INTERNATIONAL ECOLOGICAL CLASSIFICATION STANDARD:

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Nantahala - Pisgah National Forests Final Report

April 30, 2004

by

NatureServe

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This subset of the International Ecological Classification Standard covers vegetation associations and alliances attributed to the Nantahala - Pisgah National Forests (North Carolina)**.** 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 Milo Pyne milo_pyne@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.

PREFACE

This report is a final product resulting from a continuing agreement between NatureServe, The Nature Conservancy (TNC) and USDA Forest Service Region 8. This agreement provides for the application of the United States National Vegetation Classification (USNVC) standard to all Region 8 National Forests, resulting in a basic list of vegetation units (alliances and community associations) presented on a Forest by Forest basis. The USNVC provides a framework for vegetation classification and is intended to serve as a tool for conservation planning and biodiversity protection, as well as resource planning, management, and vegetation mapping. In the southeastern United States, the USNVC is being developed in cooperation with the state Natural Heritage Programs, the USDA Forest Service, and other state and Federal partners. Its development has involved consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications.

This classification subset includes all alliances and community associations attributed to the Nantahala - Pisgah National Forest (North Carolina), as well as some that are thought to occur there but for which more data are needed to confirm their occurrence. This report is intended for review and use by Forest Service personnel and other ecologists working in this geographic area. The fieldwork supporting development of this subset took place primarily in 1994-1995, during the early life of this project. This field reconnaissance was conducted in coordination with U.S. Forest Service personnel with the objective of visiting representative examples of all the major vegetation types, rare or unusual communities, and vegetation resulting from common forest management regimes. The classification has benefited enormously from the analysis of a large regional dataset, which integrated the work of numerous researchers.

We hope that the issuance of this report will stimulate the need for contued vegetation survey work on these National Forests, which occupy critical areas in the globally significant Southern Blue Ridge ecoregion, and whose conservation is critical for maintaining the biodiversity of North Carolina.

The vegetation classification produced through this agreement will form the foundation for continuing use of the USNVC on U.S. Forest Service lands in Region 8 for natural resource planning and management. The classification continues to rely on feedback and additional fieldwork to improve its coverage of the individual Forest unit. Future refinements, revisions, and additions will be made to this classification based on review by Forest Service personnel, review of other vegetation studies, and analysis of data collected during field reconnaissance. In the meanwhile, the entire National Vegetation Classification is available on-line in a fully searchable database that is updated on a quarterly basis (www.NatureServe.org).

Comments and suggestions for additions or revisions are welcome and encouraged. Please submit comments to the authors at the following address: NatureServe; Southern U. S. Office, 6114 Fayetteville Road, Suite 109, Durham, NC 27713-6284 or by phone or electronic mail: Milo Pyne: 919-484-7857 x 136 (milo_pyne@natureserve.org).

ACKNOWLEDGMENTS

We gratefully acknowledge the cooperation and participation of the USDA Forest Service and its personnel in the National Forests of North Carolina for assistance in planning, logistics and access to areas investigated in the course of this work. Steve Simon, Gary Kauffman, and Dave Danley were especially helpful in this regard. To a considerable extent, the classification is based on the analysis of a large dataset of about 3,000 plots collected by a variety of individuals, including Karen Patterson (presently with the Virginia Natural Heritage Program and formerly of The Nature Conservancy and NatureServe), Claire Newell, Steve Simon, and Chris Ulrey. Henry McNab of the Forest Service provided invaluable feedback and review. Alan Weakley (formerly of The Nature Conservancy and NatureServe), Mike Schafale of the North Carolina Natural Heritage Program, Dr. Tom Wentworth of North Carolina State University, and Dr. Bob Peet of the University of North Carolina at Chapel Hill have also led efforts for data collection and analyses that shaped this classification, in particular related to the activities of the North Carolina Vegetation Survey.

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INTRODUCTION

Background

NatureServe (formerly the Association for Biodiversity Information [ABI]) is a not-for-profit organization dedicated to developing and providing knowledge about the world's natural diversity. Working in partnership with 75 independent Natural Heritage programs and conservation data centers that gather scientific information on rare plants and animals and ecosystems in the U.S., Latin America, and Canada, NatureServe is a leading source for the biodiversity information that is essential for effective conservation action.

NatureServe was formed in July 1999 when The Nature Conservancy and the Natural Heritage Network jointly established an independent organization to achieve their mutual goal of advancing the application of biodiversity information to conservation. Although NatureServe is a new organization, its databases, staff expertise, and methods reflect more than 25 years of experience, research, and development. NatureServe addresses biodiversity information needs at the regional, national, and international levels, complementing the availability of detailed state or province-level information from individual Natural Heritage programs.

NatureServe is continuing to implement and advance approaches to the conservation of biological diversity that have been employed since 1975 by The Nature Conservancy (TNC) and the Network of Natural Heritage Programs. One component of this methodology is referred to as a "coarse filter/fine filter" approach to biological diversity conservation (Jenkins 1976, Hunter 1991). This methodology involves the identification and protection of ecological communities (coarse filter) as well as rare species (fine filter). Identifying and protecting representative examples of all ecological communities assures the conservation and maintenance of biotic interactions and ecological processes, in addition to conservation of most species. Those species whose conservation is not adequately assured through the conservation of communities -- those that fall through the coarse community filter -- are generally the rarest species. These species often have specialized life histories, or are simply so rare and restricted that their conservation requires explicit planning based on species-specific information. Using a combination of communities and species as conservation targets ensures protection of a more complete spectrum of biological diversity.

A major obstacle to using ecological communities as conservation units for national, regional, and global projects was the lack of a consistent classification system, developed through analysis of community data from a range-wide perspective. NatureServe and TNC, in conjunction with the network of Natural Heritage Programs and Conservation Data Centers, began developing a standardized, hierarchical vegetation classification system. This system, known as the International Ecological Classification Standard (IECS) (formerly called the International Classification of Ecological Communities [ICEC]), has now been used to classify and describe terrestrial communities across the United States and other parts of the world (Grossman *et al*. 1994, Grossman *et al*. 1998).

For the past decade, TNC, NatureServe and the international network of Natural Heritage Programs and Conservation Data Centers (CDC) have been developing the IECS. Within the United States, the domestic component of the international effort, the United States National Vegetation Classification (USNVC), has received widespread support from state, federal, academic, and international partners (Jennings 1993, Greenall 1996, Loucks 1996, FGDC 1997). For the first time, vegetation of all types, whether mountain bogs, shortleaf pine woodlands, or limestone glades can be treated together in one system. This classification serves many natural resource management purposes including conservation planning, biodiversity protection, scientific research, inventory, and mapping.

Many details of the classification are presented in a series of documents by NatureServe's Community Ecology Group (formerly TNC) (Grossman et al.1998, Anderson et al.1998, Maybury 1999). These documents include detailed background on the structure and development of the classification and are available on NatureServe's public web site (www.natureserve.org) under the Biodiversity Information/Ecological Communities link.

Purpose and Scope of the USNVC

The purpose of the USNVC classification system is to provide a complete, standardized listing and description of all vegetation types that represent the variation in biological diversity at the community level, and to identify those communities that require protection (Grossman et al. 1994). The shared mission of NatureServe and The Nature Conservancy is the protection of biodiversity; this, along with conservation planning, is also the principal objective for the development of the classification. The classification will be consistent throughout the United States and elsewhere at appropriate scales for conservation planning, and management, and long-term monitoring of ecological communities and ecosystems. It will also have applications as a vegetation data layer in landscape and ecosystem characterization and mapping.

Classifications of ecological systems can be based on a variety of biotic and abiotic factors including hydrology, soils, landform, and vegetation that may be used in combination or individually. The IECS classification approach presented here is based on vegetation because it is a biotic factor and hence a measurement of biodiversity, which NatureServe and TNC are directed to protect. Moreover, it integrates environmental conditions, ecological processes, and biogeographical dynamics at a site more measurably than any other

factor or suite of factors (Mueller-Dombois and Ellenberg 1974, Kimmins 1997); it is often used to infer soil and climate patterns; and it can be easily measured.

The USNVC has been developed for terrestrial vegetation, that is, all upland terrestrial vegetation and all wetland vegetation with rooted vascular plants. In relation to Cowardin et al. (1979), terrestrial includes those portions of the palustrine, lacustrine, riverine, estuarine, and marine systems that have rooted vegetation. Classification of this vegetation (the Terrestrial System) is distinct from that of unvegetated deep-water habitats (Freshwater and Marine Systems) and unvegetated subterranean habitats (Subterranean System), all of which will have their own classification systems (e.g. Lammert et al. 1997).

The classification system focuses on existing vegetation rather than potential natural vegetation, “climax vegetation”, or physical habitats. The vegetation types described in the classification range from the ephemeral to the stable and persistent. Recognizing and accommodating this variation is fundamental to protecting biodiversity. The manner in which a community occurs is, in part, an intrinsic property of the vegetation itself. A classification that is not restricted to static vegetation types ensures that the units are useful both for inventory/site description, and as the basis for building dynamic ecological models.

The USNVC includes vegetation occurring anywhere along the continuum of "natural" to “invasive” to “cultural", but it emphasizes vegetation types that are "natural" since these communities are the focus of biodiversity protection. Broadly speaking, natural types include a range of naturalness, namely, "natural" (narrowly defined), "semi-natural" and "modified" vegetation, which together reflect differences in anthropogenic disturbance regimes. However, all natural types occur spontaneously without regular human management, maintenance, or planting, and generally have a strong component of native species (see below). Natural vegetation, narrowly defined, includes plant communities that appear not to have been modified by human activities or only those human activities that mimic natural processes (e.g. prescribed burning). The term semi-natural can include “plant communities where the structure of vegetation has been changed through human activities, but where the species composition is natural” (van der Maarel and Klötzli 1996). In contrast to natural vegetation, then, "cultural" vegetation can be recognized as that which includes planted/cultivated vegetation types. Cultural, modified and exotic vegetation is classified in the USNVC at a much coarser scale than natural and semi-natural vegetation, but other organizations and agencies may refine these coarse units further. To date, most units described with the finest levels in the classification system (association) have been natural and semi-natural types. However, when necessary, modified, cultural and exotic types have been identified in the classification system, especially for the purpose of vegetation mapping. Exotic vegetation is differentiated at association level.

The USNVC has a hierarchical taxonomic structure that is a combination of physiognomic and floristic systems. The rationale for coupling physiognomic and floristic systems has developed over many years (e.g., Rübel 1930, Whittaker 1962, Ellenberg 1963, Webb et al. 1970, Westhoff 1967, Beard 1973, Werger and Spangers 1982, Borhidi 1991). These studies have found a good correlation between floristic and physiognomic classifications of the same vegetation. In the United States, Driscoll et al. (1984) recommended the development of a joint system using the physiognomic units of UNESCO (1973) and the floristic units of habitat types, of which an example has been provided by Dick-Peddie (1993) for New Mexico. The USNVC uses a similar methodology. Vankat (1990) developed a physiognomic-dominance type classification for forest types in North America. Strong et al. (1990) in Canada also proposed a combined physiognomic-floristic approach.

