, shale, diabase, serpentine, and amphibolite. *Schizachyrium scoparium* is a common dominant grass in occurrences with open canopies. It is found in a wide variety of other woodlands and grasslands, however. *Packera paupercula* and *Packera plattensis* are characteristic forbs of the special mafic and ultramafic habitat of this group.

***Classification Comments:** These glades are found mainly in the Southern and Central Appalachians and the Piedmont and are on thin soils and outcrops of igneous or metamorphic rock, which is predominantly mafic and ultramafic. They are different from the alkaline or circumneutral glades on sedimentary or meta-sedimentary rock, such as occur in the Ridge and Valley or Interior Low Plateau. Can we just call these "serpentine glades" or "mafic glades"? [Perhaps note similarity of these to other calcareous and acidic glades. Certain similarities, despite underlying bedrock differences. List them under "Similar types."]

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]: Similar groups may be found in Central Interior Acidic Scrub & Grassland Macrogroup (M509) and Central Interior Calcareous Scrub & Grassland Macrogroup (M508).

VEGETATION

Physiognomy and Structure Summary: The vegetation is a fine mosaic of different physiognomies, with open woodland and grassy herbaceous vegetation or short shrubs predominating. Bare rock outcrops are usually present in a minority of the area.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Most examples in the Appalachians are open woodlands with *Pinus rigida, Pinus virginiana, Juniperus virginiana var. virginiana*, and/or *Quercus alba, Quercus marilandica*, and *Quercus stellata* in the often stunted canopy. Canopy species in the Piedmont are tolerant of dry, shallow soils, most commonly *Juniperus virginiana var. virginiana* and various oaks and pines, but also including *Fraxinus americana, Ulmus alata*, and *Cercis canadensis* on basic soil examples. Shrubs may be dense, with species determined by soil chemistry. The herb layer is usually fairly dense and may be dominated by grasses or by a mix of grasses and forbs, both in treeless areas and beneath open canopies. The forbs include species characteristic of other rock outcrops and grassland species, with a smaller number of forest species present. Plant species richness may be fairly high in communities of this group.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The dynamics of this group are not well known. The occurrence of the group appears to be primarily determined by site physical and environmental properties, with physical and chemical properties determining the vegetation variation. Fire may be an important influence on vegetation, and may in the long run be important for keeping the vegetation structure open, though the patchy distribution of vegetation might limit fire intensity. It is possible that fire would have allowed glade structure and vegetation to extend onto slightly deeper soils and, therefore, allowed for more extensive glades. Periodic drought and wind storms may also be an important factor limiting canopy density and stature. The shallow soil would make these sites particularly prone to all three. These glades do not appear to be undergoing the kind of cyclic succession that has been described for granitic flatrocks, but some balance of soil accumulation and destruction may be occurring on a longer term or coarser scale.

ENVIRONMENT

Environmental Description: These glades are mainly in the Southern and Central Appalachians and the Piedmont and are on thin soils and outcrops of igneous or metamorphic rock. *Climate:* Humid warm temperate, humid cool temperate. *Soil/substrate/hydrology:* These are areas of gentle to moderate slopes with shallow soils over predominantly mafic and ultramafic bedrock substrates in the Piedmont and Blue Ridge, usually with significant areas of rock outcrop. Bedrock includes a variety of igneous and metamorphic rock types such as greenstone, shale, diabase, serpentine, and amphibolite. The chain of serpentine barrens found along the Pennsylvania-Maryland border is one of only three such occurrences in North America. Called the Baltimore Mafic Complex, the underlying serpentinite body formed in the Cambrian Period (about 490 million years ago) and was probably deformed and attached to the continent by the Taconic orogeny in the Ordovician Period (approximately 450 million years ago). The igneous precursor rocks to the serpentinites may have originated as part of an oceanic plate or perhaps as a magmatic intrusion into the crust of an island arc.

DISTRIBUTION

***Geographic Range:** This group is scattered throughout the Southern and Central Appalachians and Piedmont, from Pennsylvania to Georgia and Alabama.

Nations: US

States/Provinces: AL, GA, MD, NC, PA, SC, TN, VA, WV

USFS Ecoregions (2007) [optional]: 221A:CC, 221D:CC, 231A:CC, 231I:CC, M221D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]: Vegetation plot data are available, but may not be in publicly accessible databases at this time.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3469	*Selaginella rupestris* Appalachian Basic Clubmoss Alliance
A2074	*Fraxinus americana - Quercus stellata / Carex pensylvanica* Appalachian Mafic-Circumneutral Scrub Alliance
A3467	*Quercus* spp. - *Pinus* spp. Appalachian Ultramafic Scrub Alliance
A3468	*Schizachyrium scoparium - Sorghastrum nutans - Symphyotrichum depauperatum* Serpentine Grassland Alliance
A3470	Southern Appalachian Mafic Shrubland Alliance
A3471	*Deschampsia cespitosa* Serpentine Seep Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Diabase Glade	LeGrand 1988	
<	serpentine barrens	Harshberger 1903a	
<	serpentine barrens	Latham 1993	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.W. Harshberger (1903a)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman

Acknowledgments [optional]:

Version Date: 18 Mar 2010

REFERENCES

***References [Required if used in text]:**

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Pennell, F. W. 1910. Flora of the Conowingo Barrens of southeastern Pennsylvania. Academy of Natural Science Philadelphia 62:541-584.
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Pennell, F. W. 1929. On some critical species of the serpentine barrens. Bartonia 12:1-23.
Radford, A. E. 1948. The vascular flora of the olivine deposits of North Carolina and Georgia. Journal of the Elisha Mitchell Scientific Society 64:45-106.
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Wherry, E. T. 1963. Some Pennsylvania barrens and their flora. I. Serpentine. Bartonia 33:7-11.

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2. Shrub & Herb Vegetation
2.B.2.Nc. Eastern North American Grassland & Shrubland

G670. Central & Southern Appalachian Rocky Outcrop

Type Concept Sentence: These are generally treeless rock outcrops of the southern and central Appalachian Mountains, generally characterized by a mixture of low-growing lifeforms, especially lichens, mosses, and short-statured forbs with graminoids and low shrubs; characteristic species include *Carex misera, Saxifraga michauxii*, and *Vaccinium corymbosum*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nc.1. Appalachian Rocky Felsic & Mafic Scrub & Grassland (M506)

Elcode: G670
***Scientific Name:** *Carex misera - Saxifraga michauxii - Vaccinium corymbosum* Appalachian Rocky Outcrop Group
***Common (Translated Scientific) Name:** Wretched Sedge - Michaux's Saxifrage - Highbush Blueberry Appalachian Rocky Outcrop Group
***Colloquial Name:** Central & Southern Appalachian Rocky Outcrop

***Type Concept:** These are treeless rock outcrops of the southern and central Appalachian Mountains, best developed in western North Carolina and eastern Tennessee. The vegetation is generally characterized by a mixture of low-growing lifeforms, especially lichens, mosses, and short-statured forbs. Less commonly, graminoids and low shrubs are encountered. Species common to all outcrop vegetation types include *Carex misera, Saxifraga michauxii*, and *Vaccinium corymbosum*. Outcrops may be vertical to horizontal, rugged or fractured rock outcrops of peaks, ridgetops, upper slopes, and other topographically exposed locations. Higher elevation examples occur from 1200 to 2030 m in elevation; other examples may be found at elevations of 305 m (1000 feet) or lower on foothills. These outcrops occur on felsic to mafic rocks and are distinguished from surrounding systems by the prevalence of bare or lichen-encrusted rocks. This group unifies several vegetation types with widely differing physiognomies, ranging from woodland to low shrubland, to perennial grassland, to lichen-dominated with low vascular plant cover. They are unified by their common environments, which include rock outcrops, boulderfields, exfoliation outcrops, consolidated cliffs, unconsolidated bouldery talus, and rocky domes and summits in the Central and Southern Appalachians.

***Diagnostic Characteristics:** These are generally treeless rock outcrops of the central and southern Appalachian Mountains, best developed in western North Carolina and eastern Tennessee. The vegetation is generally characterized by a mixture of low-growing lifeforms, especially lichens, mosses, and short-statured forbs. Less commonly, graminoids and low shrubs are encountered. Species common to all outcrop vegetation types include *Carex misera, Saxifraga michauxii*, and *Vaccinium corymbosum* (Wiser and White 1999).

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G658	Southern Appalachian Shrub Bald	
G657	Southern Appalachian Grass Bald	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The vegetation is generally characterized by a mixture of low-growing lifeforms, especially lichens, mosses, and short-statured forbs. Less commonly, graminoids and low shrubs are encountered.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The vegetation is generally characterized by a mixture of low-growing lifeforms, especially lichens, mosses, and short-statured forbs. Less commonly, graminoids and low shrubs are encountered. Species common to all outcrop vegetation types include *Carex misera, Saxifraga michauxii*, and *Vaccinium corymbosum* (Wiser and White 1999). Additional rock outcrop herbs may be present, including *Heuchera villosa, Hylotelephium telephioides (= Sedum telephioides), Krigia montana*, and *Paronychia argyrocoma*, along with more widespread herbs of open areas such as *Danthonia compressa, Danthonia spicata, Houstonia caerulea, Potentilla canadensis*, and *Schizachyrium scoparium*. Mosses are usually present but often do not have substantial cover. High-elevation examples have an additional suite of herbs, which include some northern disjunct species such as *Huperzia selago, Minuartia groenlandica, Sibbaldiopsis tridentata*, and *Trichophorum cespitosum*. Shrubs and stunted trees are usually present in patches, where crevices or deeper soil accumulations are present. A few shrubs, such as *Leiophyllum buxifolium*, are largely limited to this system, but most are widespread species of dry forests and woodlands. Shrubs in the Ericaceae family are particularly prominent. Other characteristic herbaceous species may include *Bulbostylis capillaris, Calamagrostis cainii, Carex biltmoreana, Carex umbellata, Cheilanthes lanosa, Coreopsis major, Danthonia spicata, Houstonia longifolia, Hypericum gentianoides, Krigia montana, Minuartia groenlandica, Oclemena acuminata, Paronychia argyrocoma, Pycnanthemum* spp., *Selaginella rupestris, Selaginella tortipila*, and *Solidago glomerata*. The lichens *Cladonia* spp., *Lasallia papulosa*, and *Lasallia caroliniana (= Umbilicaria caroliniana)* may be present. Shrubs may include *Hudsonia montana, Leiophyllum buxifolium*, and *Vaccinium pallidum*. Trees are limited but may include *Pinus echinata, Pinus virginiana, Quercus montana (= Quercus prinus)*, and *Quercus stellata*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Effects in these exposed, high-elevation environments which limit tree stature and growth include nearly constant wind, as well as snow and ice, which can be extensive in the winter months.

ENVIRONMENT

Environmental Description: These are generally treeless rock outcrops of the central and southern Appalachian Mountains, best developed in western North Carolina and eastern Tennessee. The outcrops may be vertical to horizontal, rugged or fractured rock outcrops of peaks, ridgetops, upper slopes, and other topographically exposed locations (Schafale and Weakley 1990). Higher elevation examples occur from 1200 to 2030 m in elevation; other examples may be found at elevations of 305 m (1000 feet) or lower on foothills. These outcrops occur on felsic to mafic rocks.

DISTRIBUTION

***Geographic Range:** This vegetation is found at a variety of elevations in the central and southern Appalachian Mountains. It is best developed in western North Carolina and eastern Tennessee, and ranges south to Georgia and north into Virginia.
Nations: US
States/Provinces: GA, NC, SC?, TN, VA
USFS Ecoregions (2007) [optional]: M221Dc:CCC, M221Dd:CCC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A2079	*Lasallia papulosa - Lasallia caroliniana* Appalachian Rock Outcrop Alliance
A1621	*Saxifraga michauxii - Carex misera - Schizachyrium scoparium* Rocky Grassland Alliance
A3960	*Quercus montana - Pinus echinata / Schizachyrium scoparium* Scrub Alliance
A3959	*Leiophyllum buxifolium - Hudsonia montana - Rhododendron carolinianum* Shrubland Alliance
A3961	*Selaginella rupestris - Selaginella tortipila - Schizachyrium scoparium* Rocky Grassland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-07-24	G173 Minuartia glabra - Selaginella spp. - Croton willdenowii Herbaceous Vegetation Group	G173 split into G670 & G671

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al.

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne
Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by M.P. Schafale, S. Wiser, and P. White.
Version Date: 04 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina. Third approximation. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program, Raleigh. 325 pp.
Wiser, S. K., and P. S. White. 1999. High-elevation outcrops and barrens of the southern Appalachian Mountains. Pages 119-132 in: Anderson, R. C., J. S. Fralish, and J. M. Baskin, editors. Savannas, barrens and rock outcrop plant communities of North America. Cambridge University Press.

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2. Shrub & Herb Vegetation
2.B.2.Nc. Eastern North American Grassland & Shrubland

G789. North-Central Appalachian Acidic Scrub & Grassland

Type Concept Sentence: This group comprises shrublands characterized by ericaceous species, scrub oaks (generally *Quercus ilicifolia*), and dwarf *Pinus rigida*, as well as grasslands characterized by *Schizachyrium scoparium* and *Carex pensylvanica*, on acidic bedrock or dry sandy soils, found from southern Canada to higher elevations of West Virginia and Virginia.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nc.1. Appalachian Rocky Felsic & Mafic Scrub & Grassland (M506)

Elcode: G789
***Scientific Name:** North-Central Appalachian Acidic Scrub & Grassland Group
***Common (Translated Scientific) Name:** North-Central Appalachian Acidic Scrub & Grassland Group
***Colloquial Name:** North-Central Appalachian Acidic Scrub & Grassland

***Type Concept:** This group is characterized by non-forested vegetation of acidic / nutrient-poor acidic bedrock outcrops and summits, or dry, sandy, nutrient-poor soils occurring on barrens or on sandy eroding river bluffs. Physiognomy is variable, ranging from graminoid-dominated, to shrublands, with or without very scattered, usually stunted, trees. Vegetation is usually patchy, with bare, or lichen-covered substrate of variable cover. Vegetation includes "pine plains" dominated by a dwarf-shrub variant of *Pinus rigida* associated with pine barrens, as well as taller shrublands, often quite dense, dominated by *Quercus ilicifolia*. This group also includes "heathlands" comprising dwarf-shrublands of low ericaceous shrubs such as *Gaylussacia baccata, Vaccinium angustifolium*, and *Vaccinium pallidum*; *Vaccinium myrtilloides, Sibbaldiopsis tridentata*, and *Sorbus americana* also occur at higher elevations and in the north at lower elevations. Associations characterized by graminoids *Carex lucorum, Carex pensylvanica, Danthonia spicata, Deschampsia flexuosa*, or *Schizachyrium scoparium* are also included in this group. Although there is significant overlap in floristic composition, there are two distinct environmental settings supporting this group: acidic bedrock outcrops and summits, and relatively flat plains with dry to xeric sandy soils. This group also includes small mafic bedrock associations characterized by *Asplenium trichomanes, Adiantum aleuticum*, and *Cerastium arvense*, as well as vegetation occurring on sandy river bluffs characterized by widely scattered early-successional trees and dwarf-shrubs, including *Hudsonia ericoides*.

***Diagnostic Characteristics:** Acidic bedrock outcrop or summits supporting patchy ericaceous shrubs and grasses, or sand plains supporting heathlands, grasslands, and dwarf pitch pines.

***Classification Comments:** The mafic associations of this group are characterized by slightly higher base status but is nutrient-poor. An argument can be made for recognizing a separate, single-association alliance pending further information. This association is related to serpentine vegetation in the Gaspé peninsula of Quebec and western Newfoundland, but the Canadian vegetation is decidedly more arctic-alpine in nature (Bouchard et al. 1978, Dearden 1979).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G788	Laurentian-Acadian Acidic Scrub & Grassland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Vegetation structure is variable, ranging from graminoid-dominated, to shrubland, with or without very scattered, usually stunted, trees. Vegetation is usually patchy, with bare, or lichen-covered substrate of variable cover. Physiognomy includes needle-leaved dwarf-shrublands, deciduous shrublands, and patchy graminoid-dominated vegetation.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Vegetation includes "pine plains" dominated by a dwarf-shrub variant of *Pinus rigida* associated with pine barrens, as well as taller shrublands, often quite dense, dominated by *Quercus ilicifolia*. Dwarf-shrubs are common in most occurrences of this group, and usually include *Gaylussacia baccata, Vaccinium angustifolium*, and *Vaccinium pallidum*; *Vaccinium myrtilloides, Sibbaldiopsis tridentata (= Potentilla tridentata)*, and *Sorbus americana* also occur at higher elevations and in the north at lower elevations. Other associates often include *Arctostaphylos uva-ursi* and *Comptonia peregrina*. Associations characterized by graminoids are also included in this group; *Schizachyrium scoparium, Danthonia spicata, Deschampsia flexuosa, Carex lucorum, Carex pensylvanica*, or *Deschampsia cespitosa*, the latter usually confined to mafic bedrock. Other species common to this group include *Arctostaphylos uva-ursi, Comptonia peregrina, Kalmia angustifolia, Aronia melanocarpa (= Photinia melanocarpa)*, and *Pteridium aquilinum*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Fire is an important factor in maintaining these open communities in an otherwise forested landscape. A history of frequent and intense fire has played a major role in the short stature of pine plains of New Jersey and New York.

ENVIRONMENT

Environmental Description: Although there is significant overlap in floristic composition, there are two distinct environmental settings supporting this group: acidic bedrock outcrops and summits, and relatively flat plains with dry to xeric sandy soils. This group also includes small mafic bedrock associations as well as vegetation occurring on sandy river bluffs. Bedrock outcrop and summit vegetation can reach 1220 m (4000 feet) in elevation in the Central Appalachian portion of the range, and range to near sea level on sandplains.

DISTRIBUTION

***Geographic Range:** This group ranges from outliers in southeastern Canada south to higher elevations of Virginia and West Virginia.
Nations: CA, US
States/Provinces: CT, MA, MD, ME, NH, NJ, NY, ON, PA, QC, RI?, VA, VT, WV
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3910	*Danthonia spicata - Deschampsia flexuosa - Deschampsia cespitosa* Bedrock Grassland Alliance
A3913	*Vaccinium angustifolium - Vaccinium pallidum* Sandy Heath Alliance
A0682	*Schizachyrium scoparium* River Bluff Alliance
A4111	*Vaccinium angustifolium - Vaccinium pallidum* Rocky Heath Alliance
A3909	*Quercus ilicifolia - Aronia melanocarpa* Bedrock Shrubland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-11-10	G058 Vaccinium spp. - Juniperus horizontalis - Danthonia spicata Acidic Rocky Outcrop Group	G058 split into G788 & G789

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	New Jersey pine plains	Windisch 1986	
<	Rocky summit grassland	NYNHP 2013m	

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen and L. Sneddon, in Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** L.A. Sneddon
Acknowledgments [optional]:
Version Date: 04 May 2015

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***References [Required if used in text]:**

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2. Shrub & Herb Vegetation
2.B.2.Nc. Eastern North American Grassland & Shrubland

M509. Central Interior Acidic Scrub & Grassland

Type Concept Sentence: These open acidic, rocky grasslands (glades, barrens and outcrops) are dominated by *Schizachyrium scoparium, Sorghastrum nutans, Danthonia sericea*, and *Danthonia spicata* with scattered *Pinus* spp. and *Quercus* spp. trees and are found in the central Midwest and south-central Interior Highlands of the eastern United States.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.B.2.Nc.2. Eastern North American Grassland & Shrubland (D024)

Elcode: M509
***Scientific Name:** *Schizachyrium scoparium - Danthonia sericea* Acidic Scrub & Grassland Macrogroup
***Common (Translated Scientific) Name:** Little Bluestem - Silky Oatgrass Acidic Scrub & Grassland Macrogroup
***Colloquial Name:** Central Interior Acidic Scrub & Grassland

***Type Concept:** This macrogroup represents grasslands, shrublands, and scattered trees, often co-occurring in a mosaic with woodlands on quartzite, sandstone or other outcrops of acidic rock and associated thin-soil areas, primarily in unglaciated regions. The acidic soils are typically dry during the summer and autumn, becoming saturated during the winter and spring. Grasses such as *Schizachyrium scoparium* and *Sorghastrum nutans* dominate this macrogroup. Other characteristic grasses include *Danthonia sericea* and *Danthonia spicata*. Shrubs such as *Vaccinium* spp. and/or *Gaylussacia* spp. are common, as are scattered trees of *Pinus virginiana, Pinus rigida, Pinus echinata, Quercus montana, Quercus stellata*, and *Quercus marilandica*. Trees may be stunted. *Juniperus virginiana var. virginiana* can be present and often increases in the absence of fire. Herbaceous plants, including *Diamorpha smallii* and *Minuartia glabra*, are found on some of these outcrops on the Cumberland Plateau in Tennessee. Fruticose lichens such as *Cladonia* spp. may be prominent in some examples. Examples of the macrogroup are influenced by drought and infrequent to occasional fires. Prescribed fires can help maintain an open grassland or woodland structure. Examples of this macrogroup are primarily found in the Interior Highlands (Ozarks, Ouachita Mountains, Interior Low Plateau, and Cumberland Plateau regions) with rare and limited occurrences north and south of this range.

***Diagnostic Characteristics:** These are open grasslands with scattered trees and small rock outcrops which are on thin-soil acidic glades in the central and south-central United States. *Schizachyrium scoparium, Danthonia sericea*, and *Danthonia spicata* are common dominants. *Dichanthelium acuminatum, Dichanthelium linearifolium*, and *Dichanthelium sphaerocarpon* are common associates on these acidic glades. Shrubs which favor acidic soils such as *Vaccinium* spp. and/or *Gaylussacia* spp. are common, as are widely scattered trees of *Pinus virginiana, Pinus rigida, Pinus echinata, Quercus montana, Quercus stellata, Quercus marilandica*, and *Ulmus alata*. Herbaceous plants, including *Diamorpha smallii* and *Minuartia glabra*, are typical of these outcrops on the Cumberland Plateau in Tennessee. A diverse set of graminoid and forb species occurs on these glades, but rangewide review is needed to identify the diagnostic species.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M012	Central Midwest Oak Forest, Woodland & Savanna	
M016	Southern & South-Central Oak - Pine Forest & Woodland	
M508	Central Interior Calcareous Scrub & Grassland	
M505	Laurentian-Acadian Acidic Rocky Scrub & Grassland	occurs further north and northeast, in northeastern West Virginia and in Virginia in the Blue Ridge of the Central Appalachian area.
M506	Appalachian Rocky Felsic & Mafic Scrub & Grassland	

Similar NVC Types General Comments [optional]: This macrogroup is distinguished from other macrogroups with similar vegetation by its occurrence on acidic rock outcrops (primarily sandstone) and surrounding thin soil areas in the Interior Highlands including the Ozarks, Ouachita Mountains, Interior Low Plateau, and Cumberland Plateau regions. Other similar vegetation occurs in colder climates, on igneous or circumneutral substrates, such as those derived from limestone or dolomite.

VEGETATION

Physiognomy and Structure Summary: The vegetation encompasses a complex of sparsely vegetated rock outcrops, perennial grasslands, and scattered heath shrubs and trees on shallow soils.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Grasses such as *Schizachyrium scoparium* and *Sorghastrum nutans* dominate these stands, with scattered stunted oak species, including *Quercus montana (= Quercus prinus), Quercus stellata*, and Quercus marilandica, other shrubby trees such as *Celtis tenuifolia* and *Juniperus virginiana*, and shrub species such as *Vaccinium* spp. (including *Vaccinium arboreum*) and *Gaylussacia* spp. Other herbaceous plants that may be associated with these glades include *Andropogon ternarius, Coreopsis grandiflora, Coreopsis lanceolata, Croton michauxii var. ellipticus (= Croton willdenowii), Danthonia sericea, Danthonia spicata, Dichanthelium acuminatum, Dichanthelium linearifolium, Dichanthelium sphaerocarpon, Pityopsis graminifolia var. latifolia, Portulaca pilosa, Sedum nuttallianum, Selaginella rupestris, Silene regia, Silene rotundifolia*, and *Symphyotrichum patens var. patentissimum* (Nelson 2005). Herbaceous plants, including *Diamorpha smallii* and *Minuartia glabra*, are typical of the outcrops on the Cumberland Plateau in Tennessee. *Pinus virginiana* and *Acer rubrum* are typical of the current condition of many of the woodlands surrounding these outcrops on the Cumberland Plateau; *Pinus rigida* and/or *Pinus echinata* may also occur. Moss and lichen cover and diversity can be high (Nelson 2005). A fuller description of the characteristic species combination of vascular and nonvascular plants is needed for this macrogroup (Winterringer and Vestal 1956, Voigt and Mohlenbrock 1964, Baskin and Baskin 1988, Quarterman et al. 1993, Heikens and Robertson 1995, Taft 1997b, Nelson 2005).

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Examples of this macrogroup are influenced by drought and infrequent to occasional fires. Prescribed fires can be helpful for managing stands of this macrogroup by promoting an open glade structure. Droughts and deer browse may currently interact to keep these glades open. Historically, the surrounding matrix of dry oak woodlands may have been more likely to burn, and those fires and the more open canopy could have spread into the glades (West and Welsh 1998). These glades are thought to be more environmentally controlled, by shallow soils, which suggest that soil depth and the historic extent of the glade community may be related.

ENVIRONMENT

Environmental Description: *Climate:* Humid cool temperate. In summer, glades may become extremely hot, and in the most exposed situations support only the most heat- and drought-tolerant taxa. *Soil/substrate/hydrology:* This macrogroup occurs on flat outcrops of sandstone rock and along moderate to steep slopes or valley walls of rivers along most aspects. Parent material is sandstone, but also includes chert, shale, quartzite or rhyolite, novaculite, igneous quartzite or nepheline syenite bedrock with well- to excessively well-drained, shallow soils interspersed with rock and boulders. Substrates include quartzite or sandstone or other outcrops of acidic rock and associated thin-soil areas over these types of rock. Some areas are really prone to wetness in the winter and spring.

DISTRIBUTION

***Geographic Range:** This macrogroup occurs west of the Blue Ridge, in the central states. Examples of this macrogroup are found in the Interior Highlands of the Ozark, Ouachita, and Interior Low Plateau regions, as well on the Cumberland Plateau of Kentucky, Tennessee, Alabama, Georgia, Virginia, and likely West Virginia, with rare and limited occurrences in the Baraboo Hills of Wisconsin.
Nations: US
States/Provinces: AL, AR, GA, IL, IN, KY, MO, OH, OK, TN, VA, WI, WV
USFS Ecoregions (2007) [optional]: 221E:CC, 221H:CC, 223A:CC, 223B:CC, 223D:CC, 223G:CC, 231C:CC, 231H:CC, 251C:CC, M223A:CC, M231A:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.7.35a:C, 8.3.7.35e:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]: This is a distinctive environment, with distinctive vegetation patterns and locally endemic species. There is much variation among the associations, but many wide-ranging grass species are in common across association examples.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G178	Central Interior Acidic Open Glade & Barrens

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-07-24	M163 Eastern North American Prairie & Barrens Macrogroup	M163 split into M505, M506, M507, M508, M509
2012-07-24	M124 Northern & Central Alvar & Glade Macrogroup	M124 split into M507, M508, M509

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Sandstone Glade	Nelson 2005	
=	Sandstone Glades	Baskin and Baskin 1988	
=	Sandstone Outcrops (Glades)	Quarterman et al. 1993	

AUTHORSHIP

***Primary Concept Source [if applicable]:** E. Quarterman, M.P. Burbank, and D.J. Shure (1993)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman

Acknowledgments [optional]:

Version Date: 15 Oct 2014

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Taft, J. B. 1997b. Terrestrial natural communities. Pages 2-29 to 2-83 in: Illinois Department of Natural Resources Cache River Assessment. Technical Report of the Critical Trends Assessment Project - Phase II. Illinois Department of Natural Resources, Illinois Natural History Survey Division, in conjunction with Illinois State Geological Survey, Illinois State Water Survey, and Office of Realty and Environmental Planning.
Voigt, J. W., and R. H. Mohlenbrock. 1964. Plant communities of southern Illinois. Southern Illinois University Press, Carbondale. 202 pp.
West, P., and J. Welsh. 1998. Characterization of unglaciated quartzite bedrock glades in the Baraboo Hills of Wisconsin. Interim Report on RJ/KOSE 1997 Grant. Wisconsin Field Office, Madison, WI. 19 pp.
Winterringer, G. S., and A. G. Vestal. 1956. Rock-ledge vegetation in southern Illinois. Ecological Monographs 26(2):105-130.

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2. Shrub & Herb Vegetation
2.B.2.Nc. Eastern North American Grassland & Shrubland

G178. Central Interior Acidic Open Glade & Barrens

Type Concept Sentence: These glades and barrens are dominated by *Schizachyrium scoparium, Danthonia sericea*, and *Sorghastrum nutans* with shrubs such as *Vaccinium* spp. and *Gaylussacia* spp. and scattered trees of *Pinus virginiana, Pinus rigida, Pinus echinata, Quercus montana, Quercus stellata*, and *Quercus marilandica* on quartzite, sandstone or other outcrops of acidic rock and associated thin-soil areas in the Ozarks, Ouachitas, Interior Low Plateau, and Cumberland Plateau regions.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nc.2. Central Interior Acidic Scrub & Grassland (M509)

Elcode: G178
***Scientific Name:** *Schizachyrium scoparium - Danthonia sericea* Acidic Glade & Barrens Group
***Common (Translated Scientific) Name:** Little Bluestem - Silky Oatgrass Acidic Glade & Barrens Group
***Colloquial Name:** Central Interior Acidic Open Glade & Barrens

***Type Concept:** This group represents grasslands, shrublands, and scattered trees in a mosaic with woodlands on quartzite, sandstone or other outcrops of acidic rock and associated thin-soil areas, primarily in unglaciated regions. The acidic soils are typically dry during the summer and autumn, becoming saturated during the spring and winter. Grasses such as *Schizachyrium scoparium* and *Sorghastrum nutans* dominate this group. Shrubs such as *Vaccinium* spp. and/or *Gaylussacia* spp. are common, as are scattered trees of *Pinus virginiana, Pinus rigida, Pinus echinata, Quercus montana, Quercus stellata*, and *Quercus marilandica*. Trees may be stunted. *Juniperus virginiana* can be present and often increases in the absence of fire. Herbaceous plants, including *Diamorpha smallii* and *Minuartia glabra*, are typical of the outcrops on the Cumberland Plateau in Tennessee. Some characteristic grasses include *Schizachyrium scoparium* and *Danthonia sericea*. Fruticose lichens such as *Cladonia* spp. may be prominent in some examples. Examples of the group are influenced by drought and infrequent to occasional fires. Prescribed fires help manage stands by maintaining an open structure. Examples of this group are primarily found in the Interior Highlands (Ozark, Ouachita, Interior Low Plateau, and Cumberland Plateau regions) with rare and limited occurrences north and south of this primary range.

***Diagnostic Characteristics:** *Schizachyrium scoparium* is a common species on these acidic glades; however, it also occurs on other habitats. These are open grasslands and small rock outcrops which are on thin-soil acidic glades in the southeastern United States.

***Classification Comments:** The Baraboo Hills Association *Quercus alba - Carya ovata / Carex pensylvanica - Heuchera richardsonii* Quartzite Glade Woodland (CEGL005276) "should perhaps be placed in the more typical glade formation (V.A.6.N.q.) based on historic conditions." Description is a bit unclear and should be rewritten.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G017	Cross Timbers & East-Central Texas Plains Oak Forest & Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The vegetation encompasses a complex of sparsely vegetated rock outcrops, perennial grasslands, and scattered heath shrubs and trees on shallow soils.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Grasses such as *Schizachyrium scoparium* and *Sorghastrum nutans* dominate in the Central Interior Highlands, with stunted oak species *Quercus stellata, Quercus marilandica*, and shrub species such as *Vaccinium* spp. occurring on variable depth soils. Some other plants that may be associated with these glades include *Andropogon ternarius, Danthonia spicata, Symphyotrichum patens var. patentissimum, Silene rotundifolia, Pityopsis graminifolia var. latifolia, Coreopsis grandiflora, Silene regia, Coreopsis lanceolata, Croton michauxii var. ellipticus (= Croton willdenowii), Sedum nuttallianum, Selaginella rupestris*, and *Portulaca pilosa*. Herbaceous plants, including *Diamorpha smallii* and *Minuartia glabra*, are typical of the outcrops on the Cumberland Plateau in Tennessee. *Pinus virginiana* and *Acer rubrum* are typical of the current condition of many of the woodlands surrounding these outcrops on the Cumberland Plateau; *Pinus rigida, Pinus echinata*, and/or *Quercus montana (= Quercus prinus)* may also occur.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Examples of this group are influenced by drought and infrequent to occasional fires. Prescribed fires help manage stands of this group by maintaining an open glade structure. Droughts and deer browse may currently interact to keep these glades open. Historically, the surrounding matrix of dry oak forests may have been more likely to burn, and those fires and the more open canopy could have spread into the glades (West and Welsh 1998). These glades are thought to be more environmentally controlled, by shallow soils, which suggest that soil depth and the historic extent of the glade community may be related.

ENVIRONMENT

Environmental Description: This group occurs on flat outcrops of sandstone rock and along moderate to steep slopes or valley walls of rivers along most aspects. Parent material is sandstone, but also includes chert, shale, quartzite or rhyolite, novaculite, igneous quartzite or nepheline syenite bedrock with well- to excessively well-drained, shallow soils interspersed with rock and boulders. *Climate:* humid cool temperate. *Soil/substrate/hydrology:* Quartzite or sandstone or other outcrops of acidic rock and associated thin-soil areas over these types of rock. Some areas are really prone to wetness in the winter and spring. Generally, all of these glades become very dry and hot in the summer and are particularly affected by short-term drought.

DISTRIBUTION

***Geographic Range:** Examples of this group are found in the Interior Highlands of the Ozark, Ouachita, and Interior Low Plateau regions, as well on the Cumberland Plateau of Kentucky, Tennessee, Alabama, Georgia, Virginia, and likely West Virginia, with rare and limited occurrences in the Baraboo Hills of Wisconsin.
Nations: US
States/Provinces: AL, AR, GA, IL, IN, KY, MO, OH, OK, TN, VA, WI
USFS Ecoregions (2007) [optional]: 221E:CC, 221H:CC, 223A:CC, 223B:CC, 223D:CC, 223G:CC, 231C:CC, 231H:CC, 251C:CC, M223A:CC, M231A:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.7.35a:C, 8.3.7.35e:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: This is a distinctive environment, with distinctive vegetation patterns and locally endemic species. There is much variation among the associations in terms of these regional glade endemics, but many wide-ranging grass species are in common across association examples.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3472	*Kalmia latifolia - Gaylussacia baccata - Gaylussacia brachycera* Cumberland Bedrock Heath Alliance
A3474	*Schizachyrium scoparium - Danthonia sericea - Bigelowia nuttallii* Cumberland Sandstone Grassland Alliance
A1819	*Diamorpha smallii - Minuartia glabra* Cumberland Sandstone Herb Alliance
A1920	*Quercus stellata - Quercus marilandica / Schizachyrium scoparium* Interior Acidic Bedrock Scrub Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2009-02-02	G060 Eastern Glade Group	G060 split into G178 & G179

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Sandstone Glade	Nelson 2005	
=	Sandstone Glades	Baskin and Baskin 1988	
=	Sandstone Outcrops (Glades)	Quarterman et al. 1993	
><	Sandstone/Shale Savanna	Nelson 2005	

AUTHORSHIP

***Primary Concept Source [if applicable]:** E. Quarterman, M.P. Burbank, and D.J. Shure (1993)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman and D. Faber-Langendoen

Acknowledgments [optional]:

Version Date: 08 Oct 2013

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***References [Required if used in text]:**

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2. Shrub & Herb Vegetation
2.B.2.Nc. Eastern North American Grassland & Shrubland

M508. Central Interior Calcareous Scrub & Grassland

Type Concept Sentence: These glades, barrens and patch prairies are open shrublands or grasslands composed of *Schizachyrium scoparium, Sporobolus* spp., and other native warm-season grasses on thin soils and outcrops of alkaline or circumneutral rock which is of sedimentary, meta-sedimentary, igneous or metamorphic origin occurring in the east-central United States, including the Interior Highlands and Central Appalachian region.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.B.2.Nc.3. Eastern North American Grassland & Shrubland (D024)

Elcode: M508
***Scientific Name:** *Schizachyrium scoparium - Sporobolus* spp. Central Interior Calcareous Scrub & Grassland Macrogroup
***Common (Translated Scientific) Name:** Little Bluestem - Dropseed species Central Interior Calcareous Scrub & Grassland Macrogroup
***Colloquial Name:** Central Interior Calcareous Scrub & Grassland

***Type Concept:** This vegetation macrogroup includes open barrens (or prairie) vegetation of the east-central United States. Physiognomy is variable, with management or natural disturbance. These are plant communities with open canopies, ranging from herbaceous-dominated barrens (some of which are maintained today by mowing instead of fire and grazing) through savanna and woodland types. The variety of relatively open habitats that is present here includes open grassland areas, as well as savanna woodlands. Stands are dominated by grasses and forbs with scattered shrubby vegetation and, occasionally, trees. The primary dominant grasses include *Andropogon gerardii* (southward also *Andropogon glomeratus, Andropogon gyrans, Andropogon ternarius*), *Panicum* spp., *Schizachyrium scoparium, Sorghastrum nutans*, and *Sporobolus* spp. Some other typical species found in examples may include *Helianthus mollis, Helianthus occidentalis, Helianthus silphioides, Panicum anceps, Silphium terebinthinaceum*, and *Silphium trifoliatum*. The shrublands can be dominated by *Cercis canadensis, Forestiera ligustrina, Hypericum* spp., *Juniperus virginiana var. virginiana*, and *Rhus aromatica*. The scattered trees (under historical or current managed conditions) are primarily *Quercus muehlenbergii, Quercus alba*, and *Quercus macrocarpa*. Under current conditions, *Acer rubrum, Liquidambar styraciflua, Quercus coccinea*, and *Quercus falcata* may be present, but these species are not characteristic. In the Appalachians, most examples are open woodlands with *Pinus rigida, Pinus virginiana, Juniperus virginiana var. virginiana*, and/or *Quercus alba, Quercus marilandica*, and *Quercus stellata* in the often stunted canopy. Trees can include *Fraxinus americana, Ulmus alata*, and *Cercis canadensis* on basic soil examples. This vegetation was formerly more widespread, but is now found in relatively scattered and isolated remnants. Some proposed factors which have functioned to maintain the openness of these vegetation types include the droughty, gravelly soils and resulting stresses to vegetation, as well as fire and grazing.

***Diagnostic Characteristics:** These are open shrublands or grasslands on thin soils and outcrops of alkaline or circumneutral rock of sedimentary, meta-sedimentary, igneous or metamorphic origin. *Schizachyrium scoparium* is a common dominant perennial grass species; *Sporobolus* spp. are also important distinguishing grasses, along with *Andropogon gerardii* (southward also *Andropogon glomeratus, Andropogon gyrans, Andropogon ternarius*), *Panicum anceps*, and *Sorghastrum nutans*. Forbs include *Helianthus mollis, Helianthus occidentalis, Helianthus silphioides, Silphium terebinthinaceum*, and *Silphium trifoliatum*. Diagnostic shrubs include *Cercis canadensis, Forestiera ligustrina, Hypericum* spp., *Juniperus virginiana var. virginiana*, and *Rhus aromatica*. The scattered trees are primarily *Quercus muehlenbergii, Quercus alba*, and *Quercus macrocarpa*. In the Appalachians, most examples are open woodlands with *Pinus rigida, Pinus virginiana, Juniperus virginiana var. virginiana*, and/or *Quercus alba, Quercus marilandica*, and *Quercus stellata* in the often stunted canopy. Trees can include *Fraxinus americana, Ulmus alata*, and *Cercis canadensis*.

***Classification Comments:** Included here are open rock outcrops and related thin-soil annual and perennial grasslands and shrublands, from southern Ohio to Pennsylvania, southwest across the Interior Highlands of Indiana, Illinois and Missouri, south to Georgia and west to Arkansas and Oklahoma. These are open shrublands or grasslands on thin soils and outcrops of alkaline or circumneutral rock of sedimentary, meta-sedimentary, igneous or metamorphic origin. Similar vegetation in the Great Lakes region (alvars) and in Connecticut and Massachusetts are included in Laurentian-Acadian Calcareous Scrub & Grassland Macrogroup (M507).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M509	Central Interior Acidic Scrub & Grassland	occurs on acidic substrates, such as sandstone
M507	Laurentian-Acadian Calcareous Scrub & Grassland	occurs further north, in the Great Lakes region and in Connecticut and Massachusetts.
M506	Appalachian Rocky Felsic & Mafic Scrub & Grassland	is Appalachian and occurs predominantly on acidic soils and outcrops.

Similar NVC Types General Comments [optional]: M509 differs in that M508 is on thin soils and outcrops of alkaline or circumneutral rock. The distribution of M507 southward needs to be reconciled with M508.

VEGETATION

Physiognomy and Structure Summary: This vegetation is primarily dominated by perennial grasses, but includes sparsely vegetated rock outcrops, annual and perennial grasslands, shrublands, and grasslands with very widely scattered trees.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The primary dominant grasses include *Schizachyrium scoparium* and native warm season grasses. Thin soil areas may be dominated by include *Sporobolus vaginiflorus*, or *Sporobolus neglectus*. Other more mesic perennial grasses such as *Andropogon gerardii*, or *Tripsacum dactyloides* are found in deeper soil mesic and wet sites. Some typical graminoid species (varying with latitude and biogeography) include *Andropogon gerardii, Andropogon glomeratus, Andropogon gyrans, Andropogon ternarius, Aristida purpurascens var. virgata, Calamagrostis coarctata (= Calamagrostis cinnoides), Chasmanthium laxum, Dichanthelium aciculare, Dichanthelium dichotomum, Dichanthelium scoparium, Dichanthelium sphaerocarpon var. isophyllum, Gymnopogon brevifolius, Panicum anceps, Panicum rigidulum, Panicum verrucosum, Panicum virgatum*, and *Sporobolus clandestinus*. Other characteristic herbs may include *Aletris farinosa, Coreopsis major, Coreopsis tripteris, Doellingeria umbellata, Eutrochium fistulosum, Eupatorium perfoliatum, Eupatorium pilosum, Eupatorium rotundifolium, Eurybia hemispherica, Helianthus angustifolius, Helianthus hirsutus, Helianthus mollis, Helianthus occidentalis, Helianthus silphioides, Lobelia puberula, Polytrichum commune, Potentilla simplex, Pteridium aquilinum, Sericocarpus linifolius, Silphium terebinthinaceum, Silphium trifoliatum, Solidago juncea, Solidago odora, Solidago rugosa*, and *Symphyotrichum dumosum*. The scattered trees are primarily *Quercus muehlenbergii, Quercus alba*, and *Quercus macrocarpa*. In the Appalachians, most examples are open woodlands with *Pinus rigida, Pinus virginiana, Juniperus virginiana var. virginiana*, and/or *Quercus alba, Quercus marilandica*, and *Quercus stellata* in the often stunted canopy. Trees can include *Fraxinus americana, Ulmus alata*, and *Cercis canadensis*. Dominant or abundant *Juniperus virginiana var. virginiana* or other trees on these thin-soil areas is probably related to a lack of fire, grazing or drought conditions.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Due to the effects of periodic drought and winter frost-heaving, the thin rocky soils generally do not support forest vegetation. The perennial grasslands may accumulate fuel from dried drought-killed trees and may be prone to wildfire. Fires may play an important role in keeping the structure of the vegetation open and perennial grass- or shrub-dominated. Grazing and the harvesting of *Juniperus virginiana var. virginiana* trees also have played a role in keeping sites open, rather than forested (DeSelm 1994). The cessation of disturbances, such as grazing, harvesting of trees, and burning these habitats, has enabled many of the perennial grasslands to become completely dominated by *Acer rubrum, Juniperus virginiana var. virginiana, Liquidambar styraciflua, Quercus alba, Quercus falcata, Quercus stellata*, and/or the invasive exotic shrubs *Ligustrum sinense* or *Lonicera maackii*.

ENVIRONMENT

Environmental Description: Site conditions and environment are characterized by thin soils over rock, usually with rock outcrops, and typically with higher pH. These areas are subject to extremes of temperature, and short-term drought can have extreme effects on the plants. In addition, wetness in the winter and frost-heaving can be pronounced. *Climate:* Humid warm temperate, humid cool temperate. *Soil/substrate/hydrology:* The substrate includes outcrops and thin soils (i.e., <20 cm soil depth) and outcrops of alkaline or circumneutral rock of sedimentary, meta-sedimentary, igneous or metamorphic origin. These can be flat as on limestone in the Nashville Basin or on slopes as in the dolomites and limestones of the Interior Highlands, in Southeast Ohio, Indiana and Illinois, the Ozark and Ouachita mountains, the Western Valley of the Tennessee River, and the Ketona dolomite in central Alabama, or amphibolite, serpentine or shale of the Appalachians. Examples of this vegetation also occur on dry soils with limited moisture availability during the summer, such as occur over gravels or which have a fragipan. Generally the hydrology is dry upland, but there can be small saturated wetland inclusions which may support rare plant species.

DISTRIBUTION

***Geographic Range:** Included here are open rock outcrops and related dry-soil or thin-soil annual and perennial grasslands and shrublands of the Interior Highlands and Central Appalachian region, from southern Missouri to Ohio and Pennsylvania, south to Arkansas, Oklahoma and Georgia.
Nations: US
States/Provinces: AL, AR, GA, IL, IN, KY, LA, MD, MO, NC, NJ, OH, OK, PA, SC, TN, VA, WV
USFS Ecoregions (2007) [optional]: 221A:CC, 221D:CC, 221E:CC, 221H:CC, 221J:CC, 223B:CC, 223D:CC, 223E:CC, 223F:CC, 231A:CC, 231C:CC, 231D:CC, 231I:CC, M221A:CC, M221D:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: This is a distinctive alkaline to circumneutral grassland and glade environment, with great physiognomic contrast between this and surrounding forest vegetation on deeper soils. In addition, there are distinctive vegetation patterns and locally endemic and disjunct species. There is much variation among the associations in terms of these regional glade endemics and disjuncts, but wide-ranging grass species are in common across association examples.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G174	South-Central Patch Prairie
G179	Central Interior Alkaline Open Glade & Barrens

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-07-24	M163 Eastern North American Prairie & Barrens Macrogroup	M163 split into M505, M506, M507, M508, M509
2012-07-24	M124 Northern & Central Alvar & Glade Macrogroup	M124 split into M507, M508, M509

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
><	Grass-Dominated Communities	DeSelm and Murdock 1993	
<	Limestone Cedar Glades	Lawless et al. 2006	
<	Rock Outcrop Communities: Limestone	Quarterman et al. 1993	
<	Xeric Limestone Prairie	Lawless et al. 2006	

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen, in Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman

Acknowledgments [optional]: The recent work of Lawless, Baskin and Baskin is gratefully acknowledged. Elsie Quarterman's 1950 Ecology paper, "Major plant communities of Tennessee cedar glades" remains a starting point for understanding these ecosystems and their plant communities. Her pioneering work is acknowledged.

Version Date: 15 Oct 2014

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2. Shrub & Herb Vegetation
2.B.2.Nc. Eastern North American Grassland & Shrubland

G174. South-Central Patch Prairie

Type Concept Sentence: This vegetation includes open, prairie-like vegetation of distinct portions of the Cumberland Plateau, undissected portions of the Interior Low Plateau, and parts of the Ridge and Valley ecoregions. The variety of relatively open habitats which are present here include prairie-like areas, as well as barrens and savanna woodlands. Stands are dominated by grasses and forbs with scattered shrubby vegetation and occasionally trees.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nc.3. Central Interior Calcareous Scrub & Grassland (M508)

Elcode: G174
***Scientific Name:** *Andropogon gerardii - Schizachyrium scoparium - Helianthus mollis* Patch Prairie Group
***Common (Translated Scientific) Name:** Big Bluestem - Little Bluestem - Ashy Sunflower Patch Prairie Group
***Colloquial Name:** South-Central Patch Prairie

***Type Concept:** This vegetation group includes open, prairie-like vegetation of distinct portions of the Cumberland Plateau, undissected portions of the Interior Low Plateau, and parts of the Ridge and Valley ecoregions, in Kentucky, Tennessee, Alabama, and Georgia. Physiognomy is variable, with management or natural disturbance. These are plant communities with open canopies, ranging from herbaceous-dominated barrens (some of which are maintained today by mowing instead of fire and grazing), as well as prairie-like areas and savanna and woodland types. Stands are dominated by grasses and forbs with scattered shrubby vegetation and occasionally trees. The primary dominant grasses include *Schizachyrium scoparium* and *Sorghastrum nutans* as well as *Andropogon* spp., *Panicum* spp., and *Sporobolus* spp. Other more mesic grasses (*Andropogon gerardii, Tripsacum dactyloides*) are found in mesic and wet phases. Some other typical species found in examples may include *Helianthus mollis, Helianthus silphioides, Helianthus occidentalis, Panicum anceps, Silphium trifoliatum*, and *Silphium terebinthinaceum*. The scattered trees (under historical or current managed conditions) are primarily *Quercus alba, Quercus muehlenbergii*, and *Quercus macrocarpa*. Under current conditions, *Acer rubrum, Liquidambar styraciflua, Quercus coccinea*, and *Quercus falcata* may be present, but these species are not characteristic. This vegetation was formerly more widespread, but is now found in relatively scattered and isolated remnants. Some proposed factors which have functioned to maintain the openness of these vegetation types include the droughty, gravelly soils and resulting stresses to vegetation, as well as fire and grazing.

In the bluegrass region of Kentucky, the understory is composed of cool-season grasses, as far as known (e.g., *Elymus, Dichanthelium*) with *Arundinaria gigantea* (extensive canebrakes). Settlers referred to a "buffalo grass" of unknown identity (possibly *Dichanthelium clandestinum* or *Dichanthelium scoparium*). The fire regime is unknown. Characteristic remnant trees (e.g., *Fraxinus quadrangulata, Quercus macrocarpa*) are fire-tolerant. On the Cumberland Plateau, wetter areas may include *Quercus bicolor, Quercus falcata, Quercus palustris, Nyssa sylvatica, Liquidambar styraciflua*, and *Acer rubrum var. trilobum*. The primary dominant grass in the wetter phase is *Chasmanthium laxum*. This vegetation was the predominant type here in the early 1800s and earlier and probably was maintained from burning by Native Americans.

***Diagnostic Characteristics:** These are perennial grasslands of the Cumberland Plateau, undissected portions of the Interior Low Plateau, and parts of the Ridge and Valley, found on thin to deep soils (but not restricted to rock outcrops). Some soils may feature unusual edaphic features (droughtiness, impeded drainage, gravels). The primary dominant grasses include *Schizachyrium scoparium* and *Sorghastrum nutans*, as well as *Andropogon* spp., *Panicum* spp., and *Sporobolus* spp. Other more mesic grasses (*Andropogon gerardii, Tripsacum dactyloides*) are found in mesic and wet phases. Some proposed factors which have functioned to maintain the openness of these vegetation types include the droughty, gravelly soils and resulting stresses to vegetation, as well as fire and grazing.

***Classification Comments:** This vegetation group includes a variety of grassland associations ranging from relatively dry to wet-mesic, which occur in a variety of areas across the unglaciated Interior Low Plateau physiographic province. The more mesic barrens and woodlands in the Interior Low Plateau have all but disappeared from the landscape, making their inventory, classification, and regional assessments difficult.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G175	Southeastern Coastal Plain Patch Prairie	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This vegetation is primarily dominated by perennial grasses, but examples may have scattered to patchy trees and shrubs. Some proposed factors which have functioned to maintain the openness of these vegetation types include the droughty, gravelly soils and resulting stresses to vegetation, as well as fire and grazing.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The variety of relatively open habitats which are present here include prairie-like areas, as well as savanna woodlands. Stands are dominated by grasses and forbs with scattered shrubby vegetation and, occasionally, trees. The scattered trees (under historical or current managed conditions) are primarily the fire-resistant oaks *Quercus alba, Quercus muehlenbergii*, and *Quercus macrocarpa*. Under current conditions, *Acer rubrum, Liquidambar styraciflua, Quercus coccinea*, and *Quercus falcata* may be present, but these are not characteristic. The primary dominant grasses include *Schizachyrium scoparium* and *Sorghastrum nutans*. Other more mesic grasses (*Andropogon gerardii, Tripsacum dactyloides*) are found in mesic and wet phases. Some typical herbaceous and graminoid species (varying with latitude and biogeography) include *Andropogon gerardii, Andropogon glomeratus, Andropogon gyrans, Andropogon ternarius, Calamagrostis coarctata, Panicum virgatum*, and *Sporobolus clandestinus*. Other characteristic herbs may include *Aletris farinosa, Coreopsis major, Coreopsis tripteris, Doellingeria umbellata, Eupatorium pilosum, Eupatorium rotundifolium, Eupatorium perfoliatum, Eutrochium fistulosum (= Eupatorium fistulosum), Eurybia hemispherica, Helianthus angustifolius, Helianthus hirsutus, Helianthus mollis, Helianthus silphioides, Helianthus occidentalis, Lobelia puberula, Potentilla simplex, Pteridium aquilinum, Sericocarpus linifolius, Silphium trifoliatum, Silphium terebinthinaceum, Solidago juncea, Solidago odora, Solidago rugosa*, and *Symphyotrichum dumosum*., and the moss *Polytrichum commune*. Also possibly found are *Aristida purpurascens var. virgata, Chasmanthium laxum, Dichanthelium aciculare, Dichanthelium dichotomum, Dichanthelium sphaerocarpon var. isophyllum, Dichanthelium scoparium, Gymnopogon brevifolius, Panicum anceps, Panicum rigidulum*, and *Panicum verrucosum*. Woody species found today may include *Acer rubrum, Carya tomentosa (= Carya alba), Carya glabra, Diospyros virginiana, Quercus alba, Quercus falcata, Quercus marilandica, Quercus stellata, Rhus copallinum, Rosa setigera*, and *Salix humilis*, with *Rubus argutus* and *Smilax glauca*. Wetter zones may have sedges, especially *Carex atlantica* (with *var. capillacea*), *Carex debilis, Carex lurida, Rhynchospora capitellata, Rhynchospora glomerata, Scirpus cyperinus, Scirpus polyphyllus*, etc. Rushes are also common, especially *Juncus canadensis, Juncus coriaceus, Juncus effusus*, and *Juncus marginatus*. Some forbs and woody shrubs in these wetter zones may include *Alnus serrulata, Ilex opaca, Lyonia ligustrina, Aronia melanocarpa (= Photinia melanocarpa), Aronia arbutifolia (= Photinia pyrifolia), Rhus copallinum, Salix humilis, Salix sericea*, and *Spiraea tomentosa*.

In the Bluegrass region of Kentucky, the original woodland-savanna aspect, especially on drier uplands, is believed to have been dominated by fire-resistant oaks, especially *Quercus macrocarpa* and *Quercus muehlenbergii*, but also with a variety of other species such as *Acer saccharum, Carya cordiformis, Fraxinus americana, Fraxinus pennsylvanica, Fraxinus quadrangulata, Gleditsia triacanthos, Juglans nigra*, and *Robinia pseudoacacia*, and the rare *Gymnocladus dioicus*. The understory is composed of cool-season grasses, as far as known (e.g., *Elymus, Dichanthelium*) with *Arundinaria gigantea* (extensive canebrakes). Settlers referred to a "buffalo grass" of unknown identity (possibly *Dichanthelium clandestinum* and/or *Dichanthelium scoparium*). Historical descriptions also mention "pea vine," *Ageratina altissima, Trifolium stoloniferum*, two or three species of Urticaeae, and *Vernonia* spp. On the Cumberland Plateau, wetter areas may include *Quercus bicolor, Quercus falcata, Quercus palustris, Nyssa sylvatica, Liquidambar styraciflua*, and *Acer rubrum var. trilobum*. The primary dominant grass in the wetter phase is *Chasmanthium laxum* (Braun 1937).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Some proposed factors which have functioned to maintain the openness of these vegetation types include the droughty, gravelly soils and resulting stresses to vegetation, as well as fire and grazing. Fralish et al. (1999) noted that both post oak and chestnut oak woodlands are essentially the result of fire suppression in the barrens and historic savannas. Native American population decline after the 1500s may have led to a decrease in the amount and frequency of burning. In some areas, where the soils are particularly harsh (droughty, nutrient-poor, rocky), stands may retain an open aspect in the absence of fire. This vegetation was formerly more widespread, but is now found in relatively scattered and isolated remnants (DeSelm and Murdock 1993). Some proposed factors which have functioned to maintain the openness of these vegetation types include the droughty, gravelly soils and resulting stresses to vegetation, as well as fire and grazing. In the eastern Highland Rim of Tennessee, fires were frequent (potentially on a five-year return interval, documented over approximately the last 370 years), primarily of human origin, occurring in late summer to early autumn. Forestry activities (including planting of off-site loblolly pine, which is not truly native to the region) and fire suppression have led to the current forested condition with solar intensity as low as 10%. The current persistence of prairies, shrublands, and grassy-woodland/savannas is largely dependent on contemporary management regimes. The woodlands, savannas and prairies are often grown up in woody vegetation (e.g., *Acer rubrum, Liquidambar styraciflua*, as well as *Quercus* spp. and *Carya* spp.) due to fire suppression. Woodlands dominated by *Quercus alba, Quercus stellata*, and to a lesser extent *Quercus marilandica* often "fill in" with less fire-tolerant species (e.g., *Quercus falcata, Quercus coccinea, Acer rubrum, Liquidambar styraciflua, Nyssa sylvatica*, etc.) resulting in a closed-canopy forest, becoming indistinguishable from other adjacent hardwood forests.

ENVIRONMENT

Environmental Description: This vegetation tends to prevail in areas that are environmentally favorable to its development and persistence. These conditions include open, flat to gently rolling landscapes, which easily carry fire if maintained in a grassy condition. In addition, there are edaphic and substrate-driven conditions that also contribute to the persistence of the vegetation, in preference to areas of deeper soil. This is not to imply that the grass-dominated vegetation could not occur on deeper, well-drained soils, but that these soils were either converted to agriculture and have remained in that condition, or they are more subject to rapid woody plant succession in the absence of disturbance (including fire and native grazing) and have succeeded to a forested condition, either following the abandonment of agriculture or without this land use ever having occurred. In the western Highland Rim of Tennessee, these edaphic influences (as noted by Shanks (1958) and described by DeSelm (1989a)) include Cretaceous gravels which cap Mississippian limestone strata, as well as "Planosols with impeded drainage" and loess-capped silty clay loam or silty clay soils. Another well-known region of "barrens" vegetation from the Eastern Highland Rim of Tennessee is found on flat to gently sloping Fragiudult soils formed in Pleistocene loess over karstic Mississippian limestone. There is variation, with some areas being flatter, wetter, and more likely to have fragipans. Their primary presettlement environmental factors are specialized soils and extremes of hydrology, as influenced by fire and grazing. In the Inner Bluegrass Basin of Kentucky, native grasslands historically occurred on deep fertile soils. On the Cumberland Plateau of Tennessee and Kentucky, this prairie-like vegetation was the predominant cover type in the early 1800s and earlier and probably was maintained from burning by Native Americans (Braun 1937).

Climate: Average conditions in the Eastern Highland Rim of Tennessee can be summarized as follows (Wolfe 1996): January is typically the coldest month, with average high and low temperatures of 8.8º C (47.8º F) and 1.9º C (35.4º F), respectively. July is the warmest month, with average high and low temperatures of 31.3º C (88.3º F) and 18.9º C (66.0º F), respectively. Monthly mean temperatures range from 3.5º C (38.3º F) in January to 25.11º C (77.2º F) in July. The mean annual precipitation is 1438 mm (56.6 inches) (Wolfe 1996, Pyne 2000). Precipitation is heaviest from November through May, averaging between 113 and 171 mm (4.4-6.7 inches) per month. Rainfall is lightest during the months of June through October, with averages ranging from 83 mm (3.3 inches) per month to a minor peak of 122 mm (4.8 inches) in July. *Soil/substrate/hydrology:* These are primarily on upland soils, but some examples are on soils with impeded drainage.

DISTRIBUTION

***Geographic Range:** Examples of this vegetation group may occur throughout the southeastern and southern midwestern states, but are more likely to occur (and to occur at recognizable scales) where there are edaphic factors or landscapes that favor their persistence. These include the Cumberland Plateau of Kentucky and adjacent Tennessee; the Western Highland Rim of Tennessee and equivalent landforms in adjacent Alabama and Kentucky (Dickson, Hickman, Lawrence, and Lewis counties of Tennessee in Subsection 223Eg (USFS) and EPA Level IV Ecoregion 71f (EPA 2004)); the southeastern Highland Rim of Tennessee (today primarily extant in Coffee, Franklin, and Warren counties, Tennessee, part of Subsection 223Eb (USFS) and EPA Level IV Ecoregion 71g); the northern Highland Rim (Pennyroyal Plateau) of Tennessee and adjacent Kentucky; the Coosa River valley of northwestern Georgia, Tennessee, and northeastern Alabama; barrens at Oak Ridge, Tennessee; the Inner Bluegrass Basin of Kentucky (Ecoregion 71l and "S. Fork Licking River arm" of Ecoregion 71d of EPA (2004)).
Nations: US

States/Provinces: AL, GA, KY, TN, WV
USFS Ecoregions (2007) [optional]: 221J:CC, 223E:CC, 223F:CC, 231D:CC, M221A:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.3.71d:C, 8.3.3.71f:C, 8.3.3.71g:C, 8.3.3.71l:C, 8.4.1.67f:C, 8.4.1.67g:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0899	*Crataegus crus-galli - Crataegus viridis - Ilex decidua* Prairie Shrubland Alliance
A0794	*Fraxinus quadrangulata - Quercus macrocarpa / Arundinaria gigantea* Open Woodland Alliance
A3890	*Schizachyrium scoparium - Andropogon ternarius - Bouteloua curtipendula* Patch Prairie Alliance
A3889	*Andropogon gerardii - Panicum virgatum - Sporobolus clandestinus* Southeastern Patch Prairie Alliance

DISCUSSION

Discussion [optional]: Examples of this vegetation group may contain a variety of natural, semi-natural, and managed openings which provide habitat for plants and animals which are unusual in the particular ecoregion or state of occurrence, or which are globally rare. These include a variety of plants more at home in other ecoregions (disjuncts), for example, stands in the Interior Low Plateau with plants more characteristic of the coastal plain or the western prairies. These may include carnivorous plants and other specialized plants of wetlands. In addition, *Rudbeckia subtomentosa, Prenanthes barbata*, and *Agalinis auriculata* are globally rare plants found in some examples.

Stands of this vegetation may become filled in with woody plants (e.g., *Acer rubrum, Liquidambar*, and also *Quercus* and *Carya* species) due to fire suppression. *Pinus* spp. are not typically extensive in this region (except for occasional *Pinus virginiana* and *Pinus echinata*), but *Pinus taeda* has recently been extensively planted for commercial forestry in some southern parts of the range and can spread from these stands. Woodlands and forests dominated by *Quercus alba, Quercus stellata*, and *Quercus marilandica* often "fill in" with less fire-tolerant species (e.g., *Quercus falcata, Quercus coccinea, Acer rubrum, Liquidambar styraciflua, Nyssa sylvatica*, etc.), resulting in a closed-canopy forest. It is difficult to discern at this point what proportion of the landscape might have been in a "barrens" condition versus a forested one. The former condition would be more prevalent on larger, flatter fire compartments. The largest extant examples are presently found on Fort Campbell Military Reservation, Tennessee, where ecological burning and fires from live munitions use result in open herbaceous-dominated landscapes. This vegetation was the predominant type here in the early 1800s and probably originated from burning by Native Americans.

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** H.R. DeSelm (1988)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne
Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by M. Evans.

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2. Shrub & Herb Vegetation
2.B.2.Nc. Eastern North American Grassland & Shrubland

G179. Central Interior Alkaline Open Glade & Barrens

Type Concept Sentence: On glade rock outcrops annual plants dominate, such as *Leavenworthia* spp., *Sedum pulchellum, Sporobolus neglectus, Sporobolus vaginiflorus*, and *Phemeranthus calcaricus*; barrens areas that have thin soils may have perennial grasses and forbs such as *Bouteloua curtipendula, Carex crawei, Carex eburnea, Panicum capillare, Panicum flexile, Schizachyrium scoparium, Silphium* spp., and *Sorghastrum nutans*. These vegetation mosaics are associated with sedimentary and meta-sedimentary dolomite and limestone in the Central Appalachians and in the Interior Highlands of the Ozark, Ouachita, and Interior Low Plateau regions.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nc.3. Central Interior Calcareous Scrub & Grassland (M508)

Elcode: G179
***Scientific Name:** *Schizachyrium scoparium - Bouteloua curtipendula - Stenaria nigricans* Central Glade & Barrens Group
***Common (Translated Scientific) Name:** Little Bluestem - Sideoats Grama - Diamond-flowers Central Glade & Barrens Group
***Colloquial Name:** Central Interior Alkaline Open Glade & Barrens

***Type Concept:** This vegetation is found primarily in the Ridge and Valley region from southwestern Virginia southward; the Inner Nashville Basin of Tennessee; on Dolomite in Bibb County, Alabama, in the vicinity of the Little Cahaba River; at low to moderate elevations in the Central Appalachians; and in the Interior Highlands of the Ozark, Ouachita, and Interior Low Plateau regions. This alkaline and circumneutral glade group encompasses shrublands, annual and perennial herbaceous vegetation, and sparsely vegetated rock outcrops on sedimentary and meta-sedimentary dolomite and limestone. These substrates are alkaline or circumneutral, and the thin soils are derived from the underlying rock. The vegetation varies according to the depth of the soil, or absence of soil. In the outcrops, annual plants dominate, such as *Sporobolus vaginiflorus, Sporobolus neglectus, Phemeranthus calcaricus, Sedum pulchellum*, and *Leavenworthia* spp. The areas that have thin soils may have perennial grasses and forbs such as *Schizachyrium scoparium, Sorghastrum nutans, Bouteloua curtipendula, Panicum flexile, Panicum capillare, Silphium* spp., *Carex eburnea*, and *Carex crawei*. Forbs vary greatly across the range and variability of the group and may be diverse. The shrublands can be dominated by *Hypericum* spp., *Rhus aromatica, Forestiera ligustrina*, and *Juniperus virginiana var. virginiana*. Sometimes widely scattered trees occur within the shrubs or perennial grasslands and may include *Juniperus virginiana var. virginiana, Quercus muehlenbergii*, and *Quercus stellata*. Some examples have numerous regionally disjunct and near-endemic plants, and have very high conservation value because of this.

***Diagnostic Characteristics:** These are grasslands and open rocky glades on alkaline substrates mainly in the southeastern United States, but occurring in the Midwest in Wisconsin and Ohio. *Schizachyrium scoparium* is a common dominant perennial grass species, and *Bouteloua curtipendula* and *Stenaria nigricans* are characteristic of this group in the southeastern United States.

***Classification Comments:** Included here are open rock outcrops and related thin-soil annual and perennial grasslands and shrublands, from southern Ohio to and southern New England, south to Arkansas and Georgia. While the Great Lakes alvars have similar substrates and floristic composition to the vegetation included here, they occur far away from these glades in special habitats associated with the Great Lakes and are treated separately.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G016	Northeastern Chinquapin Oak - Red-cedar Alkaline Forest & Woodland	
G017	Cross Timbers & East-Central Texas Plains Oak Forest & Woodland	
G601	Chinquapin Oak - Shumard Oak - Blue Ash Alkaline Forest & Woodland	
G598	Comanchian Barrens & Glade	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group includes sparsely vegetated rock outcrops, annual and perennial grasslands, shrublands, and grasslands with very widely scattered trees. Related and adjacent woodlands are placed in other related limestone woodland groups [e.g., Northeastern Chinkapin Oak - Red-cedar Forest & Woodland Group (G016)].

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Characteristic species, which typically dominate the ground layer in open examples, include *Sporobolus vaginiflorus, Sporobolus neglectus, Phemeranthus calcaricus (= Talinum calcaricum), Sedum pulchellum, Leavenworthia* spp., *Schizachyrium scoparium, Sorghastrum nutans, Bouteloua curtipendula, Panicum flexile, Panicum capillare, Silphium* spp., *Carex eburnea, Carex crawei*, and *Hypericum* spp. Some typical woody taxa include *Rhus aromatica, Forestiera ligustrina, Viburnum rufidulum, Juniperus virginiana var. virginiana, Quercus muehlenbergii*, and *Quercus stellata*. In central Tennessee examples, there are many plants that are endemic, including *Echinacea tennesseensis, Astragalus bibullatus, Astragalus tennesseensis, Dalea gattingeri*, and *Pediomelum subacaule*. Other plants there are disjunct from further west (Somers et al. 1986). Dominant or abundant *Juniperus virginiana var. virginiana* is probably related to a lack of fire. In central Tennessee, small-scale seepage areas and washes may contain *Eleocharis compressa, Eleocharis bifida, Nothoscordum bivalve, Isoetes butleri*, and *Hypoxis hirsuta*. Characteristic forbs in northern examples include *Asclepias verticillata, Monarda fistulosa, Salvia lyrata, Symphyotrichum oblongifolium*, and *Brickellia eupatorioides* (Braun 1950). In the Cahaba Glades of Bibb County, Alabama, eight endemic taxa were found and newly described in 2001: *Castilleja kraliana, Coreopsis grandiflora var. inclinata, Dalea cahaba, Erigeron strigosus var. dolomiticola, Liatris oligocephala, Onosmodium decipiens, Silphium glutinosum*, and *Spigelia alabamensis (= Spigelia gentianoides var. alabamensis)*. Seven Alabama state records were discovered: *Solanum pumilum* (last collected in 1837 and presumed extinct), *Astrolepis integerrima* (disjunct from Texas), *Paronychia virginica* (bridging a gap between Arkansas and Virginia), *Baptisia australis var. australis, Rhynchospora capillacea, Rhynchospora thornei*, and *Spiranthes lucida* (Allison and Stephens 2001).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Due to the effects of periodic drought and winter frost-heaving, the thin rocky soils generally do not support forest vegetation. The perennial grasslands may accumulate fuel from dried drought-killed trees and may be prone to wildfire. Fires may play an important role in keeping the structure of the vegetation open and perennial grass- or shrub-dominated. Grazing and the harvesting of *Juniperus virginiana var. virginiana* trees also have played a role in keeping sites open, rather than forested (DeSelm 1994). The cessation of disturbances, such as grazing, harvesting of trees, and burning these habitats, has enabled many of the perennial grasslands to become completely dominated by *Juniperus virginiana var. virginiana* and/or the invasive exotic shrub *Ligustrum sinense*.

ENVIRONMENT

Environmental Description: Site conditions and environment are characterized by thin soils over rock, usually with rock outcrops, and typically with higher pH. These areas are subject to extremes of temperature, and short-term drought can have extreme effects on the plants. In addition, wetness in the winter and frost-heaving can be pronounced. *Climate:* Humid warm temperate, humid cool temperate. *Soil/substrate/hydrology:* The substrate includes outcrops and thin soils (i.e., <20 cm soil depth) of sedimentary or meta-sedimentary rocks, dolomite or limestone. These can be flat as on limestone in the Nashville Basin or on slopes as in the dolomites of the Interior Highlands of the Ozark and Ouachita mountains, the Western Valley of the Tennessee River, and the Ketona dolomite in central Alabama. Generally the hydrology is dry upland, but there can be small saturated wetland inclusions which may support rare plant species.

DISTRIBUTION

***Geographic Range:** This group is found in the Southern Ridge and Valley of Alabama, Georgia, Tennessee, and Virginia, Knobs region of Kentucky, into southern Ohio, northeast on the Allegheny Plateau into Pennsylvania, also into New Jersey and the marble valleys of Connecticut, and west to the Interior Highlands of the Ozark and Ouachita mountains in Arkansas and Missouri.
Nations: US
States/Provinces: AL, AR, CT?, GA, IL, IN, KY, LA, MD, MO, NC, NJ, NY?, OH, OK, PA, TN, VA, WV
USFS Ecoregions (2007) [optional]: 221E:CC, 221H:CC, 221J:CC, 223B:CC, 223D:CC, 223E:CC, 223F:CC, 231C:CC, 231D:CC, M221:C, M223:C, M231:C
Omernik Ecoregions L3, L4 [optional]: 8.3.5.65g:C, 8.3.7.35a:C, 8.4.1.67a:C, 8.4.1.67b:C, 8.4.1.67f:C, 8.4.1.67g:C, 8.4.7.37d:C, 8.4.8.36b:?
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: This is a distinctive alkaline glade environment, with great physiognomic contrast between this and surrounding forest vegetation on deeper soils. In addition, there are distinctive vegetation patterns and locally endemic and disjunct species. There is much variation among the associations in terms of these regional glade endemics and disjuncts, but wide-ranging grass species are in common across association examples.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A1458	*Eleocharis bifida - Eleocharis compressa - Nothoscordum bivalve* Alkaline Rocky Seep Alliance
A1049	*Juniperus virginiana - Rhus aromatica* Alkaline Bedrock Shrubland Alliance
A1820	*Sedum pulchellum* Alkaline Bedrock Herb Alliance
A1919	*Juniperus virginiana / Schizachyrium scoparium - Bouteloua curtipendula* Alkaline Bedrock Scrub Grassland Alliance
A4098	*Bouteloua curtipendula - Schizachyrium scoparium* Northeastern Bedrock Grassland Alliance
A1815	*Sporobolus neglectus - Sporobolus vaginiflorus* Alkaline Bedrock Annual Grassland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2009-02-02	G060 Eastern Glade Group	G060 split into G178 & G179

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** E. Quarterman (1950a)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman
Acknowledgments [optional]:
Version Date: 08 Oct 2013

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2. Shrub & Herb Vegetation
2.B.2.Nc. Eastern North American Grassland & Shrubland

M505. Laurentian-Acadian Acidic Rocky Scrub & Grassland

Type Concept Sentence: This macrogroup comprises infertile scrub vegetation characterized by variable cover of ericaceous shrubs or heath, graminoids, lichens, mosses, and occasional scattered trees, occurring on sandplains and rock outcrops in cool temperate regions of northeastern and north-central North America.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.B.2.Nc.4. Eastern North American Grassland & Shrubland (D024)

Elcode: M505
***Scientific Name:** Laurentian-Acadian Acidic Rocky Scrub & Grassland Macrogroup
***Common (Translated Scientific) Name:** Laurentian -Acidic Rocky Scrub & Grassland Macrogroup
***Colloquial Name:** Laurentian-Acadian Acidic Rocky Scrub & Grassland

***Type Concept:** This macrogroup comprises infertile scrub vegetation characterized by variable cover of shrubs, herbs, lichens, and occasional scattered trees, occurring on sandplains and rock outcrops in cool temperate regions of northeastern and north-central North America. Ericaceous shrubs or heath (*Gaylussacia baccata, Kalmia angustifolia, Vaccinium angustifolium, Vaccinium myrtilloides, Vaccinium pallidum*), scrub oaks (*Quercus ilicifolia* or *Quercus prinoides*), stunted oaks (*Quercus rubra*), and dwarf-shrubs (*Arctostaphylos uva-ursi, Corema conradii, Gaultheria procumbens, Leiophyllum buxifolium, Pyxidanthera barbulata*) characterize this vegetation throughout its range. Graminoids are mostly dominant in the herb layer and include *Carex lucorum, Carex pensylvanica, Danthonia spicata, Deschampsia flexuosa, Schizachyrium scoparium*, and/or the non-native *Poa compressa*. *Pteridium aquilinum* is a common fern. Nonvascular species are often important and may include mosses (e.g., *Dicranum* spp., *Polytrichum* spp.) and/or fruticose lichens (e.g., *Cladonia* spp.). Climate is north-temperate, continental to coastal. This vegetation develops in settings within this primarily forested region where exposed, dry, acidic, nutrient-poor conditions do not sustain forest vegetation.

***Diagnostic Characteristics:** Patchy, shrub-dominated vegetation of infertile, generally acidic substrates, including rock outcrops and sandplains (relatively flat to rolling sandy regions). Characteristic taxa are species of *Vaccinium* and other ericaceous shrubs or heath, *Arctostaphylos uva-ursi, Corema conradii, Danthonia spicata, Juniperus communis, Quercus ilicifolia, Sibbaldiopsis tridentata*, and in the New Jersey pine plains, dwarfed *Leiophyllum buxifolium, Pinus rigida* and *Pyxidanthera barbulata*.

***Classification Comments:** This macrogroup includes pine plains characterized by dwarfed *Pinus rigida*, restricted to the New Jersey Pine Barrens and Long Island, New York, as well as vegetation of serpentine rock in northern New England. The relationship of the latter to serpentine vegetation of the Gaspe Peninsula, Quebec, requires further analysis.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M502	Appalachian-Northeastern Oak - Hardwood - Pine Forest & Woodland	has broadly similar herbaceous and shrub layers in woodland portions occurring on acidic, infertile substrates.
M506	Appalachian Rocky Felsic & Mafic Scrub & Grassland	
M509	Central Interior Acidic Scrub & Grassland	

Similar NVC Types General Comments [optional]: The distribution of Central Interior Calcareous Scrub & Grassland Macrogroup (M508) northward and this macrogroup (M505) southward needs to be resolved.

VEGETATION

Physiognomy and Structure Summary: This vegetation may be shrub-, dwarf-shrub-, or herb-dominated, but is most often a patchwork of more than one physiognomy. Trees may be present, but are generally stunted in growth form (<2 m) and with low cover (<25%). Bare or lichen-encrusted rock may dominate large areas.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Ericaceous shrubs or heath (*Gaylussacia baccata, Kalmia angustifolia, Vaccinium angustifolium, Vaccinium myrtilloides, Vaccinium pallidum*), scrub oaks (*Quercus ilicifolia* or *Quercus prinoides*), stunted oaks (*Quercus rubra*) and maples (*Acer rubrum*), and dwarf-shrubs (*Arctostaphylos uva-ursi, Corema conradii, Gaultheria procumbens, Leiophyllum buxifolium, Pyxidanthera barbulata*) characterize this vegetation throughout its range. Graminoids are mostly dominant in the herb layer and include *Carex lucorum, Carex pensylvanica, Danthonia spicata, Deschampsia flexuosa, Schizachyrium scoparium*, and/or the non-native *Poa compressa*. *Pteridium aquilinum* is a common fern. *Comptonia peregrina* is common in parts of the range. Nonvascular species are often important and may include mosses (e.g., *Dicranum* spp., *Polytrichum* spp.) and/or fruticose lichens (e.g., *Cladonia* spp.). When present, trees may include scattered individuals of *Acer rubrum, Betula* spp., *Pinus* spp., *Prunus pensylvanica, Prunus serotina, Quercus* spp., and other taxa that can colonize dry, open areas.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Exposure and occasional fire are the major factors keeping this vegetation relatively open on bedrock settings, while frequent fire is more typical in sandplains. Land-use history may be very important in creating or expanding thin soil on rock outcrops and in expanding pitch pine - scrub oak communities on sand (P. Swain pers. comm. 2014). Grazing by sheep on mountains has been considered to be a cause of soil loss and expansion of outcrop communities, similar to what has been reported on coastal New England sandplains (Motzkin and Foster 2002).

ENVIRONMENT

Environmental Description: Climate is north-temperate, continental to coastal. This vegetation develops in settings within this primarily forested region where exposed, dry, nutrient-poor conditions and fire do not easily sustain forest vegetation. Sand barrens examples can be common in regions with extensive sandplains, with relatively flat to rolling sandy soils. The substrate is rock or sand, with thin or localized areas of nutrient-poor soil. Substrate chemistry is usually acidic and nutrient-poor to (rarely) ultramafic. The substrate hydrology is largely very well- to excessively well-drained, except for small pockets within the expanses of rock that may accumulate runoff and precipitation.

DISTRIBUTION

***Geographic Range:** This macrogroup ranges across southeastern Canada from the Maritime Provinces to the Great Lakes, and south through the northeastern and upper midwestern U.S. to New Jersey, Pennsylvania, Ohio, and the mountains of Virginia and West Virginia.
Nations: CA, US
States/Provinces: CT, MA, ME, MI, MN, NB, NH, NJ, NS, NY, OH, ON, PA, QC, RI, VA, VT, WI
USFS Ecoregions (2007) [optional]: 211A:CC, 211B:CC, 211C:CC, 211D:CC, 211E:CC, 211F:CC, 211I:CC, 212Jb:CCC, 212Jc:CCC, 212Jo:CCP, 212K:CC, 212Lb:CPP, 212M:CC, 212Q:CC, 212Sb:CCC, 212Sc:CCP, 212Sn:CCP, 212Sq:CCC, 212Tc:CCC, 212X:CC, 212Ya:CCC, 221A:CC, 221B:CC, M211A:CC, M211Bb:CCC, M211Bd:CCC, M211C:CC, M211D:CC, M221A:CC, M221B:CP
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G788	Laurentian-Acadian Acidic Scrub & Grassland

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-05-06	M127 Eastern North American Sub-boreal Shrubland & Grassland Macrogroup	M127 split & merged with M505

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
><	Dwarf Pine Plains	Whittaker 1979a	
<	Heath	Latham et al. 1996	
<	Heath-mat association type	Hill 1923	

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Pine-heath	Harshberger 1918	
<	Plain Formation (Coremal)	Harshberger 1916	
<	Rhodora	Latham et al. 1996	
<	Rock Outcrop System, Northern Floristic Region	Minnesota DNR 2003	
<	Scrub Oak Barrens	Latham et al. 1996	
<	Southern Ontario Granite Barrens	Catling and Brownell 1999	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.W. Harshberger (1916); A.F. Hill (1923); P.M. Catling and V.R. Brownell (1999)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler and L. Sneddon

Acknowledgments [optional]:

Version Date: 15 Oct 2014

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***References [Required if used in text]:**

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2. Shrub & Herb Vegetation
2.B.2.Nc. Eastern North American Grassland & Shrubland

G788. Laurentian-Acadian Acidic Scrub & Grassland

Type Concept Sentence: This Laurentian and near-boreal outcrop group is found across central southern Canada and the upper Midwest of the United States with patchy, often a mosaic of woodlands and open glades typically dominated by various conifers, including *Pinus banksiana* and *Picea mariana*, with occasional *Picea glauca* or *Populus tremuloides*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nc.4. Laurentian-Acadian Acidic Rocky Scrub & Grassland (M505)

Elcode: G788
***Scientific Name:** Laurentian-Acadian Acidic Scrub & Grassland Group
***Common (Translated Scientific) Name:** Laurentian-Acadian Acidic Scrub & Grassland Group
***Colloquial Name:** Laurentian-Acadian Acidic Scrub & Grassland

***Type Concept:** This Laurentian and near-boreal outcrop group is found across central southern Canada and the upper Midwest of the United States. It is found on ridges or summits of resistant acidic bedrock at low to mid elevations with soils ranging from sands to loams. The vegetation is patchy, often a mosaic of woodlands and open glades and typically dominated by various conifers, including *Pinus banksiana* and *Picea mariana*, with occasional *Picea glauca* or *Populus tremuloides*. Hardwoods include *Quercus rubra, Quercus ellipsoidalis*, and *Populus tremuloides*. Structure can vary from treed to low heath shrubs to open lichen woodland. Common grass species include *Danthonia spicata, Oryzopsis asperifolia*, and *Poa compressa*. Dwarf-shrubs include *Comptonia peregrina, Juniperus* spp. and *Vaccinium* spp. *Pteridium aquilinum* may form an almost continuous canopy of fronds in some stands. Exposure and occasional fire are the major factors in keeping the vegetation relatively open.

***Diagnostic Characteristics:** Patchy mosaic of woodlands and open glades found in the northern Midwest and southern Canada and typically dominated by shrub-form conifers with variable herbaceous cover and areas of exposed bedrock covered by lichens and mosses.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G789	North-Central Appalachian Acidic Scrub & Grassland	
G793	Great Lakes Coastal Rocky Shore	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The vegetation is patchy, often a mosaic of woodlands and open glades and typically dominated by various, often shrub-form conifers. There may be a sparse cover (0-10% cover) of trees over 5 m tall. Herbaceous cover varies, with mosses and lichens comprising much of the cover on areas of exposed bedrock.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Vegetation is dominated by northern and subboreal species. Typical tree species include *Abies balsamea, Picea glauca, Pinus banksiana, Pinus resinosa*, and *Pinus strobus*. Other common species include *Acer rubrum, Betula papyrifera, Populus tremuloides, Quercus rubra*, and *Thuja occidentalis*. In some examples, these woody species may form woodlands or thickets of shrub-form trees. Common shrubs include *Alnus viridis, Cornus sericea, Corylus cornuta, Oplopanax horridus, Prunus pensylvanica, Salix* spp., *Taxus canadensis*, and *Viburnum edule*. Dwarf-shrubs may form a distinct layer. Some common dwarf-shrub species include *Arctostaphylos uva-ursi, Comptonia peregrina, Diervilla lonicera, Empetrum nigrum, Juniperus communis*, and *Vaccinium angustifolium*. Herbaceous cover varies. Common grass species include *Elymus trachycaulus (= Agropyron trachycaulum), Bromus kalmii, Danthonia spicata*, and *Oryzopsis asperifolia*. Forbs of high constancy include *Anaphalis margaritacea, Equisetum arvense, Galium triflorum, Gymnocarpium dryopteris, Linnaea borealis, Lycopodium annotinum, Maianthemum canadense, Streptopus* *lanceolatus (= Streptopus roseus), Symphyotrichum ciliolatum (= Aster ciliolatus), Fragaria virginiana*, and *Solidago nemoralis*. Ferns may dominate some examples, including areas where *Pteridium aquilinum* may form an almost continuous canopy of fronds. A high cover of exotic or weedy species such as *Hieracium aurantiacum, Lactuca serriola (= Lactuca scariola), Phleum pratense, Poa compressa, Poa pratensis, Rumex acetosella*, and *Verbascum thapsus* (Curtis 1959) may be present in some stands. *Cladonia* spp. and *Polytrichum* spp. are two abundant nonvascular taxa.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Exposure, temperature, and thin soils maintain occurrences in an open condition. Some stands may have arisen as a result of previous logging. Fire, both natural and slash fires following logging, may be important in some examples.

ENVIRONMENT

Environmental Description: Stands occur on level plains or rolling uplands with gentle to moderate slopes and in depressions ("frost pockets") in pitted outwash topography. Soils range from loams to fine sands and are somewhat acidic (pH 4.6) and are moderately well-drained to well-drained. Soil characteristics vary depending on the age of the stand.

DISTRIBUTION

***Geographic Range:** This group occurs in the north-central United States and south-central Canada in the Great Lakes region, ranging east to New England.
Nations: CA, US
States/Provinces: ME, MI, MN, NB?, NH, NS?, NY, ON, QC, VT, WI
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A1599	*Pteridium aquilinum - Bromus kalmii* Sand Grassland Alliance
A3908	*Juniperus communis* - Mixed Scrub / *Danthonia spicata* Acidic Bedrock Alliance
A3361	*Acer spicatum - Picea glauca / Clintonia borealis* Scrub Alliance
A4110	*Vaccinium angustifolium - Vaccinium myrtilloides* Rocky Heath Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-11-10	G058 Vaccinium spp. - Juniperus horizontalis - Danthonia spicata Acidic Rocky Outcrop Group	G058 split into G788 & G789

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.T. Curtis (1959)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.E. Menard
Acknowledgments [optional]:
Version Date: 04 May 2015

REFERENCES

***References [Required if used in text]:**

Curtis, J. T. 1959. The vegetation of Wisconsin: An ordination of plant communities. Reprinted in 1987. University of Wisconsin Press, Madison. 657 pp.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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2. Shrub & Herb Vegetation
2.B.2.Nc. Eastern North American Grassland & Shrubland

M507. Laurentian-Acadian Calcareous Scrub & Grassland

Type Concept Sentence: This macrogroup encompasses open shrub, stunted or very sparse tree, and herb calcareous rocky vegetation, including rocky outcrops and limestone pavements (alvars). It is found in isolated patches in the Laurentian-Acadian region of southeastern Canada and the northeastern United States.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.B.2.Nc.5. Eastern North American Grassland & Shrubland (D024)

Elcode: M507
***Scientific Name:** *Dasiphora fruticosa ssp. floribunda - Carex eburnea* Calcareous Scrub & Grassland Macrogroup
***Common (Translated Scientific) Name:** Shrubby-cinquefoil - Bristleleaf Sedge Calcareous Scrub & Grassland Macrogroup
***Colloquial Name:** Laurentian-Acadian Calcareous Scrub & Grassland

***Type Concept:** This macrogroup encompasses calcareous outcrops and alvar grasslands and shrublands that occur in isolated patches in the Laurentian-Acadian region of southeastern Canada and the northeastern United States. Alvars are well-described, and are found in the temperate-boreal transition of the Great Lakes and Lake Winnipeg basins. They are characterized by distinctive scrub and herb flora, of eastern tallgrass prairie elements and eastern subboreal elements, with less than 10% tree cover. Alvars occur both as open grasslands and pavements, with shrubs <25% cover and as shrublands, where shrubs are >25%. Common alvar species include *Carex crawei, Carex scirpoidea, Danthonia spicata, Deschampsia cespitosa, Eleocharis compressa, Juniperus horizontalis, Packera paupercula, Schizachyrium scoparium*, and *Sporobolus heterolepis*. In more exposed areas, there is a mosaic of mossy patches and exposed bedrock that is covered with crustose and foliose lichens. In shrubby areas, the dominant shrub is the short to tall shrub *Juniperus communis*, mixed with *Juniperus horizontalis* and/or *Dasiphora fruticosa ssp. floribunda*, or a mix of scrub forms of tree species such as *Abies balsamea, Larix laricina, Picea glauca*, and *Thuja occidentalis*. Alvars are maintained by associated geologic, hydrologic, and other landscape processes. In particular, most types of alvar tend to flood each spring, then experience moderate to severe drought in summer months. They include open pavement, grassland, and shrubland/woodland types. Alvar communities occur in an ecological matrix with similar bedrock and hydrologically influenced communities. Four key ecological processes influence Great Lakes alvar communities: (1) hydrology and soil moisture regime, (2) fire regime and land-use history, (3) herbivory: browsing by deer and grazing by cattle, and (4) the invasion of exotic plant species. Calcareous rocky outcrops are poorly described in the region.

***Diagnostic Characteristics:** Calcareous scrubby-herb vegetation is characterized by a variable physiognomy, from open perennial (rarely annual) grassland or shrubland and nonvascular pavement (5-25% herb and/or shrub cover) to dense grassland or shrubland (>25%) with scattered evergreen needleleaf (more rarely broadleaf deciduous) trees <10% (variable). Species composition contains a mix of calciphilic, sometimes prairie grasses and sub-boreal to boreal shrubs and trees. Sites are on shallow soils over limestone, limestone pavement or alkaline rocky outcrops. Key dominants and differentials on alvars include the perennials *Schizachyrium scoparium, Sporobolus heterolepis, Danthonia spicata*, and *Deschampsia cespitosa* (wet to moist areas); *Sporobolus neglectus, Sporobolus vaginiflorus*, and *Panicum philadelphicum* occur in areas with the thinnest soils, typically along the margins of exposed pavement. Key shrubs, when present, are *Dasiphora fruticosa ssp. floribunda, Juniperus communis, Juniperus horizontalis*, and *Rhus aromatica*. Trees, when present, include *Pinus banksiana* (in more northern sites), *Picea glauca, Thuja occidentalis*, and *Quercus macrocarpa* or *Quercus muehlenbergii* (more southern sites).

Key characteristics of other calcareous vegetation needs to be documented.

***Classification Comments:** Excluded from the alvar concept are limestone bedrock lakeshore and rivershore pavement grasslands, and various limestone woodlands. These lack the typical diagnostic species of alvar (Reschke et al. 1998). Limestone spare woodlands (savannas) and woodlands, with >10% tree cover, are treated with Laurentian-Acadian Limestone Woodland Group (G655) in Laurentian-Acadian Pine - Hardwood Forest & Woodland Macrogroup (M159). Juniper shrublands lack many of the diagnostic species common in grassland alvars, and further review is needed to resolve their placement.

Distribution in Lower New England states is uncertain. Depending on whether Central Interior Calcareous Scrub & Grassland Macrogroup (M508) extends to Massachusetts and Connecticut for calcareous/circumneutral outcrops (currently M508 does not), Massachusetts and probably Connecticut have small outlying occurrences; not alvar, but outcrops (e.g., Massachusetts Calcareous Rocky Summit / Rock Outcrop Community). See also Weatherbee (1996) for Massachusetts and state classifications for Connecticut, Massachusetts, and Vermont (P. Swain pers. comm. 2014).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M508	Central Interior Calcareous Scrub & Grassland	
M057	Eastern North American Coastal Dune & Grassland	

Similar NVC Types General Comments [optional]: The distribution northward of Central Interior Calcareous Scrub & Grassland Macrogroup (M508) with respect to this macrogroup (M507) needs to be resolved.

VEGETATION

Physiognomy and Structure Summary: Calcareous scrub (low shrubs, stunted or sparse tree) and herb vegetation has very few trees (<10% cover of trees over 5 m tall), a variable cover of shrubs and herbaceous plants, often with exposed bedrock, which may be covered with crustose lichens, mosses, and blue-green algal mats in low-lying areas where water pools. Physiognomy varies from open nonvascular pavement with scattered vascular plants, to grassland, and shrubland or scrub types.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Alvars are well-described and are found in the temperate-boreal transition of the Great Lakes and Lake Winnipeg basins. Great Lakes alvars are characterized by distinctive scrub (shrub?) and herb flora of western, northern and southern species, depending on where in the basin they occur, with <10% tree cover. Alvars occur both as open grasslands and pavements, with shrubs <25% cover and as shrublands, where shrubs are >25%. Common alvar species include *Carex crawei, Carex scirpoidea* (only on Bruce Peninsula and Manitoulin Island in Ontario), *Deschampsia cespitosa* (not an alvar indicator, found on rocky areas near water throughout Ontario), *Eleocharis compressa, Juniperus horizontalis, Packera paupercula (= Senecio pauperculus), Schizachyrium scoparium*, and *Sporobolus heterolepis*. *Trichostema brachiatum (= Isanthus brachiatus), Panicum philadelphicum*, and *Scutellaria parvula* are common in all alvars, much more so than *Carex scirpoidea*. In more exposed areas, there is a mosaic of mossy patches and exposed bedrock that is covered with crustose and foliose lichens. In shrubby areas, the dominant shrub is the short to tall shrub *Juniperus communis*, mixed with *Juniperus horizontalis* and/or *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Rhus aromatica*, or a mix of scrub forms of tree species such as *Abies balsamea, Larix laricina, Picea glauca*, and *Thuja occidentalis*.

Further information on other calcareous stands is needed. See Lee et al. (1998) for information in southern Ontario, and state Natural Heritage Program classifications and Weatherbee (1996) in New England.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In Great Lakes alvars, natural fires appear always to have been at least an incidental part of their history, and probably instrumental in maintaining some alvar types, such as juniper alvar shrubland. But based on evidence from alvars that are open with old trees and have no burn evidence, it is clear that not all alvars require fire to remain in an open state. Therefore, the use of fire as a management tool is not advised for all alvar community types (Reschke et al. 1998). Alvars in the Great Lakes basin and elsewhere have long been influenced by grazing livestock. Brownell (1998) has noted that where grazing is intense on Great Lakes alvar grasslands, the grasses may be reduced and that species avoided by cattle such as *Eleocharis compressa* may increase in abundance. Rosette-forming species such as *Symphyotrichum ciliolatum* and *Solidago* species also may increase. *Ranunculus fascicularis* is much more frequent on some alvars subject to grazing than on adjacent non-grazed sites. Nevertheless, even light grazing tends to result in elimination of certain species, such as the disjunct *Orobanche fasciculata* (Catling and Brownell 1995). Several exotic species are invasive in alvar communities, including *Cynanchum rossicum, Echium vulgare, Hypericum perforatum, Lonicera morrowii, Lonicera tatarica*, and *Rhamnus cathartica*. *Poa compressa*, which is considered by most experts to be an introduced species, is also well-established on many alvar sites. These exotic species compete with native species for space and nutrients and, in some cases, become dominant (Reschke et al. 1998).

Dynamics of calcareous outcrops needs investigation.

ENVIRONMENT

Environmental Description: Alvars are maintained by associated geologic, hydrologic, and other landscape processes. In particular, most types of alvar experience moderate to severe drought in summer months, and some tend to flood each spring depending on topographic position. Soils are often thin (up to 30 cm of soil). Four key ecological processes influence Great Lakes alvar communities: (1) hydrology and soil moisture regime, (2) fire regime and land-use history, (3) herbivory: browsing by deer and grazing by cattle, and (4) the invasion of exotic plant species.

Calcareous rocky outcrops are poorly described in the region. See Lee et al. (1998) for information in southern Ontario, and state Natural Heritage Program classifications and Weatherbee (1996) in New England.

DISTRIBUTION

***Geographic Range:** Open shrub, scrub and herb calcareous rocky vegetation is found in isolated patches in the Laurentian-Acadian region of southeastern Canada and the northeastern United States, from Minnesota and southeastern Manitoba to Maine and Nova Scotia. Distribution in Lower New England states is uncertain.
Nations: CA, US
States/Provinces: CT?, MA?, MB, ME, MI, MN, NH, NS, NY, ON, PE?, QC, VT, WI
USFS Ecoregions (2007) [optional]: 211Ee:CCC, 212Hl:CCC, 212Rc:CCC, 212Re:CCC, 212Tb:CCC, 212Te:CCC, 222Ie:CCC, 222U:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G061	Great Lakes Alvar
G767	Northern Plains-Boreal Transition Alvar
G681	Northern Alkaline Rocky Outcrop

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-07-24	M163 Eastern North American Prairie & Barrens Macrogroup	M163 split into M505, M506, M507, M508, M509
2012-07-24	M124 Northern & Central Alvar & Glade Macrogroup	M124 split into M507, M508, M509

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen, in Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** D. Faber-Langendoen

Acknowledgments [optional]:

Version Date: 15 Oct 2014

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2. Shrub & Herb Vegetation

2.B.2.Nc. Eastern North American Grassland & Shrubland

G061. Great Lakes Alvar

Type Concept Sentence: This alvar grassland and shrubland group is found in the temperate-boreal transition of the Great Lakes basin.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nc.5. Laurentian-Acadian Calcareous Scrub & Grassland (M507)

Elcode: G061
***Scientific Name:** *Schizachyrium scoparium - Sporobolus heterolepis - Juniperus communis* Alvar Grassland & Shrubland Group
***Common (Translated Scientific) Name:** Little Bluestem - Prairie Dropseed - Common Juniper Alvar Grassland & Shrubland Group
***Colloquial Name:** Great Lakes Alvar

***Type Concept:** This alvar grassland and shrubland group is found in the temperate-boreal transition of the Great Lakes basin. The group is characterized by distinctive scrub and herb flora, of eastern tallgrass prairie elements and eastern subboreal elements, with less than 10% tree cover. It is found primarily in an arc along the Niagara Escarpment from northern Lake Michigan across northern Lake Huron and eastern Ontario and northwestern New York State. The climate is humid and subhumid, and sites are centered on areas of glaciated horizontal limestone/dolomite (dolostone) bedrock pavement with a discontinuous thin soil mantle. This group can be divided into two main variants: (1) open grasslands and pavements, with shrubs <25% cover and (2) shrublands, where shrubs are >25%. These two variants are distinguished by the amount of exposed bedrock, the cover of herbaceous plants (mostly grasses and sedges), the cover of shrubs, and the cover of trees (<10% cover).

Alvar grasslands are typically dominated by *Schizachyrium scoparium, Deschampsia cespitosa, Sporobolus heterolepis, Eleocharis compressa, Carex crawei, Juniperus horizontalis, Carex scirpoidea*, and *Packera paupercula*. Other characteristic grasses and herbs include *Sporobolus neglectus, Sporobolus vaginiflorus, Trichostema brachiatum*, and *Allium schoenoprasum*. In parts, there is a mosaic of pavement and grassland areas dominated by characteristic native species, such as *Sporobolus neglectus, Sporobolus vaginiflorus, Panicum philadelphicum, Poa compressa, Oligoneuron album, Danthonia spicata, Trichostema brachiatum, Packera paupercula, Carex crawei*, and *Panicum flexile*. In more exposed areas, there is a mosaic of mossy patches and exposed bedrock that is covered with crustose and foliose lichens.

In shrubby areas, the dominant shrub is the short to tall shrub *Juniperus communis*, mixed with *Juniperus horizontalis* and/or *Dasiphora fruticosa ssp. floribunda*, or a mix of scrub forms of tree species such as *Picea glauca, Thuja occidentalis, Larix laricina, Abies balsamea*. Mixed among the shrubs are *Danthonia spicata, Oligoneuron album, Packera paupercula, Clinopodium arkansanum*, and *Tetraneuris herbacea*. Characteristic tall shrubs (2 to 5 m tall) include scrub forms of trees such as *Juniperus virginiana, Thuja occidentalis*, and *Quercus macrocarpa*. Alvars are maintained by associated geologic, hydrologic, and other landscape processes. In particular, most types of alvar tend to flood each spring, then experience moderate to severe drought in summer months. They include open pavement, grassland, and shrubland/woodland types. Alvar communities occur in an ecological matrix with similar bedrock and hydrologically influenced communities. Four key ecological processes influence Great Lakes alvar communities: (1) hydrology and soil moisture regime, (2) fire regime and land-use history, (3) herbivory: browsing by deer and grazing by cattle, and (4) the invasion of exotic plant species.

***Diagnostic Characteristics:** This type is characterized by a variable physiognomy, from open perennial (rarely annual) grassland or shrubland and nonvascular pavement (5-25% herb and/or shrub cover) to dense grassland or shrubland (>25%) with scattered evergreen needleleaf (more rarely broadleaf deciduous) trees <10% (variable) Species composition contains a mix of prairie grasses and sub-boreal to boreal shrubs and trees. Sites are on thin-soil, limestone pavement, with a xero-hydric moisture regime. Key dominants and differentials include the perennials *Schizachyrium scoparium, Sporobolus heterolepis*, and *Deschampsia cespitosa*; less commonly with *Sporobolus neglectus, Sporobolus vaginiflorus*, and *Panicum philadelphicum*. Key shrubs, when present, are *Juniperus communis* and *Juniperus horizontalis*. Trees, when present, include *Picea glauca, Thuja occidentalis, Larix laricina*, and *Abies balsamea* (in more northern sites) and *Quercus macrocarpa* or *Quercus muehlenbergii* (more southern sites).

***Classification Comments:** Excluded from the concept are limestone bedrock lakeshore and rivershore pavement grasslands, and various limestone woodlands. These lack the typical diagnostic species of alvar (Reschke et al. 1999). Limestone savannas and woodlands, with >10% tree cover, are treated with Laurentian-Acadian Limestone Woodland Group (G655). Also excluded is the Midwest wet-mesic dolomite prairie in the upper Midwest. That grassland community occurs on shallow, temporarily flooded or frequently saturated soils overlying dolomite bedrock in northeastern Illinois. It has a dense cover of herbaceous vegetation, while woody species are virtually absent. The most abundant species include *Calamagrostis canadensis, Carex sartwellii, Carex scoparia, Carex sterilis, Arnoglossum plantagineum, Deschampsia cespitosa, Clinopodium arkansanum, Schizachyrium scoparium, Oligoneuron ohioense*, and *Spartina pectinata*. Although that grassland has a soil moisture regime very similar to alvar grasslands, the soils are generally deeper, and that community seems to be dependent upon frequent fires. The combination of the fire regime, the relative abundance of many characteristic prairie species not found in alvar, and the lack of subboreal elements, are the main reasons that community is considered a prairie instead of an alvar (Reschke et al. 1999).

Juniper shrublands lack many of the diagnostic species common in grassland alvars, and further review is needed to resolve their placement.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G681	Northern Alkaline Rocky Outcrop	
G767	Northern Plains-Boreal Transition Alvar	
G659	Western Boreal Alvar	
G793	Great Lakes Coastal Rocky Shore	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Open alvar grassland and pavement communities have very few trees (less than 10% cover of trees over 5 m tall), a low cover of shrubs (less than 25% cover), and a high abundance of either herbaceous plants or exposed bedrock, which may be covered with crustose lichens and mosses. Alvar shrubland communities have very few trees (less than 10% covers of trees over 5 m tall), moderate to high cover of especially needleleaf evergreen shrubs (at least 25% cover of shrubs), and variable amounts of cover of herbaceous and nonvascular plants.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The following is a summary of information from Reschke et al. (1999). Alvar grasslands are typically dominated by *Schizachyrium scoparium, Deschampsia cespitosa, Sporobolus heterolepis, Eleocharis compressa, Carex crawei, Juniperus horizontalis, Carex scirpoidea*, and *Packera paupercula (= Senecio pauperculus)*. Other characteristic grasses and herbs include *Sporobolus neglectus, Sporobolus vaginiflorus, Trichostema brachiatum*, and *Allium schoenoprasum*. Less common is a dry grassland phase dominated by *Danthonia spicata, Poa compressa*, and sometimes *Schizachyrium scoparium*. It may represent a disturbed phase. Typically there are several turf and weft mosses forming a patchy mat at the base of grasses and forbs; typical mosses are *Bryum pseudotriquetrum, Abietinella abietina, Tortella tortuosa*, and *Drepanocladus* spp.

In parts, there is a mosaic of pavement and grassland areas dominated by characteristic native species, such as *Sporobolus neglectus, Sporobolus vaginiflorus, Panicum philadelphicum, Poa compressa, Oligoneuron album (= Solidago ptarmicoides), Danthonia spicata, Trichostema brachiatum (= Isanthus brachiatus), Packera paupercula (= Senecio pauperculus), Carex crawei*, and *Panicum flexile*. In more exposed areas, there is a mosaic of mossy patches and exposed bedrock that is covered with crustose and foliose lichens. In the mossy patches, characteristic mosses are *Tortella tortuosa*, other *Tortella* spp., and *Tortula ruralis*, and a characteristic lichen is *Cladonia pocillum*. On exposed pavement patches, characteristic lichens are *Placynthium nigrum* and *Dermatocarpon cf. miniatum*.

In shrubby areas, a dominant shrub is often *Juniperus communis*, mixed with either *Juniperus horizontalis* and/or *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)*, or a mix of scrub forms of tree species such as *Picea glauca, Thuja occidentalis, Larix laricina*, and *Abies balsamea*. Other typical short shrubs (0.5 to 2 m tall) are *Prunus virginiana, Diervilla lonicera, Shepherdia canadensis, Cornus sericea, Rhamnus alnifolia, Cornus racemosa (= Cornus foemina ssp. racemosa), Rhus aromatica*, and *Viburnum rafinesqueanum*. Mixed among the shrubs are *Danthonia spicata, Oligoneuron album, Packera paupercula, Clinopodium arkansanum (= Calamintha arkansana)*, and *Tetraneuris herbacea (= Hymenoxys herbacea)*. There can be a "lawn" dominated by *Iris lacustris* and *Carex eburnea*. Characteristic tall shrubs (2 to 5 m tall) include scrub forms of trees such as *Juniperus virginiana, Thuja occidentalis*, and *Quercus macrocarpa*. Other less common trees (over 5 m tall) that may be present include *Carya ovata, Ulmus thomasii*, and *Fraxinus americana*. It is possible that shrub cover may increase with disturbances such as grazing or lack of fire. Once established, the shrub cover may be thick enough to prevent trees from establishing.

Exotics: Reschke et al. (1999) listed 14 species that occurred in at least 9% of observation points across the range of alvars. These are, in decreasing order of frequency, *Poa compressa, Hypericum perforatum, Potentilla recta, Verbascum thapsus, Phleum pratense, Leucanthemum vulgare, Hieracium piloselloides, Rumex crispus, Hieracium* spp., *Daucus carota, Echium vulgare, Melilotus officinalis, Poa pratensis*, and *Rhamnus cathartica*. Aggressive species which are problematic include *Rhamnus cathartica, Hypericum perforatum, Potentilla recta, Cynanchum rossicum*. *Poa compressa*, which is considered by most experts to be an introduced species, is also well-established on many alvar sites.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Fire: Natural fires appear always to have been at least an incidental part of their history, and probably instrumental in maintaining some alvar types, such as juniper alvar shrubland. This suggests that aggressive fire suppression is not needed on alvar habitats. Based on evidence from alvars that are open with old trees and have no burn evidence, it is clear that not all alvars require fire to remain in an open state. If fire is at all required in some of these alvars, it could only be on the basis of a return cycle of many hundreds of years. Therefore, the use of fire as a management tool is not advised for all alvar community types. (Reschke et al. 1999).

Grazing: White-tail deer are a native species in the Great Lakes basin, but artificially high population levels across much of the basin, created and sustained by habitat modifications and management policies, are seriously impacting plant populations in many natural habitats (Rooney et al. 2004). Alvars in the Great Lakes basin and elsewhere have long been influenced by grazing livestock. Grazing has been little studied in North America, but has been documented on alvars of the Swedish island of Oland, where grazing by domestic animals has occurred since the first centuries A.D. (Titlyanova et al. 1988). There, grazing has been considered essential to prevent encroachment in closed grasslands occurring on siliceous soils, where soil depth would potentially support woody vegetation (Bengtsson et al. 1988, Rosen 1992). Closed turf of ungrazed sites hindered germination of perennial herbs, and the short turf and gaps in grazed communities increased the abundance and persistence of some monocarpic plant species (Rusch 1988). However, the intensity of grazing appears to be critical. A comparison of ungrazed, moderately grazed, and heavily grazed sites showed decreased biomass and floristic changes in the heavily grazed sites, with perennial and annual ruderal species replacing the dominant alvar species. Alvar lichens had the highest biomass values in the moderately grazed sites (Titlyanova et al. 1988).

Brownell (1998) has noted that where grazing is intense on Great Lakes alvar grasslands, the grasses may be reduced and that species avoided by cattle such as *Eleocharis compressa* may increase in abundance. Rosette-forming species such as *Symphyotrichum ciliolatum* and *Solidago* species also may increase. *Ranunculus fascicularis* is much more frequent on some alvars subject to grazing than on adjacent non-grazed sites. Nevertheless, even light grazing tends to result in elimination of certain species, such as the disjunct *Orobanche fasciculata* (Catling and Brownell 1995). These factors led the Alvar Working Group to hypothesize that cattle grazing is generally detrimental to alvar communities, but some light grazing may help to keep alvar areas open (Reschke et al. 1999).

Exotics: Several exotic species are invasive and problematic in alvar communities, including *Hypericum perforatum* in Michigan, *Poa compressa* in Ontario and New York, and *Cynanchum rossicum, Rhamnus cathartica, Lonicera tatarica*, and *Lonicera morrowii* in New York. *Poa compressa*, which is considered by most experts to be an introduced species, is also well-established on many alvar sites. These exotic species compete with native species for space and nutrients and, in some cases, become dominant, significantly reducing the ecological value of alvar communities (Reschke et al. 1999).

ENVIRONMENT

Environmental Description: *Climate:* Alvars are found in humid and subhumid climates. *Soil/substrate/hydrology:* Alvars are natural systems of humid and subhumid climates, centered on areas of glaciated horizontal limestone/dolomite (dolostone) bedrock pavement with a discontinuous thin soil mantle. Most hydrologic studies of alvars in the Great Lakes region have concentrated on Chaumont Barrens in New York State (Feeney 1996, 1997, Reschke et al. 1999). Reschke (1995) found strong correlations between soil moisture conditions and vegetation types, with "alvar grasslands" (equivalent to tufted hairgrass wet alvar grassland) located in the wettest, seasonally flooded areas, and "calcareous pavement barrens" (equivalent to juniper alvar shrubland) in the drier, never-flooded areas. At the Limerick Cedars alvar, also in New York State, Gilman (1995) observed that alvar community structure was influenced by rapidly changing environmental conditions and differential tolerances of plants, especially to periodic drought.

Each alvar community type undoubtedly has its own special rhythm of seasonal wetness and dryness, and studies to date have only begun to document these patterns. Based on the Chaumont Barrens work, the hydrology of alvar grasslands has a considerable seasonal variation ranging from near-flooded conditions to near desiccation. Flooded conditions occur during March, April, May, and into June, and again in late September through November until snows accumulate. These alvar grasslands achieve a near-wetland condition based upon the characteristics of the principal grassland soils, vegetation, and the spring and fall hydrologic conditions. Wet spring and fall conditions are usually interrupted by a very dry period in July and August in which all ponding ends and vegetation can be stressed to near, or beyond, the wilting point. Soils are very shallow (average is about 6 cm), and hold limited supplies of water; this limited soil moisture reservoir appears to be quickly depleted in dry periods. Surface temperatures on exposed rock within alvars can reach very high levels, from 43° to 53° C during summer periods (Gilman 1995, Schaefer and Larson 1997). Because of these factors, soils approach total desiccation in August and September, even during cool wet years (Reschke et al. 1999). The rate of drying varies among different alvar community types. Shrubland alvars (in this case juniper alvar shrubland) consistently appear to dry more rapidly than grasslands (including tufted hairgrass wet alvar grassland and little bluestem alvar grassland) or adjacent woods.

The extreme range in hydrologic conditions appears to be a principal factor in limiting the invasion of woody species and maintaining grassland and other open alvar communities (Stephenson and Herendeen 1986, Reschke 1995). A hard summer drought on the Maxton Plains alvars on Drummond Island resulted in a die-back of woody plants that did not have their roots in moist bedrock cracks, along with an increased diversity of annual alvar plants the following year (Stephenson and Herendeen 1986).

DISTRIBUTION

***Geographic Range:** Almost all of North America's alvars occur within the Great Lakes basin, primarily in an arc along the Niagaran Escarpment from northern Lake Michigan across northern Lake Huron and eastern Ontario and northwestern New York State.
Nations: CA, US
States/Provinces: MI, NY, OH, ON, WI
USFS Ecoregions (2007) [optional]: 211Ee:CCC, 212Hl:CCC, 212Rc:CCC, 212Re:CCC, 212Tb:CCC, 212Te:CCC, 222Ie:CCC, 222U:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:** See Reschke et al. (1999), Appendix 2 for details on analysis.
***Plots Used to Define the Type [Med - High Confidence]:** See Reschke et al. (1999), Appendix 2 for details on analysis.

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: Data were analyzed and peer-reviewed by the International Alvar Working Group (Reschke et al. 1999).

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3104	*Sporobolus heterolepis - Deschampsia cespitosa / Dasiphora fruticosa ssp. floribunda* Alvar Grassland Alliance
A3103	*Juniperus communis - Picea glauca* Alvar Shrubland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Alvar grassland	Edinger et al. 2002	
<	Alvar pavement grassland	Edinger et al. 2002	
<	Alvar shrubland	Edinger et al. 2002	
<	Calcareous pavement woodland	Edinger et al. 2002	

AUTHORSHIP

***Primary Concept Source [if applicable]:** P.M. Catling and V.R. Brownell (1995)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Reschke and D. Faber-Langendoen
Acknowledgments [optional]:
Version Date: 07 Sep 2013

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2.B.2.Ng. Western North American Interior Chaparral

These chaparral shrublands occur between low-elevation desert landscapes and higher subalpine woodlands of the western U.S. and northern Mexico.

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2. Shrub & Herb Vegetation
2.B.2.Ng. Western North American Interior Chaparral

M091. Warm Interior Chaparral

Type Concept Sentence: This macrogroup includes all the interior chaparral in the southwestern U.S. and northern Mexico and is composed of a very diverse list of diagnostic, mostly evergreen shrubs such as *Arctostaphylos pungens, Ceanothus greggii, Garrya wrightii*, and *Quercus turbinella* which dominate large areas on foothills, xeric mountain slopes and canyons.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.B.2.Ng.2. Western North American Interior Chaparral (D061)

Elcode: M091

***Scientific Name:** *Quercus turbinella - Arctostaphylos pungens - Ceanothus greggii* Warm Interior Chaparral Macrogroup
***Common (Translated Scientific) Name:** Sonoran Scrub Oak - Pointleaf Manzanita - Desert Ceanothus Warm Interior Chaparral Macrogroup
***Colloquial Name:** Warm Interior Chaparral

***Type Concept:** This interior chaparral macrogroup occurs across central Arizona (Mogollon Rim) and southern New Mexico, east in mountains across Trans-Pecos Texas, and south into the Madrean Occidentale and Madrean Oriental in northern Mexico. Occurrences are also found in desert mountains in the Sonoran and Mojave deserts. The vegetation is characterized by a moderate to dense evergreen shrub layer less than 3 m tall that is dominated by scrub oak and sclerophyllous shrubs. Widespread diagnostic species *Quercus turbinella, Arctostaphylos pungens* or *Ceanothus greggii* frequently dominant large areas. Other characteristic shrubs include *Cercocarpus montanus var. paucidentatus, Garrya wrightii, Quercus toumeyi*, and *Rhus trilobata* with *Arctostaphylos pringlei* and *Arctostaphylos pungens* at higher elevations. In desert chaparral stands in the western extent, *Arctostaphylos glauca, Arctostaphylos patula, Cercocarpus montanus var. glaber, Eriodictyon angustifolium, Garrya flavescens, Juniperus californica, Nolina parryi, Quercus berberidifolia, Quercus cornelius-mulleri, Quercus john-tuckeri, Rhamnus ilicifolia*, and *Rhus ovata* characterize this shrubland. In the eastern extent, stands in the Chihuahuan Desert mountains and the Sierra Madre Oriental are dominated by evergreen shrub oak species, such as *Quercus mohriana, Quercus pungens*, and *Quercus vaseyana*, and several widespread chaparral species, such as *Arctostaphylos pungens, Ceanothus greggii*, and *Garrya wrightii*. Additional characteristic Madrean species are may be present such as *Arbutus xalapensis, Fendlera rigida, Garrya ovata, Purshia mexicana, Rhus virens var. choriophylla*, and several species of *Salvia*. The herbaceous layer variable, but is generally composed of semi-arid perennial grasses. Stands are found on foothills, xeric mountain slopes and canyons in hotter and drier habitats and often dominate along the mid-elevation (1000-2500 m) transition zone between desert scrub and montane woodlands. Sites are often steep and rocky.

***Diagnostic Characteristics:** This wide-ranging upland shrubland is characterized by a very diverse list of diagnostic, mostly evergreen shrubs. *Arctostaphylos pungens, Quercus turbinella*, and *Ceanothus greggii* dominate large areas. Other diagnostic and often dominant shrubs include *Arctostaphylos pringlei, Cercocarpus montanus, Eriodictyon angustifolium, Garrya flavescens, Garrya ovata, Garrya wrightii, Juniperus californica, Quercus cornelius-mulleri, Quercus mohriana, Quercus pungens, Quercus toumeyi*, and *Quercus vaseyana*.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M043	Californian Chaparral	
M094	Cool Interior Chaparral	does share some floristics, but only in a few wide-ranging shrub taxa; each have diagnostic taxa that are not shared.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This upland shrubland is typically dominated by a moderate to dense evergreen sclerophyllous shrub canopy usually less than 3 m tall. Herbaceous layers may be present and are typically dominated by perennial graminoids.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The vegetation is characterized by a moderate to dense evergreen shrub layer less than 3 m tall that is dominated by the scrub oaks (*Quercus turbinella, Quercus intricata*, and *Quercus toumeyi*) along with wide diversity of other sclerophyllous shrubs that include *Ceanothus greggii, Cercocarpus montanus var. paucidentatus, Garrya wrightii*, and *Rhus trilobata*, with *Arctostaphylos pringlei* and *Arctostaphylos pungens* at higher elevations (Carmichael et al. 1978). In desert chaparral stands in the western extent, *Arctostaphylos glauca, Arctostaphylos patula, Cercocarpus montanus var. glaber, Garrya flavescens, Juniperus californica*, and *Nolina parryi, Quercus cornelius-mulleri, Rhamnus ilicifolia*, and *Rhus ovata*, characterize this shrubland (Keeler-Wolf 2007). Scattered remnant pinyon and juniper trees may be present; however, in the western Mojave, *Juniperus californica* sometimes forms an open, shrubby tree layer over the evergreen oaks and other shrubs (Keeler-Wolf 2007). In the eastern extent, stands in the Chihuahuan Desert mountains and the Sierra Madre Oriental are dominated by evergreen shrub oak species, such as *Quercus mohriana, Quercus pungens*, and *Quercus vaseyana*, and several widespread chaparral species, such as *Arctostaphylos pungens, Ceanothus greggii, Cercocarpus montanus, Eriodictyon angustifolium, Fallugia paradoxa*, and *Garrya wrightii*. Other Madrean Orientale species include *Arbutus xalapensis (= Arbutus texana), Fraxinus greggii, Fendlera rigida (= Fendlera linearis), Garrya ovata, Juniperus pinchotii, Purshia mexicana, Rhus virens var. choriophylla (= Rhus choriophylla), Salvia lycioides (= Salvia ramosissima), Salvia roemeriana*, and *Salvia regla* (Brown 1982a). The herbaceous layer is variable, but is generally composed of perennial grasses, such as *Achnatherum speciosum, Bouteloua curtipendula, Bouteloua hirsuta, Bothriochloa barbinodis, Eragrostis intermedia, Lycurus phleoides, Muhlenbergia emersleyi*, and several species of *Aristida*, which are largely restricted to rocky, protected areas because of past heavy livestock grazing (Brown 1982a).

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Many of the communities in this macrogroup are dominated by fire-adapted shrubs. *Quercus cornelius-mulleri* sprouts vigorously from root crowns after fire. Since *Quercus cornelius-mulleri* chaparral occurs in areas of lower rainfall and sparser vegetation cover, it typically has less frequent fire and slower recovery rates than typical cismontane chaparral types elsewhere in California. *Quercus turbinella* in Arizona and New Mexico is a fire-type; it sprouts vigorously from the root crown and rhizomes. Typical fire intervals in Arizona exceed 74 years (Reid et al. 1999, Tirmenstein 1999d). Plants in the New York Mountains of California are treelike, suggesting that fires have been absent for perhaps greater than 100 years. Instead, flooding has initiated stem breakage and sprouting of some canyon bottom stands. *Ceanothus greggii* is an obligate seeder and germinates from seed after fire, and older stands will lose dominance of this shrub to other longer-lived sprouting shrubs.

Site conditions aside, the dynamics of fire within chaparral are still complex. In southern California, it has been suggested that the even-aged and large size of modern chaparral patches are a function of 20th century fire suppression feedbacks whereby intensive suppression has led to large fuel buildups over large areas of landscape leading to large stand-replacement fires of ever increasing size (Minnich 1983, 2001). Others contend that the large patch patterns are within that natural range of variability, and that they are driven more by climate trends, prevailing weather patterns, increased human ignition frequencies with increased population density, changes in land use, and landscape characteristics rather than suppression (Keeley and Fotheringham 2001a, 2001c, Moritz 2003). The pattern of chaparral distribution in southern New Mexico suggests that the latter scenario might be the case here. Because of the rugged country, effective suppression has been minimal. Hence, the large patches of chaparral may be representative of a more or less natural fire regime, but one possibly modified by increased human caused fires and fire suppression on neighboring forested lands. More frequent, intense fires leads to the decline of the grassy woodland savannas on the ridge top summits and a favoring of shrublands (possibly enhanced by increased fine fuels with the cessation of livestock grazing). In this type of fire regime, Keeley and Fotheringham (2001a) and Moritz (2003) contend that prescribed burning may be useless or even harmful and that fire suppression, at least in the short term, may be more appropriate for maintaining an ecosystem near its natural state. Minnich (2001) would likely argue the opposite saying it is fire suppression that generates the large patch pattern and that prescribed fire is needed to restore a small patch mosaic with imbedded natural fuel firebreaks. Detailed fire history studies that focus on chaparral patch age structure in a landscape context would be useful (and perhaps necessary) to help resolve these conflicting viewpoints and generate management options that are tailored to interior chaparral.

At the other end of the elevation spectrum, repeated burning of chaparral, particularly Pinchot juniper, has been suggested as a way to increase grass cover in shrubland communities (Ahlstrand 1982). Most of our understanding of how to manage of Pinchot juniper comes from the high Plains of Texas where it is seen as an invader of fine textured plains grasslands soils, and where management has focused on control and eradication to increase livestock forage. Research from the high plains indicates that the effectiveness of fire in controlling Pinchot juniper is a function of fire intensity, climatic conditions and position of the bud zone above or below the soil (Steuter and Britton 1983). Fire was particularly effective in inducing mortality in young plants with exposed buds on rocky sites, but this dropped off significantly with older plants. In addition, increased grass cover (grama grasses) can inhibit reproduction (Smith et al. 1975). As Ahlstrand (1982) has shown, fires can lead to at least short-term increases in grass cover, but because Pinchot juniper can recover 50% or more of its original cover within six or seven years of a burn, repeated prescribed fires at 10- to 15-year intervals would be needed to sustain a grassland type.

ENVIRONMENT

Environmental Description: This macrogroup occurs across central Arizona (Mogollon Rim) and southern New Mexico, east in mountains across Trans-Pecos Texas, and south into the Madrean Occidentale and Madrean Oriental in northern Mexico. Occurrences are also found in desert mountains in the Sonoran and Mojave deserts. Stands are found on foothills, xeric mountain slopes and canyons in hotter and drier habitats. They often dominate along the mid-elevation (1000-2500 m) transition zone between desert scrub and montane woodlands (encinal, pine-oak, and ponderosa pine). Sites are variable but often steep and rocky. Sometimes this macrogroup occurs in thickets along upper canyon watercourses and northerly upland slopes within the pinyon-juniper woodland zone.

Climate: This macrogroup occurs in warm semi-desert regions in the southwestern U.S. The climate is hot and may have a somewhat bi-modal precipitation regime with spring rains and warm-season monsoonal rains as well. Frosts occur in winter, and even sometime snows, which will melt rapidly. *Soil/substrate/hydrology:* Parent materials are varied. This macrogroup is found on igneous intrusives and extrusives, sedimentary, and metamorphic including andesite, basalt, diabase, gneiss, schist, shale, slate, rhyolite, sandstone, tuff, and, more commonly, limestone and coarse-textured granitic substrates.

DISTRIBUTION

***Geographic Range:** This macrogroup is found across the southern portion of the southwestern U.S. and northern Mexico. The core distributions is in central Arizona (Mogollon Rim) and southwestern New Mexico south into Madrean Occidentale and Madrean Oriental in northern Mexico. Scattered locations occur in desert mountains extending west into the Sonoran Desert, Baja Norte to the western Mojave Desert, and east across Trans-Pecos Texas.
Nations: MX, US
States/Provinces: AZ, CA, MXBC, MXCH, MXCO, MXSO, NM, NV, TX, UT
USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313C:CC, 313D:CC, 315A:CC, 315H:CC, 321A:CC, 322A:CC, 322B:CC, 322C:CC, 341A:CP, 341F:CC, M261E:CC, M313A:CC, M313B:CC, M341C:??
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G280	Eastern Madrean Chaparral
G281	Western Madrean Chaparral

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	"Arizona" Chaparral	Brown 1982a	
<	"Coahuilan" Chaparral	Brown et al. 1979	
=	Arizona Chaparral (503)	Shiflet 1994	
<	Chihuahuan Interior (Coahuila) Chaparral - 133.4	Brown et al. 1998	
<	Desert Chaparral	Keeler-Wolf 2007	
=	Interior Chaparral -133.3	Brown et al. 1979	
>	Interior Chaparral -133.3	Brown 1982a	
<	Scrub Oak Series, *Quercus intricata-Cercocarpus* spp. Association -133.316	Brown et al. 1979	
<	Scrub Oak Series, *Quercus intricata-Quercus* spp. Association -133.317	Brown et al. 1979	
<	Scrub Oak Series, *Quercus intricata* Association -133.315	Brown et al. 1979	

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Scrub Oak Series, *Quercus intricata*-mixed sclerophyll Association -133.318	Brown et al. 1979	
<	Scrub Oak Series, *Quercus turbinella-Cercocarpus betuloides* Association -133.313	Brown et al. 1979	
<	Scrub Oak Series, *Quercus turbinella-Cercocarpus breviflorus* Association -133.312	Brown et al. 1979	
<	Scrub Oak Series, *Quercus turbinella* Association -133.311	Brown et al. 1979	
<	Scrub Oak Series, *Quercus turbinella*-mixed sclerophyll Association -133.314	Brown et al. 1979	
<	Silktassel Series, *Garrya ovata* Association -133.352	Brown et al. 1979	
<	Silktassel Series, *Garrya wrightii* Association -133.351	Brown et al. 1979	
<	Southwestern Interior (Arizona) Chaparral - 133.3	Brown et al. 1998	

AUTHORSHIP

***Primary Concept Source [if applicable]:** D.E. Brown, C.H. Lowe, and C.P. Pase (1979)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** K.A. Schulz and E.H. Muldavin

Acknowledgments [optional]:

Version Date: 15 Oct 2014

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2. Shrub & Herb Vegetation
2.B.2.Ng. Western North American Interior Chaparral

G280. Eastern Madrean Chaparral

Type Concept Sentence: This chaparral group occurs in the Madrean Oriental in northern Mexico and desert mountains across Trans-Pecos Texas and is characterized by a moderate to dense shrub canopy dominated by evergreen shrub oak species *Quercus intricata, Quercus laceyi, Quercus pringlei, Quercus pungens, Quercus vaseyana*, and other chaparral species, such as *Acacia roemeriana, Ceanothus greggii, Cercocarpus montanus, Fallugia paradoxa, Fendlera rigida, Fraxinus greggii, Garrya ovata, Garrya wrightii, Juniperus pinchotii, Purshia mexicana, Rhus virens var. choriophylla, Salvia lycioides, Salvia regla, Salvia roemeriana*, and *Sophora secundiflora* that occur on foothills, mountain slopes and canyons.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Ng.2. Warm Interior Chaparral (M091)

Elcode: G280
***Scientific Name:** *Quercus intricata - Quercus laceyi - Quercus pungens* Chaparral Group
***Common (Translated Scientific) Name:** Dwarf Oak - Lacey Oak - Pungent Oak Chaparral Group
***Colloquial Name:** Eastern Madrean Chaparral

***Type Concept:** This chaparral group is found in mid-elevation sites in the Madrean Oriental in northern Mexico and desert mountains across Trans-Pecos Texas extending to the Guadalupe Mountains. It is characterized by a moderate to dense shrub canopy dominated by evergreen shrub oak species, such as *Quercus intricata, Quercus laceyi, Quercus pringlei, Quercus pungens*, and *Quercus vaseyana*, and several chaparral species, such as *Acacia roemeriana, Ceanothus greggii, Cercocarpus montanus, Dasylirion leiophyllum, Fallugia paradoxa*, and *Garrya wrightii*. Other Madrean species characteristic of this group include *Acacia roemeriana, Fendlera rigida, Fraxinus greggii, Garrya ovata, Juniperus pinchotii, Purshia mexicana, Rhus virens var. choriophylla, Salvia lycioides, Salvia regla, Salvia roemeriana*, and *Sophora secundiflora*. Stands occur on foothills, mountain slopes and canyons in drier habitats below the encinal and pine woodlands. Sites are often associated with more xeric and coarse-textured substrates such as limestone, basalt or alluvium, especially in higher-elevation transition areas with more mesic woodlands. In the Trans-Pecos of Texas, disjunct *Quercus gambelii* may occur as a significant component of this shrubland. Most chaparral species are fire-adapted, resprouting vigorously after burning or producing fire-resistant seeds. Stands occurring within montane woodlands are seral and a result of recent fires. Grass cover may be significant. Dominant grasses often include *Bouteloua curtipendula, Bouteloua hirsuta*, and *Muhlenbergia emersleyi*.

***Diagnostic Characteristics:** This upland shrubland is characterized by Sierra Madre Oriental shrub indicator species that may be present to dominate. These diagnostic species include shrubby evergreen oaks such as *Quercus intricata, Quercus invaginata, Quercus laceyi, Quercus pringlei, Quercus pungens*, and *Quercus vaseyana*, and many other species such as *Acacia roemeriana, Arbutus xalapensis, Fendlera rigida, Fraxinus greggii, Garrya ovata, Purshia mexicana, Rhus virens var. choriophylla, Salvia lycioides, Salvia roemeriana, Salvia regla* and *Sophora secundiflora*. Widespread shrub species such as *Arctostaphylos pungens, Ceanothus greggii, Cercocarpus montanus, Dasylirion leiophyllum, Fallugia paradoxa, Garrya wrightii*, and *Quercus gambelii* may dominate or codominate, but are not diagnostic. Stands dominated by shrubby evergreen oaks such as *Quercus emoryi* and *Quercus grisea* are included in Madrean Encinal Group (G201).

***Classification Comments:** Similar Western Madrean Chaparral Group (G281) has floristics mostly derived from the Sierra Madre Occidentale, whereas floristics of this group are derived from the Sierra Madre Oriental. However, this group is not mattoral (thornscrub) as it is typically dominated by shrubby evergreen oaks and chaparral species, not thornscrub species. More survey is needed to determine if *Quercus turbinella*, common in Western Madrean Chaparral Group (G281), also occurs in this group.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G281	Western Madrean Chaparral	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This upland shrubland is typically dominated by a moderate to dense evergreen sclerophyllous shrub canopy usually less than 3 m tall. Herbaceous layers may be present and are typically dominated by perennial graminoids.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Vegetation is characterized by a moderate to dense sclerophyllous shrub canopy, usually less than 3 m tall, dominated by evergreen shrub oak species, such as *Quercus intricata, Quercus invaginata, Quercus laceyi, Quercus pringlei, Quercus pungens*, and *Quercus vaseyana*, and several widespread chaparral species, such as *Arctostaphylos pungens, Ceanothus greggii, Cercocarpus montanus, Dasylirion leiophyllum, Fallugia paradoxa*, and *Garrya wrightii*. Other Madrean species characteristic of this group include *Acacia roemeriana, Arbutus xalapensis (= Arbutus texana), Fraxinus greggii, Fendlera rigida (= Fendlera linearis), Garrya ovata, Juniperus pinchotii, Purshia mexicana, Rhus virens var. choriophylla (= Rhus choriophylla), Salvia lycioides (= Salvia ramosissima), Salvia roemeriana*, and *Salvia regla*. In the Trans-Pecos of Texas, disjunct *Quercus gambelii* may occur as a significant component of this shrubland. The widespread shrub species such as *Arctostaphylos pungens, Ceanothus greggii, Cercocarpus montanus, Dasylirion leiophyllum, Fallugia paradoxa, Garrya wrightii*, and *Quercus gambelii* may dominate or codominate, but are not diagnostic. Most chaparral species are fire-adapted, resprouting vigorously after burning or producing fire-resistant seeds. Stands occurring within montane woodlands are seral and a result of recent fires. Grass cover may be significant. Dominant grasses often include *Bouteloua curtipendula, Bouteloua hirsuta*, and *Muhlenbergia emersleyi*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: Stands often dominate along the mid-elevation transition zone from the Chihuahuan Desert into mountains (1700-2500 m). It occurs on foothills, mountain slopes and canyons in drier habitats below the encinal and pine woodlands, and is often associated with more xeric and coarse-textured substrates such as limestone, basalt or alluvium, especially in transition areas with more mesic woodlands.

DISTRIBUTION

***Geographic Range:** This group is found in the Madrean Oriental in northern Mexico, in mountains across Trans-Pecos Texas, such as the Chisos and Davis mountains, and extends into southeastern New Mexico in the Guadalupe Mountains. Stands often dominate along the mid-elevation transition from the Chihuahuan Desert into mountains (1700-2500 m elevation).
Nations: MX, US
States/Provinces: MXCH, MXCO, NM, TX
USFS Ecoregions (2007) [optional]: 315A:PP, 321A:CC, M313B:CC
Omernik Ecoregions L3, L4 [optional]: 9.4.3.26q:P, 10.2.4.24a:P, 10.2.4.24b:P, 10.2.4.24c:P, 10.2.4.24d:P, 10.2.4.24e:P, 13.1.1.23a:P, 13.1.1.23b:P
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3972	*Sophora secundiflora - Acacia roemeriana - Cercocarpus montanus var. paucidentatus* Chaparral Alliance
A0505	*Juniperus pinchotii* Chaparral Alliance
A3971	*Quercus pungens - Quercus intricata - Quercus vaseyana* Chaparral Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	"Coahuilan" Chaparral	Brown 1982a	

AUTHORSHIP

***Primary Concept Source [if applicable]:** D.E. Brown (1982a)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** K.A. Schulz
Acknowledgments [optional]:
Version Date: 05 Nov 2015

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Shiflet, T. N., editor. 1994. Rangeland cover types of the United States. Society for Range Management. Denver, CO. 152 pp.

2.B.2.Nh. Southeastern North American Grassland & Shrubland

This division encompasses a diversity of grass-, herb-, and shrub-dominated communities of the Southeastern Coastal Plain and locally as far west as the Edwards Plateau of Texas. Vegetation occurs on a wide variety of soil types and depths, with highly acidic to basic pH, and deep loams to bare rock, sometimes in combination with natural fire disturbances that collectively prevent tree establishment. Vegetation types are colloquially known as barrens, flatrocks, glades, and prairies.

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2. Shrub & Herb Vegetation
2.B.2.Nh. Southeastern North American Grassland & Shrubland

M162. Florida Peninsula Scrub & Herb

Type Concept Sentence: This open shrub-dominated (oak scrub and scrubby flatwoods) and herb-dominated (dry prairie) vegetation occurs primarily in the Florida Peninsula, and some in southeastern Georgia, where sites are codominated by *Aristida beyrichiana, Ceratiola ericoides, Quercus geminata, Quercus myrtifolia*, or *Serenoa repens*.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.B.2.Nh.1. Southeastern North American Grassland & Shrubland (D102)

Elcode: M162
***Scientific Name:** *Serenoa repens - Quercus myrtifolia / Aristida beyrichiana* Scrub & Dry Prairie Macrogroup
***Common (Translated Scientific) Name:** Saw Palmetto - Myrtle Oak / Beyrich's Three-awn Scrub & Dry Prairie Macrogroup
***Colloquial Name:** Florida Peninsula Scrub & Herb

***Type Concept:** These open prairies and shrublands mainly occur in the Florida Peninsula. Sites lack trees and are codominated by *Aristida beyrichiana, Ceratiola ericoides, Quercus geminata, Quercus myrtifolia*, or *Serenoa repens*. Dry prairie sites are generally open shrubby grasslands. They are essentially treeless areas dominated by *Serenoa repens* and other low shrubs, such as *Bejaria racemosa, Ilex glabra, Lyonia fruticosa, Lyonia lucida*, and *Quercus minima*, as well as a variety of grasses, such as *Andropogon ternarius, Aristida beyrichiana, Aristida spiciformis, Schizachyrium scoparium var. stoloniferum*, and *Sorghastrum secundum*. In oak scrub and scrubby flatwoods sites, *Ceratiola ericoides, Licania michauxii, Lyonia ferruginea, Quercus chapmanii, Quercus geminata, Quercus inopina, Quercus myrtifolia*, and *Serenoa repens* are the most important shrub species. Shrubs can have very high cover in scrub sites. While in dry prairie sites shrubs tend to be <0.5 m tall, in scrub sites, shrubs can be 2-3 m tall. The height of the shrubs depends on the species present and the time since last fire.

***Diagnostic Characteristics:** Open treeless or nearly treeless prairies or scrub codominated by *Aristida beyrichiana, Ceratiola ericoides, Quercus geminata, Quercus myrtifolia*, or *Serenoa repens*. This macrogroup virtually lacks trees; it does not include woodlands. It is separated by physiognomic and floristic factors; the palm shrub physiognomy with *Serenoa repens* mixed with graminoids or broad-leaved evergreen shrubs is characteristic. It is limited to the Florida Peninsula and southeast Georgia.

***Classification Comments:** This macrogroup is broadly differentiated based on floristics, especially codominance by *Serenoa repens* and grassland or shrubland physiognomy, but there is similar vegetation (classified in Longleaf Pine Woodland Macrogroup (M007)) which has an open tree canopy of *Pinus elliottii var. densa, Pinus clausa*, or *Pinus palustris*. The scrub and the dry prairie are fairly different in hydrology, soils, and dominant species. Dry prairie is generally thought of in Florida as "flatwoods without the pines." It has higher fire frequency combined with regular flooding at the beginning of the growing season, which prevents pine seedling establishment (Platt et al. 2006a). Whereas for scrub, other than saw palmetto, dry prairie does not share any shrubs with scrub, although it does share some with scrubby flatwoods which is ecotonal between scrub and flatwoods. It also shares *Aristida stricta* with scrubby flatwoods, but not with scrub (A Johnson pers. comm. 2014).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M007	Longleaf Pine Woodland	contains woodlands of *Pinus palustris* or *Pinus clausa* which occur across many sites on dry xeric sands to Spodosols and wet Ultisols.
M309	Southeastern Coastal Plain Patch Prairie	occurs further north on the coastal plain, and *Serenoa repens* is not a component or not characteristic.

Similar NVC Types General Comments [optional]: This macrogroup (M162) is distinct by physiognomic and floristic factors and is limited to the Florida Peninsula and southeast Georgia. In Longleaf Pine Woodland Macrogroup (M007), Sand Pine Scrub Forest & Open Woodland Group (G008) has an open tree canopy of *Pinus clausa*, and Mesic Longleaf Pine Flatwoods - Spodosol Woodland Group (G596) has an open tree canopy of *Pinus palustris* or *Pinus elliottii var. densa* but *Serenoa repens* and *Aristida beyrichiana* may be dominant understory plants. South Atlantic & Gulf Coastal Dune & Grassland Group (G494), in Eastern North American Coastal Dune & Grassland Macrogroup (M057), is limited to coastal areas and has low cover of *Serenoa repens, Quercus myrtifolia*, or *Aristida beyrichiana*.

VEGETATION

Physiognomy and Structure Summary: These generally are open and essentially treeless areas, dominated by evergreen shrubs and perennial grasses. Shrubs can have very high cover in scrub sites. Thus, whereas in dry prairie sites *Serenoa repens* shrubs tend to be <0.5 m tall, in scrub sites, the shrubs can be 2-3 m tall. The height of the shrubs depends on the species present and the time since last fire.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: These open prairies and shrublands are codominated by *Aristida beyrichiana, Ceratiola ericoides, Quercus geminata, Quercus myrtifolia*, or *Serenoa repens*. Dry prairie sites are generally open shrubby grasslands. They are essentially treeless areas dominated by *Serenoa repens* and low shrubs, such as *Bejaria racemosa, Ilex glabra, Lyonia fruticosa, Lyonia lucida, Quercus minima, Vaccinium darrowii*, and *Vaccinium myrsinites*, as well as a variety of grasses, such as *Andropogon ternarius, Aristida beyrichiana, Aristida spiciformis, Dichanthelium dichotomum var. ensifolium, Dichanthelium strigosum, Paspalum setaceum, Schizachyrium scoparium var. stoloniferum, Sorghastrum secundum*, and others (Huffman and Judd 1998). In scrub sites *Ceratiola ericoides, Licania michauxii, Lyonia ferruginea, Quercus chapmanii, Quercus geminata, Quercus inopina, Quercus myrtifolia*, and *Serenoa repens* are the most important shrub species. Herbaceous ground cover is sparse in scrub sites but typically includes *Rhynchospora megalocarpa, Andropogon floridanus*, and a variety of lichens (*Cladonia* species). There are a number of endemic plant species which may occur in inland Florida scrubs, including at least 13 Federally listed threatened or endangered species; many of the rarest scrub species are found only in the Lake Wales region.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: These habitats are maintained by frequent fire, flooding during the growing season, and disturbance from hurricanes, such as very high winds and storm surge in coastal scrub. The frequency of fire is higher in dry prairie than in scrub or in the flatwoods that occur in the vicinity of dry prairies (Platt et al. 2006a). Flooding for short durations is common during the growing season in dry prairie, but most scrubs are not prone to flooding, as they generally occur on deep dry sandy uplands. Due to lack of fire, the replacement of dry prairies by oak palmetto stands has been well-documented at Myakka River State Park (Huffman and Blanchard 1990). Many of the graminoids and shrubs which occur in these habitats resprout following fire, however patches of *Ceratiola ericoides* may not survive if burned more than once in 20 years (Johnson 1982). In the sustained absence of fire, smaller shrubs and herbs may be lost as a consequence of increasing dominance of oak stems (Menges et al. 1993). Many scrub fires burn heterogeneously with resulting patches of unburned fuels, especially in the most xeric types like *Ceratiola ericoides* scrub (Menges 1994).

ENVIRONMENT

Environmental Description: Examples of dry prairie occur on flat, low-lying terrain over moderately to poorly drained soils with sandy surfaces overlying organic hardpans or clayey subsoil (FNAI 1990, Platt et al. 2006a). *Climate:* The climate is subtropical, characterized by hot, wet summers and mild, dry winters. Annual rainfall is about 127 cm and occurs mostly in June through September. *Soil/substrate/hydrology:* These dry prairies occur on flat, moderately to poorly drained sandy sites. These areas are seldom inundated but may flood with several centimeters of water for short periods in spring or after heavy summer rains. The normal water table is several centimeters (in summer and fall) to several meters (in winter and spring) below the ground surface (Duever and Brinson 1984a, Abrahamson and Hartnett 1990, Hardin 1990, Platt et al. 2006a). Soils consist of 0.1-0.9 m of undifferentiated quartz sand with a spodic horizon or clayey subsoil 30-107 cm below the surface. These acidic, nutrient-poor sands have few weatherable minerals and low clay nutrients in the surface soil (Abrahamson and Hartnett 1990). Soils supporting these sparse shrublands are classified as Arenic Haplaquods and include such series as Smyrna; types are Myakka (sandy, siliceous, hyperthermic Aeric Alaquod), Wabasso (sandy, siliceous, hyperthermic Alfic Alaquod), Oldsmar (sandy, siliceous, hyperthermic Alfic Arenic Alaquod), Immokalee (sandy, siliceous, hyperthermic Arenic Alaquod), Leon, Adamsville, and Keri sands (Moore and Swindel 1981, Duever and Brinson 1984a).

Examples of scrub are restricted to a sequence of north/south-trending sand ridges, ancient dunefields, and former shorelines in the Florida Peninsula and to a lesser extent, southeastern Georgia. The largest inland scrub is found in two primary areas, essentially isolated from one another. The so called "Big Scrub" of the Ocala National Forest is the largest expanse of this group, with a somewhat smaller, more southerly area associated with the Lake Wales Ridge. *Climate:* The climate is humid warm temperate. The area of central Florida has a very high number of lightning strikes. *Soil/substrate/hydrology:* According to Myers (1990), inland scrub occurs on Quartzipsamments which are excessively well-drained, nearly pure siliceous sands low in nutrients. Although all scrub soils are Entisols, there is considerable variation in soil color. This color variation appears to be related to the amount of leaching which has taken place, and appears to be related to the amount of time a site has been occupied by scrub vegetation. Excessive leaching, due to inferred long occupation by scrub vegetation, is believed to bleach upper soil horizons and develop pure white soils (such as the St. Lucie series), while moderate leaching, due to shorter occupation by scrub, contributes to less bleaching and consequently more yellow-colored soils (Paola and Orsino series).

DISTRIBUTION

***Geographic Range:** This macrogroup occurs in the Florida Peninsula (north of the Everglades and Big Cypress area) and southeast Georgia. Xeric scrub is found on the Lake Wales Ridge, on coastal sand ridges and on ridges along the north and east sides of coastal plain rivers. Dry prairie is found on the plains near the Myakka River, Kissimmee River, as well as north of Lake Okeechobee and near Fisheating Creek (west of Lake Okeechobee).
Nations: US
States/Provinces: FL, GA
USFS Ecoregions (2007) [optional]: 232D:CC, 232G:CC, 232K:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G177	Florida Xeric Scrub
G176	Florida Dry Prairie

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Dry Prairie	Huffman and Judd 1998	
<	Dry Prairie	Abrahamson and Hartnett 1990	
<	Oak-Saw Palmetto Scrub	Schmalzer and Hinkle 1992b	
<	Palmetto Prairie (*Serenoa - Aristida*)	Küchler 1964	
><	Sand Pine Scrub (*Pinus - Quercus*)	Küchler 1964	M162 does not include scrub vegetation with *Pinus clausa* canopy, only shrublands lacking canopy trees
><	Scrub	Myers 1990a	M162 does not include scrub vegetation with *Pinus clausa* canopy, only shrublands lacking canopy trees
><	Scrubby Flatwoods	Abrahamson and Hartnett 1990	M162 does not include scrubby flatwoods vegetation with *Pinus* spp. canopy, only shrublands lacking canopy trees
<	Scrubby Flatwoods	Abrahamson et al. 1984	
><	Scrubby Flatwoods	Huffman and Judd 1998	M162 does not include scrubby flatwoods vegetation with *Pinus* spp. canopy, only shrublands lacking canopy trees
<	Southern Scrub Oak 72, "scrubby flatwoods" variant	Eyre 1980	

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman

Acknowledgments [optional]:

Version Date: 15 Oct 2014

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2. Shrub & Herb Vegetation
2.B.2.Nh. Southeastern North American Grassland & Shrubland

G177. Florida Xeric Scrub

Type Concept Sentence: This scrub without trees is dominated by sclerophyllous shrubs, such as *Quercus myrtifolia* and *Quercus geminata, Chrysoma pauciflosculosa*, or *Ceratiola ericoides*, which occurs on deep dry sands in southern Georgia and central Florida, especially on the Lake Wales Ridge.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nh.1. Florida Peninsula Scrub & Herb (M162)

Elcode: G177
***Scientific Name:** *Quercus myrtifolia - Quercus geminata* Xeric Scrub Group
***Common (Translated Scientific) Name:** Myrtle Oak - Sand Live Oak Xeric Scrub Group
***Colloquial Name:** Florida Xeric Scrub

***Type Concept:** This group consists of xeromorphic shrub-scrub vegetation without an emergent overstory of *Pinus clausa*. It is dominated by sclerophyllous shrubs, such as *Quercus myrtifolia* and *Quercus geminata, Chrysoma pauciflosculosa*, or *Ceratiola ericoides*. Herbaceous ground cover is always sparse, and bare soil patches are typically evident. It is found on a sequence of sand ridges and ancient dunefields which are oriented essentially north-south in the Florida Peninsula (especially the Lake Wales Ridge) and to a lesser extent in southern Georgia. This group has long been noted for its unique and interesting vegetation.

***Diagnostic Characteristics:** Scrub shrubland lacking canopy of *Pinus clausa* but typically dominated by sclerophyllous shrubs, such as *Quercus myrtifolia* and *Quercus geminata* or *Ceratiola ericoides*. This vegetation occurs on deep dry sands most commonly in central Florida. Some of the best occurrences are on the Lake Wales Ridge.

***Classification Comments:** This group is floristically, biogeographically and ecologically similar to Sand Pine Scrub Forest & Open Woodland Group (G008); however, that group is dominated by *Pinus clausa*, which is lacking in this group. They are correctly split into these two groups based on the physiognomy (G008 is forest and open woodland and G177 is shrubland). The shrub vegetation of the Ohoopee Dunes and similar sand ridges in southern Georgia is included here.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G008	Sand Pine Scrub Forest & Open Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group has long been noted for its unique and interesting vegetation by authors such as Vignoles (1823), Harper (1914), Mulvania (1931), Kurz (1942), and Laessle (1958, 1968). More recent treatments by Myers (1990) and Menges (1999) have provided the most comprehensive summaries of scrub available. According to Harper (1927), "the vegetation is mostly dwarfed, gnarled and crooked, and presents a tangled, scraggly aspect." The appearance, floristics, and boundary of Florida scrub contrast dramatically with the "high pine" or sandhill vegetation which is often adjacent (Laessle 1968).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The vegetation of this group is dominated by xeromorphic, evergreen shrub species. The shrub layer composition is relatively constant, as is the abundance of individual species. *Quercus myrtifolia, Quercus inopina, Serenoa repens, Quercus geminata, Quercus chapmanii, Lyonia ferruginea*, and *Ceratiola ericoides* are the most important species. Myers (1990) indicates that much of the variability in Florida scrub is due to variation in fire-return interval, ranging from once every 10 to 100 years. Ground cover is always sparse but typically includes *Licania michauxii, Rhynchospora megalocarpa, Andropogon floridanus*, and a variety of lichens (*Cladonia* species). There are a number of endemic plant species which may occur in inland Florida scrubs, including at least 13 Federally listed species; many of the rarest scrub species are found only in the Lake Wales region.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Florida scrub is naturally prone to fire and supports plants and animals that benefit from fire. In fact, scrub is maintained by high-intensity, infrequent fires. Litter-fall rates are high, while turnover rates are low, contributing to fuel buildup (Lugo and Zucca 1983, Schmalzer and Hinkle 1996). However, scrub typically lacks dense fine-textured grassy fuels necessary for fires to start; most scrub fires ignite in other adjacent habitats. If fire spreads into scrub, it is generally only under severe conditions of high wind, low humidity, and low fuel moisture. When fires occur in scrub, the shrub layer is typically killed back to ground layer but rapidly resprouts and eventually returns to prefire levels of cover (Abrahamson 1984, Schmalzer and Hinkle 1992b). Other species such as *Ceratiola ericoides* may regenerate from seeds stored in soil (Johnson 1982). Several narrowly endemic herb species exhibit peaks in survival, recruitment, and density after fire (Menges 1999). Many scrub fires burn heterogeneously with resulting patches of unburned fuels, especially in the most xeric types such as *Ceratiola ericoides* scrub (Menges 1994). Patches of *Ceratiola ericoides* may not survive if burned more than once in 20 years (Johnson 1982). In the sustained absence of fire, smaller shrubs and herbs may be lost as a consequence of increasing dominance of oak stems (Menges et al. 1993).

ENVIRONMENT

Environmental Description: This group is restricted to a sequence of north/south-trending sand ridges, ancient dunefields, and former shorelines in the Florida Peninsula and to a lesser extent, southern Georgia. The largest inland scrub is found in two primary areas, essentially isolated from one another. The so called "Big Scrub" of the Ocala National Forest is the largest expanse of this group, with a somewhat smaller, more southerly area associated with the Lake Wales Ridge. *Climate:* The climate is humid warm temperate. The area of central Florida has a very high number of lightning strikes. *Soil/substrate/hydrology:* According to Myers (1990), inland scrub occurs on Quartzipsamments which are excessively well-drained, nearly pure siliceous sands low in nutrients. Although all scrub soils are Entisols, there is considerable variation in soil color. This color variation appears to be related to the amount of leaching which has taken place, and appears to be related to the amount of time a site has been occupied by scrub vegetation. Excessive leaching, due to inferred long occupation by scrub vegetation, is believed to bleach upper soil horizons and develop pure white soils (such as the St. Lucie series), while moderate leaching, due to shorter occupation by scrub, contributes to less bleaching and consequently more yellow-colored soils (Paola and Orsino series).

DISTRIBUTION

***Geographic Range:** This group is nearly endemic to the Florida Peninsula. It is most common in two discrete islands or patches, the Big Scrub of Ocala and the Lake Wales Ridge. It also occurs in southern Georgia on sand ridges associated with coastal plain rivers.
Nations: US
States/Provinces: FL, GA
USFS Ecoregions (2007) [optional]: 232K:CC
Omernik Ecoregions L3, L4 [optional]: 8.5.3.75b:C, 8.5.3.75c:C, 8.5.3.75d:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A0779	*Quercus geminata - Quercus myrtifolia - Quercus chapmanii* Scrub Alliance
A0817	*Ceratiola ericoides - Chrysoma pauciflosculosa* Scrub Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** H. Kurz (1942)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman
Acknowledgments [optional]:
Version Date: 12 May 2015

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Schmalzer, P. A., and C. R. Hinkle. 1996. Biomass and nutrients in aboveground vegetation and soils of Florida oak-saw palmetto scrub. Castanea 61:168-193.
Vignoles, C. B. 1823. Observations upon the Floridas. E. Bliss & E. White, New York.

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2. Shrub & Herb Vegetation
2.B.2.Nh. Southeastern North American Grassland & Shrubland

G176. Florida Dry Prairie

Type Concept Sentence: These are generally open treeless areas dominated by *Serenoa repens* and low shrubs, such as *Asimina reticulata, Hypericum tenuifolium, Ilex glabra, Morella cerifera, Quercus minima*, many heath shrubs, and a variety of grasses, such as *Andropogon ternarius, Aristida beyrichiana, Aristida spiciformis, Dichanthelium* spp., *Schizachyrium scoparium var. stoloniferum*, and *Sorghastrum secundum* which occur in extensive flat, inland areas of southern Florida, north of the Everglades and Big Cypress.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nh.1. Florida Peninsula Scrub & Herb (M162)

Elcode: G176
***Scientific Name:** *Serenoa repens / Aristida beyrichiana* Dry Prairie Group
***Common (Translated Scientific) Name:** Saw Palmetto / Beyrich's Three-awn Dry Prairie Group
***Colloquial Name:** Florida Dry Prairie

***Type Concept:** Endemic to subtropical Florida, this group is characterized by nearly treeless plains with dense cover of grasses and low shrubs, primarily *Serenoa repens*. Associates include low shrubs, such as *Asimina reticulata, Hypericum tenuifolium, Ilex glabra, Morella cerifera, Quercus minima*, many heath shrubs, and a variety of grasses, such as *Andropogon ternarius, Aristida beyrichiana, Aristida spiciformis, Dichanthelium* spp., *Schizachyrium scoparium var. stoloniferum*, and *Sorghastrum secundum*. Examples occur on flat, low-lying terrain over moderately to poorly drained soils with sandy surfaces overlying organic hardpans or clayey subsoil. Florida Dry Prairie was historically expansive in several regions of Florida. Early surveyors noted large expanses of this group on the plains near the Kissimmee River, north from Lake Okeechobee, and in the area west of Lake Okeechobee (Fisheating Creek). The original extent has been heavily reduced by clearing for agriculture and conversion for forage production. Intact examples have been further altered by lack of fire which changes the proportion of grasses and shrubs and may further alter species composition. Frequent fires were an important natural process in this group.

***Diagnostic Characteristics:** These prairies generally are open, flat and essentially treeless areas, dominated by grasses and low shrubs, especially the shrubby palm *Serenoa repens*. It occurs in flat areas in southern Florida, which may stay wet part of the year.

***Classification Comments:** This dry prairie grades into mesic pine flatwoods and may have nearly identical composition except for the absent or nearly absent overstory layer (Abrahamson and Hartnett 1990, FNAI 2010a, Huffman and Judd 1998).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G596	Mesic Longleaf Pine Flatwoods - Spodosol Woodland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These generally are open and essentially treeless areas, dominated by grasses and low shrubs, especially the dwarf palm shrub *Serenoa repens*.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Intact examples are generally open and essentially treeless areas dominated by *Serenoa repens* and low shrubs, such as *Asimina reticulata, Bejaria racemosa, Gaylussacia dumosa, Hypericum tenuifolium (= Hypericum reductum), Ilex glabra, Lyonia lucida, Lyonia fruticosa, Morella cerifera (= var. pumila), Quercus minima, Vaccinium darrowii, Vaccinium myrsinites*, as well as a variety of grasses, such as *Andropogon ternarius, Aristida beyrichiana, Aristida spiciformis, Dichanthelium dichotomum var. ensifolium, Dichanthelium strigosum, Paspalum setaceum, Schizachyrium scoparium var. stoloniferum, Sorghastrum secundum*, and others (Huffman and Judd 1998, FNAI 2010a). Forbs include *Piloblephis rigida, Pityopsis graminifolia, Polygala* spp., *Rhexia* spp., and *Xyris* spp. (FNAI 2010a).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Like the floristically and ecologically related pine flatwoods, the open structure and species composition of this group is maintained by frequent fire. However, the natural fire frequency is thought to be greater than in mesic pine flatwoods (Duever et al. 1982, Abrahamson and Hartnett 1990, Hardin 1990), about once every 1-2 years (FNAI 2010a). Dry prairie can become dominated by woody vegetation with the absence of fire, especially in the absence of fires during the dry early spring. The stress of fire at the beginning of the rainy season followed immediately by the stress of flooding with the start of the summer rainy season, both of which would have been more frequent events in dry prairie compared to the surrounding flatwoods, may have been sufficient to prevent pine seedlings from becoming established in dry prairies (Platt et al. 2006a, FNAI 2010a). At least five fairly discrete phases or "states" of this group can be identified (Huffman and Werner 2000): good conditions are typified by abundant herbaceous cover and relatively low (<40%) cover of shrubs, especially *Serenoa repens*; degraded conditions resulting from long fire-free intervals result in reduced herbaceous cover and increased shrub coverage, to the eventual exclusion of all herbaceous cover. Outright replacement of dry prairies by oak - palmetto stands has been well-documented at Myakka River State Park (Huffman and Blanchard 1990). Some sources suggest that examples of this group may be the result of anthropogenic factors that provided an unnaturally high fire frequency or removed vegetation through logging or grazing (Hardin 1990); however, dry prairie has been well-documented as part of the presettlement vegetation of the Florida Peninsula, well before extensive logging occurred (Bridges 2006).

ENVIRONMENT

Environmental Description: Examples occur on flat, low-lying terrain over moderately to poorly drained soils with sandy surfaces overlying organic hardpans or clayey subsoil (FNAI 2010a). *Climate:* The climate is subtropical, characterized by hot, wet summers and mild, dry winters. Annual rainfall is about 127 cm and occurs mostly in June through September. *Soil/substrate/hydrology:* These dry prairies occur on flat, moderately to poorly drained sandy sites. These areas are seldom inundated but may flood with several centimeters of water for short periods after heavy summer rains. The normal water table is several centimeters (in summer and fall) to several meters (in winter and spring) below the ground surface (Duever and Brinson 1984a, Abrahamson and Hartnett 1990, Hardin 1990). The lack of streams and other drainage dissection in the dry prairie landscape may result in more frequent fire and flooding than in flatwoods, which tend to occur closer to small streams (Bridges 2006, FNAI 2010a). Major soils of the dry prairie are poorly drained sandy Spodosols with an organic hardpan, including the series EauGallie, Myakka, Immokalee, Oldsmar, and Smyrna, as well as Alfisols (Malabar soils) with a subsurface clay layer that impedes drainage (Orzell and Bridges 2006a, FNAI 2010a). Soils on some sites consist of 0.1-0.9 m of undifferentiated quartz sand with a spodic horizon or clayey subsoil 30-107 cm below the surface. These acidic, nutrient-poor sands have few weatherable minerals and low clay nutrients in the surface soil (Abrahamson and Hartnett 1990). Soils supporting these sparse shrublands are classified as Arenic Haplaquods and include such series as Smyrna; types are Myakka (sandy, siliceous, hyperthermic Aeric Alaquod), Wabasso (sandy, siliceous, hyperthermic Alfic Alaquod), Oldsmar (sandy, siliceous, hyperthermic Alfic Arenic Alaquod), Immokalee (sandy, siliceous, hyperthermic Arenic Alaquod), Leon, Adamsville, and Keri sands (Moore and Swindel 1981, Duever and Brinson 1984a). Dry prairie in the Kissimmee River region occurs mostly on upland soils (Bridges 2006).

DISTRIBUTION

***Geographic Range:** This group occurs in southern Florida, mainly north of the Everglades and Big Cypress area. For example, it is found on the plains near the Myakka River, Kissimmee River, as well as north of Lake Okeechobee and near Fisheating Creek (west of Lake Okeechobee).

Nations: US

States/Provinces: FL

USFS Ecoregions (2007) [optional]: 232D:CC, 232G:CC

Omernik Ecoregions L3, L4 [optional]: 8.5.3.75b:C, 8.5.3.75c:C, 8.5.3.75d:C

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not A.E. Edwin Bridges: This needs a complete rewrite, starting from the beginning. It is totally inadequate, does not reference most of the current literature, contains many unproven and specifically later refuted hypotheses, and does not address the diversity of dominance and structure within this group of community types. I would rate it as inadequate in almost every category on the review form, and therefore it is not worth filling out the form just to re-hash conclusions already in print elsewhere. For a start, refer to and incorporate the data from all the other papers in the cited book: R. F. Noss, editor. Land of fire and water. Proceedings of the Florida Dry Prairie Conference. Painter, DeLeon Springs, FL. The references in this book supersede almost all of the other cited references, most of which are outdated and not currently accepted (except for those by Huffman).

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A1519	*Serenoa repens / Aristida* spp. Florida Dry Prairie Shrubland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Dry Prairie	FNAI 2010a	
=	Dry Prairie	Abrahamson and Hartnett 1990	
=	Palmetto	Küchler 1964	
=	Saw-palmetto or dry prairie	Davis 1943	

AUTHORSHIP

***Primary Concept Source [if applicable]:** W.G. Abrahamson and D.C. Hartnett (1990)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman

Acknowledgments [optional]: The work of J.H. Davis, Jr. over 70 years ago, and the more recent work of W.G. Abrahamson, E.L. Bridges, D.C. Hartnett, J.M. Huffman, W.S. Judd, S.L. Orzell and the staff of Florida Natural Areas Inventory are gratefully acknowledged.

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2. Shrub & Herb Vegetation
2.B.2.Nh. Southeastern North American Grassland & Shrubland

M309. Southeastern Coastal Plain Patch Prairie

Type Concept Sentence: This vegetation group encompasses the medium-scale perennial grassland, "barrens" and prairie-like vegetation of the inner coastal plains of the southeastern United States, including the Atlantic and Gulf coastal plains from Georgia to Texas, and the intervening Mississippi River Alluvial Plain of Arkansas.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.B.2.Nh.2. Southeastern North American Grassland & Shrubland (D102)

Elcode: M309
***Scientific Name:** Southeastern Coastal Plain Patch Prairie Macrogroup
***Common (Translated Scientific) Name:** Southeastern Coastal Plain Patch Prairie Macrogroup
***Colloquial Name:** Southeastern Coastal Plain Patch Prairie

***Type Concept:** This vegetation group encompasses the medium-scale grassland, "barrens" and prairie-like vegetation of the inner coastal plains of the southeastern United States, including the Atlantic and Gulf coastal plains from Georgia to Texas, and the intervening Mississippi River Alluvial Plain of Arkansas. These communities are dominated by perennial grasses, with some scattered trees and shrubs, particularly in examples which have not experienced recent disturbance. High-quality examples would support a dense herbaceous layer dominated by tall grasses such as *Sorghastrum nutans* and *Schizachyrium scoparium*. Other frequent graminoid taxa include *Andropogon glomeratus, Andropogon virginicus, Bouteloua curtipendula, Carex cherokeensis, Paspalum floridanum*, and *Schizachyrium scoparium*. In depressions and drainages, *Andropogon gerardii* and/or *Panicum virgatum* will have greater importance and *Tripsacum dactyloides* may be present. At this more mesic end of the continuum, woody plant succession may occur at a more rapid rate than in drier areas.

The most extensive and noteworthy examples of this grassland vegetation are known from specific areas where particular substrates or specific edaphic conditions favor its development and maintenance. This includes the chalky Cretaceous "Black Belt" of Alabama and Mississippi (and related areas in Georgia), calcareous or saline clay-influenced areas of the Gulf coastal plains of Louisiana and Texas, and silty or loess-influenced plains of western Tennessee, Arkansas, Oklahoma, and Mississippi. These are all Cretaceous and younger substrates, in contrast to prairie-like vegetation on older (e.g., Mississippian) limestones in the Interior Low

Plateau. In the presettlement landscape and throughout the nineteenth century, the combination of grazing (first by native ungulates and then by free-ranging cattle into the mid-twentieth century) and fire (from lightning and/or Native Americans), combined with the unusual edaphic conditions, kept these areas relatively free of woody vegetation. Many current stands suffer from a lack of disturbance that would inhibit woody plant succession. With range enclosure and an increasing lack of fire during the twentieth century, the dynamics of the landscape have changed, and the coverage of fire-intolerant woody species has increased. This grassland vegetation is now reduced to patches, or its flora persists in pastures which are under more continuous grazing pressure than the former processes would have allowed.

***Diagnostic Characteristics:** These are perennial grasslands of the coastal plains, found on a variety of soil types, many of which have unusual edaphic features (e.g., droughtiness, impeded drainage, salinity). The primary dominant grasses in examples of this macrogroup include *Schizachyrium scoparium* and *Sorghastrum nutans*, as well as *Andropogon virginicus, Panicum* spp., and *Sporobolus* spp. Other more mesic grasses, including *Andropogon gerardii, Tripsacum dactyloides*, and *Panicum virgatum*, are found in mesic and wet phases. These dominant species are wide-ranging and their distributions are not restricted to the coastal plains. *Andropogon glomeratus* is listed as a nominal as an indicator of a southern coastal plain affinity. There are some plant species with more southern affinities that are present in some associations, including *Allium canadense var. mobilense, Packera tampicana, Marshallia caespitosa*, and *Nemastylis geminiflora*, but most of the component species are either widespread of have western affinities. Some proposed factors which have functioned to maintain the openness of these vegetation types include the distinctive soils and resulting stresses to vegetation, as well as fire and grazing.

***Classification Comments:** This macrogroup concept is preliminary and needs further review. It includes a variety of grassland associations ranging from relatively dry to wet-mesic, occurring in a variety of areas across the inner coastal plains physiographic province.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M162	Florida Peninsula Scrub & Herb	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This vegetation is primarily dominated by perennial grasses, but some examples may have scattered to patchy trees and shrubs, depending on management or time since last fire. Most examples occur on circumneutral soils, or other unusual substrates (e.g., clay, gravels, etc.).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The typical perennial grasses that dominate examples of this vegetation include *Andropogon gerardii, Schizachyrium scoparium*, and *Sorghastrum nutans*. In addition, *Andropogon glomeratus* will be present in many examples, this grass has a more southern distribution relative to the others and serves as a somewhat geographically diagnostic species. Moist to wetter swales or zones may be embedded within and among the typical stands; in these areas, *Andropogon gerardii* and/or *Panicum virgatum* will have greater importance (DeSelm and Murdock 1993), and *Tripsacum dactyloides* may be present. Other plants in stands of this group vary across this broad region. There are several subregional types and variability among these which is expressed in the associations. Typical trees (whose cover may be sparse) include *Carya illinoinensis, Carya myristiciformis, Juniperus virginiana var. virginiana, Maclura pomifera* (within its native range), *Quercus muehlenbergii, Quercus shumardii, Quercus pagoda, Quercus sinuata*, and *Quercus stellata*. In the Jackson Purchase barrens, *Quercus marilandica, Quercus stellata*, and *Quercus velutina* are among the most frequent trees (Bryant and Martin 1988). Some typical shrubs and small trees include *Cercis canadensis var. canadensis, Crataegus* spp., *Diospyros virginiana, Forestiera ligustrina, Frangula caroliniana, Ilex decidua, Prunus angustifolia, Rhus aromatica, Rhus copallinum, Rosa setigera, Sideroxylon lycioides, Symphoricarpos orbiculatus*, and *Ulmus alata*. Other grasses and graminoids may include *Bouteloua curtipendula, Carex cherokeensis, Carex microdonta, Fimbristylis puberula var. puberula, Leersia virginica, Muhlenbergia capillaris, Panicum anceps, Panicum flexile*, and *Sporobolus compositus*. Forbs (which vary across the broad geographic range) may include widespread taxa such as *Desmodium ciliare, Echinacea pallida, Echinacea purpurea, Liatris aspera, Liatris squarrosa, Liatris squarrulosa, Lythrum alatum, Manfreda virginica, Ratibida pinnata, Silphium integrifolium, Silphium laciniatum, Silphium terebinthinaceum, Silphium trifoliatum var. latifolium, Solidago auriculata, Symphyotrichum dumosum (= Aster dumosus), Symphyotrichum patens (= Aster patens)*, and *Symphyotrichum lanceolatum var. lanceolatum (= Aster lanceolatus)*. Some plant species with more southern affinities that are present in some associations include *Allium canadense var. mobilense, Packera* *tampicana, Marshallia caespitosa*, and *Nemastylis geminiflora*. Some taxa of western affinities that may be present include *Acacia angustissima, Dalea candida, Dalea compacta var. compacta, Dalea purpurea, Desmanthus illinoensis, Dracopis amplexicaulis, Euphorbia bicolor, Eustoma exaltatum ssp. russellianum (= Eustoma russellianum), Grindelia lanceolata, Indigofera miniata (= Indigofera miniata var. leptosepala), Neptunia lutea, Onosmodium bejariense var. occidentale (= Onosmodium occidentale), Palafoxia reverchonii, Rudbeckia missouriensis, Stenosiphon linifolius, Thelesperma filifolium*, and *Zigadenus nuttallii*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In western Tennessee and Kentucky (the "Jackson Purchase" or "Jackson Plain" barrens), a number of early reports mentioned extensive prairies and emphasized the importance of annual fires in maintaining these grasslands (Bryant and Martin 1988). Scattered groves of fire-tolerant oaks were likely interspersed among these grasslands (M. Evans pers. comm.). With fire suppression, groves of trees rapidly expanded and largely replaced the prairies. In the Black Belt (and in other areas as well), the presence of *Juniperus virginiana*-dominated zones may represent invasion by this species in the absence of sufficiently frequent or intense fire (DeSelm and Murdock 1993). Fire-return time is variable (and speculative in some cases), but fires were probably frequent (potentially on a two- to five-year return interval), originating from lightning or human ignition origin, and are thought to have occurred in late summer to early autumn prior to European settlement. Under current conditions, individual prairie openings or barrens are small and isolated from one another but were formerly more extensive prior to European settlement, forming a more extensive mosaic of grassland and woodlands under frequent fire regimes. Some proposed factors which have functioned to maintain the openness of this vegetation following the reduction of fire frequency include the droughty soils (with clay, chalk, gravel) and resulting stresses to vegetation, as well as some occasional fire. Fralish et al. (1999) noted that both post oak and chestnut oak woodlands are essentially the result of fire suppression in the barrens and historic savannas. In some areas, where the soils are particularly harsh (droughty, nutrient-poor, and/or rocky), stands may retain an open aspect in the absence of fire. Some of the extant examples are largely dependent on contemporary management regimes.

ENVIRONMENT

Environmental Description: The most extensive and noteworthy examples are known from specific areas where particular substrates or edaphic conditions favor the development and maintenance of this grassland vegetation. This includes the chalky Cretaceous "Black Belt" of Alabama and Mississippi (and related areas in Georgia), calcareous or saline clay-influenced areas of the Gulf coastal plains of Louisiana and Texas, and well-drained, gravelly, thin-soil plains of western Tennessee and Kentucky, as well as related areas in Texas, Arkansas, Oklahoma, and Mississippi. *Climate*: Climate varies somewhat across the coastal plains, but the Black Belt area has an average annual precipitation of 130-140 cm and a frost-free period of 200-250 days.

Soil/substrate/hydrology: Examples are found on edaphically distinctive substrates, including the chalky Cretaceous "Black Belt" soils of Alabama and Mississippi (and related areas in Georgia), calcareous or saline clay-influenced areas of the Gulf coastal plains of Louisiana and Texas, and the thin-soil, well-drained, and gravelly plains of western Tennessee, Arkansas, Oklahoma, and Mississippi. The Black Belt region derives its name from the nearly black, rich topsoil that developed over Selma chalk, and has long been noted as a distinct topographic region in the state of Mississippi (Lowe 1921). The Black Belt associations generally occur on Cretaceous-age chalk, marl and calcareous clay. This includes calcareous soils of the Sumter, Binnsville, and Demopolis series, described as beds of marly clay over Selma chalk (including the Demopolis and Mooreville formations). The soils of the Jackson Prairie openings are presently mapped as the Maytag Series, a fine montmorillonitic, thermic Entic Chromudert. This deep, slowly permeable soil has formed in residuum weathered from marl of chalk of the Blackland Prairies (Wieland 1995). The soils of some examples in the Upper West Gulf Coastal Plain of Arkansas, Oklahoma, and Texas include relatively deep soils with circumneutral surface pH, as well as on chalk deposits, and thin soils over limestone outcrops with rock fragments. In Louisiana and Texas, examples are documented from the Fleming geologic formation, but are also known from the Cook Mountain Formation, the Jackson Group, as well as the Morse Clay Calcareous Prairie of the northwestern part of Louisiana and northeastern Texas. The examples in the Jackson Purchase region of Kentucky and adjacent Tennessee are found on soils that are predominantly thin, well-drained, and gravelly. This group likely did not develop on the deeper loess soils of the region. The former barrens were on flat to gently rolling lands just to the dry side of the moisture gradient (Bryant and Held 2001).

DISTRIBUTION

***Geographic Range:** Examples are known from several distinct areas in the coastal plains of the southeastern United States. In particular, these include (but are not limited to) the Jackson Purchase area of western Kentucky (primarily Graves County and parts of Calloway County), extending into limited areas of adjacent Tennessee; a relatively small natural region of the Upper West Gulf Coastal Plain of Arkansas and adjacent Oklahoma; and another relatively small natural region of Louisiana and Texas. The Black Belt Prairie component is primarily restricted to the Black Belt (Subsection 231Ba) (Keys et al. 1995) or Blackland Prairie area (EPA

Ecoregion 65a) and Flatwoods/Blackland Prairie Margins area (EPA Ecoregion 65b) of Griffith et al. (2001). This region is primarily in Alabama and Mississippi, ranging north in a depauperate form to southern Tennessee (McNairy County) (DeSelm 1989b). The Jackson Prairie component of this group is found in a relatively small natural region of Mississippi, known as the Jackson Hills Subsection 231Bj of Keys et al. (1995) and the Jackson Prairie Ecoregion 65r of EPA (2004). There is also a recently recognized component found in limited parts of Georgia (e.g., on both sides of the Ocmulgee River on the Fort Valley Plateau of Bleckley, Houston, Peach, and Twiggs counties) (Echols 2007). There are also outlying occurrences southward in the Chunnenuggee Hills and Red Hills (both of these parts of the Southern Hilly Coastal Plain, EPA Ecoregion 65d)), and Buhrstone/Lime Hills (EPA Ecoregion 65q) of southern Alabama (Washington, Wilcox, Monroe, and Clark counties). There are some limited examples in EPA Ecoregion 65i (Fall Line Hills; e.g., Jones Bluff in Alabama). Examples of the Grand Prairie vegetation occur on the oldest land surfaces in the Mississippi River Alluvial Valley and the highest land surface in the river-deposited portions of the ecoregion (Ecoregion 73 of EPA; section 234 of Keys et al. 1995) (T. Foti pers. comm.).
Nations: US
States/Provinces: AL, AR, GA, KY, LA, MS, OK, TN, TX
USFS Ecoregions (2007) [optional]: 231B:CC, 231E:CC, 231H:CC, 232B:CC, 232E:CC, 232F:CC, 234E:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G175	Southeastern Coastal Plain Patch Prairie

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Black Belt	DeSelm and Murdock 1993	
<	Grand Prairie	DeSelm and Murdock 1993	
<	Jackson Prairie	DeSelm and Murdock 1993	
<	Kentucky Barrens	DeSelm and Murdock 1993	

AUTHORSHIP

***Primary Concept Source [if applicable]:** H.R. DeSelm and N. Murdock (1993)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne

Acknowledgments [optional]:
Version Date: 15 Oct 2014

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2. Shrub & Herb Vegetation
2.B.2.Nh. Southeastern North American Grassland & Shrubland

G175. Southeastern Coastal Plain Patch Prairie

Type Concept Sentence: This vegetation group encompasses the medium-scale grassland, "barrens" and prairie-like perennial grass-dominated vegetation of the inner coastal plains of the southeastern United States, including the Atlantic and Gulf coastal plains and a portion of the Mississippi River Alluvial Plain of Arkansas. Examples which have not experienced recent disturbance may contain scattered trees and shrubs.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.2.Nh.2. Southeastern Coastal Plain Patch Prairie (M309)

Elcode: G175
***Scientific Name:** *Schizachyrium scoparium - Panicum virgatum - Andropogon glomeratus* Patch Prairie Group
***Common (Translated Scientific) Name:** Little Bluestem - Switchgrass - Bushy Bluestem Patch Prairie Group
***Colloquial Name:** Southeastern Coastal Plain Patch Prairie

***Type Concept:** This vegetation group encompasses the medium-scale grassland, "barrens" and prairie-like vegetation of the inner coastal plains of the southeastern United States, including the Atlantic and Gulf coastal plains from Georgia to Texas, and a specific portion of the Mississippi River Alluvial Plain of Arkansas. These communities are dominated by perennial grasses, with some scattered trees and shrubs, particularly in examples which have not experienced recent disturbance. The most extensive and noteworthy examples are known from specific areas where particular substrates or edaphic conditions favor the development and maintenance of this grassland vegetation. This includes the chalky Cretaceous "Black Belt" of Alabama and Mississippi (and related areas in Georgia), calcareous or saline clay-influenced areas of the Gulf coastal plains of Louisiana and Texas, and silty or loess-influenced plains of western Tennessee, Arkansas, Oklahoma, and Mississippi. These are all Cretaceous and younger substrates, in contrast to prairie-like vegetation on soils developed from older (e.g., Mississippian) limestones in the Interior Low Plateau. In the presettlement landscape and throughout the nineteenth century, the combination of grazing (first by native ungulates and then by free-ranging cattle into the mid-twentieth century) and fire (from lightning and/or Native Americans), combined with the unusual edaphic conditions, kept these areas relatively free of woody vegetation. High-quality examples would support a dense herbaceous layer dominated by tall grasses such as *Schizachyrium scoparium* and *Sorghastrum nutans*, but many stands currently suffer from a lack of disturbance which inhibits woody plant succession. With range enclosure and an increasing lack of fire during the twentieth century, the dynamics of the landscape have changed, and the coverage of fire-intolerant woody species has increased. The grassland vegetation is now reduced to patches, or its flora persists in pastures which are under more continuous grazing pressure than would have occurred under the former processes and disturbance regime. Other frequent graminoid taxa include *Andropogon glomeratus, Andropogon virginicus, Bouteloua curtipendula, Carex cherokeensis*, and *Paspalum floridanum*. In depressions and drainages, *Andropogon gerardii* and/or *Panicum virgatum* will have greater importance and *Tripsacum dactyloides* may be present. At this more mesic end of the continuum, invasion by woody plants is an even more serious threat.