A Combined Physiognomic/Floristic System

The hierarchy of the classification system employs physiognomic criteria at the highest levels and floristic criteria at the lower levels. The formation concept, with units modified from UNESCO (1973), guides the definition of the physiognomic units, and the association and alliance concepts define the floristic units (see Figure 1 and Table 1**).** This system allows the broad-scale geographic application of physiognomic characteristics to be tied to local, site-specific, floristically-defined units. In combination, these hierarchical levels can satisfy a broad range of objectives for use in a single classification system.

FIGURE 1. VEGETATION CLASSIFICATION SYSTEM.

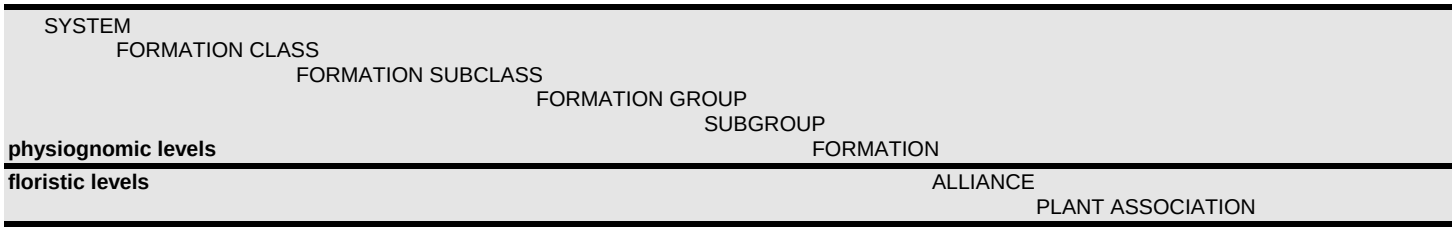

TABLE 1. HIERARCHICAL VEGETATION CLASSIFICATION SYSTEM FOR TERRESTRIAL ECOLOGICAL COMMUNITIES. (Examples)

CLASS	FOREST	WOODLAND	SHRUBLAND
SUBCLASS	Deciduous Forest	Evergreen Woodland	Deciduous Shrubland
GROUP	Cold-deciduous Forest	Temperate or Subpolar Needle-leaved Evergreen Woodland	Temperate Broad-leaved Evergreen Shrubland
SUBGROUP	Natural/Semi-natural	Natural/Semi-natural	Natural/Semi-natural
FORMATION	Lowland or Submontane Cold-deciduous Forest	Saturated Temperate or Subpolar Needle-leaved Evergreen Woodland	Sclerophyllous Temperate Broad-leaved Evergreen Shrubland
ALLIANCE	*Quercus stellata - Quercus marilandica* Forest Alliance	*Pinus palustris* Saturated Woodland Alliance	*Quercus havardii* Shrubland Alliance
ASSOCIATION	*Quercus stellata - Quercus marilandica – Carya (glabra, texana) / Vaccinium arboreum* Forest	*Pinus palustris / Leiophyllum buxifolium / Aristida stricta* Woodland	*Quercus havardii - (Penstemon ambiguus, Croton dioicus) / Sporobolus giganteus* Shrubland

The combined physiognomic/floristic system developed by TNC/NatureServe allows identification of units from both a "top-down" (divisive) and "bottom-up" (agglomerative) approach. The top-down approach allows the use of physiognomic distinctions to help map vegetation, to stratify sampling, and to delimit vegetation units where floristic information is lacking. A bottom-up approach employs plot sampling and floristic analysis as the primary means for defining associations. Where physiognomy is variable, the bottom-up approach can also be used to help determine the important physiognomic distinctions. The relationships between physiognomy and floristics are not always simple; when they do not correspond, precedent may be given to the floristic relationships over the physiognomic structure.

The basic unit of inventory, the plant association or community element, is more or less uniform in structure, composition, and habitat. The uniformity of the plant community makes the comparison and identification of protection priorities more objective than would be possible at more heterogeneous scales. The plant association is a suitable unit for conservation planning because it encompasses all the layers of vegetation in a stand, reflects ecological and human-caused processes including management activities, and is a repeating unit in different landscapes. From a site-based perspective, there may be many different community types at a given location. In fact, it is relatively rare that a site contains only a single community type. However, community elements tend to combine in predictable ways to create repeatable landscape mosaics. Thus the particular mosaic of community elements present at a site and their distribution across the landscape provide information that is fundamental to any type of ecological land management.

The rationale for coupling physiognomic and floristic systems has been developed over the years (e.g., Rubel 1930, Whittaker 1962, Ellenberg 1963, Webb *et al*. 1970, Westhoff 1967, Beard 1973, Werger and Spangers 1982). These studies have found a good fit between floristic and physiognomic classifications of the same vegetation. In the United States, Driscoll *et al*. (1984) recommended the development of a joint system using the physiognomic units of UNESCO (1973) and the floristic units of habitat types, of which an example has recently been provided by Dick-Peddie (1993) in New Mexico. Vankat (1990) developed a physiognomic-dominance type classification for forest types in North America. Strong *et al*. (1990) in Canada also proposed a combined physiognomic-floristic approach. In addition, Specht *et al*. (1974) used the joint approach to develop a conservation evaluation for Australian plant communities.

Terrestrial Vegetation; “Natural” and “Semi-natural” Types

The TNC physiognomic-floristic classification has been developed for terrestrial vegetation, that is, all upland terrestrial vegetation and all wetland vegetation with rooted vascular plants. In relation to Cowardin *et al*. (1979), terrestrial includes those portions of the palustrine, lacustrine, riverine, estuarine, and marine systems that have rooted vegetation. Classification of this vegetation (the Terrestrial System) is distinct from that of unvegetated deep-water habitats (Freshwater and Marine Systems) and unvegetated subterranean habitats (Subterranean System), all of which will have their own classification systems (e.g. Lammert *et al*. 1997).

The USNVC includes all existing vegetation, occurring anywhere along the continuum of "natural" to “cultural", but TNC has emphasized vegetation types that are "natural" since these communities are the focus of biodiversity protection. The classification system separates natural/semi-natural types from cultural types at a certain level in the hierarchy (the formation subgroup, see table 1). Broadly speaking, natural types include a range of naturalness, namely, "natural" (narrowly defined), "semi-natural" and "modified" vegetation, which together reflect differences in anthropogenic disturbance regimes. All natural types occur spontaneously without regular human management, maintenance, or planting, and generally have a strong component of native species. More specifically, "natural" vegetation includes plant communities that appear not to have been significantly modified by human activities, and "semi-natural" vegetation includes plant communities where the structure of vegetation has been noticeably changed through human activities, but where the species composition is unchanged (van der Maarel and Klotzli 1996). In contrast to natural vegetation, then, "cultural" vegetation can be recognized as that which includes planted/cultivated vegetation types. For cultural and modified vegetation, TNC classifies at a much coarser scale than for natural and semi-natural vegetation, but other organizations and agencies may refine these coarse units further. To date, most units described with the finest levels in the classification system have been natural and semi-natural

types. However, when necessary, modified and cultural types have been identified in the classification system, especially for the purpose of vegetation mapping.

Physiognomic Levels: Description And Definitions

The hierarchy for the Terrestrial System has seven levels, with five physiognomic levels (formation class, formation subclass, formation group, formation subgroup and formation) and two floristic levels (alliance and association), see Figure 1. The basic unit of the physiognomic portion of the classification is the "formation", a "community type defined by dominance of a given growth form in the uppermost stratum (or the uppermost closed stratum) of the vegetation, or by a combination of dominant growth forms" (Whittaker 1962, see also Schrader-Frechette and McCoy 1993). In practice, formations are defined by varied, conventionally-accepted combinations of growth-form dominance and characteristics of the environment (e.g., cold-deciduous alluvial forests, rounded-crowned temperate needle-leaved evergreen forest, seasonally flooded perennial forb vegetation).

The physiognomic portion of the classification is based upon the UNESCO (1973) world physiognomic classification of vegetation, which was modified and refined to provide greater consistency at all hierarchical levels and to include additional physiognomic types. Some of the revisions made by Driscoll *et al*. (1984) for the United States were incorporated, and the international scope was expanded.

Compatibility with other systems was also a consideration in the development of the physiognomic levels. The subclass level of UNESCO was modified and a new Formation Subgroup that separates natural vegetation from cultural vegetation was added to better conform to the Federal Geographic Data Committee's (FGDC) standards for vegetation classification (FGDC 1997). Hydrological modifiers based on Cowardin *et al*. (1979) also were added at the formation level since they have been used extensively to map wetlands across the United States. Each of the physiognomic levels is described in more detail by Grossman *et al*. (1998).

Floristic Levels: Description And Definitions

Since this report focuses on the floristic levels of the USNVC, the alliance and the association, the following sections provide more detail about these classification units.

THE ALLIANCE CONCEPT

The alliance is a physiognomically uniform group of plant associations (see Association definition below) sharing one or more diagnostic species (dominant, differential, indicator or character), which, as a rule, are found in the dominant and/or uppermost strata of the vegetation (Mueller-Dombois and Ellenberg 1974). Dominant species are often emphasized in the absence of detailed floristic information (such as quantitative plot data), whereas diagnostic species (including characteristic species, dominant differential, and other species groupings based on constancy) are used where detailed floristic data are available (Moravec 1993). The alliance level includes existing (not just “climax” or potential) vegetation types.

For forested communities, the alliance is similar to the “cover type” of the Society of American Foresters (Eyre 1980), developed to describe the forest types of North America. An alliance is equivalent to a cover type when the dominant species also have diagnostic value. The alliance may be finer than a cover type when the dominant species extend over large geographic areas and varied environmental conditions especially when a diagnostic species occurs in different climate zones or in both upland and wetland situation. The concept for the alliance is also similar to the concept of the “series”, a concept developed by the Habitat Type System to group habitat types that share the same dominant species under climax conditions (Daubenmire 1952, Pfister and Arno 1980). Alliances, however, are described by the diagnostic species for all existing vegetation types, whereas series are restricted to climax types and are described by the primary dominant species (see Pfister and Arno 1980).