***Diagnostic Characteristics:** These are perennial grasslands of the coastal plains, found on a variety of soil types, many of which have unusual edaphic features (droughtiness, impeded drainage, salinity). The primary dominant grasses include *Schizachyrium scoparium* and *Sorghastrum nutans*, as well as *Andropogon* spp., *Panicum* spp., and *Sporobolus* spp. Other more mesic grasses (*Andropogon gerardii, Panicum virgatum, Tripsacum dactyloides*) are found in mesic and wet phases. Some proposed factors which have functioned to maintain the openness of these vegetation types include the distinctive soils and resulting stresses to vegetation, as well as the effects of fire and grazing.

***Classification Comments:** This vegetation group includes a variety of grassland associations ranging from relatively dry to wet-mesic, occurring in a variety of areas across the inner coastal plains physiographic province.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G174	South-Central Patch Prairie	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This vegetation is primarily dominated by perennial grasses, but examples may have scattered to patchy trees and shrubs. Most examples occur on circumneutral soils, or other unusual substrates (clay, gravels, saline soils, etc.).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The typical perennial grasses that dominate examples of this vegetation include *Andropogon gerardii, Schizachyrium scoparium*, and *Sorghastrum nutans*. Moist to wetter swales or zones may be embedded within and among the typical stands; in these areas, *Andropogon gerardii* and/or *Panicum virgatum* will have greater importance (DeSelm and Murdock 1993), and *Tripsacum dactyloides* may be present. Among the most frequent trees in the Jackson Purchase barrens include *Quercus marilandica, Quercus stellata*, and *Quercus velutina* (Bryant and Martin 1988). Dominant plants in stands of this group vary across this broad region. There are several subregional types and variability among these which is expressed in the associations. Typical trees (whose cover may be sparse) include *Carya illinoinensis, Carya myristiciformis, Juniperus virginiana var. virginiana, Maclura pomifera* (within its native range), *Quercus muehlenbergii, Quercus pagoda, Quercus shumardii, Quercus sinuata*, and *Quercus stellata*. Some typical shrubs and small trees include *Cercis canadensis var. canadensis, Crataegus* spp., *Diospyros virginiana, Forestiera ligustrina, Frangula caroliniana, Ilex decidua, Prunus angustifolia, Rhus copallinum, Rhus aromatica, Rosa setigera, Sideroxylon lycioides, Symphoricarpos orbiculatus*, and *Ulmus alata*. Other grasses and graminoids may include *Bouteloua curtipendula, Carex cherokeensis, Carex microdonta, Fimbristylis puberula var. puberula, Leersia virginica, Muhlenbergia capillaris, Panicum anceps, Panicum flexile*, and *Sporobolus compositus*. Forbs (which vary across the broad geographic range) may include *Allium canadense var. mobilense, Dalea candida, Dalea purpurea, Desmanthus illinoensis, Desmodium ciliare, Echinacea pallida, Echinacea purpurea, Liatris aspera, Liatris squarrosa, Liatris squarrulosa, Lythrum alatum, Manfreda virginica, Marshallia caespitosa, Nemastylis geminiflora, Packera tampicana, Ratibida pinnata, Silphium integrifolium, Silphium laciniatum, Silphium terebinthinaceum, Silphium trifoliatum var. latifolium, Solidago auriculata, Symphyotrichum dumosum (= Aster dumosus), Symphyotrichum patens (= Aster patens), Symphyotrichum lanceolatum var. lanceolatum (= Aster lanceolatus), Thelesperma filifolium*, and *Zigadenus nuttallii*. Some more western taxa that are present in West Gulf Coastal Plain examples are *Acacia angustissima, Dalea compacta var. compacta, Dracopis amplexicaulis, Euphorbia bicolor, Eustoma exaltatum ssp. russellianum (= Eustoma russellianum), Grindelia lanceolata, Indigofera miniata (= Indigofera miniata var. leptosepala), Neptunia lutea, Onosmodium bejariense var. occidentale (= Onosmodium occidentale), Palafoxia reverchonii, Rudbeckia missouriensis*, and *Stenosiphon linifolius*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Much of the natural vegetation of the Black Belt region (and the rest of the inner coastal plain as well) has been converted to pasture and agricultural uses, with concomitant destruction of most prairie remnants (DeSelm and Murdock 1993). Of the approximately 100,000 acres of Blackland Prairies mapped during the general land surveys of the early and mid 1800s in Mississippi, probably less than 500 acres of Jackson Prairie vegetation exists today, even if one considers grazed areas and vacant agricultural lands with a semblance of prairie species (R. Wieland pers. comm.). Almost all of the lands were converted to agriculture. Some of the lands are now reverting back to prairie after being abandoned. More recently, lands are being converted to fescue pasture; other abandoned lands have become stands of eastern red-cedar. The number of acres in good condition is probably less than 100.

In western Tennessee and Kentucky (the "Jackson Purchase" or "Jackson Plain" barrens), a number of early reports mentioned extensive prairies and emphasized the importance of annual fires in maintaining these grasslands (Bryant and Martin 1988). Scattered groves of fire-tolerant oaks were likely interspersed among these grasslands (M. Evans pers. comm.). With fire suppression, groves of trees rapidly expanded and largely replaced the prairies. In the Black Belt (and in other areas as well), the presence of *Juniperus virginiana*-dominated zones may represent invasion by this species in the absence of sufficiently frequent or intense fire (DeSelm and Murdock 1993). Fire return time is variable (and speculative in some cases), but fires were probably frequent (potentially on a two- to five-year return interval), originating from lightning or human ignition origin, and are thought to have occurred in late summer to early autumn prior to European settlement. Under current conditions, individual prairie openings or barrens are small and isolated from one another but were formerly more extensive prior to European settlement, forming a more extensive mosaic of grassland and woodlands under frequent fire regimes. Some proposed factors which have functioned to maintain the openness of this vegetation following the reduction of fire frequency include the droughty soils (with clay, chalk, gravel) and resulting stresses to vegetation, as well as some occasional fire. Fralish et al. (1999) noted that both post oak and chestnut oak woodlands are essentially the result of fire suppression in the barrens and historic savannas. In some areas, where the soils are particularly harsh (droughty, nutrient-poor, and/or rocky), stands may retain an open aspect in the absence of fire. Some of the extant examples are largely dependent on contemporary management regimes.

ENVIRONMENT

Environmental Description: The most extensive and noteworthy examples are known from specific areas where particular substrates or edaphic conditions favor the development and maintenance of this grassland vegetation. This includes the chalky Cretaceous "Black Belt" of Alabama and Mississippi (and related areas in Georgia), calcareous or saline clay-influenced areas of the Gulf coastal plains of Louisiana and Texas, and well-drained, gravelly, thin-soil plains of western Tennessee and Kentucky, as well as related areas in Texas, Arkansas, Oklahoma, and Mississippi. *Climate*: Climate varies somewhat across the coastal plains, but the Black Belt area has an average annual precipitation of 130-140 cm and a frost-free period of 200-250 days.

Soil/substrate/hydrology: Examples are found on edaphically distinctive substrates, including the chalky Cretaceous "Black Belt" soils of Alabama and Mississippi (and related areas in Georgia), calcareous or saline clay-influenced areas of the Gulf coastal plains of Louisiana and Texas, and the thin-soil, well-drained, and gravelly plains of western Tennessee, Arkansas, Oklahoma, and Mississippi. The Black Belt region derives its name from the nearly black, rich topsoil that developed over Selma chalk, and has long been noted as a distinct topographic region in the state of Mississippi (Lowe 1921). The Black Belt associations generally occur on Cretaceous-age chalk, marl and calcareous clay. This includes calcareous soils of the Sumter, Binnsville, and Demopolis series, described as beds of marly clay over Selma chalk (including the Demopolis and Mooreville formations). The soils of the Jackson Prairie openings are presently mapped as the Maytag Series, a fine montmorillonitic, thermic Entic Chromudert. This deep, slowly permeable soil has formed in residuum weathered from marl of chalk of the Blackland Prairies (Wieland 1995). The soils of some examples in the Upper West Gulf Coastal Plain of Arkansas and Oklahoma include relatively deep soils with circumneutral surface pH, as well as on chalk deposits, and thin soils over limestone outcrops with rock fragments. In Louisiana, examples are documented from the Fleming geologic formation, but are also known from the Cook Mountain Formation, the Jackson Group, as well as the Morse Clay Calcareous Prairie of the northwestern part of the state. The examples in the Jackson Purchase region of Kentucky and adjacent Tennessee are found on soils that are predominantly thin, well-drained, and gravelly. This group likely did not develop on the deeper loess soils of the region. The former barrens were on flat to gently rolling lands just to the dry side of the moisture gradient (Bryant and Held 2001).

DISTRIBUTION

***Geographic Range:** Examples are known from several distinct areas in the coastal plains of the southeastern United States. In particular, these include (but are not limited to) the Jackson Purchase area of western Kentucky (primarily Graves County and parts of Calloway County), extending into limited areas of adjacent Tennessee; a relatively small natural region of the Upper West Gulf Coastal Plain of Arkansas and adjacent Oklahoma; and another relatively small natural region of Louisiana and Texas. The Black Belt Prairie component is primarily restricted to the Black Belt (Subsection 231Ba) (Keys et al. 1995) or Blackland Prairie area (Ecoregion 65a) and Flatwoods/Blackland Prairie Margins area (Ecoregion 65b) of Griffith et al. (2001). This region is primarily in Alabama and Mississippi, ranging north in a depauperate form to southern Tennessee (McNairy County) (DeSelm 1989b). The Jackson Prairie component of this group is found in a relatively small natural region of Mississippi, known as the Jackson Hills Subsection 231Bj of Keys et al. (1995) and Cleland et al. (2007) and the Jackson Prairie Ecoregion 65r of EPA (2004). There is also a recently recognized component found in limited parts of Georgia (e.g., on both sides of the Ocmulgee River on the Fort Valley Plateau of Bleckley, Houston, Peach, and Twiggs counties). There are also outlying occurrences southward in the Chunnenuggee Hills and Red Hills (both of these parts of the Southern Hilly Coastal Plain (Ecoregion 65d)), and Buhrstone/Lime Hills (Ecoregion 65q) of southern Alabama (in Washington, Wilcox, Monroe, and Clark counties). There are some limited examples in Ecoregion 65i (Fall Line Hills; e.g., Jones Bluff in Alabama). Examples of the Grand Prairie vegetation occur on the oldest land surfaces in the Mississippi River Alluvial Valley and the highest land surface in the river-deposited portions of the ecoregion (234 of Keys et al. 1995 and Cleland et al. 2007) (T. Foti pers. comm.).

Nations: US

States/Provinces: AL, AR, GA, KY, LA, MS, OK, TN, TX

USFS Ecoregions (2007) [optional]: 231Ba:CCC, 231Bj:CCC, 231E:CC, 231Ha:CCC, 234Eb:CCC

Omernik Ecoregions L3, L4 [optional]: 8.3.5.65a:C, 8.3.5.65b:?, 8.3.5.65d:C, 8.3.5.65i:C, 8.3.5.65q:C, 8.3.5.65r:C, 8.3.6.74b:C, 8.3.7.35a:C, 8.3.7.35b:C, 8.3.7.35c:C, 8.3.7.35d:C, 8.3.7.35e:C, 8.3.7.35g:C, 8.3.7.35h:C, 8.5.2.73e:C

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3318	*Schizachyrium scoparium - Sorghastrum nutans* Coastal Plain Prairie Alliance
A3316	*Crataegus crus-galli - Crataegus marshallii - Crataegus spathulata* Coastal Plain Prairie Shrubland Alliance
A3317	*Panicum virgatum - Panicum anceps* Coastal Plain Prairie Alliance
A3319	*Spartina pectinata* Interior Prairie Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** H.R. DeSelm and N. Murdock (1993)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne

Acknowledgments [optional]:

Version Date: 12 May 2015

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2. Shrub & Herb Vegetation
2.B.2.Nh. Southeastern North American Grassland & Shrubland

M308. Southern Barrens & Glade

Type Concept Sentence: The glade and barrens vegetation of this macrogroup is found across the coastal plains of the southeastern United States ranging from the inland parts of Texas and adjacent Oklahoma (including the Edwards Plateau, Lampasas Cutplain, and Crosstimbers) east to northern Florida. Examples may have scattered trees, but are dominated by grasses and forbs, including annuals, succulents, and other plants with adaptations to a very dry environment during the growing season.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.B.2.Nh.3. Southeastern North American Grassland & Shrubland (D102)

Elcode: M308
***Scientific Name:** *Sporobolus vaginiflorus - Schizachyrium scoparium - Clinopodium* spp. Southern Barrens & Glade Macrogroup
***Common (Translated Scientific) Name:** Poverty Dropseed - Little Bluestem - Calamint species Southern Barrens & Glade Macrogroup
***Colloquial Name:** Southern Barrens & Glade

***Type Concept:** This glade and barrens vegetation is found on various specialized substrates (igneous rock, clay, saline soil, limestone, sandstone) in the coastal plains of the southeastern United States ranging from the inland parts of Texas and adjacent Oklahoma through the coastal plains east to northern Florida. It is currently documented from seven distinct areas with particular substrates, in addition to the central Texas/Oklahoma zone. In inland (non-coastal plain) parts of Texas and adjacent Oklahoma including the Edwards Plateau, Lampasas Cutplain, and Crosstimbers, this vegetation consists of specialized glade communities, frequently dominated by low forbs, annual grasses, and succulents. This vegetation may occur as large to small patches, embedded in a matrix of woodlands, open forests, or perennial grass-dominated prairies. Some characteristic plants in these regions include *Lesquerella gordonii, Lesquerella ovalifolia, Schizachyrium scoparium, Sedum nuttallianum, Sedum pulchellum*, and *Sporobolus vaginiflorus* (*var. ozarkanus* and *var. vaginiflorus*).

The substrates for the more eastern examples include outcrops of marine sediment and glauconitic clays of the Weches Formation in central eastern Texas; the Catahoula geologic formation of eastern Texas and western Louisiana; distinctive, massive outcrops of igneous substrate ("nepheline syenite") in Saline and Pulaski counties, Arkansas; outcrops of indurated sandstone in the Tifton Upland of the Georgia Coastal Plain (Altamaha Grit); sandstone outcrops of Panhandle Florida; limestone outcrops of Panhandle Florida; and soils with high saline content in portions of the coastal plain west of the Mississippi River.

They will each be described separately. Weches glades are a series of small-patch communities which are endemic to San Augustine, Nacogdoches, and Sabine counties, Texas. Characteristic species include *Sedum pulchellum, Clinopodium arkansanum*, and *Sporobolus vaginiflorus*. In addition, the narrowly endemic annuals *Lesquerella pallida* and *Leavenworthia aurea var. texana* may be present. Catahoula barrens of eastern Texas and western Louisiana are a vegetational mosaic ranging from herbaceous-dominated areas on shallow soil and exposed sandstone to deeper soils with open woodland vegetation. Glades on distinctive, massive outcrops of igneous substrate ("nepheline syenite") are found in the upper coastal plain of Arkansas, near the Ouachita Mountains. Some typical dominant grasses include *Aristida purpurascens, Piptochaetium avenaceum, Schizachyrium scoparium*, and *Sporobolus clandestinus*. Altamaha Grit glade vegetation occurs on sandstone in the Tifton Upland of the Georgia coastal plain. Typical herbaceous species are *Allium cuthbertii, Aristida beyrichiana, Bigelowia nuttallii, Coreopsis major, Croton michauxii, Liatris squarrosa, Manfreda virginica, Penstemon dissectus, Schizachyrium tenerum, Phemeranthus teretifolius*, and *Tephrosia virginiana*. A typical dwarf-shrub is *Hypericum lloydii*. Occurrences can be as large as five acres. This community typically occurs in a matrix of longleaf pine woodlands.

Sandstone glades of Panhandle Florida are dominated by *Bigelowia nuttallii*. Other characteristic species include *Eurybia hemispherica* and *Schizachyrium scoparium var. scoparium*.

On the open small-patch limestone/calcareous glades that are endemic to the Panhandle of Florida and adjacent Georgia, the most characteristic dominant herbaceous species is *Schoenus nigricans*. Other characteristic taxa are *Andropogon* sp., *Dichanthelium* spp., *Stenaria nigricans var. nigricans, Helianthus radula*, and *Muhlenbergia capillaris*. Some mesic herbaceous patches dominated by *Aquilegia canadensis* are also included here.

Saline glades or barrens of the West Gulf Coastal Plain of Louisiana, Texas, and Arkansas are associated with high sodium substrates, with patchy vegetation and much bare soil. *Aristida dichotoma* is dominant. There are also related examples in the adjacent Ouachita Mountains of Arkansas; these are also accommodated here, even though this technically extends the range off of the coastal plains.

***Diagnostic Characteristics:** In general, stands of this vegetation are characterized by dominance by low forbs, perennial or annual grasses, and succulents. The most characteristic grasses are *Schizachyrium scoparium, Sporobolus vaginiflorus*, and various species of *Aristida*. The other characteristic species vary greatly across the geographic range and substrate diversity of this macrogroup. Some characteristic genera include *Anemone, Bigelowia, Bouteloua, Clinopodium, Croton, Delphinium, Lesquerella, Oenothera, Opuntia, Sedum*, and *Phemeranthus*. Many of these genera exhibit morphological adaptations to an environment in which very dry conditions prevail during the growing season.

Examples of this macrogroup are distinguished by their physiognomy (as distinct from surrounding forests and woodlands) and their occurrence on edaphically noteworthy substrates in the coastal plains of the southeastern United States. Glades and barrens are naturally heterogeneous in their physiognomy, displaying herbaceous patches interspersed with small trees and shrubs. Prairies in the same or related areas will occur on deeper soils and (under proper management) display a more uniform grassy appearance. In central Texas, these areas are shallow-soil glades on limestones and related substrates, dominated by low forbs, annual grasses, and succulents. There may be intercalated patches of dry upland and seasonally wet (or saturated) vegetation.

***Classification Comments:** The central Texas components of this macrogroup are "carbonate glade and barrens" vegetation. Its members are placed here because they are not comfortably accommodated in either the "northern and central" glades nor in the "southern coastal plain" glades. M308 (formerly Southeastern Coastal Plain Barrens & Glade) has been renamed "Southern Barrens & Glade" to accommodate them; they are placed in the "Comanchian glade and barrens" group. The characteristics of this group may overlap with that of Great Plains Cliff, Scree & Rock Vegetation Group (G567), and review is needed to clarify the limits of the two concepts.

This eastern components of this macrogroup represent a number of distinctive associations found in the coastal plains of the southeastern United States which are unified by their presence on the shallow soil of rock outcrops, primarily of circumneutral or alkaline strata or saline soils. Stands are characteristically herbaceous in composition, but may have scattered (to dense) woody plants, depending on management and time since last disturbance (including fire).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M116	Great Plains Cliff, Scree & Rock Vegetation	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: In central Texas, these glades are mosaics of patches of low-statured vegetation, including low forbs, annual grasses, and succulents, which may occur at low cover. Some of the dominant taxa (e.g., annual grasses) may not be evident at all times of the year. At some sites, the vegetated areas may be limited to cracks or depressions in the limestone bedrock where soil has developed and accumulated. There may be intercalated patches of dry upland and seasonally wet (or saturated) vegetation. This vegetation occurs as distinct and mappable patches on limestone; however, it also occurs in smaller patches in a mosaic with savanna and woodland vegetation dominated by perennial grasses, shrubs, and trees.

Further east, stands of this macrogroup are heterogeneous assemblages of herbaceous and woody plants, the proportion and distribution depending on disturbance events and management. The soils are thin, rocky, and in some cases, base-rich (circumneutral to alkaline) or saline. The vegetation of saline soils in Arkansas, Louisiana, and Texas forms a mosaic primarily consisting of open herbaceous or shrubby plant communities.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The central Texas (Comanchian) glade vegetation has a strong seasonal aspect and is typically dominated by low forbs, annual grasses, and succulents. Some characteristic plants include *Lesquerella gordonii, Lesquerella ovalifolia, Schizachyrium scoparium, Sedum nuttallianum, Sedum pulchellum*, and *Sporobolus vaginiflorus* (*var. ozarkanus* and *var. vaginiflorus*). In addition, *Nostoc commune* (a cyanobacterium) is also common. In central and western Oklahoma, examples are dominated by members of the genus *Lesquerella*, including *Lesquerella gordonii* and *Lesquerella ovalifolia*. Some associates there include *Bouteloua curtipendula, Bouteloua hirsuta, Croton monanthogynus, Mentzelia oligosperma, Oenothera macrocarpa (= Oenothera missouriensis)*, and *Opuntia humifusa* (Hoagland 2000).

On outcrops of marine sediment and glauconitic clays of the Weches Formation in central eastern Texas, characteristic species include *Clinopodium arkansanum, Sedum pulchellum*, and *Sporobolus vaginiflorus*. Other species include *Allium drummondii, Anemone caroliniana, Arnoglossum plantagineum (= Cacalia plantaginea), Calylophus berlandieri ssp. berlandieri, Camassia scilloides, Chamaesyce nutans (= Euphorbia nutans), Croton monanthogynus, Dalea compacta var. compacta, Eleocharis occulta, Galium virgatum, Ipomopsis rubra, Isoetes butleri, Liatris punctata var. mucronata (= Liatris mucronata), Minuartia drummondii, Onosmodium bejariense var. bejariense, Opuntia* spp., *Saxifraga texana*, and *Thelesperma filifolium*. A scattered shrub layer, including *Cercis canadensis, Cornus drummondii, Juniperus virginiana*, and *Sideroxylon lanuginosum*, may be present on some sites. Rare or highly restricted species typical of this community are the listed endangered *Lesquerella pallida (= Physaria pallida)* and *Leavenworthia aurea var. texana (= Leavenworthia texana)*.

Undisturbed examples of the "Catahoula Barrens" of eastern Texas and western Louisiana are dominated by *Aristida longespica, Bigelowia nuttallii, Croton michauxii (= Crotonopsis linearis), Dalea compacta var. compacta, Krameria lanceolata, Lechea san-sabeana, Selaginella arenicola, Schizachyrium scoparium, Sporobolus silveanus* and *Phemeranthus parviflorus* (Marietta and Nixon 1984). Woodlands include a *Quercus stellata*-dominated overstory grading into *Pinus palustris*-dominated areas. Rare or highly restricted species typical of this community are *Gratiola flava* and *Schoenolirion wrightii*.

Glades and barrens on igneous nepheline syenite in Saline and Pulaski counties, Arkansas, may have open stands of *Quercus stellata*, but trees may be absent. Some typical dominant grasses include *Aristida purpurascens, Piptochaetium avenaceum, Schizachyrium scoparium*, and *Sporobolus clandestinus*. Other herbs may include *Camassia scilloides, Clinopodium arkansanum, Delphinium carolinianum, Sabatia campestris*, and *Phemeranthus calycinus*. Lichens are common on the rocky substrate of some examples.

Altamaha Grit vegetation occurs on outcrops of indurated sandstone in the Tifton Upland of the Georgia Coastal Plain. Scattered trees and shrubs can be rooted in deeper soils or crevices, including *Pinus palustris, Quercus marilandica*, and *Vaccinium arboreum*. Typical herbaceous species are *Allium cuthbertii, Aristida beyrichiana, Bigelowia nuttallii, Coreopsis major, Croton michauxii (= Crotonopsis linearis), Liatris squarrosa, Manfreda virginica, Penstemon dissectus, Schizachyrium tenerum, Phemeranthus teretifolius*, and *Tephrosia virginiana*. A typical dwarf-shrub is *Hypericum lloydii*. Rare or highly restricted species typical of this community are *Cuscuta harperi, Evolvulus sericeus*, and *Penstemon dissectus*.

Sandstone glades of Panhandle Florida are dominated by *Bigelowia nuttallii*. Other characteristic species include *Eurybia hemispherica (= Aster paludosus ssp. hemisphericus)* and *Schizachyrium scoparium var. scoparium*. On the open calcareous glades of the Panhandle of Florida (primarily Gadsden and Jackson counties; also adjacent Decatur County, Georgia), the most characteristic dominant herbaceous species is *Schoenus nigricans*. Other characteristic taxa are *Andropogon* sp., *Dichanthelium* spp., *Stenaria nigricans var. nigricans (= Hedyotis nigricans var. nigricans), Helianthus radula*, and *Muhlenbergia capillaris (= var. capillaris)*. Some additional forbs are *Aristida* spp., *Asclepias viridis, Asclepias viridiflora, Callirhoe papaver, Carex cherokeensis, Delphinium carolinianum ssp. carolinianum, Lepuropetalon spathulatum, Liatris squarrosa, Ponthieva racemosa, Rhynchospora* spp., *Rudbeckia fulgida, Selaginella ludoviciana, Stachys crenata, Solidago discoidea*, and *Symphyotrichum pratense (= Aster sericeus var. microphyllus)*. In addition, *Nostoc commune* is abundant on the exposed limestone. More shaded limestone outcrops are dominated by *Aquilegia canadensis, Arenaria lanuginosa, Asplenium heterochroum, Carex willdenowii, Chaerophyllum tainturieri, Laportea canadensis, Melica mutica, Oxalis* sp., *Pachysandra procumbens, Pilea pumila, Polymnia laevigata, Thelypteris kunthii*, and *Urtica chamaedryoides*.

Saline glades or barrens of the West Gulf Coastal Plain of Louisiana, Texas, and Arkansas are associated with high sodium substrates, with patchy vegetation and much bare soil. *Aristida dichotoma* is dominant; other typical species include *Anemone caroliniana, Aristida dichotoma, Anagallis minima, Bigelowia nuttallii, Callirhoe papaver, Coreopsis tinctoria, Drosera brevifolia, Geocarpon minimum, Hedeoma hispida, Hordeum pusillum, Houstonia micrantha, Houstonia pusilla, Houstonia rosea, Isolepis carinata (= Isolepis koilolepis), Krigia occidentalis, Lepuropetalon spathulatum, Mimosa strigillosa, Neptunia lutea, Minuartia muscorum (= Minuartia muriculata), Nothoscordum bivalve, Oenothera linifolia, Ophioglossum crotalophoroides, Plantago* sp., *Polypremum procumbens, Schizachyrium scoparium var. scoparium, Schoenolirion wrightii, Spergularia echinosperma, Sporobolus pyramidatus, Phemeranthus teretifolius*, and *Tradescantia occidentalis*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In the Edwards Plateau of Texas, processes controlling succession in this vegetation are unclear; however, erosion likely plays a major role. Erosion may be exacerbated in some situations by removal of biomass through overgrazing. Erosion mediates the occurrence of this group through its effects on soil depth. within this region, there is an environmental gradient from moister representatives in the east to drier ones in the west. In the Weches Glades of Texas, soils are shallow, rocky, and basic. These factors tend to inhibit growth of woody vegetation. Outcrops are seepy and saturated during winter and early spring but become hard and dry in the summer. In the Catahoula Barrens of Texas, seasonal droughtiness, shallow soils, aluminum toxicity, and periodic fires are important factors that influence the composition and structure of the vegetation.

In the nepheline syenite outcrops of Arkansas, the absence of fire has modified the flora at some examples, with the buildup of leaf litter and organic matter eliminating the glade herbaceous flora even from shallow soils and rocky areas. Historically, fire would have prevented the establishment of fire-intolerant tree species, reduced or eliminated the organic surface layer, fostered an open canopy with fewer (and larger) trees, and maintained the grass-dominated glade communities. This vegetation responds well to fire management and removal of *Juniperus*. Similar processes and trends operate in the other examples (Catahoula Barrens, Altamaha Grit, Florida Panhandle sandstone and limestone glades).

ENVIRONMENT

Environmental Description: The most westerly examples are glades and barrens found at xeric sites on limestones and related substrates, including sandy and gravelly soils. In the Edwards Plateau of Texas, this is primarily hard-bedded limestone such as the Edwards Formation, but also soft-bedded limestone strata such as the Glen Rose and Cow Creek formations.

Soil/substrate/hydrology: Stands are found in xeric sites on limestone rock and related substrates, including sandy and gravelly soils. The vegetation of this group consists of glades and barrens on specific and edaphically unusual substrates in the coastal plains of the southeastern United States. The Weches Formation is a marine mudstone with abundant fossils of shallow-water organisms and contains appreciable arsenic, which becomes bioavailable due to weathering. The Eocene Claiborne Group of the Texas Gulf Coastal Plain contains alternating clay and quartzose sand units. The Weches Formation in the Nacogdoches area, a transgressive phase of the Claiborne Group, consists of about 20 m of fossiliferous green clay present as sand-sized aggregates ("greensand"), many of which are fecal pellets. The clay is Fe-rich and has been variously described as "mixed-layer montmorillonite" or as glauconite (Ledger and Judy 2003). Soils are mapped as Trawick series (Mollic Hapludalfs).

The habitat of the Catahoula Barrens includes shallow soil and exposed sandstone, which tend to an herbaceous-dominated vegetation expression, as well as zones of deeper soils with open woodland vegetation. Examples on nepheline syenite are present only in Saline and Pulaski counties, Arkansas, on distinctive, massive outcrops of igneous substrate. Zonal vegetation communities are present around the outcrops. Interior herbaceous-dominated zones can be mesic to wet as springs and small ephemeral streams flow across the rock outcrops and water pools in flat areas. Deeper, more heavily wooded vegetation develops along the flat or slightly sloping outcrop edges.

The Altamaha Grit, now classified by geologists as the Altamaha Formation, outcrops only in southern Georgia; it presumably extends into South Carolina (Huddlestun 1988) but has either been eroded away or remains buried under soil or other types of rock. In addition there are sandstone glades of Panhandle Florida which are dominated by *Bigelowia nuttallii*.

Small-patch limestone glade and outcrop communities are endemic to the Panhandle of Florida (primarily Gadsden and Jackson counties) and adjacent Decatur County, Georgia. This vegetation includes a range of open limestone outcrops on hillsides and hill crests where soils are either very shallow or absent. This grades into shaded, mesic lower slopes near the floodplain of the Chipola River. The soils and geology of these panhandle Florida limestone examples has been well documented. In Gadsden County, they occur on limestone outcrops of the Miocene Chattahoochee Formation (Rupert 1990) primarily between the 90- and 120-foot contour lines (27-37 m MSL). In Jackson County, they are found primarily on rather soft, chalky Oligocene Marianna Limestone (Moore 1955, H. Means pers. comm. 2007) between the 130- and 150-foot contours (40-46 m MSL). These glades usually occupy areas too small to be distinguished at the scale of county soil survey maps. They may occasionally be shown as rock outcrops within the matrix of the surrounding forest soils. In Gadsden County, these matrix soils are Binnsville soils or Cuthbert, Boswell, and Susquehanna soils on moderate to steep slopes (Thomas et al. 1961b). In Jackson County, the matrix soils are the Oktibbeha variant rock outcrop complex (Duffee et al. 1979).

The saline examples in Arkansas, Louisiana, and Texas occur on soils with high saline content, which in the most extreme examples are generally not conducive to woody plant growth. The vegetation is patchy, with much bare soil.

DISTRIBUTION

***Geographic Range:** The glade and barrens vegetation of this macrogroup is found across coastal plains of the southeastern United States ranging from the inland parts of Texas and adjacent Oklahoma (including the Edwards Plateau, Lampasas Cutplain, and Crosstimbers) east to northern Florida. Specific areas in the eastern part of this range include in a localized region of eastern Texas, primarily in San Augustine, Nacogdoches, and Sabine counties; portions of western Louisiana and eastern Texas; the Upper West Gulf Coastal Plain of Saline and Pulaski counties, Arkansas (on nepheline syenite); and the Panhandle of Florida (primarily Gadsden and Jackson counties and adjacent Decatur County, Georgia). In addition, included here are saline glades and barrens of the coastal plain of Arkansas, Louisiana, and Texas.
Nations: US
States/Provinces: AR, FL, GA, LA, OK, TX
USFS Ecoregions (2007) [optional]: 231E:CC, 232B:CC, 232F:CC, 255A:CC, 255E:CP, 315B:CC, 315C:CC, 315D:CC, 315F:CP, 331B:PP, 332F:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: More information is needed on the Comanchian Barrens & Glade (western) part of this macrogroup. There may be undescribed associations that fit in this concept. There are plots for some of the types in the eastern part of the range, but probably not all. It is a heterogeneous group and could change with peer review.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G584	Southeastern Coastal Plain Barrens & Glade

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Catahoula Barrens	Bridges and Orzell 1989a	
=	Upland Glade	FNAI 1990	
?	Upland Glade, Chalky Limestone Glade subtype	FNAI 1992b	

AUTHORSHIP

***Primary Concept Source [if applicable]:** M. Pyne and J. Teague, in Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne and J. Teague
Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by B. Hoagland, A.S. Weakley, E.L. Bridges, S. Orzell, R. Evans, B. Carr.
Version Date: 15 Oct 2014

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2. Shrub & Herb Vegetation

2.B.2.Nh. Southeastern North American Grassland & Shrubland

G584. Southeastern Coastal Plain Barrens & Glade

Type Concept Sentence: These are distinct types of glade and barrens vegetation found on various specialized substrates (igneous rock, clay, saline soil, limestone, sandstone) in the coastal plains of the southeastern United States from eastern Texas to northern Florida. Their floras are distinctive to each substrate type.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Nh.3. Southern Barrens & Glade (M308)

Elcode: G584

***Scientific Name:** *Schizachyrium scoparium - Clinopodium arkansanum - Bigelowia nuttallii* Southeastern Coastal Plain Barrens & Glade Group

***Common (Translated Scientific) Name:** Little Bluestem - Limestone Calamint - Nuttall's Rayless-goldenrod Southeastern Coastal Plain Barrens & Glade Group

***Colloquial Name:** Southeastern Coastal Plain Barrens & Glade

***Type Concept:** This glade and barrens vegetation is found on various specialized substrates (igneous rock, clay, saline soil, limestone, sandstone) in the coastal plains of the southeastern United States from eastern Texas to northern Florida. It is currently documented from seven distinct areas and their particular substrates. They will each be described separately.

On outcrops of marine sediment and glauconitic clays of the Weches Formation in central eastern Texas, a series of small-patch communities occur primarily in San Augustine, Nacogdoches, and Sabine counties, where they are endemic. These outcrops are exposed by natural erosion of hillside slopes. Soils are shallow, rocky and basic, factors which tend to inhibit growth of woody vegetation. Outcrops are seepy and saturated during winter and early spring but become hard and dry in the summer. Enormous seasonal variations in species dominance can occur. Characteristic species include *Sedum pulchellum, Clinopodium arkansanum*, and *Sporobolus vaginiflorus*. A scattered shrub layer, including *Cercis canadensis, Cornus drummondii, Juniperus virginiana*, and *Sideroxylon lanuginosum*, may be present on some sites. In addition, the narrowly endemic annuals *Lesquerella pallida* and *Leavenworthia aurea var. texana* may be present.

Another series of associations is confined to the Catahoula geologic formation of eastern Texas and western Louisiana. These sites include a vegetational mosaic ranging from herbaceous-dominated areas on shallow soil and exposed sandstone to deeper soils with open woodland vegetation. Seasonal droughtiness, shallow soils, aluminum toxicity, and periodic fires are important factors that influence the composition and structure. The woodland component (which is treated in a separate group) exhibits a post oak-dominated overstory grading into longleaf pine-dominated areas.

In Saline and Pulaski counties, Arkansas, there are glade communities restricted to distinctive, massive outcrops of igneous substrate ("nepheline syenite"). Zonal vegetation communities are present around the outcrops. Interior herbaceous-dominated zones can be mesic to wet as springs and small ephemeral streams flow across the rock outcrops and water pools in flat areas. Deeper, more heavily wooded vegetation develops along the flat or slightly sloping outcrop edges. It is possible that examples also occurred in the adjacent Ouachita Mountains of Arkansas, although extant examples are not known. These are also at least conceptually accommodated here, even though this extends the range off of the coastal plains.

Altamaha Grit glade vegetation occurs on outcrops of indurated sandstone in the Tifton Upland of the Georgia Coastal Plain. Scattered trees and shrubs can be rooted in deeper soils or crevices, including *Pinus palustris, Quercus marilandica*, and *Vaccinium arboreum*. Typical herbaceous species include *Allium cuthbertii, Aristida beyrichiana, Bigelowia nuttallii, Coreopsis major, Croton michauxii, Liatris squarrosa, Manfreda virginica, Penstemon dissectus, Schizachyrium tenerum, Phemeranthus teretifolius*, and *Tephrosia virginiana*. A typical dwarf-shrub is *Hypericum lloydii*. Rare or highly restricted species typical of this community are *Cuscuta harperi, Evolvulus sericeus*, and *Penstemon dissectus*. Occurrences can be as large as 5 acres. This community typically occurs in a matrix of longleaf pine woodlands.

Sandstone glades of Panhandle Florida are dominated by *Bigelowia nuttallii*. Other characteristic species include *Schizachyrium scoparium var. scoparium* and *Eurybia hemispherica*. Outstanding examples are found at TNC Rock Hill Preserve (Washington County, Florida).

Small-patch limestone glade and outcrop communities are endemic to the Panhandle of Florida (primarily Gadsden and Jackson counties) and adjacent Decatur County, Georgia. This vegetation includes a range of open limestone outcrops on hillsides and hill crests where soils are either very shallow or absent. This grades into shaded, mesic lower slopes near the floodplain of the Chipola River, and some mesic herbaceous patches dominated by *Aquilegia canadensis* are also included here.

In addition, there are distinctive communities that occur in portions of the coastal plain west of the Mississippi River on soils with high saline content, which in the most extreme examples are generally not conducive to woody plant growth. Thus, the vegetation forms a mosaic primarily consisting of open herbaceous or shrubby plant communities. This type is most common, and best documented in Arkansas and western Louisiana, but also occurs in eastern Texas. There are also related examples in the adjacent Ouachita Mountains of Arkansas; these are also accommodated here, even though this extends the range off of the coastal plains.

***Diagnostic Characteristics:** Examples of this group are distinguished by their physiognomy (as distinct from surrounding forests and woodlands) and their occurrence on edaphically noteworthy substrates in the coastal plains of the southeastern United States. In general, glades and barrens are better known and more extensive in the interior limestone provinces (interior Low Plateaus, Ozarks). They are naturally heterogeneous in their physiognomy, displaying herbaceous patches interspersed with small trees and shrubs. Prairies in the same or related areas will occur on deeper soils and (under proper management) display a more uniform grassy appearance.

***Classification Comments:** This group includes a number of distinctive associations found in the coastal plains of the southeastern United States which are unified by their presence on the shallow soil of rock outcrops, primarily of circumneutral or alkaline strata or saline soils. Stands are characteristically herbaceous in composition, but may have scattered (to dense) woody plants, depending on management and time since last disturbance (including fire).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G598	Comanchian Barrens & Glade	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Stands of this group are heterogeneous assemblages of herbaceous and woody plants, the proportion and distribution depending on disturbance events and management. The soils are thin, rocky, and in some cases, base-rich (circumneutral to alkaline) or saline.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: On outcrops of marine sediment and glauconitic clays of the Weches Formation in central eastern Texas, characteristic species include *Sedum pulchellum, Clinopodium arkansanum*, and *Sporobolus vaginiflorus*. Other species include *Allium drummondii, Anemone caroliniana, Arnoglossum plantagineum (= Cacalia plantaginea), Chamaesyce nutans (= Euphorbia nutans), Croton monanthogynus, Galium virgatum, Ipomopsis rubra, Minuartia patula (= Arenaria patula), Opuntia* spp., and *Valerianella radiata*. A scattered shrub layer, including *Cercis canadensis, Cornus drummondii, Juniperus virginiana*, and *Sideroxylon lanuginosum*, may be present on some sites.

Undisturbed examples of the "Catahoula Barrens" of eastern Texas and western Louisiana are dominated by *Aristida longespica, Bigelowia nuttallii, Croton michauxii (= Crotonopsis linearis), Schizachyrium scoparium*, and *Sporobolus silveanus* (Marietta and Nixon 1984). Woodlands include a *Quercus stellata*-dominated overstory grading into *Pinus palustris*-dominated areas.

Some examples of glades and barrens on distinctive massive outcrops of igneous nepheline syenite in Saline and Pulaski counties, Arkansas, will have open stands of *Quercus stellata*, but trees may be absent. Some typical dominant grasses include *Aristida purpurascens, Piptochaetium avenaceum, Schizachyrium scoparium*, and *Sporobolus clandestinus*. Other herbs may include *Camassia scilloides, Clinopodium arkansanum, Delphinium carolinianum, Sabatia campestris*, and *Phemeranthus calycinus (= Talinum calycinum)*. Lichens are common on the rocky substrate of some examples.

Sandstone glades of Panhandle Florida are dominated by *Bigelowia nuttallii*. Other characteristic species include *Eurybia hemispherica (= Aster paludosus ssp. hemisphericus)* and *Schizachyrium scoparium var. scoparium*.

On the open calcareous glades of the Panhandle of Florida (primarily Gadsden and Jackson counties; also adjacent Decatur County, Georgia), the dominant herbaceous species are *Andropogon* sp., *Dichanthelium* sp., *Stenaria nigricans var. nigricans (= Hedyotis nigricans var. nigricans), Helianthus radula, Muhlenbergia capillaris (= var. capillaris), Schoenus nigricans*, and *Setaria* sp. Some additional forbs are *Aristida* spp., *Asclepias viridis, Asclepias viridiflora, Callirhoe papaver, Carex cherokeensis, Delphinium carolinianum ssp. carolinianum, Lepuropetalon spathulatum, Liatris squarrosa, Ponthieva racemosa, Rhynchospora* spp., *Rudbeckia fulgida, , Selaginella ludoviciana, Solidago discoidea, Stachys crenata*, and *Symphyotrichum pratense (= Aster sericeus var. microphyllus)*. *Nostoc commune* is abundant on the exposed limestone. Also included here are shaded limestone outcrops with herbaceous vegetation which are dominated by *Aquilegia canadensis, Arenaria lanuginosa, Asplenium heterochroum, Carex willdenowii, Chaerophyllum tainturieri, Laportea canadensis, Melica mutica, Oxalis* sp., *Pachysandra procumbens, Pilea pumila, Polymnia laevigata, Thelypteris kunthii*, and *Urtica chamaedryoides*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In the Weches Glades of Texas, soils are shallow, rocky, and basic. These factors tend to inhibit growth of woody vegetation. Outcrops are seepy and saturated during winter and early spring but become hard and dry in the summer. In the Catahoula Barrens of Texas, seasonal droughtiness, shallow soils, aluminum toxicity, and periodic fires are important factors that influence the composition and structure of the vegetation.

In the nepheline syenite outcrops of Arkansas, the absence of fire has modified the flora at some examples, with the buildup of leaf litter and organic matter eliminating the glade herbaceous flora even from shallow soils and rocky areas. Historically, fire would have prevented the establishment of fire-intolerant tree species, reduced or eliminated the organic surface layer, fostered an open canopy with fewer (and larger) trees, and maintained the grass-dominated glade communities. This vegetation responds well to fire management and removal of *Juniperus*.

ENVIRONMENT

Environmental Description: The vegetation of this group consists of glades and barrens on specific and edaphically unusual substrates in the coastal plains of the southeastern United States. In panhandle Florida limestone examples, the soils and geology has been well documented. In Gadsden County, they occur on limestone outcrops of the Miocene Chattahoochee Formation (Rupert 1990) primarily between the 90- and 120-foot contour lines (27-37 m MSL). In Jackson County, they are found primarily on Oligocene Marianna Limestone (Moore 1955, Means pers. comm. 2007) between the 130- and 150-foot contours (40-46 m MSL). These glades usually occupy areas too small to be distinguished at the scale of county soil survey maps. They may occasionally be shown as rock outcrops within the matrix of the surrounding forest soils. In Gadsden County, these matrix soils are Binnsville soils or Cuthbert, Boswell, and Susquehanna soils on moderate to steep slopes (Thomas et al. 1961b). In Jackson County, the matrix soils are the Oktibbeha variant rock outcrop complex (Duffee et al. 1979).

The Weches Formation is a marine mudstone with abundant fossils of shallow-water organisms and contains appreciable arsenic, which becomes bioavailable due to weathering. The Eocene Claiborne Group of the Texas Gulf Coastal Plain contains alternating clay and quartzose sand units. The Weches Formation in the Nacogdoches area, a transgressive phase of the Claiborne Group, consists of about 20 m of fossiliferous green clay present as sand-sized aggregates ("greensand"), many of which are fecal pellets. The clay is Fe-rich and has been variously described as "mixed-layer montmorillonite" or as glauconite (Ledger and Judy 2003). Soils are mapped as Trawick series (Mollic Hapludalfs).

The habitat of the Catahoula Barrens includes shallow soil and exposed sandstone, which tend to an herbaceous-dominated vegetation expression, as well as zones of deeper soils with open woodland vegetation.

Examples on nepheline syenite are present only in Saline and Pulaski counties, Arkansas, on distinctive, massive outcrops of igneous substrate. Zonal vegetation communities are present around the outcrops. Interior herbaceous-dominated zones can be mesic to wet as springs and small ephemeral streams flow across the rock outcrops and water pools in flat areas. Deeper, more heavily wooded vegetation develops along the flat or slightly sloping outcrop edges.

The Altamaha Grit, now classified by geologists as the Altamaha Formation, outcrops only in southern Georgia; it presumably extends into South Carolina (Huddlestun 1988) but has either been eroded away or remains buried under soil or other types of rock. In addition there are sandstone glades of Panhandle Florida which are dominated by *Bigelowia nuttallii*.

The calcareous glades of the warm temperate coastal plain of Gadsden and Jackson counties, Florida, and Decatur County, Georgia are found in rather soft, chalky limestone.

The saline examples in Arkansas, Louisiana, and Texas occur on soils with high saline content, which in the most extreme examples are generally not conducive to woody plant growth. Thus, the vegetation forms a mosaic primarily consisting of open herbaceous or shrubby plant communities.

The presence of an intrusive igneous outcrop-forming rock (nepheline syenite) in the Arkansas coastal plain seems anomalous. The plutonic rock intruded into both the coastal plain and the adjacent Ouachitas, but the Ouachita examples no longer have any intact glade and barrens vegetation (assuming they ever did).

DISTRIBUTION

***Geographic Range:** Vegetation of this group is known from at least four distinct regions, but other examples could occur elsewhere in the coastal plains. There are known examples in a localized region of eastern Texas, primarily in San Augustine, Nacogdoches, and Sabine counties; portions of western Louisiana and eastern Texas; the Upper West Gulf Coastal Plain of Saline and Pulaski counties, Arkansas (on nepheline syenite); and the Panhandle of Florida (primarily Gadsden and Jackson counties and adjacent Decatur County, Georgia). In addition, included here are saline glades and barrens of the coastal plain of Arkansas, Louisiana, and Texas.

Nations: US

States/Provinces: AR, FL, GA, LA, TX

USFS Ecoregions (2007) [optional]: 231E:CC, 232B:CC

Omernik Ecoregions L3, L4 [optional]: 8.3.5.65g:C, 8.3.7.35a:C, 8.3.7.35e:C

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]: There are plots for some, but probably not all, of these. It is a heterogeneous group and could change with peer review.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A4091	Southern Coastal Plain Acidic Bedrock Scrub & Grassland Alliance
A4090	Southern Coastal Plain Circumneutral Bedrock Grassland Alliance
A4092	*Bigelowia nuttallii - Aristida longespica - Schizachyrium scoparium* West Gulf Coastal Plain Grassland Alliance
A4094	*Sporobolus clandestinus - Clinopodium arkansanum - Delphinium carolinianum* Nepheline Syenite Bedrock Grassland Alliance
A4093	*Iva angustifolia - Clinopodium arkansanum - Distichlis spicata* West Gulf Coastal Plain Saline & Weches Bedrock Grassland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Catahoula Barrens	Bridges and Orzell 1989a	
<	Eastern Redcedar: 46	Eyre 1980	
<	Post Oak - Blackjack Oak: 40	Eyre 1980	
=	Upland Glade	FNAI 1990	
?	Upland Glade, Chalky Limestone Glade subtype	FNAI 1992b	

AUTHORSHIP

***Primary Concept Source [if applicable]:** M. Pyne, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne
Acknowledgments [optional]:
Version Date: 12 May 2015

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***References [Required if used in text]:**

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Coultas, C. L. 1983. Examination of soils associated with four small "limestone glade communities" surrounded by forest in the hills of western Gadsden County. Florida Natural Areas Inventory, Tallahassee.

Duffee, E. M., W. J. Allen, and H. C. Ammons. 1979. Soil survey of Jackson County, Florida. USDA Soil Conservation Service in cooperation with the University of Florida Institute of Food and Agricultural Sciences, Agricultural Experiment Stations, Soil Science Department, Gainesville, FL.

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2.B.4. Temperate to Polar Scrub & Herb Coastal Vegetation

Temperate to Polar Scrub & Herb Coastal Vegetation is found in temperate to polar coastal habitats, including beaches, bluffs and dunes, where wind and water are major drivers of the vegetation, across the mid to polar latitudes from 23° to 60-70°N and S latitude, dominated by prostrate perennials on the beach and foredune, and graminoids and scrub on backdunes and bluffs.

2.B.4.Na. Eastern North American Coastal Scrub & Herb Vegetation

This division is comprised of shrub and herbaceous upland vegetation growing on rapidly drained sandy and, occasionally, rocky substrates along the immediate coasts of the Great Lakes, the Gulf of Saint Lawrence, the Atlantic Ocean, the Gulf of Mexico, Lake Champlain, and possibly other large lakes in eastern North America, and that is subjected to maritime processes of wave disturbance, constant wind, freezing spray, and/or salt spray.

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2. Shrub & Herb Vegetation
2.B.4.Na. Eastern North American Coastal Scrub & Herb Vegetation

M060. Eastern North American Coastal Beach & Rocky Shore

Type Concept Sentence: This macrogroup encompasses sparse annual vegetation occurring on the irregularly flooded tidal zone of coastal beaches of the Atlantic and Gulf of Mexico coasts of North America.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.B.4.Na.1. Eastern North American Coastal Scrub & Herb Vegetation (D026)

Elcode: M060
***Scientific Name:** Eastern North American Coastal Beach & Rocky Shore Macrogroup
***Common (Translated Scientific) Name:** Eastern North American Coastal Beach & Rocky Shore Macrogroup
***Colloquial Name:** Eastern North American Coastal Beach & Rocky Shore

***Type Concept:** The coastal beach vegetation of this macrogroup is variable, depending on the amount of exposure to wave and wind action, but on average vegetation cover is sparse and no species can be considered dominant. Characteristic annual or biennial species more-or-less restricted to beach habitats include *Cakile edentula ssp. edentula, Honckenya peploides*, or *Sesuvium portulacastrum*. This macrogroup includes annual-dominated sandy, gravel, or cobble surfaces of upper ocean beaches fronting the ocean or on the sheltered beaches of barrier islands. The tidal regime is characterized by irregular tidal flooding, within the reach of storm tides and extreme lunar tides.

***Diagnostic Characteristics:** Usually sparsely vegetated with annual species, often succulents, occurring above mean high tide on ocean beaches and the baysides of barrier islands. *Cakile edentula* and *Sesuvium portulacastrum* are characteristic and diagnostic. But from the north, North American Arctic & Boreal Coast Vegetation Macrogroup (M402) may also extend into this region, and the limits of these two macrogroups needs to be resolved.

***Classification Comments:** The northern limits of this macrogroup are uncertain. It is expected to occur into the Atlantic maritime region of eastern Canada, and may extend northward into the boreal regions of Newfoundland and Labrador.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M057	Eastern North American Coastal Dune & Grassland	
M402	North American Arctic Coastal Shore	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Vegetation cover is variable, depending on the amount of exposure to wave and wind action, but on average is sparse. Succulent species are characteristic, and typically low-growing or mat-forming.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: No single species can be considered dominant. Characteristic annual or biennial species more-or-less restricted to beach habitats include *Cakile edentula ssp. edentula*, as well as *Amaranthus retroflexus, Ammophila breviligulata, Atriplex cristata (= Atriplex arenaria), Cenchrus tribuloides, Chamaesyce polygonifolia (= Euphorbia polygonifolia), Chenopodium album, Erechtites hieraciifolius, Honckenya peploides ssp. diffusa (= Arenaria peploides), Salsola kali ssp. kali (= Salsola caroliniana)*, and *Triplasis purpurea*. Other associates in the southern portion of the range include various succulent species, including most characteristically *Atriplex patula, Sesuvium maritimum, Sesuvium portulacastrum*, and *Suaeda linearis*. Other species which may occur are *Cyperus* spp., *Ipomoea imperati, Ipomoea sagittata, Panicum amarum, Spartina patens, Sporobolus virginicus*, and *Vigna luteola*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: This vegetation is maintained at the tension zone between the marine and terrestrial realms and flooded irregularly by storm and neap tides. It is extremely dynamic in nature, and forms at this tension zone as it moves with beach erosion or accretion. The wrack line has seed sources for (re)establishment of plants on the beach, and provides cover for invertebrates and vertebrates using the beach.

ENVIRONMENT

Environmental Description: This vegetation occurs on the baysides and ocean-fronting upper ocean beaches, within the reach of storm tides and extreme lunar tides. The South Atlantic coast part of the range occupies the upper portion of ocean beaches of the microtidal region (barrier islands with coastal geomorphology dominated by hurricane overwash rather than tidal energy). The substrate is bare sand but is often covered with dried algae, driftwood, shells, and other materials deposited by waves.

DISTRIBUTION

***Geographic Range:** This vegetation ranges from the Canadian Maritime Provinces south to the Gulf coast of Florida and possibly Mississippi.
Nations: CA, MX, US
States/Provinces: AL, CT, DE, FL, GA?, LB?, MA, MD, ME, MS?, NB?, NC, NF?, NH, NJ, NS?, NY, PE?, QC?, RI, SC, VA
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G661	South Atlantic & Gulf Coastal Beach
G660	North Atlantic Coastal Beach
G793	Great Lakes Coastal Rocky Shore
G764	Great Lakes Sand Beach
G342	Eastern North American Inland Beach & Rocky Shore

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
?	*Cakiletum edentula*	Conard 1935	
?	Beach community	Johnson 1985b	
?	Beach community	Hill 1986	
?	beach	Higgins et al. 1971	
?	beach	Fender 1937	
?	beach	McDonnell 1979	
?	beach community	Baumann 1978b	
?	beach vegetation	Moul 1973	
?	dune-strand area	Clovis 1968	
?	embryo dune	Klotz 1986	
?	middle beach	Nichols 1920	
?	middle beach	Shreve et al. 1910	
?	pioneer beach community	Boule 1979	
?	sea-strand vegetation, beach formation	Harshberger 1900	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.W. Harshberger (1900); H.S. Conard (1935)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** L. Sneddon
Acknowledgments [optional]:
Version Date: 15 Oct 2014

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2. Shrub & Herb Vegetation

2.B.4.Na. Eastern North American Coastal Scrub & Herb Vegetation

G661. South Atlantic & Gulf Coastal Beach

Type Concept Sentence: This vegetation type combines sparse beach vegetation of the outer coastal zone dominated by various combinations of *Cakile* species and *Ipomoea* species, as well as by *Atriplex patula, Sesuvium portulacastrum*, and *Suaeda linearis*, in irregularly flooded beaches and salt flats from Delaware to Texas and adjacent Mexico.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.4.Na.1. Eastern North American Coastal Beach & Rocky Shore (M060)

Elcode: G661
***Scientific Name:** South Atlantic & Gulf Coastal Beach Group
***Common (Translated Scientific) Name:** South Atlantic & Gulf Coastal Beach Group
***Colloquial Name:** South Atlantic & Gulf Coastal Beach

***Type Concept:** This vegetation type accommodates sparse beach vegetation of the outer coastal zone dominated by various combinations of *Cakile* species (*Cakile constricta, Cakile edentula ssp. harperi, Cakile geniculata*) and *Ipomoea* species (*Ipomoea pes-caprae, Ipomoea imperati*). Other typical species include *Atriplex patula, Canavalia rosea, Chamaesyce mesembrianthemifolia, Iva imbricata, Portulaca* spp., *Sesuvium portulacastrum, Suaeda linearis*, and others. This vegetation occurs along the Atlantic and portions of the northern Gulf of Mexico coasts, from Delaware to Texas and adjacent Mexico. It includes annual-dominated sand flats on island end flats and upper ocean beaches, within the reach of storm tides and extreme lunar tides, as well as irregularly flooded beaches and salt flats.

***Diagnostic Characteristics:** This sparse beach vegetation of the outer coastal zone from North Carolina to Texas is dominated by various combinations of *Cakile* and *Ipomoea* species as well as by *Atriplex patula, Sesuvium portulacastrum*, and *Suaeda linearis* in irregularly flooded beaches and salt flats.

***Classification Comments:** Split between North Atlantic versus South Atlantic is based on the Acadian vs. Virginian marine zones, which meets in central Virginia (L. Sneddon pers. comm. 2012). For more information on diagnostic criteria for the range limits of this group, see information in *Uniola paniculata - Panicum amarum* Dune Grassland Alliance (A1199).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G660	North Atlantic Coastal Beach	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group consists of sparse beach, sand flat, and salt flat vegetation from the outer coastal zone of the southeastern United States and adjacent Mexico. The physiognomy of the *Atriplex*-dominated phases tends to be of scattered mound-like clumps of vegetation (mostly *Sesuvium portulacastrum*) in a wet sand flat.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Examples of this vegetation are dominated by various combinations of *Cakile* species (*Cakile constricta, Cakile edentula ssp. harperi, Cakile geniculata*) and *Ipomoea* species (*Ipomoea pes-caprae, Ipomoea imperati, Ipomoea sagittata*). Other typical species include *Atriplex patula, Canavalia rosea, Chamaesyce mesembrianthemifolia, Iva imbricata, Portulaca* spp., *Sesuvium maritimum, Sesuvium portulacastrum, Suaeda linearis, Vigna luteola*, and others. Several taxa are succulents. In the South Atlantic coastal zone, other characteristic species include mostly annual herbs, such as the rare *Amaranthus pumilus, Chamaesyce bombensis, Chamaesyce polygonifolia*, and *Salsola kali ssp. kali* (exotic). Grasses may be present, including *Panicum amarum, Spartina patens*, and *Sporobolus virginicus*. The composition and structure of some southern examples show transition towards some tropical beach vegetation.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: This vegetation is affected and maintained by storm tides and extreme lunar tides.

ENVIRONMENT

Environmental Description: This vegetation includes annual-dominated sand flats on island end flats and upper ocean beaches, within the reach of storm tides and extreme lunar tides. The South Atlantic Coast phase of this vegetation occupies the upper portion of ocean beaches in the southern part (Cape Hatteras, North Carolina, to Cape Romain, South Carolina) of the microtidal region (barrier islands with coastal geomorphology dominated by hurricane overwash rather than tidal energy). The *Atriplex*-dominated phases of this vegetation are found on the backside of the ends of barrier islands, where examples are only irregularly flooded. In contrast to *Salicornia*- or *Distichlis*-dominated areas, they apparently accumulate less salt. The physiognomy tends to be of scattered mound-like clumps of vegetation (mostly *Sesuvium portulacastrum*) in a wet sand flat.

DISTRIBUTION

***Geographic Range:** This vegetation occurs along the Atlantic and portions of the northern Gulf of Mexico coasts, from Delaware to Texas and adjacent Mexico.
Nations: MX, US
States/Provinces: AL, DE, FL, GA, LA, MD, MS, MXTM, NC, SC, TX, VA
USFS Ecoregions (2007) [optional]: 232Ac:CCC, 232Ce:CCC, 232Gb:CCC, 232Hc:CCC, 232Ib:CCC, 232La:CCC, 232Lb:CCC, 232Lc:CCC
Omernik Ecoregions L3, L4 [optional]: 8.5.1.63d:C, 8.5.1.63g:C, 8.5.2.73o:C, 8.5.3.75b:C, 8.5.3.75d:C, 8.5.3.75f:C, 8.5.3.75j:C, 8.5.3.75k:C, 9.5.1.34g:P, 9.5.1.34h:C, 9.5.1.34i:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3683	*Cakile* spp. - *Ipomoea* spp. Sparse Beach Alliance
A1868	*Sesuvium portulacastrum - Atriplex patula - Suaeda linearis* Salt Flat Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2012-07-25	G124 Iva imbricata - Cakile spp. - Chamaesyce spp. Beach Vegetation Group	G124 split into G660 & G661

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen and M. Pyne, in Faber-Langendoen et al. (2015)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne
Acknowledgments [optional]: We have incorporated significant descriptive information developed and compiled by J.B. Nelson, M.P. Schafale, and A.S. Weakley.

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***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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2. Shrub & Herb Vegetation
2.B.4.Na. Eastern North American Coastal Scrub & Herb Vegetation

G660. North Atlantic Coastal Beach

Type Concept Sentence: This group covers non-forested, sparsely to moderately vegetated boulder, cobble, and gravel shores characterized by *Cakile edentula*, above the normal high-tide line along the immediate Atlantic coast, from northern North Carolina to the Canadian Maritimes.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.4.Na.1. Eastern North American Coastal Beach & Rocky Shore (M060)

Elcode: G660
***Scientific Name:** North Atlantic Coastal Beach Group
***Common (Translated Scientific) Name:** North Atlantic Coastal Beach Group
***Colloquial Name:** North Atlantic Coastal Beach

***Type Concept:** This group covers mostly non-forested, sparsely to moderately vegetated boulder, cobble, and gravel shores, above the normal high-tide line along the immediate Atlantic coast, from northern North Carolina to the Canadian Maritimes. On the mainland, it is often a narrow zone between the high-tide line and the upland forest; this zone becomes wider with increasing maritime influence, e.g., on some islands. The substrate is sand flats and beaches, or sandy with broken rock, ranging from cobbles to gravels, sometimes with a shallow soil layer. Tree growth is prevented by extreme exposure to wind, salt spray, and fog. Cover is patchy herbs with an occasional shrub. On cobble beaches, where storm waves create an unstable substrate, vascular plant cover is low, with typical species including *Cakile edentula ssp. edentula, Calystegia sepium, Chamaesyce polygonifolia, Chenopodium album, Elymus repens, Galeopsis bifida, Honckenya peploides ssp. diffusa, Lathyrus japonicus, Raphanus raphanistrum, Rumex crispus, Salsola kali, Sisymbrium altissimum, Solanum dulcamara*, and *Solidago sempervirens*. *Mertensia maritima* is an infrequent but diagnostic species of cobble beaches. Open rocky shore habitats are characterized by sparse (<25%) cover of salt-tolerant herbs such as *Argentina egedii ssp. groenlandica, Atriplex prostrata, Glaux maritima, Limonium carolinianum, Puccinellia maritima, Salicornia depressa, Spergularia salina*, and *Suaeda maritima*. Detritus washed in by the tides may be prominent. In Atlantic Canada, an unusual treed cobble beach can occur.

***Diagnostic Characteristics:** Atlantic maritime ocean beach comprising sand, gravel, or cobbles; ranging north from central Virginia; *Cakile edentula* is characteristic.

***Classification Comments:** Initial split between North Atlantic versus South Atlantic is based on the Acadian versus Virginian marine zones, which meets in central Virginia (L. Sneddon pers. comm. 2012). However, this leaves two groups and two alliances, with one association each, and little floristic difference.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G793	Great Lakes Coastal Rocky Shore	
G661	South Atlantic & Gulf Coastal Beach	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is characterized by sparse and patchy vegetation dominated primarily by succulent annual plants not generally exceeding 0.5 m in height. Trees are absent, and shrubs, if present, are very sparsely distributed and stressed.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Cakile edentula* is the most frequently occurring species across the range. Other associates may include *Chamaesyce polygonifolia, Honckenya peploides ssp. diffusa (= Arenaria peploides), Salsola kali ssp. kali, Xanthium strumarium*, as well as wave-deposited wrack comprising marine alga. On cobble beaches, where storm waves create an unstable substrate, vascular plant cover is low, with typical species including *Cakile edentula ssp. edentula, Calystegia sepium, Chamaesyce polygonifolia, Chenopodium album, Elymus repens, Galeopsis bifida, Honckenya peploides ssp. diffusa (= Arenaria peploides), Lathyrus japonicus, Raphanus raphanistrum, Rumex crispus, Salsola kali, Sisymbrium altissimum, Solanum dulcamara*, and *Solidago sempervirens*. *Mertensia maritima* is an infrequent but diagnostic species of cobble beaches. Open rocky shore habitats are characterized by sparse (<25%) cover of salt-tolerant herbs such as *Argentina egedii ssp. groenlandica, Atriplex prostrata, Glaux maritima, Limonium carolinianum, Puccinellia maritima, Salicornia depressa, Spergularia salina (= Spergularia marina)*, and *Suaeda maritima*. Detritus washed in by the tides may be prominent. In Atlantic Canada, an unusual treed cobble beach can occur.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: This group is influenced by irregular tidal flooding, wave action, and storm tides. Its position between the regularly flooded, unvegetated beach, and the base of dunes or upland shores is not fixed. Intense storms often disturb or completely remove the habitat, but the easily dispersed annual plants comprising this group re-establish on newly formed habitat where the new wrack line develops.

ENVIRONMENT

Environmental Description: This group occurs on Atlantic beaches above the limit of mean high tide, but is inundated by wave action during spring tides and storm tides. It occurs on ocean-fronting beaches of barrier islands, and the mainland coast, as well as on the more protected beaches of bay beaches. The substrate is sand, cobble, gravel, or a mixture of these.

DISTRIBUTION

***Geographic Range:** This group is found along the immediate Atlantic coast, from northern North Carolina to the Canadian Maritimes.
Nations: CA, US
States/Provinces: CT, DE, LB, MA, MD, ME, NB?, NF, NH, NJ, NS, NY, ON, PE, QC?, RI, VA
USFS Ecoregions (2007) [optional]: 211Cb:CCC, 211Db:CCC, 211Dc:CCC, 221Aa:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ak:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CCC, 232Hc:CCC, 232Ib:CCC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3639	*Cakile edentula ssp. edentula* Atlantic Beach Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-02-28	G564 Cakile edentula - Limonium carolinianum Rocky Strand Group	G564 merged into G660

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	*Cakile edentula - Chenopodium album* community	Metzler and Barrett 1996	
=	*Cakiletum edentula*	Conard 1935	
=	Beach community	Johnson 1985b	
=	Beach community	Hill 1986	
=	Marine intertidal gravel/sand beach community	Breden 1989	
=	Maritime beach	Reschke 1990	
=	beach	Higgins et al. 1971	
=	beach	Fender 1937	
=	beach	McDonnell 1979	
=	beach community	Baumann 1978b	
=	beach vegetation	Moul 1973	
?	embryo dune	Klotz 1986	
?	middle beach	Nichols 1920	
?	middle beach	Shreve et al. 1910	
=	pioneer beach community	Boule 1979	
=	sea-strand vegetation, beach formation	Harshberger 1900	

AUTHORSHIP

***Primary Concept Source [if applicable]:** L.A. Sneddon, in Faber-Langendoen et al. (2012)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** L.A. Sneddon

Acknowledgments [optional]:

Version Date: 05 May 2015

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2. Shrub & Herb Vegetation
2.B.4.Na. Eastern North American Coastal Scrub & Herb Vegetation

G764. Great Lakes Sand Beach

Type Concept Sentence: These sand beaches occur along the shores of the Great Lakes where waves and ice-scour maintain open, nearly barren sand. Vegetation cover is sparse.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.4.Na.1. Eastern North American Coastal Beach & Rocky Shore (M060)

Elcode: G764
***Scientific Name:** Great Lakes Sand Beach Group
***Common (Translated Scientific) Name:** Great Lakes Sand Beach Group
***Colloquial Name:** Great Lakes Sand Beach

***Type Concept:** This group is found along the shores of the Great Lakes, particularly along Lake Michigan. It is found on sandy substrates with little or no soil development within a few meters elevation of the water. The sandy substrate is not stabilized by significant vegetation and is easily moved. Stands of this group are subject to frequent disturbance by wind, waves, and ice-scour. Stands are typically narrow and linear but may extend for miles along the lakeshore. Vegetation is absent to sparse; that which is present is short and dominated by herbaceous species. *Cakile edentula* is the most common species. *Chamaesyce polygonifolia, Juncus arcticus ssp. littoralis, Lathyrus japonicus*, and *Argentina anserina* can be found, as well. *Ammophila breviligulata* may be present where dunes are associated with the beach.

***Diagnostic Characteristics:** *Cakile edentula* is the most common species.

***Classification Comments:** There may be small dunes within this group, but areas where dunes are more extensive should be placed within Great Lakes Dune Group (G089). Cobble beaches are not included in this group but are in Eastern North American Inland Beach & Rocky Shore Group (G342).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G342	Eastern North American Inland Beach & Rocky Shore	
G089	Great Lakes Dune	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Vegetation is absent to sparse; that which is present is short and dominated by herbaceous species or sometimes short shrubs and vines.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Cakile edentula* is common. *Chamaesyce polygonifolia (= Euphorbia polygonifolia), Juncus arcticus ssp. littoralis (= Juncus balticus), Lathyrus japonicus*, and *Argentina anserina (= Potentilla anserina)* can be found, as well. *Ammophila breviligulata* may be present where dunes are associated with the beach. Areas that have avoided significant wave or ice-scour action for a few years can have greater cover of vegetation, often from nearby dune communities. Shrubs that may be found in these areas include *Juniperus communis, Juniperus horizontalis, Prunus pumila, Salix* spp., and *Toxicodendron rydbergii*. Tree seedlings can establish in times of limited disturbance but are usually killed by subsequent wave or ice-scour.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Stands are subject to frequent disturbance by wind, waves (with storm surges), and ice-scour. This leads to erosion or deposition of the sandy substrate by wind or water. The disturbances keep the beaches nearly free of vegetation.

ENVIRONMENT

Environmental Description: This type is found on sandy substrates with little or no soil development within a few meters elevation of the water. It rarely extends more than 30-50 m from the water. The sandy substrate is not stabilized by significant vegetation and is easily moved. Stands are subject to frequent disturbance by wind, waves, and ice-scour. In areas with abundant sand, such as Lake Michigan, this group can be found on long stretches of the shoreline, sometimes next to more vegetated dunes. In areas with less sand, this group is limited to protected bays or near river mouths where sand can accumulate.

DISTRIBUTION

***Geographic Range:** This group is found in along the margins of the Great Lakes from western Lake Superior to Lake Erie and possibly into Lake Ontario. It is most common along Lake Michigan and widely scattered or absent in other areas, such as the Minnesota shore and northern Lake Superior. In Minnesota it is largely confined to Minnesota Point in the estuary of the St. Louis River.
Nations: CA, US
States/Provinces: IL?, IN, MI, NY?, OH?, ON, PA?, VT, WI
USFS Ecoregions (2007) [optional]: 212Ha:CCC, 212Hf:CCC, 212Hl:CCP, 212J:CP, 212L:CP, 212Ra:CCP, 212Rc:CCP, 212S:CC, 212T:CC, 212Ya:CCC, 212Zc:CCP, 222Ia:CP?, 222Ja:CCC, 222Kg:CCC, 222Ua:CCP, 222Uc:CCP, 222Ud:CCP, 222Ue:CCP
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A4008	*Cakile edentula* Great Lakes Beach Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Great Lakes Beach	Epstein et al. 2002	
=	Sand Beach (Lake Superior) Type [LKu32c]	Minnesota DNR 2010b	
>	Sand and Gravel Beach	Kost et al. 2007	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. Drake, in Faber-Langendoen et al. (2013)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake
Acknowledgments [optional]:
Version Date: 05 May 2015

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2. Shrub & Herb Vegetation
2.B.4.Na. Eastern North American Coastal Scrub & Herb Vegetation

G342. Eastern North American Inland Beach & Rocky Shore

Type Concept Sentence: This group comprises wave-washed bedrock and cobble shores of inland lakes of the upper midwestern United States and Canada, exclusive of the Great Lakes.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.4.Na.1. Eastern North American Coastal Beach & Rocky Shore (M060)

Elcode: G342
***Scientific Name:** Eastern North America Inland Beach & Rocky Shore Group
***Common (Translated Scientific) Name:** Eastern North America Inland Beach & Rocky Shore Group
***Colloquial Name:** Eastern North American Inland Beach & Rocky Shore

***Type Concept:** This heterogeneous group encompasses primarily upland vegetation along lakeshores or rivershores in the upper midwestern United States and Canada, exclusive of the Great Lakes. Some areas may be briefly inundated during high water periods. The substrate is gravelly, cobbly, or consolidated rock. Soils are shallow or confined to crevices. Substrate is igneous and metamorphic bedrock, cobble, or gravel. These shores may be narrow zones of shrubs and/or sparse vegetation on rocky or gravelly shores. Little rangewide information from this group is available. Zonation in vegetation may be evident as a result of differential degree of overwash by waves or ice-scour. Shrubs may include *Alnus* spp., *Chamaedaphne calyculata, Myrica gale*, and *Spiraea alba*. Forbs and graminoids include *Agrostis* spp., *Campanula rotundifolia, Danthonia spicata, Iris versicolor, Lysimachia terrestris*, and *Sibbaldiopsis tridentata*.

***Diagnostic Characteristics:** Patchy to sparse mixtures of shrubs and herbs on gravelly to rocky inland lakeshores (exclusive of the Great Lakes), above the zone of regular inundation.

***Classification Comments:** Vegetation in these habitats has not been well-sampled. Description of this group is taken from Minnesota DNR (2003) description of Inland Lake Rocky Shore.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G764	Great Lakes Sand Beach	
G793	Great Lakes Coastal Rocky Shore	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Shrub- or herb-dominated vegetation, often patchy and/or sparse. These shores may be narrow zones of vegetation on rocks, cobble, or gravel shores.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Little rangewide information from this group is available; description of this group here is taken from Minnesota DNR (2003) description of Inland Lake Rocky Shore. Zonation may be evident where there are different degree of wave-wash or ice scour. Shrubs may include *Alnus* spp., *Chamaedaphne calyculata, Myrica gale*, and *Spiraea alba*. Forbs and graminoids include *Agrostis* spp., *Campanula rotundifolia, Danthonia spicata, Iris versicolor, Lysimachia terrestris*, and *Sibbaldiopsis tridentata (= Potentilla tridentata)*. Scattered trees usually occur at the upland border, and include *Betula papyrifera, Pinus banksiana, Pinus strobus*, and *Thuja occidentalis*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Wave action and ice-scour are important factors maintaining the open condition of vegetation, especially close to the water. These effects diminish with increasing distance from the shore. Water level fluctuation can change the width and placement of zones from year to year.

ENVIRONMENT

Environmental Description: *Climate:* Climate is north-temperate; the adjacent waterbodies freeze during the winter. *Soil/substrate/hydrology:* Some areas may be briefly inundated during high water periods. The substrate is gravelly, cobbly, or consolidated rock. Soils are shallow or confined to crevices. Substrate is igneous and metamorphic bedrock, cobble, or gravel.

DISTRIBUTION

***Geographic Range:** This group occurs across the upper midwestern United States to northern Minnesota, and adjacent Canada and occasionally southwards.
Nations: CA, US
States/Provinces: MB, ME, MI, MN, NY, ON, RI, WI
USFS Ecoregions (2007) [optional]: 211A:CP, 211B:CP, 211C:CP, 211D:CP, 211F:CC, 212Tb:CC, 221:C
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A4109	Inland Lake Non-alkaline Rocky Shore Alliance
A1862	Inland Lake Strand Beach Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Bedrock Shore (Inland Lake) Type [LKi43b]	Minnesota DNR 2003	
>	Boulder Shore (Inland Lake) Type [LKi43a]	Minnesota DNR 2003	
<	Inland Lake Rocky Shore Class [LKi43]	Minnesota DNR 2010a	
<	Inland Lake Sand/Gravel/Cobble Shore Class [LKi32]	Minnesota DNR 2010a	

AUTHORSHIP

***Primary Concept Source [if applicable]:** L. Sneddon, after Minnesota DNR (2010a)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler and L.A. Sneddon
Acknowledgments [optional]:
Version Date: 06 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Gawler, S. C., and A. Cutko. 2010. Natural landscapes of Maine: A classification of vegetated natural communities and ecosystems. Maine Natural Areas Program, Department of Conservation, Augusta.

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2. Shrub & Herb Vegetation
2.B.4.Na. Eastern North American Coastal Scrub & Herb Vegetation

M057. Eastern North American Coastal Dune & Grassland

Type Concept Sentence: This coastal grassland, shrubland and open vegetation type is found on well-drained to excessively drained sands on dunes and along shorelines around the Great Lakes and along the Atlantic and Gulf coasts, on rocky headlands in the North Atlantic, and sandplains near the New England coast.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.B.4.Na.2. Eastern North American Coastal Scrub & Herb Vegetation (D026)

Elcode: M057
***Scientific Name:** *Ammophila breviligulata - Uniola paniculata - Solidago sempervirens* Dune & Grassland Macrogroup
***Common (Translated Scientific) Name:** American Beachgrass - Sea-oats - Seaside Goldenrod Dune & Grassland Macrogroup
***Colloquial Name:** Eastern North American Coastal Dune & Grassland

***Type Concept:** This macrogroup encompasses coastal grasslands and shrublands along the Great Lakes, Lake Champlain, and Atlantic and Gulf coasts, occurring on sandy dunes and beaches along coastal shorelines and barrier islands, as well as on rocky headlands in the North Atlantic. It includes areas ranging from sparsely vegetated to lichen-dominated to grasslands and grassland-shrub complexes depending upon the degree of deposition, erosion, and distance from shore. Species composition varies geographically. Within the Great Lakes region and along the North Atlantic Coast, *Ammophila breviligulata* characterizes most herbaceous stands. *Schizachyrium scoparium* is common in many of these northern (not in Canada) sites as well. Common shrubs include *Arctostaphylos uva-ursi, Hudsonia tomentosa, Juniperus communis*, and *Juniperus horizontalis*. Some examples in the Great Lakes may also have a scattered overstory canopy dominated by *Pinus banksiana, Pinus resinosa*, and/or *Pinus strobus*, and on the Atlantic Coast, *Pinus rigida* or *Pinus taeda*. Along the Atlantic Coast *Morella pensylvanica* shrublands are common, and dwarf-shrubs include *Empetrum nigrum* or, less commonly, *Corema*. *Solidago sempervirens* is typical on Atlantic coastal sites. *Uniola paniculata* is diagnostic within sites along the South Atlantic Coast. *Panicum amarum* occurs on the foredunes, and *Spartina patens* and *Schizachyrium littorale* are common on the older dunes and sand flats. Soils are typically well-drained to excessively drained sands with little to no horizon development, or a thin patchy layer of organic material on rocky headlands. Heavy winds significantly impact these communities which can cause reworking of sand or by slower eolian processes. Sites along the Atlantic Coast are shaped by salt spray, overwash, and very high humidity. Fire suppression in the range of this macrogroup can cause an increase in woody species. Many areas have also been impacted by agriculture and grazing.

***Diagnostic Characteristics:** This vegetation is found on rocky headlands of the North Atlantic Coast, on coastal sandplains, and dynamic sandy dunes along and near shorelines of the Great Lakes, and Atlantic and Gulf coasts. Dunes are characterized by shifting sands and blowouts. The vegetation physiognomy ranges from sparsely vegetated to lichen-dominated to shrub-herb complexes and may contain a scattered coniferous overstory. *Ammophila breviligulata* is common in the Great Lakes and North Atlantic Coast examples and often occurs in conjunction with scattered low shrubs. *Solidago sempervirens* is characteristic on Atlantic coastal sites. In the South Atlantic and Gulf coasts, *Uniola paniculata* is the most common species.

***Classification Comments:** It is not clear to what extent inland sandplains with dune-like characteristics fall here. The term "dune" could be generalized to be "shoreline." The extent of this type inward from the beach can be difficult to define, as dunes become more stable. Coastal grasslands, particularly on limestone, around the Great Lakes may fit here or in Laurentian-Acadian Calcareous Scrub & Grassland Macrogroup (M507). Interdunal swales that have the diagnostic features of wetland types are excluded from this macrogroup. In the Canadian Maritimes, not all coastal headlands are rocky or even thin-soiled. In warmer areas, rock precludes tree development, hence the shrubland. In colder areas, trees (and in some cases taller shrubs) are excluded by harsh climatic influences. The soils/environmental setting of this type concept is heavily weighted to dune conditions (S. Basquill pers. comm. 2015).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M507	Laurentian-Acadian Calcareous Scrub & Grassland	includes coastal grasslands on limestone, some alvar-like, and may overlap with this vegetation, if rocky coastal areas are included.
M060	Eastern North American Coastal Beach & Rocky Shore	includes the tidal vegetation maintained at the tension zone between the marine and terrestrial realms, flooded irregularly by storm and neap tides.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The cover and structure of vegetation are highly variable across the range of this macrogroup. It can range from sparsely to completely vegetated and include lichen-dominated, herb-dominated, shrub-herb complexes, and shrub-dominated areas. Some examples within the Great Lakes and North Atlantic Coast may contain a scattered coniferous overstory.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This macrogroup includes a combination of grasslands, dwarf-shrublands, shrublands and open-treed savannas. On dunes along the Great Lakes and North Atlantic Coast, *Ammophila breviligulata* is the most common grass species (*Leymus mollis* may replace it northward in Newfoundland); *Ammophila champlainensis* is the most common grass on the shore of Lake Champlain. Other common species include *Calamovilfa longifolia, Panicum* spp., and *Schizachyrium scoparium*. In the Great Lakes, low evergreen shrubs such as *Arctostaphylos uva-ursi, Juniperus communis*, and *Juniperus horizontalis* occupy dune crests, dune fields, and also the ground layer in the savanna edge of dunes and sandplains. *Prunus pumila, Salix cordata*, and *Salix myricoides (= Salix glaucophylloides)* may occur, and *Pinus banksiana, Pinus resinosa, Pinus strobus*, and *Thuja occidentalis* often form a scattered overstory canopy. Coastal dunes of the Northeast are characterized by *Carex silicea, Cenchrus tribuloides, Hudsonia tomentosa, Lathyrus japonicus, Morella pensylvanica, Panicum amarum, Panicum virgatum, Polygonella articulata, Schizachyrium littorale, Schizachyrium scoparium*, and *Solidago sempervirens*.

Unusual expressions are sandplain grasslands and heathlands of the southern New England / New York coast. These are areas of graminoid- and shrub-dominated vegetation maintained by the combination of extreme conditions and periodic fire or other disturbance. Developing on acidic, nutrient-poor, and very well-drained soils within a few kilometers of the ocean, they may occur as heathlands, grasslands, or support a patchwork of grass and shrub vegetation. Characteristic species include *Amelanchier nantucketensis, Arctostaphylos uva-ursi, Carex pensylvanica, Corema conradii, Deschampsia flexuosa, Gaylussacia baccata, Hudsonia ericoides, Hudsonia tomentosa, Schizachyrium scoparium*, and *Vaccinium angustifolium*. Human disturbances may be partly responsible for the origins of these grasslands and heathlands (Motzkin and Foster 2002).

On rocky headlands of northern New England and Canadian Maritime Provinces, *Juniperus horizontalis* and *Juniperus communis* may occur, with *Empetrum nigrum, Plantago maritima, Solidago sempervirens*, and *Ligusticum scoticum*. Dwarf heath-grassland is dominated by *Festuca rubra, Aronia melanocarpa (= Photinia melanocarpa), Symphyotrichum novi-belgii, Vaccinium angustifolium, Vaccinium vitis-idaea*, among others. Low coastal shrublands are *Gaylussacia baccata*- or *Gaylussacia dumosa*-dominated. Tall shrublands are dominated by *Alnus incana ssp. rugosa, Ilex mucronata (= Nemopanthus mucronatus), Aronia x prunifolia (= Photinia floribunda), Prunus pensylvanica*, and *Viburnum nudum*. *Gaylussacia baccata* and *Morella pensylvanica* occur in the understory. Common herbs include *Pteridium aquilinum var. latiusculum, Trientalis borealis*, and *Maianthemum canadense* (S. Basquill pers. comm. 2015).

Along the South Atlantic Coast, *Panicum amarum* and *Uniola paniculata* are characteristic on the foredunes, and *Spartina patens (= var. monogyna)* and *Schizachyrium littorale* on the older dunes and sand flats. *Iva imbricata* is a characteristic shrub. Examples along the Gulf Coast contain *Ceratiola ericoides, Chrysoma pauciflosculosa, Helianthemum arenicola, Paronychia erecta*, and *Schizachyrium maritimum*. On the western Gulf Coast, this macrogroup includes ridges dominated by *Schizachyrium littorale* and a mixture of forbs, and swales dominated by *Andropogon gerardii, Muhlenbergia capillaris, Paspalum monostachyum*, and *Sorghastrum nutans*.

Dunes in the northern Great Lakes region, especially Lake Superior, shift in composition. A description is needed.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The environment of this macrogroup is one of the most dynamic in existence for terrestrial vegetation. The dunes are reworked by storms or by more gradual eolian processes that may completely change the local environment in a short time. Many of these sites are fairly early in the process of primary succession on recent surfaces. The sandy sites found in this macrogroup are influenced by wind deposition, including active dune processes of wind-caused "blowouts" and subsequent restabilization. Environmental processes include sand deposition, sand erosion, and stabilization. Along the Atlantic and Gulf coasts, overwash, erosion, and sea spray from storms occur often. Hurricanes and lesser storms significantly alter this vegetation on a regular basis. Vegetation interacts strongly with geologic processes with the presence of grass an important factor in the development of new dunes. Alteration of dynamic processes, such as artificial enhancement of dunes by planting or sand fencing, can have drastic effects on this vegetation, causing large areas to succeed to woody vegetation.

Great Lakes dunes are relatively young, as the Great Lakes were occupied by ice until approximately 16,000 years ago. The dune sands are derived from glacial sediments, including lacustrine and outwash sands and sandy tills. Most of the larger dune complexes are associated with the Lake Nipissing stage of the Great Lakes, when water levels were 7.6 to 9 m (25-30 feet) higher than present-day lake levels (Dorr and Eschman 1970, cited in Kost et al. 2007). These higher lake levels resulted in greater amounts of coastal erosion and dune formation. A combination of water erosion and wind deposition resulted in the formation of Great Lakes coastal dunes. The sand source for the coastal dunes was glacial sediment that was eroded by streams and by waves eroding bluffs along the Great Lakes shoreline. These sediments were then moved along the Great Lakes shoreline by near-shore currents, and then deposited along the shoreline by wave action. Strong winds then carried the sands inland, creating dunes. Blowouts, sand burial and abrasion, excessively well-drained and droughty soils, desiccating winds, and occasional fires maintain open conditions (Kost et al. 2007). Great Lakes dunes have been negatively impacted by residential development.

On dunes in the Northeast, this vegetation has been altered by hardening of shorelines, trampling, off-road vehicle traffic, and residential development. Barrier islands may be heavily grazed by wild horses.

ENVIRONMENT

Environmental Description: This macrogroup occurs on well-drained to excessively well-drained sands near shorelines along the Great Lakes, and Atlantic and Gulf coasts. Sites in the Great Lakes include beaches, embayments, sandplains and dunes, and include the full range of dune types, including foredunes, parallel dunes, parabolic dunes, perched dunes, blowouts, and barrier dunes (Kost et al. 2007). Along the Atlantic and Gulf coasts, sites also occur on coastal strands and barrier islands. Rocky headlands support this vegetation on the North Atlantic Coast. Soils are low in nutrient-holding capacity and have little or no horizon development. Sand movement across dunes, including dunal blowouts, strongly impact this macrogroup. Along the Atlantic and Gulf coasts, salt spray provides a source of nutrients and can strongly impact vegetation patterns.

DISTRIBUTION

***Geographic Range:** This macrogroup occurs along the Great Lakes shores of the United States and Canada ranging from Wisconsin to Ontario and New York and along the Atlantic Coast from the Maritime Provinces to southern Florida and along the Gulf Coast to Texas.
Nations: CA, MX, US
States/Provinces: AL, CT, DE, FL, GA, IL, IN, MA, MD, ME, MI, MN, MS, NC, NH, NJ, NS, NY, OH, ON, PA, RI, SC, TX, VA, VT, WI
USFS Ecoregions (2007) [optional]: 211Db:CCC, 211Ee:CCC, 212Ha:CCC, 212Hf:CCC, 212Hl:CCC, 212J:CC, 212L:CC, 212Ra:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC, 212Sb:CCC, 212Sc:CCC, 212Sn:CCC, 212Sq:CCC, 212Te:CCC, 212Ya:CCC, 212Zc:CPP, 221Aa:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ak:CCC, 221An:CCC, 222Ia:CC?, 222Ib:CCP, 222Ie:CCC, 222Ja:CCC, 222Kg:CCC, 222Ua:CCP, 222Uc:CCP, 222Ud:CCC, 222Ue:CCC, 232Ab:CCC, 232C:CC, 232D:CC, 232E:CC, 232Hc:CCC, 232I:CC, 232L:CC, 255D:CC, 315E:CC, 411A:CC

Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G494	South Atlantic & Gulf Coastal Dune & Grassland
G582	North Atlantic Coastal Rocky Headland
G493	North Atlantic Coastal Dune & Grassland
G089	Great Lakes Dune

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-05-28	M306 North American Atlantic Sea Cliff & Outcrop Macrogroup	M306 split & merged with M057

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	*Myrica* thicket	Chrysler 1930	
><	Beach Dune	FNAI 1990	
><	Coastal Grassland	FNAI 1990	
<	Coastal Heathland and Sandplain Grassland	Dunwiddie et al. 1996	
<	Middle beach	Chrysler 1930	
<	Upper beach	Chrysler 1930	

AUTHORSHIP

***Primary Concept Source [if applicable]:** M.A. Chrysler (1930); H.J. Oosting and W.D. Billings (1942); D.A. Albert (1995b); S.C. Gawler and A. Cutko (2010)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard, L. Sneddon, J. Cohen, and D. Faber-Langendoen
Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by Jim Drake, Sue Gawler and Sean Basquill.
Version Date: 21 May 2015

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2. Shrub & Herb Vegetation
2.B.4.Na. Eastern North American Coastal Scrub & Herb Vegetation

G494. South Atlantic & Gulf Coastal Dune & Grassland

Type Concept Sentence: This vegetation of sandy coastlines and barrier islands ranges along the Atlantic and Gulf coasts from North Carolina south to Texas. It includes somewhat sparse herbaceous dune vegetation, backdune shrublands and shrub-herb patchworks, non-tidal maritime grasslands, and temporarily flooded interdunal swales. Possible dominants include *Uniola paniculata* and *Panicum amarum* on the foredunes and *Spartina patens* and *Schizachyrium littorale* on the older dunes and sand flats, as well as many other species.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.4.Na.2. Eastern North American Coastal Dune & Grassland (M057)

Elcode: G494
***Scientific Name:** *Morella cerifera - Uniola paniculata - Schizachyrium littorale* Dune & Grassland Group
***Common (Translated Scientific) Name:** Wax-myrtle - Sea-oats - Shore Little Bluestem Dune & Grassland Group
***Colloquial Name:** South Atlantic & Gulf Coastal Dune & Grassland

***Type Concept:** This group encompasses vegetation of sandy coastlines and barrier islands, ranging from northernmost North Carolina south along the Atlantic Coast and around the coast of the Gulf of Mexico to Texas. A range of physiognomies may be present, from somewhat sparse herbaceous dune vegetation with *Uniola paniculata* diagnostic, to backdune shrublands and shrub-herb patchworks, non-tidal maritime grasslands, and temporarily flooded interdunal swales. Characteristic species of the dunes include *Uniola paniculata* and *Panicum amarum* on the foredunes, and *Spartina patens* and *Schizachyrium littorale* on the older dunes and sand flats. *Iva imbricata* is a characteristic shrub. On the northern Gulf Coast, this group includes a number of diagnostic and endemic plant species, including *Ceratiola ericoides, Chrysoma pauciflosculosa, Schizachyrium maritimum, Paronychia erecta*, and *Helianthemum arenicola*. On the western Gulf Coast, this group includes vegetation of eolian deposits of the South Texas Sand Sheet, with ridges dominated by *Schizachyrium littorale* and a mixture of forbs, and swales dominated by *Paspalum monostachyum, Andropogon gerardii, Muhlenbergia capillaris*, and *Sorghastrum nutans*. Dominant ecological processes are those associated with the maritime environment, including frequent salt spray, saltwater overwash, and sand movement, that can be severe enough to limit tree growth. The environment of this group is highly dynamic. Reworking of sand by storms or by slower eolian processes may completely change the local environment in a short time, and portions of the group may occupy sites fairly early in the process of primary succession.

***Diagnostic Characteristics:** This is distinctive vegetation of sandy coastlines and barrier islands from North Carolina south to Texas containing or dominated by *Uniola paniculata* and *Panicum amarum* on the foredunes and *Spartina patens* and *Schizachyrium littorale* on the older dunes and sand flats.

***Classification Comments:** This group shares physiognomic character and some species with the North Atlantic Coast analog North Atlantic Coastal Dune & Grassland Group (G493), but treating the two as one group results in one that ranges from Maine to Texas with almost no species in common at the extremes. The separation of the groups parallels broad-scale biogeographic and climatic differences believed to be important in this environment, and occurs more-or-less in the southern part of the Virginian Province (as labeled by Cowardin et al. 1979) as it transitions to the Carolinian Province around Cape Hatteras. A useful vegetation indicator of this transition is the shift in herbaceous dominance on the dunes from *Ammophila breviligulata* in the present group to *Uniola paniculata* in the south. Although the location of this shift itself is somewhat imprecise because of widespread planting of both species on artificially enhanced dunes, this boundary appears to be well approximated by Omernik Ecoregion 63g vs. 63d (EPA 2004).

North Atlantic versus South Atlantic meet in central Virginia (south of the James River - the cut-off line between Chesapeake Bay and Mid-Atlantic ecoregions). This is where *Uniola* and *Quercus virginiana* start up, and *Ammophila* drops out. *Prunus maritima* drops out in Maryland, a little farther north. (L. Sneddon pers. comm. 2012, but G. Fleming suggests this may be a line of convenience, and need further review). For more information on diagnostic criteria for the range limits of this group, see information in *Uniola paniculata - Panicum amarum* Dune Grassland Alliance (A1199).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G089	Great Lakes Dune	
G493	North Atlantic Coastal Dune & Grassland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The cover and structure of this vegetation is highly variable both in space and in time. It includes herb-dominated, mixed shrub-herb, and shrub-dominated vegetation with total cover ranging from sparse to nearly complete. Shrubs may be of various heights.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Characteristic species of the dunes include *Uniola paniculata* and *Panicum amarum* on the foredunes, and *Spartina patens (= var. monogyna)* and *Schizachyrium littorale* on the older dunes and sand flats. *Iva imbricata* is a characteristic shrub. On the northern Gulf Coast, this group includes a number of diagnostic and endemic plant species, including *Ceratiola ericoides, Chrysoma pauciflosculosa, Schizachyrium maritimum, Paronychia erecta*, and *Helianthemum arenicola*. On the western Gulf Coast, this group includes vegetation of eolian deposits of the South Texas Sand Sheet, with ridges dominated by *Schizachyrium littorale* and a mixture of forbs, and swales dominated by *Paspalum monostachyum, Andropogon gerardii, Muhlenbergia capillaris*, and *Sorghastrum nutans*. Other common herbs there include *Eragrostis* spp., *Paspalum plicatulum, Acalypha radians, Argythamnia mercurialina var. pilosissima, Chamaecrista flexuosa var. texana, Cnidoscolus texanus, Croton argyranthemus, Dalea phleoides, Froelichia floridana, Galactia canescens, Gaura mckelveyae, Helianthemum georgianum, Monarda fruticulosa (= Monarda punctata var. fruticulosa), Phlox cuspidata, Rhynchosia americana, Stillingia sylvatica*, and *Thelesperma nuecense*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**

***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The environment of this group is one of the most dynamic in existence for terrestrial vegetation. Reworking of sand by storms or by slower eolian processes may completely change the local environment in a short time, changing one association to another. Many of these sites are fairly early in the process of primary succession on recent surfaces. Chronic salt spray is an ongoing stress. Overwash and extreme salt spray from storms are frequent disturbances. Vegetation interacts strongly with geologic processes; the presence of grass is an important factor in the development of new dunes. Alteration of dynamic processes, such as artificial enhancement of dunes by planting or sand fencing, can have drastic effects on this vegetation, causing large areas to succeed to woody vegetation. Maritime grasslands on barrier islands and mainland areas near the coast of southern Texas, including grasslands of primary and secondary dunes, interdune swales, and barrier flats, naturally occurred as an open matrix of midgrass species within native mesquite - acacia shrublands dominated by *Acacia farnesiana, Acacia rigidula*, and *Prosopis glandulosa* but have become shrub-dominated due to a lack of fire. In many areas this vegetation has been virtually eliminated due to conversion to tame pasture, cropland, or due to lack of burning.

ENVIRONMENT

Environmental Description: *Soil/substrate/hydrology:* These are generally upland plant communities and less commonly non-flooded dune swale wetlands. Strong salt spray is an important influence on vegetation in many parts of the range. Overwash by seawater during storms is important on sand flats not protected by continuous dunes. On dunes, present or recent sand movement is an important factor. The combination of these factors prevents the dominance of woody vegetation. Sites may be either dry or saturated by freshwater from rainfall and the local water table. Areas connected to tidal influence and areas with ponded freshwater are placed in other systems. Soils are sandy, with little organic matter and little or no horizon development. Soils may be excessively drained on the higher dunes. Soils are low in nutrient-holding capacity, but aerosol input of sea salt provides a continuous source of nutrients. There is variation in vegetation patterns and patch size with the aspect of the barrier island.

DISTRIBUTION

***Geographic Range:** This group ranges on the Atlantic Coast from northern North Carolina (around Cape Hatteras) to central Florida, becoming sporadic around southern Florida, and then along the Gulf Coast west to Texas.
Nations: MX?, US
States/Provinces: AL, FL, GA, LA, MS, NC, SC, TX
USFS Ecoregions (2007) [optional]: 232C:CC, 232D:CC, 232E:CC, 232I:CC, 232L:CC, 255D:CC, 315E:CC, 411A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A1222	*Schizachyrium maritimum - Heterotheca subaxillaris* Dune Grassland Alliance
A3690	*Quercus virginiana - Ilex vomitoria - Morella cerifera* Shrubland Alliance
A3691	*Smilax auriculata - Toxicodendron radicans* Dune Vine Alliance
A3689	*Quercus geminata - Quercus myrtifolia* Dune Shrubland Alliance
A1199	*Uniola paniculata - Panicum amarum* Dune Grassland Alliance
A3687	*Andropogon capillipes - Panicum tenerum - Dichanthelium wrightianum* Wet Grassland Alliance
A3688	*Muhlenbergia filipes - Spartina patens* Dune Grassland Alliance
A3693	*Uniola paniculata - Muhlenbergia filipes - Ernodea littoralis* Subtropical Dune Grassland Alliance
A1029	*Vachellia farnesiana - Opuntia dillenii - Lycium carolinianum var. quadrifidum* Dune Scrub Alliance
A4061	*Spartina spartinae - Schizachyrium scoparium - Liatris bracteata* Saline Coastal Prairie Alliance
A1200	*Schizachyrium littorale - Paspalum monostachyum - Panicum amarum* Texas Coastal Grassland Alliance
A1061	*Chrysoma pauciflosculosa - Schizachyrium maritimum* Dune Scrub Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
><	Beach Dune	FNAI 1990	
><	Coastal Grassland	FNAI 1990	

AUTHORSHIP

***Primary Concept Source [if applicable]:** H.J. Oosting and W.D. Billings (1942)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler

Acknowledgments [optional]: Sean Basquill

Version Date: 05 May 2015

REFERENCES

***References [Required if used in text]:**

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van der Valk, A. G. 1975b. The floristic composition and structure of foredune plant communities of Cape Hatteras National Seashore. Chesapeake Science 16:115-126.

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2. Shrub & Herb Vegetation

2.B.4.Na. Eastern North American Coastal Scrub & Herb Vegetation

G582. North Atlantic Coastal Rocky Headland

Type Concept Sentence: This group comprises sparsely vegetated sea cliffs of northeastern Maine and adjacent Canada; vegetation is characterized by *Solidago sempervirens, Plantago maritima, Campanula rotundifolia*, and others.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.4.Na.2. Eastern North American Coastal Dune & Grassland (M057)

Elcode: G582
***Scientific Name:** *Solidago sempervirens - Juniperus horizontalis - Rhodiola rosea* Coastal Rocky Headland Group
***Common (Translated Scientific) Name:** Seaside Goldenrod - Creeping Juniper - Roseroot Stonecrop Coastal Rocky Headland Group
***Colloquial Name:** North Atlantic Coastal Rocky Headland

***Type Concept:** This group encompasses sparsely vegetated cliffs and shoreline outcrops along the North Atlantic Coast, primarily northeast of Penobscot Bay (Maine). Common species include *Achillea millefolium, Campanula rotundifolia, Festuca rubra, Plantago maritima, Prenanthes trifoliolata, Primula laurentiana*, and *Solidago sempervirens*. *Juniperus horizontalis* occurs in some locations and is indicative of the exposed coastal environment. In many locations, subarctic lithophilic plant species occur; these include *Euphrasia randii, Iris setosa, Lomatogonium rotatum, Rhodiola rosea*, and *Sagina nodosa ssp. borealis*. From Cobscook Bay east, *Dasiphora fruticosa ssp. floribunda* is also characteristic. Settings range from steep cliffs to nearly flat expanses of bedrock, all influenced by salt spray, frequent fog, and exposure to wind. Other sites include thin-soil areas, or cold-stressed sites. Dwarf heath-grassland is dominated by *Festuca rubra, Aronia melanocarpa, Symphyotrichum novi-belgii, Vaccinium angustifolium, Vaccinium vitis-idaea*, among others. Low coastal shrublands are *Gaylussacia baccata*- or *Gaylussacia dumosa*-dominated. Tall shrublands are dominated by *Alnus incana ssp. rugosa, Ilex mucronata, Aronia x prunifolia, Prunus pensylvanica*, and *Viburnum nudum*. *Gaylussacia baccata* and *Morella pensylvanica* occur in the understory. Common herbs include *Pteridium aquilinum var. latiusculum, Trientalis borealis*, and *Maianthemum canadense*.

***Diagnostic Characteristics:** Sparsely vegetated expanses of shoreline bedrock with some combination of *Solidago sempervirens, Plantago maritima, Achillea millefolium, Campanula rotundifolia*, and *Prenanthes trifoliolata*, along with other species.

***Classification Comments:** This group is primarily Canadian and is not currently well-described. Sean Basquill (pers. comm. 2015) suggests that rocky headlands could be a distinct macrogroup. That is, there is more ecological separation between coastal dunes and coastal (glacial) shrubland than there is between dunes (M057) and beaches (M060).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These shoreline outcrops support only sparse and patchy vegetation. Composition is mostly forb- and graminoid-dominated, with occasional dwarf-shrubs.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Common species include *Solidago sempervirens, Plantago maritima, Achillea millefolium, Campanula rotundifolia, Prenanthes trifoliolata*, and *Festuca rubra*. *Juniperus horizontalis* occurs in some locations and is indicative of the exposed coastal environment. In many locations, subarctic lithophilic plant species occur; these include *Rhodiola rosea, Iris setosa, Lomatogonium rotatum, Sagina nodosa ssp. borealis*, and *Euphrasia randii*. From Cobscook Bay east, *Dasiphora fruticosa ssp. floribunda* is also characteristic. Sea cliff plants noted from Labrador (Harshberger 1913) include *Cochlearia groenlandica (= Cochlearia officinalis), Ligusticum scoticum, Plantago maritima, Primula laurentiana, Puccinellia* spp., and *Rhodiola rosea (= Sedum roseum)*. Other sites include thin-soil areas, or cold-stressed sites. Dwarf heath-grassland is dominated by *Festuca rubra, Aronia melanocarpa (= Photinia melanocarpa), Symphyotrichum novi-belgii, Vaccinium angustifolium, Vaccinium vitis-idaea*, among others. Low coastal shrublands are *Gaylussacia baccata*- or *Gaylussacia dumosa*-dominated. Tall shrublands are dominated by *Alnus incana ssp. rugosa, Ilex mucronata (= Nemopanthus mucronatus), Aronia x prunifolia (= Photinia floribunda), Prunus pensylvanica*, and *Viburnum nudum*. *Gaylussacia baccata* and *Morella pensylvanica* occur in the understory. Common herbs include *Pteridium aquilinum var. latiusculum, Trientalis borealis*, and *Maianthemum canadense* (S. Basquill pers. comm. 2015).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Rocky sea cliffs and headlands experience high winds, salt spray, and occasional wave overwash during storms. Rocky sea cliffs experience erosion at the base by mechanical abrasion, and over the long term, can result in slumping. At higher latitudes, cold temperatures can cause frost-wedging of rock and eventual slumping (Emery and Kuhn 2013).

ENVIRONMENT

Environmental Description: Vegetation is exposed to wind, salt spray, fog, and direct sun. Soil development is minimal and limited to rock crevices where plants are rooted. Sites may also occur on thin soil, till.

DISTRIBUTION

***Geographic Range:** This group ranges from central Maine east through the Canadian Maritimes.
Nations: CA?, US
States/Provinces: ME, NS, QC
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3933	Eastern North American Coastal Cliff & Outcrop Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
?	Sea cliff formation	Harshberger 1913	
=	Seaside Goldenrod - Goosetongue Open Headland	Gawler and Cutko 2010	

AUTHORSHIP

***Primary Concept Source [if applicable]:** S.C. Gawler and A. Cutko (2010)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler, L.A. Sneddon and D. Faber-Langendoen
Acknowledgments [optional]: Sean Basquill
Version Date: 06 May 2015

REFERENCES

***References [Required if used in text]:**

Emery, K. O., and G. G. Kuhn. 1982. Sea cliffs: Their processes, profiles, and classification. Geological Society of America Bulletin 93(7):644-654.

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Fernald, M. L., and K. M. Wiegand. 1910. A summer's botanizing in eastern Maine and western New Brunswick. Rhodora 12:101-146.

Gawler, S. C., and A. Cutko. 2010. Natural landscapes of Maine: A classification of vegetated natural communities and ecosystems. Maine Natural Areas Program, Department of Conservation, Augusta.

Harshberger, J. W. 1913. Phytogeographic survey of North America. Bulletin of the American Geographical Society 45(1):38-42.

Olday, F. C., S. Gawler, and B. Vickery. 1983. Seven unusual sub-arctic plants of the Maine coast. A report prepared for the critical areas program, Maine State planning office.

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2. Shrub & Herb Vegetation

2.B.4.Na. Eastern North American Coastal Scrub & Herb Vegetation

G493. North Atlantic Coastal Dune & Grassland

Type Concept Sentence: This group encompasses northeastern maritime dune vegetation comprising grasses, low shrubs, dwarf-shrubs, and forbs ranging from sparse to patchy in cover. It occupies sandy coastlines and barrier islands, ranging from northernmost North Carolina northward to southern Maine where extensive sandy coastlines are replaced by rocky coasts.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.4.Na.2. Eastern North American Coastal Dune & Grassland (M057)

Elcode: G493
***Scientific Name:** *Morella pensylvanica - Ammophila breviligulata - Schizachyrium littorale* Dune & Grassland Group
***Common (Translated Scientific) Name:** Northern Bayberry - American Beachgrass - Shore Little Bluestem Dune & Grassland Group
***Colloquial Name:** North Atlantic Coastal Dune & Grassland

***Type Concept:** This group encompasses vegetation of sandy coastlines and barrier islands, ranging from northernmost North Carolina northward to southern Maine where extensive sandy coastlines are replaced by rocky coasts. A range of physiognomies may be present, from somewhat sparse herbaceous dune vegetation with *Ammophila breviligulata* diagnostic, to backdune shrublands, and shrub-herb patchworks on nearshore sandplains. Characteristic species (in different associations within the group) include *Ammophila breviligulata, Andropogon virginicus, Cenchrus tribuloides, Diodia teres, Hudsonia tomentosa, Morella pensylvanica, Panicum amarum, Panicum virgatum, Polygonella articulata, Schizachyrium littorale, Schizachyrium scoparium*, and *Solidago sempervirens*, among others. Dominant ecological processes are those associated with the maritime environment, including frequent salt spray, wind exposure, saltwater overwash, and wind-transported sand movement that are severe enough to limit tree growth. Vegetation in this group includes grasslands and shrublands of foredunes and more stabilized backdunes, as well as sandplain grasslands and heathlands of the southern New England / New York coast. In Atlantic Canada, coastal sandplain grasslands can also occur with 10s to 100s of meters from the coast. Most of the dwarf dune heath is *Empetrum* spp.-dominated, but some stands feature *Corema conradii* and *Hudsonia tomentosa*.

***Diagnostic Characteristics:** Restricted to maritime sand dunes and coastal sandplains; dominance by low shrubs and grasses, ranging from sparse to patchy in cover. This group does not include maritime forests also occurring on dunes.

***Classification Comments:** This group shares physiognomic character and some species with the Carolinian and Gulf coasts analog South Atlantic & Gulf Coastal Dune & Grassland Group (G494), but treating the two as one group results in one that ranges from Maine to Texas with almost no species in common at the extremes. The separation of the groups parallels broad-scale biogeographic and climatic differences believed to be important in this environment, and occurs more-or-less in the southern part of the Virginian Province (as labeled by Cowardin et al. 1979) as it transitions to the Carolinian Province around Cape Hatteras. A useful vegetation indicator of this transition is the shift in herbaceous dominance on the dunes from *Ammophila breviligulata* in the present group to *Uniola paniculata* in the south. Although the location of this shift itself is somewhat imprecise because of widespread planting of both species on artificially enhanced dunes, this boundary appears to be well approximated by Omernik Ecoregion 63g vs. 63d (EPA 2004). The group extends north to the end of extensive sandy coastlines and the beginning of rocky coasts.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G089	Great Lakes Dune	
G494	South Atlantic & Gulf Coastal Dune & Grassland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This vegetation is variable in structure, ranging from sparsely distributed grasses on foredunes, sometimes intermixed with low deciduous shrubs, to dwarf-shrublands of interdunes and low shrublands of coastal sandplains.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Morella pensylvanica, Ammophila breviligulata*, and *Hudsonia tomentosa* are species that distinguish this group from vegetation in similar habitats farther south. The foredune areas tend to be low in plant species richness but have a characteristic set of forbs and occasional low shrubs associated with them. Backdune areas may be dominated by a variety of herbs and sometimes have fairly high species richness. Characteristic species (in different associations within the group) include *Ammophila breviligulata, Andropogon virginicus, Cenchrus tribuloides, Diodia teres, Hudsonia tomentosa, Morella pensylvanica, Panicum amarum, Panicum virgatum, Polygonella articulata, Schizachyrium littorale, Schizachyrium scoparium*, and *Solidago sempervirens*, among others. *Schoenoplectus pungens* sometimes occurs in overwash areas where sand has buried interdunal wetlands. Heathland and sandplain grassland settings are characterized by *Amelanchier nantucketensis, Arctostaphylos uva-ursi, Carex pensylvanica, Corema conradii, Deschampsia flexuosa, Gaylussacia baccata, Hudsonia ericoides, Hudsonia tomentosa, Schizachyrium scoparium*, and *Vaccinium angustifolium*. They provide habitat for several rare or uncommon forbs, including *Liatris scariosa var. novae-angliae* and *Agalinis acuta*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The environment of this group is one of the most dynamic in existence for terrestrial vegetation. Reworking of sand by storms or by slower eolian processes may completely change the local environment in a short time, altering the substrate that effectively removes existing vegetation and provides new habitat for establishment of different vegetation. Some plants, such as *Ammophila breviligulata* and *Hudsonia tomentosa*, are well-adapted to sand burial and can send new shoots above the sand surface. Many of these sites are fairly early in the process of primary succession on recent surfaces. Chronic salt spray is an ongoing stress. Overwash and extreme salt spray from storms are frequent disturbances. Vegetation interacts strongly with geologic processes; the presence of grass is an important factor in the development of new dunes. Alteration of dynamic processes, such as artificial enhancement of dunes by planting or sand fencing, can have drastic effects on this vegetation, causing large areas to succeed to woody dominance. Limited areas along the New York and New England coastline support maritime sandplains, where sand movement is more limited but exposure to the elements is still high. The sandplain grasslands and heathlands that develop in these habitats have been affected by a combination of exposure, fire, and land use. Prior to European settlement, these habitats are believed to have occurred in limited areas near the coast, where the effects of wind and salt spray prevented tree growth; there may also have been patches in the vicinity of Native American settlements, based on the prevalence of charcoal in some palynological cores. Some heathlands may have developed on severely disturbed soils following the abandonment of agriculture and grazing.

ENVIRONMENT

Environmental Description: *Climate:* Vegetation in this group is subject to a north-temperate maritime climate. Wind and salt spray are important factors in vegetation development. *Soil/substrate/hydrology:* This vegetation occurs on coastal strands and barrier islands, on sand dunes and sand flats. Strong salt spray is an important influence on vegetation in many parts. Overwash by seawater during storms is important on sand flats not protected by continuous dunes. Overwash caused by coastal storms can profoundly change the character of the vegetation where it overwhelms dunes and deposits new sand over existing vegetation. On dunes, present or recent sand movement is an important factor. On sandplains away from the immediate shore, but still subject to maritime influence, sand movement is less of a factor but wind and salt spray remain important. The combination of these factors prevents the dominance of woody vegetation. Most sites may be dry, but some areas are temporarily wet by freshwater from rainfall and the local water table. Soils are sandy, with little organic matter and little or no horizon development. Soils may be excessively drained on the higher dunes. Soils are low in nutrient-holding capacity, but aerosol input of sea salt provides a continuous source of nutrients.

DISTRIBUTION

***Geographic Range:** This group ranges from northernmost North Carolina (EPA ecoregion 63d) and southeastern Virginia to southern Maine. The southern portion is a transition zone from around Kitty Hawk, North Carolina, to the Virginia-North Carolina border. The northern limit is around Merrymeeting Bay, Maine.
Nations: CA, US
States/Provinces: CT, DE, MA, MD, ME, NB, NC, NH, NJ, NS, NY, PE, RI, VA
USFS Ecoregions (2007) [optional]: 211Db:CCC, 221Aa:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ak:CCC, 221An:CCC, 232Ab:CCC, 232Hc:CCC, 232I:CC
Omernik Ecoregions L3, L4 [optional]: 8.1.7.59d:C, 8.1.7.59e:C, 8.5.1.63d:C, 8.5.4.84a:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A1274	*Spartina patens - Schoenoplectus pungens* Atlantic Overwash Dune Grassland Alliance
A1207	*Ammophila breviligulata* Dune Grassland Alliance
A0902	*Morella pensylvanica* Dune Shrubland Alliance
A3638	*Schizachyrium littorale - Schizachyrium scoparium* Northern Coastal Plain Grassland Alliance
A1062	*Hudsonia tomentosa* Dune Dwarf-shrubland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	*Andropogon Hempsteadi*	Cain et al. 1937	
<	*Hudsonietum tomentosi*	Conard 1935	
<	Beach heather community	Robichaud and Buell 1973	
<	Coastal Heathland and Sandplain Grassland	Dunwiddie et al. 1996	
<	Coastal sand dune	Dunlop and Crow 1983	
<	Dunegrass community	Robichaud and Buell 1973	
<	Middle beach	Chrysler 1930	
<	Myrica thicket	Chrysler 1930	
<	Upper beach	Chrysler 1930	

AUTHORSHIP

***Primary Concept Source [if applicable]:** M.A. Chrysler (1930)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler and L.A. Sneddon

Acknowledgments [optional]:

Version Date: 06 May 2015

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Harper, R. M. 1912. The Hempstead Plains of Long Island. Bulletin of the Torrey Botanical Club 12:277-287.

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Lundgren, J., B. Hammond, J. Stone, and L. Sneddon. 2000. Vegetation classification and mapping of Nantucket Island, Massachusetts. Final Draft. The Nature Conservancy, March 2000. 59 pp.

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Moul, E. T. 1969. Flora of Monomoy Island, Massachusetts. Rhodora 71:18-28.

Robichaud, B., and M. F. Buell. 1973. Vegetation of New Jersey. Rutgers University Press, New Brunswick, NJ. 340 pp.

Stalter, R., and E. E. Lamont. 1987. Vegetation of Hempstead Plains, Mitchell Field, Long Island, New York. Bulletin of the Torrey Botanical Club 114:330-335.

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2. Shrub & Herb Vegetation

2.B.4.Na. Eastern North American Coastal Scrub & Herb Vegetation

G089. Great Lakes Dune

Type Concept Sentence: This group is found on dunes within the Great Lakes and nearby New England lakes of the United States and Canada, and includes sparsely vegetated to open grasslands and shrublands, with scattered trees, influenced by sand deposition, sand erosion, and distance from the lake.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.4.Na.2. Eastern North American Coastal Dune & Grassland (M057)

Elcode: G089

***Scientific Name:** *Juniperus horizontalis - Ammophila breviligulata* Coastal Dune & Grassland Group

***Common (Translated Scientific) Name:** Creeping Juniper - American Beachgrass Coastal Dune & Grassland Group

***Colloquial Name:** Great Lakes Dune

***Type Concept:** This group occurs along the Great Lakes shores region of the United States and Canada. It often occurs within dunal complexes but can also occur on coastal shorelines, on sandy former lake embayments, and sandplains. Component plant communities vary from sparsely vegetated to communities dominated by a combination of grasses, shrubs, and scattered trees, depending on the degree of sand deposition, sand erosion, and distance from the lake. Depositional areas, where Great Lakes beachgrass foredunes and coastal beaches are found, are dominated by *Ammophila breviligulata* (or in the eastern part of the range *Ammophila champlainensis*). Erosional areas, such as slacks in blowouts and dunefields, may be dominated by *Calamovilfa longifolia*, and stabilized areas by *Schizachyrium scoparium*. Low evergreen shrubs (*Arctostaphylos uva-ursi, Juniperus communis, Juniperus horizontalis*) occupy dune crests and also the ground layer in the savanna edge of dunes and sandplains. Deciduous shrubs are dominant in many areas and include *Prunus pumila, Salix cordata*, and *Salix myricoides*. *Populus deltoides* can form an open overstory canopy, while *Juniperus communis, Juniperus horizontalis, Arctostaphylos uva-ursi*, and *Koeleria macrantha* form a scattered ground layer along low dunefields and sandplains with more advanced plant succession that often follows the first open dunes and swales. Due to lakeshore proximity, heavy winds commonly affect this group.

***Diagnostic Characteristics:** This group is found solely within the Great Lakes region of the United States and Canada and is composed of dwarf-shrublands, tall shrublands, grasslands, open woodlands, or sparsely vegetated beaches, or a complex of any of these communities depending on the distance from the lake along with the amount of sand deposition or erosion.

***Classification Comments:** Documented examples of this group are found at Apostle Islands National Lakeshore, Pictured Rocks National Lakeshore (especially along Grand Sable Dune), Indiana Dunes National Lakeshore, and Sleeping Bear Dunes National Lakeshore.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G493	North Atlantic Coastal Dune & Grassland	
G764	Great Lakes Sand Beach	
G494	South Atlantic & Gulf Coastal Dune & Grassland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Examples of this group may include dwarf-shrublands, tall shrublands, grasslands, open woodlands, or sparsely vegetated beaches, or a complex of any of these communities. These vegetative types are grouped according to substrate and proximity to Great Lakes shorelines.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This group contains one or a combination of grassland, dwarf-shrubland, shrubland, and open-treed savanna communities. *Ammophila breviligulata* (or in the eastern part of the range *Ammophila champlainensis*) occurs in many examples of this group and may range from sparse to moderate cover. It can form monocultures in some areas. Erosional areas, such as slacks in blowouts and dunefields, may be dominated by *Calamovilfa longifolia*, and stabilized areas by *Schizachyrium scoparium*. Low evergreen shrubs such as *Arctostaphylos uva-ursi, Juniperus communis*, and *Juniperus horizontalis* occupy dune crests and also the ground layer in the savanna edge of dunes and sandplains. *Prunus pumila, Salix cordata*, and *Salix myricoides (= Salix glaucophylloides)* may occur mixed with other species or as monocultures. *Populus deltoides* can form a scattered overstory canopy in some examples, while *Juniperus communis, Juniperus horizontalis, Arctostaphylos uva-ursi*, and *Koeleria macrantha* form a scattered ground layer along low dunefields and sandplains with more advanced plant succession that often follows the first open dunes and swales.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: This group is influenced by wind deposition including active dune processes of wind-caused "blowouts" and subsequent restabilization. Environmental processes include sand deposition, sand erosion, and stabilization. Open forested beach ridges may support fire regimes characteristic of similar upland forest systems outside of these complexes. Due to proximity to lakeshores, heavy winds and resultant windthrow are common and changes in water levels and wave disturbances can affect this group.

ENVIRONMENT

Environmental Description: This group occurs on gently sloping beaches, sandy lake embayments, sandplains, and dunes with any aspect. Sites range from somewhat steep, west-facing dune summits and kame terraces to moderate to gentle north- and northwest-facing shoreline to flat to moderate west- and south-facing transverse dunes. Dunal blowouts also are contained within this group. Soils are rapidly drained sand. Surficial geology is lacustrine sand and gravel and coarse-textured glacial till.

DISTRIBUTION

***Geographic Range:** This group occurs along the Great Lakes shores of the United States and Canada ranging from Wisconsin to Ontario and New York in the Great Lakes, and in isolated occurrences along the shores of Lake Champlain, Vermont.
Nations: CA, US
States/Provinces: IL, IN, MI, MN, NY, OH, ON, PA, VT, WI
USFS Ecoregions (2007) [optional]: 211Ee:CCC, 212Ha:CCC, 212Hf:CCC, 212Hl:CCC, 212J:CC, 212L:CC, 212Ra:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC, 212Sb:CCC, 212Sc:CCC, 212Sn:CCC, 212Sq:CCC, 212Te:CCC, 212Ya:CCC, 212Z:CC, 222Ib:CCP, 222Ie:CCC, 222Ud:CCC, 222Ue:CCC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3719	*Ammophila breviligulata - Juniperus* spp. Great Lakes Dune Grassland Alliance
A1493	*Populus deltoides* Dune Woodland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Wooded Dune and Swale Complex	Kost et al. 2007	

AUTHORSHIP

***Primary Concept Source [if applicable]:** D.A. Albert (1995b)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.E. Menard
Acknowledgments [optional]:
Version Date: 05 May 2015

REFERENCES

***References [Required if used in text]:**

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Comer, P., and D. Albert. 1993. A survey of wooded dune and swale complexes in Michigan. Michigan Natural Features Inventory, Natural Heritage Program. Lansing, MI. 158 pp.

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MNFI [Michigan Natural Features Inventory]. 1999. Natural community abstract for wooded dune and swale complex. Lansing, MI. 6 pp. Compiled by D. A. Albert and P. J. Comer.

2.C. Shrub & Herb Wetland

Shrub & Herb Wetland includes open bogs, fens, fresh and saltwater marshes, wet meadows and wet shrublands. The vegetation occurs from tropical to polar regions.

2.C.2. Temperate to Polar Bog & Fen

Temperate to Polar Bog & Fen includes temperate bogs and fens dominated by *Sphagnum* or brown mosses with ericaceous shrubs, graminoids, and low scrub tree growth forms, across the mid-latitudes of the Northern Hemisphere from 23° to 70°N, but is much less common in the southern mid-latitudes.

2.C.2.Na. North American Bog & Fen

This division includes open and treed bogs and fens throughout much of North America from the boreal zone in Canada south to northern California, montane areas in the western United States, the northern Great Plains, and much of the midwestern and northeastern United States and southeastern Canada.

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2. Shrub & Herb Vegetation
2.C.2.Na. North American Bog & Fen

M876. North American Boreal & Subboreal Bog & Acidic Fen

Type Concept Sentence: This boreal acidic bog and fen macrogroup extends across the boreal regions of North America, extending south into subboreal regions of the Pacific Maritimes and Rocky Mountains, the Great Lakes region and northeastern U.S. It is dominated by a continuous layer of *Sphagnum* mosses (sometimes submerged in bog pools), typically to depths exceeding 40 cm, as well as ericaceous dwarf-shrubs and thin-leaved graminoids. Scrub trees may be common, but trees are otherwise sparse.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.C.2.Na.1. North American Bog & Fen (D029)

Elcode: M876
***Scientific Name:** *Chamaedaphne calyculata - Vaccinium oxycoccos - Carex oligosperma* Bog & Acidic Fen Macrogroup

***Common (Translated Scientific) Name:** Leatherleaf - Small Cranberry - Few-seed Sedge Bog & Acidic Fen Macrogroup
***Colloquial Name:** North American Boreal & Subboreal Bog & Acidic Fen

***Type Concept:** This macrogroup extends across the boreal regions of North America, extending south into subboreal regions of the Pacific Maritime and Rocky Mountain divisions, Great Lakes region and northeastern U.S. It occurs where sufficiently cold climatic conditions allow the rate of peat accumulation to exceed its decomposition, resulting in ombrotrophic and acidic peatlands in which the bog surface is raised above the water table. Stands are dominated by a continuous layer of *Sphagnum* mosses (sometimes submerged in bog pools) and ericaceous dwarf-shrubs and thin-leaved graminoids. Scrub trees <2 m may be common, but trees >5 m are <10% cover. Dominant shrubs include *Andromeda polifolia, Betula nana, Chamaedaphne calyculata, Empetrum nigrum, Gaultheria hispidula, Kalmia polifolia, Ledum palustre ssp. decumbens, Ledum groenlandicum, Rubus chamaemorus, Vaccinium macrocarpon* (east), *Vaccinium oxycoccos, Vaccinium vitis-idaea*, and *Vaccinium uliginosum*. The herbaceous layer is typically graminoid-dominated. Species include *Carex aquatilis, Carex lasiocarpa, Carex livida, Carex membranacea, Carex microglochin, Carex oligosperma* (more eastern), *Carex pauciflora, Carex pluriflora, Carex rariflora* (more eastern), *Carex rotundata* (more eastern), *Carex stylosa, Eriophorum angustifolium, Eriophorum brachyantherum*, and *Eriophorum virginicum*. Graminoids common to both poorer and richer fens include *Carex chordorrhiza, Carex lasiocarpa*, and *Carex limosa* Insectivorous plants are common features of bogs and may include *Drosera intermedia, Drosera rotundifolia, Sarracenia purpurea*, and *Utricularia intermedia*. Trees include *Picea mariana, Picea glauca*, and *Larix laricina*.

Acidic peatlands range from strictly ombrotrophic bog (isolated from groundwater, precipitation-fed) to weakly minerotrophic poor fen. The surface morphology of a bog may be more-or-less level, domed, or eccentric, but typically is above the water table. As peat accumulates, ridges may form, which can be relatively dry compared to the flat areas. Secondary bog pools (schlenke) may be present in the raised portions of the peatlands. Peat deposits are composed primarily of partially decomposed *Sphagnum* mosses, and depth of peat exceeds 40 cm, separating this from similar wetlands that are non-peatlands. The water table is at or just above the surface, although the surface of some bogs is raised above the surrounding terrain.

In the eastern U.S., acidic peatlands extend southward through the Great Lakes and Northeast. Here *Sphagnum* and shrub peatlands occur in basins south through the Laurentian-Acadian region down to near the glacial boundary in the northeastern and north-central U.S. Unlike the true raised bogs of boreal regions, the vegetation is not raised above the groundwater level. The nutrient-poor substrate and the reduced throughflow of water create oligotrophic conditions fostering the development of *Sphagnum* peat and the growth of peatland vegetation. Although these peatlands are often called bogs, in most cases they are technically "poor fens," as the vegetation remains in contact with the weakly minerotrophic (nutrient-poor) groundwater.

In the Atlantic region, from Labrador to Downeast Maine, acidic peatlands take a somewhat different form. In basins, they develop raised plateaus with undulating sedge and dwarf-shrub vegetation. *Trichophorum cespitosum* may form sedge lawns on the raised plateau. The system may also occur as "blanket bogs" over a sloping rocky substrate in extreme maritime settings; here, dwarf-shrubs and *Sphagnum* are the dominant cover. Species characteristic of this maritime setting include *Empetrum nigrum* and *Rubus chamaemorus*. Typical bog heaths such as *Gaylussacia dumosa, Gaylussacia baccata, Kalmia angustifolia, Kalmia polifolia*, and *Ledum groenlandicum* are also present. Morphological characteristics and certain coastal species distinguish these from more inland acidic peatlands.

***Diagnostic Characteristics:** This macrogroup contains a continuous (>80% cover) layer of *Sphagnum* peatmoss (sometimes submerged in bog pools), to depths exceeding 40 cm, with ericaceous dwarf-shrubs and thin-leaved graminoids >25% cover. Scrub trees <2 m may be common, but trees >5 m are <10% cover. Diagnostic species include low ericaceous shrubs, including *Andromeda polifolia, Betula nana, Chamaedaphne calyculata, Empetrum nigrum, Gaultheria hispidula, Kalmia angustifolia* (east), *Kalmia polifolia, Ledum palustre ssp. decumbens, Ledum groenlandicum, Rubus chamaemorus, Vaccinium macrocarpon* (east), *Vaccinium oxycoccos, Vaccinium vitis-idaea*, and *Vaccinium uliginosum*. Ericaceous shrubs are typically >75% of total shrub cover. Trees, if present, include *Picea mariana* and *Larix laricina*. Graminoids such as *Carex oligosperma* (more east), *Carex magellanica ssp. irrigua, Carex pauciflora, Eriophorum vaginatum*, and *Eriophorum virginicum* are common in the herb layer, and together these graminoids have greater cover than medium to rich fen graminoid indicators (*Carex lasiocarpa, Carex livida, Carex interior, Carex limosa, Eriophorum viridicarinatum, Muhlenbergia glomerata, Trichophorum alpinum*). Species diversity is low.

***Classification Comments:** North American arctic bog was moved under this macrogroup, based on the view from Alaskan ecologists that arctic bogs (which are uncommon) are not that different from boreal bogs. Strong diagnostic species that separate eastern from western acidic peatlands are not currently known. Clarification of the limits of this type with respect to Vancouverian (North Pacific) and Rocky Mountain acidic fens is also needed. Forested acidic bogs and fens (poor swamps) are not included here [see North American Boreal Conifer Poor Swamp Macrogroup (M299), but that concept is under review (as of May 2014)]. There is a shift in composition and physiognomy from north to south, including from evergreen conifers and shrubs to deciduous shrub and hardwood species.

Inclusion of "northern temperate" (subboreal) acidic peatlands and Atlantic maritime peatlands needs review; they may need to be separated out into distinct macrogroups (K. Baldwin pers. comm. 2014).

Both this macrogroup (M876) and North American Boreal & Subboreal Alkaline Fen Macrogroup (M877) are organic wetlands or peatlands in the Canadian wetland classification system. The Canadian system separates bogs from fens based on the influence of nutrient-rich groundwater in fens, which is missing in bogs. However, here we include poor fens with bogs because both bogs and poor fens tend to be acidic, are similar in vascular species composition, and are dominated by *Sphagnum* spp. in the bryophyte layer.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M299	North American Boreal Conifer Poor Swamp	
M063	North Pacific Bog & Fen	
M877	North American Boreal & Subboreal Alkaline Fen	
M061	Eastern North American Cool Temperate Seep	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This macrogroup contains a continuous (>80% cover) layer of *Sphagnum* moss (sometimes submerged in bog pools). The vegetation is otherwise dominated by low ericaceous shrubs with patches of conifers, graminoids and bryophyte lawns. Stunted trees may form a partial to moderate cover over parts of the peatland, but the tree layer is <10% cover (Damman and French 1987). The overall topography of acidic peatlands is flat to gently undulating with microtopography characterized by hummocks and hollows (Heinselman 1963, Vitt and Slack 1975, Wheeler et al. 1983, Glaser et al. 1990). The pronounced microtopography in these systems leads to extreme and fine-scale gradients in soil moisture and pH (Bridgham et al. 1996).

The landscape morphology of acidic peatlands is often very striking. A variety of approaches has been taken to describe these forms: in Maine, see Davis and Anderson (2001); in Canada, see National Wetlands Working Group (1988); and in Minnesota see Glaser (1992a). In Canada, bog and fen peatlands each have their own set of forms. In Minnesota, Glaser treats bogs and fens together as part of larger patterned peatland complexes (mire complexes). Particularly distinctive are the ribbed bogs or fens in which a pattern of narrow (2- to 3-m wide), low (less than 1 m deep) ridges are oriented at right angles to the direction of the drainage (National Wetlands Working Group 1988). Wet pools or depressions occur between the ridges. These patterned peatlands may include string bog, Atlantic ribbed fen, or northern ribbed fen (National Wetlands Working Group 1988). They develop almost entirely north of 46°N latitude in east-central Canada and the adjacent U.S. They are minerotrophic peatlands in which the vegetation has developed into a pattern of strings (raised, usually linear features, and often more acidic) and flarks (wet depressions separating the strings, often less acidic). These patterned peatlands usually develop in open basins and flat plains, and the patterned portion may occupy only a fraction of the entire peatland. The edge of the basin may be shallow to deep peat over a sloping substrate, where seepage waters provide nutrients.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: In the western part of the range, the stunted and sparse tree layer includes *Picea mariana* and *Larix laricina* (*Picea glauca* is occasionally present). Dominant shrubs include *Andromeda polifolia, Betula nana, Chamaedaphne calyculata, Empetrum nigrum, Kalmia polifolia, Ledum groenlandicum, Ledum palustre ssp. decumbens, Rubus chamaemorus, Vaccinium oxycoccos, Vaccinium uliginosum*, and *Vaccinium vitis-idaea*. The herbaceous layer is typically graminoid-dominated. Species include *Carex chordorrhiza, Carex lasiocarpa, Carex limosa, Carex livida, Carex membranacea, Carex microglochin, Carex pauciflora, Carex pluriflora, Carex rariflora* (more eastern), *Carex rotundata* (more eastern), *Carex stylosa, Eriophorum brachyantherum*, and *Eriophorum angustifolium*. Dominant mosses include, among others, *Sphagnum fuscum* and *Sphagnum capillifolium (= Sphagnum nemoreum)* (Horton et al. 1979). In the Rocky Mountains, acidic fens associated with peatlands more closely resemble the vegetation of bogs, with sphagnum mosses and ericaceous shrubs. Dominant species include *Carex aquatilis, Carex livida, Carex lasiocarpa, Dulichium arundinaceum, Ledum glandulosum*, and *Trichophorum cespitosum* (Cooper 1986b, Windell et al. 1986, Steen and Coupé 1997).

In the east, tree species include *Picea mariana, Picea glauca*, and *Larix laricina* (less commonly *Picea glauca, Abies balsamea* and *Thuja occidentalis*). Dwarf-shrubs include *Andromeda polifolia, Chamaedaphne calyculata, Kalmia polifolia, Ledum groenlandicum, Vaccinium macrocarpon, Vaccinium oxycoccos*, and occasionally *Gaultheria hispidula* or *Betula pumila*. Rarely, tall ericaceous shrubs such as *Vaccinium corymbosum* (northeast temperate peatlands) are dominant. Common sedges include *Carex magellanica ssp. irrigua (= Carex paupercula)* and *Carex oligosperma*. Graminoids common to both poorer and richer fens include *Carex chordorrhiza, Carex lasiocarpa*, and *Carex limosa*. Other herbs include *Eriophorum vaginatum, Eriophorum virginicum, Menyanthes trifoliata*, and *Scheuchzeria palustris*. Dominant mosses include *Sphagnum fuscum* and *Sphagnum magellanicum*, and less commonly *Sphagnum angustifolium*. *Pleurozium schreberi* can be common on raised mats (Harris et al. 1996, Minnesota DNR 2003). Insectivorous plants are common features of acidic peatlands and may include *Drosera rotundifolia, Drosera intermedia, Sarracenia purpurea*, and *Utricularia intermedia*. *Rhynchospora alba, Xyris montana*, and *Xyris torta* can be especially common on floating mats (Kost et al. 2007).

In the Atlantic region, from Labrador to Downeast Maine, acidic peatlands develop raised plateaus with undulating sedge and dwarf-shrub vegetation. *Trichophorum cespitosum* may form sedge lawns on the raised plateau. The system may also occur as "blanket bogs" over a sloping rocky substrate in extreme maritime settings; here, dwarf-shrubs and *Sphagnum* are the dominant cover. Species characteristic of this maritime setting include *Empetrum nigrum* and *Rubus chamaemorus*. Typical bog heaths such as *Gaylussacia dumosa, Gaylussacia baccata, Kalmia angustifolia, Kalmia polifolia*, and *Ledum groenlandicum* are also present. *Betula michauxii* may also be common. Morphological characteristics and certain coastal species distinguish these from more inland acidic peatlands.

Further south in the sub-boreal region, two major physiognomic types occur: first, the ericaceous dwarf-shrub bog, often dominated by *Chamaedaphne calyculata*, sometimes with distinctive southern and coastal elements such as *Gaylussacia dumosa, Ilex glabra*, and *Morella pensylvanica*, and with other constant and dominant species, including *Kalmia angustifolia* (east), *Kalmia polifolia* (north),and *Ledum groenlandicum* (north); and second, a tall-shrub peat thicket dominated by deciduous ericaceous shrubs, especially *Vaccinium corymbosum* (*Ilex verticillata* and *Cephalanthus occidentalis* can dominate on shallower peat and the moat along the bog border), and wet peatland margins. Graminoids such as *Carex oligosperma, Carex magellanica ssp. irrigua (= Carex paupercula), Eriophorum angustifolium* (north and midwest), *Eriophorum virginicum* (throughout and southward), and *Eriophorum vaginatum* are common in the herb layer. Some peatlands may have a sparse tree layer (<10% cover) or stunted (<2 m) stems of *Larix laricina, Picea mariana*, or *Acer rubrum*. Somewhat richer sites may include *Myrica gale* and *Dulichium arundinaceum* (Damman and French 1987). Distinctive southern shrubs present include *Alnus serrulata, Clethra alnifolia, Gaylussacia frondosa, Lyonia ligustrina, Rhododendron periclymenoides (= Rhododendron nudiflorum), Rhododendron viscosum*, and *Toxicodendron vernix (= Rhus vernix)*. Diagnostic southern herbs include *Woodwardia virginica*. More northern (but not boreal) shrubs include *Alnus incana ssp. rugosa (= Alnus rugosa), Alnus viridis* (along coast), *Ilex mucronata (= Nemopanthus mucronatus)*, and *Viburnum nudum var. cassinoides* (Damman and French 1987).

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In boreal wetlands the general successional trend is sometimes portrayed as proceeding from marsh to fen to treed bog. Although often true (Klinger and Short 1996), succession is not necessarily directional, and environmental conditions, such as nutrient content and abundance of groundwater, may prevent fens from developing into bogs (Zoltai et al. 1988). Succession can begin in shallow ponds or low-lying wetlands formed by processes such as glacial recession and floodplain dynamics (oxbows) or thermokarst. An organic root mat typically develops and is either anchored to the mineral soil or floating on water such as a pond's edge. Over time, peat-forming mosses and sedges may fill in the basin. As the peat layer develops, low and/or dwarf-shrubs become established. Dwarf-trees may establish on the well-developed peat and also around the margin of the peatland.

Many researchers have reported fire as a significant part of the disturbance regime of bogs (Dean and Coburn 1927, Gates 1942, Curtis 1959). The role of fire disturbance in acidic peatlands needs review.

Beaver, through their dam-building activities, can cause substantial hydrologic change to peatland systems, either causing flooding or the lowering of the water table, depending on the location of the peatland in relation to the dam (Gates 1942, Curtis 1959, Heinselman 1963, Jeglum 1975, Futyma and Miller 1986, cited in Kost et al. 2007).

Many peatlands on the Kenai Lowland formed in kettles after remnant glacial ice melted. In this region there is a trend toward peatlands drying and ponds shrinking and filling in. Permafrost degradation leading to collapse scars and thaw ponds is common in boreal Alaska, and studies from the Tanana Flats show areas of widespread degradation. Thaw ponds form when ice-rich permafrost degrades and collapses forming a basin. Aquatic plants rapidly colonize the pond. Over time, marsh plants and sphagnum mosses invade creating peatland conditions. This trend is leading to widespread ecosystem conversion in the Tanana Flats (Jorgenson et al. 2001b). If a collapse scar is isolated, succession follows a bog development model, whereas in an open hydrologic setting, succession follows a fen development model. Pond systems may become connected as adjacent permafrost thaws.

ENVIRONMENT

Environmental Description: Sites are generally hummocky with gently to more steeply (up to 8°) sloping terrain. Peatlands form where the rate of peat accumulation exceeds its decomposition, resulting in ombrotrophic and acidic peatlands in which the bog surface may be raised above the water table. Sites are found in depressions, on acidic seepage slopes, with either ombrotrophic or weakly minerotrophic groundwater. They occur in a variety of landforms, including peat bog-lake systems (lake-fill bogs, moat bogs, and pond border bogs), perched water-peatland systems in valleys and depressions, peat bog-stream systems, and ombrogenous peatland systems, including raised bogs (Damman and French 1987). Permafrost is only present in boreal Alaska and northern Canada, where it may form permafrost plateaus (Camill 1999). Where permafrost is present, thermokarst pools may result in roughly circular open pools with floating carpets of *Sphagnum riparium* and *Sphagnum jensenii*, with low *Sphagnum angustifolium* mounds in shallow spots (Horton et al. 1979, L. Allen pers. comm. 2014).

Acidic peatlands found in kettle depressions are associated with active or extinct glacial lakes. Within kettle depressions, the "kettle bogs" can occupy the entire basin or frequently occur as a mat (floating or grounded) on the margin of the remaining glacial lake. When bogs and poor fens occur along the edge of large bodies of water, they are found in sheltered bays or coves that are protected from wave and ice action, which can prevent the development of peat or erode existing peat mats. Those occurring on former glacial lakebeds and drainageways tend to be more extensive than kettle bogs, which are limited in area by the size of the glacial ice-block that formed the basin (Kost et al. 2007).

In the northeastern United States, true bogs may reach their core southern limit in Maine and extreme northern New Hampshire and Vermont (Damman and French 1987, figure 3), though isolated occurrences are possible southward, including in New York. Southward poor fens are found in areas where glacial stagnation left coarse deposits and glacial depressions (many are "kettleholes"). The basins are generally closed, i.e., without inlets or outlets of surface water, and typically small in area. The nutrient-poor substrate and the reduced throughflow of water create oligotrophic conditions fostering the development of *Sphagnum* peat and the growth of peatland vegetation. These acidic peatlands occur in a variety of landforms, including peat bog-lake systems (lake-fill bogs, moat bogs, and pond border bogs), perched water-peatland systems in valleys and depressions, and more rarely peat bog-stream systems.

In the Rocky Mountains, fens are wetlands that develop where a relatively constant supply of groundwater maintains saturated conditions and the water chemistry reflects the mineralogy of the local soils and geological materials (Bedford and Godwin 2003). Organic soil of partially decomposed peat has a minimum depth of 40 cm (although some authors use 30-cm depth criteria). Acidic fens arise either because the groundwater accounts for only a small fraction of the annual water budget or because groundwater inputs move through materials with low solubility and are non-calcareous (e.g., basalt gneiss, granite) or have low buffering capacity (e.g., sand, quartz) (Bedford and Godwin 2003).

DISTRIBUTION

***Geographic Range:** This macrogroup extends across the western boreal regions of North America, extending south into subboreal regions of the Pacific Maritime and Rocky Mountain divisions. In the east, it extends across the boreal regions of central and eastern Canada and southward into adjacent subboreal and cold temperate regions of Canada and northeast and north-central United States. It occurs infrequently throughout the mountains of the Interior West, the Sky Islands of Arizona and high mountains and plateaus of Nevada and Utah, and the Rocky Mountains of Utah, Colorado, Wyoming, Montana, Idaho, and north into interior Canada, where it is known from interior (non-coastal) British Columbia, Alberta and Alaska. It is associated with the glacial terminus or stagnation zones, and interior from the Atlantic Coastal Plain. Maritime examples occur near the coast from eastern Maine (Mount Desert Island) eastward into the Canadian Maritimes and the coast of Labrador. Subboreal acidic peatlands are found in lower New England and southern New York, south to Pennsylvania, New Jersey and high montane regions of West Virginia, and westward to extreme southern Ontario, northern Ohio, northern Indiana and Illinois, Michigan and Wisconsin.
Nations: CA, US
States/Provinces: AB, AK, BC, CT, ID?, IL, IN, MA, MB, ME, MI, MN, MT, NB, NH, NJ, NS, NT, NY, OH, ON, OR?, PA, PE?, QC, RI, SK, VT, WA?, WI, WV, YT
USFS Ecoregions (2007) [optional]: 211A:CP, 211E:CC, 211F:CC, 211I:CC, 211J:CC, 212Ha:CCP, 212Hb:CCP, 212Hc:CCP, 212Hd:CCP, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCP, 212Hi:CCC, 212Hj:CCP, 212Hk:CCC, 212Hl:CCC, 212Hm:CCP, 212J:CC, 212K:CC, 212L:CC, 212M:CC, 212N:CC, 212Q:CP, 212Ra:CCP, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC, 212S:CC, 212Tb:CCC, 212Te:CCP, 212X:CC, 212Y:CC, 212Z:CC, 221A:CC, 221B:CC, 221D:CC, 221E:CC, 221Fa:CCC, 222H:CC, 222I:CC, 222Ja:CCC, 222Jb:CCC, 222Jc:CCC, 222Je:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222R:CC, 222Ua:CCP, 222Ud:CCC, 222Ue:CCC, M211A:CP, M211B:CP, M211C:CC, M242D:??
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G748	Eastern North American Boreal Bog & Acidic Fen

Elcode	Scientific or Colloquial Name
G745	Eastern North American Subboreal Bog & Acidic Fen
G515	Rocky Mountain Acidic Fen
G360	Western North American Boreal Bog & Acidic Fen

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-11-18	M064 Carex limosa - Eleocharis quinqueflora - Carex buxbaumii Rocky Mountain Fen Macrogroup	M064 split into M876 & M877

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Bog Wetland Class	National Wetlands Working Group 1988	
=	Bog and Poor Fen	Kost et al. 2007	
=	Bog and Poor Fen	Cohen et al. 2015	
>	Peatlands	Mitsch and Gosselink 2000	

AUTHORSHIP

***Primary Concept Source [if applicable]:** National Wetlands Working Group (1988)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** D. Faber-Langendoen, G. Kittel, M. Reid, M. Hall, K. Boggs, T. Boucher, S.C. Gawler

Acknowledgments [optional]:

Version Date: 29 Mar 2017

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2. Shrub & Herb Vegetation
2.C.2.Na. North American Bog & Fen

G748. Eastern North American Boreal Bog & Acidic Fen

Type Concept Sentence: These acidic peatlands are found in eastern boreal regions of central and eastern Canada and southward into adjacent subboreal regions of northeast and north-central United States. Species diversity is low. Dwarf-shrubs include *Chamaedaphne calyculata, Ledum groenlandicum, Kalmia polifolia, Andromeda polifolia, Vaccinium oxycoccos, Vaccinium macrocarpon*, occasionally *Gaultheria hispidula* or *Betula pumila*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.2.Na.1. North American Boreal & Subboreal Bog & Acidic Fen (M876)

Elcode: G748
***Scientific Name:** *Chamaedaphne calyculata - Carex oligosperma - Kalmia polifolia* Boreal Bog & Acidic Fen Group
***Common (Translated Scientific) Name:** Leatherleaf - Few-seed Sedge - Bog Laurel Boreal Bog & Acidic Fen Group
***Colloquial Name:** Eastern North American Boreal Bog & Acidic Fen

***Type Concept:** These acidic peatlands are found in eastern boreal regions of central and eastern Canada and southward into adjacent subboreal regions of northeast and north-central United States. Climates are cold enough to allow the rate of peat accumulation to exceed its decomposition. They contain a continuous (>80% cover) layer of *Sphagnum* mosses (sometimes submerged in bog pools), to depths exceeding 40 cm, with ericaceous dwarf-shrubs and thin-leaved graminoids >25% cover. Scrub trees <2 m may be common, but trees >5 m are <10% cover. Acidic peatlands range from strictly ombrotrophic bog (isolated from groundwater, precipitation fed) to weakly minerotrophic poor fen. They occur in extensive areas of low flats, or develop in open or closed, relatively shallow basins with nutrient-poor and acidic conditions. Many occur in association with larger lakes or streams. Some occur as kettlehole fens (usually called kettlehole "bogs") associated with eskers or other glacial deposits. Poor fens often develop adjacent to open water and may form a floating mat over water. The surface morphology of a bog may be more-or-less level, domed, or eccentric, but typically is above the water table. As peat accumulates, ridges may form, which can be relatively dry compared to the flat areas. Secondary bog pools (schlenke) may be present in the raised portions of the peatlands. *Sphagnum* mosses play a key role in these systems because they trap base cations, causing the organic soils to acidify, and they retain moisture, thus slowing the decomposition rate and promoting peat accumulation. Species diversity is low. Dwarf-shrubs include *Chamaedaphne calyculata, Ledum groenlandicum, Kalmia polifolia, Andromeda polifolia, Vaccinium oxycoccos, Vaccinium macrocarpon*, occasionally *Gaultheria hispidula* or *Betula pumila*. Rarely, tall ericaceous shrubs such as *Vaccinium corymbosum* are dominant. Common sedges include *Carex oligosperma, Carex chordorrhiza, Carex magellanica ssp. irrigua, Carex limosa*, and *Carex lasiocarpa*. Other herbs include *Eriophorum vaginatum, Eriophorum virginicum, Drosera rotundifolia, Menyanthes trifoliata, Sarracenia purpurea*, and *Scheuchzeria palustris*. When present, stunted *Picea mariana* and *Larix laricina* are the dominant trees. Dominant mosses include *Sphagnum fuscum* and *Sphagnum magellanicum*, and less commonly *Sphagnum angustifolium*. *Pleurozium schreberi* can be common on raised mats.

In the Atlantic region, from Labrador to Downeast Maine, acidic peatlands take a somewhat different characteristics. In basins, they develop raised plateaus with undulating sedge and dwarf-shrub vegetation. *Trichophorum cespitosum* may form sedge lawns on the raised plateau. The system may also occur as "blanket bogs" over a sloping rocky substrate in extreme maritime settings; here, dwarf-shrubs and *Sphagnum* are the dominant cover. Species characteristic of this maritime setting include *Empetrum nigrum* and *Rubus chamaemorus*. Typical bog heaths such as *Kalmia angustifolia, Kalmia polifolia, Gaylussacia baccata, Ledum groenlandicum*, and *Gaylussacia dumosa* are also present. Morphological characteristics and certain coastal species distinguish these from more inland acidic peatlands.

***Diagnostic Characteristics:** This type contains a continuous (>80% cover) layer of *Sphagnum* peat moss (sometimes submerged in bog pools), to depths exceeding 40 cm, with ericaceous dwarf-shrubs and thin-leaved graminoids >25% cover. Scrub trees <2 m may be common, but trees >5 m are <10% cover. Diagnostic species include low ericaceous shrubs, including *Kalmia angustifolia, Kalmia polifolia, Ledum groenlandicum*, and *Chamaedaphne calyculata*. Ericaceous shrubs are typically >75% of total shrub cover. Trees, if present, include *Picea mariana* and *Larix laricina*. Graminoids such as *Carex oligosperma, Carex magellanica ssp. irrigua, Eriophorum* *vaginatum, Eriophorum virginicum* are common in the herb layer, and together these graminoids have greater cover than medium to rich fen graminoids indicators (*Carex lasiocarpa, Carex livida, Carex interior, Carex limosa, Muhlenbergia glomerata, Trichophorum alpinum, Eriophorum viridicarinatum*). Species diversity is low. Species of southern acidic peatlands (Laurentian-Acadian region) are absent [see Eastern North American Sub-Boreal Acidic Bog & Fen Group (G745)].

***Classification Comments:** The concept for this group is under review with Canadian ecologists; the current concept overlaps with Eastern North American Subboreal Bog & Acidic Fen Group (G745). This group corresponds in geography to Glaser and Janssens' (1986) forested and "semi-forested continental bogs," but is somewhat different in scope as it includes both the raised bogs and the flat bogs, and emphasizes the open scrub-herb vegetation. Eastward, this type includes Acadian Maritime Bog. Northwestward in northern Ontario, continental non-forested bogs are common (Glaser and Janssens 1986, figure 2). These acidic peatlands may overlap in common terminology with that of "muskeg," a flat bog peatland with scattered trees and a fairly dense shrub layer on hummocky peat, but muskeg could include poor fens and acidic swamps as well as bogs, as does the term "mire" (Rydin and Jeglum 2006). Placement of forested stands on raised bogs is a challenge. Currently, to be consistent with physiognomic criteria, they are placed in Ontario-Québec Boreal Black Spruce Poor Swamp Group (G806) or Atlantic Boreal Black Spruce - Balsam Fir Poor Swamp Group (G807), provided they typically exceed 5 m in height.

This group is largely absent from the Laurentian-Acadian region.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G807	Atlantic Boreal Black Spruce - Balsam Fir Poor Swamp	
G806	Ontario-Québec Boreal Black Spruce Poor Swamp	
G804	Eastern North American Boreal Alkaline Fen	
G360	Western North American Boreal Bog & Acidic Fen	
G185	Eastern North American Subboreal Alkaline Fen	
G745	Eastern North American Subboreal Bog & Acidic Fen	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The vegetation of acidic peatlands is dominated by low ericaceous shrubs with patches of conifers, graminoids and bryophyte lawns, or more open forest, where trees may form a partial cover over parts of the peatland (but <10% cover for trees over 5 m). The organic peat layer typically exceeds 40 cm, dominated by *Sphagnum* mosses.

The landscape morphology of acidic peatlands is often very striking. A variety of approaches has been taken to describe these forms: in Maine, see Davis and Anderson (2001); in Canada, see National Wetlands Working Group (1988), and in Minnesota see Glaser (1992a). In Canada, bog and fen peatlands each have their own set of forms. In Minnesota, Glaser treats bogs and fens together as part of larger patterned peatland complexes (mire complexes). Particularly distinctive are the ribbed bogs or fens in which a pattern of narrow (2- to 3-m wide), low (less than 1 m deep) ridges are oriented at right angles to the direction of the drainage (National Wetlands Working Group 1988). Wet pools or depressions occur between the ridges. These patterned peatlands may include string bog, Atlantic ribbed fen, or northern ribbed fen (National Wetlands Working Group 1988). They develop almost entirely north of 46°N latitude in east-central Canada and the adjacent U.S. They are minerotrophic peatlands in which the vegetation has developed into a pattern of strings (raised, usually linear features) and flarks (wet depressions separating the strings). The substrate chemistry is entirely acidic in some peatlands; in others, where bedrock or other substrate influence creates circumneutral to calcareous conditions, peatland chemistry may be entirely calcareous or vary from acidic to calcareous within the same peatland. In acidic portions, typical bog heaths predominate mixed with sedges. *Dasiphora fruticosa ssp. floribunda* is diagnostic of circumneutral to calcareous conditions. These peatlands usually develop in open basins and flat plains, and the patterned portion may occupy only a fraction of the entire peatland. The edge of the basin may be shallow to deep peat over a sloping substrate, where seepage waters provide nutrients.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Species diversity is low. Dwarf-shrubs include *Chamaedaphne calyculata, Ledum groenlandicum, Kalmia polifolia, Andromeda polifolia, Vaccinium oxycoccos, Vaccinium macrocarpon*, and occasionally *Gaultheria hispidula* or *Betula pumila*. Rarely, tall ericaceous shrubs such as *Vaccinium corymbosum* are dominant. Common sedges include *Carex oligosperma, Carex chordorrhiza, Carex magellanica ssp. irrigua (= Carex paupercula), Carex limosa*, and *Carex lasiocarpa*. Other herbs include *Eriophorum vaginatum, Eriophorum virginicum, Drosera rotundifolia, Menyanthes trifoliata, Sarracenia purpurea*, and *Scheuchzeria* *palustris*. When present, stunted *Picea mariana* and *Larix laricina* are the dominant trees. Dominant mosses include *Sphagnum fuscum* and *Sphagnum magellanicum*, and less commonly *Sphagnum angustifolium*. *Pleurozium schreberi* can be common on raised mats (Harris et al. 1996, Minnesota DNR 2003).

In the Atlantic region, from Labrador to Downeast Maine, acidic peatlands take a somewhat different characteristics. In basins, they develop raised plateaus with undulating sedge and dwarf-shrub vegetation. *Trichophorum cespitosum* may form sedge lawns on the raised plateau. The system may also occur as "blanket bogs" over a sloping rocky substrate in extreme maritime settings; here, dwarf-shrubs and *Sphagnum* are the dominant cover. Species characteristic of this maritime setting include *Empetrum nigrum* and *Rubus chamaemorus*. Typical bog heaths such as *Kalmia angustifolia, Kalmia polifolia, Gaylussacia baccata, Ledum groenlandicum*, and *Gaylussacia dumosa* are also present. *Betula michauxii* may also be common. Morphological characteristics and certain coastal species distinguish these from more inland acidic peatlands.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: *Climate:* Bogs occur in both continental and maritime climates. In the northeastern United States, true bogs may reach their core southern limit in Maine and extreme northern New Hampshire and Vermont (Damman and French 1987, figure 3), though isolated occurrences are possible elsewhere. *Soil/substrate/hydrology:* Sites are found in depressions, on acidic seepage slopes, with either ombrotrophic or weakly minerotrophic groundwater. They occur in a variety of landforms, including peat bog-lake systems (lake-fill bogs, moat bogs, and pond border bogs), perched water-peatland systems in valleys and depressions, peat bog-stream systems, and ombrogenous peatland systems, including raised bogs (Damman and French 1987).

DISTRIBUTION

***Geographic Range:** These acidic peatlands are found in eastern boreal regions of central and eastern Canada and southward into adjacent sub-boreal regions of the northeastern and north-central United States, from Manitoba to Newfoundland and Labrador and south from Minnesota to Maine. It is associated with the glacial terminus or stagnation zones, and interior from the coastal plain, but rarely occurs in the Laurentian-Acadian Division. Maritime examples occur near the coast from eastern Maine (Mount Desert Island) eastward into the Canadian Maritimes and the coast of Labrador.
Nations: CA, US
States/Provinces: CT?, MA?, MB, ME, MI?, MN, NB, NH, NS, NY?, ON, PE?, QC, WI?
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3480	*Carex oligosperma - Carex lasiocarpa* Acidic Graminoid Bog & Fen Alliance
A3836	*Picea mariana / Sphagnum* spp. Eastern Boreal Treed Bog Alliance
A3481	*Chamaedaphne calyculata - Kalmia polifolia / Carex oligosperma* Acidic Shrub Bog & Fen Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-03-12	G053 North American Boreal Acidic Peatland Group	G053 replaced by G386 (DFL 12-9-09); subsequently G386 split into G745 & G748
2013-03-12	G386 Chamaedaphne calyculata - Carex oligosperma - Kalmia polifolia Boreal Bog & Acidic Fen Group	G386 split into G745 & G748

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Black Spruce (western type): 204	Eyre 1980	
><	Black Spruce - Lichen (904)	Shiflet 1994	
>	Muskeg	Kost et al. 2007	

AUTHORSHIP

***Primary Concept Source [if applicable]:** S.C. Gawler and D. Faber-Langendoen, in D. Faber-Langendoen et al. (2010)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** D. Faber-Langendoen and S.C. Gawler

Acknowledgments [optional]:

Version Date: 02 Jun 2015

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2. Shrub & Herb Vegetation
2.C.2.Na. North American Bog & Fen

G745. Eastern North American Subboreal Bog & Acidic Fen

Type Concept Sentence: These *Sphagnum* and shrub peatlands occur in basins south of the Laurentian-Acadian region down to near the glacial boundary in the northeastern and north-central U.S. Unlike the true raised bogs of boreal regions, the vegetation is not raised above the groundwater level.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.2.Na.1. North American Boreal & Subboreal Bog & Acidic Fen (M876)

Elcode: G745
***Scientific Name:** Eastern North American Subboreal Bog & Acidic Fen Group
***Common (Translated Scientific) Name:** Eastern North American Subboreal Bog & Acidic Fen Group
***Colloquial Name:** Eastern North American Subboreal Bog & Acidic Fen

***Type Concept:** These *Sphagnum* and shrub peatlands occur in basins and open peatlands in the Laurentian-Acadian region down to near the glacial boundary in the northeastern and north-central U.S. Unlike the true raised bogs of boreal regions, the vegetation is rarely or not raised above the groundwater level. The nutrient-poor substrate and the reduced throughflow of water create oligotrophic conditions fostering the development of *Sphagnum* peat and the growth of peatland vegetation. Major physiognomic types include two primary types. First, the ericaceous dwarf-shrub bog, often dominated by *Chamaedaphne calyculata* (sometimes with distinctive southern and coastal elements such as *Gaylussacia dumosa, Ilex glabra*, and *Morella pensylvanica*). Second, tall-shrub thicket peatlands are dominated by deciduous ericaceous shrubs, especially *Vaccinium corymbosum* (*Ilex verticillata* can dominate on shallower peat and near the bog border). Graminoids such as *Carex oligosperma, Carex magellanica ssp. irrigua, Eriophorum angustifolium, Eriophorum virginicum*, and *Eriophorum vaginatum* are most common, and together these graminoids have greater cover than medium to rich fen graminoid indicators (*Carex lasiocarpa, Carex livida, Carex interior, Carex limosa, Muhlenbergia glomerata, Trichophorum alpinum, Eriophorum viridicarinatum*). Transitional poor to medium sites may include *Myrica gale* and *Dulichium arundinaceum*. Some peatlands may have a sparse tree layer (<10% cover), and stunted (<2 m) trees may be common, usually *Picea mariana, Larix laricina*, and *Acer rubrum*. These peatlands are found in colder regions, mostly in areas where glacial stagnation left coarse deposits and glacial depressions (many are "kettleholes"). The basins are generally closed, i.e., without inlets or outlets of surface water, and typically small in area. In deeper basins, the vascular vegetation grows on a *Sphagnum* mat over water, with no mineral soil development. Species diversity is typically low. Although these peatlands are often called bogs, in most cases they are technically "poor fens," as the vegetation remains in contact with the weakly minerotrophic (nutrient-poor) groundwater.

***Diagnostic Characteristics:** *Chamaedaphne calyculata* and *Andromeda polifolia* are two fairly consistent ericaceous dwarf-shrubs across this type, whereas other more northern ericaceous shrubs such as *Kalmia polifolia* and *Ledum groenlandicum* are uncommon northern species. A suite of other shrubs, including *Alnus serrulata, Clethra alnifolia, Gaylussacia frondosa, Lyonia ligustrina, Rhododendron periclymenoides, Rhododendron viscosum*, and *Toxicodendron vernix*, and several herbs, including *Woodwardia virginica*, help distinguish this type from more boreal bogs and poor fens. Other shrubs are common in the Laurentian-Acadian region, but they are not found in the main boreal region. These include *Ilex mucronata* and *Vaccinium corymbosum*. *Empetrum nigrum* is absent from this type.

***Classification Comments:** [The concept for this group is under review with Canadian ecologists; the current concept overlaps with Eastern North American Boreal Bog & Acidic Fen Group (G748). This group is defined as occurring in the Laurentian-Acadian ecoprovince in the Midwest, and the Northern Appalachian ecoregion in the Northeast, and inland from the Coastal Plain. These acidic peatlands are distinctive and discrete elements of the landscape, and contain a suite of southern indicators that separate this type from Eastern North American Boreal Bog & Acidic Fen Group (G748). But it may be challenging to separate this group from that group, given that individual sites are often species-poor [see Diagnostic Characteristics]. The type is typically shrub-dominated and it is not clear if there are any graminoid associations. But *Dulichium arundinaceum* may dominate in peatland margins and wetter sites.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G183	Midwest Prairie Alkaline Fen	

Elcode	Scientific or Colloquial Name	Note
G185	Eastern North American Subboreal Alkaline Fen	
G805	North-Central Interior & Appalachian Alkaline Fen	
G804	Eastern North American Boreal Alkaline Fen	
G748	Eastern North American Boreal Bog & Acidic Fen	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This type contains a continuous (>80% cover) layer of *Sphagnum* peatmoss (sometimes submerged in bog pools), to depths exceeding 40 cm. The vegetation is otherwise dominated by low ericaceous shrubs with patches of conifers, graminoids and bryophyte lawns. Stunted trees may form a partial to moderate cover over parts of the peatland, but the tree layer is <10% cover (Damman and French 1987).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This type contains a continuous (>80% cover) layer of *Sphagnum* peatmoss (sometimes submerged in bog pools), to depths exceeding 40 cm. Two major physiognomic types occur. First, the ericaceous dwarf-shrub bog, often dominated by *Chamaedaphne calyculata*, sometimes with distinctive southern and coastal elements such as *Gaylussacia dumosa, Ilex glabra*, and *Morella pensylvanica*, and with other constant and dominant species, including *Kalmia angustifolia* (east), *Kalmia polifolia* (north),and *Ledum groenlandicum* (north). Second, a tall-shrub peat thicket occurs, dominated by deciduous ericaceous shrubs, especially *Vaccinium corymbosum* (*Ilex verticillata* can dominate on shallower peat and near the bog border); and wet peatland margins. Graminoids such as *Carex oligosperma, Carex magellanica ssp. irrigua (= Carex paupercula), Eriophorum angustifolium* (north and midwest), *Eriophorum virginicum* (throughout and southward), and *Eriophorum vaginatum* are common in the herb layer, and together these graminoids have greater cover than medium to rich fen graminoids indicators (*Carex lasiocarpa, Carex livida, Carex interior, Carex limosa, Muhlenbergia glomerata, Trichophorum alpinum, Eriophorum viridicarinatum*). Species diversity is low. Some peatlands may have a sparse tree layer (<10% cover) or stunted (<2 m) stems of *Larix laricina, Picea mariana*, or *Acer rubrum*. Somewhat richer sites may include *Myrica gale* and *Dulichium arundinaceum* (Damman and French 1987).

Distinctive southern shrubs present in this type include *Alnus serrulata, Clethra alnifolia, Gaylussacia frondosa, Lyonia ligustrina, Rhododendron periclymenoides (= Rhododendron nudiflorum), Rhododendron viscosum*, and *Toxicodendron vernix (= Rhus vernix)*. Diagnostic southern herbs include *Woodwardia virginica*. More northern (but not boreal) shrubs include *Alnus incana ssp. rugosa (= Alnus rugosa), Alnus viridis* (along coast), *Ilex mucronata (= Nemopanthus mucronatus)*, and *Viburnum nudum var. cassinoides* (Damman and French 1987).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: Sub-boreal bogs are often limited to specific geological and microclimate settings. They are found in colder regions, mostly in areas where glacial stagnation left coarse deposits and glacial depressions (many are "kettleholes"). The basins are generally closed, i.e., without inlets or outlets of surface water, and typically small in area. The nutrient-poor substrate and the reduced throughflow of water create oligotrophic conditions fostering the development of *Sphagnum* peat and the growth of peatland vegetation. These acidic peatlands occur in a variety of landforms, including peat bog-lake systems (lake-fill bogs, moat bogs, and pond border bogs), perched water-peatland systems in valleys and depressions, and more rarely peat bog-stream systems. Ombrogenous peatland systems do not occur in this group; it is too far south (Damman and French 1987).

DISTRIBUTION

***Geographic Range:** This group is found across the Laurentian-Acadian region from temperate regions of Atlantic Canada and Quebec, and from New England and southern New York, south to Pennsylvania, New Jersey and high montane regions of West Virginia, and west to central Ontario, northern Ohio, Michigan, northern Indiana and Illinois, Wisconsin and Minnesota.
Nations: CA, US
States/Provinces: CT, IL, IN, MA, ME, MI, MN, NB, NH, NJ, NS, NY, OH, ON, PA, RI, VT, WI, WV
USFS Ecoregions (2007) [optional]: 211F:CC, 211I:CP, 211J:CC, 221A:CC, 221B:CC, 221D:CC, 221E:CC, 221Fa:CCC, 222I:CC, 222Ja:CCC, 222Jb:CCC, 222Jc:CCC, 222Je:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222R:CC, 222Ua:CCP, 222Ud:CCC, 222Ue:CCC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A1018	*Vaccinium corymbosum* Peat Shrubland Alliance
A3483	*Gaylussacia* spp. / *Trichophorum cespitosum / Sphagnum* spp. Maritime Acidic Graminoid Bog & Fen Alliance
A3451	*Sphagnum rubellum - Rhynchospora alba* Subboreal Graminoid-Moss Fen Alliance
A3450	*Chamaedaphne calyculata / Carex lasiocarpa* Subboreal Acidic Shrub Bog & Fen Alliance
A3452	*Dulichium arundinaceum - Carex canescens* Subboreal Acidic Graminoid Fen Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-03-18	G115 Chamaedaphne calyculata - Vaccinium corymbosum - Peltandra virginica Bog & Fen Group	G115 merged into G745

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** S.C. Gawler, in Faber-Langendoen et al. (2013)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** D. Faber-Langendoen
Acknowledgments [optional]:
Version Date: 02 Jun 2015

REFERENCES

***References [Required if used in text]:**

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, M. Russo, K. Schulz, K. Snow, J. Teague, and R. White. 2003-present. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, VA.

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Kost, M. A., D. A. Albert, J. G. Cohen, B. S. Slaughter, R. K. Schillo, C. R. Weber, and K. A. Chapman. 2007. Natural communities of Michigan: Classification and description. Report No. 2007-21, Michigan Natural Features Inventory, Lansing. 314 pp. [http://web4.msue.msu.edu/mnfi/reports/2007-21_Natural_Communites_of_Michigan_Classification_and_Description.pdf]

2.C.2.Nb. Atlantic & Gulf Coastal Plain Pocosin

The saturated wetland evergreen shrub vegetation of this division typically occurs in large peatlands called pocosins on the Southeastern Coastal Plain and is dominated by characteristic shrubs, which include *Cyrilla racemiflora, Ilex coriacea, Ilex glabra, Lyonia lucida*, and *Zenobia pulverulenta*, along with the evergreen vine *Smilax laurifolia*.

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2. Shrub & Herb Vegetation
2.C.2.Nb. Atlantic & Gulf Coastal Plain Pocosin

M065. Southeastern Coastal Bog & Fen

Type Concept Sentence: The saturated wetland evergreen shrub vegetation of this macrogroup typically occurs in large peatlands called pocosins on the Southeastern Coastal Plain and is dominated by characteristic shrubs which include *Cyrilla racemiflora, Ilex coriacea, Ilex glabra, Lyonia lucida*, and *Zenobia pulverulenta*, which occur along with the evergreen vine *Smilax laurifolia*.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.C.2.Nb.1. Atlantic & Gulf Coastal Plain Pocosin (D324)

Elcode: M065
***Scientific Name:** *Lyonia lucida - Ilex glabra - Cyrilla racemiflora* Bog & Fen Macrogroup
***Common (Translated Scientific) Name:** Shining Fetterbush - Inkberry - Swamp Titi Bog & Fen Macrogroup
***Colloquial Name:** Southeastern Coastal Bog & Fen

***Type Concept:** The vegetation of this wetland macrogroup is predominantly dense shrubland. Primarily evergreen shrubs and *Smilax laurifolia* vines dominate. The characteristic shrubs include *Cyrilla racemiflora, Ilex coriacea, Ilex glabra, Lyonia lucida*, and *Zenobia pulverulenta*, which occur along with *Smilax laurifolia*. The most characteristic tree is *Pinus serotina*; other scattered trees include *Gordonia lasianthus, Magnolia virginiana*, and *Persea palustris*. Herbs are scarce, but small patches dominated by *Woodwardia virginica, Carex striata, Sarracenia flava*, and *Sarracenia purpurea* are frequent in some examples. Mosses such as *Sphagnum* spp. may be common in patches. Under pre-European settlement fire regimes, stands of *Arundinaria tecta* (canebrakes) would have been more common and extensive, and herbaceous patches would have been more extensive. The vegetation of this macrogroup includes wetlands of organic soils, occurring on broad flats or gentle basins, primarily on the outer terraces of the Atlantic Coastal Plain of the Carolinas and southeastern Virginia, and also parts of the Atlantic and Gulf coastal plains further south and west to Georgia and Alabama and possibly Mississippi. Soil saturation, sheetflow, and peat depth create a distinct gradient in structure within pocosins, with the tallest statured woody vegetation on the edges and shortest in the center. Catastrophic fires are important in this macrogroup, naturally occurring at moderate frequency. Fires generally burn all above-ground vegetation in large patches, creating a shifting mosaic. Vegetation structure and biomass recover rapidly in most of the burned areas, primarily by sprouting. In the Upper East Gulf Coastal Plain of Alabama, adjacent Georgia, and possibly Mississippi, the wetlands generally occur in small patches on slopes within a matrix of *Pinus palustris*-dominated vegetation. Wetland conditions are maintained by seepage flow from adjacent uplands. Examples of this macrogroup can vary between densely shrubby and fairly open and herbaceous, depending on frequency of fire and amount of elapsed time since the previous fires.

***Diagnostic Characteristics:** *Cyrilla racemiflora, Ilex coriacea, Ilex glabra, Lyonia lucida*, and *Zenobia pulverulenta*, are the most characteristic evergreen shrubs. Other shrubs of the heath family (Ericaceae) are common. The evergreen vine *Smilax laurifolia* is found in many examples. *Pinus serotina* is present at very low cover in some examples. This vegetation is typical of pocosin wetlands.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M032	Southern Coastal Plain Evergreen Hardwood - Conifer Swamp	is tree-dominated.
M067	Atlantic & Gulf Coastal Plain Wet Prairie & Marsh	

Similar NVC Types General Comments [optional]: This shrubland macrogroup has floristic, environmental, and site similarities to the forested swamp macrogroup M032, but the physiognomy separates the two macrogroups. M032 is dominated by trees and M065 is shrub-dominated. This vegetation is also distinguished from Atlantic & Gulf Coastal Plain Pondshore & Wet Prairie Group (G111) by its dominance by mostly broadleaf evergreen shrubs.

VEGETATION

Physiognomy and Structure Summary: The vegetation included in this macrogroup is evergreen shrub-dominated. Some associations may have widely scattered needle-leaved trees. The vegetation may vary in height depending on the fire-return interval. The habitats are influenced by high water tables and organic soils.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The vegetation of this macrogroup is typically found in large wetlands called pocosins. The communities have in common a dense shrub layer of wetland shrubs tolerant of the organic soils, low nutrient conditions, and fire. *Arundinaria tecta (= Arundinaria gigantea ssp. tecta), Cyrilla racemiflora, Ilex coriacea, Ilex glabra, Lyonia lucida, Lyonia mariana, Morella cerifera (= Myrica cerifera var. cerifera), Symplocos tinctoria*, and *Zenobia pulverulenta* are characteristic and usually dominant in some combination, along with *Smilax laurifolia*. *Pinus serotina* is the characteristic tree, and it along with a set of evergreen hardwoods, including *Gordonia lasianthus, Magnolia virginiana*, and *Persea palustris*, are generally the only trees present. Under pre-European settlement fire regimes, stands of *Arundinaria tecta* (canebrakes) would have been more common and extensive. Component communities tend to be low in plant species richness, and woody species richness exceeds herbaceous in most associations, with herbs being limited to small open patches. Some herbs may include *Woodwardia virginica* and *Carex striata var. striata*. The physiognomy, in terms of vegetation height and density, is variable, depending on fire history, and can vary from densely shrubby to herbaceous. In current condition, most examples are shrubby, but may have scattered trees.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Under current conditions, the vegetation is predominantly dense shrubland. Herbaceous plants are present only as small patches. Vegetation is typically zoned. The vegetation of pocosins is zoned, with the lowest statured vegetation in the center, with woodlands on the edges and in the smaller occurrences. Under pre-European settlement fire regimes, stands of *Arundinaria tecta* (canebrakes) would have been more common and extensive. Fire is an important factor in these systems, with the pre-settlement fire regime probably being very different from that observed under current conditions. Natural fire-return intervals are not well-known, but are probably on the order of one to five or more decades in the wettest areas. Peripheral areas may be subject to fire as often as the surrounding vegetation burns, which may naturally have been an average of 3 years. Fires are typically intense due to density and flammability of the vegetation, killing all above-ground vegetation. They are followed by vigorous root sprouting by shrubs and hardwoods, leading to recovery of standing biomass within a few years. *Pinus serotina* recovers by epicormic sprouting or by regeneration from seeds released from serotinous cones. Fires during droughts may ignite peat, forming holes that take longer to recover. Herb-dominated openings in pocosins may depend on peat fires, though this is not well-documented. Natural fires occur in large patches, creating a shifting patch structure that interacts with the vegetational zonation created by peat depth. The intensity of fire in these systems makes fire control difficult; prescribed burning is seldom done, and wild fires continue to be a significant influence. The larger peatlands are believed to have been created by paludification following natural blocking of drainage (Otte 1981). Peat buildup raises the water table in the center, creating the domed structure of the largest peatlands and allowing the wetland to spread out as wetness is increased at the edges. Deeper pocosin peats contain fossil logs that indicate dominance by a swamp forest in past millennia. Otte (1981) noted that peat fires likely limit the height to which the peat can accumulate, in proportion to how high it can raise the local water table. The dominance of mostly broadleaf evergreen shrubs as opposed to a canopy of deciduous hardwoods distinguishes this macrogroup from nonriverine swamp forests.

ENVIRONMENT

Environmental Description: Vegetation of this macrogroup occurs on broad interfluvial flats and in small to large, very gentle basins and swales, largely on the outermost terraces of the Outer Coastal Plain. Some occurrences are in large to small peat-filled Carolina bays (Bennett and Nelson 1991). Smaller patches occur in shallow swales associated with relict coastal dune systems or other irregular sandy surfaces. Soils range from wet mineral soils with mucky surface layers to peats several meters deep. Most of the largest occurrences are domed peatlands with the deepest peat associated with topographic highs in the center, but deep peats are also associated with buried drainage channels. Hydrology is driven by rainfall and sheetflow. The low hydraulic conductivity of the organic material limits interaction with the groundwater. The raised center of domed peatlands is fed only by rainwater and is therefore a true ombrotrophic bog. More peripheral portions are fed by sheetflow from the center, and so receive only acidic water low in nutrients. Occurrences in Carolina bays and other basins appear to be similarly isolated from surface or groundwater inflow from adjacent areas. Soils are normally saturated throughout the winter and well into the growing season, though the organic material may dry enough to burn during droughts. Standing water is limited to local depressions and disturbed areas. Soil saturation and peat depth, with its corresponding nutrient limitation, are the primary drivers of vegetational zonation, as well as the distinction between this macrogroup and adjacent ones, but their effect may be modified by drainage patterns. In the Upper East Gulf Coastal Plain, examples may be found along steep to gentle slopes in the historically longleaf pine-dominated landscape.

DISTRIBUTION

***Geographic Range:** Vegetation of this macrogroup ranges through the southern coastal plains, being most prevalent in peatland regions of North Carolina, and extending into northern South Carolina and southeastern Virginia, extending in the Gulf Coastal Plain and the Upper East Gulf Coastal Plain from Florida to Louisiana.
Nations: US
States/Provinces: AL, FL, GA, LA, MS, NC, SC, VA
USFS Ecoregions (2007) [optional]: 232C:CC, 232I:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G186	Southeastern Coastal Pocosin & Shrub Bog

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
?	Bay Forest	Bennett and Nelson 1991	
<	Pocosin	Bennett and Nelson 1991	
=	Pocosins	Christensen 2000	

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Pocosins	Richardson and Gibbons 1993	
><	Pond Pine Woodland	Bennett and Nelson 1991	

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne and C.W. Nordman
Acknowledgments [optional]:
Version Date: 15 Oct 2014

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2. Shrub & Herb Vegetation
2.C.2.Nb. Atlantic & Gulf Coastal Plain Pocosin

G186. Southeastern Coastal Pocosin & Shrub Bog

Type Concept Sentence: These shrublands include *Cyrilla racemiflora, Ilex coriacea, Ilex glabra, Lyonia lucida*, and *Zenobia pulverulenta*, along with *Smilax laurifolia*, and the trees *Pinus serotina*, along with *Gordonia lasianthus, Magnolia virginiana*, and *Persea palustris*, occurring on organic soils on broad flats or gentle basins, primarily on the outer terraces of the Atlantic Coastal Plain of the Carolinas and southeastern Virginia.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.2.Nb.1. Southeastern Coastal Bog & Fen (M065)

Elcode: G186
***Scientific Name:** *Lyonia lucida - Ilex glabra - Cyrilla racemiflora* Pocosin & Shrub Bog Group
***Common (Translated Scientific) Name:** Shining Fetterbush - Inkberry - Swamp Titi Pocosin & Shrub Bog Group

***Colloquial Name:** Southeastern Coastal Pocosin & Shrub Bog

***Type Concept:** The vegetation of this group includes wetlands of organic soils, occurring on broad flats or gentle basins, primarily on the outer terraces of the Atlantic Coastal Plain of the Carolinas and southeastern Virginia, with more limited expressions in other parts of the Atlantic and Gulf coastal plains south and west to Georgia and Alabama and possibly Mississippi. Under current conditions, the vegetation is predominantly dense shrubland. A characteristic suite of primarily evergreen shrubs and *Smilax* species dominate. These characteristic shrubs include *Cyrilla racemiflora, Ilex coriacea, Ilex glabra, Lyonia lucida*, and *Zenobia pulverulenta*, along with *Smilax laurifolia*. The most characteristic tree is *Pinus serotina*, along with *Gordonia lasianthus, Magnolia virginiana*, and *Persea palustris*. Herbs are scarce, but small patches dominated by *Woodwardia virginica, Carex striata, Sarracenia flava, Sarracenia purpurea*, or *Sphagnum* spp. are frequent in some examples. Under pre-European settlement fire regimes, stands of *Arundinaria tecta* (canebrakes) would have been more common and extensive, and herbaceous patches would have been more extensive. Soil saturation, sheetflow, and peat depth create a distinct gradient in structure, with the highest statured woody vegetation on the edges and lowest in the center. Catastrophic fires are important in this group, naturally occurring at moderate frequency. Fires generally kill all above-ground vegetation in large patches, creating a shifting mosaic. Vegetation structure and biomass recover rapidly in most of the burned areas, primarily by sprouting. In the Upper East Gulf Coastal Plain of Alabama, adjacent Georgia, and possibly Mississippi, the wetlands generally occur in small patches on slopes within a matrix of *Pinus palustris*-dominated vegetation. Wetland conditions are maintained by seepage flow from adjacent uplands. Examples of this group can vary between densely shrubby and fairly open and herbaceous, depending on frequency of fire and amount of elapsed time since the previous fires. The globally rare pitcher plant *Sarracenia rubra ssp. alabamensis* may be present in some examples.