Examples include:

- *Fagus grandifolia - Quercus alba* Forest Alliance;
- *Quercus alba – (Quercus rubra, Carya* spp.*)* Forest alliance
- *Nyssa (aquatica, biflora, ogeche)* Pond Seasonally Flooded Forest Alliance
- *Fagus grandifolia - Magnolia grandiflora* Forest Alliance
- *Pinus pungens - (Pinus rigida)* Woodland Alliance
- *Quercus stellata – Quercus marilandica* Woodland Alliance
- *Cephalanthus occidentalis* Semipermanently Flooded Shrubland Alliance
- *Alnus serrulata* Saturated Shrubland Alliance
- *Andropogon virginicus* Herbaceous Alliance

The use of a joint physiognomic-floristic classification influences the alliance concept developed in the national classification. The alliance is constrained both by the floristic patterns of the associations it contains and by the physiognomic-ecologic patterns of the formation that it represents. From a top-down perspective, this facilitates identification of alliances. Information from a wide variety of sources that describes the dominant species of different formations (e.g., wet meadows, saturated peatlands, or temperate broad-leaved evergreen forests) can be used to develop some initial floristic groupings. From a bottom-up perspective, however, this may lead to alliances that differ physiognomically, but otherwise share many species in common. Associations that share a number of dominant or diagnostic species may be placed under different alliances that are in separate formations.

Guidelines for alliance nomenclature are as follows. Dominant and diagnostic species are identified from the dominant and/or top strata of the vegetation. Species placed in parentheses are less consistently found in all associations of the alliance, and the names within parentheses generally are listed alphabetically. Vascular plant species nomenclature follows the nationally standardized list, Kartesz (1999), with very few exceptions. Nomenclature for nonvascular plants follows Anderson (1990), Anderson *et al.* (1990), Egan (1987, 1989, 1990), Esslinger and Egan (1995), and Stotler and Crandall-Stotler (1977). Alliance names include the formation class in which they are listed, e.g., *Pinus ponderosa* Forest Alliance. For wetland alliances, the hydrologic regime that the alliance is found in is always provided for clarity, e.g., *Acer saccharinum* Temporarily Flooded Forest Alliance. Therefore, all alliances that have no hydrological modifier are upland alliances. Environmental or geographic descriptors are used sparingly, to more clearly separate alliances with the same nominal species or to provide clarity when differential species are not yet known (e.g., *Quercus stellata* Flatwoods Forest Alliance; *Acer grandidentatum* Montane Forest Alliance; *Taxodium ascendens* Tropical Woodland Alliance).

THE ASSOCIATION CONCEPT

The association (or plant association) is the finest level of the classification system. For the terrestrial system, plant association is defined as "a plant community of definite floristic composition, presenting a uniform physiognomy, and growing in uniform habitat conditions" (Flahault and Schroter 1910). This basic concept has been used by most schools of vegetation classification (Whittaker 1962, Braun-Blanquet 1965, Westhoff and van der Maarel 1978). In this traditional sense, the plant association concept applies to existing vegetation regardless of successional status. The terms "association", "plant association", "community", and "community association" are used interchangeably.

The plant association is differentiated from the alliance level by additional plant species, found in any stratum, which indicate finer scale environmental patterns and disturbance regimes. This level is derived from analyzing complete floristic composition of the vegetation unit when plot data are available. In the absence of a complete data set, approximation of this level is reached by using available information on the dominant species or environmental modifiers, and their hypothesized indicator species. NatureServe will primarily use the plant association as the level at which community inventory and conservation action are aimed.

While this definition of a plant association is still generally accepted as an international standard, a few clarifications of the use of the definition for the USNVC may be helpful:

- "Habitat" refers to the combination of environmental conditions and ecological processes influencing the community.
- Uniformity of physiognomy and habitat conditions may include patterned heterogeneity (*e.g.*, hummock/hollow).
- As a rule, community elements occur repeatedly over the natural landscape.
- The scale of the community element varies. Among other factors, the variation is determined by the size and apparent homogeneity of the occurrences across the landscape, the amount of data that has been collected and the interpretation of these data by the field experts.
- The community element may be composed of a complex of plant associations that constitutes a functioning ecological unit if the plant associations always occur together (e.g., prairie mound and intermound, wooded ridge and swale complex).

Associations are named with one or more species from the alliance name, and have additional species that represent dominants or indicators from any layer of the vegetation. Associations are named with one or more component plant species, separated by punctuation to indicate strata, followed by a descriptor of the physiognomic class. Strata are separated by the 'forward slash' /, while species within strata are separated by hyphens. Nominal species which are substantially inconstant, that is, often absent in a given occurrence (stand) of the type, are placed in parentheses. Within a stratum, parenthetic species are always placed following nonparenthetic (more constant) species. If more than one species in a stratum is parenthetic, the species are separated by commas and alphabetized. For instance, the *Pinus palustris - Pinus (echinata, taeda)* Woodland can include stands dominated by a mixture of *Pinus palustris* and either or both *Pinus echinata* and *Pinus taeda*. An environmental or geographic descriptor such as wetland, mesic, serpentine, etc., are used sparingly, when species composition for a type is not known well enough to provide full representation using only species in a name. When an environmental/geographic descriptor is used, it is inserted between the floristic nominals and the class descriptor.

EXAMPLES: *Quercus palustris - Quercus bicolor - Quercus macrocarpa - Acer rubrum* Sand Flatwoods Forest
Quercus falcata - Quercus alba - Carya spp. Interior Plateau Forest

[Association name = floristic nominals in stratal order + [optional environmental/geographic descriptor] + class descriptor]

In theory, additional data will allow a modification to the name (for instance, addition of another nominal) to clearly separate this association from similar associations, and then the environmental/geographic descriptor will be unnecessary.

When an association has several layers, an attempt is made to include species that are dominants or indicators from at least the two most dominant layers. Indicator species are those species, other than dominants, which have been chosen to distinguish an association or alliance from others like it, or to indicate specific environmental conditions that have a controlling influence on vegetation in the community. However, the indicator species are seldom limited to the association. For instance, *Sideroxylon lanuginosum* is added to the name of the Gulf coast shell midden woodland to distinguish this type from its close relative, the Atlantic coast shell midden woodland, since its range does not extend onto the Atlantic Coast. At the same time, this *Sideroxylon* species is present in other communities along the Gulf Coast and in the lower Midwest.

The Purpose of Naming

The purpose of naming is, in a sense, obvious, but bears restating. The primary purpose of naming the units in a classification is to create a label for the units, to facilitate unambiguous communication. A secondary goal is to create a name which is meaningful and easy to remember and use (mnemonic). These purposes are somewhat in conflict. The primary purpose of an unambiguous label is met by 'Community association 2546', but such a label is not meaningful or easy to remember. A long descriptive name is meaningful, but difficult to remember and use. To meet these varying requirements, we try to create a name that is a good compromise between these needs. We also use codes and common names to achieve these sometimes conflicting needs.

While it is tempting to interpret the floristic name of an association as a shorthand description of the community, it is important to remember that the name is not a description. The name does not describe an association any more than the name of a species describes it. An association is defined by more than the nominal species used in its names -- it is defined as well based on relative similarity of overall floristic composition, vegetation structure, and environment. One does not expect to be able to recognize *Quercus alba* because it is an oak and white, or *Quercus virginiana* because it is an oak and "from Virginia". Each association in the classification has (or will have) a detailed description of the floristic composition, physiognomic structure, environment (soils, geology, hydrology, climate, etc.), dynamics (fire, flooding, succession, etc.), geographic distribution, and taxonomic distinction from similar associations.

Ideally, the name of an association should provide, to a person relatively knowledgeable about the vegetation of an area and familiar with the taxonomic and nomenclatural principles of the classification, a clear indication of the type. Thus, community names are more meaningful or descriptive than the names of species, but do not purport to provide a full diagnosis or description of the type.

In this report, at least three identifiers are provided for each association. The **NVCS association name** (or Global Name) is the scientific name of the association and uses Latin names of component species (as described above). The **Database Code** (or Element Code) is a unique, 10 character code assigned to each association in the USNVC. However, in this report the **Common Name,** which is an informal, descriptive name, is the identifier used at the beginning of each association description. Where Common Names have not been developed, a **Translated Name** (using common names instead of scientific names for nominal species) is provided. Since Common Names have not been standardized, the Element Code or Global Name should be use when querying any USNVC database or when providing input about the USNVC.

Applications of the Classification System

CONSERVATION RANKING AND ITS USE IN PLANNING

The ability to apply conservation ranks to vegetation units is integral to the success of the classification system as a tool in biodiversity conservation. Associations are ranked by their relative endangerment to determine their relative conservation priority. These ranks are based on factors such as present geographic extent, threats, number of distinct occurrences, degree of decline from historic extent, and degree of alteration of natural processes affecting the dynamics, composition, or function of the type. Ranks are customarily assigned by the various members of the Natural Heritage Programs and of the national, regional, and state offices of NatureServe. For a given community type, ranks are assigned at three declining hierarchical levels of geography, from global or rangewide (the Global Rank or GRANK), through national or country (the National Rank or NRANK), to state, province, or other subnational unit (the State Rank or SRANK). A numeric scalar of 1 to 5 is added, with 1 indicating critical imperilment due to rarity, endemism, and/or threats, and 5 indicating little or no risk of extirpation or elimination. For example, a rank of G1 indicates critical imperilment on a rangewide basis, i.e. a great risk of "extinction" of the type worldwide; S1 indicates critical imperilment within a specific state, province, or other subnational jurisdiction, i.e. a great risk of extirpation of the type from the subnation.

When detailed information is available, two primary ranking factors are used in assessing the appropriate conservation status rank for a community element: (1) the total number of occurrences and (2) the total area (acreage) of the element. Secondary ranking factors such as the geographic range over which the element occurs, the threats to the occurrences, and the viability of the extant occurrences also affect the rank.

Although community ranking is best done when information on all the factors listed above is available, it is often necessary to establish preliminary ranks when this information is lacking or incomplete. This is particularly true for communities that have not been well described. In practice, four main factors have been useful in arriving at a preliminary assessment of a community's rangewide (global) rank:

1. The geographic range over which the type occurs.
2. The long term decline of the type across this range.
3. The degree of site specificity exhibited by the type.
4. The rarity across the range based on state ranks assigned by state Natural Heritage Programs.

Most of the ranks currently applied to USNVC types are based on such preliminary assessments of rarity.

Imperiled community types (and species), those ranked G1 through G3, are often regarded as the principal targets for conservation action, although NatureServe is dedicated to the conservation of all native community types. Special attention is generally given to taxa of high endangerment, as opportunities for their conservation may be limited in space and time. However, some highly ranked community types may be essentially secure because of their occurrence in areas that are remote from human alteration, that already have high degrees of protection, or that are unsuitable as human habitat. Others are essentially secure because of their intrinsic resistance to alteration or degradation. The conservation status of highly ranked communities should be assessed and steps should be taken to ensure their adequate protection.