***Diagnostic Characteristics:** These coastal plain evergreen shrublands include *Cyrilla racemiflora, Ilex coriacea, Ilex glabra, Lyonia lucida*, and *Zenobia pulverulenta*, along with *Smilax laurifolia*, and the trees *Pinus serotina*, along with *Gordonia lasianthus, Magnolia virginiana*, and *Persea palustris*, occurring on organic soils on broad flats or gentle basins.

***Classification Comments:** The associations placed in Atlantic Coastal Plain Streamhead Seepage Swamp, Pocosin and Baygall (CES203.252), need to be evaluated for their membership in this group. Some of these share many plant species, but they may have a slightly different landscape position and hydrologic regime. Some of them (in particular *Cyrilla racemiflora - Cliftonia monophylla* Wet Scrub (CEGL003847); *Gordonia lasianthus / Woodwardia virginica - Osmunda regalis var. spectabilis* Swamp Forest (CEGL004410); *Magnolia virginiana - Nyssa biflora / Carpinus caroliniana / Thelypteris noveboracensis - Athyrium filix-femina* Swamp Forest (CEGL004722); *Pinus serotina - (Liriodendron tulipifera) / Lyonia lucida - Clethra alnifolia - Ilex glabra* Swamp Woodland (CEGL004435); and *Pinus serotina / Gordonia lasianthus - Persea palustris* Swamp Woodland (CEGL007996)) are placed in Coastal Plain Mixed Evergreen Swamp Group (G037), and the relationship between this and Southeastern Coastal Pocosin & Shrub Bog Group (G186) needs to be resolved. One is ostensibly forest and the other shrubland, but this normally clear distinction is blurred by the variety of woody plant responses to catastrophic fire in these fire-prone landscapes. Also an alliance placed here is also typical of seepage hillsides, *Ilex coriacea - Ilex glabra - Kalmia latifolia* Hillside Seepage Shrub Bog Alliance (A3442), but is otherwise very similar to the other shrubland vegetation included here, and perhaps should be moved to Atlantic & Gulf Coastal Plain Seep Group (G187).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G776	Atlantic & Gulf Coastal Plain Shrub Swamp	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The vegetation included in this group is evergreen shrub-dominated. Some associations may have widely scattered needle-leaved trees. The vegetation may vary in height depending on the fire-return interval. The habitats are influenced by high water tables and organic soils.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The vegetation of this group is a series of distinctive associations known as pocosins. The communities have in common a dense shrub layer of wetland shrubs tolerant of the organic soils, low nutrient conditions, and fire. *Arundinaria tecta (= Arundinaria gigantea ssp. tecta), Cyrilla racemiflora, Ilex coriacea, Ilex glabra, Lyonia lucida, Lyonia mariana, Morella cerifera (= Myrica cerifera var. cerifera), Symplocos tinctoria*, and *Zenobia pulverulenta* are characteristic and usually dominant in some combination, along with *Smilax laurifolia*. *Pinus serotina* is the characteristic tree, and it along with a set of evergreen hardwoods, including *Gordonia lasianthus, Magnolia virginiana*, and *Persea palustris*, are generally the only trees present. Under pre-European settlement fire regimes, stands of *Arundinaria tecta* (canebrakes) would have been more common and extensive. Component communities tend to be low in plant species richness, and woody species richness exceeds herbaceous in most associations, with herbs being limited to small open patches. Some herbs may include *Woodwardia virginica* and *Carex striata var. striata*. The physiognomy, in terms of vegetation height and density, is variable, depending on fire history, and can vary from densely shrubby to herbaceous. In current condition, most examples are shrubby, but may have scattered trees.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Under current conditions, the vegetation is predominantly dense shrubland. Herbaceous plants are present only as small patches. Vegetation is typically zoned. The vegetation of pocosins is zoned, with the lowest statured vegetation in the center, with woodlands on the edges and in the smaller occurrences. Under pre-European settlement fire regimes, stands of *Arundinaria tecta* (canebrakes) would have been more common and extensive. Fire is an important factor in these systems, with the pre-settlement fire regime probably being very different from that observed under current conditions. Natural fire-return intervals are not well-known, but are probably on the order of one to five or more decades in the wettest areas. Peripheral areas may be subject to fire as often as the surrounding vegetation burns, which may naturally have been an average of every three years. Fires are typically intense due to density and flammability of the vegetation, killing all above-ground vegetation. They are followed by vigorous root sprouting by shrubs and hardwoods, leading to recovery of standing biomass within a few years. *Pinus serotina* recovers by epicormic sprouting or by regeneration from seeds released from serotinous cones. Fires during droughts may ignite peat, forming holes that take longer to recover. Herb-dominated openings in pocosins may depend on peat fires, though this is not well-documented. Natural fires occur in large patches, creating a shifting patch structure that interacts with the vegetational zonation created by peat depth. The intensity of fire in these systems makes fire control difficult; prescribed burning is seldom done, and wild fires continue to be a significant influence. The larger peatlands are believed to have been created by paludification following natural blocking of drainage (Otte 1981). Peat buildup raises the water table in the center, creating the domed structure of the largest peatlands and allowing the wetland to spread out as wetness is increased at the edges. Deeper pocosin peats contain fossil logs that indicate dominance by a swamp forest in past millennia. Otte (1981) noted that peat fires likely limit the height to which the peat can accumulate, in proportion to how high it can raise the local water table. The dominance of mostly broadleaf evergreen shrubs as opposed to a canopy of deciduous hardwoods distinguishes this group from nonriverine swamp forests. This vegetation is also distinguished from Atlantic & Gulf Coastal Plain Pondshore & Wet Prairie Group (G111) by its dominance by mostly broadleaf evergreen shrubs.

ENVIRONMENT

Environmental Description: Vegetation of this group occurs on broad interfluvial flats and in small to large, very gentle basins and swales, largely on the outermost terraces of the Outer Coastal Plain. Some occurrences are in large to small peat-filled Carolina bays (Bennett and Nelson 1991). Smaller patches occur in shallow swales associated with relict coastal dune systems or other irregular sandy surfaces. Soils range from wet mineral soils with mucky surface layers to peats several meters deep. Most of the largest occurrences are domed peatlands with the deepest peat associated with topographic highs in the center, but deep peats are also associated with buried drainage channels. Hydrology is driven by rainfall and sheetflow. The low hydraulic conductivity of the organic material limits interaction with the groundwater. The raised center of domed peatlands is fed only by rainwater and is therefore a true ombrotrophic bog. More peripheral portions are fed by sheetflow from the center, and so receive only acidic water low in nutrients. Occurrences in Carolina bays and other basins appear to be similarly isolated from surface or groundwater inflow from adjacent areas. Soils are normally saturated throughout the winter and well into the growing season, though the organic material may dry enough to burn during droughts. Standing water is limited to local depressions and disturbed areas. Soil saturation and peat depth, with its corresponding nutrient limitation, are the primary drivers of vegetational zonation, as well as the distinction between this group and adjacent ones, but their effect may be modified by drainage patterns. In the Upper East Gulf Coastal Plain, examples may be found along steep to gentle slopes in the historically longleaf pine-dominated landscape.

DISTRIBUTION

***Geographic Range:** Vegetation of this group ranges through the southern coastal plains, being most prevalent in peatland regions of North Carolina, and extending into northern South Carolina and southeastern Virginia, extending in the Gulf Coastal Plain and the Upper East Gulf Coastal Plain from Florida to Louisiana.
Nations: US

States/Provinces: AL, FL, GA, LA, MS, NC, SC, VA
USFS Ecoregions (2007) [optional]: 232C:CC, 232H:CC, 232I:CC, 232J:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.5.65p:?, 8.5.1.63b:?, 8.5.1.63c:C, 8.5.1.63d:?, 8.5.1.63e:?, 8.5.1.63g:?, 8.5.1.63h:?
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:** A number of plots have been collected in North and South Carolina by the Carolina Vegetation Survey and Duke University researchers (Christensen et al. 1988). These communities are generally under-represented by plots because of the difficulty of working in them. Uncharacteristic marginal vegetation may be over-represented because of the difficulty of getting to the interior.

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3442	*Ilex coriacea - Ilex glabra - Kalmia latifolia* Hillside Seepage Shrub Bog Alliance
A1054	*Zenobia pulverulenta - Lyonia lucida* Shrub Pocosin Alliance
A3441	*Chamaedaphne calyculata / Carex striata* Dwarf-shrub Pocosin Alliance
A0802	*Cyrilla racemiflora - Ilex coriacea* Wet Shrubland Alliance
A0804	*Arundinaria tecta* Wet Shrubland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
?	Bay Forest	Bennett and Nelson 1991	
<	Pocosin	Bennett and Nelson 1991	
><	Pond Pine Woodland	Bennett and Nelson 1991	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C.J. Richardson and J.W. Gibbons (1993)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne and C.W. Nordman
Acknowledgments [optional]: M. Schafale
Version Date: 13 May 2015

REFERENCES

***References [Required if used in text]:**
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Christensen, N. L., R. B. Wilbur, and J. S. McLean. 1988. Soil-vegetation correlations in pocosins of Croatan National Forest, North Carolina. USDI Fish and Wildlife Service Biological Report 88 (28). 98 pp.
Christensen, N., R. Burchell, A. Liggett, and E. Simms. 1981. The structure and development of pocosin vegetation. Pages 43-61 in: C. J. Richardson, editor. Pocosin wetlands: An integrated analysis of Coastal Plain freshwater bogs in North Carolina. Hutchinson Ross Publishing Company, Stroudsburg, PA.
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Frost, C. C. 1989. History and status of remnant pocosin, canebrake and white cedar wetlands in Virginia. Unpublished report. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond.
Otte, L. J. 1981. Origin, development, and maintenance of the pocosin wetlands of North Carolina. Unpublished report to the North Carolina Natural Heritage Program. North Carolina Department of Natural Resources and Community Development, Raleigh.
Richardson, C. J. 2003. Pocosins: Hydrologically isolated or integrated wetlands on the landscape? Wetlands 23:563-576.
Richardson, C. J., and J. W. Gibbons. 1993. Pocosins, Carolina bays, and mountain bogs. Pages 257-310 in: W. H. Martin, S. G. Boyce, and A. C. Echternacht, editors. Biodiversity of the southeastern United States: Lowland terrestrial communities. John Wiley and Sons, Inc., New York.
Sharitz, R. R., and J. W. Gibbons. 1982. The ecology of southeastern shrub bogs (pocosins) and Carolina bays: A community profile. USDI Fish & Wildlife Service, Office of Biological Service. FWS/OBS-82/O4. Washington, DC. 93 pp.

2.C.3. Tropical Freshwater Marsh, Wet Meadow & Shrubland

Tropical Freshwater Marsh, Wet Meadow & Shrubland includes freshwater wet meadows, shallow and deep emergent marshes, with the upper limits of salinity at 0.5 ppt, above which it is considered saltwater. The vegetation comprises evergreen emergent aquatic macrophytes, chiefly graminoids such as rushes, reeds, grasses and sedges, and shrubs and other herbaceous species such as broad-leaved emergent macrophytes, floating-leaved and submergent species, and nonvascular plants such as brown mosses, liverworts, and macroscopic algae. It is found widely throughout wetland habitats of the tropical latitudes, from the equator to about 23°N and S.

2.C.3.Ef. Caribbean-Mesoamerican Freshwater Marsh, Wet Meadow & Shrubland

2. Shrub & Herb Vegetation
2.C.3.Ef. Caribbean-Mesoamerican Freshwater Marsh, Wet Meadow & Shrubland

M710. Caribbean Freshwater Marsh, Wet Meadow & Shrubland

Type Concept Sentence: Freshwater marsh communities of this macrogroup encompass south Florida's freshwater marshes and wet prairies, flooded open palm savannas from Cuba, grass marshes that are part of large coastal wetlands in Cuba, Puerto Rico, and Trinidad, lowland depressional pondshore communities and communities under constant saturated conditions, such as waterfalls, rapids, and streams, in montane environments throughout the Caribbean islands.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.C.3.Ef.1. Caribbean-Mesoamerican Freshwater Marsh, Wet Meadow & Shrubland (D262)

Elcode: M710
***Scientific Name:** *Cladium mariscus ssp. jamaicense - Eleocharis cellulosa - Panicum hemitomon* Marsh Macrogroup
***Common (Translated Scientific) Name:** Jamaica Swamp Sawgrass - Gulf Coast Spikerush - Maidencane Marsh Macrogroup
***Colloquial Name:** Caribbean Freshwater Marsh, Wet Meadow & Shrubland

***Type Concept:** The mosaic formed in south Florida by freshwater marshes and wet prairies communities is determined by the amount of precipitation, the length of the hydroperiod, fine topographic gradients, substrate, and fire regime. Tall or short-statured sawgrass marsh, dominated by *Cladium mariscus ssp. jamaicense* is the most extensive community in the Everglades due to its ability to survive fire, low nutrient conditions and occasional freezing. Deeper marshes may support an array of emergent plants that includes sparse *Cladium mariscus ssp. jamaicense, Panicum hemitomon, Rhynchospora tracyi*, or *Eleocharis cellulosa*. Florida's wet prairies in the Everglades (often referred to as "flats") are characterized by short emergent plants (mostly grasses), and are the transition zone between sawgrass areas and sloughs. Wet flats may be dominated by *Eleocharis cellulosa, Rhynchospora tracyi, Pontederia cordata*, or *Panicum hemitomon*. Wet marl prairie dominants may include one or more of the following: *Eragrostis elliottii, Muhlenbergia filipes, Rhynchospora divergens, Schizachyrium rhizomatum, Schoenus nigricans, Spartina bakeri*, and a short form of sawgrass. Wet prairies occur on higher and drier sites than marshes and sloughs, on both peat and marl soil; they dry out on an annual basis but require seasonal flooding with 6-10 months of standing water.

In the Greater Antilles, some characteristic freshwater marsh species include *Cladium mariscus ssp. jamaicense, Cyperus* spp., *Eleocharis interstincta, Isoetes* sp., *Paspalum floridanum, Saccharum giganteum, Thalia geniculata*, and *Typha domingensis*. These freshwater herbaceous wetlands are often associated with a body of freshwater such as a river, stream, lake, lagoon, or pond, or the wetland's freshwater supply also can come from precipitation or groundwater upwelling. These marshes can be flooded for long periods of time or they may be inundated infrequently. Depending on their location with respect to the coast, some freshwater marshes can experience the influence of tides. The *Copernicia* or *Sabal* waterlogged savannas included in this macrogroup are secondary savannas that result from the frequent logging of timber species and fuel woods of the wooded swamps, followed by burning and grazing, a process which converts them into a *Sabal* wet grassland.

***Diagnostic Characteristics:** Communities within this macrogroup are generally vegetated by a diverse group of herbaceous plants, including grasses, sedges, rushes, swamp ferns, broad-leaved aquatic plants, and soft-stemmed aquatic plants such as cattails, arrowheads, pickerelweed and reeds, growing in water or wet soils.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M066	Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh	

Similar NVC Types General Comments [optional]: South Florida Freshwater Marsh & Wet Prairie Group (G129), included in this macrogroup, has several characteristics shared with Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh Group (G110) in Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh Macrogroup (M066), especially for the dominance in both cases of *Cladium mariscus ssp. jamaicense*; however, some of the important accompanying grass species differ at the species level.

VEGETATION

Physiognomy and Structure Summary: In south Florida and much of the Caribbean, these are graminoid wetlands. The stature can vary from 20 cm to over 3 m tall.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: In south Florida, marsh communities include tall and short-statured *Cladium mariscus ssp. jamaicense, Sagittaria lancifolia*, and *Pontederia cordata*. Wet flats may be dominated by *Eleocharis cellulosa, Rhynchospora tracyi*, or *Panicum hemitomon*. In the absence of fire, portions of stands will become dominated by *Salix caroliniana*. Other aquatic and wetland plants that may be present include *Bacopa caroliniana, Ceratophyllum demersum, Chara* sp., *Najas guadalupensis, Nuphar advena, Nymphaea odorata, Pistia stratiotes, Sagittaria lancifolia, Thalia geniculata*, and *Utricularia inflata*. Ferns include *Acrostichum danaeifolium, Nephrolepis exaltata*, and *Blechnum serrulatum*. Grasses and graminoids may include *Schoenoplectus tabernaemontani, Typha domingensis*, and *Zizaniopsis miliacea*. Dominants of the wet marl flats may include *Eragrostis elliottii, Muhlenbergia filipes (= Muhlenbergia sericea), Rhynchospora divergens, Schizachyrium rhizomatum, Schoenus nigricans, Spartina bakeri*, and a short form of sawgrass. Marshes in depression ponds have some different plants; *Aristida palustris* is characteristic and possibly *Hypericum fasciculatum*, depending upon fire history. A large number of other wetland species may be present, such as *Eriocaulon compressum, Eriocaulon decangulare, Rhexia cubensis, Rhynchospora filifolia, Rhynchospora inundata, Xyris elliottii, Xyris fimbriata, Xyris jupicai*, and others. Patches of woody species, including *Annona glabra, Cephalanthus occidentalis, Morella cerifera (= Myrica cerifera)*, and *Salix caroliniana*, are often scattered in deeper pockets of peat (FNAI 2010a).

Detailed information across much of the Caribbean is lacking. Some characteristic freshwater marsh species include *Cladium mariscus ssp. jamaicense, Cyperus* spp., *Eleocharis interstincta, Isoetes* sp., *Montrichardia* sp., *Paspalum floridanum (= Paspalum giganteum), Phragmites* sp., *Saccharum giganteum (= Erianthus giganteus), Thalia geniculata*, and *Typha domingensis*. The *Copernicia* or *Sabal* waterlogged savannas included in this macrogroup are secondary savannas that result from the frequent logging of timber species and fuel woods of the wooded swamps, followed by burning and grazing, a process which converts them into a *Sabal* wet grassland.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The successional dynamics of the Everglades is controlled by the interaction of hydroperiod, fire frequency, degree of fire intensity, animal activity and drought. Alligator activity can also change the hydrology and nutrient status of sites and create ponds (Richardson 2000). Drought, absence of fire, or drainage allows the invasion of upland macrophytes, scrub and hardwood species, such as *Salix caroliniana* and eventually *Acer rubrum*. Across the Antilles the composition and dynamics of freshwater marshes is also controlled by hydroperiod, substrate, and drought seasonality; the influence of fire as part of the natural processes is not documented. The *Copernicia* or *Sabal* waterlogged savannas are the result of a "savannization" process of swamp forests that starts by logging of timber species and fuel woods turning the diverse swamps into a *Sabal* palm swamp, which by burning and grazing is converted into a *Sabal* wet grassland and eventually into a wet pasture with scattered *Sabal* palms (Borhidi 1988).

ENVIRONMENT

Environmental Description: *Climate:* Subtropical to tropical in the Antilles. Rainfall is higher in the summer than the winter. Given the wide geographic distribution of this macrogroup, mean annual precipitation and temperature vary greatly. In the Everglades over a 70-year period the median annual precipitation was 1336 mm with a low of 990 and a high of 1955 mm (Richardson 2000). The Caribbean islands also have a rainy season from May through October and a dry season during the winter of the Northern Hemisphere. Even during the rainy season, precipitation ranges vary depending on aspect (windward versus leeward sides of the islands), and on elevation, with contrasting annual rainfall amounts of over 3000 mm in mountainous areas and below 1000 mm in lowland leeward sides. Average daily temperatures are above 10^oC, even in the winter, and from April through October the daily average is above 27^oC. Hydroperiod ranges from 5-12 months; some marshes have a hydroperiod of 8-12 months. Seasonal droughts are also an important component of the dynamic processes.

Soil/substrate: The soils of the Everglades are primarily peats and mucks that have accumulated to a depth of 4 m in the north but are less than 20 cm deep in portions in the south. The other dominant soil type is a calcareous mud, formed by cyanobacteria that reprecipitate calcium carbonate, or marl, originally derived from the limestone substrate. This soil is highly alkaline and impermeable, sealing off the underlying limestone and causing water to pond during the wet season (Richardson 2000). In the Caribbean islands, several lowland wetlands have also developed on marine sediments of carbonated rocks with varying degrees of karstification and peat formation on top. Flooded palm savannas occur on poor sandy soils or lateritic soils with an impermeable layer close to the surface. As with the Florida freshwater wetlands, soils in the Caribbean wetlands are affected by the hydrogeological conditions, and the formation of peat is related to the duration and depth of flooding.

DISTRIBUTION

***Geographic Range:** This macrogroup is found in southern Florida and across the Caribbean region.
Nations: BS, CU, DM, DO, GD, GP, HT, JM, MQ, MS, PR, TT, US, VC, VG, VI, XA, XC, XD
States/Provinces: FL
USFS Ecoregions (2007) [optional]: 411A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G462	Cuban Seasonally Flooded Copernicia - Sabal Secondary Savanna
G470	Caribbean Freshwater Marsh
G471	Caribbean Acidic Depression Graminoid Wet Meadow
G129	South Florida Freshwater Marsh & Wet Prairie

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-09-17	M041 Caribbean & Central American Freshwater Marsh Macrogroup	M041 split into M710 & M711

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Saw Grass Marshes	Craighead 1971	
<	Spike Rush Marshes	Craighead 1971	
=	The Everglades	Gunderson and Loftus 1993	
=	The Everglades (Southern Fen Peatland)	Richardson 2000	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse, in Faber-Langendoen et al. (2015)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Josse

Acknowledgments [optional]:

Version Date: 13 Apr 2015

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Gunderson, L. H., and W. F. Loftus. 1993. The Everglades. Pages 199-255 in: W. H. Martin, S. G. Boyce, and A. C. Echternacht, editors. Biodiversity of the southeastern United States: Lowland terrestrial communities. John Wiley and Sons, New York. 502 pp.
Kushlan, J. A. 1990. Freshwater marshes. Pages 324-363 in: R. L. Myers and J. J. Ewel, editors. Ecosystems of Florida. University of Central Florida Press, Orlando.
Richardson, C. J. 2000. Freshwater wetlands. Pages 448-499 in: M. G. Barbour and W. D. Billings, editors. North American terrestrial vegetation. Second edition. Cambridge University Press, New York. 434 pp.

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2. Shrub & Herb Vegetation
2.C.3.Ef. Caribbean-Mesoamerican Freshwater Marsh, Wet Meadow & Shrubland

G129. South Florida Freshwater Marsh & Wet Prairie

Type Concept Sentence: The Everglades of southern Florida is a very large and slowly flowing freshwater marsh dominated by *Cladium mariscus ssp. jamaicense*, with slightly higher wet flats dominated by *Eleocharis cellulosa, Rhynchospora tracyi, Pontederia cordata*, or *Panicum hemitomon*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.3.Ef.1. Caribbean Freshwater Marsh, Wet Meadow & Shrubland (M710)

Elcode: G129
***Scientific Name:** *Cladium mariscus ssp. jamaicense - Eleocharis cellulosa - Rhynchospora tracyi* Freshwater Marsh Group
***Common (Translated Scientific) Name:** Jamaica Swamp Sawgrass - Gulf Coast Spikerush - Tracy's Beaksedge Freshwater Marsh Group
***Colloquial Name:** South Florida Freshwater Marsh & Wet Prairie

***Type Concept:** This group encompasses south Florida freshwater marsh communities which commonly are dominated by tall or short-statured *Cladium mariscus ssp. jamaicense*. Wet flats may be dominated by *Eleocharis cellulosa, Rhynchospora tracyi, Pontederia cordata*, or *Panicum hemitomon*. This group includes the extensive Everglades, as well as herbaceous marshes in depression wetlands in south Florida. Marshes in depression ponds have some different plants; *Aristida palustris* is characteristic. Soils vary from shallow marl to relatively deep peat. Hydroperiods range from 5-12 months.

***Diagnostic Characteristics:** *Cladium mariscus ssp. jamaicense* is the single most characteristic and dominant species of this group. *Eleocharis cellulosa, Rhynchospora tracyi, Nymphaea odorata, Pontederia cordata*, and *Panicum hemitomon* can all be dominant in certain areas. This group represents vegetation limited to south Florida, most notably the Everglades.

***Classification Comments:** *Cladium mariscus ssp. jamaicense* communities outside of southern Florida are not included here.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G557	Southeastern Ruderal Marsh, Wet Meadow & Shrubland	
G188	Atlantic & Gulf Coastal Plain River & Basin Freshwater Marsh	
G110	Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh	
G111	Atlantic & Gulf Coastal Plain Pondshore & Wet Prairie	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are graminoid wetlands. The stature can vary from 20 cm to over 3 m tall.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Marsh communities include tall and short-statured *Cladium mariscus ssp. jamaicense*. Wet flats may be dominated by *Eleocharis cellulosa, Rhynchospora tracyi, Pontederia cordata*, or *Panicum hemitomon*. In the absence of fire, portions of stands will become dominated by *Salix caroliniana*. Other aquatic and wetland plants that may be present include *Bacopa caroliniana, Ceratophyllum demersum, Najas guadalupensis, Utricularia inflata, Nuphar advena, Nymphaea odorata, Chara* sp., *Pistia stratiotes, Sagittaria lancifolia*, and *Thalia geniculata*. Ferns include *Acrostichum danaeifolium, Nephrolepis exaltata*, and *Blechnum serrulatum*. Grasses and graminoids may include *Schoenoplectus tabernaemontani, Typha domingensis*, and *Zizaniopsis miliacea*. Marshes in depression ponds have some different plants; *Aristida palustris* is characteristic and possibly *Hypericum fasciculatum*, depending upon fire history. A large number of other wetland species may be present, such as *Xyris jupicai, Rhexia cubensis, Rhynchospora filifolia*, and others.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: In the absence of fire, portions of stands will become dominated by *Salix caroliniana*. If fire continues to be absent, these areas may succeed to *Acer rubrum*.

ENVIRONMENT

Environmental Description: *Climate:* Subtropical, rainfall is higher in the summer than the winter. *Soil/substrate/hydrology:* Soils vary from shallow marl to relatively deep peat. Hydroperiod ranges from 5-12 months; some marshes have a hydroperiod of 8-12 months. The effect of fire is influenced by both soils and hydroperiod and affects them both in turn. For example, peat accumulates in the absence of fire, but under certain conditions, fires may burn away accumulated sawgrass peat resulting in a thin, residual, marly soil and relative increase of effective water depth (resulting in vegetation community change).

DISTRIBUTION

***Geographic Range:** This group is endemic to southern Florida.
Nations: US
States/Provinces: FL
USFS Ecoregions (2007) [optional]: 232Gd:???, 411Ab:CCC, 411Ad:CC?, 411Af:CCC
Omernik Ecoregions L3, L4 [optional]: 8.5.3.75d:?, 15.4.1.76a:C, 15.4.1.76b:C, 15.4.1.76c:?
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Everglades: River of Grass	Douglas 1947	
=	Glades Marsh	FNAI 2010a	
<	Saw Grass Marshes	Craighead 1971	
<	Spike Rush Marshes	Craighead 1971	
=	The Everglades	Gunderson and Loftus 1993	
=	The Everglades (Southern Fen Peatland)	Richardson 2000	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Nordman, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C. Nordman
Acknowledgments [optional]: We acknowledge the important past work of F. Craighead, M. Douglas, L. Gunderson, W. Loftus, C. Richardson, the staff scientists of Florida Natural Areas Inventory, and many others who have increased our understanding of the Everglades.
Version Date: 22 May 2015

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2.C.4. Temperate to Polar Freshwater Marsh, Wet Meadow & Shrubland

Temperate to Polar Freshwater Marsh, Wet Meadow & Shrubland includes wet riparian and swamp shrublands, wet meadows, wet prairies, and shallow and deep emergent marshes. The vegetation comprises seasonal green emergent, hydrophytic shrubs and herbs with at least 10% cover, on mucky, inundated or saturated soils across the mid-latitudes of the Northern and Southern hemispheres from 23° to 70°.

2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

This division contains marshes, wet meadows and shrublands, singly and in mosaics, along riparian corridors, around vernal pools, depressions, seeps and springs on mineral soils or shallow organic layers over mineral substrates in temperate (and possibly southern boreal) latitudes of western North America.

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

M894. North American Boreal Marsh, Wet Meadow & Shrubland [Proposed (Submitted)]

Type Concept Sentence:

OVERVIEW

***Hierarchy Level:** Macrogroup

***Placement in Hierarchy:** 2.C.4.Nb.6. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland (D031)

Elcode: M894

***Scientific Name:** *Alnus incana - Carex utriculata* Boreal Marsh, Wet Meadow & Shrubland Macrogroup

***Common (Translated Scientific) Name:** Gray Alder - Northwest Territory Sedge Boreal Marsh, Wet Meadow & Shrubland Macrogroup
***Colloquial Name:** North American Boreal Marsh, Wet Meadow & Shrubland

***Type Concept:**

***Diagnostic Characteristics:**

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary:

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary:

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description:

DISTRIBUTION

***Geographic Range:**
Nations: CA, US
States/Provinces: AB, AK, BC, MB, NT, NU, SK, YT
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Proposed (Submitted)
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G528	Western Boreal Wet Meadow & Marsh
G768	Eastern North American Boreal Freshwater Marsh, Wet Meadow & Shrubland
G865	Western Boreal Wet Birch - Willow Low Shrubland

Elcode	Scientific or Colloquial Name
G866	Western Boreal Wet Alder - Willow Tall Shrub Swamp

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2018-05-22	M075 Alnus viridis ssp. sinuata / Carex utriculata Marsh, Wet Meadow & Shrubland Macrogroup	M075 split into M893 (AB, AZ, BC, CA, CO, ID, MT, NM, NV, OR, SD, UT, WA, WY) & M894 (AB, AK, BC, MB, NT, NU, SK, YT).

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:**

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:**

Acknowledgments [optional]:

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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2. Shrub & Herb Vegetation

2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G768. Eastern North American Boreal Freshwater Marsh, Wet Meadow & Shrubland

Type Concept Sentence:

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Nb.6. North American Boreal Marsh, Wet Meadow & Shrubland (M894)

Elcode: G768

***Scientific Name:** Eastern North American Boreal Freshwater Marsh, Wet Meadow & Shrubland Group

***Common (Translated Scientific) Name:** Eastern North American Boreal Freshwater Marsh, Wet Meadow & Shrubland Group

***Colloquial Name:** Eastern North American Boreal Freshwater Marsh, Wet Meadow & Shrubland

***Type Concept:**

***Diagnostic Characteristics:**

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary:

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary:

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description:

DISTRIBUTION

***Geographic Range:**
Nations: CA, US
States/Provinces: AB, MB, ON, QC?, SK, YT
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:**

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:**

Acknowledgments [optional]:

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

This division consists of vegetation in eastern cool-temperate and boreal North America, including the Great Plains. Stands are dominated by shrubs and/or non-hydromorphic herbaceous plants that are facultatively to obligately adapted to freshwater wetland conditions and that grow in mineral or mucky organic soils with regular (intermittent to permanent) saturated and flooded conditions.

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

M069. Eastern North American Marsh, Wet Meadow & Shrubland

Type Concept Sentence: This largely freshwater wetland macrogroup encompasses shrub swamps, marshes, wet meadows and wet prairies of temperate and boreal eastern North America, north of the southern Atlantic and Gulf coastal plains and east of the Great Plains and Yukon Territory. It is dominated by graminoids (e.g., species of the genera *Calamagrostis, Carex, Echinochloa, Glyceria, Juncus, Leersia, Schoenoplectus, Scirpus, Sparganium, Typha, Zizania*), forbs (e.g., species of the genera *Bidens, Eupatorium, Lobelia, Polygonum, Rumex, Sagittaria*), and shrubs (e.g., *Alnus incana, Alnus serrulata, Cornus sericea*, other *Cornus* spp., *Salix* spp., *Spiraea* spp., *Viburnum* spp.) in a widely variable composition and structure. This macrogroup also contains eastern inland saline meadows characterized by *Atriplex patula, Juncus gerardii*, and others.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.C.4.Nd.2. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland (D323)

Elcode: M069
***Scientific Name:** *Typha latifolia - Ageratina altissima - Juncus* spp. Marsh, Wet Meadow & Shrubland Macrogroup
***Common (Translated Scientific) Name:** Broadleaf Cattail - White Snakeroot - Rush species Marsh, Wet Meadow & Shrubland Macrogroup
***Colloquial Name:** Eastern North American Marsh, Wet Meadow & Shrubland

***Type Concept:** This largely freshwater wetland macrogroup encompasses shrub swamps, marshes, wet meadows and wet prairies of temperate and boreal eastern North America, north of the southern Atlantic and Gulf coastal plains and east of the Great Plains and Yukon Territory. It is dominated by graminoids (e.g., species of the genera *Calamagrostis, Carex, Echinochloa, Glyceria, Juncus, Leersia, Schoenoplectus, Scirpus, Sparganium, Typha, Zizania)*, forbs (e.g., species of the genera *Bidens, Eupatorium, Lobelia, Polygonum, Rumex, Sagittaria*), and shrubs (e.g., species of *Alnus, Cornus, Salix, Spiraea, Viburnum*) in a widely variable composition and structure. This macrogroup also contains eastern inland saline meadows characterized by *Atriplex patula, Juncus gerardii*, and others. Freshwater marshes and shrub swamps occur in closed or open basins that are generally flat and shallow and are frequently to nearly always flooded. Water depths during high water periods range from a few centimeters to approximately 1 m. Stands assigned to this macrogroup are associated with lakes, ponds, slow-moving streams, non-forested seepages, and/or impoundments or ditches on mineral soils with or without a well-decomposed muck layer. This vegetation spans a wide range, from southeastern and south-central Canada southwest to the Great Lakes states and provinces, south to the Ozarks in Arkansas and east through the northern regions of the Gulf coast states to the southern Appalachian Mountains in Tennessee. It includes the Appalachian Mountain, Piedmont, and Interior Plateau regions, but not the Atlantic or Gulf coastal plains.

***Diagnostic Characteristics:** Saturated or seasonally flooded to semipermanently flooded freshwater emergent marshes, seepage wet meadows, or shrub swamps characterized by wetland herbs, e.g., species of the genera *Calamagrostis, Carex, Echinochloa, Glyceria, Juncus, Leersia, Schoenoplectus, Scirpus, Sparganium, Typha, Zizania*), forbs (e.g., species of the genera *Bidens, Eupatorium, Lobelia, Polygonum, Rumex, Sagittaria*), and wetland shrubs such as *Alnus incana, Alnus serrulata, Cornus sericea*, other *Cornus* spp., and *Salix* spp. The substrate is mineral soil or deep muck, but not peat.

***Classification Comments:** This unit is geographically and hydrologically rather broad, and, ultimately, some subdivision may be warranted. Also Atlantic & Gulf Coastal Plain Wet Prairie & Marsh Macrogroup (M067) overlaps a great deal and is confusing because it is coastal, mostly, and this macrogroup (M069) is mostly non-coastal except for Northern & Mid-Atlantic Coastal Wetland Group (G752). The distinction between these two needs to be made very clear.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M303	Eastern-Southeastern North American Ruderal Marsh, Wet Meadow & Shrubland	monodominant stands of invasives, such as *Phragmites australis* or *Typha angustifolia* are present in some sites. Where they are mixed with natives they can be treated with M069.
M071	Great Plains Marsh, Wet Meadow, Shrubland & Playa	has substantial overlap in species composition but vegetation of the Great Plains can be differentiated by marsh and wet meadow species that do not occur or are rare in the East, such as *Beckmannia syzigachne, Calamagrostis stricta, Carex nebrascensis, Pascopyrum smithii, Scolochloa festucacea, Sporobolus airoides*, and others.
M066	Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh	
M067	Atlantic & Gulf Coastal Plain Wet Prairie & Marsh	overlaps a great deal and is confusing because it is coastal, mostly, and M069 is mostly non-coastal except G752.
M108	Eastern North American Freshwater Aquatic Vegetation	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Physiognomy is widely variable among and often within sites, ranging from dense shrub swamp, to herbaceous wetland with varying but generally small amounts of shrub or tree sapling cover. Evergreens are generally absent or unimportant.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: These freshwater marshes and shrub swamps are characterized by a high diversity of species. *Typha* spp. and *Schoenoplectus* spp. are common and widespread, but a wide variety may be dominant in any single stand. Dominant shrubs include *Alnus incana ssp. rugosa* or *Alnus serrulata, Cephalanthus occidentalis, Cornus* spp., or *Vaccinium corymbosum*. Associates include *Ilex verticillata, Myrica gale, Spiraea alba, Salix* spp., and *Viburnum nudum var. cassinoides*. Many other graminoids or broad-leaved forbs can be found in these wetlands. Some of the common ones are *Calamagrostis canadensis, Carex aquatilis, Carex lacustris, Carex pellita, Carex stricta, Dulichium arundinaceum, Eleocharis palustris, Juncus* spp., *Leersia oryzoides, Peltandra virginica, Pontederia cordata, Sagittaria latifolia, Schoenoplectus acutus, Schoenoplectus americanus, Bolboschoenus fluviatilis (= Schoenoplectus fluviatilis), Schoenoplectus tabernaemontani, Scirpus atrovirens, Scirpus cyperinus, Sparganium* spp., *Spartina pectinata, Zizania aquatica*, and *Zizania palustris*. Along the drier margins of some sites where soils are more saturated than flooded, *Calla palustris, Symplocarpus foetidus*, and *Thelypteris palustris* can sometimes be found. The invasives *Lythrum salicaria* and *Phragmites australis* are present in some sites.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The dynamics of water levels are the most important factor in this vegetation, differentiating it from both the surrounding uplands and among the various alliances and associations comprising the macrogroup. Variation in rainfall patterns and in site drainage drives variation in duration of flooding. Wave and current action is typically minor, although especially strong storms may create large waves and/or currents that break up marsh vegetation. Prolonged drought or a lowering of the water table may lead to exposure of the soil and invasion by plants less tolerant of prolonged flooding. Fire is presumably naturally rare in this vegetation. Although they would naturally be exposed to fires in the surrounding uplands, standing water and lack of continuous fuel limit fires to the edges, except perhaps in early fall. Presumably important as a dynamic process is the migration of amphibians, which concentrate here for breeding. Ecosystem dynamics may be strongly affected by the suitability of surrounding uplands for amphibian adult habitat.

ENVIRONMENT

Environmental Description: The climate of these wetlands ranges from temperate to boreal in Canada and the northern United States. Hydrology ranges from saturated to seasonally flooded to semipermanently flooded. Stands occur on flat to gently sloping to undulating surfaces, in shallow to deep basins of sinkholes or other isolated depressions on uplands, or associated with water courses, lakes, or ponds. Soils are poorly drained to very poorly drained, and surface water may be present for extended periods of time, rarely becoming dry. The typical hydrology is seasonally flooded, but the hydroperiod may be of greater or lesser length, depending on the depth of the basin or depression feature and the annual rainfall. Water depth may vary greatly on a seasonal basis and may be a meter deep or more in the winter in examples with longer hydroperiods. Some examples become dry in the summer. Most examples are eutrophic with muck over mineral soil as the substrate. Where associated with lakes or ponds, wave or currents are more active, and the mineral soil may be exposed.

DISTRIBUTION

***Geographic Range:** This freshwater marsh macrogroup is found across temperate and boreal eastern North America, north of the southern Atlantic and Gulf coastal plains and east of the Great Plains and Yukon Territory. It stretches from eastern to central boreal Canada, from New England and New Brunswick, excluding the Atlantic Coastal Plain, west through the Great Lakes area to eastern North Dakota and northwestern Ontario, south to Missouri and east to the Southern Blue Ridge and Southern and Central Appalachians.
Nations: CA, US
States/Provinces: AB, AR, CT, DE, IA, IL, IN, KY, MA, MB, MD, ME, MI, MN, MO, NB, ND, NF, NH, NJ, NS, NY, OH, ON, PA, PE, QC, RI, SD, SK, TN, VA, VT, WI, WV
USFS Ecoregions (2007) [optional]: 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212J:CC, 212Lb:CPP, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC, 212Sc:CCC, 212Sn:CCC, 212Sq:CCC, 212Te:CCC, 212Tf:CCC, 212Y:CC, 212Z:CC, 222Ja:CCC, 222Jb:CCC, 222Jc:CCC, 222Je:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Ua:CCC, 222Ud:CCC, 222Ue:CCC
Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G125	Eastern North American Freshwater Marsh
G167	Eastern North American Shrub Swamp
G599	Central Interior-Appalachian Open Depression Pond
G770	Midwest Wet Prairie & Wet Meadow
G771	Laurentian-Northeastern Wet Meadow
G773	Eastern North American Inland Saline Marsh
G803	Southeastern Granite Outcrop Pool

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-07-16	M160 Northern & Central Tall Shrub Wetland Macrogroup	M160 merged into M069

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Atlantic Freshwater Marshes	National Wetlands Working Group 1988	
<	Eastern Temperate Marsh	National Wetlands Working Group 1988	
<	Emergent Aquatics	Curtis 1959	Does not include the Great Lakes shore marshes in Wisconsin.
>	Freshwater Marsh	Mitsch and Gosselink 2000	
><	Freshwater wetland	Golet and Larson 1974	
>	Scrub-Shrub Wetland: Broad-lead Deciduous subclass	Cowardin et al. 1979	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.T. Curtis (1959); F.C. Golet (1973)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake, S.C. Gawler, L. Sneddon
Acknowledgments [optional]:
Version Date: 11 Jan 2016

REFERENCES

***References [Required if used in text]:**

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. FWS/OBS-79/31. USDI Fish & Wildlife Service, Office of Biological Services, Washington, DC. 103 pp.

Curtis, J. T. 1959. The vegetation of Wisconsin: An ordination of plant communities. Reprinted in 1987. University of Wisconsin Press, Madison. 657 pp.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Golet, F. C. 1973. Wildlife wetland evaluations mode. In: J. S. Larson, editor. A guide to important characteristics and values of freshwater wetlands in the Northeast. Publication 31. Water Resources Research Center, University of Massachusetts, Amherst. 91 pp.

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Mitsch, W. J., and J. G. Gosselink. 2000. Wetlands. Third edition. John Wiley & Sons, Inc., New York. 920 pp.

National Wetlands Working Group. 1988. Wetlands of Canada. Ecological Land Classification Series, No. 24. Sustainable Development Branch, Environment Canada, Ottawa, Ontario, and Polyscience Publications Inc., Montreal, Quebec. 452 pp.

Wharton, C. H. 1978. The natural environments of Georgia. Georgia Department of Natural Resources, Atlanta. 227 pp.

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G125. Eastern North American Freshwater Marsh

Type Concept Sentence: This group is composed of freshwater emergent herbaceous marshes in the cool-temperate region of eastern North America from western Minnesota and northern Missouri east. Stands of this group are usually dominated by medium to tall graminoids, though short forbs dominate some stands in the east. Sites are flooded for a few weeks to the entire growing season but water depth is shallow.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.4.Nd.2. Eastern North American Marsh, Wet Meadow & Shrubland (M069)

Elcode: G125
***Scientific Name:** *Schoenoplectus* spp. - *Typha* spp. Freshwater Marsh Group
***Common (Translated Scientific) Name:** Bulrush species - Cattail species Freshwater Marsh Group
***Colloquial Name:** Eastern North American Freshwater Marsh

***Type Concept:** These freshwater emergent marshes are dominated by herbaceous vegetation, primarily graminoids. *Schoenoplectus* spp., *Typha* spp., and *Zizania* spp. are common dominants though other species can be abundant or even form nearly monotypic stands. They are common throughout the northern half of the eastern United States and adjacent Canadian provinces. Freshwater marshes occur in closed or open basins that are generally flat and shallow and are always or nearly always flooded. Water depths range from a few centimeters to approximately 1 m. They are associated with lakes, ponds, slow-moving streams, and/or impoundments or ditches. These marshes include those along the shores and estuaries of the Great Lakes. Dominant vegetation tends to be 1-2 m tall and cover varies from moderate to dense. Scattered shrubs may be present but total less than 25% cover. Trees are generally absent and, if present, are scattered. The substrate is typically muck over mineral soil, though where waves or currents are stronger or in some low-nutrient sites, the mineral soil may be exposed.

***Diagnostic Characteristics:** Permanently or semipermanently flooded freshwater emergent marshes dominated by herbaceous species, often including *Typha* spp. and/or *Schoenoplectus* spp. but many species are possible, including *Equisetum fluviatile, Eriocaulon aquaticum, Peltandra virginica, Pontederia cordata*, and *Zizania* spp. Tall shrubs have <25% cover.

***Classification Comments:** Freshwater marshes have some overlap floristically and spatially with these other groups: Midwest Wet Prairie & Wet Meadow Group (G770), Laurentian-Northeastern Wet Meadow Group (G771), Great Plains Freshwater Marsh Group (G325), and Eastern North American Shrub Swamp Group (G167). G770 and G771 have flooding that is less deep and less permanent (sites often dry up by mid- to late-summer), and sites tend to be dominated by *Carex* spp., *Calamagrostis canadensis*, or *Spartina pectinata*. G325 is in similar habitats but found further west. Species and ranges of G325 and this group (G125) overlap and need to be clarified. G167 is similar to this group but dominated by tall shrubs and may be drier in some cases.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G599	Central Interior-Appalachian Open Depression Pond	
G771	Laurentian-Northeastern Wet Meadow	
G770	Midwest Wet Prairie & Wet Meadow	
G325	Great Plains Freshwater Marsh	
G167	Eastern North American Shrub Swamp	
G556	Eastern Ruderal Wet Meadow & Marsh	
G110	Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh	
G188	Atlantic & Gulf Coastal Plain River & Basin Freshwater Marsh	
G595	Eastern North American Ruderal Aquatic Vegetation	
G114	Eastern North American Freshwater Aquatic Vegetation	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Freshwater emergent marshes are dominated by medium to tall herbaceous plants, typically graminoids. Typical heights are 1-2 m, though a variety of low-forbs can predominate in some stands with heights rarely exceeding 0.5 m above the water surface. Vegetation cover is extremely variable from sparse to very dense. Shrubs are not common; when present, they tend to be on the drier portions of these communities.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: These freshwater marshes can be dominated by a variety of species. *Typha* spp. and *Schoenoplectus* spp. are common and widespread, but a wide variety of species may be dominant in any single stand. Dominants include *Equisetum fluviatile, Eriocaulon aquaticum* (in the eastern portion of the range and tends to be on more oligotrophic sites), *Pontederia cordata* (in the eastern portion of the range), *Schoenoplectus acutus, Schoenoplectus americanus, Bolboschoenus fluviatilis (= Schoenoplectus fluviatilis), Schoenoplectus tabernaemontani, Sparganium* spp., *Typha angustifolia, Typha latifolia, Zizania aquatica*, and *Zizania palustris*. Many other graminoids or broad-leaved forbs can be found in these marshes. Some of the common ones are *Carex aquatilis, Carex lacustris, Carex pellita, Carex stricta, Eleocharis palustris, Leersia oryzoides, Peltandra virginica*, and *Sagittaria latifolia*. Along the drier margins of some sites where soils are more saturated than flooded, *Calla palustris, Symplocarpus foetidus*, and *Thelypteris palustris* can sometimes be found, and in areas with more variable or shallow flooding, some wet meadow species may be present. *Calamagrostis canadensis, Dulichium arundinaceum*, and *Spartina pectinata* are typical of these areas. Floating-leaved or submergent species can be present where the water is deeper. Non-rooted floating-leaved species, typically *Lemna* spp., *Spirodela polyrrhiza*, and *Wolffia* spp., are often present to abundant in the spaces between the emergent plants. The invasives *Lythrum salicaria* and *Phragmites australis* are abundant in some sites and may even form nearly monotypic stands. Shrubs are absent to rare; when present, *Alnus incana, Ilex verticillata, Myrica gale*, and *Spiraea alba* are typical.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Wave and current action is typically minor in these marshes. Especially strong storms may create especially strong waves and/or currents that break up marsh vegetation. Prolonged drought or a lowering of the water table may lead to exposure of the soil and invasion by plants more typical of wet meadows. Prolonged increases in the water level will favor submergent or floating-leaved vegetation. These dynamics of flood and drought are more common on the western edge of this group's range, though not as common as in the Great Plains.

ENVIRONMENT

Environmental Description: *Climate:* The climate of these marshes ranges from cool-temperate to sub-boreal in southern Canada and the northern United States to nearly warm-temperate in the Atlantic Coastal Plain in Virginia and Maryland.

Soil/substrate/hydrology: Most examples of these marshes are eutrophic with muck over mineral soil as the substrate. Where wave or currents are more active, the mineral soil may be exposed. Some examples of these marshes occur on oligotrophic sites where sand is the substrate. Parts of these marshes can occur on floating root mats which may move with prevailing currents or winds. Marshes are permanently to semipermanently flooded with water depths from a few centimeters to over 1 m deep except in very dry years.

DISTRIBUTION

***Geographic Range:** This freshwater marsh group is found across most of the northern half of the eastern United States and adjacent Canada. This area stretches from New England and New Brunswick south to Virginia and west through the Great Lakes area to eastern North Dakota and northwestern Ontario, south to northern Missouri.
Nations: CA, US
States/Provinces: CT, DC?, DE, IA, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, NB, ND, NE, NH, NJ, NS, NY, OH, ON, PA, PE, QC, RI, SD, TN, VA, VT, WI, WV
USFS Ecoregions (2007) [optional]: 211A:CC, 211B:CC, 211C:CC, 211D:CC, 211E:CC, 211F:CC, 211G:CC, 211I:CC, 211J:CC, 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212J:CC, 212K:CC, 212Lb:CCP, 212M:CC, 212N:CC, 212Q:CC, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC, 212Sc:CCC, 212Sn:CCC, 212Sq:CCC, 212Te:CCC, 212Tf:CCC, 212Y:CC, 212Z:CC, 221A:CC, 221B:CC, 221D:CC, 221F:CC, 222I:CC, 222Ja:CCC, 222Jb:CCC, 222Jc:CCC, 222Je:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222K:CC, 222L:CC, 222M:CC, 222N:CC, 251A:CC, 251B:CC, 251C:CC, 251D:CC, 251H:C?, M211A:C?, M211B:C?, M211C:C?, M211D:C?
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3666	*Schoenoplectus tabernaemontani - Bolboschoenus fluviatilis - Typha* spp. Shallow Marsh Alliance
A3664	*Schoenoplectus acutus - Bolboschoenus fluviatilis - Schoenoplectus tabernaemontani* Marsh Alliance
A1436	*Typha angustifolia - Typha latifolia - Schoenoplectus* spp. Deep Marsh Alliance
A3669	*Peltandra virginica - Pontederia cordata - Sagittaria* spp. Marsh Alliance
A3667	*Equisetum fluviatile - Eleocharis palustris* Marsh Alliance
A1441	*Zizania aquatica - Zizania palustris* Marsh Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Emergent Aquatics	Curtis 1959	Does not include the Great Lakes shore marshes in Wisconsin.
<	Emergent Marsh	Kost et al. 2007	
><	Great Lakes Marsh	Kost et al. 2007	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. Drake, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake

Acknowledgments [optional]:

Version Date: 19 May 2015

REFERENCES

***References [Required if used in text]:**

Curtis, J. T. 1959. The vegetation of Wisconsin: An ordination of plant communities. Reprinted in 1987. University of Wisconsin Press, Madison. 657 pp.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Kost, M. A., D. A. Albert, J. G. Cohen, B. S. Slaughter, R. K. Schillo, C. R. Weber, and K. A. Chapman. 2007. Natural communities of Michigan: Classification and description. Report No. 2007-21, Michigan Natural Features Inventory, Lansing. 314 pp. [http://web4.msue.msu.edu/mnfi/reports/2007-21_Natural_Communites_of_Michigan_Classification_and_Description.pdf]

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2. Shrub & Herb Vegetation

2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G167. Eastern North American Shrub Swamp

Type Concept Sentence: This group encompasses mineral-soil wetlands dominated by tall shrubs in the northeastern and north-central United States and adjacent Canada, commonly dominated by either *Alnus incana ssp. rugosa* or *Alnus serrulata*, with *Cornus sericea* and/or *Spiraea alba*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Nd.2. Eastern North American Marsh, Wet Meadow & Shrubland (M069)

Elcode: G167

***Scientific Name:** *Alnus incana - Cornus* spp. - *Cephalanthus occidentalis* Shrub Swamp Group

***Common (Translated Scientific) Name:** Gray Alder - Dogwood species - Common Buttonbush Shrub Swamp Group

***Colloquial Name:** Eastern North American Shrub Swamp

***Type Concept:** This group encompasses mineral-soil wetlands dominated by tall shrubs in the northeastern and north-central United States and adjacent Canada. It is best developed in glaciated territory but extends southward in the mountains to West Virginia. These shrublands develop in poorly drained basins and along smaller low-gradient streams, on mineral soils with or without a well-decomposed muck layer. The classic physiognomy is a dense cover of shrubs over 1 m tall, and often over 2 m tall. Trees may be scattered but form less than 25% cover. Herb cover varies depending on how much light reaches the ground. The most common dominant is *Alnus*, either *Alnus incana ssp. rugosa* or *Alnus serrulata*. Other important species include *Cornus sericea* and *Spiraea alba*. Associates include *Ilex verticillata, Viburnum nudum var. cassinoides*, and *Salix* spp. This group also includes wetlands where the above species may be only incidental, if present at all, with dominance by *Cephalanthus occidentalis* or, less commonly, *Vaccinium corymbosum*. Typical herbs of these swamps include *Calamagrostis canadensis, Thelypteris palustris, Eutrochium maculatum, Lycopus uniflorus, Impatiens capensis, Chelone glabra*, and *Onoclea sensibilis*. This group includes wetlands that are more-or-less stable shrub swamps, as well as shrub swamps on formerly cleared lands that may be developing into wooded swamps.

***Diagnostic Characteristics:** Wetlands on mineral soils (a muck layer may be present, but these are not peatlands) in which the tree canopy (of individuals > 6 m tall) is less than 25% and where the dominant canopy is formed by shrubs 2-6 m tall or less commonly 1-2 m tall. Shrubs are generally deciduous.

***Classification Comments:** These swamps are not well-documented as a group in the literature or in available plot data. In Atlantic Canada, some species of this type, such as *Cephalanthus occidentalis*, may be more typical on the coast (S. Basquill pers. comm. 2015).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G125	Eastern North American Freshwater Marsh	
G771	Laurentian-Northeastern Wet Meadow	
G770	Midwest Wet Prairie & Wet Meadow	
G599	Central Interior-Appalachian Open Depression Pond	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The canopy is formed by tall shrubs, mostly over 2 m, but sometimes 1-2 m tall. Shrub cover is typically dense, forming thickets. Scattered trees may emerge above the shrub canopy. The herb layer is variable in cover but usually fairly well-developed.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The most common dominant is *Alnus*, either *Alnus incana ssp. rugosa* or *Alnus serrulata*. Other important species include *Cornus sericea* and *Spiraea alba*. Associates include *Ilex verticillata, Viburnum nudum var. cassinoides*, and *Salix* spp. This group also includes wetlands with dominance by *Cephalanthus occidentalis* or, less commonly, *Vaccinium corymbosum*. Typical herbs of these swamps include *Calamagrostis canadensis, Thelypteris palustris, Eutrochium maculatum (= Eupatorium maculatum), Lycopus uniflorus, Impatiens capensis, Chelone glabra*, and *Onoclea sensibilis*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: *Climate:* North-temperate eastern North America. *Soil/substrate/hydrology:* The wet soils of these swamps range from saturated to seasonally flooded, less often permanently flooded. There may be a layer of well-decomposed muck over the mineral soils substrate. Soil chemistry varies; most documented sites are in the weakly circumneutral to moderately acidic range.

DISTRIBUTION

***Geographic Range:** This group ranges across northeastern and north-central United States and adjacent Canada, from the Maritime Provinces across New England and New York to Minnesota, and south to Iowa, Ohio, West Virginia, and Virginia.
Nations: CA, US
States/Provinces: CT, DE, IA, IL, IN, MA, MD, ME, MI, MN, NB, NH, NJ, NS, NY, OH, ON, PA, QC, RI, VA, VT, WI, WV
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3684	*Alnus incana - Cornus amomum* Alluvial & Tidal Shrub Swamp Alliance
A3670	*Cephalanthus occidentalis - Decodon verticillatus* Shrub Swamp Alliance
A0795	*Arundinaria gigantea* Shrub Swamp Alliance
A3685	*Alnus* spp. - *Salix* spp. Lakeshore & Depression Shrub Swamp Alliance
A3656	*Cornus sericea - Salix* spp. Shrub Swamp Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Northern Wet Meadow/Carr Class [WMn82]	Minnesota DNR 2003	List of dominants is drawn from 236 plots.
>	Scrub-Shrub Wetland: Broad-lead Deciduous subclass	Cowardin et al. 1979	
=	Shrub swamp	Edinger et al. 2002	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.T. Curtis (1959)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler

Acknowledgments [optional]:

Version Date: 23 Mar 2010

REFERENCES

***References [Required if used in text]:**

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. FWS/OBS-79/31. USDI Fish & Wildlife Service, Office of Biological Services, Washington, DC. 103 pp.

Curtis, J. T. 1959. The vegetation of Wisconsin: An ordination of plant communities. Reprinted in 1987. University of Wisconsin Press, Madison. 657 pp.

Edinger, G. J., D. J. Evans, S. Gebauer, T. G. Howard, D. M. Hunt, and A. M. Olivero, editors. 2002. Ecological communities of New York state. Second edition. A revised and expanded edition of Carol Reschke's ecological communities of New York state. (Draft for review). New York Natural Heritage Program, New York State Department of Environmental Conservation, Albany, NY.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Kost, M. A., D. A. Albert, J. G. Cohen, B. S. Slaughter, R. K. Schillo, C. R. Weber, and K. A. Chapman. 2007. Natural communities of Michigan: Classification and description. Report No. 2007-21, Michigan Natural Features Inventory, Lansing. 314 pp. [http://web4.msue.msu.edu/mnfi/reports/2007-21_Natural_Communites_of_Michigan_Classification_and_Description.pdf]

Minnesota DNR [Minnesota Department of Natural Resources]. 2003. Field guide to the native plant communities of Minnesota: The Laurentian Mixed Forest Province. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. Minnesota Department of Natural Resources, St. Paul.

G770. Midwest Wet Prairie & Wet Meadow

Type Concept Sentence: This herbaceous group is found in the midwestern United States and Canada on wet-mesic to wet sites dominated by medium to tall graminoids, generally 1-2 m tall. Dominant species include *Andropogon gerardii, Calamagrostis canadensis, Panicum virgatum*, and *Spartina pectinata*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.4.Nd.2. Eastern North American Marsh, Wet Meadow & Shrubland (M069)

Elcode: G770
***Scientific Name:** *Spartina pectinata - Calamagrostis canadensis - Carex* spp. Midwest Wet Prairie & Wet Meadow Group
***Common (Translated Scientific) Name:** Prairie Cordgrass - Bluejoint - Sedge species Midwest Wet Prairie & Wet Meadow Group
***Colloquial Name:** Midwest Wet Prairie & Wet Meadow

***Type Concept:** This herbaceous group is found on wet-mesic to wet sites dominated by medium to tall graminoids, generally 1-2 m tall. Dominant species include *Andropogon gerardii, Calamagrostis canadensis, Panicum virgatum*, and *Spartina pectinata*. Some stands are affected by saline groundwater and have other species such as *Calamagrostis stricta, Carex praegracilis*, and *Carex sartwellii*. A wide variety of forbs can be found in this group and some can be very common in some places. Shrubs are absent to sparse in most stands but some can have significant cover of *Betula pumila, Salix petiolaris, Salix discolor*, and *Spiraea tomentosa*, though still with a wet-prairie herbaceous layer. This group is found on flat or very gently sloping sites. It can occur on silt, loam, clay, or fine sands but all sites are flooded or saturated for a few to several weeks in most years.

***Diagnostic Characteristics:** This group is characterized by graminoid-dominated wet and wet-mesic prairies found in the tallgrass and southern Great Lakes regions of the Midwest and Canada. Dominants usually include *Andropogon gerardii, Calamagrostis canadensis, Carex* spp., *Panicum virgatum*, and *Spartina pectinata*. Shrubs are usually absent to uncommon but some stands can have a prominent shrub layer of *Betula pumila, Salix petiolaris, Salix discolor*, and *Spiraea tomentosa* with a similar herbaceous layer to non-shrub-dominated sites.

***Classification Comments:** This group can be very similar to Laurentian-Northeastern Wet Meadow Group (G771) in the central and western Great Lakes area. Each group can have stands dominated by *Calamagrostis canadensis, Carex lacustris*, and *Carex stricta*. Differential species are not well known but could include *Carex atherodes* and *Carex sartwellii* for G770 and *Carex utriculata* and *Carex vesicaria* for G771. Stands in the central and western Great Lakes area lacking good differential species and dominated by *Calamagrostis canadensis, Carex lacustris*, and *Carex stricta* may need to be placed in a group based on their geographic location. Stands in Province 212 go to G771 and stands in Province 222 go to G770 (Cleland et al. 2007).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G167	Eastern North American Shrub Swamp	
G125	Eastern North American Freshwater Marsh	
G771	Laurentian-Northeastern Wet Meadow	
G556	Eastern Ruderal Wet Meadow & Marsh	
G773	Eastern North American Inland Saline Marsh	
G336	Great Plains Wet Prairie, Wet Meadow & Seepage Fen	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Sites have a moderate to dense cover of medium to tall (1-2 m) graminoids. Shrubs are uncommon in most stands but can be abundant in some. These shrubs tend to be around 2 m tall.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This group is usually dominated by graminoids *Andropogon gerardii, Calamagrostis canadensis, Panicum virgatum, Spartina pectinata*, and a variety of wetland *Carex* spp. Common Carices include *Carex aquatilis, Carex atherodes, Carex lacustris, Carex pellita, Carex stricta*, and *Carex vulpinoidea*. More saline sites have *Carex praegracilis* and *Carex sartwellii*. Seeps in the Great Plains typically have *Schoenoplectus pungens, Schoenoplectus tabernaemontani, Typha latifolia*, and Carices, such as *Carex emoryi, Carex hystericina, Carex lurida*, and *Carex pellita*. A wide variety of forbs can occur and they can be abundant on some sites. Typical forbs include *Asclepias incarnata, Apocynum cannabinum, Campanula aparinoides, Comarum palustre, Epilobium leptophyllum, Eutrochium maculatum (= Eupatorium maculatum), Eupatorium perfoliatum, Helianthus grosseserratus, Impatiens capensis, Iris versicolor, Lythrum alatum, Polygonum amphibium, Pycnanthemum virginianum, Symphyotrichum ericoides (= Aster ericoides), Symphyotrichum lanceolatum, Symphyotrichum novae-angliae (= Aster novae-angliae)*, and *Thalictrum dasycarpum*. Shrubs are usually uncommon but some sites can have abundant *Betula pumila, Salix petiolaris, Salix discolor*, and *Spiraea tomentosa*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Stands are flooded or saturated for at least a few weeks each year and can remain saturated for most of the growing season in some stands. Prolonged changes in hydrologic regime, either wetter or drier, often result in a change to a different group (emergent marshes if a wetter regime and mesic prairie if a drier regime). Fires, usually spreading from adjacent uplands, can move through examples of this group periodically, removing plant litter and woody species. These fires are more common in the grassland-dominated landscapes of the tallgrass prairie region and less common in forested landscapes such as southern Wisconsin and central Minnesota.

ENVIRONMENT

Environmental Description: This group occurs in shallow depressions and along the edges of deeper wetlands or where groundwater seeps to the surface. Soils are often fine-textured but they can be sandy where there is a shallow water table or where a sub-surface layer of more impermeable soil allows water to remain close to the surface for longer periods.

DISTRIBUTION

***Geographic Range:** This group is found across much of the tallgrass and southern Great Lakes region from northwestern Minnesota and eastern North Dakota south to eastern Oklahoma east to central Ohio and southern Ontario.
Nations: CA, US
States/Provinces: AR, IA, IL, IN, KS, KY?, MB, MI, MN, MO, ND, NE, OH, OK, ON, QC?, SD, WI
USFS Ecoregions (2007) [optional]: 222H:CC, 222J:CC, 222K:CC, 222L:CC, 222M:CC, 222N:CC, 222R:CC, 222U:CC, 251A:CC, 251B:CC, 251C:CC, 251D:CC, 251E:CC, 251F:CP, 251H:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3494	*Carex* spp. - *Typha latifolia - Schoenoplectus pungens* Seep Alliance
A4105	*Carex* spp. - *Calamagrostis canadensis* Midwest Wet Meadow Alliance
A1350	*Calamagrostis stricta - Carex sartwellii - Carex praegracilis* Saline Wet Meadow Alliance
A3654	*Spartina pectinata* Wet Prairie Alliance
A4056	*Andropogon gerardii - Panicum virgatum* Wet Prairie Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-07-16	G112 Carex spp. - Calamagrostis canadensis - Spartina pectinata Wet Meadow & Wet Prairie Group	G112 split into G770, G771 & G773

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. Drake, in Faber-Langendoen et al. (2015)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake
Acknowledgments [optional]:
Version Date: 20 May 2015

REFERENCES

***References [Required if used in text]:**

Cleland, D. T., J. A. Freeouf, J. E. Keys, Jr., G. J. Nowacki, C. Carpenter, and W. H. McNab. 2007. Ecological subregions: Sections and subsections for the conterminous United States. A. M. Sloan, cartographer. General Technical Report WO-76. USDA Forest Service, Washington, DC. [1:3,500,000] [CD-ROM].

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G771. Laurentian-Northeastern Wet Meadow

Type Concept Sentence: This Laurentian-Northeastern group is found in basins or along rivers and streams in areas of low current where soils are saturated or flooded with shallow water for part to most of the growing season and the vegetation is dominated by short to medium-tall forbs and graminoids or, rarely, the shrub *Spiraea alba*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.4.Nd.2. Eastern North American Marsh, Wet Meadow & Shrubland (M069)

Elcode: G771
***Scientific Name:** *Carex* spp. - *Calamagrostis canadensis* - *Scirpus cyperinus* Wet Meadow Group
***Common (Translated Scientific) Name:** Sedge species - Bluejoint - Woolgrass Wet Meadow Group
***Colloquial Name:** Laurentian-Northeastern Wet Meadow

***Type Concept:** This group is found in the Laurentian region of the Great Lakes and the northeastern United States and adjacent Canada north from West Virginia. It is characterized by wet-mesic to wet sites and can be dominated by a variety of graminoids and forbs. Common abundant species include the graminoids *Calamagrostis canadensis, Carex lacustris, Carex stricta, Carex vesicaria, Carex utriculata, Glyceria striata, Leersia oryzoides*, and *Scirpus cyperinus*. Forbs that may be common or dominant include *Boltonia asteroides var. asteroides, Eutrochium fistulosum, Eupatorium perfoliatum, Impatiens capensis, Impatiens pallida, Mentha arvensis, Sagittaria latifolia, Solidago canadensis, Solidago rugosa, Symphyotrichum racemosum*, and *Verbesina alternifolia*. Sites are found in basins or along slow-moving rivers and streams and are flooded or saturated for at least some of the growing season but rarely more than 0.3 m deep.

***Diagnostic Characteristics:** This group is characterized by wet-mesic to wet sites dominated by graminoids and forbs. Sites are found in basins or along slow-moving rivers and streams and are flooded or saturated for at least some of the growing season but rarely more than 0.3 m deep. Sites are relatively rich and lack significant bog or fen indicator species.

***Classification Comments:** This group can be very similar to Midwest Wet Prairie & Wet Meadow Group (G770) in the central and western Great Lakes area. Each group can have stands dominated by *Calamagrostis canadensis, Carex lacustris*, and *Carex stricta*. Differential species are not well known but could include *Carex atherodes* and *Carex sartwellii* for G770 and *Carex utriculata* and *Carex vesicaria* for G771. Stands in the central and western Great Lakes area lacking good differential species and dominated by *Calamagrostis canadensis, Carex lacustris*, and *Carex stricta* may need to be placed in a group based on their geographic location. Stands in Province 212 go to G771 and stands in Province 222 go to G770 (Cleland et al. 2007).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G167	Eastern North American Shrub Swamp	
G770	Midwest Wet Prairie & Wet Meadow	
G556	Eastern Ruderal Wet Meadow & Marsh	
G125	Eastern North American Freshwater Marsh	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group usually has a moderate to dense cover of graminoids and forbs 0.5-1.5 m tall. Shrubs and trees are usually absent to uncommon (<25%) but stands in the Allegheny Mountains of West Virginia can have a dense layer of shrubs approximately 2 m tall.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: A variety of forbs and graminoids can dominate stands of this group. Graminoids may be more common across the group and some can be very abundant, forming low-diversity stands strongly dominated by a few species but stands with a wide variety of forbs and graminoids can also be found. Graminoids that can be common to dominant are *Calamagrostis canadensis* and *Carex* spp., usually *Carex lacustris, Carex stricta, Carex vesicaria*, and *Carex utriculata, Glyceria striata, Leersia oryzoides, Scirpus atrovirens*, and *Scirpus cyperinus*. Forbs that may be common or dominant include *Boltonia asteroides var. asteroides, Eutrochium fistulosum (= Eupatorium fistulosum), Eupatorium perfoliatum, Impatiens capensis, Impatiens pallida, Mentha arvensis, Sagittaria latifolia, Solidago canadensis, Solidago rugosa, Symphyotrichum racemosum*, and *Verbesina alternifolia*. A variety of other graminoids and forbs may be present, including *Agrostis gigantea, Carex aquatilis, Dulichium arundinaceum, Glyceria grandis, Juncus effusus, Poa palustris*, and *Typha* spp., and common forbs include *Acorus calamus, Boehmeria cylindrica, Comarum palustre, Iris versicolor, Polygonum amphibium, Symphyotrichum lanceolatum*, and *Thelypteris palustris*. Shrubs typically have <25% cover and include *Alnus incana, Alnus serrulata, Cephalanthus occidentalis* (in the east), and *Vaccinium corymbosum*. Some stands noted in West Virginia have a high cover of *Spiraea alba*. Trees are absent to uncommon and may include *Acer rubrum, Fraxinus nigra, Fraxinus pennsylvanica, Salix nigra, Thuja occidentalis*, and others. The grass *Phalaris arundinacea* and the exotic shrubs *Rhamnus cathartica* and *Rosa multiflora* are sometimes invasive in this community and can become very abundant.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Stands are flooded or saturated for at least a few weeks each year and can remain saturated for most of the growing season in some stands. Prolonged changes in hydrologic regime, either wetter or drier, often result in a change to a different group. This group is common behind beaver dams.

ENVIRONMENT

Environmental Description: This group occurs in basins or along the edges of slow-moving rivers or streams. Sites are saturated or flooded by shallow water for at least a few weeks during the growing season. Water is usually less than 0.3 m deep. Soils are alluvial, muck, or sometimes peaty. This group occurs from low elevations near the coast in New England and New Jersey to the high Allegheny Mountains in West Virginia.

DISTRIBUTION

***Geographic Range:** This group is common in the Laurentian region of the Great Lakes and in the northeastern United States and adjacent Canada but does not extend into the Mid-Atlantic Coastal Plain.
Nations: CA, US
States/Provinces: CT, DC?, DE, MA, MD, ME, MI, MN, NB, NH, NJ, NS, NY, OH, ON, PA, PE, QC, RI, VA, VT, WI, WV
USFS Ecoregions (2007) [optional]: 211A:CC, 211B:CC, 211C:C?, 211D:C?, 211E:CC, 211F:CC, 211G:CC, 211I:CC, 211J:CC, 212H:CC, 212J:CC, 212K:CC, 212L:CC, 212M:CC, 212N:CC, 212Q:CC, 212R:CC, 212S:CC, 212T:CC, 212X:CC, 212Z:CC, 221A:CC, 221B:CC, 221D:CP, 221E:C?, 221F:CC, M211A:CC, M211B:CC, M211C:CC, M211D:CC, M221A:CP, M221B:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A4107	*Carex* spp. - *Calamagrostis canadensis* Eastern Wet Meadow Alliance
A1399	*Leersia oryzoides - Glyceria striata* Wet Meadow Alliance
A3661	*Impatiens capensis - Impatiens pallida - Eupatorium* spp. Wet Meadow Alliance
A3027	*Boltonia asteroides* Pondshore Wet Meadow Alliance
A1386	*Scirpus cyperinus* Wet Meadow Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-07-16	G112 Carex spp. - Calamagrostis canadensis - Spartina pectinata Wet Meadow & Wet Prairie Group	G112 split into G770, G771 & G773

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. Drake, in Faber-Langendoen et al. (2015)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake
Acknowledgments [optional]:
Version Date: 19 May 2015

REFERENCES

***References [Required if used in text]:**

Cleland, D. T., J. A. Freeouf, J. E. Keys, Jr., G. J. Nowacki, C. Carpenter, and W. H. McNab. 2007. Ecological subregions: Sections and subsections for the conterminous United States. A. M. Sloan, cartographer. General Technical Report WO-76. USDA Forest Service, Washington, DC. [1:3,500,000] [CD-ROM].

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Kost, M. A., D. A. Albert, J. G. Cohen, B. S. Slaughter, R. K. Schillo, C. R. Weber, and K. A. Chapman. 2007. Natural communities of Michigan: Classification and description. Report No. 2007-21, Michigan Natural Features Inventory, Lansing. 314 pp. [http://web4.msue.msu.edu/mnfi/reports/2007-21_Natural_Communites_of_Michigan_Classification_and_Description.pdf]

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2. Shrub & Herb Vegetation

2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G773. Eastern North American Inland Saline Marsh

Type Concept Sentence: This group consists of rare inland salt marshes in the mid-Atlantic and southern Great Lakes areas that are dominated by salt-tolerant herbaceous species.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Nd.2. Eastern North American Marsh, Wet Meadow & Shrubland (M069)

Elcode: G773

***Scientific Name:** Eastern North American Inland Saline Marsh Group

***Common (Translated Scientific) Name:** Eastern North American Inland Saline Marsh Group

***Colloquial Name:** Eastern North American Inland Saline Marsh

***Type Concept:** This inland salt marsh group occurs in just a few known locations in Virginia, New York, Michigan, and Illinois. Total vegetation cover is sparse to open in Great Lakes area stands but dense in Virginia. Stands are dominated by medium and tall herbaceous species tolerant of the saline conditions, typically including *Alisma subcordatum, Atriplex patula, Eleocharis parvula, Hordeum jubatum, Juncus gerardii, Salicornia depressa, Bolboschoenus maritimus, Bolboschoenus robustus, Spergularia salina*, and *Sium suave*. Shrubs and trees are essentially absent. These salt marshes occur where saline water emerges as spring or seeps, often as pockets within a larger freshwater marsh. Soils can be mineral, muck, or peat.

***Diagnostic Characteristics:** This group is characterized by inland saline herbaceous wetlands dominated by salt-tolerant species, usually including *Atriplex patula, Eleocharis parvula, Juncus gerardii, Bolboschoenus maritimus*, and *Bolboschoenus robustus*.

***Classification Comments:** This group contains a few unusual stands of inland saline wetlands in the eastern U.S. They show some resemblance to Atlantic coast salt marshes, and could be assigned to that macrogroup, but their ecology and floristics also overlap with freshwater marshes.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G770	Midwest Wet Prairie & Wet Meadow	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group has open to dense cover by medium and short herbaceous species. Stands near the Great Lakes tend to be open (<50% cover), while the single known stand in Virginia has dense herbaceous cover. Shrubs and trees are essentially absent, except possibly along the margins.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Stands are dominated by medium and tall herbaceous species tolerant of the saline conditions, typically including *Alisma subcordatum, Atriplex patula, Eleocharis parvula, Hordeum jubatum, Juncus gerardii, Salicornia depressa (= Salicornia virginica), Bolboschoenus maritimus (= Schoenoplectus maritimus), Bolboschoenus robustus (= Schoenoplectus robustus), Spergularia salina (= Spergularia marina)*, and *Sium suave*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Increased water from high precipitation or other sources can result in a lowering of the salinity in this group. Short-term seasonal changes of this nature are common during heavy rains or after snowmelt in the north but long-term changes in the hydrology will result in a change in the vegetation.

ENVIRONMENT

Environmental Description: These salt marshes occur where saline water emerges as spring or seeps, often as pockets within a larger freshwater marsh. Soils can be mineral, muck, or peat.

DISTRIBUTION

***Geographic Range:** This group is rare and widely scattered with a few known sites in Illinois, Michigan, and New York and one site in Virginia. It may occur in southern Ontario.
Nations: CA, US
States/Provinces: IL, MI, NS, NY, ON?, VA
USFS Ecoregions (2007) [optional]: 221E:PP, 222I:CC, 222J:CC, 222U:C?, M221A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A1434	*Bolboschoenus robustus - Bolboschoenus maritimus - Atriplex patula* Inland Saline Marsh Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-07-16	G112 Carex spp. - Calamagrostis canadensis - Spartina pectinata Wet Meadow & Wet Prairie Group	G112 split into G770, G771 & G773

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Inland Salt Marsh	Fleming and Patterson 2011a	
=	Inland Salt Marsh	Kost et al. 2007	
=	Inland salt marsh	Edinger et al. 2002	

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen, in Faber-Langendoen et al. (2013)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake
Acknowledgments [optional]:
Version Date: 19 May 2015

REFERENCES

***References [Required if used in text]:**

Edinger, G. J., D. J. Evans, S. Gebauer, T. G. Howard, D. M. Hunt, and A. M. Olivero, editors. 2002. Ecological communities of New York state. Second edition. A revised and expanded edition of Carol Reschke's ecological communities of New York state. (Draft for review). New York Natural Heritage Program, New York State Department of Environmental Conservation, Albany, NY.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Fleming, G. P., and K. D. Patterson. 2011a. Natural communities of Virginia: Ecological groups and community types. Natural Heritage Technical Report 11-07. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond. 34 pp.

Kost, M. A., D. A. Albert, J. G. Cohen, B. S. Slaughter, R. K. Schillo, C. R. Weber, and K. A. Chapman. 2007. Natural communities of Michigan: Classification and description. Report No. 2007-21, Michigan Natural Features Inventory, Lansing. 314 pp. [http://web4.msue.msu.edu/mnfi/reports/2007-21_Natural_Communites_of_Michigan_Classification_and_Description.pdf]

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

M071. Great Plains Marsh, Wet Meadow, Shrubland & Playa

Type Concept Sentence: This wetland macrogroup is found throughout the Great Plains in riparian and non-riparian settings, dominated by a wide variety of herb or shrub obligate or facultative wetland species.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.C.4.Nd.5. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland (D323)

Elcode: M071
***Scientific Name:** *Spartina pectinata* - *Typha* spp. - *Schoenoplectus* spp. Great Plains Marsh, Wet Meadow, Shrubland & Playa Macrogroup
***Common (Translated Scientific) Name:** Prairie Cordgrass - Cattail species - Bulrush species Great Plains Marsh, Wet Meadow, Shrubland & Playa Macrogroup
***Colloquial Name:** Great Plains Marsh, Wet Meadow, Shrubland & Playa

***Type Concept:** This herbaceous- or shrub-dominated wetland is found throughout the Great Plains. Sites can be dominated by emergent wetland-obligate species or by herbaceous or shrub species tolerant of seasonal flooding in riparian and non-riparian settings. Abundant species vary widely in this wide-ranging and environmentally diverse macrogroup. Common species in wetter sites include *Sagittaria* spp. *Schoenoplectus* spp., *Sparganium* spp., and *Typha* spp. In wet meadows and wet prairies, *Calamagrostis canadensis, Calamagrostis stricta, Carex* spp. (including *Carex atherodes, Carex pellita, Carex nebrascensis*), *Eleocharis palustris, Glyceria* spp., *Juncus* spp., *Lycopus americanus, Panicum virgatum, Spartina pectinata*, and *Triglochin maritima* are common. *Pascopyrum smithii* often occurs on the drier edges of stands in the western parts of its range and in temporarily flooded basins in the southern Great Plains along with *Panicum obtusum* and *Bouteloua dactyloides*. In more saline areas, common species can include *Carex sartwellii, Carex praegracilis, Hordeum jubatum, Plantago eriopoda*, and *Schoenoplectus pungens*. Shrubs are less common range-wide but dominate some sites. Typical species are *Amorpha fruticosa, Artemisia cana ssp. cana* and *Artemisia tridentata* (in the northwest portion of the range), *Cornus drummondii, Cornus sericea, Prunus virginiana, Salix* spp. (especially *Salix interior*), *Symphoricarpos occidentalis*, and the exotic *Elaeagnus angustifolia*. Seedlings of riparian trees, especially *Populus deltoides*, can be found in some stands. This macrogroup occurs in basins and along rivers and streams throughout the semi-arid to dry-temperate Great Plains. The hydrologic regime varies from sites flooded for only a few weeks each growing season to those flooded for years at a time. The water source for these sites can be snowmelt (either local or from the Rocky Mountains), rain, or groundwater. Sites with limited watersheds and little or no groundwater connection tend to be wet for short periods of time, while those with larger watersheds or more reliable water sources can be saturated or flooded for most or all of the growing season. Water varies from fresh to moderately saline. Many sites are on fine-textured, poorly drained soils either on the surface or forming an impermeable subsurface layer that prevents rapid water drainage. Some sites have coarse, often alluvial soils. Soils are nearly always mineral, but muck can accumulate on some sites, and this macrogroup includes fens where marl or peat can form.

***Diagnostic Characteristics:** This macrogroup has a range of hydrologic regimes in both riparian and non-riparian settings, but all sites are flooded for at least a few weeks during the growing season. Sites are dominated by herbaceous or shrub species that are tolerant of this inundation or are annual species that germinate after sites dry. These wetlands occur in a largely prairie landscape.

***Classification Comments:** Criteria for separating this macrogroup (M071) from Eastern North American Marsh, Wet Meadow & Shrubland Macrogroup (M069) need to be better defined.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M073	Vancouverian Lowland Marsh, Wet Meadow & Shrubland	
M069	Eastern North American Marsh, Wet Meadow & Shrubland	has substantial overlap in species composition but vegetation of the Great Plains can be differentiated by marsh and wet meadow species that do not occur or are rare in the East, such as *Beckmannia syzigachne, Calamagrostis stricta, Carex nebrascensis, Pascopyrum smithii, Scolochloa festucacea, Sporobolus airoides*, and others.
M303	Eastern-Southeastern North American Ruderal Marsh, Wet Meadow & Shrubland	
M067	Atlantic & Gulf Coastal Plain Wet Prairie & Marsh	
M077	Great Plains Saline Wet Meadow & Marsh	less-saline stands can be similar but species such as *Hordeum jubatum* and *Distichlis spicata* are more common in this macrogroup.
M108	Eastern North American Freshwater Aquatic Vegetation	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Most examples of this macrogroup are dominated by perennial herbaceous species. This includes emergent species up to 2 m tall in shallower, semipermanently flooded wetlands, and graminoids and forbs in seasonally flooded or saturated sites. Shrubs 1-3 m tall are present in some examples and can be dominant, particularly in riparian settings.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Abundant species vary widely in this wide-ranging and environmentally diverse macrogroup. Common species in wetter sites include *Sagittaria* spp., *Schoenoplectus acutus, Schoenoplectus americanus, Bolboschoenus fluviatilis (= Schoenoplectus fluviatilis), Bolboschoenus maritimus (= Schoenoplectus maritimus), Schoenoplectus tabernaemontani, Sparganium* spp., *Typha angustifolia, Typha domingensis* (in the south), and *Typha latifolia*. In wet meadows and wet prairies, *Calamagrostis canadensis, Calamagrostis stricta, Carex* spp. (including *Carex atherodes, Carex pellita, Carex nebrascensis*), *Glyceria* spp., *Eleocharis palustris, Juncus* spp., *Lycopus americanus, Panicum virgatum, Spartina pectinata*, and *Triglochin maritima* are common. *Pascopyrum smithii* often occurs on the drier edges of stands in the western parts of its range and in temporarily flooded basins in the southern Great Plains along with *Panicum obtusum* and *Bouteloua dactyloides (= Buchloe dactyloides)*. Fens contain species rarely found elsewhere in this macrogroup. These include *Carex prairea, Dulichium arundinaceum, Lobelia kalmii, Onoclea sensibilis*, and *Rhynchospora capillacea*. In more saline areas, common species can include *Carex sartwellii, Carex praegracilis, Hordeum jubatum, Plantago eriopoda*, and *Schoenoplectus pungens*. Shrubs are less common range-wide but dominate some sites. Typical species are *Amorpha fruticosa, Artemisia cana ssp. cana* and *Artemisia tridentata* (in the northwest portion of the range), *Cornus drummondii, Cornus sericea, Prunus virginiana, Salix* spp. (especially *Salix interior*), and *Symphoricarpos occidentalis*, and the exotic *Elaeagnus angustifolia*. Seedlings of riparian trees, especially *Populus deltoides*, can be found in some stands.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: These wetlands occur in a semi-arid to dry-temperate climate and so are very susceptible to seasonal and inter-annual changes in precipitation within their watersheds. With the high evaporation rates in the climatic zone, reductions in water input (through reduced rain, snowmelt, or groundwater discharge) are quickly translated to reductions in water levels. Many examples of this macrogroup are shaped by seasonal or temporary fluctuations in available water with plants able to take advantage of the higher water in the spring or after heavy rains and then tolerant of the relatively drier conditions between flooding events. Other sites have more consistent sources of water and have species that require near permanent flooding or saturation to flourish, but even these sites can be affected by inter-annual changes in precipitation levels. Many wetlands in the Great Plains change greatly in size and composition over a period of several years as precipitation levels rise and fall. Changes in water depth of over a meter are possible over several years (Stewart and Kantrud 1971). These multi-year changes promote floristic diversity by creating shifting environments and vegetation at any one place on the landscape. During the wetter seasonal or multi-year periods, temporary connections may be formed between otherwise discontinuous wetlands, allowing the spread of species and possibly affecting water chemistry through flushing of salts or other dissolved chemicals into or out of basins (Leibowitz and Vining 2003). Fire in adjacent uplands can spread into drier examples of this macrogroup, removing litter and reducing dense vegetation.

ENVIRONMENT

Environmental Description: This macrogroup occurs in basins and along rivers and streams throughout the semi-arid to dry-temperate Great Plains. The hydrologic regime varies from sites flooded for only a few weeks each growing season to those under water for years at a time. Water depth rarely exceeds 1 m for extended periods. The water source for these sites can be snowmelt (either local or from the Rocky Mountains), rain, or groundwater. Sites with limited watersheds and little or no groundwater connection tend to be wet for short periods of time while those with larger watersheds or more reliable water sources can be saturated or flooded for most or all of the growing season. Water varies from fresh to moderately saline. Many sites are on fine-textured, poorly drained soils either on the surface or forming an impermeable subsurface layer that prevents rapid water drainage. Some sites have coarse, often alluvial soils. Soils are nearly always mineral, but muck can accumulate on some sites, and this macrogroup includes fens where marl or peat can form.

DISTRIBUTION

***Geographic Range:** This macrogroup is found throughout the Great Plains from the southern Canadian Prairie Provinces to northern Texas and from the High Plains below the Rocky Mountains to the Tallgrass Prairies in the central United States.
Nations: CA, MX?, US
States/Provinces: AB, CO, IA, KS, MB, MN, MO, MT, ND, NE, NM, OK, SD, SK, TX, WY
USFS Ecoregions (2007) [optional]: 251A:CC, 251B:CC, 251C:CC, 251F:CC, 251H:CC, 315D:CC, 315F:CP, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331J:CC, 331K:CC, 331L:CC, 331M:CC, 331N:CC, 332A:CC, 332B:CC, 332C:CC, 332D:CC, 332E:CC, 332F:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G325	Great Plains Freshwater Marsh
G336	Great Plains Wet Prairie, Wet Meadow & Seepage Fen
G337	Great Plains Riparian Wet Meadow & Shrubland
G568	Great Plains Riverscour Vegetation
G136	Great Plains Playa & Rainwater Basin Wetland

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Prairie Potholes	Richardson 2000	

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake
Acknowledgments [optional]:
Version Date: 15 Oct 2014

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G325. Great Plains Freshwater Marsh

Type Concept Sentence: This herbaceous wetland group is found in much of the Great Plains in permanently flooded sites, and is often dominated by *Typha* spp. and *Schoenoplectus* spp., though other species may be dominant in some sites.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Nd.5. Great Plains Marsh, Wet Meadow, Shrubland & Playa (M071)

Elcode: G325
***Scientific Name:** *Typha* spp. - *Schoenoplectus americanus* - *Scolochloa festucacea* Great Plains Freshwater Marsh Group
***Common (Translated Scientific) Name:** Cattail species - Chairmaker's Bulrush - Common Rivergrass Great Plains Freshwater Marsh Group
***Colloquial Name:** Great Plains Freshwater Marsh

***Type Concept:** This herbaceous wetland group is found in the semi-arid and parts of the temperate zones of the Great Plains from southern Canada to northern Texas. Herbaceous species, typically between 1 and 2 m tall, dominate. Cover can vary from fairly open to very dense. Woody cover is sparse to absent. *Typha* spp. and *Schoenoplectus* spp. are the most common, though many other species can be locally abundant. Sites are usually in basins but can be found along slow-moving streams or rivers. Most sites are flooded with 0.2 to 1 m of water most or all of the growing season except in very dry or wet years.

***Diagnostic Characteristics:** This group consists of herbaceous marshes on sites that are flooded for much of the growing season in all but the driest years.

***Classification Comments:** This group has a lot of overlap with Eastern North American Freshwater Marsh Group (G125). They share a dominance by *Typha* spp. and *Schoenoplectus* spp. and have similar physiognomic and environmental characteristics. Possibly this group (G325) can be distinguished by a higher abundance of associated species such as *Beckmannia syzigachne, Calamagrostis stricta, Scolochloa festucacea, Schoenoplectus americanus* (particularly in the south), and others?