More common and less imperiled community types, those ranked G4 and G5, are also conservation priorities. In most parts of the world, these more common community types have generally been highly altered and degraded by human action, and have often also been fragmented and their functioning impaired. For the conservation of many rare and common species, these relatively secure communities are of critical importance. In North America, a large tract of a common vegetation type in pristine condition that occurs in an essentially intact landscape with relatively intact ecological processes is of high priority for conservation. Though the type itself is common, large, high quality examples are rare and the opportunity to conserve such an example may be very limited. Generally, the conservation of lower ranked community types should be focused on examples in especially good condition, of large extent, with high landscape integrity/connectivity, and with ancillary conservation benefits. Because a primary purpose of the USNVC is to help set conservation priorities for natural community types, the recognition and naming of units reflects their relative naturalness. There generally exists a strong correlation between naturalness and conservation priority.

The dynamic nature of vegetation presents some additional complications in the evaluation of the naturalness and conservation priority of community units. Early- and mid-seral vegetation may be readily classifiable as distinct in composition and physiognomy from later seral vegetation, but may be transient on the landscape. Transience makes this vegetation difficult to "track" or monitor over time and the conservation of seral sequences will generally be dependent on the conservation of large landscapes that contain a mosaic of seral stages.

Also, disturbances cannot be clearly and cleanly classified as "natural" or "anthropogenic". Some anthropogenic disturbances are similar enough to natural disturbances that the resulting successional communities cannot be clearly distinguished, while others may create unique and unprecedented communities that do not occur in the natural landscape.

We therefore have developed categories and a resulting ranking system for communities that go beyond those used for species conservation. The various ranks used for communities presented in this document are listed and briefly described in Table 2. For further information on ranking see Master (1991).

TABLE 2: Global Rank Definitions

GX ELIMINATED throughout its range, with no restoration potential due to extinction of dominant or characteristic species.

GH PRESUMED ELIMINATED (HISTORIC) throughout its range, with no or virtually no likelihood that it will be rediscovered, but with the potential for restoration (e.g., *Castanea dentata* Forest).

G1 CRITICALLY IMPERILED
Generally 5 or fewer occurrences and/or very few remaining acres or very vulnerable to elimination throughout its range due to other factor(s).

G2 IMPERILED
Generally 6-20 occurrences and/or few remaining acres or very vulnerable to elimination throughout its range due to other factor(s).

G3 VULNERABLE
Generally 21-100 occurrences. Either very rare and local throughout its range or found locally, even abundantly, within a restricted range or vulnerable to elimination throughout its range due to specific factors.

G4 APPARENTLY SECURE
Uncommon, but not rare (although it may be quite rare in parts of its range, especially at the periphery). Apparently not vulnerable in most of its range.

G5 SECURE
Common, widespread, and abundant (though it may be quite rare in parts of its range, especially at the periphery). Not vulnerable in most of its range.

GU UNRANKABLE
Status cannot be determined at this time.

G? UNRANKED
Status has not yet been assessed.

GC PLANTED/CULTIVATED
Vegetation which has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation.

GW INVASIVE EXOTIC
Vegetation dominated by invasive alien species.

GD RUDERAL
Vegetation resulting from succession following anthropogenic disturbance of an area.

GM MODIFIED
Vegetation resulting from the management or modification of natural vegetation, it is readily restorable by management or time, and/or the restoration of ecological processes.

Modifiers and Rank Ranges

? A question mark added to a rank expresses an uncertainty about the rank in the range of 1 either way on the 1-5 scale. For example a G2? rank indicates that the rank is thought to be a G2, but could be a G1 or a G3.

G#G# Greater uncertainty about a rank is expressed by indicating the full range of ranks which may be appropriate. For example, a G1G3 rank indicates the rank could be a G1, G2, or a G3.

Q A "Q" added to a rank denotes questionable taxonomy. It modifies the degree of imperilment and is *only* used in cases where the type would have a *less imperiled* rank, if it were not recognized as a valid type (i.e., if it were combined with a more common type). A GUQ rank often indicates that the type is unrankable *because of* daunting taxonomic/definitional questions.

APPLICATIONS OF THE USNVC BY USDA FOREST SERVICE AND OTHER FEDERAL AGENCIES OF THE UNITED STATES

The USNVC is increasingly used by the federal agencies (including Forest Service, Fish and Wildlife Service, Dept. of Defense, National Park Service, Bureau of Land Management, USGS Biological Resources Division, Environmental Protection Agency, and others), and The Nature Conservancy as a fundamental basis for ecosystem management, natural resource planning, and land management. The various lower hierarchical levels of the USNVC, particularly the alliance and the association, have particularly appropriate uses.

The **U.S. Forest Service**, a long-time user and supporter of this classification effort, is using the alliance level to describe the existing and potential vegetation for the ecoregional provinces, sections, and subsections in the Eastern and Southern Regions (Keys *et al*. 1995). This information is used for determining management and conservation goals. Other potential uses include using the alliance to characterize stand types in forest inventory or to characterize the habitats of wildlife species, including neotropical migrant birds, other birds, and other vertebrate animals. Alliances could easily be aggregated into the USFS "old growth types" or used to map dominant vegetation cover.

The association level is being used to by the Forest Service to describe and classify existing and potential natural vegetation. Individual National Forests throughout the country are using the community associations in the USNVC to conduct inventories of natural plant communities. The conservation status information contained within the USNVC can be used to rank the imperilment status of ecosystems and communities and to assess the conservation needs for both rare and representative community types on National Forest lands. Since rare species are linked to associations in the USNVC, associations can easily be used to help characterize the habitats and habitat needs of Proposed, Endangered, Threatened, and Sensitive (PETS) species. As part of the Forest planning process, the associations can be used to set priorities for representation in Research Natural Areas (RNA) and Special Interest Areas (SIA). Associations can also be used to develop management prescriptions, for prescribed fire, thinning, and other land management and restoration activities.

The **USGS BRD Gap Analysis Program** uses the alliance level of the USNVC to map vegetation using TM satellite imagery on a state level. As a requirement of this program he imagery must be classified at the alliance level, and those states that have not mapped to the alliance level must describe the relationship between their classification units and the alliance units.

The **U.S. Fish and Wildlife Service** is interested in applying the same classification and mapping standards as the NBS/NPS Vegetation Mapping Program for the wildlife refuge system. The Service believes that identifying vegetation communities throughout the National Wildlife Refuge System will improve the management of the System's fish and wildlife resources. Natural community inventories using the USNVC are currently underway on many refuges.

As part of the National Park Service Inventory and Monitoring Program, the **USGS BRD/NPS Vegetation Mapping Program** is currently involved in a long-term project to map the vegetation of all National Park units using the standard classification. This program requires the mapping of vegetation according to the classification, using a minimum mapping unit of 0.5 hectare (about 1 acre) mapped to a standard 1:24,000 scale USGS topographic quadrangle. Alliances or plant associations must be assigned to each vegetation polygon delineated. All vegetation maps, associated vegetation plot data, and accuracy assessment points are geographically referenced and made available in digital form that is GIS compatible.

As part of an assessment of the status of biodiversity, the **Environmental Protection Agency** has sponsored reviews of natural communities in both the Great Lakes region (TNC, Great Lakes Program 1994) and Great Plains (Ostlie *et al*. 1996). The Great Plains review contributed to a thorough review of the identification and status of all natural communities throughout the Great Plains. Follow-up surveys in specific landscapes are being planned. In addition, the agency has sponsored the Midwest Oak Ecosystems Recovery Plan (Leach and Ross 1995), which uses the structure of this classification to define the Midwest oak savanna and woodland types.

Structure and Format of this Report

The descriptions in this report may vary widely in length and level of detail. Some vegetation types are well studied, and well documented; while others are poorly known with little or no published material available. Ecological dynamics, disturbance regimes and successional processes of some vegetation types have also been studied and documented, but for others this sort of information is scanty. The user will find some descriptions to be fairly comprehensive and complete, and others to be missing pieces of information. As part of the USNVC, these descriptions are dynamic and are continuously changing and improving as more information becomes available. In its current form, we consider the classification complete and accurate enough to be usable for the full variety of possible potential applications, and that use will inevitably result in revisions, modifications, and enhancements.

All scientific names for vascular species in the report follow that of Kartesz (1999). Nomenclature for nonvascular plants follows Anderson (1990), Anderson *et al.* (1990), Egan (1987, 1989, 1990), Esslinger and Egan (1995), and Stotler and Crandall-Stotler (1977).

The main body of this report is presented in two sections, both containing vegetation descriptions for the area of interest. The first contains information on associations and the second includes information on alliances.

FORMAT OF ALLIANCE DESCRIPTIONS

The Table of Contents includes an index to alliance descriptions found in this report. The first level of this index is the Class, while the second and third level show the Formation and Alliance. The Formation Code (e.g. I.A. 8.N.b.) shows the position of the alliance within the physiognomic portion of the national classification hierarchy. The Alliance Code (e.g. I.A.8.N.b.14) includes the Formation Code plus a one to three digit counter that is assigned by the national classification database. Additionally listed is an Alliance Key (e.g. A.127), which is a unique identifier assigned to each alliance in the national classification.

Alliance descriptions are arranged in the hierarchical order of the national classification, with alliances in the same formation listed in order of their alliance codes.

Each alliance description is divided into sections and fields of information reported from the national classification database. Figure 3 presents the format of an alliance description with a description of the information contained in each field or section, including caveats about the data in that field or section.

FIGURE 3: ALLIANCE DESCRIPTION CONTENT

Formation
Alliance Code - Scientific Name of the Alliance (Nomenclature follows Kartesz 1999) – (**Alliance Key)**
Translated Name (Common) of the Alliance -

ALLIANCE CONCEPT

Summary: Description of the conceptual borders of the alliance in terms of vegetation composition and structure, expected geographic distribution, and expected environmental factors such as characteristic landscape position, rock type, soil texture, hydrology, etc..

Related Concepts: A list of common synonyms for the alliance from other vegetation or natural community classifications. An exhaustive survey for all possible other names for individual alliances has not been completed. Synonymy is usually provided to the Society of American Foresters (SAF) classification of forest cover types (Eyre 1980), as well as to the first TNC Southeast Regional Ecological Community Classification (Allard 1990). Synonymy to state Heritage Program classifications is also sometimes given, but this synonymy is not fully populated. The synonym is followed by the short citation for the author of the synonym. There often follows a comment on the relationship of the alliance to its synonym ("In part" is the most common comment). "In part" is used to describe a relationship in which the alliance and its synonym overlap to some degree but are not equivalent. Full citations are provided in the Bibliography at the end of this report.

Classification Comments: Text description of any classification questions for the alliance that may not have been addressed in other fields. This includes comments on relationships between similar alliances, comments on the level of documentation for the alliance, discussion of classification problems of individual associations, and reporting of physiognomic variability of the alliance that may affect it's placement in the hierarchy.

ALLIANCE DISTRIBUTION

Range: Text description of the alliance's known or suspected range of distribution. This may be reported by broad geographic regions or a list of states and provinces. A state, province, or country shown without a "?" indicates that the alliance is documented to occur there, or is very likely to occur there. A "?" indicates that the distribution is uncertain or speculative -- the uncertainty often relates to taxonomic questions about the circumscription of the alliance, but sometimes is simply the result of lack of information. For most alliances, this listing is intended to be (and should be) comprehensive. For some alliances, particularly those that are peripheral to our region from north, west, or south (tropical), the listing may only represent partial information, generally biased towards political units or ecoregions in close proximity to our area of concern. Note that a state, may be mentioned in the alliance distribution, but not for any of its associations (see below); this generally indicates that other associations remain to be described in the alliance.

Subnations: A listing of states or provinces where associations in this alliance have been defined. A state, province, or country shown without a "?" indicates that the alliance is documented to occur there, or is very likely to occur there. A "?" indicates that the distribution is uncertain or speculative.

TNC Ecoregions: The distribution of the alliance in ecoregions defined by TNC, with a level of confidence for the alliance's status in that ecoregion. Ecoregion codes from TNC are followed by a colon and letters that indicate confidence in the occurrence of an alliance in each ecoregion. Confidence levels are defined as follows: C = alliance occurrence is certain, P = alliance occurrence is probable, ? = alliance occurrence is possible. Ecoregions that are not listed for an alliance should not necessarily be taken to mean that the alliance absolutely does not occur there. Inventory efforts for many taxonomic groups of vegetation types, and in some geographic areas, are incomplete.

USFS Ecoregions: The distribution of the alliance at the ecoregion section level, with a level of confidence for the alliance's status in that ecoregion section. Ecoregion codes are from Keys et al. 1995. Ecological Units of the Eastern United States -- First approximation (map). A list ecoregion codes and names is included in an appendix at the end of this report. Each code is followed by a colon and letters that indicate confidence in the occurrence of an alliance in each section. Confidence levels are defined as follows: C = alliance occurrence is certain, P = alliance occurrence is probable, ? = alliance occurrence is possible. Sections that are not listed for an alliance should not necessarily be taken to mean that the alliance absolutely does not occur there. Inventory efforts for many taxonomic groups of vegetation types, and in some geographic areas, are incomplete.

Federal Lands: This field lists federal land units (such as National Park Service units, individual National Forests, etc.) within which the alliance occurs. This field is incompletely populated. The intent is to develop a comprehensive listing of the occurrence of vegetation types on the lands of important federal land-managing agencies, especially (in the Southeast) the U.S. Forest Service, Department of Defense, National Park Service, U.S. Fish and Wildlife Service, and Corps of Engineers. Because the field is in the process of being populated, the absence of a federal land management unit should not be considered to indicate that the type is absent on that unit, but the listing of a federal land management unit is generally a reliable indication of the type's likely occurrence there. The information is
currently most complete for U.S. Forest Service units, and for selected other units on which effort has been concentrated.

ALLIANCE SOURCES

References: References listed are those that have contributed directly to the concept of the alliance. It is by no means an exhaustive list of literature which deals with the alliance. The list of references is in a short citation format and the reader should consult the Bibliography at the back of the report for a full citation.

FORMAT OF ASSOCIATION DESCRIPTIONS

The hierarchical nature of the USNVC generally places structurally and compositionally related vegetation types (alliances and associations) near one another. Thus, the Forest Class (vegetation dominated by closed canopies of trees) is followed by the Woodland Class (vegetation dominated by open canopies of trees). All temperate pine forests will be found together in I.A. (Evergreen Forest subclass). Of course, such a linear ordering of types does not and cannot capture all relationships, and sometimes communities that are closely related ecologically are separated widely in the physiognomic hierarchy. For example, temperate live oak Woodlands are grouped together in II.C, separately from the temperate live oak Forests (I.C.). Similarly, related wetland communities, such as tidal flat communities may be found classed all across the hierarchy as Shrublands (III), Dwarf Shrublands (IV) or Herbaceous Vegetation (V).

For this reason, the association descriptions in this report have been organized into ecological groupings rather than following the hierarchical ordering of the upper levels of the USNVC. These groupings are not intended for use as a standard classification level, but are just a way of organizing the report. This ordering is intended to facilitate the use of this document by those unfamiliar with the USNVC hierarchy, by grouping ecologically related associations under a single heading. Additionally, ecological groups may provide another method for aggregating associations into higher level units for mapping or other management purposes.

The Table of Contents includes a index to association descriptions organized by Ecological Groups. The associations are then listed within each group. Within the main body of this report, the ecological group is printed at the beginning of each associations.

Each association description is divided into sections and fields of information reported from the national classification database. Figure 2 presents the format of an association description with a description of the information contained in each field or section, including caveats about the data in that field or section.

FIGURE 2: ASSOCIATION DESCRIPTION CONTENT

ECOLOGICAL SYSTEM

COMMON NAME OF ASSOCIATION

ELEMENT IDENTIFIERS

NVC association: The scientific name (Global name) of the association based on Latin names of dominant or characteristic plant species. The standard name used in the USNVC. (nomenclature follows Kartesz 1999).

Database Code: Element Code (ELCODE). The database code used to identify the association in the national community database (BCD).

Formation: The lowest physiognomic level of the national classification hierarchy. The formation represents a grouping of community types that share a definite physiognomy or structure and broadly defined environmental factors, such as elevation and hydrologic regime.

Alliance: Alliance scientific name based on the Latin names of the dominant or characteristic plant species, followed by the alliance code from the national community database (BCD).

ELEMENT CONCEPT

Summary: A short description of the association including information on physiognomy, landscape setting, dominant species, range, primary environmental characteristics, and any other unique or noteworthy characteristics.

Environment: A description of the most important environmental determinants of the biological composition or structure of this association and/or its subtypes.

Vegetation: Vegetation attributes of the association including species richness, diversity, physiognomic structure, spatial distribution of vegetation, strata height, dominant life-forms, coverage of unvegetated substrate, and additional compositional comments.

Dynamics: Important natural disturbance regimes, successional status, and temporal dynamics for the association.

Similar Associations: Closely related or similar communities which make classification difficult, with comments on how they differ.

Related Concepts:. A list of common synonyms for the association from other vegetation or natural community classifications and the scientific literature. An exhaustive survey for all possible other names for individual associations has not been completed. Synonymy is usually provided to the Society of American Foresters (SAF) classification of forest cover types (Eyre 1980), as well as to the first TNC Southeast Regional Ecological Community Classification (Allard 1990). Synonymy is also given to names used in the scientific literature, especially when that literature has been used as a primary source for development of the taxonomic unit and its description. Synonymy to state Heritage Program classifications is given in the element distribution section (below).The synonym is followed by the short citation for the author of the synonym. Full citations are provided in the Bibliography at the end of this report.

Classification Comments: Additional comments about the association, including comments about classification criteria used to define the association, outstanding classification issues, comments on relationships between similar associations, comments on the level of documentation for the association, comments about the variability among occurrences of the association.

CONSERVATION RANKING & RARE SPECIES

GRank: The Global Element Rank which characterizes the relative rarity or endangerment of the association world-wide and the reason for assigning the Global Element Rank, such as number of occurrences, number of hectares, total area reduction from original, threats, degradation, etc.

High-ranked species: Latin names of high-ranking (G3 or higher) plant species expected to be found within occurrences of this association.

ELEMENT DISTRIBUTION

Range: Description of the association's present range.

Subnations: A listing of states or provinces where the associations are thought to occur. A state, province, or country shown without a "?" indicates that the association is documented to occur there, or is very likely to occur there. A "?" indicates that the distribution is uncertain or speculative.

USFS Ecoregions: The distribution of the association by USFS Ecoregions. Ecoregion codes are from Keys et al. 1995. Ecological Units of the Eastern United States -- First approximation (map) and are listed to as fine a level as possible (Province, Section, Subsection). A list of ecoregion codes and names is included in an appendix at the end of this report. Each code is followed by a colon and letters that indicate confidence in the occurrence of an association at each mapping level. Confidence levels are defined as follows: C = association occurrence is certain, P = association occurrence is probable, ? = association is possible. Ecoregions that are not listed for an association should not necessarily be taken to mean that the association absolutely does not occur there. Inventory efforts for many taxonomic groups of vegetation types, and in some geographic areas, are incomplete.

Federal Lands: This field lists federal land units (such as National Park Service units, individual National Forests, etc.) within which the association occurs. Federal units where an association is predicted to occur, but on which it has not been documented, are marked with a question mark (?). This field is incompletely populated. The intent is to develop a comprehensive listing of the occurrence of vegetation types on the lands of important federal land-managing agencies, especially (in the Southeast) the U.S. Forest Service, Department of Defense, National Park Service, U.S. Fish and Wildlife Service, and Corps of Engineers. Because the field is in the process of being populated, the absence of a federal land management unit should not be considered to indicate that the type is absent on that unit, but the listing of a federal land management unit is generally a reliable indication of the type's likely occurrence there. The information is currently most complete for U.S. Forest Service units, and for selected other units on which effort has been concentrated.

ELEMENT SOURCES

References: This is a listing (by no means complete at this time) of literature which deals with the association. References listed are those that have contributed directly to its development. The list of references is in a short citation format and the reader should consult the Bibliography at the back of this report for a full citation.

The final section of this report includes a bibliography of references relevant to the alliances and associations included herein.

Comments regarding the content of the classification are welcomed and encouraged. Please submit comments and suggestions to the authors at the following address: NatureServe, Southern U.S. Office; 6114 Fayetteville Road Suite 109, Durham, NC 27713; or by electronic mail to:Milo Pyne: milo_pyne@natureserve.org.

REFERENCES CITED

Anderson M., P. Comer, D. Grossman, C. Groves, K. Poiani, M. Reid, R. Schneider, B. Vickery, A. Weakley. 1999. Guidelines for Representing Ecological Communities in Ecoregional Conservation Plans. The Nature Conservancy. Arlington, Virginia, USA. 74 p.

Anderson, M., P. Bourgeron, M. T. Bryer, R. Crawford, L. Engelking, D. Faber-Langendoen, M. Gallyoun, K. Goodin, D. H. Grossman, S. Landaal, K. Metzler, K. D. Patterson, M. Pyne, M. Reid, L. Sneddon, and A. S. Weakley. 1998. International classification of ecological communities: terrestrial vegetation of the United States. Volume II. The National Vegetation Classification System: list of types. The Nature Conservancy, Arlington, Virginia, USA.

Beard, J. S. 1973. The physiognomic approach. Pp. 355-386 *in* R. H. Whittaker (ed.). Ordination and classification of communities. Handbook of Vegetation Science, Part 5. Dr. W. Junk b.v. Publishers, The Hague.

Braun-Blanquet, J. 1965. Plant sociology: the study of plant communities. (English translation of 2nd ed.) (Trans. rev. and ed. by C.D. Fuller and H.S. Conard) Hafner, London. 439 p.