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G556	Eastern Ruderal Wet Meadow & Marsh	
G336	Great Plains Wet Prairie, Wet Meadow & Seepage Fen	is drier, with little *Typha* spp., often on the upland side of G325.
G125	Eastern North American Freshwater Marsh	
G595	Eastern North American Ruderal Aquatic Vegetation	
G114	Eastern North American Freshwater Aquatic Vegetation	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This is an herbaceous wetland. Woody plants are sparse to absent, but height and cover of herbaceous plants can vary greatly among sites and even at a given site over time. Herbaceous cover can vary from sparse to complete, and height can vary from short (<0.5 m) to tall (2 m), though most sites have an herbaceous canopy between 1 and 2 m tall. If there is a deep water edge (water deeper than will support these marshes), then the vegetation is typically fairly open and sparse along that edge.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: These marshes have a variety of species present though *Typha* spp. (*Typha latifolia, Typha angustifolia*, or, in the south, *Typha domingensis*) and *Schoenoplectus* spp. (most commonly *Schoenoplectus acutus, Schoenoplectus americanus, Bolboschoenus fluviatilis (= Schoenoplectus fluviatilis), Bolboschoenus maritimus (= Schoenoplectus maritimus)*, and *Schoenoplectus tabernaemontani*) are by far the most common species throughout the range. Within individual marshes there may be zonation where different species grow. Some favor the deeper, more permanently flooded sections, while others can tolerate or even prefer the shallower sections that dry out more frequently. Other species common locally or in parts of this group's range include *Carex* spp. (especially *Carex aquatilis* and *Carex atherodes*), *Eleocharis palustris, Eleocharis compressa, Leersia oryzoides, Polygonum pensylvanicum, Polygonum lapathifolium, Sagittaria* spp. (in wetter areas), *Scolochloa festucacea, Sparganium* spp., and *Triglochin maritima*. On drier margins or when water levels are low, *Calamagrostis stricta, Equisetum hyemale, Glyceria* spp., and *Spartina pectinata* can sometimes be found though these are more common in other vegetation types. Species abundance can change from year to year at a given site depending on water levels.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Hydrologic changes are the main natural dynamic affecting this group. These marshes are fed by larger drainage basins, and sometimes also by groundwater sources, and are thus more hydrologically stable than other basin wetlands in the Great Plains, but they still occur in a climate that is semi-arid or the dry end of temperate so water can evaporate quickly. This group occurs on sites flooded for most or all of the growing season, and these conditions need to persist at any given site for multiple years for this group to become established, but longer-term precipitation cycles result in longer-term changes in water levels that can change the vegetation at any given site from wet meadow to the deeper marshes in this group and back (Kantrud et al. 1989a). Fire can spread from adjacent uplands, particularly in late summer or fall, and dense *Typha* spp. or *Schoenoplectus* spp. can provide abundant fuel. Fires can affect the composition of these marshes by removing standing and fallen litter which allows more light to reach the surface but also reduces the amount of snow trapped during the winter (in the northern parts of the range of this group) and thus can reduce water levels the following year. Many sites have been affected by agricultural practices either through draining and conversion to cropland or through trampling and grazing by livestock. Herbivory by muskrats (*Ondatra zibethicus*) can alter vegetation cover and composition.

ENVIRONMENT

Environmental Description: Examples of this group are found in basins, along lakeshores, and sometimes along slow-moving creeks or in the backwaters of rivers. Water depth is typically between 0.2 and 1 m except in very wet or dry years. Soils are usually fine-textured though some sites are on sands. Soils are also usually high in organic material and tend toward mucks. Some sites can have moderately saline water and soils, particularly if water levels have dropped. *Climate:* Semi-arid to temperate.

DISTRIBUTION

***Geographic Range:** This group occurs from the southern Canadian Prairie Provinces of Alberta, Saskatchewan, and Manitoba south through western Minnesota, eastern Kansas, central Oklahoma, and the panhandle of Texas. The distribution of this group extends west to north-central Montana, eastern Wyoming, and eastern Colorado.
Nations: CA, US
States/Provinces: AB, CO, IA, KS, MB, MN, MT, ND, NE, OK, SD, SK, TX, WY
USFS Ecoregions (2007) [optional]: 251A:CC, 251B:CC, 251C:CC, 251F:C?, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CP, 331H:CP, 332A:CC, 332B:CC, 332C:CC, 332D:CC, 332E:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3488	*Sagittaria latifolia - Sagittaria cuneata - Leersia oryzoides* Great Plains Marsh Alliance
A3486	*Schoenoplectus acutus - Bolboschoenus maritimus - Schoenoplectus tabernaemontani* Marsh Alliance
A3487	*Typha angustifolia - Typha latifolia - Schoenoplectus* spp. Marsh Alliance
A3485	*Schoenoplectus americanus* Marsh Alliance
A3484	*Carex atherodes - Carex aquatilis - Scolochloa festucacea* Marsh Alliance
A3490	*Polygonum pensylvanicum - Polygonum lapathifolium* Marsh Alliance
A3489	*Eleocharis palustris* Great Plains Marsh Alliance
A3665	*Zizania texana* Marsh Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Prairie Potholes	Richardson 2000	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C.J. Richardson, in Barbour and Billings (2000)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake

Acknowledgments [optional]:

Version Date: 08 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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2. Shrub & Herb Vegetation

2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G336. Great Plains Wet Prairie, Wet Meadow & Seepage Fen

Type Concept Sentence: This group of seasonally flooded herbaceous wetlands is found in the northern and central Great Plains, usually in basins but sometimes on the margins of floodplains; most sites have abundant *Calamagrostis stricta, Carex* spp., and *Spartina pectinata*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Nd.5. Great Plains Marsh, Wet Meadow, Shrubland & Playa (M071)

Elcode: G336

***Scientific Name:** *Spartina pectinata - Calamagrostis stricta - Carex* spp. Great Plains Wet Prairie, Wet Meadow & Seepage Fen Group

***Common (Translated Scientific) Name:** Prairie Cordgrass - Slimstem Reedgrass - Sedge species Great Plains Wet Prairie, Wet Meadow & Seepage Fen Group

***Colloquial Name:** Great Plains Wet Prairie, Wet Meadow & Seepage Fen

***Type Concept:** This group includes herbaceous wetlands and fens in the eastern and central Great Plains. Examples occur in basins or along slow-moving streams or rivers. Sites are flooded or saturated for part of the growing season but often dry out in late summer. These wet meadows and wet prairies typically have moderate to dense cover of herbaceous vegetation 1-2 m tall. *Calamagrostis stricta, Carex* spp., and *Spartina pectinata* are common dominants, though several other species are common locally or in some parts of the range. Soils are fine-textured and may be mineral or mucky in most sites. In fens, soils are muck or peat.

***Diagnostic Characteristics:** Shallow, seasonally flooded or sometimes saturated herbaceous wetlands that are found in the Great Plains. Woody species are rare or absent. Some sites have moderate levels of salinity.

***Classification Comments:** This group is similar in concept to Midwest Wet Prairie & Wet Meadow Group (G770), which occurs further east, but there is substantial overlap in species composition and physiognomic and environmental characteristics. *Carex nebrascensis* might help distinguish from it Eastern North American Wet Meadow Group (it occurs in the western U.S. but not east of Great Plains).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G325	Great Plains Freshwater Marsh	is similar but wetter and has more species tolerant of long-term flooding such as *Typha* spp.
G337	Great Plains Riparian Wet Meadow & Shrubland	
G136	Great Plains Playa & Rainwater Basin Wetland	
G556	Eastern Ruderal Wet Meadow & Marsh	
G770	Midwest Wet Prairie & Wet Meadow	
G324	Great Plains Saline Wet Meadow & Marsh	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These wet meadows and wet prairies are dominated by herbaceous plants, usually graminoids. Vegetation cover is typically moderate to dense and between 1 and 2 m tall.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This group is dominated by medium to tall herbaceous species. Abundant species include *Spartina pectinata, Calamagrostis stricta, Calamagrostis canadensis, Carex* spp. (including *Carex atherodes, Carex pellita, Carex nebrascensis*), *Glyceria* spp., *Juncus* spp., *Lycopus americanus, Panicum virgatum, Schoenoplectus tabernaemontani*, and *Triglochin maritima*. *Pascopyrum smithii* often occurs on the drier edges of this group in the western parts of its range. Fens in the Great Plains are included in this group. In those sites, some species rarely found elsewhere in this group occur. These include *Rhynchospora capillacea, Lobelia kalmii, Dulichium arundinaceum, Carex prairea*, and *Onoclea sensibilis*. In more saline areas, common species can include *Carex sartwellii, Carex praegracilis, Plantago eriopoda*, and *Schoenoplectus pungens*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Hydrologic changes (flooding and drought) affect sites in this group significantly. In drier years, sites can be invaded by species from adjacent prairies, while in wetter years, species typical of more permanently flooded marshes do well. Also, fire spreading from adjacent upland prairies can sweep through examples of this group. Many sites have been affected by agricultural practices and either converted to row crops or affected by grazing and trampling by livestock.

ENVIRONMENT

Environmental Description: This group occurs on poorly drained nearly level sites with few exceptions. Most sites are in basins or along slow-moving streams or rivers and have seasonally flooded fine-textured soils. Some sites can be moderately saline: these are more common in the western parts of the distribution of this group. Fens in the Great Plains are included in this group. The fens occur where minerotrophic groundwater emerges at the surface, typically on the lower slopes of a hill or cliff or in floodplains. Marl or peat can form in these fens.

DISTRIBUTION

***Geographic Range:** This group is found throughout the eastern and central Great Plains from the southern Prairie Provinces of Canada to Oklahoma. It probably does not extend west into the shortgrass prairie beyond eastern Montana, eastern Wyoming, and western Kansas or east beyond western Minnesota, central Iowa, and northwestern Missouri.
Nations: CA, US
States/Provinces: CO, IA, KS, MB, MN, MO, MT, ND, NE, OK, SD, SK, WY
USFS Ecoregions (2007) [optional]: 251A:CC, 251B:CC, 251C:CC, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331H:C?, 332A:CC, 332B:CC, 332C:CC, 332D:CC, 332E:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3495	*Carex* spp. - *Triglochin maritima* - *Eleocharis quinqueflora* Alkaline Fen Alliance
A3493	*Spartina pectinata* Great Plains Wet Meadow Alliance
A3492	*Panicum virgatum* - *Pascopyrum smithii* Wet Meadow Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Prairie Potholes	Richardson 2000	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C.J. Richardson, in Barbour and Billings (2000)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake
Acknowledgments [optional]:
Version Date: 08 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Lauver, C. L., K. Kindscher, D. Faber-Langendoen, and R. Schneider. 1999. A classification of the natural vegetation of Kansas. The Southwestern Naturalist 44:421-443.

Richardson, C. J. 2000. Freshwater wetlands. Pages 448-499 in: M. G. Barbour and W. D. Billings, editors. North American terrestrial vegetation. Second edition. Cambridge University Press, New York. 434 pp.

Stewart, R. E., and H. A. Kantrud. 1971. Classification of natural ponds and lakes in the glaciated prairie region. USDI Bureau of Sport Fisheries and Wildlife Resources, Publication 92. Washington, DC. 77 pp.

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G337. Great Plains Riparian Wet Meadow & Shrubland

Type Concept Sentence: This group consists of shrub- and herbaceous-dominated stands along perennial or intermittent rivers in the Great Plains; a wide variety of shrub and herbaceous species can be dominant.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.4.Nd.5. Great Plains Marsh, Wet Meadow, Shrubland & Playa (M071)

Elcode: G337
***Scientific Name:** *Cornus* spp. - *Prunus virginiana / Pascopyrum smithii* Great Plains Riparian Wet Meadow & Shrubland Group
***Common (Translated Scientific) Name:** Dogwood species - Chokecherry / Western Wheatgrass Great Plains Riparian Wet Meadow & Shrubland Group
***Colloquial Name:** Great Plains Riparian Wet Meadow & Shrubland

***Type Concept:** This group consists of shrub- and herbaceous-dominated stands along perennial or intermittent rivers in the Great Plains. This riparian group can be found throughout most of the Great Plains from the U.S. border in central Montana and North Dakota to Oklahoma. Sites are found on raised islands and terraces above the main channel that experience periodic flooding. Shrubs or herbaceous plants can dominate. Common species include *Cornus drummondii, Cornus sericea, Symphoricarpos occidentalis, Prunus virginiana, Pascopyrum smithii, Schizachyrium scoparium* (in the west and south), and the exotics *Poa pratensis* and *Melilotus* spp. Scattered trees may be present, and examples of this group may occur on a floodplain interspersed with Great Plains Cottonwood - Green Ash Floodplain Forest Group (G147).

***Diagnostic Characteristics:** Shrubby or herbaceous riparian areas found above active channels in the Great Plains. Often these occur on terraces or islands.

***Classification Comments:** Diagnostics to differentiate this group (G337) and Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland Group (G526) along the junction of the Great Plains and Rocky Mountain foothills need to be better established. The current list of associations assigned to this group does not extend south of Nebraska (with one very minor exception). There should be riparian shrub and herb associations in the southern Great Plains.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G147	Great Plains Cottonwood - Green Ash Floodplain Forest	
G526	Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland	
G568	Great Plains Riverscour Vegetation	
G336	Great Plains Wet Prairie, Wet Meadow & Seepage Fen	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is composed of both deciduous shrublands and herbaceous vegetation. Sites can be dominated by short, medium, or tall shrubs (up to approximately 2-3 m) or can lack significant shrub cover and be dominated by mid or tall grasses. Vegetation cover is usually moderate to high, though it can be less, particularly in the drier, western portion of the range of this group or on sites that have experienced recent severe flooding.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Dominants in this physiognomically and geographically wide-ranging group can vary substantially. Typical shrub dominants include *Cornus drummondii, Cornus sericea, Amorpha fruticosa, Symphoricarpos occidentalis, Prunus virginiana, Artemisia cana ssp. cana* (in the northwest portion of the range), *Artemisia tridentata* (in the northwest portion of the range), and the exotic *Elaeagnus angustifolia*. Common herbaceous species are *Andropogon gerardii, Sporobolus cryptandrus, Pascopyrum smithii, Spartina pectinata, Sporobolus heterolepis, Schizachyrium scoparium, Hesperostipa spartea, Solidago canadensis*, and the exotics *Melilotus* spp., *Poa pratensis*, and *Bromus tectorum* (in the western portion of the range).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Flooding and other hydrologic events strongly affect this group. Examples are typically found near enough to streams to be flooded at some point in the growing season but far enough away from larger streams that the flooding is not of a long duration. Fire can spread into stands of this group from surrounding upland prairies, particularly in the central and eastern Great Plains where fire is more common.

ENVIRONMENT

Environmental Description: Examples of this group are found on alluvial soils on terraces, raised islands, and banks near streams and rivers. Sites are typically flooded in the spring or after heavy rains but flooding is not of long duration. Sites are generally lower than much of the surrounding landscape, and this combined with proximity to watercourses makes these sites relatively mesic.

DISTRIBUTION

***Geographic Range:** This group is found in much of the Great Plains from the U.S.-Canadian border region to Oklahoma.
Nations: CA, US
States/Provinces: AB, CO, KS, MB, MT, ND, NE, OK, SD, SK, WY
USFS Ecoregions (2007) [optional]: 251C:C?, 251F:CP, 251H:CC, 315F:PP, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331J:CC, 331K:CC, 331L:CC, 331M:CC, 331N:CC, 332A:CC, 332B:CC, 332C:CC, 332D:CC, 332E:CC, 332F:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: Concept is strong but this needs work on the geographic range, particularly on the eastern boundary.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3590	*Shepherdia argentea* Wet Shrubland Alliance
A3587	*Schoenoplectus* spp. - *Poa palustris* Marsh Alliance
A3588	*Cornus drummondii - Amorpha fruticosa* Wet Shrubland Alliance
A3589	*Salix interior* Wet Shrubland Alliance
A0942	*Alnus maritima ssp. oklahomensis* Wet Shrubland Alliance
A3586	*Artemisia cana ssp. cana* Wet Shrubland Alliance
A0918	*Elaeagnus commutata* Wet Shrubland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. Drake, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake

Acknowledgments [optional]:

Version Date: 08 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G136. Great Plains Playa & Rainwater Basin Wetland

Type Concept Sentence: This group is composed of intermittently or temporarily flooded grasslands found mostly in shallow basins in the central and southern Great Plains, and is often dominated by *Bouteloua dactyloides, Panicum obtusum, Panicum virgatum, Pascopyrum smithii*, and sometimes annual graminoids and forbs.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Nd.5. Great Plains Marsh, Wet Meadow, Shrubland & Playa (M071)

Elcode: G136

***Scientific Name:** *Pascopyrum smithii - Panicum obtusum - Bouteloua dactyloides* Playa & Rainwater Basin Wetland Group

***Common (Translated Scientific) Name:** Western Wheatgrass - Vine-mesquite - Buffalograss Playa & Rainwater Basin Wetland Group

***Colloquial Name:** Great Plains Playa & Rainwater Basin Wetland

***Type Concept:** Communities within this group are associated with the playa lakes and rainwater basins in the central Great Plains south to New Mexico and the Edwards Plateau in Texas. Perennial grasses <1 m tall dominate most examples of this group, sometimes forming dense sod cover. Where the duration of flooding is longer and kills or inhibits the perennial grasses, annuals can be common when the ground dries. Typical perennial grasses are *Bouteloua dactyloides, Panicum obtusum, Panicum virgatum*, and *Pascopyrum smithii* while annuals may include *Cyperus* spp., *Echinochloa* spp., and *Polygonum* spp. Dominant species typifying examples in the Edwards Plateau may include *Bouteloua dactyloides, Chaetopappa bellidifolia, Paronychia* spp., *Pleuraphis mutica, Sedum nuttallianum, Sedum pulchellum, Sporobolus vaginiflorus*, and the alga *Nostoc commune*. The group is primarily found in upland depressional basins. Sites are typified by the presence of an impermeable layer, such as a dense clay, hydric soil, and is usually recharged by rainwater and nearby runoff. They are rarely linked to outside groundwater sources and do not have an extensive watershed.

***Diagnostic Characteristics:** Mesic, small, typically temporarily flooded herbaceous sites found in shallow depressions or, rarely, floodplains. Dominant species in the Great Plains usually include *Bouteloua dactyloides, Panicum obtusum, Panicum virgatum*, and *Pascopyrum smithii* while in the Edwards Plateau *Bouteloua dactyloides, Chaetopappa bellidifolia, Paronychia* spp., *Pleuraphis mutica, Sedum nuttallianum, Sedum pulchellum, Sporobolus vaginiflorus*, and the alga *Nostoc commune* are typical.

***Classification Comments:** This group was originally defined to include both drier and wetter parts of playas throughout the Great Plains. Currently all of the component associations are flooded or wet for only part of the growing season so it is temporarily flooded, at best, and it is limited to the central and southern Great Plains.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G336	Great Plains Wet Prairie, Wet Meadow & Seepage Fen	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Perennial herbaceous graminoids and forbs typically <1 m tall dominate the group, though annuals or a mix of annuals and perennials can dominate some areas. Composition varies depending on the depth and duration of flooding and on substrate, with stands occurring over limestone bedrock in the Edwards Plateau often having some differences from those on deep soils in the Great Plains.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Species richness varies considerably among individual examples of this group. Common perennials are *Pascopyrum smithii, Panicum obtusum, Panicum virgatum*, and *Bouteloua dactyloides (= Buchloe dactyloides)*; the first two in particular may form lush stands in some cases. Sites that are dry most of the growing season but where flooding duration is too long for the upland perennials to thrive typically have more annuals. These include *Cyperus* spp., *Echinochloa* spp., *Mollugo verticillata*, and *Polygonum* spp. Those examples in the Edwards Plateau typically are dominated by *Bouteloua dactyloides, Chaetopappa bellidifolia, Paronychia* spp., *Pleuraphis mutica, Sedum nuttallianum, Sedum pulchellum, Sporobolus vaginiflorus*, and the alga *Nostoc commune*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Playas have a large change in hydrologic status over much of their areas. That is, most of the area of an individual playa is wet or flooded at one point in the growing season but dries out for much of the growing season. Some do have deeper areas that are wet or flooded for nearly the entire growing season but those do not fit within this group (they likely fall within Great Plains Freshwater Marsh Group (G325) or Arid West Interior Freshwater Marsh Group (G531)). Multiple wet-dry cycles during one growing season in response to rain and dry periods is more common. This rapid change in available moisture and in exposed soil limits the species that can grow. This often results in strong dominance by a few perennial species able to tolerate these conditions or by annuals that can go through their life cycle before conditions change (Haukos and Smith 1993). However, the unconnected nature of playas combined with the variable environmental conditions throughout the year favors the formation of differing assemblages of vegetation at any one time on playas across the landscape. This contributes to regional diversity of plant and animal habitats throughout the year (Haukos and Smith 1994). Fire can spread into this system from surrounding grasslands but it is uncommon. The surrounding grasslands are typically short to mid grasses and do not have sufficient fuel to carry fire well and, while playas usually have more dense vegetation cover than the adjacent uplands, they may be wet.

ENVIRONMENT

Environmental Description: This group is typified by upland depressional basins with an impermeable layer such as dense clay, hydric soils. Most examples of this group occur in shallow basins where a small change in water depth spreads over a relatively large area. Soils are dense silts and clays, occasionally loess-derived, that flood in winter or after heavy rains but dry out for much of the growing season. Examples in the Edwards Plateau of Texas occur in shallow depressions over limestone. Rainwater and runoff primarily recharge this group, and it is rarely linked to outside groundwater sources. Sites can be moderately saline. A small number of stands in this group occur on floodplains.

DISTRIBUTION

***Geographic Range:** This group can be found throughout the eastern portion of the Western Great Plains Division; however, it is most prevalent in the central states of Nebraska, Kansas and Oklahoma. In addition, it does occur farther to the west, in central and eastern Montana and eastern Wyoming, and south into the Edwards Plateau of Texas and New Mexico.
Nations: MX?, US
States/Provinces: CO, KS, NE, NM, OK, TX
USFS Ecoregions (2007) [optional]: 251F:CC, 251H:CC, 315D:CC, 315F:CP, 331B:CP, 331C:CC, 331D:C?, 331E:CC, 331F:CC, 331G:CP, 331H:CC, 331K:CP, 331L:CP, 331M:CP, 332B:CC, 332C:CC, 332D:CC, 332E:CC, 332F:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A1348	*Polygonum* spp. - *Echinochloa* spp. - *Distichlis spicata* Wet Meadow Alliance
A1238	*Panicum obtusum* Wet Meadow Alliance
A3597	*Pascopyrum smithii* Wet Meadow Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Menard, K. Kindscher, J. Drake
Acknowledgments [optional]:
Version Date: 08 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Haukos, D. A., and L. M. Smith. 1993. Seed-bank composition and predictive ability of field vegetation in playa lakes. Wetlands 13(1):32-40.

2.C.4.Ne. Atlantic & Gulf Coastal Marsh, Wet Meadow & Shrubland

The marshes are discontinuous along the Atlantic and Gulf coasts of the United States and adjacent Canada from Newfoundland to Texas. They include fresh and oligohaline tidal marshes, as well as non-tidal shrub and herb wetlands found in coastal plain depressions and basins, seepage slopes, interdunal swales and poorly drained wet flats.

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2. Shrub & Herb Vegetation
2.C.4.Ne. Atlantic & Gulf Coastal Marsh, Wet Meadow & Shrubland

M066. Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh

Type Concept Sentence: These fresh and oligohaline tidal marshes are discontinuous along the Atlantic and Gulf coasts of the United States and adjacent Canada from Newfoundland to Texas. Where found, they are the primary vegetation between outer tidal salt and brackish marshes and inland non-tidally influenced vegetation (upland or wetland).

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.C.4.Ne.1. Atlantic & Gulf Coastal Marsh, Wet Meadow & Shrubland (D322)

Elcode: M066
***Scientific Name:** *Zizania aquatica - Spartina patens - Pontederia cordata* Fresh-Oligohaline Tidal Marsh Macrogroup
***Common (Translated Scientific) Name:** Annual Wild Rice - Saltmeadow Cordgrass - Pickerelweed Fresh-Oligohaline Tidal Marsh Macrogroup
***Colloquial Name:** Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh

***Type Concept:** These fresh and oligohaline tidal marshes constitute the primary vegetation between outer tidal salt and brackish marshes and inland non-tidally influenced vegetation (upland or wetland). Examples are found from Newfoundland to Texas along the Atlantic and Gulf coasts of the United States and adjacent Canada. They may grade into uplands or non-tidal freshwater marshes and swamps. Most examples of this vegetation are characterized by a mixture of annual and perennial grasses, forbs, sedges, rushes, other grass-like plants, floating or submerged aquatics, shrubs, and scattered tree saplings. Dominance patterns change seasonally, yearly, and geographically. In addition to regional variability, freshwater tidal marshes may also exhibit floristic zonation based on age, water depth, tidal regime, and other factors, into a low and high marsh. This vegetation supports broad-leaved emergent plants such as *Nuphar advena, Nuphar orbiculata, Nuphar sagittifolia, Peltandra virginica, Pontederia cordata*, and *Sagittaria* spp.; annual and perennial grasses such as *Calamagrostis canadensis, Leersia oryzoides, Panicum hemitomon, Spartina cynosuroides, Spartina patens, Zizania aquatica, Zizaniopsis miliacea*; sedges and rushes such as *Carex* spp., *Cladium mariscus ssp. jamaicense, Eleocharis* spp., *Fuirena* spp., *Schoenoplectus pungens, Schoenoplectus tabernaemontani*; other grass-like plants and annual and perennial forbs such as *Acorus calamus, Amaranthus cannabinus, Ambrosia trifida, Bidens* spp., *Impatiens capensis, Hibiscus moscheutos, Kosteletzkya virginica, Polygonum* spp., *Sium suave, Typha* spp.; and scattered shrubs such as *Cephalanthus occidentalis* and *Morella cerifera*.

***Diagnostic Characteristics:** Among the hundreds of species found in freshwater tidal marshes (Tinder 2013), there appear to be few that are unique to this type, apart from *Aeschynomene virginica*, which is a federally threatened plant species (Odum et al. 1984). Tidal and non-tidal freshwater habitats share many species. Rather than the presence of specific freshwater species, this vegetation might better be differentiated by a mixture of wetland plants that are also tolerant of low salinity levels, including annual and perennial grasses, forbs, sedges, rushes, other grass-like plants, floating or submerged aquatics, shrubs, and scattered tree saplings. Dominance patterns change seasonally, yearly, and geographically. In addition to regional variability, freshwater tidal marshes may also exhibit floristic zonation based on age, water depth, tidal regime, and other factors, into a low and high marsh. Some species that occur in and may dominate or codominate various examples of this vegetation across its range include *Bidens* spp., *Cladium mariscus ssp. jamaicense, Eleocharis* spp., *Hydrocotyle* spp., *Panicum hemitomon, Peltandra virginica, Polygonum* spp., *Pontederia cordata, Sagittaria* spp., *Schoenoplectus pungens, Schoenoplectus tabernaemontani*, and *Spartina cynosuroides, Spartina patens, Zizania aquatica*, and *Zizaniopsis miliacea*.

***Classification Comments:** Some researchers consider fresh tidal marshes narrowly, including only marshes with salinity levels below 0.5 ppt. Based on floristic similarities between fresh and oligohaline tidal marshes, we have taken a broader view by including both in this macrogroup. We also include vegetation influenced by irregular, low-amplitude, wind-driven tides, not just lunar tides. Floristic overlap can be seen in many studies of fresh and oligohaline marshes (Penfound and Hathaway 1938, Chabreck 1972, Gosselink et al. 1979, Gosselink 1984, Mitsch and Gosselink 1986c, Visser et al. 1998, 2000, Tiner 2013). Salinity levels vary seasonally, temporally and spatially but as indicated by vegetation dominants are expected to be in the range of fresh to oligohaline. Species composition strongly overlaps with non-tidal freshwater marshes. Association membership of tidal marsh macrogroups/groups (fresh/oligohaline versus salt/brackish) may need further review. More research is needed to interpret the complex interactions between temporal and spatial disturbance patterns (e.g., hydrology, salinity), geomorphology, species life histories, and other factors to better elucidate the rangewide and local patterns in vascular plant communities of freshwater tidal marshes. In addition, more work is needed to better understand the ecology of nonvascular plants in this ecosystem (Mitsch and Gosselink 1986c).

This macrogroup currently encompasses a single group that represents all of the tidal fresh to oligohaline marshes of the Atlantic and Gulf coasts of North America. Further consideration should be given to a latitudinal split. Such a split might require additional floristic information from marsh occurrences along the latitudinal gradient. The current alliance structure reflects this separation except for three broad-ranging alliances and associations that would need to be split: *Zizania aquatica - Zizaniopsis miliacea* Tidal Freshwater Marsh Alliance (A1485), *Stuckenia pectinata - Zannichellia palustris - Ceratophyllum demersum* Freshwater Subtidal Marsh Alliance (A3581), and *Morella cerifera - Rosa palustris* Tidal Freshwater Shrubland Alliance (A0806). In addition, more information is needed to better document the relative role of annuals in this vegetation regionally. Are annuals more important in northern latitudes? Are perennial grasses more important along the Gulf Coast? One common perennial grass in this vegetation, *Zizania aquatica*, acts as an annual in northern latitudes and a perennial in southern (Godfrey and Wooten 1979). Do the unique deltaic processes of coastal Louisiana support floristic differences at the group level, or do the differences between the deltaic processes of Louisiana marshes and the processes associated with drowned river valleys more common throughout the rest of the range of this vegetation support such floristic differences? Great temporal and spatial floristic variability at local and regional scales, especially the seasonal and annual differences (driven by a myriad of interrelated factors such as hydrology, sedimentation, salinity, erosion, scouring, wrack deposition, seed banks, competition, herbivory, and other disturbances) complicate the sampling and classification of this vegetation, especially at the lower levels such as alliance and association.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M710	Caribbean Freshwater Marsh, Wet Meadow & Shrubland	
M880	Eastern North American Wet Shoreline Vegetation	
M069	Eastern North American Marsh, Wet Meadow & Shrubland	
M067	Atlantic & Gulf Coastal Plain Wet Prairie & Marsh	
M079	North American Atlantic & Gulf Coastal Salt Marsh	
M108	Eastern North American Freshwater Aquatic Vegetation	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Most examples of this vegetation are characterized by a mixture of annual and perennial grasses, forbs, sedges, rushes, other grass-like plants, floating or submerged aquatics, and more rarely, shrubs, and scattered tree saplings (Tiner 2013). The importance of annuals in this vegetation can lead to high variability in yearly and seasonal dominance patterns. In some high marsh occurrences, annual forbs begin to grow early in the season and appear to dominate, but a little latter perennials overtop them, only to be overtopped themselves by emergent annuals later in the season (Leck et al. 2009).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: There are no plant species unique to freshwater tidal habitats (Odum et al. 1984), and the list of possible components numbers in the hundreds (Tiner 2013). Most examples of this vegetation are characterized by a mixture of annual and perennial grasses, forbs, sedges, rushes, other grass-like plants, floating or submerged aquatics, shrubs, and scattered tree saplings (Tiner 2013). Dominance patterns change seasonally, yearly, and geographically. In addition to regional variability, freshwater tidal marshes may also exhibit floristic zonation based on age, water depth, tidal regime, and other factors, into a low and high marsh (Odum et al. 1984, Mitsch and Gosselink 1986c, Tiner 2013). Zonation in freshwater tidal marshes is not as pronounced as in salt marshes (Odum et al. 1984, Mitsch and Gosselink 1986c, Tiner 2013), and may often be more of a spatial mosaic driven by a diverse seed bank (Leck and Simpson 1987). Where present, low marsh is younger, more erodible, more deeply flooded for longer periods of time, has lower litter accumulation, lower organic matter in the soils, and lower primary productivity than high marsh (Odum et al. 1984, Mitsch and Gosselink 1986c, Tiner 2013).

The low marsh is typically characterized by species such as *Amaranthus cannabinus, Heteranthera reniformis, Nuphar advena, Nuphar orbiculata, Nuphar sagittifolia, Peltandra virginica, Pontederia cordata, Sagittaria* spp., *Schoenoplectus pungens, Schoenoplectus tabernaemontani*, and *Zizania aquatica*. The high marsh is more diverse and often includes a mixture of annual and perennial grasses, forbs, sedges, rushes, other grass-like plants, and shrubs (Odum et al. 1984, Mitsch and Gosselink 1986c). In the mid-Atlantic a high marsh may be dominated by a mixed group of annuals in mid-season (e.g., *Acorus calamus, Bidens laevis, Hibiscus moscheutos, Impatiens capensis, Iris versicolor, Polygonum* spp. *Pilea pumila, Amaranthus cannabinus, Symphyotrichum subulatum, Zizania aquatica* and others); later in the season perennial grasses such as *Spartina cynosuroides, Typha* spp., and *Zizaniopsis miliacea* may become monodominant (Odum et al. 1984, Mitsch and Gosselink 1986c, Tiner 2013). Dominants in Louisiana freshwater tidal marshes include *Bidens laevis, Eleocharis* spp., *Hydrocotyle* spp., *Panicum hemitomon, Sagittaria lancifolia, Schoenoplectus pungens, Spartina patens*, and *Zizaniopsis miliacea*. Associates include *Alternanthera philoxeroides* (non-native), *Bacopa monnieri, Cladium mariscus ssp. jamaicense (= Cladium jamaicense), Echinochloa walteri, Leptochloa fusca ssp. fascicularis (= Leptochloa fascicularis), Pluchea camphorata, Pontederia cordata, Sagittaria* spp., *Schoenoplectus californicus*, and *Vigna luteola* (Gosselink et al. 1979, Gosselink 1984, Visser et al. 1998, 2000). Plant composition of freshwater tidal marshes in New Jersey generally occurs as a mosaic of patches dominated by a few or a single species and has dramatic seasonal variation. Tidal freshwater marshes (0-0.5 ppt) are characterized by *Acorus calamus, Ambrosia trifida* (levees), *Bidens laevis, Eleocharis* spp., *Impatiens capensis, Peltandra virginica, Polygonum punctatum, Pontederia cordata*, and *Sagittaria* spp. Freshwater tidal flats (0-0.5 ppt) are characterized by sparse, low-growing mats of *Bidens eatonii, Crassula aquatica, Eriocaulon parkeri, Isoetes riparia, Lindernia dubia, Ludwigia palustris, Polygonum punctatum*, and *Sagittaria subulata*. Freshwater tidal communities in this region often contain one or more regionally or globally rare plant species, such as *Aeschynomene virginica, Eriocaulon parkeri*, and *Bidens bidentoides* (Walz et al. 2007). In addition, some of these same dominants may comprise another type of freshwater tidal marsh, a floating marsh (flotant), where the marsh vegetation and the underlying mat of roots, organic matter, and sediments detach from and float above the mineral substrate (Sasser et al. 1995, 1996, 2009). Flotants are the most common freshwater marsh in the Louisiana's delta marshes, estimated to cover approximately 130,000 ha (Sasser et al. 2009).

Many of the dominant and characteristic species in this macrogroup (e.g., *Asclepias incarnata, Cephalanthus occidentalis, Echinochloa walteri, Hibiscus moscheutos, Kosteletzkya virginica, Eleocharis palustris, Eleocharis quadrangulata, Leersia oryzoides, Mikania scandens, Panicum virgatum, Peltandra virginica, Polygonum arifolium, Polygonum sagittatum, Polygonum punctatum, Polygonum glabrum (= Polygonum densiflorum), Polygonum hydropiperoides, Pontederia cordata, Rosa palustris, Rumex verticillatus, Sagittaria latifolia, Sagittaria lancifolia ssp. media (= Sagittaria falcata), Saururus cernuus, Schoenoplectus tabernaemontani, Schoenoplectus americanus, Scirpus cyperinus, Spartina cynosuroides, Typha latifolia, Typha domingensis, Typha angustifolia, Typha x glauca*, and *Zizania aquatica*) occur across a range of salinities that span fresh (<0.5 ppt) to oligohaline (0.5-5.0 ppt) (Odum et al. 1984). While some species that characterize this vegetation (e.g., *Spartina patens*) are tolerant of mesohaline water (5.0-18.0 ppt), they occur in freshwater tidal habitats in a mixture with species most common in oligohaline or freshwater habitats. Once salinity becomes greater than 5.0 ppt, freshwater marshes tend to turn over to saltwater marshes (Mitsch and Gosselink 1986c).

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Hydrology and salinity are the most important driving processes determining the range of potential vegetation in this macrogroup. Variations in flooding, sedimentation rates, erosion, scouring, wrack deposition and salinity are regular disturbances (Tiner 2013). Seed bank dynamics also drive the temporal and spatial diversity (Leck et al. 2009). Herbivory and competition also play an important role in vegetation patterns and some components (e.g., *Typha* and *Peltandra virginica*) are reported to be allelopathic (Bonasera et al. 1979). Rising sea level is an important driver of longer term vegetation trends, including expansion into adjacent swamp areas. Fire is also an important natural process in all but the smallest and most isolated patches. C. Frost (pers. comm.) estimates that many marshes burned as often as every three years in presettlement times and were an important source of ignition for adjacent communities. Marshes that have not burned recently have lower species richness, are more strongly dominated by the large graminoids, and are believed to be poorer habitat for waterfowl. Lack of fire may also allow for invasion of trees into the marsh. Marshes often show evidence of transition to or from treed communities, in the form of young invading trees and shrubs or standing dead older trees (Odum et al. 1984, Tiner 2013). More research is needed to interpret the complex interactions between temporal and spatial disturbance patterns (e.g., hydrology, salinity, sedimentation, erosion, herbivory, hurricanes, etc.), geomorphology, species life histories, and other factors to better elucidate the rangewide and local patterns in vascular plant communities of freshwater tidal marshes. It is unclear how subsidence, freshwater withdrawal, sea level rise, and climate change will impact this ecosystem, but changes are expected. Though causation is unclear, vegetation changes have already been documented in Louisiana since 1968 (Visser et al. 1999) and other areas (Barendregt and Swarth 2013).

ENVIRONMENT

Environmental Description: Tidal fresh marshes exist along low-relief coastlines and upper reaches of tidal rivers and creeks where there is sufficient freshwater input from rain and rivers, and enough tidal amplitude to reach upstream into marshes along bays and rivers (e.g., Hudson River, Delaware River, Cape Fear River). Both lunar and wind tides are important, though wind tides may be more important in areas where tidal amplitude is low (e.g., the Gulf coast and the embayed region of NC and VA). Along the Atlantic coast this vegetation is often found on rivers where there is a geomorphological constriction that increases tidal amplitude (Odum et al. 1984). Within any specific region tidal marshes occur along elevational gradients that result in varying water depths. Tidal freshwater marshes tend to be common along the coastal edge of river systems with large watersheds and no dams (Tiner 2013). Most of the Atlantic coast freshwater tidal marshes are riverine (Odum et al. 1984). They formed as sea level rose after the last glaciation. Sediment carried by streams and rivers filled drowned river valleys that were downcut during the Pleistocene glaciations. Marshes built up and expanded as streams and rivers deposited their sediment load and the tides helped to extend the area of available habitat. Similar marshes are present along the Gulf coast, but in Louisiana where the majority of freshwater tidal marshes in the U.S. are found, freshwater marshes were formed through the deltaic processes of the Mississippi River (Gosselink 1984, Mitsch and Gosselink 1986c, Visser et al. 1998, 2000). Hydrology and salinity are the most important driving processes determining the range of potential vegetation in this macrogroup. Variations in flooding, sedimentation rates, erosion, scouring, wrack deposition and salinity are regular disturbances (Tiner 2013).

Tidal freshwater marshes occur in a variety of settings, including "mature marshes," marshes that may be more than 500 years old with a well-developed peat substrate (found most commonly on the Atlantic coast), "floating marshes," marshes that have broken loose from the mineral substrate and float on the water surface (found on the northern Gulf coast), and "new marshes" in areas where sedimentation by rivers is exceeding erosion and subsidence such as prograding deltas (found throughout the range) (Odum et al. 1984, Mitsch and Gosselink 1986c, 2000, Mitsch et al. 2009, Tiner 2013). In some areas, marshes have expanded in the recent past as a result of streams and rivers carrying and depositing higher sediment loads because of inland erosion (Odum et al. 1984). Soils in older marshes tend to be high in organic matter and those in younger marshes high in clays and silts (Odum et al. 1984).

More research is needed to interpret the complex interactions between temporal and spatial disturbance patterns (e.g., hydrology, salinity, sedimentation, erosion, herbivory, hurricanes, etc.), geomorphology, species life histories, and other factors to better elucidate the rangewide and local patterns in vascular plant communities of freshwater tidal marshes. It is unclear how subsidence, freshwater withdrawal, sea level rise, and climate change will impact this ecosystem, but changes are expected. Though causation is unclear, vegetation changes have already been documented in Louisiana since 1968 (Visser et al. 1999) and New Jersey (Leck et al. 2009).

Common characteristics of tidal freshwater marshes include variable rates of sedimentation and vertical accretion of sediments and organic matter (Perry et al. 2009). In many places, this is often offset by subsidence, reduced sedimentation due to water diversion, and a rising sea level. The substrate of tidal wetlands varies from primarily black, fibrous organic muck over sandy or silt clay loam occasionally mixed with woody peat, underlain by deep coastal plain quartzite sand deposits in New Jersey (Tedrow 1986), to thin or thick mats of floating roots and peat over muck and clay in Louisiana (Sasser et al. 2009). The New Jersey Geological Survey publication by Waksman et al. (1943) entitled "The Peats of New Jersey and Their Utilization" distinguishes marine salt marsh peats found along the coast and in bays that have fine mud rich in organic matter derived of decomposed grasses from the freshwater tidal marshes of drowned estuarine streams with freshwater alluvial peat and sedge-and-reed-peat characterized by coarse fibrous organic material often with wood particles and large amounts of mineral sediment (Walz et al. 2007). Odum et al. (1984) described the substrate underlying most tidal freshwater marshes in the eastern U.S. as "a dark, mucky soil" with high levels of silts and clays in the low marsh and higher levels of organic matter in the high marsh.

Tidal freshwater and oligohaline marshes are complex entities that are affected by movement of the salt line resulting from seasonal fluctuations in precipitation as well as changes in the periodicity and amplitude of tidal inundation (lunar and wind). Sea level rise due to global warming, and the resulting change in salt intrusion, vegetation composition, marsh acreage, and function, are serious concerns for the future of these critically important estuarine wetlands (Walz et al. 2007).

DISTRIBUTION

***Geographic Range:** Vegetation of this macrogroup extends from the Atlantic provinces of Canada south to the inland portions of the Hudson, Connecticut, Merrimack, Kennebec, and Penobscot rivers and their tributaries, as well as the rivers of southern New Jersey, to include the Chesapeake Bay and Delaware Bay drainages. It also includes the embayed region of North Carolina and Virginia. It continues from the vicinity of Morehead City, North Carolina (south of the Embayed Region), south around Florida, and along the northern Gulf of Mexico in northwestern Florida, southern Alabama, and southeastern Mississippi. Large expanses are found in the deltaic and chenier plains of Louisiana. It extends along the Gulf coast south to approximately Corpus Christi Bay. These marshes are estimated to cover about 164,000 ha along the Atlantic Coast (Odum et al. 1984), and 468,000 ha in Louisiana (Chabreck 1972). Approximately one-half of the coastal tidal freshwater marshes that exist along the middle Atlantic seaboard occur

in New Jersey (Odum et al. 1984). Not included here are estimates of area occupied by freshwater tidal marshes in the remaining coastal areas of the northeastern Gulf of Mexico and Canada.
Nations: CA, MX?, US
States/Provinces: AL, CT, DE, GA, LA, LB, MA, MD, ME, MS, NB, NC, NF, NJ, NS, NY, PA, PE?, QC, SC, TX, VA
USFS Ecoregions (2007) [optional]: 211C:C?, 211D:CC, 221A:CC, 232A:CC, 232C:CC, 232D:CC, 232E:CC, 232G:CC, 232H:CC, 232I:CC, 232L:CC, 255D:??, 411A:??
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G110	Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Floodplain Marsh	FNAI 2010a	
<	Tidal Fresh Marshes	Tiner 2013	
<	Tidal Freshwater Marshes	Odum et al. 1984	
=	Tidal Freshwater Marshes	Mitsch and Gosselink 1986d	
=	Tidal freshwater marsh/wet coastal prairie	MSNHP 2006	

AUTHORSHIP

***Primary Concept Source [if applicable]:** W.J. Mitsch and J.G. Gosselink 1986c (and later editions 1993, 2000); R.W. Tiner (2013)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Teague
Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by D. Faber-Langendoen and M. Pyne.
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2. Shrub & Herb Vegetation
2.C.4.Ne. Atlantic & Gulf Coastal Marsh, Wet Meadow & Shrubland

G110. Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh

Type Concept Sentence: This tidal fresh and oligohaline marsh vegetation is found between oceanward salt and brackish marshes and inland, non-tidally influenced vegetation, and occurs from Newfoundland to Texas along the Atlantic and Gulf coasts. The flooding regime is driven by lunar and wind tides. Most examples of this vegetation are characterized by a mixture of annual and perennial grasses, forbs, sedges, rushes, other grass-like plants, floating or submerged aquatics, shrubs, and scattered tree saplings.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.4.Ne.1. Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh (M066)

Elcode: G110
***Scientific Name:** *Zizania aquatica - Spartina patens - Pontederia cordata* Fresh-Oligohaline Tidal Marsh Group
***Common (Translated Scientific) Name:** Annual Wild Rice - Saltmeadow Cordgrass - Pickerelweed Fresh-Oligohaline Tidal Marsh Group
***Colloquial Name:** Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh

***Type Concept:** Vegetation of this fresh and oligohaline marsh group constitutes the primary vegetation between oceanward salt and brackish marshes and inland, non-tidally influenced vegetation from Newfoundland south to Florida and west to Texas along the Atlantic and Gulf coasts. These freshwater marshes are characterized by fresh to oligohaline waters which are driven by lunar and wind tides. The environment includes areas well inside the mouths of tidal creeks and rivers, where there is adequate riverflow and discharge to maintain fresh to oligohaline conditions, while still within tidal range. This group typically occurs as complexes of several associations characterized by a mixture of annual and perennial grasses, forbs, sedges, rushes, other grass-like plants, floating or submerged aquatics, shrubs, and scattered tree saplings. Dominance patterns change seasonally, yearly, and geographically. In addition to regional variability, freshwater tidal marshes may also exhibit floristic zonation based on age, water depth, tidal regime, and other factors, into a low and high marsh. This vegetation supports broad-leaved emergent plants such as *Nuphar advena, Nuphar orbiculata, Nuphar sagittifolia, Peltandra virginica, Pontederia cordata*, and *Sagittaria* spp.; annual and perennial grasses such as *Calamagrostis canadensis, Leersia oryzoides, Panicum hemitomon, Spartina cynosuroides, Spartina patens, Zizania aquatica, Zizaniopsis miliacea*; sedges and rushes such as *Carex* spp., *Cladium mariscus ssp. jamaicense, Eleocharis* spp., *Fuirena* spp., *Schoenoplectus pungens, Schoenoplectus tabernaemontani*; other grass-like plants and annual and perennial forbs such as *Acorus calamus, Amaranthus cannabinus, Ambrosia trifida, Bidens* spp., *Impatiens capensis, Hibiscus moscheutos, Kosteletzkya virginica, Polygonum* spp., *Sium suave, Typha* spp.; and scattered shrubs such as *Cephalanthus occidentalis* and *Morella cerifera*. While some association dominants are tolerant of brackish water, they are associated with plants restricted to oligohaline or freshwater. Irregular flooding and fire are both important forces in this group, and rising sea level is a particularly important driver of long-term trends.

***Diagnostic Characteristics:** Among the hundreds of species found in freshwater tidal marshes (Tinder 2013), there appear to be few that are unique to this type, apart from *Aeschynomene virginica*, which is a federally threatened plant species (Odum et al. 1984). Tidal and non-tidal freshwater habitats share many species. Rather than the presence of specific freshwater species, this vegetation might better be differentiated by a mixture of wetland plants that are also tolerant of low salinity levels, including annual and perennial grasses, forbs, sedges, rushes, other grass-like plants, floating or submerged aquatics, shrubs, and scattered tree saplings. Dominance patterns change seasonally, yearly, and geographically. In addition to regional variability, freshwater tidal marshes may also exhibit floristic zonation based on age, water depth, tidal regime, and other factors, into a low and high marsh. Some species that occur in and may dominate or codominate various examples of this vegetation across its range include *Bidens* spp., *Cladium mariscus ssp. jamaicense, Eleocharis* spp., *Hydrocotyle* spp., *Panicum hemitomon, Peltandra virginica, Polygonum* spp., *Pontederia cordata, Sagittaria* spp., *Schoenoplectus pungens, Schoenoplectus tabernaemontani*, and *Spartina cynosuroides, Spartina patens, Zizania aquatica*, and *Zizaniopsis miliacea*.

***Classification Comments:** Some researchers consider fresh tidal marshes narrowly, including only marshes with salinity levels below 0.5 ppt. Based on floristic similarities between fresh and oligohaline tidal marshes, we have taken a broader view by including both in this group. We also include vegetation influenced by irregular, low-amplitude, wind-driven tides, not just lunar tides. Floristic overlap can be seen in many studies of fresh and oligohaline marshes (Penfound and Hathaway 1938, Chabreck 1972, Gosselink et al. 1979, Gosselink 1984, Mitsch and Gosselink 1986c, Visser et al. 1998, 2000, Tiner 2013). Salinity levels vary seasonally, temporally and spatially but, as indicated by vegetation dominants, are expected to be in the range of fresh to oligohaline. Species composition strongly overlaps with non-tidal freshwater marshes. Association membership of tidal marsh groups (fresh/oligohaline versus salt/brackish) may need further review. More research is needed to interpret the complex interactions between temporal and spatial disturbance patterns (e.g., hydrology, salinity), geomorphology, species life histories, and other factors to better elucidate the rangewide and local patterns in vascular plant communities of freshwater tidal marshes. In addition, more work is needed to better understand the ecology of nonvascular plants in this ecosystem (Mitsch and Gosselink 1986c). This group is currently the only group in Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh Macrogroup (M066) that represents all of the tidal fresh to oligohaline marshes of the Atlantic and Gulf coasts of North America. Further consideration should be given to a latitudinal split. Such a split might require additional floristic information from marsh occurrences along the latitudinal gradient. The current alliance structure reflects this separation except for three broad ranging alliances and associations that would need to be split: *Zizania aquatica - Zizaniopsis miliacea* Tidal Freshwater Marsh Alliance (A1485), *Stuckenia pectinata - Zannichellia palustris - Ceratophyllum demersum* Freshwater Subtidal Marsh Alliance (A3581), and *Morella cerifera - Rosa palustris* Tidal Freshwater Shrubland Alliance (A0806). In addition, more information is needed to better document the relative role of annuals in this vegetation regionally. Are annuals more important in northern latitudes? Are perennial grasses more important along the Gulf Coast? One common perennial grass in this vegetation, *Zizania aquatica*, acts as an annual in northern latitudes and a perennial in southern (Godfrey and Wooten 1979). Do the unique deltaic processes of coastal Louisiana support floristic differences at the group level, or do the differences between the deltaic processes of Louisiana marshes and the processes associated with drowned river valleys more common throughout the rest of the range of this vegetation support such floristic differences? Great temporal and spatial floristic variability at local and regional scales, especially the seasonal and annual differences (driven by a myriad of interrelated factors such as hydrology, sedimentation, salinity, erosion, scouring, wrack deposition, seed banks, competition, herbivory, and other disturbances) complicate the sampling and classification of this vegetation, especially at the lower levels such as alliance and association.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G129	South Florida Freshwater Marsh & Wet Prairie	
G755	Eastern North American Riverine Wetland Vegetation	
G125	Eastern North American Freshwater Marsh	
G756	Eastern North American Wet Shoreline Vegetation	
G595	Eastern North American Ruderal Aquatic Vegetation	
G114	Eastern North American Freshwater Aquatic Vegetation	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Most examples of this vegetation are characterized by a mixture of annual and perennial grasses, forbs, sedges, rushes, other grass-like plants, floating or submerged aquatics, and more rarely, shrubs, and scattered tree saplings (Tiner 2013). The importance of annuals in this vegetation can lead to high variability in yearly and seasonal dominance patterns. In some high marsh occurrences, annual forbs begin to grow early in the season and appear to dominate, but a little latter perennials overtop them, only to be overtopped themselves by emergent annuals later in the season (Leck et al. 2009).

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: There are no plant species unique to freshwater tidal habitats (Odum et al. 1984), and the list of possible components numbers in the hundreds (Tiner 2013). Most examples of this vegetation are characterized by a mixture of annual and perennial grasses, forbs, sedges, rushes, other grass-like plants, floating or submerged aquatics, shrubs, and scattered tree saplings (Tiner 2013). Dominance patterns change seasonally, yearly, and geographically. In addition to regional variability, freshwater tidal marshes may also exhibit floristic zonation based on age, water depth, tidal regime, and other factors, into a low and high marsh (Odum et al. 1984, Mitsch and Gosselink 1986c, Tiner 2013). Zonation in freshwater tidal marshes is not as pronounced as in salt marshes (Odum et al. 1984, Mitsch and Gosselink 1986c, Tiner 2013), and may often be more of a spatial mosaic driven by a diverse seed bank (Leck and Simpson 1987). Where present, low marsh is younger, more erodible, more deeply flooded for longer periods of time, has lower litter accumulation, lower organic matter in the soils, and lower primary productivity than high marsh (Odum et al. 1984, Mitsch and Gosselink 1986c, Tiner 2013).

The low marsh may be characterized by species such as *Amaranthus cannabinus, Heteranthera reniformis, Nuphar advena, Nuphar orbiculata, Nuphar sagittifolia, Peltandra virginica, Pontederia cordata, Sagittaria* spp., *Schoenoplectus pungens, Schoenoplectus tabernaemontani*, and *Zizania aquatica*. The high marsh is more diverse and often includes a mixture of annual and perennial grasses, forbs, sedges, rushes, other grass-like plants, and shrubs (Odum et al. 1984, Mitsch and Gosselink 1986c). In the mid-Atlantic a high marsh may be dominated by a mixed group of annuals in mid-season (e.g., *Acorus calamus, Amaranthus cannabinus, Bidens laevis, Hibiscus moscheutos, Impatiens capensis, Iris versicolor, Polygonum* spp. *Pilea pumila, Symphyotrichum subulatum, Zizania aquatica* and others); later in the season perennial grasses such as *Spartina cynosuroides, Typha* spp., and *Zizaniopsis miliacea* may become monodominant (Odum et al. 1984, Mitsch and Gosselink 1986c, Tiner 2013). Dominants in Louisiana freshwater tidal marshes include *Bidens laevis, Eleocharis* spp., *Hydrocotyle* spp., *Panicum hemitomon, Sagittaria lancifolia, Schoenoplectus pungens, Spartina patens*, and *Zizaniopsis miliacea*. Associates include *Alternanthera philoxeroides* (non-native), *Bacopa monnieri, Cladium mariscus ssp. jamaicense (= Cladium jamaicense), Echinochloa walteri, Leptochloa fusca ssp. fascicularis (= Leptochloa fascicularis), Pluchea camphorata, Pontederia cordata, Sagittaria* spp., *Schoenoplectus californicus*, and *Vigna luteola* (Gosselink et al. 1979, Gosselink 1984, Visser et al. 1998, 2000). Plant composition of freshwater tidal marshes in New Jersey generally occurs as a mosaic of patches dominated by a few or a single species and has dramatic seasonal variation. Tidal freshwater marshes (0-0.5 ppt) are characterized by *Acorus calamus, Ambrosia trifida* (levees), *Bidens laevis, Eleocharis* spp., *Impatiens capensis, Peltandra virginica, Polygonum punctatum, Pontederia cordata*, and *Sagittaria* spp. Freshwater tidal flats (0-0.5 ppt) are characterized by sparse, low-growing mats of *Bidens eatonii, Crassula aquatica, Eriocaulon parkeri, Isoetes riparia, Lindernia dubia, Ludwigia palustris, Polygonum punctatum*, and *Sagittaria subulata*. Freshwater tidal communities in this region often contain one or more regionally or globally rare plant species, such as *Aeschynomene virginica, Eriocaulon parkeri*, and *Bidens bidentoides* (Walz et al. 2007). In addition, some of these same dominants may comprise another type of freshwater tidal marsh, a floating marsh (flotant), where the marsh vegetation and the underlying mat of roots, organic matter, and sediments detach from and float above the mineral substrate (Sasser et al. 1995, 1996, 2009). Flotants are the most common freshwater marsh in the Louisiana's delta marshes, estimated to cover approximately 130,000 ha (Sasser et al. 2009).

Many of the dominant and characteristic species in this group (e.g., *Asclepias incarnata, Cephalanthus occidentalis, Echinochloa walteri, Eleocharis palustris, Eleocharis quadrangulata, Hibiscus moscheutos, Kosteletzkya virginica, Leersia oryzoides, Mikania scandens, Panicum virgatum, Peltandra virginica, Polygonum arifolium, Polygonum sagittatum, Polygonum punctatum, Polygonum glabrum (= Polygonum densiflorum), Polygonum hydropiperoides, Pontederia cordata, Rosa palustris, Rumex verticillatus, Sagittaria latifolia, Sagittaria lancifolia ssp. media (= Sagittaria falcata), Saururus cernuus, Schoenoplectus tabernaemontani, Schoenoplectus americanus, Scirpus cyperinus, Spartina cynosuroides, Typha latifolia, Typha domingensis, Typha angustifolia, Typha x glauca*, and *Zizania aquatica*) occur across a range of salinities that span fresh (<0.5 ppt) to oligohaline (0.5-5.0 ppt) (Odum et al. 1984). While some species that characterize this vegetation (e.g., *Spartina patens*) are tolerant of mesohaline water (5.0-18.0 ppt), they occur in freshwater tidal habitats in a mixture with species most common in oligohaline or freshwater habitats. Once salinity becomes greater than 5.0 ppt, freshwater marshes tend to turn over to saltwater marshes (Mitsch and Gosselink 1986c).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Hydrology is the most important driving process, with the constant saturation determining the potential vegetation, and the variable flooding and variations in salinity in the fresh to brackish range a primary disturbance. Variations in flooding, sedimentation rates, erosion, scouring, wrack deposition and salinity are regular disturbances (Tiner 2013). Seed bank dynamics also drive the temporal and spatial diversity (Leck et al. 2009). Herbivory and competition also play an important role in vegetation patterns and some components (e.g., *Typha* and *Peltandra virginica*) are reported to be allelopathic (Bonasera et al. 1979). Rising sea level is an important driver of longer term vegetation trends, including expansion into adjacent swamp areas. Fire is also an important natural process in all but the smallest and most isolated patches. C. Frost (pers. comm.) estimates that many marshes burned as often as every three years in presettlement times and were an important source of ignition for adjacent communities. Marshes that have not burned recently have lower species richness, are more strongly dominated by the large graminoids, and are believed to be poorer habitat for waterfowl. Marshes often show evidence of transition to or from treed communities, in the form of young invading trees and shrubs or standing dead older trees (Odum et al. 1984, Tiner 2013). Lack of fire appears to be allowing sufficient tree invasion to eventually produce a swamp forest in some upstream examples, but the trend in most places is toward development of marshes in former swamp areas. More research is needed to interpret the complex interactions between temporal and spatial disturbance patterns (e.g., hydrology, salinity, sedimentation, erosion, herbivory, hurricanes, etc.), geomorphology, species life histories, and other factors to better elucidate the rangewide and local patterns in vascular plant communities of freshwater tidal marshes. It is unclear how subsidence, freshwater withdrawal, sea level rise, and climate change will impact this ecosystem, but changes are expected. Though causation is unclear, vegetation changes have already been documented in Louisiana since 1968 (Visser et al. 1999) and other areas (Barendregt and Swarth 2013).

ENVIRONMENT

Environmental Description: Tidal fresh marshes exist along low-relief coastlines and upper reaches of tidal rivers and creeks where there is sufficient freshwater input from rain and rivers, and enough tidal amplitude to reach upstream into marshes along bays and rivers (e.g., Hudson River, Delaware River, Cape Fear River). Both lunar and wind tides are important, though wind tides may be more important in areas where tidal amplitude is low (e.g., the Gulf Coast and the embayed region of North Carolina and Virginia). Along the Atlantic Coast this vegetation is often found on rivers where there is a geomorphological constriction that increases tidal amplitude (Odum et al. 1984). Within any specific region tidal marshes occur along elevational gradients that result in varying water depths. Tidal freshwater marshes tend to be common along the coastal edge of river systems with large watersheds and no dams (Tiner 2013). Most of the Atlantic Coast freshwater tidal marshes are riverine (Odum et al. 1984). They formed as sea level rose after the last glaciation. Sediment carried by streams and rivers filled drowned river valleys that were downcut during the Pleistocene glaciations. Marshes built up and expanded as streams and rivers deposited their sediment load and the tides helped to extend the area of available habitat. Similar marshes are present along the Gulf Coast, but in Louisiana where the majority of freshwater tidal marshes in the U.S. are found, freshwater marshes were formed through the deltaic processes of the Mississippi River (Gosselink 1984, Mitsch and Gosselink 1986c, Visser et al. 1998, 2000). Hydrology and salinity are the most important driving processes determining the range of potential vegetation in this group. Variations in flooding, sedimentation rates, erosion, scouring, wrack deposition and salinity are regular disturbances (Tiner 2013).

Tidal freshwater marshes occur in a variety of settings, including "mature marshes," marshes that may be more than 500 years old with a well-developed peat substrate (found most commonly on the Atlantic Coast), "floating marshes," marshes that have broken loose from the mineral substrate and float on the water surface (found on the northern Gulf Coast), and "new marshes" in areas where sedimentation by rivers is exceeding erosion and subsidence such as prograding deltas (found throughout the range) (Odum et al. 1984, Mitsch and Gosselink 1986c, 2000, Mitsch et al. 2009, Tiner 2013). In some areas, marshes have expanded in the recent past as a result of streams and rivers carrying and depositing higher sediment loads because of inland erosion (Odum et al. 1984). Soils in older marshes tend to be high in organic matter and those in younger marshes high in clays and silts (Odum et al. 1984).

More research is needed to interpret the complex interactions between temporal and spatial disturbance patterns (e.g., hydrology, salinity, sedimentation, erosion, herbivory, hurricanes, etc.), geomorphology, species life histories, and other factors to better elucidate the rangewide and local patterns in vascular plant communities of freshwater tidal marshes. It is unclear how subsidence, freshwater withdrawal, sea level rise, and climate change will impact this ecosystem, but changes are expected. Though causation is unclear, vegetation changes have already been documented in Louisiana since 1968 (Visser et al. 1999) and New Jersey (Leck et al. 2009).

Common characteristics of tidal freshwater marshes include variable rates of sedimentation and vertical accretion of sediments and organic matter (Perry et al. 2009). In many places, this is often offset by subsidence, reduced sedimentation due to water diversion, and a rising sea level. The substrate of tidal wetlands varies from primarily black, fibrous organic muck over sandy or silt clay loam occasionally mixed with woody peat, underlain by deep coastal plain quartzite sand deposits in New Jersey (Tedrow 1986), to thin or thick mats of floating roots and peat over muck and clay in Louisiana (Sasser et al. 2009). The New Jersey Geological Survey publication by Waksman et al. (1943) entitled "The Peats of New Jersey and Their Utilization" distinguishes marine salt marsh peats found along the coast and in bays that have fine mud rich in organic matter derived of decomposed grasses from the freshwater tidal marshes of drowned estuarine streams with freshwater alluvial peat and sedge-and-reed-peat characterized by coarse fibrous organic material often with wood particles and large amounts of mineral sediment (Walz et al. 2007). Odum et al. (1984) described the substrate underlying most tidal freshwater marshes in the eastern U.S. as "a dark, mucky soil" with high levels of silts and clays in the low marsh and higher levels of organic matter in the high marsh.

Tidal freshwater and oligohaline marshes are complex entities that are affected by movement of the salt line resulting from seasonal fluctuations in precipitation as well as changes in the periodicity and amplitude of tidal inundation (lunar and wind). Sea level rise due to global warming, and the resulting change in salt intrusion, vegetation composition, marsh acreage, and function, are serious concerns for the future of these critically important estuarine wetlands (Walz et al. 2007).

DISTRIBUTION

***Geographic Range:** Vegetation of this group extends from the Atlantic provinces of Canada south to the inland portions of the Hudson, Connecticut, Merrimack, Kennebec, and Penobscot rivers and their tributaries, as well as the rivers of southern New Jersey, to include the Chesapeake Bay and Delaware Bay drainages; it also includes the embayed region of North Carolina and Virginia. It continues from the vicinity of Morehead City, North Carolina (south of the Embayed Region), south around Florida, and along the northern Gulf of Mexico in northwestern Florida, southern Alabama, and southeastern Mississippi. It is also found in freshwater channels of the Mississippi Delta, and along the Gulf Coast from Vermillion Bay, Louisiana, south to approximately Corpus Christi Bay. Large expanses are found in the deltaic and chenier plains of Louisiana.

These marshes are estimated to cover about 164,000 ha along the Atlantic Coast (Odum et al. 1984), and 468,000 ha in Louisiana (Chabreck 1972). Approximately one-half of the coastal tidal freshwater marshes that exist along the middle Atlantic seaboard occur in New Jersey (Odum et al. 1984). At least 45,000 hectares exist in South Carolina and Georgia (Odum et al. 1984); the extent of this type in northern Florida is unknown. Not included here are estimates of area occupied by freshwater tidal marshes in the remaining coastal areas of the northeastern Gulf of Mexico and Canada.

Nations: CA, MX?, US

States/Provinces: AL, CT, DE, FL, GA, LA, LB, MA, MD, ME, MS, NB, NC, NF, NJ, NS, NY, PA, PE?, QC, SC, TX, VA

USFS Ecoregions (2007) [optional]: 211C:C?, 211D:CC, 221A:CC, 232A:CC, 232C:CC, 232D:CC, 232E:CC, 232G:CC, 232H:CC, 232I:CC, 232L:CC, 255D:??, 411A:??

Omernik Ecoregions L3, L4 [optional]: 8.5.1.63b:C, 8.5.1.63c:C, 8.5.1.63d:C, 8.5.1.63e:C, 8.5.1.63g:C, 8.5.1.63n:C, 8.5.2.73o:C, 8.5.3.75k:C, 8.5.3.75l:C, 9.5.1.34g:C

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]: USNVC Confidence from peer reviewer, not AE.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3020	*Nelumbo lutea* Tidal Freshwater Marsh Alliance
A1987	*Sagittaria lancifolia* Gulf Coast Tidal Freshwater Marsh Alliance
A3580	*Schoenoplectus californicus* Gulf Coast Tidal Freshwater Marsh Alliance
A4014	*Spartina patens* Gulf Coast Brackish Tidal Marsh Alliance
A4220	Gulf Coastal Plain Floating Marsh Alliance
A4015	*Typha domingensis - Eleocharis rostellata* Gulf Coastal Plain Oligohaline Tidal Marsh Alliance
A3578	*Panicum hemitomon* Floating Marsh Alliance
A4017	*Peltandra virginica - Pontederia cordata - Sagittaria* spp. Oligohaline Tidal Marsh Alliance
A3581	*Stuckenia pectinata - Zannichellia palustris - Ceratophyllum demersum* Freshwater Subtidal Marsh Alliance
A4016	*Eleocharis fallax - Osmunda regalis* Oligohaline Tidal Marsh Alliance
A1708	*Nuphar advena - Nuphar sagittifolia* Tidal Freshwater Marsh Alliance
A3579	*Isoetes riparia - Eriocaulon parkeri* Intertidal Freshwater Marsh Alliance
A1485	*Zizania aquatica - Zizaniopsis miliacea* Tidal Freshwater Marsh Alliance
A0806	*Morella cerifera - Rosa palustris* Tidal Freshwater Shrubland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Tidal freshwater marsh/wet coastal prairie	MSNHP 2006	

AUTHORSHIP

***Primary Concept Source [if applicable]:** W.E. Odum, T.J. Smith, III, J.K. Hoover, and C.C. McIvor (1984)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Teague
Acknowledgments [optional]: We have incorporated significant descriptive information previously compiled by M. Pyne.
Version Date: 15 Jun 2015

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2. Shrub & Herb Vegetation
2.C.4.Ne. Atlantic & Gulf Coastal Marsh, Wet Meadow & Shrubland

M067. Atlantic & Gulf Coastal Plain Wet Prairie & Marsh

Type Concept Sentence: Common plants of these herbaceous or shrub wetlands include species of *Eleocharis, Fimbristylis, Panicum, Rhynchospora, Sarracenia*, and *Xyris*, or shrubs *Cephalanthus occidentalis* or *Vaccinium* spp., which occur in warm-temperate Atlantic and Gulf coastal plains depressions and basins, seepage slopes, interdunal swales and poorly drained wet flats.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.C.4.Ne.2. Atlantic & Gulf Coastal Marsh, Wet Meadow & Shrubland (D322)

Elcode: M067
***Scientific Name:** *Rhynchospora* spp. - *Eleocharis* spp. - *Panicum* spp. Atlantic & Gulf Coastal Plain Wet Prairie & Marsh Macrogroup
***Common (Translated Scientific) Name:** Beaksedge species - Spikerush species - Panicgrass species Atlantic & Gulf Coastal Plain Wet Prairie & Marsh Macrogroup
***Colloquial Name:** Atlantic & Gulf Coastal Plain Wet Prairie & Marsh

***Type Concept:** Common taxa of these marshes and wet prairies include species of *Eleocharis, Fimbristylis, Panicum, Rhynchospora, Sarracenia*, and *Xyris*. Also included are warm-temperate shrub swamps dominated by the shrubs *Cephalanthus occidentalis, Vaccinium corymbosum, Vaccinium formosum*, or *Vaccinium fuscatum*. These wetlands occur on the Atlantic and Gulf coastal plains in depressions and basins, seepage slopes, interdunal swales and poorly drained wet flats. The vegetation ranges from floating-leaved aquatics in deeper basins, to emergent marsh in semipermanent water, to drawdown zones with diverse small graminoid and forb vegetation, to shrub swamp and shrub edges. Wet prairie vegetation is also found on extensive wet flats and consists of primarily herbaceous wetland vegetation with relatively thick cover of graminoid species. Examples occupy low, flat plains on poorly drained soils, often saturated for 50-100 days per year. In addition to saturation or flooding, occasional to frequent fires, including during the early growing season, promote the maintenance of this vegetation.

***Diagnostic Characteristics:** These are herbaceous wetlands, often mixed with low shrubs. They occur in depressions, basins, and interdunal swales, and on seepage slopes, or on wet flats on the coastal plain of the southeastern United States, including some areas as far north as Cape Cod, Massachusetts. Common taxa include species of graminoids *Rhynchospora, Panicum, Eleocharis, Aristida, Xyris*, forbs *Pontederia cordata* and *Sarracenia* and shrubs *Hypericum, Vaccinium, Ilex*, and *Cephalanthus occidentalis*.

***Classification Comments:** Generally this macrogroup represents warm-temperate vegetation, extending into the cool-temperate zone in New England and with some disjunct occurrences in the Great Lakes area. It includes a wide variety of mainly herbaceous graminoid wetlands, and also some forb and shrub wetlands. Wetland interdune swales are included. Federal land distribution should be updated to include Assateague, Cape Cod, Chincoteague, Fire Island, Plum Island, and maybe others.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M161	Pond-cypress Basin Swamp	supports trees *Taxodium* spp., *Pinus elliottii var. elliottii*, or *Nyssa biflora*. Canopy cover

Elcode	Scientific or Colloquial Name	Note
		may be sparse, and herb and forb composition may be very similar to M067.
M065	Southeastern Coastal Bog & Fen	is dominated by evergreen shrubs, in bog and fen habitats, such as pocosins.
M071	Great Plains Marsh, Wet Meadow, Shrubland & Playa	is cool temperate, occurs in the Great Plains only, and does not support *Rhynchospora* spp., but may be dominated by *Eleocharis palustris, Panicum obtusum*, or *Panicum virgatum*.
M069	Eastern North American Marsh, Wet Meadow & Shrubland	is cool temperate, occurs in the Midwest, Appalachia and New England outside the Coastal Plain, and is not dominated by species of *Rhynchospora, Panicum*, or *Eleocharis*. Both occur in Massachusetts, M069 on the coastal plain and M067 inland away from the coastal plain.
M303	Eastern-Southeastern North American Ruderal Marsh, Wet Meadow & Shrubland	includes only ruderal vegetation, and includes otherwise similar warm temperate marsh in addition to cool temperate marsh.
M066	Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh	only includes freshwater tidal marsh, but M067 is not tidal.
M108	Eastern North American Freshwater Aquatic Vegetation	

Similar NVC Types General Comments [optional]: Similar vegetation also occurring on the warm-temperate Southeastern Coastal Plain is either an open woodland (M161), ruderal (M303) or tidal freshwater (M066).

VEGETATION

Physiognomy and Structure Summary: These wetlands are generally dominated by graminoid vegetation. There often are some woody plants, such as low shrubs and/or scattered tall shrubs or very sparse trees present. The tall shrubs have more cover on sites that have not been recently burned. Included here are southern shrublands dominated by *Cephalanthus occidentalis* or *Vaccinium* spp.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Common taxa include species of *Eleocharis, Fimbristylis, Panicum, Rhynchospora, Sarracenia*, and *Xyris*. Graminoids include *Andropogon glomeratus, Aristida beyrichiana, Aristida palustris, Aristida stricta, Calamovilfa* spp., *Carex striata, Ctenium aromaticum, Cyperus haspan, Cyperus virens, Dichanthelium erectifolium, Dichanthelium wrightianum, Eleocharis elongata, Eleocharis equisetoides, Eleocharis microcarpa, Eleocharis quadrangulata, Fuirena scirpoidea, Fuirena squarrosa, Juncus abortivus, Juncus effusus, Juncus repens, Leersia hexandra, Panicum hemitomon, Panicum rigidulum, Panicum verrucosum, Panicum virgatum, Rhynchospora chapmanii, Rhynchospora corniculata, Rhynchospora filifolia, Rhynchospora harperi, Rhynchospora inundata, Rhynchospora tracyi, Saccharum* spp., and *Steinchisma hians*. Forbs include *Bartonia verna, Centella erecta, Lachnanthes caroliana, Lachnocaulon minus, Ludwigia glandulosa, Ludwigia linearis, Ludwigia* spp., *Proserpinaca* spp., *Rhexia alifanus, Rhexia cubensis, Rhexia* spp., *Sabatia angularis, Sagittaria longiloba, Sagittaria papillosa, Symphyotrichum subulatum*, and *Xyris jupicai*. Large wetland ferns such as *Osmunda cinnamomea* and *Osmunda regalis* also often dominate. Some examples have a very sparse tree component of *Magnolia virginiana, Pinus elliottii var. elliottii, Pinus palustris, Pinus serotina*, or *Taxodium* spp. and scattered shrubs, such as *Morella cerifera, Morella pensylvanica, Vaccinium corymbosum*, or *Clethra alnifolia*. Other woody plants may include *Acer rubrum, Cephalanthus occidentalis, Cyrilla racemiflora, Hypericum chapmanii, Hypericum fasciculatum, Hypericum tenuifolium (= Hypericum reductum), Ilex coriacea, Ilex glabra, Ilex myrtifolia, Lyonia lucida, Nyssa biflora*, and *Vaccinium* spp. Other characteristic and often dominant species for the northern part of the range (Massachusetts to New York or New Jersey) include *Cyperus dentatus, Dichanthelium meridionale, Eleocharis acicularis, Eleocharis robbinsii, Eriocaulon aquaticum (= Eriocaulon septangulare), Euthamia caroliniana (= Euthamia tenuifolia), Gratiola aurea, Juncus militaris, Juncus pelocarpus, Lobelia dortmanna*, and *Xyris difformis*. Along rivers in northeastern, central and southern Florida, *Cladium mariscus ssp. jamaicense* or *Panicum hemitomon* and *Polygonum punctatum* were apparently the historical dominant plant species.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: While many of these wetlands are in depressions, slopes and flats, examples which are along rivers are subject to river flooding. The depth, duration and season of flooding are primary influences on the dynamics of this wetland vegetation (Kirkman et al. 2012). Large fluctuations in the water level cause both anaerobic and dry conditions, which promote herbaceous plants rather than trees. Due to these factors and the irregular occurrence of wildland fire during dry conditions, these habitats are maintained as open herbaceous (including some shrub) vegetation. In the humid warm-temperate climatic zone, forests and woodlands are the dominant natural vegetation. Plant species composition (including dominants) may vary seasonally or annually depending on inundation and fire history. Fire may also be necessary to stimulate growth, flowering and seed production of many herbaceous species found in communities of this macrogroup. In the absence of fire, vegetation may become heavily wooded, resulting in the eventual elimination of the herbaceous vegetation (Folkerts 1982).

ENVIRONMENT

Environmental Description: *Climate:* South of Virginia, the climate is humid, warm-temperate. From eastern Virginia to Cape Cod, Massachusetts, the climate is humid, cool-temperate. *Soil/substrate/hydrology*: This macrogroup includes non-tidal, freshwater herbaceous marsh, wet prairie, and shrub swamp vegetation. These wetlands occur along rivers and in different types of depressions such as former lake basins, shallow peat-filled valleys, and zones around existing natural lakes (Kushlan 1990). It also includes oligotrophic wetlands maintained by seepage at the zone between an overlaying, permeable sandy layer and a lower layer of relatively impermeable material such as sandstone or clay. This vegetation also includes wetlands of low, flat plains on poorly drained soils, such as Ultisols, Spodosols, Inceptisols, and Entisols (Collins et al. 2001); some of these soils have an argillic horizon which impedes drainage and contributes to high water tables. The low areas where this vegetation occurs on barrier islands and similar immediate coastal areas are dune swales or other basins. These ponds have standing water well into the growing season, and many are permanently saturated. The vegetation also occurs in small basins and depressions, primarily in sandy terrain of the Atlantic Coastal Plain, from southeastern Virginia to Florida, including the Lake Wales Ridge area of central Florida. Most southeastern basins are formed by subsidence of surface sediments caused by solution in underlying limestone, but origins may be different from Delaware northward.

DISTRIBUTION

***Geographic Range:** This macrogroup occurs primarily in the warm-temperate climatic zone on the Atlantic and Gulf coastal plains, including the Mississippi Embayment. It ranges from Massachusetts to Florida and Texas, and also rarely occurs in the Great Lakes region of the United States and Canada (Ontario).
Nations: CA, MX?, US
States/Provinces: AL, AR?, CT?, DE, FL, GA, IN, LA, MA, MD, MI, MS, NC, NJ, NY, ON, RI?, SC, TX, VA, WI?, WV
USFS Ecoregions (2007) [optional]: 221Ab:CCC, 221Ad:CCC, 221An:CCC, 232A:CC, 232B:CC, 232C:CC, 232D:CC, 232E:CC, 232Fb:CCC, 232G:CC, 232H:CP, 232I:CC, 232J:CC, 232K:CC, 232L:CC, 234A:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G188	Atlantic & Gulf Coastal Plain River & Basin Freshwater Marsh
G776	Atlantic & Gulf Coastal Plain Shrub Swamp
G777	Atlantic & Gulf Coastal Interdunal Marsh & Prairie
G111	Atlantic & Gulf Coastal Plain Pondshore & Wet Prairie
G187	Atlantic & Gulf Coastal Plain Seep
G752	Northern & Mid-Atlantic Coastal Wetland

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Bog Swamp (Okefenokee), Prairies	Wharton 1978	
<	Deep Fresh-water Marshes	Penfound 1952	
<	Depression marshes	Edwards et al. 2013	
<	Freshwater Marsh	Kushlan 1990	
<	Freshwater marshes	Penfound 1967	
=	Graminoid-dominated wetlands	Christensen 2000	This does not include the shrub swamps which are included with M067.
<	Gulf Coast pitcher plant bog	Folkerts 1982	
?	Herb bogs (pitcher plant bogs)	Wharton 1978	
<	Interdunal wetlands	Edwards et al. 2013	
<	Limesink	Wharton 1978	
<	Marsh Ponds (in part)	Wharton 1978	
<	Okefenokee Swamp Prairies	Edwards et al. 2013	
<	Seepage slope herb bogs	Edwards et al. 2013	
<	Shallow Fresh-water Marshes	Penfound 1952	
<	Southern Depression Wetlands, open- canopied herbaceous-dominated communities	Kirkman et al. 2012	
<	Southern wet meadow (grass-sedge bog)	Penfound 1967	
<	grass-sedge savannah	Clewell 1981	

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman and A.S. Weakley
Acknowledgments [optional]:
Version Date: 15 Oct 2014

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2. Shrub & Herb Vegetation
2.C.4.Ne. Atlantic & Gulf Coastal Marsh, Wet Meadow & Shrubland

G188. Atlantic & Gulf Coastal Plain River & Basin Freshwater Marsh

Type Concept Sentence: These are non-tidal freshwater marshes dominated by emergent graminoid, floating-leaved aquatic vegetation, or shrubs. The dominant species may vary, but *Pontederia cordata* and *Panicum hemitomon* are typical. These are found on coastal plains from Massachusetts to Louisiana and Texas along rivers or in the headwaters of rivers, and in depressions, including karst depressions.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.4.Ne.2. Atlantic & Gulf Coastal Plain Wet Prairie & Marsh (M067)

Elcode: G188
***Scientific Name:** *Pontederia cordata - Panicum hemitomon* River & Basin Freshwater Marsh Group
***Common (Translated Scientific) Name:** Pickerelweed - Maidencane River & Basin Freshwater Marsh Group
***Colloquial Name:** Atlantic & Gulf Coastal Plain River & Basin Freshwater Marsh

***Type Concept:** These are non-tidal freshwater marshes dominated by emergent graminoid vegetation, floating-leaved aquatic vegetation, or shrubs. They occur on the coastal plains from Massachusetts to Louisiana and Texas. These marshes are most extensive in Florida along rivers or in the headwaters of rivers, and in karst depressions. The vegetation mosaic includes a range of mostly herbaceous wetland plant communities that may be referred to as marshes, meadows and prairies. The dominant species may vary, but *Pontederia cordata* and *Panicum hemitomon* are typical. Along rivers in Florida, *Cladium mariscus ssp. jamaicense* or *Panicum hemitomon* and *Polygonum punctatum* were apparently the historical dominant plant species, but a variety of other species may also be present. In the deeper water of karst depressions, common plants include *Typha latifolia, Pontederia cordata, Nelumbo lutea*, and others. In areas with less flooding, *Panicum hemitomon, Leersia hexandra*, and other species may be found. Plant species composition (including dominants) may vary seasonally or annually depending on inundation and fire history (especially in Florida).

***Diagnostic Characteristics:** These are non-tidal freshwater marshes dominated by emergent graminoid, floating-leaved aquatic vegetation, or shrubs. The dominant species may vary, but *Pontederia cordata* and *Panicum hemitomon* are typical. These are found on the coastal plains along rivers or in the headwaters of rivers, and in depressions, including karst depressions.

***Classification Comments:** The floristic differences between these non-tidal coastal plain graminoid freshwater marshes and other eastern North American marshes may be minor; separation is better defined as warm-temperate or cold-temperate freshwater marshes. This group is the warm-temperate graminoid freshwater marsh.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G129	South Florida Freshwater Marsh & Wet Prairie	
G557	Southeastern Ruderal Marsh, Wet Meadow & Shrubland	
G125	Eastern North American Freshwater Marsh	
G777	Atlantic & Gulf Coastal Interdunal Marsh & Prairie	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These long-hydroperiod herbaceous wetlands include floating-leaved aquatic vegetation in the areas with the longest duration of flooding, and emergent graminoid vegetation in areas that usually dry out for some period of time in the growing season. In Florida, the extensive graminoid marsh areas may be prone to wildland fire, and in absence of disturbances may become shrub-dominated. The role of hurricanes is probably important in reducing the cover of tall shrubs and trees and promoting the anaerobic conditions that restrict the survival of upland plants.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Diverse assemblages of vegetation, ranging from open-water communities to emergent and graminoid marshes and scattered shrublands occur in these marshes. Along rivers in Florida, *Cladium mariscus ssp. jamaicense* or *Panicum hemitomon* and *Polygonum punctatum* were apparently the historical dominant plant species, but a variety of other species may also be present. In marshes along rivers outside of Florida, typical species include *Zizaniopsis miliacea, Zizania aquatica*, and *Pontederia cordata*. Sandbars along coastal plain rivers may be dominated by *Panicum rigidulum, Polygonum hydropiperoides*, and *Polygonum punctatum*. Marsh areas in large depressions with approximately a meter of standing water tend to support dense stands of emergent herbaceous perennials, often in stands dominated by one species. Species include *Typha latifolia, Pontederia cordata, Nelumbo lutea*, and others. Where there is less water (usually present only during the wet season), more graminoid vegetation is present, with species such as *Panicum hemitomon, Leersia hexandra*, and others.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Examples which are along rivers are subject to river flooding. Plant species composition (including dominants) may vary seasonally or annually depending on inundation and fire history. In the absence of fire, portions of stands may become dominated by *Salix caroliniana*. Then they may succeed to *Acer rubrum* until a replacement fire or mechanical activity restores the marsh. The marshes in large karst depressions are subject to long-term changes in hydroperiods in addition to the typical year-to-year fluctuations. The lakes in central Florida can become dry in a short time, as has happened at Paynes Prairie where water levels have fluctuated greatly over time (Patton and Judd 1986).

ENVIRONMENT

Environmental Description: *Climate:* Humid, warm temperate. *Soil/substrate/hydrology:* This group occupies non-tidal, generally narrow, but widely fluctuating, zones of freshwater herbaceous marsh vegetation along rivers and in different types of large depressions such as former lake basins, shallow peat-filled valleys, and zones around existing natural lakes (Kushlan 1990). Included here are streamside marshes (such as in the New Jersey Pine Barrens) and graminoid vegetation on sandbars of coastal plain rivers. The rivers in Florida where it extensively occurs include the Myakka, St. Johns, Kissimmee, and perhaps Caloosahatchee rivers. The hydroperiod is generally longer than 180 days, 7 to 12 months (Kushlan 1990). Outside of Florida, this vegetation mostly occurs in smaller areas.

DISTRIBUTION

***Geographic Range:** This group is most extensive in the Florida peninsula, but occurs elsewhere in the coastal plain, from Massachusetts to Louisiana and Texas, and in limited interior areas, in Kentucky, Tennessee and West Virginia.
Nations: US
States/Provinces: AL, CT, DE, FL, GA, KY, LA, MA, MD, MS, NC, NH?, NJ, NY, PA?, RI, SC, TN, TX, VA, WV
USFS Ecoregions (2007) [optional]: 221A:CC, 223:?, 231:?, 232B:CC, 232D:CC, 232G:CC, 232J:CC, 232K:CC
Omernik Ecoregions L3, L4 [optional]: 8.3.5.65o:C, 8.5.3.75a:C, 8.5.3.75b:C, 8.5.3.75c:C, 8.5.3.75d:C, 8.5.3.75f:C, 8.5.3.75l:C, 15.4.1.76c:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3668	*Hottonia inflata - Ludwigia palustris* Aquatic Vegetation Alliance
A4065	*Orontium aquaticum - Schoenoplectus subterminalis* Marsh Alliance
A3406	*Cladium mariscoides - Rhynchospora alba* Riverside Sea Level Fen Alliance
A1369	*Cladium mariscus ssp. jamaicense* Floodplain Marsh Alliance
A3407	*Schoenoplectus tabernaemontani - Pontederia cordata - Panicum hemitomon* Basin Marsh Alliance
A3404	*Zizaniopsis miliacea - Zizania aquatica - Pontederia cordata* Southeastern Floodplain Marsh Alliance
A3405	*Panicum rigidulum - Polygonum hydropiperoides - Polygonum punctatum* Southeastern Sandbar Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Basin Marsh	FNAI 1990	
>	Floodplain Marsh	FNAI 1990	
>	Freshwater Marsh	Kushlan 1990	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.A. Kushlan (1990)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman
Acknowledgments [optional]:
Version Date: 13 May 2015

REFERENCES

***References [Required if used in text]:**

FNAI [Florida Natural Areas Inventory]. 1990. Guide to the natural communities of Florida. Florida Natural Areas Inventory and Florida Department of Natural Resources, Tallahassee. 111 pp.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Huffman, J. M., and W. S. Judd. 1998. Vascular flora of Myakka River State Park, Sarasota and Manatee counties, Florida. Castanea 63:25-50.

Kushlan, J. A. 1990. Freshwater marshes. Pages 324-363 in: R. L. Myers and J. J. Ewel, editors. Ecosystems of Florida. University of Central Florida Press, Orlando.

Patton, J. E., and W. S. Judd. 1986. Vascular flora of Paynes Prairie Basin and Alachua Sink Hammock, Alachua County, Florida. Castanea 51:88-110.

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2. Shrub & Herb Vegetation

2.C.4.Ne. Atlantic & Gulf Coastal Marsh, Wet Meadow & Shrubland

G776. Atlantic & Gulf Coastal Plain Shrub Swamp

Type Concept Sentence: These southern wetlands occur in floodplains, flatwoods, and other poorly drained areas and are dominated by broad-leaved deciduous shrubs up to 3 m tall, especially *Cephalanthus occidentalis, Vaccinium corymbosum, Vaccinium formosum*, or *Vaccinium fuscatum*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Ne.2. Atlantic & Gulf Coastal Plain Wet Prairie & Marsh (M067)

Elcode: G776

***Scientific Name:** *Cephalanthus occidentalis - Vaccinium corymbosum* Coastal Plain Shrub Swamp Group

***Common (Translated Scientific) Name:** Common Buttonbush - Highbush Blueberry Coastal Plain Shrub Swamp Group

***Colloquial Name:** Atlantic & Gulf Coastal Plain Shrub Swamp

***Type Concept:** This deciduous shrub swamp vegetation is up to 3 m tall and is dominated by the broad-leaved deciduous shrubs *Cephalanthus occidentalis, Vaccinium corymbosum, Vaccinium formosum*, or *Vaccinium fuscatum*. These wetlands tend to have very few trees, if any. Other plants include shrubs, graminoid herbs, forbs, and aquatic plants. This vegetation occurs in wetland areas including depressions in floodplains and coastal plain flatwoods.

***Diagnostic Characteristics:** These are deciduous shrub swamps dominated by *Cephalanthus occidentalis*, deciduous heath shrubs *Vaccinium formosum, Vaccinium fuscatum*, and *Vaccinium corymbosum*, or native woody vine-dominated swamp areas.

***Classification Comments:** These include deciduous shrub swamps of the Southeastern Coastal Plain.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G037	Coastal Plain Mixed Evergreen Swamp	
G186	Southeastern Coastal Pocosin & Shrub Bog	
G752	Northern & Mid-Atlantic Coastal Wetland	
G777	Atlantic & Gulf Coastal Interdunal Marsh & Prairie	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This seasonally flooded, cold-deciduous shrub or woody vine-dominated swamp has a canopy less than 5 m in height. The herbaceous layer is sparse or dominated by graminoids. Many examples lack trees, but a sparse canopy of wetland trees (up to 25% cover) may be present.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This vegetation includes deciduous shrub swamps dominated by *Cephalanthus occidentalis*, deciduous heath shrubs such as *Vaccinium formosum, Vaccinium fuscatum*, and *Vaccinium corymbosum*, and floodplain vegetation dominated by woody vines, including *Nekemias arborea (= Ampelopsis arborea), Berchemia scandens, Bignonia capreolata, Brunnichia ovata, Campsis radicans, Parthenocissus quinquefolia, Smilax rotundifolia, Toxicodendron radicans ssp. radicans*, and *Vitis rotundifolia*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Inundation is usually continuous throughout the year, but these sites can become dry in mid or late summer or during periods of prolonged drought. *Cephalanthus occidentalis* is very tolerant of extended periods of inundation which, by slowing canopy closure of trees and maintaining higher light levels, may favor this shrub (Conner et al. 1981). The vine-dominated shrub swamp vegetation occurs in large floodplain canopy gaps, and is often in disturbed floodplain areas, such as from extreme floods, tornados, hurricanes, ice-storm damage or areas which have been logged. These woody vine-dominated areas can have reduced regeneration of floodplain trees, due to competition with the vines.