Cook, J. E. 1995. Implications of modern successional theory for habitat typing: a review. Forest Science 42:67-75.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. Biol. Serv. Progr., U.S. Fish and Wildl. Serv., Washington, DC, Publication No. FWS/OBS-79/31. 103 pp.

Daubenmire, R. 1952. Forest vegetation of northern Idaho and adjacent Washington, and its bearing on concepts of vegetation classification. Ecological Monographs 22:301-330.

Dick-Peddie, W. A. 1993. New Mexico Vegetation: past, present and future. University of New Mexico Press, Albuquerque. 244 pp.

Driscoll, R. S., D. L. Merkel, R. L. Radloff, D. E. Snyder, and J. S. Hagihara. 1984. An ecological land classification framework for the United States. United States Department of Agriculture, Forest Service Miscellaneous Publication Number 1439. Washington, DC. 56 pp.

Ellenberg, H. 1963. Vegetation Mitteleuropas mit dem Alpen. Eugene Ulmer, Stuttgart. 943 P. 2nd.ed, 1974.

Eyre, F. H. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington D.C. 148 p.

FGDC. 1997. National Vegetation Classification Standard. FGDC-STD-005. Federal Geographic Data Committee, Vegetation Subcommittee, U.S. Geological Survey, Reston, VA. Web address: http://www.fgdc.gov/standards/status/sub2_1.html (accessed April 30, 2004)

Greenall, J. 1996. Manitoba's terrestrial plant communities. Manitoba Conservation Data Centre MS Report 96-02. Winnipeg, Manitoba, Canada. 32 pp.

Grossman, D. H., D. Faber-Langendoen, A. W. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K. D. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. International classification of ecological communities: terrestrial vegetation of the United States. Volume I. The National Vegetation Classification System: development, status, and applications. The Nature Conservancy, Arlington, Virginia, USA.

Grossman, D. H., K. L. Goodin, and C. L. Reuss (editors). 1994. Rare plant communities of the conterminous United States: an initial survey. The Nature Conservancy, Arlington, VA. 620 pp.

Hunter, M. 1991. Coping with ignorance: the coarse-filter strategy for maintaining biodiversity. Pages 256-281 in K.A. Kohm, ed., Balancing on the Brink of Extinction-the Endangered Species Act and Lessons for the Future. Island Press, Washington, DC.

Jenkins, R. E. 1976. Maintenance of natural diversity: approach and recommendations. Pages 441-451 in Transactions of the 41st North American Wildlife Conference, 4 March 1976, Washington, DC. Wildlife Management Institute, Washington, DC.

Jennings, M. 1993. Natural terrestrial cover classification; assumptions and definitions. Gap Analysis Technical Bulletin 2. U.S. Fish and Wildlife Service, Idaho Cooperative Fish and Wildlife Research Unit, University of Idaho, Moscow, ID.

Kartesz, J. T. 1999. A synonymized checklist and atlas with biological attributes for the vascular flora of the United States, Canada, and Greenland. First edition. In: J. T. Kartesz and C. A. Meacham. Synthesis of the North American Flora, Version 1.0. North Carolina Botanical Garden, Chapel Hill, NC.

Keys, Jr., J. C. Carpenter, S. Hooks, F. 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). Atlanta, Georgia, U.S. Department of Agriculture, Forest Service, presentation scale 1:3,500,000, colored.

Lammert, M., J. Higgins, D. Grossman, and M. Bryer. 1997. A classification framework for freshwater communities: Proceedings of The Nature Conservancy's Aquatic Community Classification Workshop, April 9-11, 1996, New Haven, Missouri.

Leach, M. and L. Ross. 1995. Midwest oak ecosystems recovery plan: a call to action. The Nature Conservancy, Illinois Field Office, Chicago, IL.

Loucks, O. 1996. 100 years after Cowles: a national classification for vegetation. Bulletin of the Ecological Society of America 77:75-76.

Master, L.L. 1991. Assessing threats and setting priorities for conservation. Conservation Biology 5:559-563.

Maybury, Kathleen P., editor. 1999. Seeing the Forest and the Trees: Ecological Classification for Conservation. The Nature Conservancy, Arlington, Virginia.

Moravec, J. 1993. Syntaxonomic and nomenclatural treatment of Scandinavian-type associations and sociations. Journal of Vegetation Science 4:833-838.

Ostlie, W.R., R. S. Schneider, J.M. Aldrich, R.L.B. McKim, T. Faust, and H. Watson. 1996. The status of biodiversity in the Great Plains. The Nature Conservancy, Great Plains Program, Minneapolis, MN.

Pfister, R. D., and S. F. Arno. 1980. Classifying forest habitat types based on potential climax vegetation. Forest Science 26:52-70.

Rubel, E. 1930. Pflanzengesellschaften der erde. Bern-Berlin.

Schrader-Frechette, K. S. and E. D. McCoy. 1993. Methods in ecology: strategies for conservation. Cambridge University Press, NY. 328 p.

Specht, R., E. M. Roe, and V. H. Boughton. 1974. Conservation of major plant communities in Australia and Papua New Guinea. Australian Journal of Botany, Supplement 7. 667 pp.

Strong, W. L., E. T. Oswald, and D. J. Downing. 1990. The Canadian vegetation classification system, first approximation. National Vegetation Working Group, Canadian Committee on Ecological Land Classification. Ecological Land Classification Series, No. 25, Sustainable Development, Corporate Policy Group, Environment Canada, Ottawa, Canada.

The Nature Conservancy Great Lakes Program. 1994. The conservation of biological diversity in the Great Lakes ecosystem: issues and opportunities.

The Nature Conservancy 1995. Descriptions of 31 Rare/Special Ecological Groups in the Southern Appalachian Mountains. Report submitted to the U.S. Forest Service for the Southern Appalachian Assessment. Prepared by the Nature Conservancy, Southern Science Dept., Community Ecology Group. Sept. 1995.

UNESCO. 1973. International Classification and Mapping of Vegetation, Series 6 Ecology and Conservation. United Nations Education, Scientific, and Cultural Organization. Paris. 93 pp.

van der Maarel, E. and F. Klotzli. 1996. Community ecology and conservation biology: Introduction. Journal of Vegetation Science 7:6.

Vankat, J. L. 1990. A classification of the forest types of North America. Vegetatio 88: 53-66.

Webb, L. J., J. G. Tracey, W. T. Williams, and G. N. Lance. 1970. Studies in the numerical analysis of complex rainforest communities. V. A comparison of the properties of floristic and physiognomic-structural data. Journal of Ecology 58:203-232.

Werger, M. J. A., and J. T. C. Sprangers. 1982. Comparison of floristic and structural classification of vegetation. Vegetatio 50:175-183.

Westhoff, V. 1967. Problems and use of structure in the classification of vegetation. The diagnostic evaluation of structure in the Braun-Blanquet system. Acta Bot. Neerl. 15:495-511.

Westhoff, V. and E. van der Maarel. 1973. The Braun-Blanquet approach. Pp. 617-726 *In* R. H. Whittaker (editor). Handbook of vegetation science, Part V: ordination and classification of communities. Junk, The Hague, The Netherlands.

Whittaker, R. H. 1962. Classification of natural communities. Botanical Review 28:1-239.

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ALLIANCES BY US NATIONAL VEGETATION CLASSIFICATION HIERARCHY

I. Forest

I.A.8.C.x. Planted/cultivated temperate or subpolar needle-leaved evergreen forest

I.A.8.C.X. *PINUS STROBUS* PLANTED FOREST ALLIANCE (A.98) EASTERN WHITE PINE PLANTED FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance contains plantations of *Pinus strobus* that are maintained for the extraction of forest products. The canopy of these stands is usually dense, and the natural vascular species ground layer vegetation may be sparse to absent. Stands of *Pinus strobus* have been widely planted throughout the northeastern and upper midwestern United States. *Pinus strobus* is susceptible to a variety of diseases, including White Pine Blister Rust (*Cronartium ribicola*) and Southern Pine Beetle (*Dendroctonus frontalis*), which has limited some of its commercial use.

Related Concepts:

- Eastern White Pine: 21 (Eyre 1980) I

Classification Comments: On the Daniel Boone National Forest of Kentucky, *Pinus strobus* plantings are of limited extent, and are related to wildlife plantings. There has been some damage from the Southern Pine Beetle (*Dendroctonus frontalis*).

ALLIANCE DISTRIBUTION

Range: This alliance is found in the Appalachian Mountain regions of Georgia, Kentucky, North Carolina, South Carolina, Tennessee, and Virginia. It also occurs in the northeastern and upper midwestern U.S. and Ontario, Canada.
Subnations: GA, KY, MD, NC, NH, NY, PA, SC, TN, VA
TNC Ecoregions: 47:C, 48:C, 50:C, 51:C, 61:C, 63:C
USFS Ecoregions: 212:C, 221Ai:CCC, 221He:CCC, M212:C, M221Aa:CCC, M221Ce:CCC, M221Dc:CCC, M221Dd:CCP
Federal Lands: USFS (Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

References: Eyre 1980

I.A.8.C.X. *PINUS VIRGINIANA* PLANTED FOREST ALLIANCE (A.100) VIRGINIA PINE PLANTED FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes planted stands of *Pinus virginiana* with little understory, but they may have admixtures of other native or off-site pines (e.g., *Pinus echinata, Pinus strobus, Pinus taeda*). These are cultivated forests and are not considered natural or near-natural vegetation. They are maintained as plantations for the harvest of forest products. Stands have suffered some damage from the Southern Pine Beetle (*Dendroctonus frontalis*). Stands are planted in the Inner Coastal Plain for Christmas tree production.

Related Concepts:

- Virginia Pine: 79 (Eyre 1980) I

Classification Comments: *Pinus virginiana* is planted for pulpwood and lumber in the southeastern United States. It is also planted for production of Christmas trees and on strip-mined sites. Stands have suffered some damage from the Southern Pine Beetle (*Dendroctonus frontalis*).

ALLIANCE DISTRIBUTION

Range: This alliance is found throughout the Piedmont of the southeastern United States and ranges into parts of the Cumberland Plateau, Interior Low Plateau, Inner Coastal Plain, and the Southern Blue Ridge. It is known to occur in Alabama, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia, and may possibly range into Mississippi.
Subnations: AL, GA, KY, MS?, NC, SC, TN, VA
TNC Ecoregions: 43:C, 44:P, 50:C, 51:C, 52:C
USFS Ecoregions: 221Hc:CCC, 221He:CCC, 222Eb:CCC, 231B:CC, 232:?, M221Dc:CC?, M221Dd:CC?
Federal Lands: DOD (Arnold, Fort Gordon, Fort Stewart?); USFS (Chattahoochee, Cherokee, Daniel Boone, Land Between the Lakes?, Nantahala?, Pisgah?, Uwharrie?)

ALLIANCE SOURCES

References: Burns and Honkala 1990a, Eyre 1980

I.A.8.N.b. Rounded-crowned temperate or subpolar needle-leaved evergreen forest

I.A.8.N.B. *PINUS STROBUS - TSUGA CANADENSIS* FOREST ALLIANCE (A.127)
EASTERN WHITE PINE - EASTERN HEMLOCK FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: Forests codominated by *Pinus strobus* and *Tsuga canadensis* occurring from eastern Wisconsin and the upper peninsula of Michigan to eastern Pennsylvania and Maine, south through the Appalachians to northern Georgia and South Carolina. Isolated occurrences could potentially occur in the Cumberland Plateau of Kentucky and Tennessee. Generally, *Tsuga canadensis* and *Pinus strobus* are codominant, but other common associates can include *Fagus grandifolia, Acer rubrum, Betula lenta, Betula alleghaniensis, Quercus rubra*. *Picea rubens* is often a component in the northeastern part of range, while *Liriodendron tulipifera* and *Betula lenta* are the common associates in the southern Appalachians. Typical shrubs/saplings include *Acer spicatum, Hamamelis virginiana*, and *Acer pensylvanicum* (in the north), and *Ilex opaca, Leucothoe fontanesiana, Rhododendron maximum* (in the south). The herbaceous stratum may be sparse and generally depauperate, including *Clintonia borealis, Cypripedium acaule, Gaultheria procumbens, Lycopodium* spp., *Maianthemum canadense*, and *Trientalis borealis* (in the north), and *Chimaphila maculata, Mitchella repens, Galax urceolata, Viola blanda*, and *Polystichum acrostichoides* (in the south). Stands of this alliance are found on acidic, nutrient-poor, usually moderately well-drained soils such as sandy loams. Communities of the eastern portion of the range (New England) generally occur on well-drained midslopes, and apparently are not significantly affected by aspect. In the southern Appalachian Mountains and Cumberland Plateau, these forests occur on alluvial terraces and steep, protected gorge slopes. Communities of this alliance are commonly established following disturbance, either natural (fire, windthrow, catastrophic flood events) or anthropogenic (logging). Old-growth examples of the alliance are known, and these forests were likely to have been widespread prior to European settlement. However, without periodic disturbance, communities of this alliance will eventually succeed to other alliances (Barnes 1991).

Related Concepts:

- *Pinus - Tsuga* (Morey 1936) ?
- Canada Hemlock Forest (Schafale and Weakley 1990) I
- Eastern White Pine: 21 (Eyre 1980) I
- IA5b. Southern Appalachian Hemlock Cove Forest (Allard 1990) I
- Northern Hardwoods - Hemlock - White Pine Forest (Swain and Kearsley 2001) ?
- Spruce - Fir - Northern Hardwoods Forest (Swain and Kearsley 2001) ?
- White Pine - Hemlock: 22 (Eyre 1980) I beech-hemlock association (Morey 1936) ?
- hemlock - beech forest type (Gordon 1937b) ?
- hemlock - white pine group (Brown et al. 1982b) ?
- white pine region (Bromley 1935) I

Classification Comments: Forests within this alliance can have significant numbers of associated trees and can thus be similar to several other alliances, but it is distinguished by occurring in non-wetland situations and having a canopy dominated by the two nominal species, with less than 25% canopy coverage by deciduous trees. Disjunct occurrences of *Pinus strobus* are also known from Kentucky's Shawnee Hills (Todd County), but these may be better covered in the *Pinus strobus* Forest Alliance (A.128).

ALLIANCE DISTRIBUTION

Range: This alliance is found in northern Wisconsin, Michigan, from western Pennsylvania to Maine, including Connecticut, Massachusetts, Maryland (?), New Hampshire, and New York (?), and in Canada in southern Ontario and possibly southern Quebec. It may occur farther south in the Appalachian Mountains to Virginia and West Virginia. This alliance is also found in Georgia, Kentucky, North Carolina, South Carolina, and Tennessee.

Subnations: CT, GA, KY, MA, MD, ME, MI, NB, NC, NH, NY, ON, PA, QC?, RI, SC, TN, VA, VT, WI, WV

TNC Ecoregions: 44:P, 47:C, 48:C, 49:C, 50:C, 51:C, 52:C, 59:C, 60:C, 61:C, 62:C, 63:C, 64:C

USFS Ecoregions: 212Aa:CCC, 212Ab:CCC, 212Ba:CCC, 212Bb:CCC, 212Ca:CCC, 212Cb:CCC, 212Da:CCC, 212Db:CCP, 212Dc:CCC, 212Ea:CCC, 212Eb:CCC, 212Ec:CCP, 212Ed:CCP, 212Ee:CCC, 212Fa:CCP, 212Fb:CCP, 212Fc:CCC, 212Fd:CCP, 212Ga:CCP, 212Gb:CCP, 212Ha:CC?, 212Hb:CC?, 212He:CCP, 212Hh:CCP, 212Hi:CCP, 212Hj:CCC, 212Hk:CC?, 212Hl:CCC, 212Hm:CCP, 212Hn:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hu:CC?, 212Hv:CCP, 212Hw:CCP, 212Hx:CCP, 212Hy:CCC, 212Ja:CCC, 212Jb:CCP, 212Jc:CCC, 212Je:CCP, 212Jf:CCP, 212Jj:CCC, 212Jl:CCC, 212Jm:CCC, 212Jn:CCP, 212Jo:CCP, 212Js:CCC, 221Aa:CCP, 221Ab:CCP, 221Ac:CCP, 221Ad:CCP, 221Ae:CCC, 221Af:CCC, 221Ag:CCP, 221Ah:CCP, 221Ai:CCC, 221Aj:CCP, 221Ak:CCC, 221Al:CCC, 221Ba:CCP, 221Bb:CCC, 221Bc:CCP, 221Bd:CCC, 221Da:C??, 221Db:C??, 221Ea:CCP, 221Eb:CCP, 221Ec:CCP, 221Fa:CCP, 221Hc:CCC, 221He:CCC, 221Ja:C??, 222Dg:C??, 222Eo:CCC, 222Ia:C??, 222Ib:C??, 222Ic:C??, 222Ie:C??, 222If:C??, 222Ja:C??, 222Ob:CCP, 231Aa:CC?, 231Ae:CC?, 231Ak:CCC, 231Al:CC?, 231Ap:CCP, M212Aa:CCC, M212Ab:CCC, M212Ac:CC?, M212Ad:CCC, M212Ae:CCC, M212Ba:CCP, M212Bb:CCC, M212Bc:CCC, M212Bd:CCC, M212Ca:CCP, M212Cb:CCC, M212Cc:CCC, M212Cd:CCP, M212Da:CCC, M212Db:CCC, M212Dc:CCC, M212Dd:CCC, M212De:CCC, M212Df:CCC, M212Ea:CCC, M212Eb:CCC, M212Fa:CPP, M212Fb:CPP, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ba:CCP, M221Bb:CCC, M221Bc:CCP, M221Bd:CCC, M221Be:CCP, M221Bf:CCP, M221Ca:CCP, M221Cb:CCP, M221Cc:CC?, M221Cd:CC?, M221Da:CCC, M221Db:CC?, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Acadia, Blue Ridge Parkway?, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

References: Allard 1990, Barnes 1991, Bromley 1935, Brown et al. 1982b, DeYoung 1979, Eyre 1980, Faber-Langendoen et al. 1996, Gordon 1937b, Hinkle 1978, Morey 1936, Patterson 1994, Rawinski et al. 1996, Schafale and Weakley 1990, Seischab 1990, Swain and Kearsley 2001, Thomas 1966, Thomas 1989, Tobe et al. 1992

I.A.8.N.B. *PINUS STROBUS* FOREST ALLIANCE (A.128)
EASTERN WHITE PINE FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance, found near the Great Lakes and in the southern Appalachian Mountains and northeastern United States, is composed of dry-mesic to mesic pine forests. Stands of this alliance are characterized by a moderate to complete tree canopy. The shrub layer is absent to well-developed, while the herbaceous layer is moderately to poorly developed. Understory vegetation is sparse where the canopy is closed, due to the limited amount of light and the duff buildup on the forest floor. The overstory is heavily dominated by coniferous trees, usually *Pinus strobus* alone but sometimes with *Pinus resinosa*. Other canopy and subcanopy trees include *Abies balsamea* (in the northern part of this alliance's range), *Acer rubrum, Betula papyrifera, Populus tremuloides*, and *Thuja occidentalis*. The shrub layer typically contains species such as *Acer spicatum, Corylus cornuta, Diervilla lonicera, Linnaea borealis*, and *Vaccinium* spp., especially *Vaccinium myrtilloides* and *Vaccinium angustifolium*. The herb layer contains species adapted to the dry-mesic nature of stands of this alliance. These include *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Gaultheria procumbens*, and *Maianthemum canadense*.

Stands of this alliance are found on loamy sand, sandy loam, loam, and clay loam soils which are typically moderately deep to deep (60-100 cm) except in the Driftless Area where they may be very shallow. The soils are acidic and rarely contain a significant amount of organic material. Stands of this alliance are often found on glacial till or outwash plains, although in northeastern Minnesota they occur near lakes and on lower slopes. This alliance can be found on a variety of landscapes, varying from nearly level to rolling across much of its range to steep slopes in the Driftless Area. In the southern Appalachians these forests occur below 3000 feet (900 m) elevation on upper slopes and ridgetops protected by higher landforms, or as successional forests on abandoned agricultural land.

Related Concepts:

- Eastern Needleleaf Forests: 95: Great Lakes Pine Forest (*Pinus*) (Kuchler 1964) I
- Eastern White Pine: 21 (Eyre 1980) I IA6f. Dry White Pine Ridge Forest (Allard 1990) I
- Northern Dry-mesic Forest (Curtis 1959) I
- White Pine BR, RV, CUPL (Pyne 1994) ?
- White Pine Forest (Schafale and Weakley 1990) ?

Classification Comments: Natural *Pinus strobus* stands occur in mesic gorges of eastern Kentucky over *Rhododendron maximum* or with a lush herbaceous stratum. KP 11-99: might these be closer to CEGL007102, in A.127? MP: *Pinus strobus* occurs as a disjunct species in Tennessee's Western Highland Rim (Cheatham and Dickson counties) but occurs in a mixed pine - oak forest community.