ENVIRONMENT

Environmental Description: This shrub swamp occupies shallow-water depressions, oxbow ponds, sinkhole ponds, and backwater sloughs of stream and river floodplains throughout swampy forested areas in the southeastern United States. Inundation is usually continuous throughout the year, but these sites can become dry in mid or late summer or during periods of prolonged drought. *Cephalanthus occidentalis* is very tolerant of extended periods of inundation which, by slowing canopy closure of trees and maintaining higher light levels, may favor this shrub (Conner et al. 1981). Soils can vary in texture from clays to sands, with organic horizons overlying these soils. Heath swamps occur in depression wetlands.

DISTRIBUTION

***Geographic Range:** This vegetation occurs in the southeastern and south-central United States, from Oklahoma and Texas to Ohio, Georgia, Florida and New England, in the coastal plain or adjacent ecoregions.
Nations: US
States/Provinces: AL, AR, CT, DC, DE, FL?, GA, IL, IN, KS, KY, LA, MA, MD, MO, MS, NC, NH, NJ, NY, OH, OK, PA?, RI, SC, TN, TX, VA
USFS Ecoregions (2007) [optional]: 211F:PP, 211G:PP, 212H:CC, 221A:CC, 221B:CC, 221D:CC, 221E:CC, 221F:CC, 221H:CC, 222H:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A1011	*Cephalanthus occidentalis* Shrub Swamp Alliance
A0992	*Vaccinium formosum - Vaccinium fuscatum - Vaccinium corymbosum* Wet Shrubland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Vinelands, woody, Peppervine-greenbrier mottes	Penfound 1967	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Nordman, in Faber-Langendoen et al. (2013)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman

Acknowledgments [optional]:

Version Date: 13 May 2015

REFERENCES

***References [Required if used in text]:**

Conner, W. H., J. G. Gosselink, and R. T. Parrondo. 1981. Comparison of the vegetation of three Louisiana swamp sites with different flooding regimes. American Journal of Botany 68:320-331.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Penfound, W. T. 1967. A physiognomic classification of vegetation in conterminous United States. Botanical Review 33:289-320.

Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina. Third approximation. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program, Raleigh. 325 pp.

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2. Shrub & Herb Vegetation

2.C.4.Ne. Atlantic & Gulf Coastal Marsh, Wet Meadow & Shrubland

G777. Atlantic & Gulf Coastal Interdunal Marsh & Prairie

Type Concept Sentence: This graminoid marsh occurs in coastal interdunal wetlands and coastal prairies, which are not tidal and are dominated by graminoids such as *Andropogon glomeratus, Cladium mariscus ssp. jamaicense, Cyperus* spp., *Eleocharis* spp., *Fimbristylis castanea, Fuirena scirpoidea, Muhlenbergia filipes, Panicum* spp., *Rhynchospora colorata, Sagittaria lancifolia, Schoenoplectus pungens, Setaria magna, Spartina bakeri*, and *Typha domingensis*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Ne.2. Atlantic & Gulf Coastal Plain Wet Prairie & Marsh (M067)

Elcode: G777

***Scientific Name:** *Fimbristylis castanea - Eleocharis* spp. - *Fuirena scirpoidea* Coastal Interdunal Marsh & Prairie Group

***Common (Translated Scientific) Name:** Marsh Fimbry - Spikerush species - Southern Umbrella-sedge Coastal Interdunal Marsh & Prairie Group

***Colloquial Name:** Atlantic & Gulf Coastal Interdunal Marsh & Prairie

***Type Concept:** This group occurs in coastal interdunal swales, interdunal depressions or poorly drained wet coastal flats. These are graminoid-dominated wetlands; dominant graminoid species can include *Andropogon brachystachyus, Carex hyalinolepis, Cladium mariscus ssp. jamaicense, Eleocharis elongata, Eleocharis equisetoides, Eleocharis quadrangulata, Fimbristylis caroliniana, Fimbristylis castanea, Fuirena scirpoidea, Leptochloa fusca ssp. fascicularis, Muhlenbergia filipes, Panicum hemitomon, Panicum tenerum, Paspalum vaginatum, Rhynchospora* spp., *Spartina patens, Schoenoplectus pungens*, and *Typha domingensis*. These are not tidally influenced, but may be subject to salt or brackish water from storm surge events. The vegetation may range from open water or floating-leaved aquatics in the center of the deepest interdunal depressions, to emergent marsh zones in semipermanent water, to shallower drawdown zones with diverse graminoid and forb vegetation. Wet coastal prairie vegetation is found on wet coastal flats and consists of primarily herbaceous wetland vegetation with a relatively thick cover of graminoid herbs.

***Diagnostic Characteristics:** This group occurs in coastal interdunal swales, interdunal depressions or poorly drained wet coastal flats. These are graminoid-dominated wetlands. These are not tidally influenced, but may be subject to salt or brackish water from storm surge events.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G111	Atlantic & Gulf Coastal Plain Pondshore & Wet Prairie	
G188	Atlantic & Gulf Coastal Plain River & Basin Freshwater Marsh	
G187	Atlantic & Gulf Coastal Plain Seep	
G752	Northern & Mid-Atlantic Coastal Wetland	
G776	Atlantic & Gulf Coastal Plain Shrub Swamp	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are graminoid-dominated wetlands, but the vegetation may range from open water or floating-leaved aquatics in the center of the deepest interdunal depressions, to emergent marsh zones in semipermanent water, to shallower drawdown zones with diverse graminoid and forb vegetation.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: These are graminoid-dominated wetlands; dominant graminoid species can include *Andropogon brachystachyus, Carex hyalinolepis, Cladium mariscus ssp. jamaicense, Eleocharis elongata, Eleocharis equisetoides, Eleocharis quadrangulata, Fimbristylis caroliniana, Fimbristylis castanea, Fuirena scirpoidea, Leptochloa fusca ssp. fascicularis, Muhlenbergia filipes, Panicum hemitomon, Panicum tenerum, Paspalum vaginatum, Rhynchospora* spp., *Spartina patens, Schoenoplectus pungens*, and *Typha domingensis*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: These wetlands are not tidally influenced, but may be subject to salt or brackish water from storm surge events. These wetlands are prone to landscape level disturbance from major tropical storms such as hurricanes which cause dune movement, coastal erosion and accretion. In areas where these wetlands are within a developed rather than natural coastal landscape, hurricane-related disturbance is a greater threat (Feagin et al. 2010).

ENVIRONMENT

Environmental Description: This group occurs in coastal interdunal swales, interdunal depressions or poorly drained wet coastal flats. These are not tidally influenced, but may be subject to salt or brackish water from storm surge events.

DISTRIBUTION

***Geographic Range:** This group is found in Atlantic and Gulf of Mexico coastal areas from Maryland and Virginia south to Florida and west to Texas and perhaps Tamaulipas, Mexico.
Nations: MX?, US
States/Provinces: AL, FL, GA, LA, MD, MS, MXTM?, NC, SC, TX, VA

USFS Ecoregions (2007) [optional]: 232C:CC, 232D:CC, 232E:CC, 232G:CC, 232H:CC, 232I:CC, 232L:CC, 255D:CC
Omernik Ecoregions L3, L4 [optional]: 8.5.2.73n:C, 8.5.2.73o:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3692	*Spartina patens - Schoenoplectus pungens* Coastal Marsh Alliance
A1389	*Spartina bakeri* Coastal Marsh Alliance
A1372	*Fimbristylis castanea - Schoenoplectus pungens* Coastal Marsh Alliance
A3399	*Typha domingensis* Coastal Marsh Alliance
A3401	*Eleocharis elongata - Eleocharis equisetoides - Fuirena scirpoidea* Interdunal Marsh Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Nordman, in Faber-Langendoen et al. (2013)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman
Acknowledgments [optional]:
Version Date: 13 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Feagin, R. A., W. K. Smith, N. P. Psuty, D. R. Young, M. L. Martinez, G. A. Carter, K. L. Lucas, J. C. Gibeat, J. N. Gemma, and R. E. Koske. 2010. Barrier islands: Coupling anthropogenic stability with ecological sustainability. Journal of Coastal Research 26:987-992.

G111. Atlantic & Gulf Coastal Plain Pondshore & Wet Prairie

Type Concept Sentence: These eastern coastal plain depression wetlands occur within poorly drained flats, or in limesinks in areas influenced by karst. The vegetation is dominated by graminoid herbs such as *Rhynchospora* spp., *Eleocharis* spp., and *Xyris* spp. with other graminoid herbs such as species of *Andropogon, Aristida, Carex, Eriocaulon*, and *Panicum*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.4.Ne.2. Atlantic & Gulf Coastal Plain Wet Prairie & Marsh (M067)

Elcode: G111
***Scientific Name:** *Rhynchospora* spp. - *Eleocharis* spp. - *Xyris* spp. Pondshore & Wet Prairie Group
***Common (Translated Scientific) Name:** Beaksedge species - Spikerush species - Yellow-eyed-grass species Pondshore & Wet Prairie Group
***Colloquial Name:** Atlantic & Gulf Coastal Plain Pondshore & Wet Prairie

***Type Concept:** This group occurs in depressions or poorly drained wet flats. The vegetation in depressions usually ranges from open water or floating-leaved aquatics in the center of the deepest basins, to emergent marsh zones in semipermanent water, to drawdown zones with diverse small graminoid and forb vegetation, to dense shrub or woodland edges. Wet prairie vegetation is found on extensive wet flats and consists of primarily herbaceous wetland vegetation with relatively thick cover of grasses and sedge species. Examples occupy low, flat plains on poorly drained soils, often saturated for 50-100 days per year. Occasional to frequent fires, including growing-season burns, are essential for maintenance of this vegetation. Some examples have a sparse tree component of *Pinus elliottii* or *Pinus palustris* and scattered shrubs, such as *Morella cerifera* from Virginia south and *Pinus rigida* and *Morella pensylvanica* to the north. Common taxa include *Rhynchospora* spp., *Eleocharis* spp., and *Xyris* spp. These often occur with other graminoids such as species of *Andropogon, Aristida, Carex, Eriocaulon*, and *Panicum*. This group is found from Cape Cod, Massachusetts, to the Delmarva Peninsula to the Outer Coastal Plain of Virginia, to Florida.

***Diagnostic Characteristics:** These are herbaceous wetlands, often mixed with low shrubs. They occur in depressions or on wet flats on the coastal plain of the southeastern United States, including some areas as far north as Cape Cod, Massachusetts. Common taxa include species of *Rhynchospora, Eleocharis, Aristida*, and *Xyris*.

***Classification Comments:** This group occurs in depressions and on poorly drained wet flats. Floristically, it may overlap with Atlantic & Gulf Coastal Plain Seep Group (G187), which occurs on seepage wetlands, and generally has some slope. These two groups are separated based on hydrogeomorphic factors, and a better understanding of the floristic similarities and differences is needed. Dune swales are covered in Atlantic & Gulf Coastal Interdunal Marsh & Prairie Group (G777) so they are omitted from this group (G111). Plus some dune swales are subject to salt spray, saltwater overwash, and heavy rainfall from storms, which may affect these dune swales and limit vegetation to species that are somewhat salt-tolerant. For coastal uplands, North Atlantic Coastal Dune & Grassland Group (G493) covers New England, New York, and Great Lakes dune swales; South Atlantic & Gulf Coastal Dune & Grassland Group (G494) captures the dune and coastal grasslands and shrublands of the mid or south Atlantic Coast. Dune associations CEGL003790 and CEGL004117 have been moved to *Fimbristylis castanea - Schoenoplectus pungens* Coastal Marsh Alliance (A1372) in G777. CEGL004137 and CEGL004138 (*Typha* associations) have been moved to *Typha domingensis* Coastal Marsh Alliance (A3399) also in G777. CEGL004639 is *Crataegus*-dominated and has been moved to *Crataegus aestivalis - Crataegus opaca - Crataegus rufula* Swamp Forest Alliance (A0320) in Coastal Plain Hardwood Basin Swamp Group (G038). CEGL007733, also a *Crataegus* forests has been dropped. CEGL006177 is a tidal association; it has been moved to *Peltandra virginica - Pontederia cordata - Sagittaria* spp. Oligohaline Tidal Marsh Alliance (A4017) in Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh Group (G110). CEGL006350 is maritime and should be reviewed. CEGL007790 has been moved to *Spartina spartinae - Schizachyrium scoparium - Liatris bracteata* Saline Coastal Prairie Alliance (A4061) in South Atlantic & Gulf Coastal Dune & Grassland Group (G494). If dune swales are included (now placed in G777), then Federal lands (of G777) should be updated to include Assateague, Cape Cod, Chincoteague, Fire Island, Plum Island, and maybe others.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G190	Wet-Mesic Longleaf Pine Open Woodland	
G129	South Florida Freshwater Marsh & Wet Prairie	
G557	Southeastern Ruderal Marsh, Wet Meadow & Shrubland	
G187	Atlantic & Gulf Coastal Plain Seep	
G777	Atlantic & Gulf Coastal Interdunal Marsh & Prairie	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These wetlands are generally dominated by herbaceous graminoid vegetation. There often are some woody plants, such as low shrubs and/or scattered tall shrubs or trees present. The tall shrubs have more cover on sites that have not been recently burned.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Common taxa include *Rhynchospora* spp., *Eleocharis* spp., and *Xyris* spp. Herbaceous plants include *Aristida beyrichiana, Aristida palustris, Bartonia verna, Carex striata, Centella erecta, Ctenium aromaticum, Cyperus haspan, Cyperus virens, Dichanthelium erectifolium, Dichanthelium wrightianum, Eleocharis elongata, Eleocharis equisetoides, Eleocharis microcarpa, Eleocharis quadrangulata, Fuirena scirpoidea, Fuirena squarrosa, Juncus abortivus, Juncus effusus, Juncus repens, Lachnanthes caroliana, Lachnocaulon minus, Leersia hexandra, Ludwigia glandulosa, Ludwigia linearis, Ludwigia* spp., *Panicum hemitomon, Panicum rigidulum, Panicum verrucosum, Panicum virgatum, Proserpinaca* spp., *Rhexia alifanus, Rhexia cubensis, Rhexia* spp., *Rhynchospora chapmanii, Rhynchospora corniculata, Rhynchospora filifolia, Rhynchospora harperi, Rhynchospora inundata, Rhynchospora tracyi, Sabatia angularis, Saccharum* spp., *Sagittaria longiloba, Sagittaria papillosa, Steinchisma hians, Symphyotrichum subulatum*, and *Xyris jupicai*. Some examples have a sparse tree component of *Pinus elliottii, Pinus palustris*, or *Pinus rigida* and scattered shrubs, such as *Clethra alnifolia, Morella cerifera, Morella pensylvanica*, or *Vaccinium corymbosum*. Other woody plants include *Acer rubrum, Cephalanthus occidentalis, Hypericum chapmanii, Hypericum fasciculatum, Hypericum tenuifolium (= Hypericum reductum), Ilex myrtifolia, Magnolia virginiana, Nyssa biflora, Nyssa sylvatica*, and *Taxodium ascendens*. Other characteristic and often dominant species for the northern part of the range (Massachusetts to New York or New Jersey) include *Cyperus dentatus, Dichanthelium meridionale, Eleocharis acicularis, Eleocharis robbinsii, Eriocaulon aquaticum (= Eriocaulon septangulare), Euthamia caroliniana (= Euthamia tenuifolia), Gratiola aurea, Juncus militaris, Juncus pelocarpus, Lobelia dortmanna*, and *Xyris difformis*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Water table fluctuations are probably the most important factor affecting examples of this vegetation (Bridges and Orzell 1989a). In depressions, hydroperiod can vary substantially from year to year, and vegetation can similarly vary significantly in aspect and dominants. Fire is also an important natural dynamic process, especially when sites are saturated, without standing water at the surface. On barrier islands, ponds usually occur in stable portions of the islands, where they may last for decades.

ENVIRONMENT

Environmental Description: *Climate:* South of Virginia, the climate is humid, warm temperate. From eastern Virginia to Cape Cod, Massachusetts, the climate is humid, cool temperate. *Soil/substrate/hydrology*: This vegetation occupies low, flat plains on poorly drained Ultisols. Other soil orders may include Spodosols, Inceptisols, and Entisols (Collins et al. 2001); some of these soils have an argillic horizon which impedes drainage and contributes to high water tables. On Eglin Air Force Base, this group is found on the Rutledge series (Kindell et al. 1997). The low areas where this vegetation occurs on barrier islands and similar immediate coastal areas are dune swales or other basins. The ponds have standing water well into the growing season, and most are permanently saturated. The vegetation also occurs in small basins, primarily in sandy terrain of the Atlantic Coastal Plain, from southeastern Virginia to Florida, including the Lake Wales Ridge area of central Florida. Most southeast basins are formed by subsidence of surface sediments caused by solution in underlying limestone, but origins may be different from Delaware northward.

DISTRIBUTION

***Geographic Range:** This group is found from Cape Cod, Massachusetts, to the Delmarva Peninsula to the Outer Coastal Plain of Virginia, to Florida. Review is needed to determine if the type extends to southeastern Texas and Louisiana.
Nations: CA, US
States/Provinces: AL, DE, FL, GA, LA?, MA, MD, ME, MS, NC, NJ, NY, SC, TX?, VA
USFS Ecoregions (2007) [optional]: 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221An:CCC, 232A:CC, 232B:CC, 232C:CC, 232D:CC, 232E:CC, 232Fb:CCC, 232G:CC, 232H:CP, 232I:CC, 232J:CC, 232K:CC, 232L:CC

Omernik Ecoregions L3, L4 [optional]: 8.3.5.65f:C, 8.3.5.65g:C, 8.3.5.65h:C, 8.3.5.65l:C, 8.3.5.65m:C, 8.3.5.65o:C, 8.3.7.35f:C, 8.5.1.63b:C, 8.5.1.63c:C, 8.5.1.63e:C, 8.5.1.63f:C, 8.5.1.63h:C, 8.5.3.75a:C, 8.5.3.75b:C, 8.5.3.75c:C, 8.5.3.75d:C, 8.5.3.75e:C, 8.5.3.75f:C, 8.5.3.75g:C, 8.5.3.75h:C, 8.5.3.75j:C, 9.5.1.34a:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A1430	*Juncus militaris* Pondshore Marsh Alliance
A1384	*Rhynchospora* spp. - *Panicum rigidulum - Panicum verrucosum* Pondshore Marsh Alliance
A3388	*Hypericum chapmanii - Hypericum lissophloeus* Pondshore Shrubland Alliance
A1379	*Panicum hemitomon* Pondshore Marsh Alliance
A3397	*Rhynchospora* spp. - *Calamagrostis canadensis - Rhexia virginica* Coastal Plain Pondshore Marsh Alliance
A1429	*Eleocharis* spp. - *Eriocaulon aquaticum* Coastal Plain Pondshore Marsh Alliance
A3393	*Aristida palustris - Panicum virgatum - Eriocaulon* spp. Pondshore Marsh Alliance
A3402	*Andropogon capillipes - Andropogon glaucopsis - Panicum* spp. Wet Prairie & Basin Marsh Alliance
A1383	*Rhynchospora careyana - Rhynchospora inundata* Pondshore Marsh Alliance
A3394	*Rhynchospora filifolia - Dichanthelium erectifolium - Dichanthelium wrightianum* Southern Limesink Marsh Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
><	Clastic Upland Lake	FNAI 1990	
><	Coastal Interdunal Swale	FNAI 1990	
><	Depression Marsh	FNAI 1990	
><	Flatwoods/Prairie/Marsh Lake	FNAI 1990	
><	Limesink	Wharton 1978	
<	Open Water Lake	Bennett and Nelson 1991	
?	Sandhill Upland Lake	FNAI 1990	
><	Sinkhole Lake	FNAI 1990	
><	Wet Prairie	FNAI 1990	
><	grass-sedge savannah	Clewell 1981	

AUTHORSHIP

***Primary Concept Source [if applicable]:** A.F. Clewell (1981)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman, D. Faber-Langendoen and J. Lundgren
Acknowledgments [optional]: J. Lundgren
Version Date: 13 May 2015

REFERENCES

***References [Required if used in text]:**

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Peet, R. K., and D. J. Allard. 1993. Longleaf pine vegetation of the Southern Atlantic and Eastern Gulf Coast regions: A preliminary classification. Pages 45-81 in: S. M. Hermann, editor. The Longleaf Pine Ecosystem: Ecology, restoration and management. Proceedings of the eighteenth Tall Timbers fire ecology conference. Tall Timbers Research Station, Tallahassee, FL.
Sneddon, L. A., M. Anderson, and J. Lundgren. 1999. Classification of coastal plain pondshore communities of the Cape Cod National Seashore using the U.S. National Vegetation Classification. Unpublished report to the Cape Cod National Seashore. The Nature Conservancy, Boston, MA.
Wharton, C. H. 1978. The natural environments of Georgia. Georgia Department of Natural Resources, Atlanta. 227 pp.
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2\. Shrub & Herb Vegetation
2.C.4.Ne. Atlantic & Gulf Coastal Marsh, Wet Meadow & Shrubland

G752. Northern & Mid-Atlantic Coastal Wetland

Type Concept Sentence: This group comprises wetlands of maritime and coastal regions of the northeast and mid-Atlantic states; it includes small-patch wetlands generally referred to as "interdunal swales" and other non-forested wetlands of this region.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.4.Ne.2. Atlantic & Gulf Coastal Plain Wet Prairie & Marsh (M067)

Elcode: G752
***Scientific Name:** Northern & Mid-Atlantic Coastal Wetland Group
***Common (Translated Scientific) Name:** Northern & Mid-Atlantic Coastal Wetland Group
***Colloquial Name:** Northern & Mid-Atlantic Coastal Wetland

***Type Concept:** This group comprises small-patch non-forested wetlands exclusive of those that are tidally flooded in maritime and coastal areas of the northeast and mid-Atlantic states. It includes small-patch wetlands generally known as "interdunal swales" as well as other non-forested coastal wetlands that are not tidally flooded. Characteristic species include *Fimbristylis castanea, Morella cerifera, Morella pensylvanica, Panicum virgatum, Schoenoplectus pungens, Vaccinium corymbosum, Vaccinium macrocarpon*, and species of *Juncus*.

***Diagnostic Characteristics:** Small-patch non-forested wetlands that are not tidally flooded, restricted to maritime or coastal settings in the northeast and mid-Atlantic regions. They are common in maritime dune systems across the range, or on morainal deposits in coastal New England.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G776	Atlantic & Gulf Coastal Plain Shrub Swamp	overlaps in range at the southern limit of G752, but is limited to shrub-dominated wetlands of the coastal plain.
G777	Atlantic & Gulf Coastal Interdunal Marsh & Prairie	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group ranges from herbaceous-dominated to shrub-dominated. Generally the vegetation is well-developed with high cover, especially later in the growing season. Vegetation of this group is best developed in late summer.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Interdunal swales of the glaciated region are commonly dominated by *Vaccinium macrocarpon*, with associates including *Cladium mariscoides* and species of *Rhynchospora*. They generally lack *Chamaedaphne calyculata*, but support other species often found in bogs, including species of *Drosera, Sphagnum*, and *Pogonia ophioglossoides*. In the Mid-Atlantic, interdunal swales are generally more floristically diverse, often characterized by *Fimbristylis castanea, Hibiscus moscheutos, Juncus canadensis, Juncus dichotomus, Pluchea odorata, Schoenoplectus pungens*, and *Thelypteris palustris*. Other wetlands support shrub thickets dominated by *Cephalanthus occidentalis, Morella cerifera* (in the mid-Atlantic), *Morella pensylvanica* (characteristic of ponds on moraine landscapes in New England), and *Vaccinium corymbosum*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Groundwater and rainwater are the only sources of inundation, and water levels decrease or standing water may absent later in the growing season. Some interdunal swales are slightly saline as a result of occasional overwash.

ENVIRONMENT

Environmental Description: These small-patch wetlands occur in shallow, seasonally flooded basins occurring in hollows of major dune systems. They also occur on the shores of larger, sometimes deeper ponds that occur on morainal deposits in the glaciated part of the region.

DISTRIBUTION

***Geographic Range:** This group ranges from Maine south along the immediate coast to South Carolina discontinuously to Florida. This group may also occur in southern Canada.
Nations: CA?, US
States/Provinces: CT, DE, MA, MD, ME, NC, NH, RI, SC, VA
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3651	*Vaccinium macrocarpon* Coastal Wet Shrubland Alliance
A3650	*Morella pensylvanica* Coastal Wet Shrubland Alliance
A3652	*Panicum virgatum* Coastal Wet Meadow Alliance
A3649	*Morella cerifera* Coastal Wet Shrubland Alliance
A3653	*Schoenoplectus pungens - Spartina patens* Interdunal Marsh Alliance
A1427	*Juncus dichotomus* Interdunal Wet Meadow Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	*Panicum virgatum* wetland association	Heckscher et al. 1995	
>	*Vaccinietum macrocarponi*	Conard 1935	
>	Brackish Interdunal Swales	NYNHP 2013v	
>	Interdune swales and ponds	Fleming et al. 2013	
>	Mesic shrub zone	Higgins et al. 1971	

AUTHORSHIP

***Primary Concept Source [if applicable]:** P.C. Swain and J.B. Kearsley (2011); G.P. Fleming et al. (2013)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** L.A. Sneddon

Acknowledgments [optional]:

Version Date: 13 May 2015

REFERENCES

***References [Required if used in text]:**

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2.C.5. Salt Marsh

Salt Marsh is a wetland that has shallow water and levels that usually fluctuate due primarily to tides along the coast or changes in water depth in depressions. Coastal salt marshes are primarily intertidal; that is, they are found in areas at least occasionally inundated by high tide but not flooded during low tide, including estuaries, lagoons, and the lee side of barrier islands. The vegetation comprises emergent shrubs and herbs with at least 10% cover, especially saline or halophytic species. They occur at all latitudes around the globe, but are concentrated in the temperate mid-latitudes (23-70°N and S).

2.C.5.Na. North American Great Plains Saline Marsh

Brackish marsh and saline wet meadows found along shallow lakes and basins and surrounding areas across the Great Plains of North America.

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2. Shrub & Herb Vegetation
2.C.5.Na. North American Great Plains Saline Marsh

M077. Great Plains Saline Wet Meadow & Marsh

Type Concept Sentence: This macrogroup consists of graminoid-dominated saline shallow depressions and mudflats dominated by *Distichlis spicata, Hordeum jubatum, Pascopyrum smithii*, or *Salicornia rubra*, as well as other flood- and saline-tolerant species. It occurs throughout the Great Plains from southern Canada to the panhandle of Texas and west into the plains of Montana, Wyoming and Colorado.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.C.5.Na.1. North American Great Plains Saline Marsh (D033)

Elcode: M077
***Scientific Name:** Great Plains Saline Wet Meadow & Marsh Macrogroup
***Common (Translated Scientific) Name:** Great Plains Saline Wet Meadow & Marsh Macrogroup
***Colloquial Name:** Great Plains Saline Wet Meadow & Marsh

***Type Concept:** This macrogroup covers graminoid-dominated saline shallow depressions and mudflats found throughout the Great Plains. The most abundant species at a site typically include *Distichlis spicata* or *Hordeum jubatum*. Other common associates or dominants are *Atriplex patula, Eleocharis* spp., *Iva annua, Pascopyrum smithii, Poa arida, Puccinellia nuttalliana, Salicornia rubra, Bolboschoenus maritimus, Sporobolus airoides*, and *Suaeda calceoliformis*. Soils are saline and any standing water is brackish. This macrogroup occurs throughout the Great Plains from southern Canada to the panhandle of Texas and west into the plains of Montana, Wyoming and Colorado.

***Diagnostic Characteristics:** Sites in this macrogroup are intermittently to seasonally flooded, dominated by short to medium-tall graminoids, on saline soils.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M071	Great Plains Marsh, Wet Meadow, Shrubland & Playa	
M079	North American Atlantic & Gulf Coastal Salt Marsh	
M082	Warm & Cool Desert Alkali-Saline Marsh, Playa & Shrubland	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Stands are dominated by short to medium-tall herbaceous species, usually graminoids.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This macrogroup is dominated by herbaceous, usually graminoid, species. The most abundant species include *Distichlis spicata* or *Hordeum jubatum*. Other common associates or dominants are *Atriplex patula, Eleocharis* spp., *Iva annua, Pascopyrum smithii, Poa arida, Puccinellia nuttalliana, Salicornia rubra, Bolboschoenus maritimus (= Schoenoplectus maritimus), Sporobolus airoides*, and *Suaeda calceoliformis*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Variations in water and salinity levels have a strong impact on this macrogroup. Abundant plant species within this macrogroup are tolerant of moderate salinity and periodic flooding. Increases in precipitation will prolong the flooding period and dilute salt concentrations, allowing other species to encroach.

ENVIRONMENT

Environmental Description: This macrogroup occurs in shallow basins and mudflats that have seasonal periodic flooding. Sites may dry out by the end of the growing season. Soils are saline and create brackish water. Salt brought to the surface by water that later evaporates may form crusts.

DISTRIBUTION

***Geographic Range:** This macrogroup occurs throughout the Great Plains from southern Canada to the panhandle of Texas and west into the plains of Montana, Wyoming and Colorado. The eastern limit of this macrogroup is in western Minnesota, eastern Nebraska, northwestern Missouri, and eastern Kansas. Rare saline marshes in the southern and eastern Great Lakes area are also included in this macrogroup.
Nations: CA, MX?, US
States/Provinces: CO, IL, KS, MB?, MI, MN, MO, MT, ND, NE, OK, ON, QC, SD, SK, TX, WY
USFS Ecoregions (2007) [optional]: 251A:C?, 251B:CC, 251C:CP, 251F:CP, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CP, 331I:CP, 332A:CC, 332B:CC, 332C:CC, 332D:CC, 332E:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G324	Great Plains Saline Wet Meadow & Marsh
G534	Western Great Plains Saline Wet Meadow

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake
Acknowledgments [optional]:
Version Date: 15 Oct 2014

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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2. Shrub & Herb Vegetation
2.C.5.Na. North American Great Plains Saline Marsh

G534. Western Great Plains Saline Wet Meadow

Type Concept Sentence: This wetland group consists of alkaline grasslands with and without an open shrub layer with dominant grasses that include *Distichlis spicata, Muhlenbergia porteri, Panicum obtusum, Puccinellia nuttalliana, Scleropogon brevifolius*, and/or *Sporobolus airoides*, and found in the Great Plains and Rocky Mountain foothills.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.5.Na.1. Great Plains Saline Wet Meadow & Marsh (M077)

Elcode: G534
***Scientific Name:** Western Great Plains Saline Wet Meadow Group
***Common (Translated Scientific) Name:** Western Great Plains Saline Wet Meadow Group
***Colloquial Name:** Western Great Plains Saline Wet Meadow

***Type Concept:** This saline wet meadow group is found in the northern, southern and western Great Plains and in the Rocky Mountain foothills. Dominant grasses include *Distichlis spicata, Muhlenbergia porteri, Panicum obtusum, Puccinellia nuttalliana, Scleropogon brevifolius*, and/or *Sporobolus airoides*. Scattered shrubs may include *Allenrolfea occidentalis, Artemisia frigida, Artemisia tridentata, Atriplex canescens, Chrysothamnus* spp., *Gutierrezia sarothrae*, and *Sarcobatus vermiculatus*. Stands occur in a wide variety of lowland sites, such as stream terraces, swales, interdune basins, and alluvial flats. This group has a high water table because of land position and impermeable subsurface horizons. Soils are moderately saline and usually alkaline. Soil surface textures are sandy to clayey. The soils morphology often includes a claypan, caliche layer or other subsurface horizon that impedes water movement. Soils are saline or alkaline, but salt crusts on the surface are absent. Although periodic flooding is rare, stands of this group receive more water than the surrounding uplands through runoff.

***Diagnostic Characteristics:** Moderately saline stands dominated by *Sporobolus airoides, Sarcobatus vermiculatus*, and/or *Puccinellia nuttalliana*.

***Classification Comments:** Recently split from a wider ranging group, this group is limited to the Great Plains.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G537	North American Desert Alkaline-Saline Wet Scrub	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Perennial grassland <1 m in height, shrubs and dwarf shrubs often present with generally <25% cover.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Dominant grasses include *Distichlis spicata, Muhlenbergia porteri, Panicum obtusum, Puccinellia nuttalliana, Scleropogon brevifolius*, and/or *Sporobolus airoides*. Scattered shrubs may include *Allenrolfea occidentalis, Artemisia frigida, Artemisia tridentata, Atriplex canescens, Chrysothamnus* spp., *Gutierrezia sarothrae*, and *Sarcobatus vermiculatus*. Other common grasses are *Bouteloua dactyloides (= Buchloe dactyloides), Hordeum jubatum, Hordeum pusillum, Pascopyrum smithii*, and *Sporobolus cryptandrus*. Forbs and shrubs are typically sparse. Common forb associates are *Chaetopappa ericoides, Grindelia squarrosa, Helianthus* spp., *Machaeranthera* spp., *Plantago* spp., *Ratibida* spp., *Sphaeralcea* spp., *Symphyotrichum ericoides (= Aster ericoides)*, and *Salicornia rubra* (on more saline inclusions).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Periodic subsurface irrigation is needed to maintain this group.

ENVIRONMENT

Environmental Description: This group is not defined by a flood regime so much as that the soil often has a high water table because of land position and impermeable subsurface horizons. Soils are moderately saline and usually alkaline, but salt crusts on the surface are absent (Thilenius et al. 1995). Soil surface textures are sandy to clayey. The soils morphology often includes a claypan, caliche layer or other subsurface horizon that impedes water movement. Parent material is typically alluvium derived from limestone, shale, or sandstone.

DISTRIBUTION

***Geographic Range:** This group is found in the Great Plains, generally western portions, but ranges from north to south throughout.
Nations: CA, US
States/Provinces: MT, ND, SD, SK?, WY
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3904	*Sporobolus airoides* Great Plains Marsh Alliance
A3905	*Sarcobatus vermiculatus* Great Plains Wet Shrubland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al.

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** G. Kittel

Acknowledgments [optional]:

Version Date: 03 Dec 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

2.C.5.Nb. North American Atlantic & Gulf Coastal Salt Marsh

This division comprises all regularly and irregularly flooded tidal marshes of the North Atlantic and Gulf coasts in North America, ranging from polyhaline (salt) marshes to mesohaline (brackish) marshes, dominated or characterized by an abundance of halophytic species, including *Distichlis spicata, Spartina alterniflora, Spartina patens*, and species of *Salicornia* and *Sarcocornia*.

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2. Shrub & Herb Vegetation
2.C.5.Nb. North American Atlantic & Gulf Coastal Salt Marsh

M079. North American Atlantic & Gulf Coastal Salt Marsh

Type Concept Sentence: This macrogroup comprises all regularly and irregularly flooded tidal marshes of the North Atlantic and Gulf coasts in North America, ranging from polyhaline (salt) marshes to mesohaline (brackish) marshes, dominated or characterized by an abundance of halophytic species, including *Distichlis spicata, Spartina alterniflora, Spartina patens*, and species of *Salicornia* and *Sarcocornia*.

OVERVIEW

***Hierarchy Level:** Macrogroup

***Placement in Hierarchy:** 2.C.5.Nb.1. North American Atlantic & Gulf Coastal Salt Marsh (D034)

Elcode: M079

***Scientific Name:** North American Atlantic & Gulf Coastal Salt Marsh Macrogroup

***Common (Translated Scientific) Name:** North American Atlantic & Gulf Coastal Salt Marsh Macrogroup
***Colloquial Name:** North American Atlantic & Gulf Coastal Salt Marsh

***Type Concept:** This macrogroup encompasses eastern North American tidal marshes along the Atlantic and Gulf coasts, ranging in halinity from salt to brackish, and in tidal regime from regularly twice-daily flooding on low marshes to irregularly flooded high marshes, as well as hypersaline pannes. It also includes saline inland prairie. *Distichlis spicata, Spartina alterniflora, Spartina patens*, and species of *Salicornia* and *Sarcocornia* are characteristic throughout the range. These species are present but less abundant in brackish marshes that occur along tidal rivershores or in other settings receiving freshwater mixing. Here, additional species include *Spartina cynosuroides, Schoenoplectus americanus, Typha angustifolia*, and others. Associated species vary across the north-to-south expanse of this macrogroup. Towards the north, common associates include *Juncus gerardii, Limonium carolinianum, Plantago maritima var. juncoides*, and *Triglochin maritima*. From the Chesapeake and mid-Atlantic south, *Batis maritima, Juncus roemerianus, Monanthochloe littoralis, Sesuvium portulacastrum, Spartina spartinae*, and *Typha domingensis* become increasingly common associates. Salt marshes and pannes are regularly to irregularly flooded by shallow polyhaline waters as a result of lunar, wind and storm tides. Brackish tidal marshes develop along estuaries where freshwater mixes with ocean saltwater moving up the estuary from the tidal force. Waters in brackish marshes are generally in the salinity range of 0.5-18 ppt, and the vegetation is subject to flooding from the twice-daily tides. This macrogroup ranges along the Atlantic Coast and Gulf of Mexico region from the New England states and the southern Maritime Provinces of Canada south to northern Mexico.

***Diagnostic Characteristics:** Herbaceous vegetation of the Atlantic coast of North America, characterized by halophytic or mesohalophytic species (*Spartina alterniflora, Spartina cynosuroides, Spartina patens, Spartina spartinae, Salicornia* spp., *Sarcocornia* spp.) subjected to regular or irregular tidal flooding.

***Classification Comments:** Salt marsh zonation has been long recognized and well-studied. The four groups in North American Atlantic & Gulf Coastal Salt Marsh Macrogroup (M079) reflect these common salt marsh zones (low marsh, high marsh, brackish marsh, panne) [see, for example, Adam (1990) and Mendelssohn and McKee (2000)]. Brackish marshes are found within a tidal river, along the upland side of salt marshes where freshwater inputs modify the salinity, or even brackish conditions on tidal streams within a salt marsh. They typically have reduced cover of *Spartina patens* and increased cover of associated brackish marsh species such as *Amaranthus cannabinus, Polygonum* spp., *Schoenoplectus americanus*, and *Typha angustifolia*.

The Texas Saline Inland Prairie is added to the range of this macrogroup and Atlantic & Gulf Coastal Tidal Flat & Panne Group (G123). There are both southeastern and southwestern warm temperate floristic patterns but the dominants are more southeastern. That is, *Borrichia frutescens, Spartina spartinae*, and *Sporobolus virginicus* are Gulf Coast saline. *Chloracantha spinosa* and *Helianthus ciliaris* are southwest saline.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M066	Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh	is also tidally flooded but lacks halophytic species.
M077	Great Plains Saline Wet Meadow & Marsh	is also characterized by halophytes, but is non-tidal and has no marine influence.
M735	Tropical Western Atlantic-Caribbean Salt Marsh	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This macrogroup is characterized by graminoids or forbs, with a notably simple structure, often forming large, even-height monotypic patches, especially where tidal flooding is regular. Marshes of mixed height, comprising graminoids and forbs, are often more characteristic in brackish settings. Shrubs may be interspersed, especially near the transition to upland or non-tidal vegetation, with graminoid cover remaining extensive below. Where present, shrub cover can range widely. Vegetation may also be very sparse on immediate shorelines and tidal flats.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Distichlis spicata, Spartina alterniflora, Spartina patens*, and species of *Salicornia* and *Sarcocornia* are characteristic throughout the range. These species are present but less abundant in brackish marshes that occur along tidal rivershores or in other settings receiving freshwater mixing. Here, additional species include *Schoenoplectus americanus, Spartina cynosuroides, Typha angustifolia, Typha domingensis*, and others. Associated species vary across the north-to-south expanse of this macrogroup. Towards the north, common associates include *Juncus arcticus, Juncus gerardii, Limonium carolinianum, Solidago sempervirens, Plantago maritima var. juncoides*, and *Triglochin maritima*. From the Chesapeake and mid-Atlantic south, *Batis maritima, Juncus roemerianus, Monanthochloe littoralis, Sesuvium portulacastrum, Spartina spartinae*, and *Typha domingensis* become increasingly common associates. Succulent genera *Sarcocornia* (e.g., *Sarcocornia pacifica*) and *Salicornia* (e.g., *Salicornia depressa (= Salicornia virginica), Salicornia bigelovii, Salicornia maritima*), as well as several grasses (which may be stunted), including *Spartina spartinae, Spartina alterniflora, Sporobolus virginicus*, and *Distichlis spicata*, characterize hypersaline pannes. Macroalgae such as *Ascophyllum nodosum* may be present (though sparse) particularly in the northern part of the macrogroup's range.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Wave and ice-scour can have a significant influence on the year-to-year appearance of the vegetation, and also influences variations in physiognomy and composition along estuary reaches. High marshes develop in areas above mean high water that still receive tidal influence from lunar spring tides, wind tides, or storm tides. Storm tides often deposit sand on salt marsh surfaces where overwash breaches the barrier dune. Salt pannes are part of the shifting mosaic of plant communities of the salt marsh complex. They tend to occur more frequently on the high marsh, but are present in the low marsh as well. Pannes are variable in shape and likely variable in origin. Formation can result from ice-scouring or rafting flotsam that scrapes away or smothers existing vegetation, or from peat compaction, mosquito ditch levees, or tidal creekbank erosion that blocks or impedes drainage. Lack of vegetation decreases local sedimentation, which also maintains lower micro-relief (Redfield 1972).

ENVIRONMENT

Environmental Description: Salt marshes and pannes are regularly to irregularly flooded by shallow polyhaline waters as a result of lunar, wind and storm tides. They generally develop on fine-grained sediments, but can develop over sands as well. Production exceeds decomposition, leading to the buildup of marsh peat. Pannes form in depressions that range from 2-30 cm lower than the elevation of the marsh. The depressions are regularly to irregularly flooded by tides, and as the water evaporates during low tide, the salinity concentration increases, forming "salt pannes." Substrate is soft, silty muck or peat of variable density. Brackish tidal marshes develop along estuaries where freshwater mixes with ocean saltwater moving up the estuary from the tidal force. They also occur near uplands where freshwater inputs reduce the salinity of the salt marsh. Waters in brackish marshes are generally in the salinity range of 0.5-18 ppt, and the vegetation is subject to flooding from the twice-daily tides. This macrogroup ranges along the Atlantic coast and Gulf of Mexico region from the New England states and the southern Maritime Provinces of Canada south to northern Mexico.

DISTRIBUTION

***Geographic Range:** This vegetation is found along the North American Atlantic and Gulf of Mexico coasts from the Bay of Fundy south to Texas and possibly northern Mexico.
Nations: CA, MX, US
States/Provinces: AL, CT, DC, DE, FL, GA, LA, MA, MD, ME, MS, MXTM?, NB, NC, NH, NJ, NS, NY, RI, SC, TX, VA
USFS Ecoregions (2007) [optional]: 211Cb:CCC, 211Db:CCC, 211Dc:CCC, 221Aa:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ak:CCC, 232A:CC, 232C:CC, 232D:CC, 232E:CC, 232G:CC, 232H:CC, 232I:CC, 232L:CC, 255Da:CCC, 255Dc:CCC
Omernik Ecoregions L3, L4 [optional]: 8.1.7.59e:C, 8.1.7.59f:C, 8.1.7.59g:C, 8.1.8.82f:C, 8.1.8.82g:C, 8.5.1.63b:C, 8.5.1.63c:C, 8.5.1.63d:C, 8.5.1.63e:C, 8.5.1.63g:C, 8.5.1.63n:C, 8.5.2.73o:C, 8.5.3.75d:C, 8.5.3.75j:C, 8.5.3.75k:C, 8.5.3.75l:C, 8.5.4.84a:C, 8.5.4.84c:C, 9.5.1.34g:C, 9.5.1.34h:C, 9.5.1.34i:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G122	Atlantic & Gulf Coastal Low Salt Marsh
G123	Atlantic & Gulf Coastal Tidal Flat & Panne
G121	Atlantic & Gulf Coastal High Salt Marsh
G120	Atlantic & Gulf Coastal Brackish Salt Marsh

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Estuarine Persistent Emergent Wetland	Cowardin et al. 1979	
=	High Marsh	Mendelssohn and McKee 2000	
>	High Marsh	Adams 1963	
?	Salt Marsh	Rawinski 1984a	formerly Southern New England and Gulf of Maine Salt Marshes
>	Salt marsh ecosystem	Odum and Copeland 1974	

AUTHORSHIP

***Primary Concept Source [if applicable]:** H.T. Odum and B.J. Copeland (1974)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler and L.A. Sneddon

Acknowledgments [optional]:

Version Date: 20 May 2015

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2. Shrub & Herb Vegetation
2.C.5.Nb. North American Atlantic & Gulf Coastal Salt Marsh

G122. Atlantic & Gulf Coastal Low Salt Marsh

Type Concept Sentence: These are salt marshes found along the North American Atlantic and Gulf of Mexico coasts from the Bay of Fundy to Texas and possibly Mexico, typically dominated by *Spartina alterniflora*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.5.Nb.1. North American Atlantic & Gulf Coastal Salt Marsh (M079)

Elcode: G122
***Scientific Name:** *Spartina alterniflora* Low Salt Marsh Group
***Common (Translated Scientific) Name:** Smooth Cordgrass Low Salt Marsh Group
***Colloquial Name:** Atlantic & Gulf Coastal Low Salt Marsh

***Type Concept:** This group encompasses salt marsh vegetation that is flooded twice daily by polyhaline waters and dominated by *Spartina alterniflora*. *Spartina alterniflora* is constant, dominant, and sometimes monospecific. Halophytic forbs (or forblike woody plants in the case of *Sarcocornia*) such as *Sarcocornia perennis* may be present though not abundant, and individuals of species more common in the high marsh, such as *Limonium carolinianum, Juncus roemerianus*, and *Distichlis spicata*, may also occur. Other species include *Limonium carolinianum, Plantago maritima, Salicornia* spp., *Spartina patens*, and *Spergularia canadensis*. Macroalgae such as *Ascophyllum nodosum* may be present (though sparse) particularly in the northern part of the group's range. It is often found fringing tidal creeks, and in places forms extensive flats of low marsh vegetation.

***Diagnostic Characteristics:** Graminoid coastal marsh vegetation in which *Spartina alterniflora* is strongly dominant and often monospecific. Brackish water associates such as *Schoenoplectus* spp., *Spartina cynosuroides*, or *Spartina pectinata* are absent.

***Classification Comments:** Salt marsh zonation has long been recognized and well-studied. The four groups in North American Atlantic & Gulf Coastal Salt Marsh Macrogroup (M079) reflect these common salt marsh zones (low marsh, high marsh, brackish marsh, panne); see, for example, Adam (1990) and Mendelssohn and McKee (2000).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G121	Atlantic & Gulf Coastal High Salt Marsh	is generally adjacent to vegetation in this group and occurs above mean high water; it is dominated by *Spartina patens*.
G120	Atlantic & Gulf Coastal Brackish Salt Marsh	occurs in mesohaline settings such as estuaries with more freshwater input; *Spartina alterniflora* may be present in some places, but associated species are far more varied that in this low marsh group.
G123	Atlantic & Gulf Coastal Tidal Flat & Panne	includes saltmarsh vegetation that may be embedded within high marsh in hypersaline flats; it is distinguished by a suite of halophytic forbs and graminoids and sparse or absent *Spartina*.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: *Spartina alterniflora* dominates the dense graminoid flats of this vegetation. This species grows in both a tall form and a short form (Valiela et al. 1978). The tall form (generally over 1 m in height) is common along tidal creeks and at marsh edges; the short form (10-40 cm tall) is typically found in more extensive flats landward of the tall form.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Spartina alterniflora* is constant, dominant, and sometimes monospecific. Halophytic forbs (or forblike woody plants in the case of *Sarcocornia*) such as *Sarcocornia perennis* may be present though not abundant, and individuals of species more common in the high marsh, such as *Limonium carolinianum, Juncus roemerianus*, and *Distichlis spicata*, may also occur. Other species include *Limonium carolinianum, Plantago maritima, Salicornia* spp., *Spartina patens*, and *Spergularia canadensis*. Macroalgae such as *Ascophyllum nodosum* may be present (though sparse) particularly in the northern part of the group's range.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Storm tides often deposit sand on salt marsh surfaces where overwash breaches the barrier dune. Flood-deposited wrack can smother the underlying marsh, converting it to an unvegetated flat. Decline of low salt marsh has been documented on the Atlantic and Gulf coasts in recent decades; loss is attributed to intense grazing by a nocturnal crab, which is most pronounced at tidal creek edges (Smith 2009).

ENVIRONMENT

Environmental Description: *Climate:* Cool-temperate to warm-temperate maritime climate. *Soil/substrate/hydrology:* Tides bring nutrients, making the regularly flooded marshes fertile. Salt marshes generally develop on fine-grained sediments, but can develop over sands as well. Production exceeds decomposition, leading to the buildup of marsh peat. Low marsh is flooded twice daily by polyhaline waters as a result of lunar, wind and storm tides.

DISTRIBUTION

***Geographic Range:** This vegetation is found along the North American Atlantic and Gulf of Mexico coasts from the Bay of Fundy south to Texas and possibly Mexico.
Nations: CA, MX?, US
States/Provinces: AL, CT, DE, FL, GA, LA, MA, MD, ME, MS, MXTM?, NB, NC, NH, NJ, NS, NY, RI, SC, TX, VA
USFS Ecoregions (2007) [optional]: 211Cb:CCC, 211Db:CCC, 211Dc:CCC, 221Aa:CCC, 221Ak:CCC, 232A:CC, 232C:CC, 232D:CC, 232E:CC, 232G:CC, 232H:CC, 232I:CC, 232L:CC, 255D:CC
Omernik Ecoregions L3, L4 [optional]: 8.1.7.59e:C, 8.1.7.59g:C, 8.1.8.82f:C, 8.1.8.82g:C, 8.5.1.63b:C, 8.5.1.63c:C, 8.5.1.63d:C, 8.5.1.63e:C, 8.5.1.63g:C, 8.5.1.63n:C, 8.5.2.73o:C, 8.5.3.75d:C, 8.5.3.75j:C, 8.5.3.75k:C, 8.5.3.75l:C, 8.5.4.84a:C, 8.5.4.84c:C, 9.5.1.34g:C, 9.5.1.34h:C, 9.5.1.34i:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A1471	*Spartina alterniflora* Low Salt Marsh Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Estuarine Persistent Emergent Wetland	Cowardin et al. 1979	
=	Low Marsh	Adams 1963	
=	Low Marsh	Mendelssohn and McKee 2000	
<	Salt marsh ecosystem	Odum and Copeland 1974	

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen, L. Sneddon, and C. Nordman, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler, L. Sneddon, M. Pyne and D. Faber-Langendoen
Acknowledgments [optional]: Sean Basquill
Version Date: 05 Jun 2015

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***References [Required if used in text]:**
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2. Shrub & Herb Vegetation
2.C.5.Nb. North American Atlantic & Gulf Coastal Salt Marsh

G123. Atlantic & Gulf Coastal Tidal Flat & Panne

Type Concept Sentence: These are tidally-influenced hypersaline areas found along the Atlantic and Gulf of Mexico coasts from the New England states and the Canadian Maritime Provinces south to northern Mexico, dominated by *Salicornia* spp. and *Sarcocornia* spp., as well as *Batis maritima, Distichlis spicata, Spartina alterniflora, Spartina spartinae*, and/or *Sporobolus virginicus*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.5.Nb.1. North American Atlantic & Gulf Coastal Salt Marsh (M079)

Elcode: G123
***Scientific Name:** *Salicornia* spp. - *Sarcocornia* spp. - *Spartina spartinae* Tidal Flat & Panne Group
***Common (Translated Scientific) Name:** Saltwort species - Swampfire species - Gulf Cordgrass Tidal Flat & Panne Group
***Colloquial Name:** Atlantic & Gulf Coastal Tidal Flat & Panne

***Type Concept:** Vegetation of this group occupies tidally-influenced hypersaline areas along the Atlantic Coast and Gulf of Mexico region from the New England states and the Canadian Maritime Provinces, along the southeastern coast and south to northern Mexico. Examples of this vegetation may occur in patches throughout this relatively large range. The southern limit depends on where the temperate-tropical line is set in relation to this division. These irregularly tidally-flooded marshes are generally somewhat hypersaline from evaporation of seawater after storm surges or exceptionally high tides. They vary somewhat locally in expression, but all tend to exhibit low vascular plant diversity, dominated by halophytic species. There are relatively few plant species which are able to occupy these environments. These include various species of the succulent genera *Salicornia* spp. and *Sarcocornia* spp., as well as several grasses (which may be stunted), including *Distichlis spicata, Spartina alterniflora, Spartina spartinae*, and/or *Sporobolus virginicus*. Some more southerly associations may contain or be dominated by *Batis maritima*. Common associates include *Atriplex* spp., *Limonium carolinianum, Monanthochloe littoralis, Plantago maritima var. juncoides, Suaeda maritima*, and *Triglochin maritima*. Total vegetative cover is quite variable, from near total absence of vascular plants to a dense cover of vascular and nonvascular plants; however, unlike high marsh *Spartina* vegetation, pannes do not feature dense *Spartina* cover. Algal mats are characteristically present, visible even in densely vegetated pannes. In some cases, blue-green algae may contribute significantly more biomass than vascular species.

***Diagnostic Characteristics:**

***Classification Comments:** Salt marsh zonation has long been recognized and well-studied. The four groups in North American Atlantic & Gulf Coastal Salt Marsh Macrogroup (M079) reflect these common salt marsh zones (low marsh, high marsh, brackish marsh, panne); see, for example, Adam (1990) and Mendelssohn and McKee (2000). This type description fits Atlantic Canada. Salt pannes there usually include *Triglochin maritima, Glaux maritima*, and *Plantago maritima*. In western Nova Scotia, they include *Agalinis maritima* (a coastal plain species).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G121	Atlantic & Gulf Coastal High Salt Marsh	
G122	Atlantic & Gulf Coastal Low Salt Marsh	
G486	Caribbean Salt Flat & Pond	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These pannes are typically dominated by low, salt-tolerant forbs, with variable cover, and they typically occur as islands within other marsh vegetation. Stunted saltmarsh grasses may be present.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: There are relatively few plant species which are able to occupy these environments. These include various species of the succulent genera *Salicornia* (e.g., *Salicornia depressa (= Salicornia virginica), Salicornia bigelovii, Salicornia maritima*) and *Sarcocornia* (e.g., *Sarcocornia pacifica*), as well as several grasses (which may be stunted), including *Distichlis spicata, Spartina alterniflora, Spartina spartinae*, and/or *Sporobolus virginicus*. Some more southerly associations may contain or be dominated by *Batis maritima*. Other common associates include *Agalinis maritima, Atriplex* spp., *Blutaparon vermiculare, Cynanchum angustifolium, Limonium carolinianum, Lycium carolinianum, Monanthochloe littoralis, Plantago maritima var. juncoides, Sesuvium portulacastrum, Suaeda maritima, Symphyotrichum tenuifolium (= Aster tenuifolius)*, and *Triglochin maritima*. Scattered individuals of *Avicennia germinans* can occur in Florida and southern Texas. Total vegetative cover is quite variable, from near total absence of vascular plants to a dense cover of vascular and nonvascular plants. Algal mats are characteristically present, visible even in densely vegetated pannes. Blue-green algae are an important component of these mats, in some cases contributing significantly more biomass to the community than do vascular species. The following algae were noted to occur in association with *Spartina alterniflora* in the littoral zone of a Massachusetts salt marsh: *Hydrocoleum lyngbyaceum, Lyngbea* spp., *Microcoleus chthonoplastes, Nodularia harveyana, Oscillatoria amphibia, Oscillatoria subuliformis*, and *Symploca* spp. (Webber 1967). In Atlantic Canada, in addition to the above species, salt pannes may include *Glaux maritima*, and in western Nova Scotia, they include *Agalinis maritima* (a coastal plain species) (S. Basquill pers. comm. 2015).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Salt pannes are part of the shifting mosaic of plant communities of the salt marsh complex. They tend to occur more frequently on the high marsh, but are present in the low marsh as well. Pannes are variable in shape and likely variable in origin. Formation can result from ice-scouring or rafting flotsam that scrapes away or smothers existing vegetation, or from peat compaction, mosquito ditch levees, or tidal creekbank erosion that blocks or impedes drainage. Lack of vegetation decreases local sedimentation, which also maintains lower micro-relief (Redfield 1972). Evaporation from these poorly drained shallow depressions leads to hypersaline conditions (Niering and Warren 1980, Bertness et al. 1992). Gradients of salinity and standing water depth and duration correlate to vegetative cover and composition. The lowest portions of pannes tend to be wetter and more saline and can have little or no vegetation. As duration of wetness and salinity decrease across the micro-relief, forb-dominated species assemblages tend to dominate followed by mixed graminoid-forb assemblages at the outer, higher edges (Redfield 1972). Pannes can be ephemeral features on the marsh, and vegetation cover and composition can vary from year to year. Unvegetated, soft-bottomed pannes generally have plentiful worm and crab burrows (Godfrey et al. 1978).

ENVIRONMENT

Environmental Description: Vegetation of this association tends to develop in shallow depressions in salt marshes where drainage is poor. They tend to occur more frequently on the high marsh but occur within low marsh as well. Pannes form in depressions that range from 2-30 cm lower than the elevation of the marsh. The depressions are regularly to irregularly flooded by tides, and as the water evaporates during low tide, the salinity concentration increases, forming "salt pannes." Substrate is soft, silty muck or peat of variable density.

DISTRIBUTION

***Geographic Range:** This hypersaline vegetation is found along the Atlantic Coast and Gulf of Mexico region from the New England states and the southern Maritime Provinces of Canada south to northern Mexico. The southern limit depends on where the temperate-tropical line is set in relation to this division.
Nations: CA, MX, US
States/Provinces: AL, CT, DE, FL, GA, LA, MA, MD, ME, MS, MXTM, NB, NC, NH, NJ, NS, NY, RI, SC, TX, VA
USFS Ecoregions (2007) [optional]: 211C:PP, 211D:PP, 221Aa:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ak:CCC, 232A:CC, 232C:CC, 232D:CC, 232E:CC, 232G:CC, 232H:CC, 232I:CC, 232L:CC, 255Da:CCC, 255Dc:CCC
Omernik Ecoregions L3, L4 [optional]: 8.1.7.59e:C, 8.1.7.59g:C, 8.1.8.82f:C, 8.1.8.82g:C, 8.5.1.63b:C, 8.5.1.63c:C, 8.5.1.63d:C, 8.5.1.63e:C, 8.5.1.63g:C, 8.5.1.63n:C, 8.5.2.73o:C, 8.5.3.75d:C, 8.5.3.75j:C, 8.5.3.75k:C, 8.5.3.75l:C, 8.5.4.84a:C, 8.5.4.84c:C, 9.5.1.34g:C, 9.5.1.34h:C, 9.5.1.34i:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3958	Atlantic & Gulf Intertidal Algal Bed Alliance
A3955	*Batis maritima - Sarcocornia* spp. - *Salicornia* spp. Intertidal Salt Flat Alliance
A3957	*Spartina spartinae - Sporobolus virginicus - Monanthochloe littoralis* Intertidal Salt Marsh Alliance
A3956	*Distichlis spicata - Sporobolus virginicus* Intertidal Salt Marsh Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	*Salicornia - Bassia* salt flat	Harvill 1965	Virginia
=	*Salicornia* tidal flat	Clovis 1968	Virginia
=	*Salicornietum ambiguae*	Conard 1935	New York
=	*Sarcocornia perennis - (Distichlis spicata, Spartina alterniflora)* Dwarf-shrubland	Bartgis 1986	
=	*Spartina alterniflora / Salicornia europaea* community [Salt panne]	Clancy 1993b	Delaware
><	Glasswort-Saltwort Series	Diamond 1993	
=	Pan	Nichols 1920	Connecticut
=	Panne	Good 1965	New Jersey
=	Panne marsh	Baumann 1978b	Virginia

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Pans	Hill 1986	Assateague Island
=	Pans	Higgins et al. 1971	Assateague Island
?	Salt Marsh	Rawinski 1984a	formerly Southern New England and Gulf of Maine Salt Marshes
=	Salt marsh complex, pannes	Breden 1989	New Jersey
=	Salt pan	Klotz 1986	Virginia
=	Salt panne	Miller and Egler 1950	Connecticut
=	Salt panne	Reschke 1990	New York
=	Stunted *Spartina alterniflora* community	Miller and Egler 1950	Connecticut

AUTHORSHIP

***Primary Concept Source [if applicable]:** W.R. Miller and F.E. Egler (1950)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne and D. Faber-Langendoen

Acknowledgments [optional]: Sean Basquill

Version Date: 05 Jun 2015

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2. Shrub & Herb Vegetation
2.C.5.Nb. North American Atlantic & Gulf Coastal Salt Marsh

G121. Atlantic & Gulf Coastal High Salt Marsh

Type Concept Sentence: These are upper herbaceous or herb-shrub zones of salt marshes found along the North American Atlantic and Gulf of Mexico coasts from the Bay of Fundy to Texas, dominated by species such as *Distichlis spicata, Iva frutescens, Salicornia* spp., and *Spartina patens*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.5.Nb.1. North American Atlantic & Gulf Coastal Salt Marsh (M079)

Elcode: G121
***Scientific Name:** *Spartina patens - Iva frutescens* High Salt Marsh Group
***Common (Translated Scientific) Name:** Saltmeadow Cordgrass - Jesuit's-bark High Salt Marsh Group
***Colloquial Name:** Atlantic & Gulf Coastal High Salt Marsh

***Type Concept:** This group encompasses vegetation in the regularly flooded, upper herbaceous or herb-shrub zones of salt marshes of the Atlantic Coast of temperate North America subject to polyhaline tidal waters. Dominance is most often by graminoids, with *Spartina patens* usually present and often dominant. Other characteristic species include *Distichlis spicata* and *Salicornia* spp. A fringe of shrub-herb vegetation, or sometimes more extensive areas of salt-tolerant shrubs, is common at the upper edges of the high marsh zone. High marsh vegetation generally develops between the levels of an area's mean daily high tides and spring tides. Wind tides may be important in marshes associated with barrier island systems. Associated species vary across the north-to-south expanse of this group. Towards the north, in the Gulf of Maine, common associates include *Juncus gerardii, Solidago sempervirens, Symphyotrichum novi-belgii*, and *Limonium carolinianum*; from the Chesapeake south, *Juncus roemerianus* is common and other associates such as *Baccharis halimifolia* are characteristic.

***Diagnostic Characteristics:** Graminoid or shrub-graminoid vegetation in polyhaline tidal marshes with *Spartina patens* prominent and usually dominant.

***Classification Comments:** Salt marsh zonation has been long recognized and well-studied. The four groups in North American Atlantic & Gulf Coastal Salt Marsh Macrogroup (M079) reflect these common salt marsh zones (low marsh, high marsh, brackish marsh, panne); see, for example, Adam (1990) and Mendelssohn and McKee (2000).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G122	Atlantic & Gulf Coastal Low Salt Marsh	is generally adjacent to vegetation in this group and occurs below mean high water; it is dominated by *Spartina alterniflora*.
G120	Atlantic & Gulf Coastal Brackish Salt Marsh	occurs in mesohaline settings such as estuaries with more freshwater input; *Spartina patens* may be present in some places, but associated species are far more varied than in this high marsh group.
G123	Atlantic & Gulf Coastal Tidal Flat & Panne	includes vegetation that may be embedded within high marsh in hypersaline flats; it is distinguished by a suite of halophytic forbs and graminoids and sparse or absent *Spartina*.

Similar NVC Types General Comments [optional]: Groups in North American Pacific Coastal Salt Marsh Macrogroup (M081) may share many species.

VEGETATION

Physiognomy and Structure Summary: These high marshes often present as an expanse of low graminoid cover, usually covering all or most of the ground surface. Shrubs may be interspersed, especially near the transition to upland or non-tidal vegetation, with graminoid cover remaining extensive below. Where present, shrub cover can range widely.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Spartina patens* is diagnostic and often dominant. Associated species can vary throughout the range and include *Agalinis maritima, Borrichia frutescens, Distichlis spicata, Juncus gerardii, Juncus roemerianus, Limonium carolinianum, Salicornia* spp., *Bolboschoenus robustus (= Schoenoplectus robustus), Spartina bakeri, Spartina patens, Spartina spartinae*, and others. *Baccharis halimifolia* and *Iva frutescens* are the primary shrub species.

In Atlantic Canada, there can be patches of *Distichlis spicata, Agrostis stolonifera*, or (in western Nova Scotia) *Deschampsia cespitosa*. *Solidago sempervirens* is constant across the type, but is patchy in the field. Other characteristic species include *Argentina egedii, Atriplex glabriuscula var. acadiensis (= Atriplex acadiensis), Glaux maritima, Salicornia maritima, Salicornia depressa (= Salicornia virginica), Spergularia salina, Suaeda maritima, Symphyotrichum novi-belgii*, and others. The upper edge of the *Spartina patens* marsh supports higher levels of *Juncus gerardii, Solidago sempervirens, Panicum virgatum*, and *Limonium carolinianum*, which is often a distinct band and is sometimes considered its own community. *Iva frutescens* may also be present (S. Basquill pers. comm. 2015).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: High marshes develop in areas above mean high water that still receive tidal influence from lunar spring tides, wind tides, or other events. For marshes on the back of barrier islands, overwash in storms may deposit sand in the marsh.

ENVIRONMENT

Environmental Description: *Climate:* Cool-temperate to warm-temperate maritime climate. *Soil/substrate/hydrology:* Tides bring nutrients, making the regularly flooded marshes fertile. Salt marshes generally develop on fine-grained sediments, but can develop over sands as well. Production exceeds decomposition, leading to the buildup of marsh peat. High marsh, above mean high tide, is regularly to irregularly flooded by shallow polyhaline waters as a result of lunar, wind and storm tides.

DISTRIBUTION

***Geographic Range:** These marshes are found along the North American Atlantic and Gulf of Mexico coasts from the Bay of Fundy south and west to Texas and adjacent Mexico.
Nations: CA, MX, US
States/Provinces: AL, CT, DE, FL, GA, LA, MA, MD, ME, MS, NB, NC, NH, NJ, NS, NY, RI, SC, TX, VA
USFS Ecoregions (2007) [optional]: 211C:CC, 211D:CC, 221A:CC, 232A:CC, 232C:CC, 232D:CC, 232E:CC, 232G:CC, 232H:CC, 232I:CC, 232L:CC, 255D:CC
Omernik Ecoregions L3, L4 [optional]: 8.1.7.59e:C, 8.1.7.59g:C, 8.1.8.82f:C, 8.1.8.82g:C, 8.5.1.63b:C, 8.5.1.63c:C, 8.5.1.63d:C, 8.5.1.63e:C, 8.5.1.63g:C, 8.5.1.63n:C, 8.5.2.73o:C, 8.5.3.75d:C, 8.5.3.75j:C, 8.5.3.75k:C, 8.5.3.75l:C, 8.5.4.84a:C, 8.5.4.84c:C, 9.5.1.34g:C, 9.5.1.34h:C, 9.5.1.34i:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A4020	*Juncus roemerianus* Salt Marsh Alliance
A1026	*Borrichia frutescens* Tidal Shrub Salt Marsh Alliance
A1481	*Spartina patens* High Salt Marsh Alliance
A1230	*Spartina spartinae* Saline Marsh Alliance
A1023	*Iva frutescens* Tidal Shrub Salt Marsh Alliance
A1479	*Spartina bakeri* Salt Marsh Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Estuarine Persistent Emergent Wetland	Cowardin et al. 1979	
=	High Marsh	Adams 1963	
=	High Marsh	Mendelssohn and McKee 2000	

AUTHORSHIP

***Primary Concept Source [if applicable]:** S.W. Nixon (1982)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler and D. Faber-Langendoen
Acknowledgments [optional]: Sean Basquill
Version Date: 05 Jun 2015

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2. Shrub & Herb Vegetation
2.C.5.Nb. North American Atlantic & Gulf Coastal Salt Marsh

G120. Atlantic & Gulf Coastal Brackish Salt Marsh

Type Concept Sentence: These are brackish tidal marshes found along the North American Atlantic and Gulf of Mexico coasts from the Bay of Fundy to Texas, dominated by species such as *Schoenoplectus americanus, Schoenoplectus pungens, Bolboschoenus robustus, Spartina cynosuroides, Typha angustifolia*, and *Typha domingensis*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.5.Nb.1. North American Atlantic & Gulf Coastal Salt Marsh (M079)

Elcode: G120
***Scientific Name:** *Typha domingensis - Schoenoplectus* spp. - *Sagittaria subulata* Tidal Salt Marsh Group
***Common (Translated Scientific) Name:** Southern Cattail - Bulrush species - Awl-leaf Arrowhead Tidal Salt Marsh Group
***Colloquial Name:** Atlantic & Gulf Coastal Brackish Salt Marsh

***Type Concept:** Brackish tidal marshes develop where saltwater mixes with freshwater, primarily in estuaries but also sometimes on the lee side of barrier islands or in other settings. The vegetation is primarily herbaceous, but there may be areas of shrub dominance. Graminoids are prominent and typically include tall species such as *Typha angustifolia, Typha domingensis, Schoenoplectus americanus, Schoenoplectus pungens, Bolboschoenus robustus*, and *Spartina cynosuroides*. The salt marsh grasses *Spartina patens* and *Spartina alterniflora* may also be present, but generally are mixed with other species instead of exhibiting strong dominance as they do in the salt marsh setting. Those *Spartina* are typically most abundant where brackish marsh is transitioning to salt marsh, for example at the estuary mouth. Some brackish tidal marshes are forb-dominated; common species in these settings include *Sagittaria subulata, Limosella australis, Lilaeopsis chinensis, Sagittaria calycina var. spongiosa, Polygonum arifolium, Polygonum hydropiperoides, Zannichellia palustris, Eleocharis parvula*, and *Amaranthus cannabinus*. Some of these forbs also occur as associates where graminoids are dominant.

In Atlantic Canada, the brackish marshes have a somewhat different character. They are characterized by *Carex paleacea, Hierochloe odorata, Juncus arcticus ssp. littoralis, Spartina pectinata*, and/or *Schoenoplectus maritimus/pungens*; *Solidago sempervirens* is frequent; freshwater species, such as *Typha latifolia, Typha angustifolia, Solidago uliginosa*, among others, are typical; *Carex mackenziei, Cladium mariscoides, Eleocharis parvula, Hordeum jubatum, Limosella australis, Samolus valerandi*, and

Teucrium canadense may be present. Coastal plain species such as *Schoenoplectus americanus, Eleocharis rostellata*, and *Lilaeopsis chinensis* (more typical in low salt marsh) are only found in western Nova Scotia.

***Diagnostic Characteristics:** Herbaceous (less often shrub-herbaceous) vegetation influenced by mesohaline (brackish) tidal waters (generally 0.5-18 ppt salinity); dominance by a variable mixture of species that includes some plants intolerant of higher salinity waters; *Schoenoplectus americanus, Typha angustifolia, Amaranthus cannabinus, Polygonum* spp., *Sagittaria* spp., *Limosella australis, Lilaeopsis chinensis, Eleocharis parvula, Spartina patens*, and/or *Spartina alterniflora* may be present, but do not form monocultures.

***Classification Comments:** Brackish marshes are distinguished by being confined within a tidal river and by reduced cover of *Spartina patens* and increased cover of associated brackish marsh species such as *Schoenoplectus americanus, Typha angustifolia, Amaranthus cannabinus*, and *Polygonum* spp. Flats with low forbs will be dominated by plants such as *Sagittaria subulata* and *Limosella australis* rather than by the halophytes (*Salicornia* and *Sarcocornia* spp., for example) seen in salt marsh flats. Associations with some brackish influence that occur as patches in the high marsh are somewhat intermediate and are placed in Atlantic & Gulf Coastal High Salt Marsh Group (G121).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G121	Atlantic & Gulf Coastal High Salt Marsh	occurs in saltwater rather than brackish settings and is dominated by *Spartina patens*. Brackish marshes can grade into vegetation in this group at the mouths of estuaries where more extensive salt marshes develop.
G122	Atlantic & Gulf Coastal Low Salt Marsh	occurs in saltwater rather than brackish settings and is dominated by *Spartina alterniflora*. Brackish marshes can grade into vegetation in this group at the mouths of estuaries where more extensive salt marshes develop.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Dominance ranges from extensive grasslands (tall *Schoenoplectus* spp., etc.) to sparsely vegetated mudflats.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Graminoids typically include tall species such as *Typha angustifolia, Typha domingensis, Schoenoplectus americanus, Schoenoplectus pungens, Bolboschoenus robustus (= Schoenoplectus robustus)*, and *Spartina cynosuroides*. The salt marsh grasses *Spartina patens* and *Spartina alterniflora* may also be present, but generally are mixed with other species, and are most abundant where brackish marsh is transitioning to salt marsh, for example at the estuary mouth. Some brackish tidal marshes are forb-dominated; common species in these settings include *Sagittaria subulata, Limosella australis, Lilaeopsis chinensis, Sagittaria calycina var. spongiosa, Polygonum arifolium, Polygonum hydropiperoides, Zannichellia palustris, Eleocharis parvula*, and *Amaranthus cannabinus*. Some of these forbs also occur as associates where graminoids are dominant.

In Atlantic Canada, the brackish marshes have a somewhat different character. They are characterized by *Carex paleacea, Hierochloe odorata, Juncus arcticus ssp. littoralis (= Juncus balticus), Spartina pectinata*, and/or *Schoenoplectus maritimus/pungens*; *Solidago sempervirens* is frequent; freshwater species, such as *Typha latifolia, Typha angustifolia, Solidago uliginosa*, among others, are typical; *Carex mackenziei, Cladium mariscoides, Eleocharis parvula, Hordeum jubatum, Limosella australis, Samolus valerandi*, and *Teucrium canadense* may be present. Coastal plain species such as *Schoenoplectus americanus, Eleocharis rostellata*, and *Lilaeopsis chinensis* (more typical in low salt marsh) are only found in western Nova Scotia (S. Basquill pers. comm. 2015).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Wave and ice-scour can have a significant influence on the year-to-year appearance of the vegetation, and also influences variations in physiognomy and composition along estuary reaches.

ENVIRONMENT

Environmental Description: *Climate:* Cool-temperate to warm-temperate maritime climate. *Soil/substrate/hydrology:* Brackish tidal marshes develop along estuaries where freshwater mixes with ocean saltwater moving up the estuary from the tidal force. Waters in brackish marshes are generally in the 0.5-18 ppt salinity range, and the vegetation is subject to flooding from the twice-daily tides.

DISTRIBUTION

***Geographic Range:** This group occurs along the North American Atlantic and Gulf of Mexico coasts from the Bay of Fundy to Texas.
Nations: CA, US
States/Provinces: CT, DC, DE, FL, LA, MA, MD, ME, NB, NC, NH, NJ, NS, NY, RI, SC, TX, VA
USFS Ecoregions (2007) [optional]: 211Cb:CCC, 211Db:CCC, 211Dc:CCC, 221Aa:CCC, 221Ak:CCC, 232A:CC, 232C:CC, 232D:CC, 232E:CC, 232G:CC, 232H:CC, 232I:CC, 232L:CC, 255D:CC
Omernik Ecoregions L3, L4 [optional]: 8.1.7.59e:C, 8.1.7.59g:C, 8.1.8.82f:C, 8.1.8.82g:C, 8.5.1.63b:C, 8.5.1.63c:C, 8.5.1.63d:C, 8.5.1.63e:C, 8.5.1.63g:C, 8.5.1.63n:C, 8.5.2.73o:C, 8.5.3.75d:C, 8.5.3.75j:C, 8.5.3.75k:C, 8.5.3.75l:C, 8.5.4.84a:C, 8.5.4.84c:C, 9.5.1.34g:C, 9.5.1.34h:C, 9.5.1.34i:C
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A4013	*Spartina alterniflora - Spartina cynosuroides* Brackish Tidal Marsh Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
>	Estuarine Persistent Emergent Wetland	Cowardin et al. 1979	

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen, L. Sneddon, and C. Nordman, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler and D. Faber-Langendoen
Acknowledgments [optional]: Sean Basquill
Version Date: 05 Jun 2015

REFERENCES

***References [Required if used in text]:**
Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. FWS/OBS-79/31. USDI Fish & Wildlife Service, Office of Biological Services, Washington, DC. 103 pp.
Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]
Ferren, W. R., Jr., R. E. Good, R. Walker, and J. Arsenault. 1981. Vegetation and flora of Hog Island, a brackish wetland in the Mullica River, New Jersey. Bartonia 48:1-10.
McCormick, J., and T. Ashbaugh. 1972. Vegetation of a section of Oldmans Creek Tidal Marsh and related areas in Salem and Gloucester counties, New Jersey. Bulletin of the New Jersey Academy of Science 17:31-37.
Odum, W. E., T. J. Smith, III, J. K. Hoover, and C. C. McIvor. 1984. The ecology of tidal freshwater marshes of the United States east coast: A community profile. FWS/OBS-83/17. USDI Fish & Wildlife Service, Office of Biological Services, Washington, DC. 176 pp.
Visser, J. M., C. E. Sasser, R. H. Chabreck, and R. G. Linscombe. 2000. Marsh vegetation types of the Chenier Plain, Louisiana, USA. Estuaries 23(3):318-327.

2.C.5.Ue. Tropical Atlantic Coastal Salt Marsh

2. Shrub & Herb Vegetation
2.C.5.Ue. Tropical Atlantic Coastal Salt Marsh

M735. Tropical Western Atlantic-Caribbean Salt Marsh

Type Concept Sentence: This macrogroup comprises all regularly and irregularly flooded tidal marshes of the tropical western Atlantic and Caribbean coasts, ranging from polyhaline (salt) marshes to mesohaline (brackish) marshes, dominated or characterized by an abundance of halophytic species, typically including dwarf evergreen shrubs *Batis maritima, Cryptocarpus pyriformis, Rachicallis americana*, and graminoids *Cyperus laevigatus, Distichlis spicata, Paspalum vaginatum, Sporobolus virginicus*, and *Spartina alterniflora*.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 2.C.5.Ue.1. Tropical Atlantic Coastal Salt Marsh (D037)

Elcode: M735
***Scientific Name:** *Spartina alterniflora - Batis maritima - Sesuvium portulacastrum* Salt Marsh Macrogroup
***Common (Translated Scientific) Name:** Smooth Cordgrass - Turtleweed - Shoreline Sea-purslane Salt Marsh Macrogroup
***Colloquial Name:** Tropical Western Atlantic-Caribbean Salt Marsh

***Type Concept:** This macrogroup comprises all regularly and irregularly flooded tidal marshes of the tropical western Atlantic and Caribbean coasts, ranging from polyhaline (salt) marshes to mesohaline (brackish) marshes, often associated with mangroves. The macrogroup also includes communities found in semipermanently flooded coastal ponds or lagoons, or tidally flooded salt flats, as well as sand and mudflats behind barrier beaches. The vegetation is dominated or characterized by an abundance of halophytic species, including grasses, sedges, low shrubs or succulents. Dominant graminoids include *Cyperus laevigatus, Cyperus ligularis, Distichlis spicata, Paspalum vaginatum, Sporobolus virginicus, Juncus roemerianus*, and *Spartina alterniflora*. Succulent herbs include *Alternanthera maritima, Blutaparon portulacoides, Blutaparon vermiculare*, and *Sesuvium portulacastrum*. Halophytic shrubs include *Atriplex cristata, Batis maritima, Cryptocarpus pyriformis*, and *Salicornia "virginica"* s.l. (*Salicornia "fruticosa"* s.l.). Salt marsh shrub thickets are dominated by *Hibiscus tiliaceus*, forming an often dense belt of thickets immediately inland from mangrove formations of the Brazilian and Guianan coasts. Essentially monospecific communities of mud and salt flats dominated by *Batis maritima* are also included in this macrogroup.

***Diagnostic Characteristics:** This macrogroup is dominated by halophytic, succulent dwarf evergreen shrubs *Batis maritima, Cryptocarpus pyriformis, Rachicallis americana*, annual or perennial succulents, and by graminoids *Cyperus laevigatus, Distichlis spicata, Paspalum vaginatum, Sporobolus virginicus*, and *Spartina alterniflora*. Further review is needed to determine whether distinctive tropical species can be listed that separate this type from the temperate salt marshes.

***Classification Comments:** It is unclear if tropical salt marshes occur in south Florida, but if they are associated with mangrove habitats, they would be included here.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M079	North American Atlantic & Gulf Coastal Salt Marsh	ranges along the Atlantic coast and Gulf of Mexico south to northern Mexico.
M085	West Pacific Salt Marsh	covers the west coast salt marshes of tropical South and Central America.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This macrogroup is characterized by halophytic succulent dwarf-shrubs and herbs, and graminoids, with a notably simple structure, often forming large, even-height monotypic patches, especially where tidal flooding is regular. Marshes of mixed height, comprising graminoids and forbs, are often more characteristic in brackish settings. Shrubs may be interspersed, especially near the transition to upland or non-tidal vegetation, with graminoid cover remaining extensive below. Where present, shrub cover can range widely. Vegetation may also be very sparse on immediate shorelines and tidal flats.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The vegetation is dominated or characterized by an abundance of halophytic species, including grasses, sedges, low shrubs or succulents. Dominant graminoids include *Cyperus laevigatus, Distichlis spicata, Paspalum vaginatum, Sporobolus virginicus*, and *Spartina alterniflora (= Spartina brasiliensis)*. Succulent herbs include *Alternanthera maritima, Blutaparon vermiculare (= Philoxerus vermicularis), Philoxerus portulacoides*, and *Sesuvium portulacastrum*. Halophytic shrubs include *Atriplex cristata, Batis maritima, Cryptocarpus pyriformis*, and *Salicornia "virginica"* s.l. (*Salicornia "fruticosa"* s.l.). Salt marsh shrub thickets are dominated by *Hibiscus tiliaceus*, forming an often dense belt of thickets immediately inland from mangrove formations of the Brazilian and Guianan coasts (Institute of Terrestrial Ecology 1996).

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The main natural factors that are responsible for the vegetation composition and processes in the estuarine and coastal wetland habitats where these marshes develop are freshwater flow, seasonal freshwater pulsing, estuarine salinity, tidal flushing, coastal geomorphology, and depositional area for sediment and nutrient input. Adams (1990) states that there may be a dynamic relationship between mangroves and salt marsh; as the salt marsh advances seaward, so the upper part of the marsh is invaded and replaced by mangrove.

ENVIRONMENT

Environmental Description: Where hypersaline conditions develop in the upper intertidal zone, extensive salt flats may occur above the level of mangrove (Adams 1990). West (1977) states that extensive salt marshes can occur as (1) a pioneer community on the ocean side of mangroves, (2) as a zone on the inner edge or within a mangrove stand, or (3) as a secondary or disturbance type on disturbed or degraded mangrove stands. These disturbed types may be dominated by *Spartina alterniflora* or the fern *Acrostichum aureum*. Salt marshes and salt flats are regularly to irregularly flooded by shallow polyhaline waters as a result of lunar, wind and storm tides. Brackish tidal marshes develop along estuaries where freshwater mixes with ocean saltwater moving up the estuary from the tidal force. They also occur near uplands where freshwater inputs reduce the salinity of the salt marsh. Waters in brackish marshes are generally in the salinity range of 0.5-18 ppt, and the vegetation is subject to flooding from the twice-daily tides. Salt marsh soils range from deep mucks with high clay and organic content in the deeper portions to silts and fine sands in higher areas. The organic soils have a high salinity, neutral reaction, and high sulfur content (FNAI 2010a).

DISTRIBUTION

***Geographic Range:** This macrogroup is found in the Antilles and the Caribbean and Atlantic coasts of South America south to southern Brazil.
Nations: BR, BS, CO, CU, DO, GY, JM, KY, MQ, PR, SR, US, VE, XC
States/Provinces: FL
USFS Ecoregions (2007) [optional]: 411A:??
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G486	Caribbean Salt Flat & Pond

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2013-03-26	M084 Caribbean & Central American Salt Marsh Macrogroup	M084 replaced by M735

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	*Batidi-Salicornietea*	Borhidi 1991	
>	Tropical coastal salt marshes	Institute of Terrestrial Ecology 1996	The authors include in this type all Caribbean and South American salt marshes. We include only the Atlantic and Caribbean salt marsh.

AUTHORSHIP

***Primary Concept Source [if applicable]:** Institute of Terrestrial Ecology (1996)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** D. Faber-Langendoen and C. Josse
Acknowledgments [optional]:
Version Date: 08 Jan 2015

REFERENCES

***References [Required if used in text]:**
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Borhidi, A. 1991. Phytogeography and vegetation ecology of Cuba. Akademiai Kiado. Budapest, Hungary. 858 pp. plus color plates and map by A. Borhidi and O. Muniz (1970) inside of back cover.
FNAI [Florida Natural Areas Inventory]. 2010a. Guide to the natural communities of Florida: 2010 edition. Florida Natural Areas Inventory, Tallahassee, FL. 228 pp.
Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]
Institute of Terrestrial Ecology. 1996. Habitats of South America. Report May 1996. Institute of Terrestrial Ecology and Institut Royal des Sciences Naturelles de Belgique. 417 pp.
West, R. C. 1977. Tidal salt-marsh and mangal formations of Middle and South America. Pages 193-213 in: V. J. Chapmann, editor. Ecosystems of the world. 1. Wet coastal ecosystems. Elsevier, Amsterdam.

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2. Shrub & Herb Vegetation
2.C.5.Ue. Tropical Atlantic Coastal Salt Marsh

G486. Caribbean Salt Flat & Pond

Type Concept Sentence: Dwarf evergreen shrubs with succulent leaves and patches of graminoid herbaceous plants are typical of this Caribbean coastal vegetation, which is found in semipermanently flooded coastal ponds, or tidally flooded salt flats, as well as sand and mudflats behind barrier beaches and surrounding mangroves.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.C.5.Ue.1. Tropical Western Atlantic-Caribbean Salt Marsh (M735)

Elcode: G486
***Scientific Name:** *Batis maritima* Caribbean Salt Flat & Pond Group
***Common (Translated Scientific) Name:** Turtleweed Caribbean Salt Flat & Pond Group
***Colloquial Name:** Caribbean Salt Flat & Pond

***Type Concept:** This group is found in semipermanently flooded coastal ponds, or tidally flooded salt flats, as well as sand and mudflats behind barrier beaches and surrounding mangroves. The following list of species is diagnostic for this group: *Amaranthus crassipes, Annona glabra, Atriplex cristata, Bacopa monnieri, Batis maritima, Blutaparon vermiculare, Heliotropium curassavicum, Heterostachys ritteriana, Sesbania sericea, Sesuvium portulacastrum*, and *Sporobolus virginicus*.

***Diagnostic Characteristics:** Occurs only in coastal areas near the high tide line. Dwarf evergreen shrubs with succulent leaves and patches of graminoid herbaceous plants are typical.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G123	Atlantic & Gulf Coastal Tidal Flat & Panne	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Dwarf evergreen shrubs with succulent leaves and patches of graminoid herbaceous plants are typical. Vegetation may have sparse or barren patches, which may be hypersaline flats subject to evaporation and salt concentration.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The following list of species is diagnostic for this group: *Amaranthus crassipes, Annona glabra, Atriplex cristata (= Atriplex pentandra), Bacopa monnieri, Batis maritima, Blutaparon vermiculare (= Philoxerus vermicularis), Heliotropium curassavicum, Heterostachys ritteriana, Sesbania sericea, Sesuvium portulacastrum*, and *Sporobolus virginicus*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Short-term seasonal droughts, very high rainfall from hurricanes, storm tides and king tides are part of the dynamics which contribute to hypersaline conditions (from evaporation) and other stresses on the vegetation, limiting the species which can survive on these sites. The main natural factors that are responsible for the vegetation composition and processes in the estuarine and coastal wetland habitats where these marshes develop are freshwater flow, seasonal freshwater pulsing, estuarine salinity, tidal flushing, coastal geomorphology, and depositional area for sediment and nutrient input. Adams (1990) states that there may be a dynamic relationship between mangroves and salt marsh; as the salt marsh advances seaward, so the upper part of the marsh is invaded and replaced by mangrove.

ENVIRONMENT

Environmental Description: *Climate:* The climate is seasonal and subtropical. Short-term seasonal droughts, very high rainfall from hurricanes, storm tides and king tides are part of the dynamics which contribute to hypersaline conditions (from evaporation) and other stresses on the vegetation, limiting the species which can survive on these sites.

Soil/substrate/hydrology: Where hypersaline conditions develop in the upper intertidal zone, extensive salt flats may occur above the level of mangrove (Adams 1990). West (1977) states that extensive salt marshes can occur as (1) a pioneer community on the ocean side of mangroves, (2) as a zone on the inner edge or within a mangrove stand, or (3) as a secondary or disturbance type on disturbed or degraded mangrove stands. These disturbed types may be dominated by *Spartina alterniflora* or the fern *Acrostichum aureum*. Salt marshes and pannes are regularly to irregularly flooded by shallow polyhaline waters as a result of lunar, wind and storm tides. Salt marsh soils range from deep mucks with high clay and organic content in the deeper portions to silts and fine sands in higher areas. The organic soils have a high salinity, neutral reaction, and high sulfur content (FNAI 2010a).

DISTRIBUTION

***Geographic Range:** This group is found near the high tide line in coastal areas of the Caribbean.
Nations: BS, CU, MQ, PR, US, VE, VI, XC
States/Provinces: FL
USFS Ecoregions (2007) [optional]: M411Aa:CCC, M411Ab:CCC, M411Ac:CCC, M411Ad:CC?, M411Ae:CCC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	(ESU 4) Graminoid Supratidal Scrub	Ross et al. 1992	
<	(ESU 5) Succulent Supratidal Scrub	Ross et al. 1992	
>	Beach-grass Sward -- 19.6	Dansereau 1966	
>	Glasswort Mat -- 9.6	Dansereau 1966	
=	Keys Tidal Rock Barren	FNAI 2010a	
=	Puerto Rico land cover type 61, Salt and mudflats	Gould et al. 2008	Typically <20% vegetation cover, often periodically flooded. Salt flats in low-lying coastal areas seasonally flooded with brackish water, part of a mangrove habitat complex when associated with mangrove trees.
>	Salt-fern Prairie -- 12.5	Dansereau 1966	
>	Saltwort Scrub - 11.4	Dansereau 1966	
>	Sea-purslane Mat -- 10.6	Dansereau 1966	
=	Tidally flooded evergreen dwarf-shrubland formation	Areces-Mallea et al. 1999	

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Josse and C. Nordman, in Faber-Langendoen et al. (2016)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** C.W. Nordman

Acknowledgments [optional]:

Version Date: 18 Jul 2016

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3. DESERT & SEMI-DESERT

Cool and warm semi-deserts dominated by xeromorphic growth forms, including *succulent* (e.g., cacti, euphorbias) and *small-leaved shrubs* and *trees*, desert grasses and other xeromorphic growth forms, with an irregular horizontal canopy spacing that is often open to very sparse (1%) cover.

3.A. Warm Desert & Semi-Desert Woodland, Scrub & Grassland

Warm Desert & Semi-Desert Woodland, Scrub & Grassland occurs in dry warm-temperate, subtropical and tropical climates, uncommon near the equator to increasingly common between 15° and 35°N and S latitude.

3.A.2. Warm Desert & Semi-Desert Scrub & Grassland

Warm Desert & Semi-Desert Scrub & Grassland occurs in dry warm-temperate, subtropical and tropical climates, is uncommon near the equator to increasingly common between 15° and 35°N and S latitude.

3.A.2.Na. North American Warm Desert Scrub & Grassland

This division contains aridland shrublands and grasslands dominated by xerophytic woody shrubs, succulents and grasses that occur among the lowland intermountain basins and foothills of desert mountain ranges across the southwestern U.S. and northern Mexico.

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3. Desert & Semi-Desert
3.A.2.Na. North American Warm Desert Scrub & Grassland

M130. Tamaulipan Scrub & Grassland

Type Concept Sentence: This macrogroup is a heterogeneous assemblage of upland drought-tolerant thornscrub and grassland-savanna vegetation types of the Tamaulipan biotic region of southern Texas and northeastern Mexico that have been highly impacted by clearing and overgrazing. The thornscrub vegetation is characterized by small-leaved, thorny, woody species such as *Celtis ehrenbergiana, Prosopis glandulosa*, and many others; the grasslands include *Bothriochloa barbinodis, Trichloris pluriflora*, and many other characteristic grasses.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 3.A.2.Na.1. North American Warm Desert Scrub & Grassland (D039)

Elcode: M130
***Scientific Name:** *Prosopis glandulosa - Celtis ehrenbergiana / Trichloris pluriflora* Tamaulipan Scrub & Grassland Macrogroup
***Common (Translated Scientific) Name:** Honey Mesquite - Spiny Hackberry / Multi-flower Rhodesgrass Tamaulipan Scrub & Grassland Macrogroup
***Colloquial Name:** Tamaulipan Scrub & Grassland

***Type Concept:** This heterogeneous vegetation assemblage of the Tamaulipan biotic region of southern Texas and northeastern Mexico combines upland drought-tolerant thornscrub with related grassland and savanna vegetation types. The thornscrub vegetation is characterized by small-leaved, thorny, woody species that range in height from 1-6 m, including *Celtis ehrenbergiana, Leucophyllum frutescens*, and *Prosopis glandulosa*, along with *Acacia berlandieri, Acacia greggii var. wrightii, Acacia rigidula, Castela erecta, Citharexylum berlandieri, Condalia hookeri, Cordia boissieri, Diospyros texana, Ehretia anacua, Eysenhardtia texana, Guaiacum angustifolium, Havardia pallens, Karwinskia humboldtiana, Leucophyllum frutescens, Cylindropuntia leptocaulis, Yucca* *treculeana, Zanthoxylum fagara*, and *Ziziphus obtusifolia*. Grasses are present among the shrubs, characterized by *Bothriochloa barbinodis* and *Trichloris pluriflora*, with other herbaceous species including *Bouteloua* spp., *Bouteloua dactyloides, Trichloris crinita, Heteropogon contortus, Hilaria belangeri, Pappophorum bicolor, Schizachyrium scoparium*, and *Setaria* spp. These same species constitute the components of the related grassland vegetation types of this region. This vegetation has been highly impacted by clearing and overgrazing. Few high-quality examples remain.

***Diagnostic Characteristics:** This macrogroup is characterized by thornscrub and grasslands occupying dry uplands in the Tamaulipan region of southern Texas and northeastern Mexico.

***Classification Comments:** Both Tamaulipan Dry Mesquite & Thornscrub Group (G099) and Tamaulipan Dry Grassland Group (G100) are floristically variable, and some of their components may be better classified with related subtropical vegetation, and others with related temperate vegetation. More data, analysis, and review are needed to discern how to best classify this vegetation, its natural process and threats (Reid et al. 1990, Fowler et al. 2011). This vegetation has been highly impacted by clearing, overgrazing, disruption of natural processes, and invasive species (Jahrsdoerfer and Leslie 1988, Manzano and Navar 2000, Fulbright 2001, Ewing and Best 2004, Foroughbakhch et al. 2014). Little data on high-quality examples exist on which to base this classification. As currently described, the groups that constitute this macrogroup (M130) do not include the savanna/scrub woodland vegetation (Texas Live Oak - Wax Mallow Motte & Coastal Forest Group (G799)) of the South Texas Sand Plain that is characterized by woody mottes of *Prosopis glandulosa* and *Quercus fusiformis* along with many shrub and grass species shared with Tamaulipan Dry Mesquite & Thornscrub Group (G099) and Tamaulipan Dry Grassland Group (G100); Tamaulipan Saline Thornscrub (CES301.711) occurs in this macrogroup and is currently represented by one association, *Varilla texana - Castela erecta ssp. texana - Isocoma coronopifolia / Hilaria belangeri* Shrubland (CEGL007763), which is included in G099.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This vegetation ranges in physiognomy from low dense shrublands to open short woodlands (<6 m tall) (Bray 1901) to perennial grasslands that may occur in a mosaic with patches of thornscrub species. It also varies in canopy closure and height. It is also adapted for xeric conditions and many species have semi-tropical to tropical affinities.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: The thornscrub phase of this vegetation, Tamaulipan Dry Mesquite & Thornscrub Group (G099), is characterized by small-leaved, thorny, woody species that range in height from 1-6 m, including *Celtis ehrenbergiana (= Celtis pallida), Leucophyllum frutescens*, and *Prosopis glandulosa*, along with *Acacia berlandieri, Acacia greggii var. wrightii (= Acacia wrightii), Acacia rigidula, Aloysia gratissima, Castela erecta, Citharexylum berlandieri, Condalia hookeri, Cordia boissieri, Diospyros texana, Ehretia anacua, Eysenhardtia texana, Guaiacum angustifolium (= Porlieria angustifolia), Havardia pallens, Karwinskia humboldtiana, Leucophyllum frutescens, Cylindropuntia leptocaulis (= Opuntia leptocaulis), Yucca treculeana, Zanthoxylum fagara*, and *Ziziphus obtusifolia*. Grasses are present among the shrubs, characterized by *Bothriochloa barbinodis* and *Trichloris pluriflora (= Chloris pluriflora)*, with other herbaceous species including *Bouteloua* spp., *Bouteloua dactyloides (= Buchloe dactyloides), Trichloris crinita (= Chloris crinita), Heteropogon contortus, Hilaria belangeri, Pappophorum bicolor, Schizachyrium scoparium*, and *Setaria* spp. These same species constitute the components of the related grassland vegetation of this region, Tamaulipan Dry Grassland Group (G100). Other woody scrub species present may include *Ebenopsis ebano, Sideroxylon lanuginosum*, and *Cordia boissieri*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: More data, analysis, and review are needed to document and understand the natural process and threats of this vegetation (Reid et al. 1990, Fowler et al. 2011).

ENVIRONMENT

Environmental Description: This vegetation is found in semi-arid and subtropical southern Texas over a variety of soil depths and textures. Rainfall is highly variable both spatially and temporally and can range from 38 to 76 cm (15-30 inches) annually in a given locality, but all areas are prone to drought and water deficits (Bray 1901, Gilbert 1982, Jahrsdoerfer and Leslie 1988).

DISTRIBUTION

***Geographic Range:** This vegetation occurs in the central and southern part of the Tamaulipan biotic region of Texas and Mexico.
Nations: MX, US
States/Provinces: MXCO, MXNU, MXTM, TX
USFS Ecoregions (2007) [optional]: 315E:CC, 321A:CC, 321B:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]: Classification of this vegetation is based on limited information and data. More data, analysis, and review are needed to better classify this vegetation.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G099	Tamaulipan Dry Mesquite & Thornscrub
G100	Tamaulipan Dry Grassland

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
><	Eastern Coastal Plain Scrub	Muller 1939	
><	Mesquite - Granjeno - Acacia (728)	Shiflet 1994	
><	Mesquite-Acacia-Andropogon-Setaria Savanna	Küchler 1964	
><	Piedmont Scrub	Muller 1939	
=	Rio Grande Chaparral	Bray 1901	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. Teague and K. Schultz, in Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** M. Pyne and J. Teague
Acknowledgments [optional]:
Version Date: 10 Jun 2015

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3. Desert & Semi-Desert
3.A.2.Na. North American Warm Desert Scrub & Grassland

G099. Tamaulipan Dry Mesquite & Thornscrub

Type Concept Sentence: This group represents upland, drought-tolerant, thornscrub vegetation of the Tamaulipan biotic region of southern Texas and northeastern Mexico, often characterized by some mixture of the following woody species: *Acacia berlandieri, Acacia rigidula, Castela erecta, Celtis ehrenbergiana, Citharexylum berlandieri, Condalia hookeri, Cordia boissieri, Diospyros texana, Ehretia anacua, Eysenhardtia texana, Guaiacum angustifolium, Karwinskia humboldtiana, Leucophyllum frutescens, Prosopis glandulosa, Yucca treculeana, Zanthoxylum fagara*, and *Ziziphus obtusifolia* with variable cover of grasses and forbs beneath and between the shrubs.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 3.A.2.Na.1. Tamaulipan Scrub & Grassland (M130)

Elcode: G099
***Scientific Name:** *Prosopis glandulosa - Celtis ehrenbergiana - Leucophyllum frutescens* Thornscrub Group
***Common (Translated Scientific) Name:** Honey Mesquite - Spiny Hackberry - Texas Barometerbush Thornscrub Group
***Colloquial Name:** Tamaulipan Dry Mesquite & Thornscrub

***Type Concept:** As circumscribed, this is a large and heterogeneous group of upland drought-tolerant thornscrub vegetation occurring in the Tamaulipan region of southern Texas and northeastern Mexico. The shrub canopy varies from open to impenetrable thickets. Thornscrub vegetation is characterized by small-leaved, thorny, woody species that range in height from 1-6 m, including *Prosopis glandulosa, Ehretia anacua, Zanthoxylum fagara, Diospyros texana, Acacia rigidula, Acacia berlandieri, Leucophyllum* *frutescens, Castela erecta, Citharexylum berlandieri, Guaiacum angustifolium, Condalia hookeri, Ziziphus obtusifolia, Celtis ehrenbergiana, Eysenhardtia texana, Karwinskia humboldtiana, Cordia boissieri*, and *Yucca treculeana*. Herbaceous cover varies depending on density of woody cover, soil development and moisture. It is characterized by *Trichloris pluriflora* and *Bothriochloa barbinodis*. Other herbaceous species include *Bouteloua* spp., *Setaria* spp., *Pappophorum bicolor, Bouteloua dactyloides, Hilaria belangeri, Trichloris crinita*, and *Heteropogon contortus*.

***Diagnostic Characteristics:** This matrix vegetation of the Tamaulipan region of Texas and northeastern Mexico is characterized by upland drought-tolerant, thorny small trees and shrubs with variable cover of grasses and forbs.

***Classification Comments:** This group is a placeholder for upland thornscrub vegetation in the Tamaulipan region of Texas and adjacent Mexico. It is floristically variable, and some components may be better classified with related subtropical vegetation and others with related temperate vegetation. Species composition in this shrubland group is a highly variable. Bray (1901) reports up to 40 species and "in many cases a limited area being tolerably uniformly covered by at least half of all the species." This diversity and variability in dominance creates difficulty in selecting an adequate name that contains only three species. As currently described, this group does not include the savanna/scrub woodland vegetation of the South Texas Sand Plain that is characterized by woody mottes of *Prosopis glandulosa* and *Quercus fusiformis* along with many shrub and grass species shared with the *Celtis ehrenbergiana - Leucophyllum frutescens* thornscrub, but also includes species that range farther east and north. More data, analysis, and review are needed to discern how to best classify this vegetation. This vegetation has been highly impacted by clearing, overgrazing, disruption of natural processes, and invasive species.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This vegetation varies in canopy closure and height from low dense shrublands to open short woodlands (<6 m tall) (Bray 1901). Vegetation is adapted for xeric conditions and many species have semi-tropical to tropical affinities.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Woody species include *Acacia berlandieri, Acacia rigidula, Aloysia gratissima, Castela erecta, Celtis ehrenbergiana (= Celtis pallida), Citharexylum berlandieri, Condalia hookeri, Cordia boissieri, Diospyros texana, Ehretia anacua, Eysenhardtia texana, Guaiacum angustifolium (= Porlieria angustifolia), Karwinskia humboldtiana, Leucophyllum frutescens, Prosopis glandulosa, Yucca treculeana, Zanthoxylum fagara*, and *Ziziphus obtusifolia*. Herbaceous cover varies depending on density of woody cover, soil development and moisture. It is characterized by *Trichloris pluriflora (= Chloris pluriflora)* and *Bothriochloa barbinodis*. Other herbaceous species include *Bouteloua* spp., *Bouteloua dactyloides (= Buchloe dactyloides), Trichloris crinita (= Chloris crinita), Heteropogon contortus, Hilaria belangeri, Pappophorum bicolor*, and *Setaria* spp.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: This vegetation has been highly impacted by clearing, overgrazing, disruption of natural processes, and invasive species.

ENVIRONMENT

Environmental Description: This group is found in semi-arid and subtropical southern Texas over a variety of soil depth and texture. Rainfall is highly variable both spatially and temporally and can range from 38 to 76 cm (15-30 inches) annually in a given locality, but all areas are prone to drought and water deficits (Bray 1901, Gilbert 1982, Jahrsdoerfer and Leslie 1988).

DISTRIBUTION

***Geographic Range:** This group occurs in the Tamaulipan region of Texas and Mexico.
Nations: MX, US
States/Provinces: MXCO, MXNU, MXTM, TX
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: Classification of this vegetation is based on limited information and data. More data, analysis, and review are needed to better classify this vegetation.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3191	*Acacia rigidula - Leucophyllum frutescens - Acacia berlandieri* Tamaulipan Calcareous Thornscrub Alliance
A3193	*Ebenopsis ebano - Phaulothamnus spinescens* Thornscrub Alliance
A3169	*Prosopis glandulosa* Tamaulipan Mixed Deciduous Thornscrub Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	*Acacia amentacea* formation	Bray 1901	
<	*Acacia berlandieri* or huajillo formation	Bray 1901	
<	*Acacia farnesiana* or huisache formation	Bray 1901	
<	*Acacia wrightii* formation	Bray 1901	
<	*Leucophyllum texanum* formation	Bray 1901	
<	*Opuntia lindheimeri* formation	Bray 1901	
<	*Parkinsonia texana* formation	Bray 1901	
<	*Prosopis juliflora* or mesquite formation	Bray 1901	
<	Blackbrush-twisted acacia Association	McLendon 1991	
><	Creosotebush-prickly pear Association	McLendon 1991	
><	Eastern Coastal Plain Scrub	Muller 1939	
<	Guajillo-cenizo Association	McLendon 1991	
><	Mesquite - Granjeno - Acacia (728)	Shiflet 1994	
><	Mesquite-Acacia-Andropogon-Setaria Savanna	Küchler 1964	
><	Mesquite-granjeno Association	McLendon 1991	
><	Piedmont Scrub	Muller 1939	
=	Rio Grande Chaparral	Bray 1901	

AUTHORSHIP

***Primary Concept Source [if applicable]:** W.L. Bray (1901)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Teague
Acknowledgments [optional]:
Version Date: 10 Jun 2015

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***References [Required if used in text]:**

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Jahrsdoerfer, S. E., and D. M. Leslie. 1988. Tamaulipan brushland of the lower Rio Grande Valley of south Texas: Description, human impacts, and management options. USDI Fish & Wildlife Service. Biological Report 88(36). 63 pp.

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Shiflet, T. N., editor. 1994. Rangeland cover types of the United States. Society for Range Management. Denver, CO. 152 pp.

3. Desert & Semi-Desert
3.A.2.Na. North American Warm Desert Scrub & Grassland

G100. Tamaulipan Dry Grassland

Type Concept Sentence: This group represents grasslands and savannas of the Tamaulipan region of southern Texas and northeastern Mexico characterized by some mixture of the following grasses: *Aristida purpurea var. purpurea, Bothriochloa barbinodis, Bouteloua* spp., *Bouteloua dactyloides, Trichloris crinita, Trichloris pluriflora, Heteropogon contortus, Hilaria belangeri, Pappophorum bicolor, Schizachyrium scoparium, Setaria* spp., *Trachypogon spicatus, Tridens muticus*, and *Tridens texanus*.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 3.A.2.Na.1. Tamaulipan Scrub & Grassland (M130)

Elcode: G100
***Scientific Name:** *Trichloris pluriflora - Bothriochloa barbinodis - Opuntia engelmannii var. lindheimeri* Grassland Group
***Common (Translated Scientific) Name:** Multi-flower Rhodesgrass - Cane Bluestem - Texas Prickly-pear Grassland Group
***Colloquial Name:** Tamaulipan Dry Grassland

***Type Concept:** As currently circumscribed, this group represents grasslands and savannas of the Tamaulipan region of southern Texas and northeastern Mexico. Characteristic grasses include *Aristida purpurea var. purpurea, Bothriochloa barbinodis, Bouteloua* spp., *Bouteloua dactyloides, Trichloris crinita, Trichloris pluriflora, Heteropogon contortus, Hilaria belangeri, Pappophorum bicolor, Schizachyrium scoparium, Setaria* spp., *Trachypogon spicatus, Tridens muticus*, and *Tridens texanus*. This vegetation has been highly impacted by clearing, overgrazing, disruption of natural processes, and invasive species. Few high-quality examples remain.

***Diagnostic Characteristics:** This group is characterized by perennial grasses and forbs occurring with a matrix of open and closed canopy thornscrub in the Tamaulipan region of Texas and northeastern Mexico.

***Classification Comments:** This group is a placeholder for upland grassland and open shrubland vegetation in the Tamaulipan region of Texas and adjacent Mexico. More information is needed to document the composition, relationship and relative extent of natural grasslands and shrublands in the Tamaulipan area of south Texas and northeastern Mexico. Johnston (1963) described two main prairie types that occur within or near the Tamaulipan region, the "Ingleside and Kenedy sand prairies" at the northeastern border of the region on the South Texas Sand Plain (South Atlantic & Gulf Coastal Dune & Grassland Group (G494)), and the "Loreto grasslands" on the caliche sand plain near Loreto, Mexico (included here). In addition to the "Loreto grasslands" (Tamaulipan Caliche

Grassland Alliance (A3168)), this group includes grasslands with a sparse woody cover that Johnston (1963) specifically excluded from his description (*Schizachyrium scoparium - Bothriochloa barbinodis* Tamaulipan Grassland Alliance (A3138)). The "Kleberg clay prairie" that Johnston (1963) described is part of Blackland & Coastal Tallgrass Prairie Group (G335). More data, analysis, and review are needed to discern how to best classify this vegetation. This vegetation has been highly impacted by clearing, overgrazing, disruption of natural processes, and invasive species (Jahrsdoerfer and Leslie 1988, Manzano and Navar 2000, Fulbright 2001, Ewing and Best 2004).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This perennial grassland may occur in a mosaic with *Prosopis glandulosa, Acacia* spp., and other thornscrub species. The natural extent of this group is unknown, but believed to have been limited. The surrounding matrix is open to closed-canopy thornscrub.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Vegetation is dominated by perennial mid and short grasses such as *Aristida purpurea var. purpurea, Bothriochloa barbinodis, Bouteloua* spp., including *Bouteloua radicosa, Bouteloua dactyloides (= Buchloe dactyloides), Trichloris crinita (= Chloris crinita), Trichloris pluriflora (= Chloris pluriflora), Heteropogon contortus, Hilaria belangeri, Pappophorum bicolor, Schizachyrium scoparium, Setaria* spp., *Trachypogon spicatus, Tridens muticus*, and *Tridens texanus*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: This Tamaulipan group occurs on a variety of soil texture and depth in semi-arid and subtropical South Texas. Rainfall is highly variable both spatially and temporally and can range from 38 to 76 cm (15-30 inches) annually in a given locality, but all areas are prone to drought and water deficits (Bray 1901, Gilbert 1982, Jahrsdoerfer and Leslie 1988).

DISTRIBUTION

***Geographic Range:** This vegetation has been highly impacted by clearing, overgrazing, disruption of natural processes, and invasive species.
Nations: MX, US
States/Provinces: MXCO, MXNU, MXTM, TX
USFS Ecoregions (2007) [optional]: 315E:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: Classification of this vegetation is based on limited information and data. More data, analysis, and review are needed to better classify this vegetation.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3168	Tamaulipan Caliche Grassland Alliance
A3138	*Schizachyrium scoparium - Bothriochloa barbinodis* Tamaulipan Grassland Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
><	Eastern Coastal Plain Scrub	Muller 1939	
><	Mesquite - Granjeno - Acacia (728)	Shiflet 1994	
><	Mesquite-Acacia-Andropogon-Setaria Savanna	Küchler 1964	
=	Rio Grande Chaparral	Bray 1901	

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. Teague, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Teague
Acknowledgments [optional]:
Version Date: 10 Jun 2015

REFERENCES

***References [Required if used in text]:**

Bray, W. L. 1901. The ecological relations of the vegetation of western Texas. Botanical Gazette 32:102.

Ewing, K., and C. Best. 2004. South Texas Tamaulipan thornscrub restoration experiment measures growth of planted woody vegetation. Ecological Restoration 22(1):11-17.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Fulbright, T. E. 2001. Human-induced vegetation changes in the Tamaulipan scrub of La Frontera. Pages 166-175 in: G. L. Webster and C. J. Bahre, editors. Changing plant life of La Frontera: Observations on vegetation in the United States/Mexico borderlands. University of New Mexico Press, Albuquerque.

Gilbert, L. E. 1982. An ecosystem perspective on the role of woody vegetation, especially mesquite, in the Tamaulipan biotic region of South Texas. Tamaulipan Biotic Province. A Symposium: Resource, Management, Conservation. Unpublished.

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Manzano, M., and J. Navar. 2000. Processes of desertification by goats overgrazing in the Tamaulipan thornscrub (matorral) in north-eastern Mexico. Journal of Arid Environments 44:1-17.

Muller, C. H. 1939. Relation of the vegetation and climatic types in Nuevo Leon, Mexico. The American Midland Naturalist 21:687-729.

Shiflet, T. N., editor. 1994. Rangeland cover types of the United States. Society for Range Management. Denver, CO. 152 pp.

4. POLAR & HIGH MONTANE SCRUB, GRASSLAND & BARRENS

Tundra, alpine and tropical high montane habitats dominated by cryomorphic growth forms (including *dwarf-shrubs*, krummholz, associated *herbs, lichens* and *mosses*), with low height and open to closed canopy.

4.B. Temperate to Polar Alpine & Tundra Vegetation

Alpine dwarf-shrublands, krummholz, forb meadows, grasslands, and cryptogam barrens occurring above treeline in temperate and boreal regions around the globe, predominantly in North America and Eurasia, with more isolated occurrences in the Southern Hemisphere. Polar tundra is dominated by dwarf-shrubs, cushion shrubs, sedges and grasses, mosses and lichens, and is found in the high latitudes north of 60°N in the Arctic region and south of 50°S in the Antarctic region, in permafrost soils that range from dry to seasonally saturated.

4.B.1. Temperate & Boreal Alpine Tundra

Alpine dwarf-shrublands, forb meadows and grasslands occurring above the continuous forest line in temperate and boreal regions around the globe, predominantly in North America and Eurasia, with more isolated occurrences in the Southern Hemisphere.

4.B.1.Na. Eastern North American Alpine Tundra

This alpine vegetation occurs near or above treeline extending into subalpine, on mountain ridges and summits within the northern temperate and boreal areas of eastern North America, south of the continental (arctic) treeline, where wind, low mean annual temperatures or limited growing days, and cloud cover limit the length of the growing season for plants.

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4. Polar & High Montane Scrub, Grassland & Barrens
4.B.1.Na. Eastern North American Alpine Tundra

M131. Eastern North American Alpine Tundra

Type Concept Sentence: This dwarf-shrub-, herb-, or lichen-dominated vegetation occurs above treeline on northeastern mountains of North America, where wind, snow, low mean annual temperatures (or limited growing degree days), and cloud cover limit plant growth. Sites encompass the ancient and weathered summits and plateaus of the Canadian Shield, Canadian maritime provinces, and the northern Appalachian Mountains. Most of the vegetation is dwarf-shrubland or lichen-dominated; islands of taller shrubs or small graminoid meadows may occur in protected spots. The dominant plants are ericads: *Vaccinium uliginosum* is diagnostic and often dominant, and *Vaccinium vitis-idaea* is often common.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 4.B.1.Na.1. Eastern North American Alpine Tundra (D042)

Elcode: M131
***Scientific Name:** Eastern North American Alpine Tundra Macrogroup
***Common (Translated Scientific) Name:** Eastern North American Alpine Tundra Macrogroup
***Colloquial Name:** Eastern North American Alpine Tundra

***Type Concept:** This dwarf-shrub-, herb-, or lichen-dominated vegetation occurs above treeline on northeastern mountains of North America, where wind, snow, and cloud-cover fog limit plant growth. Sites encompass the ancient and weathered summits and plateaus of the Canadian Shield, Canadian maritime provinces, and the northern Appalachian Mountains. Most of the cover is dwarf-shrubland or lichen-dominated; islands of taller shrubs or small graminoid meadows may occur in protected spots. The dominant plants are ericads: *Vaccinium uliginosum* is diagnostic and often dominant; *Vaccinium vitis-idaea* and, less often, *Vaccinium boreale*, is often common. Other alpine-restricted heaths such as *Arctostaphylos alpina, Loiseleuria procumbens, Phyllodoce caerulea*, and *Rhododendron lapponicum* are present, with composition generally varying by microsite characteristics. Other low shrubs include dwarf birches, alders and willows, such as *Alnus viridis, Betula glandulosa, Betula minor, Salix argyrocarpa, Salix herbacea*, and *Salix uva-ursi*. *Diapensia lapponica* is a characteristic cushion-plant, especially in highly exposed flats. *Carex bigelowii* is a characteristic and locally dominant sedge, *Agrostis mertensii* and *Anthoxanthum monticola ssp. alpinum* are characteristic grasses, and *Juncus trifidus* is a dominant rush. Forbs are comparatively scarce (except in snowbank settings), with characteristic species including *Minuartia groenlandica, Prenanthes boottii, Solidago cutleri*, and in a few locations, *Geum peckii* and *Potentilla robbinsiana*. In Atlantic Canada, some alpine forbland/grassland is characterized by alpine plants such as *Festuca altaica, Juncus trifidus, Luzula spicata, Polygonum viviparum*, and other (boreal) plants.

***Diagnostic Characteristics:** Alpine dwarf-shrub and herbaceous vegetation of the region's highest elevations above treeline, with one or more of these diagnostic species: *Agrostis mertensii, Arctostaphylos alpina, Betula glandulosa, Carex bigelowii, Diapensia lapponica, Geum peckii, Harrimanella hypnoides, Loiseleuria procumbens, Phyllodoce caerulea, Prenanthes boottii, Rhododendron lapponicum, Salix herbacea, Salix uva-ursi*, and *Solidago cutleri*; *Vaccinium uliginosum* and *Juncus trifidus* are typical and often dominant.

***Classification Comments:** This macrogroup differs from Laurentian-Acadian Acidic Scrub & Grassland Group (G788) in Laurentian-Acadian Acidic Rocky Scrub & Grassland Macrogroup (M505) in being primarily above treeline and in the presence of alpine-restricted species. In the southern part of its range, it is typically above 1220 m (4000 feet), but elevational limits change with latitude and aspect. In addition, there are many open summits in Maine and New Hampshire in the range of about 1200-1500 m (4000-5000 feet) that are above treeline where *Vaccinium uliginosum* and *Juncus trifidus* are common, but the sites may or may not have the listed "alpine obligate'" species (A. Cutko pers. comm. 2012). In Cape Breton, there are "summits" above the treeline at 350 m with alpine obligates such as *Vaccinium uliginosum, Vaccinium boreale*, the herbaceous species listed above, and numerous alpine lichens and bryophytes. There a few treeless peaks in New Brunswick with alpine vegetation, but fewer species represented (S. Basquill pers. comm. 2015). A recent publication by Jones and Willey (2012) provides an excellent general overview, as well as natural history descriptions of key sites throughout the range of this type, and should be consulted when future revisions are made. In particular, Jones et al. (2012) provide an overview of the vegetation. In the northern part of its range, particularly in exposed areas near the sea, including many areas of Newfoundland and coastal Labrador, as well as at high latitude in northern Quebec and Labrador, it becomes less clear what constitutes alpine landscape (Jones and Willey 2012). The alliances described for this macrogroup include everything from the typical dwarf-shrub and graminoid communities to wet snowbeds, bogs and fens. It may be appropriate to divide Eastern Alpine Tundra Group (G104) in this macrogroup (M131) by these broad categories, but first we need to learn how distinct the bogs and fens are in the alpine zone relative to lower elevation types. Eastern Alpine Cliff, Scree & Rock Vegetation Group (G108) in this macrogroup contains descriptions for the lichen fell-fields and cliffs.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Vegetation is patchy, with areas of dwarf-shrub dominance (often <10 cm tall), areas of shrub-herb mixtures, and areas of lichen-encrusted rock.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Vaccinium uliginosum* is diagnostic and often dominant, and *Vaccinium vitis-idaea* is often common. Alpine-restricted heaths include *Arctostaphylos alpina, Loiseleuria procumbens, Phyllodoce caerulea*, and *Rhododendron lapponicum*. Other low shrubs include Alnus viridis, Betula glandulosa, Betula minor, Salix argyrocarpa, Salix herbacea, and *Salix uva-ursi*. *Diapensia lapponica* is a characteristic cushion-plant, especially in highly exposed flats. *Carex bigelowii* is a characteristic and locally dominant sedge, *Agrostis mertensii* and *Anthoxanthum monticola ssp. alpinum (= Hierochloe alpina)* are characteristic grasses, and *Juncus trifidus* is a dominant rush. Forbs include *Solidago cutleri, Minuartia groenlandica, Prenanthes boottii*, and in a few locations *Geum peckii* and *Potentilla robbinsiana*. Less frequent species that are also more-or-less restricted to this group (in eastern North America) include *Arnica lanceolata, Epilobium hornemannii, Oxyria digyna, Phleum alpinum, Polygonum viviparum (= Persicaria vivipara), Saxifraga foliolosa*, and *Veronica wormskjoldii*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics:

ENVIRONMENT

Environmental Description: *Climate:* The climate combines north temperate day lengths with tundra-like exposure. High winds, late-melting snow, and cloud-cover fog are important factors in combination with slope, aspect and elevation. This vegetation is restricted to highly exposed areas above 1220 m (4000 feet) elevation in the southern parts of its range, but in the north, alpine areas may be contiguous with low-elevation tundra ecosystems (Jones and Willey 2012). *Soil/substrate/hydrology:* Soils are extremely limited and most vegetation is growing on bare rock or gravel with very rapid drainage.

DISTRIBUTION

***Geographic Range:** This macrogroup occupies the higher summits of the northern Appalachian Mountains, from northern New England and the Adirondacks into Canada in the Gaspé region of Quebec, Newfoundland and Labrador, and higher peaks of New Brunswick and Cape Breton, Nova Scotia.
Nations: CA, US
States/Provinces: LB, ME, NB, NF, NH, NS, NY, QC, VT
USFS Ecoregions (2007) [optional]: M211A:CC, M211B:CC, M211C:CC, M211D:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: A recent publication by Jones and Willey (2012), which provides an excellent general overview of this macrogroup, as well as natural history descriptions of key sites throughout the range of this type, should be consulted when future revisions are made. In particular Jones et al. (2012) provide an overview of the vegetation.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G087	Eastern Subalpine Shrub - Herb Vegetation
G104	Eastern Alpine Tundra
G108	Eastern Alpine Cliff, Scree & Rock Vegetation

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2014-08-18	M133 Eastern Alpine Cliff, Scree & Rock Vegetation Macrogroup	M133 merged into M131.

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Diapensia	Bliss 1963	
<	Dwarf shrub heath	Bliss 1963	
<	Dwarf shrub heath - rush	Bliss 1963	
<	Sedge meadow	Bliss 1963	
<	Sedge-rush-dwarf shrub heath	Bliss 1963	
<	Snowbank	Bliss 1963	

AUTHORSHIP

***Primary Concept Source [if applicable]:** L.C. Bliss (1963)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler and D. Faber-Langendoen
Acknowledgments [optional]:
Version Date: 21 May 2015

REFERENCES

***References [Required if used in text]:**

Bliss, L. C. 1963. Alpine plant communities of the Presidential Range, New Hampshire. Ecology 44:678-697.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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Jones, M., L. Willey, and M. Anions. 2012a. Vegetation. Pages 49-78 in: M. Jones and L. Willey, editors. Eastern alpine guide: Natural history and conservation of mountain tundra east of the Rockies. Beyond Ktaadn, Inc., and Boghaunter Books, New Salem, MA.

Jones, M., and L. Willey, editors. 2012a. Eastern alpine guide: Natural history and conservation of mountain tundra east of the Rockies. Beyond Ktaadn, Inc., and Boghaunter Books, New Salem, MA.

Kimball, K. D., and D. M. Weihrauch. 2000. Alpine vegetation communities and the alpine-treeline ecotone boundary in New England as biomonitors for climate change. USDA Forest Service, Proceedings RMRS-P-15 3:93-101.

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NYNHP [New York Natural Heritage Program]. 2013i. Online conservation guide for Alpine Krummholz. New York Natural Heritage Program, Albany, NY. [http://www.acris.nynhp.org/guide.php?id=9962] (accessed September 25, 2013).

Sperduto, D. D., and C. V. Cogbill. 1999. Alpine and subalpine vegetation of the White Mountains, New Hampshire. New Hampshire Natural Heritage Inventory, Concord, NH. 25 pp. plus figures.

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4. Polar & High Montane Scrub, Grassland & Barrens
4.B.1.Na. Eastern North American Alpine Tundra

G087. Eastern Subalpine Shrub - Herb Vegetation [Proposed (Submitted)]

Type Concept Sentence: This vegetation comprises stunted coniferous-dominated krummholz of high elevations in the Northern Appalachians and Canadian Maritime Provinces.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 4.B.1.Na.1. Eastern North American Alpine Tundra (M131)

Elcode: G087
***Scientific Name:** *Kalmia angustifolia - Rhododendron canadense - Vaccinium uliginosum* Shrub - Herb Vegetation Group
***Common (Translated Scientific) Name:** Sheep Laurel - Rhodora - Bog Blueberry Shrub - Herb Vegetation Group
***Colloquial Name:** Eastern Subalpine Shrub - Herb Vegetation

***Type Concept:** Vegetation in this group is dominated by stunted coniferous trees, usually *Picea mariana*, occurring on bare or thin-soiled rock at high elevations, or at lower elevations where cold-air drainage accumulates at the base of talus slopes. The vegetation ranges from patchy, with areas of shrubs interspersed with open rock or lichen-dominated areas, to dense shrubland. This vegetation often occurs just above treeline on the higher mountains of the Northern Appalachians, and forms the transition between the forest and true alpine zones on the few eastern mountains where those exist. At higher latitudes, in the Canadian Maritime Provinces and eastern Quebec, this vegetation can be found on sub-boreal tillplains of coarse glacial debris. At the upper elevations, exposure appears critical in determining the vegetation structure; while on the tillplains, fire may be an important component. The dominant vegetation is either heath shrubs or, on upper slopes forming krummholz, procumbent *Picea mariana* and/or *Abies balsamea*; *Picea glauca* is a frequent component in the Maritime Provinces. *Betula papyrifera var. cordifolia* is a frequent associate. Prominent ericads include *Kalmia angustifolia, Rhododendron canadense, Ledum groenlandicum*, and *Vaccinium angustifolium*, whereas *Empetrum eamesii ssp. atropurpureum (= Empetrum atropurpureum), Empetrum nigrum*, and *Vaccinium uliginosum* are indicative of the subalpine zone. *Vaccinium boreale* occurs rarely but is diagnostic where it is present. *Sibbaldiopsis tridentata* is a characteristic forb.

***Diagnostic Characteristics:** Stunted coniferous trees, usually wind-flagged, dominated by *Picea mariana* and *Abies balsamea*, occurring at high elevations or latitudes.

***Classification Comments:** This group is related to, and often adjacent to, Eastern Alpine Dwarf-Shrub - Herb Vegetation Group (G104), but is much more widespread and lacks the cryomorphic species found in the alpine group. It occupies a transition zone between north-temperate and alpine vegetation.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note

Similar NVC Types General Comments [optional]: G104 & G788

VEGETATION

Physiognomy and Structure Summary: On subalpine slopes, this vegetation forms as patchy expanses of low shrub, sometimes with stunted tree islands (tree canopy <25%), over bare or more often lichen-encrusted rock. Herbs are sparse in pockets of soil that shrubs have not occupied. On tillplains, the shrub cover tends to be somewhat more uniform, although fruticose lichens (e.g., *Cladina* spp.) are common beneath the shrubs and in openings between them.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Stunted and scattered trees include *Picea mariana* and/or *Abies balsamea*, and sometimes *Betula papyrifera*. Prominent ericads include *Kalmia angustifolia, Rhododendron canadense, Ledum groenlandicum*, and *Vaccinium angustifolium*, whereas *Vaccinium uliginosum, Empetrum nigrum*, and *Empetrum eamesii ssp. atropurpureum (= Empetrum atropurpureum)* are indicative of the subalpine zone. *Vaccinium boreale* occurs rarely but is diagnostic where it is present. *Sibbaldiopsis tridentata* is a characteristic forb.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: High winds and cold temperatures maintain this vegetation in stunted condition.

ENVIRONMENT

Environmental Description: *Climate:* This vegetation develops at the elevational or latitudinal transition from temperate to boreal climate conditions. *Soil/substrate/hydrology:* The substrate is either rock with thin soil in pockets, coarse glacial till, or boulder talus. In all cases, the soils are mostly excessively well-drained, acidic, and nutrient-poor. Microtopography can create pockets that remain saturated for prolonged periods and include species more expected in wetland conditions.

DISTRIBUTION

***Geographic Range:** This group ranges from high elevations of the Northern Appalachians of New England and New York, north to the Canadian Maritime Provinces and eastern Quebec.
Nations: CA, US
States/Provinces: LB, ME, NB, NF, NH, NS, NY, QC, VT
USFS Ecoregions (2007) [optional]: 211B:CC, 211C:CC, 211I:CP, M211A:CC, M211B:CC, M211C:CC, M211D:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Proposed (Submitted)
USNVC Confidence Comments [optional]: Group needs better documentation in the literature.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	*Empetrum nigrum* Shrubland	Doyle et al. 1987	
<	*Kalmia angustifolia* Shrubland	Doyle et al. 1987	
<	Deciduous shrub community	Whitney and Moeller 1982	
<	Dwarf evergreen shrub community	Whitney and Moeller 1982	
<	Heath/Krummholz	Sperduto and Cogbill 1999	
<	Spruce - Fir Krummholz	Gawler and Cutko 2010	
?	Tuckamore	Jones and Willey 2012a	

AUTHORSHIP

***Primary Concept Source [if applicable]:** K.M. Doyle, J. Fahey, and R.D. Paratley (1987)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler and L.A. Sneddon

Acknowledgments [optional]:

Version Date: 06 May 2015

REFERENCES

***References [Required if used in text]:**

Doyle, K. M., T. J. Fahey, and R. D. Paratley. 1987. Subalpine heathlands of the Mahoosuc Range, Maine. Bulletin of the Torrey Botanical Club 114:429-436.

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G104. Eastern Alpine Tundra

Type Concept Sentence: This group encompasses dwarf-shrub and low herbaceous vegetation growing above the natural treeline at high elevations, or at lower elevations at higher latitudes in the northeastern U.S. and adjacent Canada.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 4.B.1.Na.1. Eastern North American Alpine Tundra (M131)

Elcode: G104
***Scientific Name:** *Vaccinium uliginosum - Diapensia lapponica - Carex bigelowii* Alpine Tundra Group
***Common (Translated Scientific) Name:** Bog Blueberry - Pincushion Plant - Bigelow's Sedge Alpine Tundra Group
***Colloquial Name:** Eastern Alpine Tundra

***Type Concept:** This dwarf-shrub-, herb-, or lichen-dominated vegetation occurs above treeline on northeastern mountains of North America, where wind, snow, and cloud-cover fog limit plant growth. Sites encompass the ancient and weathered summits and plateaus of the Canadian Shield and the northern Appalachian Mountains. Most of the cover is dwarf-shrubland or lichen-dominated; islands of taller shrubs or small graminoid meadows may occur in protected spots. The dominant plants are ericads: *Vaccinium uliginosum* is diagnostic and often dominant, and *Vaccinium vitis-idaea* is often common. Other alpine-restricted heaths such as *Phyllodoce caerulea, Rhododendron lapponicum, Arctostaphylos alpina*, and *Loiseleuria procumbens* are present, with composition generally varying by microsite characteristics. Other low shrubs include dwarf birches, alders and willows, such as *Betula minor, Betula glandulosa, Alnus viridis, Salix uva-ursi*, and *Salix argyrocarpa*. *Diapensia lapponica* is a characteristic cushion-plant, especially in highly exposed flats. *Carex bigelowii* is a characteristic and locally dominant sedge, *Agrostis mertensii* and *Anthoxanthum monticola ssp. alpinum* are characteristic grasses, and *Juncus trifidus* is a dominant rush. Forbs are comparatively scarce (except in snowbank settings), with characteristic species including *Solidago cutleri, Minuartia groenlandica, Prenanthes boottii*, and in a few locations, *Geum peckii* and *Potentilla robbinsiana*.

***Diagnostic Characteristics:** Alpine dwarf-shrub and herbaceous vegetation of the region's highest elevations above treeline, with one or more of these diagnostic species: *Agrostis mertensii, Arctostaphylos alpina, Betula glandulosa, Carex bigelowii, Diapensia lapponica, Harrimanella hypnoides, Loiseleuria procumbens, Phyllodoce caerulea, Prenanthes boottii, Rhododendron lapponicum, Salix herbacea, Salix uva-ursi*, and *Solidago cutleri*; *Vaccinium uliginosum* and *Juncus trifidus* are typical and often dominant.

***Classification Comments:** This group differs from the more temperate Laurentian-Acadian Acidic Scrub & Grassland Group (G788) in being primarily above treeline and in the presence of alpine-restricted species. In the southern part of its range, it is typically above 1220 m (4000 feet), but elevational limits change with latitude, aspect, and continentality. In addition, there are many open summits in Maine and New Hampshire in the range of about 1200-1500 m (4000-5000 feet) that are above treeline where *Vaccinium uliginosum* and *Juncus trifidus* are common, but the sites may or may not have the listed "alpine obligate'" species (A. Cutko pers. comm. 2012). A recent publication by Jones and Willey (2012) provides an excellent general overview of this group, as well as natural history descriptions of key sites throughout the range of this type, and should be consulted when future revisions are made to this group. In particular, Jones et al. (2012) provide an overview of the vegetation. In the northern part of its range, particularly in exposed areas near the sea, including many areas of Newfoundland and coastal Labrador, as well as at high latitude in northern Quebec and Labrador, it becomes less clear what constitutes alpine landscape (Jones and Willey 2012). The alliances described for this group include everything from the typical dwarf-shrub and graminoid communities to wet snowbeds, bogs and fens. It may be appropriate to divide this group by these broad categories, but first we need to learn how distinct the bogs and fens are in the alpine zone relative to lower elevation types. Eastern Alpine Cliff, Scree & Rock Vegetation Group (G108) contains descriptions for the lichen fell-fields and cliffs. This type is likely to occur in Nova Scotia and may be on one or two higher New Brunswick peaks, but more research is needed.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G108	Eastern Alpine Cliff, Scree & Rock Vegetation	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Vegetation is patchy, with areas of dwarf-shrub dominance (often <10 cm tall), areas of shrub-herb mixtures, and areas of lichen-encrusted rock.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: *Vaccinium uliginosum* is diagnostic and often dominant, and *Vaccinium vitis-idaea* is often common. Alpine-restricted heaths include *Arctostaphylos alpina, Loiseleuria procumbens, Phyllodoce caerulea*, and *Rhododendron lapponicum*. Other low shrubs include *Alnus viridis, Betula glandulosa, Betula minor, Salix argyrocarpa, Salix herbacea*, and *Salix uva-ursi*. *Diapensia lapponica* is a characteristic cushion-plant, especially in highly exposed flats. *Carex bigelowii* is a characteristic and locally dominant sedge, *Agrostis mertensii* and *Anthoxanthum monticola ssp. alpinum (= Hierochloe alpina)* are characteristic grasses, and *Juncus trifidus* is a dominant rush. Forbs include *Solidago cutleri, Minuartia groenlandica*, and *Prenanthes boottii*. Less frequent species that are also more-or-less restricted to this group (in eastern North America) include *Arnica lanceolata, Epilobium hornemannii, Oxyria digyna, Phleum alpinum, Polygonum viviparum (= Persicaria vivipara), Saxifraga foliolosa*, and *Veronica wormskjoldii*. Plants occurring on limestone include *Dryas integrifolia, Saxifraga aizoides, Saxifraga oppositifolia, Saxifraga paniculata*, and *Silene acaulis*. Heaths, except for *Rhododendron lapponicum*, are generally absent, while species of Caryophyllaceae are prominent, including *Arenaria humifusa, Minuartia marcescens, Minuartia rubella*, and *Silene suecica*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: An average growing season temperature of 44°F, very high winds, ice, and dense cloud cover act in concert to suppress the establishment of trees in this zone. The formation of rime ice, and the wind-transported snow and ice crystals act as a sandblaster on exposed vegetation. The high degree of precipitation and low accumulation of organic material results in the development of shallow bogs over bedrock, contributing to the patchwork assemblage of upland and wetland vegetation.

ENVIRONMENT

Environmental Description: *Climate:* The climate combines north-temperate day lengths with tundra-like exposure. High winds, late-melting snow, and cloud-cover fog are important factors in combination with slope, aspect and elevation. This vegetation is restricted to highly exposed areas above 1220 m (4000 feet) elevation in the southern parts of its range, but in the north, alpine areas may be contiguous with low-elevation tundra ecosystems (Jones and Willey 2012). *Soil/substrate/hydrology:* Soils are extremely limited and most vegetation is growing on bare rock or gravel with very rapid drainage. Much of this vegetation occurs on acidic metamorphic rocks, but examples also occur on limestone and serpentine (the latter confined to Canada). This group also includes snowbank vegetation that grows in sheltered areas that accumulate great depths of snow that persist well into the growing season. These depressions have some of the highest soil accumulation. Occasionally, this vegetation can be found growing on thicker soil deposits but in extremely cold climates (S. Basquill pers. comm. 2015).

DISTRIBUTION

***Geographic Range:** This group occupies the higher summits of the northern Appalachian Mountains, from northern New England and the Adirondacks into Canada in the Gaspé region of Quebec, and in Newfoundland and Labrador.
Nations: CA, US
States/Provinces: LB, ME, NB, NF, NH, NS, NY, QC, VT
USFS Ecoregions (2007) [optional]: M211A:CC, M211B:CC, M211C:CC, M211D:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]: A recent publication by Jones and Willey (2012), which provides an excellent general overview of this group, as well as natural history descriptions of key sites throughout the range of this type, should be consulted when future revisions are made to this group. In particular Jones et al. (2012) provide an overview of the vegetation.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3360	*Picea mariana* Krummholz Alliance
A1116	*Vaccinium uliginosum* - Mixed Alpine Heath Alliance
A3286	*Ledum groenlandicum / Trichophorum cespitosum / Sphagnum* spp. Alpine Bog & Fen Alliance
A1295	*Carex bigelowii* Alpine Meadow Alliance
A1120	*Diapensia lapponica* - Mixed Alpine Dwarf-shrubland Alliance
A3285	*Betula papyrifera var. cordifolia - Betula glandulosa - Alnus viridis* Alpine Shrubland Alliance
A3287	*Salix herbacea / Trichophorum cespitosum - Carex bigelowii* Alpine Snowbed Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2015-11-17	G087 Kalmia angustifolia - Rhododendron canadense - Vaccinium uliginosum Shrub - Herb Vegetation Group	G087 merged into G104

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Diapensia	Bliss 1963	
<	Dwarf shrub heath	Bliss 1963	
<	Dwarf shrub heath - rush	Bliss 1963	
<	Sedge meadow	Bliss 1963	
<	Sedge-rush-dwarf shrub heath	Bliss 1963	
<	Snowbank	Bliss 1963	

AUTHORSHIP

***Primary Concept Source [if applicable]:** L.C. Bliss (1963)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler, D. Faber-Langendoen and L.A. Sneddon
Acknowledgments [optional]: Sean Basquill
Version Date: 06 May 2015

REFERENCES

***References [Required if used in text]:**

Bliss, L. C. 1963. Alpine plant communities of the Presidential Range, New Hampshire. Ecology 44:678-697.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Jones, M., L. Willey, and M. Anions. 2012a. Vegetation. Pages 49-78 in: M. Jones and L. Willey, editors. Eastern alpine guide: Natural history and conservation of mountain tundra east of the Rockies. Beyond Ktaadn, Inc., and Boghaunter Books, New Salem, MA.

Jones, M., and L. Willey, editors. 2012a. Eastern alpine guide: Natural history and conservation of mountain tundra east of the Rockies. Beyond Ktaadn, Inc., and Boghaunter Books, New Salem, MA.

Kimball, K. D., and D. M. Weihrauch. 2000. Alpine vegetation communities and the alpine-treeline ecotone boundary in New England as biomonitors for climate change. USDA Forest Service, Proceedings RMRS-P-15 3:93-101.

Sperduto, D. D., and C. V. Cogbill. 1999. Alpine and subalpine vegetation of the White Mountains, New Hampshire. New Hampshire Natural Heritage Inventory, Concord, NH. 25 pp. plus figures.

4. Polar & High Montane Scrub, Grassland & Barrens
4.B.1.Na. Eastern North American Alpine Tundra

G108. Eastern Alpine Cliff, Scree & Rock Vegetation

Type Concept Sentence: This group encompasses sparse vegetation confined to bedrock, talus, or cliffs in the alpine zone of northern New England and adjacent Canada.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 4.B.1.Na.1. Eastern North American Alpine Tundra (M131)

Elcode: G108
***Scientific Name:** *Rhizocarpon geographicum - Carex bigelowii - Carex scirpoidea* Alpine Cliff, Scree & Rock Vegetation Group
***Common (Translated Scientific) Name:** World Map Lichen - Bigelow's Sedge - Northern Single-spike Sedge Alpine Cliff, Scree & Rock Vegetation Group
***Colloquial Name:** Eastern Alpine Cliff, Scree & Rock Vegetation

***Type Concept:** This group encompasses lithomorphic sparse or nonvascular vegetation above treeline in alpine areas of Eastern North America. It includes lichen-dominated expanses known as felsenmeer ("sea of rocks") as well as alpine cliffs where the near-vertical exposure prevents much vegetation growth. On flat or gently-sloped tablelands and ridgelines, felsenmeer develops where freeze-thaw cycles have broken rocks into variously-sized fragments. Crustose, umbilicate, and foliose lichens dominate. Scattered vascular plants such as *Juncus trifidus, Minuartia groenlandica*, and *Carex bigelowii* occur where patches of soil have accumulated. On alpine cliffs, the patchy vegetation is concentrated in areas kept wet by runoff and is dominated by bryophytes and certain alpine vascular plants. Some plants on the cliffs, such as *Juncus trifidus, Minuartia groenlandica, Vaccinium uliginosum, Ledum groenlandicum*, and *Agrostis mertensii*, can be found in other types of northeastern alpine vegetation. Others are more-or-less restricted to these alpine cliffs: these include *Polygonum viviparum, Festuca rubra, Saxifraga cernua, Saxifraga paniculata, Cardamine bellidifolia, Carex scirpoidea, Pinguicula vulgaris*, and *Phleum alpinum*.

***Diagnostic Characteristics:** Sparsely vegetated areas above treeline, primarily either flat or gently sloping areas of fractured rock dominated by lichens, or near-vertical cliffs with patchy vegetation concentrated in areas receiving moisture from above.

***Classification Comments:** Vegetation in this group is not well-documented.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G104	Eastern Alpine Tundra	generally occurs on the same summits and ridges but is more densely vegetated.
G841	Central Midwest-Interior Cliff & Rock Vegetation	
G840	Appalachian Cliff & Rock Vegetation	
G842	Southeast Coastal Plain Cliff & Rock Vegetation	
G839	Laurentian-Acadian-Great Lakes Cliff & Rock Vegetation	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Vegetation is sparse. On flatter expanses of felsenmeer, lichens dominate with low vascular plants occasional in small, relatively protected spots. On cliffs, vegetation is dominated by bryophytes with scattered dwarf-shrubs and herbs.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Typical lichen species of flat, exposed areas include *Arctoparmelia centrifuga, Lasallia papulosa, Lecanora polytropa, Lecidea lapicida, Melanelia hepatizon, Melanelia stygia, Ophioparma ventosa, Orphniospora moriopsis, Porpidia flavicunda (= Porpidia flavocaerulescens), Protoparmelia badia, Racomitrium lanuginosum, Rhizocarpon geographicum, Stereocaulon* spp., Tremolecia atrata, Umbilicaria hyperborea, Umbilicaria polyphylla, Umbilicaria proboscidea, and *Umbilicaria torrefacta*. Alpine cliffs support bryophytes, along with *Agrostis mertensii, Arnica lanceolata, Campanula rotundifolia, Castilleja septentrionalis, Dasiphora fruticosa ssp. floribunda, Juncus trifidus, Ledum groenlandicum, Loiseleuria procumbens, Minuartia groenlandica, Oxyria digyna, Trichophorum cespitosum, Vaccinium uliginosum*, and several species more-or-less restricted to this habitat such as *Cardamine bellidifolia, Carex scirpoidea, Festuca rubra (= Festuca prolifera), Phleum alpinum, Pinguicula vulgaris, Polygonum viviparum (= Persicaria vivipara), Saxifraga cernua*, and *Saxifraga paniculata (= Saxifraga aizoon)*.

Nova Scotia rare plant surveys indicate the following species are found on alpine cliffs and/or summits: *Artemisia campestris ssp. borealis, Diapensia lapponica, Draba norvegica var. clivicola, Festuca altaica, Festuca rubra, Hordeum brachyantherum, Juncus trifidus, Loiseleuria procumbens, Luzula spicata, Oxyria digyna, Phyllodoce caerulea, Poa alpina, Rhododendron lapponicum, Salix glauca ssp. callicarpaea, Salix reticulata, Salix uva-ursi, Salix vestita, Saxifraga aizoides, Saxifraga cernua, Saxifraga oppositifolia, Vaccinium uliginosum*, and others. In New Brunswick, *Carex bigelowii* is known from one peak (not known from Nova Scotia). *Minuartia groenlandica* is found at sea level and some peaks in New Brunswick and Nova Scotia. *Rhizocarpon geographicum* does not occur (S. Basquill pers. comm. 2015).

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The steep slopes and exposed bedrock undergo a number of processes that result in changes in the vegetation over time. Willey et al. (2012) describe a number of processes falling under two broad categories: mechanical weathering and mass movement. Mechanical weathering results in frost-shattering (fluctuating temperatures cause expansion and contraction of rocks that ultimately break apart); cryoturbation (freeze-thaw cycles that result in unusual formations such as rock polygons and soil stripes); and exfoliation (deterioration of granite cliff faces allows expansion of underlying rock, resulting in a peeling away of surface rock). Mass movements include snow (avalanches) and soil (landslides caused by unstable substrate sliding along a sheer sloped surface, and debris flows caused by torrential rain).

ENVIRONMENT

Environmental Description: *Climate:* The climate is severe and combines north-temperate day-lengths with tundra-like exposure. High winds, late-melting snow, and cloud-cover fog are important factors. This vegetation is restricted to highly exposed areas above 1220 m (4000 feet) elevation. *Soil/substrate/hydrology:* Massifs of various lithologies, either on consolidated bedrock, such as cirque walls, or on fractured pieces of bedrock on tablelands or ridgelines.

DISTRIBUTION

***Geographic Range:** This group occupies higher summits of the Northern Appalachian Mountains, from northern New England and the Adirondacks into the Canadian Gaspé.
Nations: CA, US
States/Provinces: ME, NB, NH, NS, NY, QC, VT
USFS Ecoregions (2007) [optional]: M211A:CC, M211B:CC, M211C:CC, M211D:CC
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]: Not well-sampled in the U.S., and currently lacking data from Canada.

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A4003	*Rhizocarpon geographicum - Umbilicaria hyperborea* Eastern Alpine Fell-field Alliance
A4004	Northern Appalachian Alpine Cliff Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Alpine cliff + Felsenmeer	Sperduto and Cogbill 1999	
<	Fellfield	Kimball and Weihrauch 2000	
<	Felsenmeer	Bliss 1963	

AUTHORSHIP

***Primary Concept Source [if applicable]:** S.C. Gawler, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler, L.A. Sneddon and D. Faber-Langendoen
Acknowledgments [optional]: Sean Basquill
Version Date: 06 May 2015

REFERENCES

***References [Required if used in text]:**

Bliss, L. C. 1963. Alpine plant communities of the Presidential Range, New Hampshire. Ecology 44:678-697.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Gawler, S. C., and A. Cutko. 2010. Natural landscapes of Maine: A classification of vegetated natural communities and ecosystems. Maine Natural Areas Program, Department of Conservation, Augusta.

Kimball, K. D., and D. M. Weihrauch. 2000. Alpine vegetation communities and the alpine-treeline ecotone boundary in New England as biomonitors for climate change. USDA Forest Service, Proceedings RMRS-P-15 3:93-101.

Sperduto, D. D., and C. V. Cogbill. 1999. Alpine and subalpine vegetation of the White Mountains, New Hampshire. New Hampshire Natural Heritage Inventory, Concord, NH. 25 pp. plus figures.

6. OPEN ROCK VEGETATION

Tropical, temperate, and boreal habitats are characterized or dominated by plant growth forms, such as *lichen, bryophyte, alga*, or *fern*, that have structural adaptations for living on stable rock surfaces or on unstable rocky substrates, such as cliffs, talus, scree, pavement, cobble, lava or boulderfields, and with associated mesomorphic grass, shrub and tree growth forms.

6.B. Temperate & Boreal Open Rock Vegetation

Rocky habitats (such as cliffs, talus, scree, pavement, cobbles, recent lava flows, or large rock outcrops) characterized by temperate, including Mediterranean, and boreal lithomorphic and lithophilic growth forms, including saxicolous *lichens, bryophytes, algae*, and/or *ferns* and other pteridophytes. Tree growth forms typically have <10% cover, are very sparse; woody growth forms, when present, include cold-deciduous broad-leaved and needle-leaved trees and shrubs. Vegetation found on temperate and boreal rocky habitats (such as cliffs, talus, recent lava flows, or rock outcrops) at low to moderate elevations at mid-latitudes from 23°to 70°N or S latitude around the globe that are characterized by nonvascular plant growth forms that have structural adaptations for living on these habitats.

6.B.1. Temperate & Boreal Cliff, Scree & Other Rock Vegetation

Vegetation in temperate and boreal habitats found in rocky or rocklike habitats (such as cliffs, talus, scree, pavement, cobbles, lava, boulderfields, or badlands) at low elevations at mid-latitudes around the globe characterized by nonvascular plant growth forms that have structural adaptations for living on stable rock surfaces or in unstable rocky substrates. A sparse cover of vascular mesomorphic growth forms, including needle-leaved and cold-deciduous broad-leaved woody plants, may be present.

6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation

This type encompasses vegetation of eastern and boreal North America found on somewhat to strongly vertical cliffs, talus slopes, and erosional bluffs and characterized by sparse and patchy vascular vegetation and often high nonvascular and fern cover.

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation

M111. Eastern North American Cliff & Rock Vegetation

Type Concept Sentence: This type encompasses vegetation of eastern temperate and boreal North America found on somewhat to strongly vertical cliffs, talus slopes, and erosional bluffs and characterized by sparse and patchy vascular vegetation and often high nonvascular and fern cover.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 6.B.1.Na.1. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation (D051)

Elcode: M111
***Scientific Name:** *Sibbaldiopsis tridentata - Polypodium virginianum / Cladonia* spp. Eastern North American Cliff & Rock Vegetation Macrogroup
***Common (Translated Scientific) Name:** Shrubby Fivefingers - Rock Polypody / Cup Lichen species Eastern North American Cliff & Rock Vegetation Macrogroup
***Colloquial Name:** Eastern North American Cliff & Rock Vegetation

***Type Concept:** This type encompasses vegetation of eastern temperate and boreal North American cliffs, talus slopes and erosional bluffs characterized by often sparse and patchy vascular vegetation and often high nonvascular cover. It ranges from the East Coast west to the Ouachitas and upper Great Lakes and through central and eastern boreal Canada. Vegetation structure varies widely, and may include scattered small trees such as *Betula papyrifera, Juniperus virginiana, Picea glauca, Pinus banksiana, Pinus strobus, Thuja occidentalis*, and *Quercus* spp. Other commonly encountered species may include *Asplenium* spp., *Cystopteris fragilis, Danthonia spicata, Dasiphora fruticosa ssp. floribunda, Deschampsia cespitosa, Dryopteris marginalis, Hydrangea arborescens, Parthenocissus quinquefolia, Polypodium virginianum, Ribes* spp., *Rubus pubescens, Sibbaldiopsis tridentata*, and *Toxicodendron radicans*. Characteristic foliose and fruticose macrolichen genera include *Cladonia, Lasallia, Stereocaulon*, and *Umbilicaria*. Crustose lichens are also common. Substrates include all lithologies from acidic granites to circumneutral basalts to calcareous limestones, with concomitant floristic variation. These cliffs are prone to harsh climatic conditions; frequent disturbances include drought stress and wind and storm damage. Most of the substrate is dry and exposed, but small (occasionally large) areas of seepage are often present. The vegetation is patchy and sparse overall, except in some wet, or seepy, areas where the rocks are often densely or moderately covered with bryophytes or algae. Outside of the glaciated regions and the Appalachian Mountains, this vegetation is primarily limited to river gorges and bluffs. A specialized habitat within this macrogroup is the vertical walls of limestone sinkholes. Vegetation occurring on shoreline examples seems to be mostly restricted to areas protected from wave action, ice-scour, and wind.

***Diagnostic Characteristics:** This type has sparse vascular vegetation and variable cryptogam (bryophyte, lichen and ferns) cover found on some to strongly vertical cliffs, talus slopes, and erosional bluffs of eastern temperate and central to eastern boreal North America. Cliffs and other rock vegetation with >10% vascular cover of trees, shrubs and herbs are placed elsewhere.

***Classification Comments:** This is a large and "bulky" macrogroup which is geographically broad and floristically heterogeneous. More sampling is needed to determine how best to divide it, either at the group or alliance level, and whether the boreal group should be moved with other boreal rock groups to a separate boreal macrogroup or even division. Rocky outcrop vegetation, typically on flat, more vascular-vegetated habitats, is placed elsewhere in a number of shrub and grassland macrogroups in 2.B.2.Nc Eastern North American Grassland & Shrubland Division (D024). Cliffs with sufficient cover of vascular plants (>10% cover) are placed with forest and woodland, shrubland and grassland types. There may be some degree of floristic overlap between rock outcrops and cliff and talus, and the distinction may be strongest when based on overall physiognomy (i.e., <10% vascular cover, cryptogam cover variable).

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M880	Eastern North American Wet Shoreline Vegetation	occupies open rocky shorelines on rivers and beaches, if wet enough.
M116	Great Plains Cliff, Scree & Rock Vegetation	is similarly sparsely vegetated but geographically separated.

Similar NVC Types General Comments [optional]: This macrogroup is very broadly defined, with sparse, widely variable vegetation composition and structure. It has similar substrate types but they are influenced by different macroclimatic features.

VEGETATION

Physiognomy and Structure Summary: Vascular vegetation is sparse, patchy, and widely variable in structure, with scattered trees, shrubs, and herbs. The nonvascular and fern component varies from sparse to dense cover. Physiognomy is variable.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Floristics vary with geography, substrate, and moisture availability. Taxa include *Aquilegia canadensis, Asplenium* spp., *Arabis* spp., *Betula* spp., *Corydalis sempervirens, Cystopteris bulbifera, Cystopteris fragilis, Danthonia spicata, Dasiphora fruticosa ssp. floribunda, Deschampsia cespitosa, Dryopteris marginalis, Hydrangea arborescens, Juniperus virginiana, Parthenocissus quinquefolia, Pellaea atropurpurea, Phlox subulata, Picea glauca, Pinus banksiana, Pinus strobus, Polypodium* spp., *Quercus* spp., *Sibbaldiopsis tridentata (= Potentilla tridentata), Saxifraga michauxii, Saxifraga virginiensis, Schizachyrium scoparium, Thuja occidentalis, Toxicodendron radicans*, and *Woodsia obtusa*. Characteristic foliose and fruticose lichen genera include *Cladonia, Flavoparmelia, Lasallia, Stereocaulon*, and *Umbilicaria*. Characteristic crustose lichen genera include *Caloplaca, Dimelaena, Fuscidea, Lepraria, Physcia*, and *Porpidia*. Bryophytes are also common.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: On cliffs, plants that are rooted in crevices or ledges are subject to erosion or slumping. Severe drought can also limit woody encroachment on sites with dry aspects.

ENVIRONMENT

Environmental Description: *Climate:* Climate is primarily north temperate and boreal, but this type spans a wide area. *Soil/substrate/hydrology:* Substrate includes rocky cliffs, talus, and unconsolidated to mineral materials (bluffs) that are somewhat to strongly vertical. Consolidated rock substrates comprise various lithologies, including basalt-diabase, granite-metamorphic, limestone-dolostone, shale, or sandstone. Landforms include cliffs, erosional slopes, talus slopes, riverside outcrops and gorges, and shorelines of waterbodies. Cliffs range from overhanging to vertical to nearly vertical, with the physical structure usually irregular, with some ledges and crevices. Moisture levels vary drastically over short distances. Seepage of groundwater from adjacent soils or through rock fractures often creates permanently or seasonally flooded microsites, while lack of soil makes other portions extremely dry. In less sheltered topography, slope and aspect affect overall moisture levels to some degree. Rock chemistry and moisture appear to be the most important factors affecting different associations on cliff sites. On talus, small pockets among the rocks provide rooting substrates; on bluffs, plants have more rooting sites available, but they are subject to erosion or slumping.

DISTRIBUTION

***Geographic Range:** This type ranges in the boreal region from eastern to central Canada, and in the temperate region from New England and adjacent Canada west to the Great Lakes and northern Minnesota, south through the Appalachians and Piedmont (occasional in the Atlantic Coastal Plain), and west across the Cumberland Plateau and Interior Low Plateau to the Ozarks.
Nations: CA, MX?, US

States/Provinces: AB?, AL, AR, CT, FL, GA, IA, IL, IN, KY, LA, MA, MB, MD, ME, MI, MN, MO, MS, NB, NC, NH, NJ, NS, NY, OH, OK, ON, PA, QC, RI, SC, SK?, TN, TX, VA, VT, WI, WV
USFS Ecoregions (2007) [optional]: 211:C, 212:C, 251:C, M211:C, M221:C
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G340	Northeastern Erosional Bluff Vegetation
G839	Laurentian-Acadian-Great Lakes Cliff & Rock Vegetation
G840	Appalachian Cliff & Rock Vegetation
G841	Central Midwest-Interior Cliff & Rock Vegetation
G842	Southeast Coastal Plain Cliff & Rock Vegetation

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note
2016-01-12	M879 North American Boreal Cliff, Scree & Rock Vegetation Macrogroup	M879 split & merged with M111

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Gawler, D. Faber-Langendoen, and S. Menard, in Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S. Gawler, S. Menard, L. Sneddon, D. Faber-Langendoen
Acknowledgments [optional]:
Version Date: 08 Jan 2016

REFERENCES

***References [Required if used in text]:**

Albert, D. A., P. J. Comer, R. A. Corner, D. Cuthrell, M. Penskar, and M. Rabe. 1995. Bedrock shoreline survey of the Niagaran Escarpment in Michigan's Upper Peninsula: Mackinac County to Delta County. Michigan Natural Features Inventory for Land and Water Management Division (grant # CD-0.02).

Clark, P. W. 2012. Cliff ecology: Extent, biota, and recreation of cliff environments in the New River Gorge, WV. M.S. thesis, Department of Geology and Geography, West Virginia University, Morgantown. 106 pp.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Larson, D. W., U. Matthes, and P. E. Kelly. 2000b. Cliff ecology: Patterns and processes in cliff ecosystems. Cambridge University Press, Cambridge, MA.

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation

G340. Northeastern Erosional Bluff Vegetation

Type Concept Sentence: This vegetation comprises sparse and lichen-dominated vegetation occurring on talus slopes and boulderfields, and on erosional bluffs on lakes, rivers, and coastal settings in the eastern and midwestern U.S. and Canada.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 6.B.1.Na.1. Eastern North American Cliff & Rock Vegetation (M111)

Elcode: G340
***Scientific Name:** *Polypodium* spp. - *Umbilicaria* spp. - *Danthonia spicata* Talus, Bluff & Rock Vegetation Group
***Common (Translated Scientific) Name:** Polypody species - Rocktripe Lichen species - Poverty Oatgrass Talus, Bluff & Rock Vegetation Group
***Colloquial Name:** Northeastern Erosional Bluff Vegetation

***Type Concept:** This group encompasses sparse vascular or nonvascular vegetation on steep, unconsolidated substrates in temperate eastern North America. The two main substrate types are talus slopes and erosional bluffs. Vegetation varies with substrate character and chemistry. Open talus features sparse vascular vegetation with *Dryopteris marginalis, Parthenocissus quinquefolia, Polypodium* spp., *Ribes* spp., *Toxicodendron radicans*, or *Toxicodendron rydbergii* characteristic, and/or areas dominated by macrolichens. Characteristic foliose and fruticose macrolichen genera include *Umbilicaria, Lasallia, Cladonia*, and *Stereocaulon*. Crustose lichens are also common. Scattered small trees may be present, including *Juniperus virginiana*. Vegetation on erosional bluffs is sparse and highly variable. Species in these habitats tolerate disturbance, and can include *Carex scoparia, Comptonia peregrina, Danthonia spicata, Dichanthelium depauperatum, Equisetum arvense, Equisetum hyemale, Impatiens capensis, Oenothera biennis, Polygonella articulata, Schizachyrium scoparium, Solidago nemoralis*, and non-native weeds including *Tussilago farfara*.

***Diagnostic Characteristics:** Sparse vegetation of talus slopes, boulderfields, and erosional slopes; rock chemistry and species composition vary.

***Classification Comments:** More data are needed to better circumscribe and describe this group.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G839	Laurentian-Acadian-Great Lakes Cliff & Rock Vegetation	
G842	Southeast Coastal Plain Cliff & Rock Vegetation	
G841	Central Midwest-Interior Cliff & Rock Vegetation	
G840	Appalachian Cliff & Rock Vegetation	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Vegetation is sparse and primarily herb-dominated. Nonvascular plants may also be prominent, especially on talus and boulderfields. Shrubs and small trees are occasional. Unvegetated substrate is common on erosional bluffs.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Open talus features sparse vascular vegetation with *Dryopteris marginalis, Parthenocissus quinquefolia, Polypodium* spp., *Ribes* spp., *Toxicodendron radicans*, or *Toxicodendron rydbergii* characteristic, and/or areas dominated by macrolichens. Characteristic foliose and fruticose macrolichen genera include *Umbilicaria, Lasallia, Cladonia*, and *Stereocaulon*.

Crustose lichens are also common. Scattered small trees may be present. Vegetation on erosional bluffs is sparse and highly variable. Species in these habitats tolerate disturbance and can include *Carex scoparia, Comptonia peregrina, Danthonia spicata, Dichanthelium clandestinum (= Panicum clandestinum), Dichanthelium depauperatum (= Panicum depauperatum), Equisetum arvense, Equisetum hyemale, Impatiens capensis, Oenothera biennis, Polygonella articulata, Schizachyrium scoparium, Solidago nemoralis*, and non-native weeds including *Tussilago farfara*.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: The open character of the vegetation on talus and boulderfields is maintained by exposure to wind, temperature fluctuations, and movement of unstable substrate downslope. Freeze-thaw cycles allow water to permeate bedrock above cliffs, resulting in fracturing of rock that accumulates on and at the base of the slope. Frequent natural disturbance caused by soil slumping of unstable unconsolidated sediments is characteristic of erosional bluffs. Additional processes here include wave action, flood scour, ice-scour, and exposure to storms.

ENVIRONMENT

Environmental Description: *Climate:* North-temperate. *Soil/substrate/hydrology:* The unconsolidated substrate contributes to spatially and temporally variable vegetation. On talus, small pockets among the rocks provide rooting substrates; on bluffs, plants have more rooting sites available, but they are subject to erosion or slumping.

DISTRIBUTION

***Geographic Range:** This group ranges from New England and adjacent Canada west to the Great Lakes and northern Minnesota, south through the Appalachians and Piedmont (occasional in the Atlantic Coastal Plain), and west across the Cumberland Plateau and Interior Low Plateau to the Ozarks.
Nations: CA, US
States/Provinces: AR, CT, GA, IA, IL, IN, KY, MA, MB, MD, ME, MI, MN, MO, MS, NB, NC, NH, NJ, NS, NY, OK, ON, PA, QC, RI, SC, TN, TX, VA, VT, WI, WV
USFS Ecoregions (2007) [optional]:
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3992	Eastern North American Erosional Bluff Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
<	Erosional River Bluff + Open Talus	Thompson and Sorenson 2000	

AUTHORSHIP

***Primary Concept Source [if applicable]:** S.C. Gawler, D. Faber-Langendoen, and S.E. Menard, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** S.C. Gawler and L.A. Sneddon
Acknowledgments [optional]:
Version Date: 06 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Thompson, E. H., and E. R. Sorenson. 2000. Wetland, woodland, wildland: A guide to the natural communities of Vermont. The Nature Conservancy and the Vermont Department of Fish and Wildlife. University Press of New England, Hanover, NH. 456 pp.

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation

M116. Great Plains Cliff, Scree & Rock Vegetation

Type Concept Sentence: This macrogroup is found throughout the Great Plains on cliffs, bluffs, and rock outcrops, with vegetation comprised of sparse, rocky vegetation and sparse to abundant lichens.

OVERVIEW

***Hierarchy Level:** Macrogroup
***Placement in Hierarchy:** 6.B.1.Na.2. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation (D051)

Elcode: M116
***Scientific Name:** Great Plains Cliff, Scree & Rock Vegetation Macrogroup
***Common (Translated Scientific) Name:** Great Plains Cliff, Scree & Rock Vegetation Macrogroup
***Colloquial Name:** Great Plains Cliff, Scree & Rock Vegetation

***Type Concept:** This macrogroup consists of cliffs, bluffs, and rock outcrops in the Great Plains from the U.S.-Canadian border area south to Texas. It is defined by having sparse vascular vegetation, cryptograms and an abundance of exposed bedrock. The bedrock exposure can be vertical, sloping, or horizontal along rivers, at the tops of buttes, in dry canyons, or, rarely, large, low bedrock outcrops. The bedrock is usually sedimentary (sandstone, limestone, shale, gypsum, siltstone), but granite, rhyolite and (rarely) quartzite also occur. Vegetation is generally sparse except where soil accumulates in pockets or ledges. Dominant species vary greatly depending on geology of the bedrock, climate, aspect, slope, and slope position. Lichens predominate on exposed rock. Common vascular species found in this macrogroup are able to tolerate the dry to xeric conditions and poor soil development. These include *Bouteloua eriopoda* (in the southwest), *Bouteloua gracilis, Bouteloua hirsuta, Bouteloua rigidiseta, Cercocarpus montanus, Erioneuron pilosum, Juniperus* spp., *Opuntia* spp., *Rhus trilobata*, and *Vulpia octoflora*. Cryptogams, especially lichen species, need to be described.

***Diagnostic Characteristics:** This macrogroup is characterized by sparse, rocky vegetation (generally <10% vascular cover) on consolidated rock outcrops or scree/talus fields below cliffs in the Great Plains. Nonvascular species, especially lichens, can be very common on exposed rock.

***Classification Comments:** The concept of this macrogroup is fairly distinct within the Great Plains though individual sites may have enough vegetation to be confused with dry prairie or dry woodland macrogroups. This macrogroup is largely defined by the Great

Plains vascular flora associated with it, and it is on that basis that we separate it from other open bedrock macrogroups, both in the East, i.e., Eastern North American Cliff & Rock Vegetation Macrogroup (M111), and the West, i.e., Western North American Cliff, Scree & Rock Vegetation Macrogroup (M887), as well as more vascular-dominated rocky types, such as Southern Barrens & Glade Macrogroup (M308), that contain rocky grasslands. Badlands vegetation in Great Plains Badlands Vegetation Macrogroup (M115) is distinct in its substrate (thin erodible clays and silts over bedrock), sparse vascular vegetation, and lack of cryptogams, especially lichens.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
M308	Southern Barrens & Glade	is found generally south and east of M116, but where their ranges are adjacent or overlap in the southern Great Plains, better diagnostic criteria are needed.
M118	Intermountain Basins Cliff, Scree & Badland Sparse Vegetation	
M111	Eastern North American Cliff & Rock Vegetation	
M115	Great Plains Badlands Vegetation	is distinct in its substrate (thin erodible clays and silts over bedrock), sparse vascular vegetation, and rarely contains cryptogams, such as lichens.

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Examples of this macrogroup have low, sparse vascular vegetation and a range of nonvascular, typically lichen, cover. The most abundant vascular species at a site are usually small trees, shrubs or grasses but can be forbs in a few cases. Trees and shrubs are typically short, and mixedgrass species dominate the herbaceous stratum. Nonvascular cover is not well-described.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: Species composition is a product of soil depth. In locations and patches where soils are the shallowest, only drought-tolerant plants will persist, many of which are annuals. The number of perennial taxa increases with increasing soil depth. On exposed rock surfaces, the dominant species may be nonvascular plants such as lichens. Common grass species include *Aristida oligantha, Bouteloua curtipendula, Bouteloua hirsuta, Bouteloua rigidiseta, Erioneuron pilosum, Schizachyrium scoparium*, and *Vulpia octoflora (= Festuca octoflora)*. Common forbs are *Asclepias pumila, Calylophus hartwegii, Chaetopappa asteroides, Chaetopappa ericoides, Cheilanthes feei, Croton monanthogynus, Dalea enneandra, Echinacea angustifolia, Echinocereus reichenbachii, Eriogonum flavum, Eriogonum longifolium, Evolvulus nuttallianus, Haploesthes greggii, Stenaria nigricans, Heliotropium tenellum, Hybanthus verticillatus, Lesquerella gordonii, Lesquerella ovalifolia, Mentzelia oligosperma, Nama stevensii, Pellaea atropurpurea, Pediomelum cuspidatum, Penstemon cobaea, Penstemon fendleri, Paronychia jamesii, Plantago patagonica, Plantago wrightiana, Scutellaria wrightii, Sedum nuttallianum, Sedum pulchellum, Selaginella peruviana, Symphyotrichum fendleri*, and *Thelesperma ambiguum*. When present, woody taxa might include *Cissus trifoliata, Forestiera pubescens, Juniperus ashei, Juniperus monosperma, Juniperus pinchotii, Juniperus virginiana, Mimosa borealis, Quercus mohriana, Rhus aromatica, Sapindus saponaria*, and *Sideroxylon lanuginosum*.

Common trees and shrubs are junipers, including *Juniperus monosperma* (in the southwest), *Juniperus scopulorum* (in the west), *Juniperus virginiana* (in the east and north), *Juniperus communis, Juniperus horizontalis*, and other shrubs, such as *Artemisia longifolia, Cercocarpus montanus, Rhus trilobata*, and *Ribes aureum*. Common grasses include *Bouteloua eriopoda* (in the southwest), *Bouteloua gracilis, Bouteloua hirsuta, Bouteloua rigidiseta, Calamovilfa longifolia, Cercocarpus montanus, Erioneuron pilosum, Pseudoroegneria spicata* (in the northwest), *Schizachyrium scoparium*, and *Vulpia octoflora*. Nonvascular species, especially lichens, can be very common on exposed rock, and further review of their species composition is needed.

***Floristics Table [Med - High Confidence]:**
***Number of Plots: *Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Drought and erosion, both from wind and water, are important in maintaining sites in this macrogroup. These factors, combined with the steep slopes on many sites, greatly limit the species that can exist.

ENVIRONMENT

Environmental Description: *Climate:* The division occurs within two climate types (sensu Trewartha): Temperate Continental and Dry Steppe (semi-arid). As a result, there are distinct gradients of precipitation and temperate within the division. The precipitation gradient extends along an east-to-west axis, with an average annual precipitation of 1014mm at Lawrence, Kansas, to 477.5mm at Boise City, Oklahoma. The western extent of the region is subject to periodic, often severe, droughts. The temperature gradient follows a south-north gradient. The annual average temperature in the southern extent of the division is 18.6°C (mean high of 25.7°C and a mean low 11.6°C) at San Angelo, Texas, to 3.1°C in Regina, Saskatchewan (a mean high of 18.9°C in July and a mean low of -14.7°C). Nevertheless, these sites all tend to be xeric and very hot during the summer months.

Soils/substrate: Sites in this macrogroup have significant exposure of bedrock. The bedrock can be vertical, sloping, or horizontal along rivers, at the tops of buttes, in dry canyons, or, rarely, large, low bedrock outcrops. The bedrock is usually sedimentary (sandstone, limestone, shale, gypsum, siltstone), but granite and rhyolite also occur and in southwestern Minnesota, an area of quartzite outcrops is included in this macrogroup. Soil development is limited to cracks, ledges, or depressions in the bedrock. Soils are dry and easily erodible. This macrogroup is found in an arid to semi-arid climate with infrequent heavy summer rains that can erode soils that have developed.

DISTRIBUTION

***Geographic Range:** This macrogroup is found in the Great Plains from southern Canadian Great Plains south to northern Texas, and from the Rocky Mountain foothills to southwestern Minnesota, eastern Kansas and possibly northwestern Iowa and Missouri.
Nations: CA, US
States/Provinces: AB, CO, IA?, KS, MB, MN, MO?, MT, ND, NE, NM, OK, SD, SK?, TX, WY
USFS Ecoregions (2007) [optional]: 251B:CC, 251C:C?, 251E:CP, 251F:CC, 251H:CC, 315A:CC, 315B:CC, 315F:CC, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331K:CP, 331L:CC, 331M:CC, 331N:CC, 332A:CP, 332B:CC, 332C:CC, 332D:CC, 332E:CP, 332F:CC, 342F:PP, M313B:PP, M331B:PP, M331F:PP, M331I:PP
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
G567	Great Plains Cliff, Scree & Rock Vegetation

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note
=	Crystalline Bedrock Outcrop (Prairie) Type [ROs12a]	Minnesota DNR 2005b	

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al. (2014)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake, D. Faber-Langendoen and B. Hoagland

Acknowledgments [optional]:

Version Date: 14 Jan 2016

REFERENCES

***References [Required if used in text]:**

Anderson, R. C., J. S. Fralish, and J. M. Baskin, editors. 1999b. Savannas, barrens, and rock outcrop plant communities of North America. Cambridge University Press, Cambridge. 470 plus ix pp.

Collins, S. L., G. S. Mitchell, and S. C. Klahr. 1989. Vegetation-environment relationships in a rock outcrop community in southern Oklahoma. American Midland Naturalist 122:339-348.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Minnesota DNR [Minnesota Department of Natural Resources]. 2005b. Field guide to the native plant communities of Minnesota: The Prairie Parkland and Tallgrass Aspen Parklands provinces. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. Minnesota Department of Natural Resources, St. Paul.

Uno, G. E., and S. L. Collins. 1987. Primary succession on granite outcrops of southwestern Oklahoma. Bulletin of the Torrey Botanical Club 114:387-392.

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6. Open Rock Vegetation

6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation

G567. Great Plains Cliff, Scree & Rock Vegetation

Type Concept Sentence: This group is composed of cliffs, bluffs, and rock outcrops in the Great Plains from the U.S.-Canadian border area south to Texas where vascular vegetation cover is sparse or nonexistent.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 6.B.1.Na.2. Great Plains Cliff, Scree & Rock Vegetation (M116)

Elcode: G567

***Scientific Name:** *Rhus trilobata / Bouteloua gracilis - Opuntia* spp. Great Plains Cliff, Scree & Rock Vegetation Group

***Common (Translated Scientific) Name:** Skunkbush Sumac / Blue Grama - Prickly-pear species Cliff, Scree & Rock Vegetation Group

***Colloquial Name:** Great Plains Cliff, Scree & Rock Vegetation

***Type Concept:** This group is composed of cliffs, bluffs, and rock outcrops in the Great Plains from the U.S.-Canadian border area south to Texas. It is defined by having sparse vegetation and the abundance of exposed bedrock. The bedrock exposure can be vertical, sloping, or horizontal along rivers, at the tops of buttes, in dry canyons, or, rarely, large, low bedrock outcrops. The bedrock is usually sedimentary (sandstone, limestone, shale, gypsum, siltstone), but an area of quartzite outcrops in southwestern Minnesota is included in this group. Vegetation is generally sparse except where soil accumulates in pockets or ledges. Dominant species vary greatly depending on geology of the bedrock, climate, aspect, slope, and slope position. Common species are able to tolerate the dry to xeric conditions and poor soil development found in this group. These include *Bouteloua eriopoda* (in the southwest), *Bouteloua gracilis, Cercocarpus montanus, Juniperus* spp., *Opuntia* spp., and *Rhus trilobata*.

***Diagnostic Characteristics:** This group is characterized by sparse vegetation (generally less than 10% cover) on rock outcrops in the Great Plains.

***Classification Comments:** The concept of this group is fairly distinct within the Great Plains though individual sites may have enough vegetation to be confused with dry prairie or dry woodland groups. At the edges of the distribution of this group, there could be confusion with the sparse vegetation bedrock groups in the East, i.e., Laurentian-Acadian-Great Lakes Cliff & Rock Vegetation Group (G839), Appalachian Cliff & Rock Vegetation Group (G840), Central Midwest-Interior Cliff & Rock Vegetation Group (G841), and Southeast Coastal Plain Cliff & Rock Vegetation Group (G842), and the West, i.e., Rocky Mountain Cliff, Scree & Rock Vegetation Group (G565). Characteristics of this group may overlap with that of Comanchian Barrens & Glade Group (G598), and review is needed to clarify the limits of the two concepts.

***Similar NVC Types [if applicable]:**

Elcode	Scientific or Colloquial Name	Note
G598	Comanchian Barrens & Glade	
G569	North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation	
G570	Intermountain Basins Cliff, Scree & Badland Sparse Vegetation	
G841	Central Midwest-Interior Cliff & Rock Vegetation	
G840	Appalachian Cliff & Rock Vegetation	
G839	Laurentian-Acadian-Great Lakes Cliff & Rock Vegetation	
G842	Southeast Coastal Plain Cliff & Rock Vegetation	
G565	Rocky Mountain Cliff, Scree & Rock Vegetation	

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Examples of this group have sparse vegetation. The most abundant species at a site tend to be small trees, shrubs, or grasses but can be forbs in a few cases. Trees and shrubs are typically short, and mixedgrass species dominate the herbaceous stratum.

Physiognomy and Structure Table [optional]:

Physiognomy-Structure Category	Prevailing Height (m)	Height Range (opt.)	Mean % Cover	Cover Range (opt.)
				-

Floristics Summary: This group has scattered vascular species found in cracks, depressions, or ledges in the bedrock where some soil can accumulate. Dominant species vary greatly depending on geology of the bedrock, climate, aspect, slope, and slope position. Common trees and shrubs are *Juniperus monosperma* (in the southwest), *Juniperus scopulorum* (in the west), *Juniperus virginiana* (in the east and north), *Artemisia longifolia, Cercocarpus montanus*, and *Rhus trilobata*. Common grasses include *Bouteloua eriopoda* (in the southwest), *Bouteloua gracilis, Calamovilfa longifolia*, and *Schizachyrium scoparium*. Forbs tend not to be as abundant as woody vegetation and grasses but are scattered. *Eriogonum* spp., *Gutierrezia sarothrae*, and *Opuntia* spp. are typical. Nonvascular species, especially lichens, can be very common on exposed rock.

***Floristics Table [Med - High Confidence]:**
***Number of Plots:**
***Cover Scale Used:**

Physiognomy-Structure Category	Taxon Name	Specific Growth Form (opt.)	Const-ancy	Mean % Cover	Cover Range (opt.)	Differ-ential	Diagnostic Combin-ation
					-		

Dynamics: Drought and erosion, both from wind and water, are important in maintaining sites in this group.

ENVIRONMENT

Environmental Description: Sites in this group have significant exposure of bedrock. The bedrock can be vertical, sloping, or horizontal along rivers, at the tops of buttes, in dry canyons, or, rarely, large, low bedrock outcrops. The bedrock is usually sedimentary (sandstone, limestone, shale, gypsum, siltstone), but an area of quartzite outcrops in southwestern Minnesota is included in this group. Soil development is usually limited to cracks, ledges, or depressions in the bedrock.

DISTRIBUTION

***Geographic Range:** This group is found in the Great Plains from near the U.S.-Canadian border south to northern Texas and from the Rocky Mountain foothills to southwestern Minnesota, eastern Kansas and possibly northwestern Iowa and Missouri. The granitic, igneous, and metamorphic formations in the Black Hills and nearby are not included in this group.
Nations: CA, US
States/Provinces: CO, IA?, KS, MB, MN, MO?, MT, ND, NE, NM, OK, SD, TX, WY
USFS Ecoregions (2007) [optional]: 251B:CC, 251C:C?, 251E:CP, 251F:CC, 251H:CC, 315A:CC, 315B:CC, 315F:CC, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331K:CP, 331L:CC, 331M:CC, 331N:CC, 332A:CP, 332B:CC, 332C:CC, 332D:CC, 332E:CP, 332F:CC, 342F:PP, M313B:PP, M331B:PP, M331F:PP, M331I:PP
Omernik Ecoregions L3, L4 [optional]:
MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**
***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate
USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

Elcode	Scientific or Colloquial Name
A3981	Great Plains Acidic Cliff Alliance
A3982	Great Plains Acidic Rock Outcrop Alliance
A3980	Great Plains Alkaline Cliff Alliance

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

Date	Predecessor	Note

RELATED CONCEPTS

Supporting Concepts [optional]:

Relationship to NVC	Supporting Concept Name	Short Citation	Note

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)

Relationship to NVC	Name Used in Source	Short Citation	Note

***Author of Description:** J. Drake
Acknowledgments [optional]:
Version Date: 08 May 2015

REFERENCES

***References [Required if used in text]:**

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, M. Russo, K. Schulz, K. Snow, J. Teague, and R. White. 2003-present. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, VA.

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2018. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

MNNHP [Minnesota Natural Heritage Program]. 1993. Minnesota's native vegetation: A key to natural communities. Version 1.5. Minnesota Department of Natural Resources, Natural Heritage Program, St. Paul, MN. 110 pp.