ALLIANCE DISTRIBUTION

Range: This alliance is found in Michigan, northern Wisconsin, northern and eastern Minnesota, extreme northeastern Iowa, Maine, New Hampshire, North Carolina, South Carolina, Georgia, Tennessee, Kentucky (?), and Virginia. In Canada, it is found in Ontario.
Subnations: GA, IA, KY?, ME, MI, MN, NB, NC, NH, NS?, NY, ON, PA, QC?, SC, TN, VA, VT, WI, WV
TNC Ecoregions: 46:C, 47:C, 48:C, 49:C, 50:C, 51:C, 59:C, 60:C, 61:C, 62:C, 63:C, 64:C
USFS Ecoregions: 212Aa:CC?, 212Ab:CC?, 212Ba:CCP, 212Bb:CCP, 212Ca:CCC, 212Cb:CCC, 212Da:CCC, 212Ea:CCP, 212Eb:CCP, 212Ec:CCC, 212Fa:C??, 212Fb:C??, 212Fc:C??, 212Ga:C??, 212Ha:CCC, 212Hb:CCP, 212He:CCP, 212Hh:CCC, 212Hi:CCP, 212Hj:CCC, 212Hl:CCC, 212Hm:CCC, 212Ho:CCC, 212Hp:CCC, 212Hq:CCP, 212Hr:CCC, 212Hs:CCP, 212Ht:CCP, 212Hu:CCP, 212Hv:CCP, 212Hw:CCP, 212Hx:CCP, 212Hy:CCP, 212Ia:CCC, 212Ja:CCP, 212Jb:CCC, 212Jc:CCC, 212Je:CCC, 212Jf:CC?, 212Jj:CC?, 212Jl:CCC, 212Jm:CCC, 212Jn:CCP, 212Jr:CCC, 212Ka:CCC, 212Kb:CCC, 212La:CCC, 212Lb:CCC, 212Lc:CCC, 212Ld:CCP, 212Ma:CCC, 212Mb:CCC, 212Na:CCC, 212Nb:CCC, 212Nc:CCC, 212Nd:CCP, 221Ae:CCC, 221Af:CCP, 221Al:CCC, 221Ba:CPP, 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 221Ja:C??, 221Jc:C??, 222En:CCC, 222Eo:CCC, 222Ib:C??, 222Ic:C??, 222Id:C??, 222Ie:C??, 222If:C??, 222Lc:CCC, 222Ld:CCC, 222Le:CCC, 222Lf:CCC, 222Ma:CCC, 222Mc:CCC, 231:C, M212Ab:CCC, M212Ac:CCC, M212Ae:CCC, M212Ag:CCC, M212Ba:CCC, M212Bc:CCC, M212Cb:CCC, M212Cc:CCC, M212Da:CCP, M212Db:CCP, M212Dc:CCP, M212Ea:CCP, M212Eb:CCP, M212Fa:C??, M212Fb:C??, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Bb:CCC, M221Bd:CCC, M221Bf:CCP, M221Cb:CPP, M221Cd:CPP, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Acadia, Blue Ridge Parkway?, Carl Sandburg Home, Great Smoky Mountains, Voyageurs); USFS (Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

References: Allard 1990, Burns and Honkala 1990a, Curtis 1959, DeYoung 1979, DuMond 1970, Eyre 1980, Faber-Langendoen et al. 1996, Govus 1982, Hinkle 1989, Kuchler 1964, MNNHP 1993, Ohmann and Ream 1971, Patterson 1994, Pyne 1994, Schafale and Weakley 1990, Sims et al. 1989, Tobe et al. 1992

I.A.8.N.B. *PINUS ECHINATA* FOREST ALLIANCE (A.119) SHORTLEAF PINE FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes forests dominated by *Pinus echinata*, which on very dry sites may be virtually the only tree species present. This is a wide-ranging alliance; it is currently known from wide areas of the eastern United States from the central Appalachians south, through the Southern Blue Ridge and Cumberland Plateau and Mountains, possibly extending into the Piedmont, and in the central United States in the Ouachita Mountains and Ozarks, extending south into the Gulf Coastal Plain. Other pine species may be present in small amounts; these vary with geography and include *Pinus taeda, Pinus virginiana, Pinus pungens*, and *Pinus rigida*. Typical hardwood associates include *Quercus alba, Quercus falcata, Quercus velutina, Quercus coccinea, Quercus marilandica, Nyssa sylvatica, Liquidambar styraciflua, Carya alba*, and *Carya glabra*. Understory species vary across the range of the alliance, but some common components are *Vaccinium arboreum, Vaccinium pallidum, Vaccinium stamineum, Symplocos tinctoria, Ulmus alata, Diospyros virginiana, Acer rubrum, Cornus florida*, and *Oxydendrum arboreum*. One association in the West Gulf Coastal Plain of Arkansas has *Vaccinium elliottii, Aesculus pavia var. pavia*, and *Chasmanthium laxum*. Common herbaceous species in this Coastal Plain association include *Smilax glauca, Silphium compositum, Pteridium aquilinum var. latiusculum, Scleria oligantha, Piptochaetium avenaceum*, and *Tephrosia virginiana*. Some associations can result from natural or anthropogenic disturbances such as fire or windstorms, while others occur naturally on the landscape, are maintained by edaphic situations, and may even be 'climax' on these sites. Soils of these forests are acidic and are derived from sandstone, chert or granitic rock situated on ravines, ridges, and steep, often south-facing, slopes; the surface is often rocky. In the Coastal Plain, this alliance is particularly typical of clay soils, on hillsides, ridges, flats, and low hills. In the Ouachita Mountains and Ozarks, forests of this alliance typically occur on south-facing slopes and saddles, and rocky outcrops and bluffs, but may also occur on lower, north-facing slopes and flat uplands, especially in the Piedmont and flat uplands, especially in the Piedmont.

Related Concepts:

- *Pinus echinata* forest alliance (Hoagland 1998a) I
- Dry Shortleaf Pine - Oak Forest (Foti 1994b) I
- IA6a. Dry Shortleaf Pine - Oak - Hickory Forest (Allard 1990) I
- IA7a. Xeric Shortleaf Pine - Oak Forest (Allard 1990) I
- Pine--Oak/Heath (Nelson 1986) I Shortleaf Pine - Oak: 76 (Eyre 1980) I
- Shortleaf Pine CP, BR, RV (Pyne 1994) ?
- Shortleaf Pine: 75 (Eyre 1980) I
- T1A9bI1a. *Pinus echinata* (Foti et al. 1994) ?

Classification Comments: Stands have suffered some damage from the southern pine beetle (*Dendroctonus frontalis*).

ALLIANCE DISTRIBUTION

Range: This is a wide-ranging alliance; it is currently known from wide areas of the eastern United States from the central Appalachians south, through the Southern Blue Ridge and Cumberland Plateau and Mountains, possibly extending into the Piedmont, and in the central United States in the Ouachita Mountains and Ozarks, extending south into the Gulf Coastal Plain. Associations in this alliance are found in southern Missouri, Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, and possibly in West Virginia.

Subnations: AL, AR, GA, KY, LA, MD, MO, MS, NC, OK, SC, TN, TX, WV?

TNC Ecoregions: 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:C, 50:C, 51:C, 52:P, 53:C, 59:C

USFS Ecoregions: 221Db:CCC, 221Ha:CCP, 221Hc:CCC, 221He:CCC, 221Jb:CCC, 221Jc:CCP, 222A:CC, 222Ej:CPP, 222En:CP?, 222Eo:CPP, 222Hc:CCC, 231Aa:CCC, 231Ab:CCP, 231Ac:CCP, 231Ad:CC?, 231Ae:CCC, 231Ag:CCP, 231Ah:CCP, 231Ai:CCP, 231Aj:CCP, 231Ak:CCP, 231Al:CCC, 231Am:CCP, 231An:CCP, 231Ao:CCP, 231Ap:CCP, 231Bb:CPP, 231Bc:CPP, 231Bd:CPP, 231Be:CPP, 231Bg:CP?, 231Bk:CP?, 231Ca:C??, 231Da:CP?, 231Dc:CPP, 231Ea:CCC, 231Ef:CCC, 231Ej:CCC, 231Fa:CPP, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Ba:CCC, 232Bb:CCP, 232Bd:CC?, 232Bj:CC?, 232Bk:CC?, 232Bm:CCC, 232Fe:CCC, 234Ab:CCC, M221A:CC, M221B:C?, M221Ca:CC?, M221Cd:CCP, M221Ce:CCC, M221Dc:CCC, M221Dd:CCC, M222A:CC, M231Aa:CCP, M231Ab:CCC, M231Ac:CCC

Federal Lands: DOD (Camp Robinson); NPS (Buffalo, Cowpens, Great Smoky Mountains?, Kings Mountain, Little River Canyon?); TVA (Tellico); USFS (Angelina, Bienville, Chattahoochee, Cherokee?, Daniel Boone, Davy Crockett, De Soto, Holly Springs, Mark Twain, Nantahala, Oconee, Ouachita, Ozark, Sabine NF, Sam Houston, St. Francis, Sumter, Talladega?, Tombigbee, Tuskegee)

ALLIANCE SOURCES

References: Allard 1990, Allred and Mitchell 1955, Bruner 1931, Cain and Shelton 1994, Eyre 1980, Faber-Langendoen et al. 1996, Foti 1994b, Foti et al. 1994, Fountain and Sweeney 1987, Frothingham et al. 1926, Hoagland 1998a, Nelson 1986, Pyne 1994, Racine 1966

I.A.8.N.B. *PINUS VIRGINIANA* FOREST ALLIANCE (A.131) VIRGINIA PINE FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes forests dominated by *Pinus virginiana* and occurring in the Piedmont from Pennsylvania south to Alabama, and ranging west into the Appalachians, Ridge and Valley, the Cumberland Plateau, and in scattered locales of the Interior Low Plateau. Forests in this alliance may have admixtures of *Pinus taeda, Pinus echinata, Pinus pungens*, and/or *Pinus rigida*. These other species, if present, can have canopy coverage between 1 and 50%. Other associated species vary with the geographic distribution of the alliance. In many associations, a dense ericaceous shrub stratum is typical. This alliance includes both early successional forests resulting from natural or anthropogenic disturbance and natural forests in edaphically extreme situations. Typically, *Pinus virginiana* communities are short-lived as a forest and are more common as woodland communities [see II.C.3.N.a *Pinus (rigida, pungens, virginiana) - Quercus prinus* Woodland Alliance (A.677)]. Associated species vary with the geographic distribution of the alliance.

Related Concepts:

- Appalachian pine-oak forest (Evans 1991) I
- IA7a. Xeric Shortleaf Pine - Oak Forest (Allard 1990) I
- Pine--Oak/Heath (Nelson 1986) I
- Pine--Oak/Heath (Schafale and Weakley 1990) I
- Virginia Pine - Mixed Oaks HR (Pyne 1994) ?
- Virginia Pine CUPL, BR, RV (Pyne 1994) ?
- Virginia Pine: 79 (Eyre 1980) I

Classification Comments: Appalachian pine-dominated associations need to be revisited in relation to the ecology of shortleaf pine, *Pinus echinata*. Are some stands of this type ones that historically were dominated by shortleaf pine? (MP 2002-03).

ALLIANCE DISTRIBUTION

Range: Forests in this alliance are possible in the Piedmont from Pennsylvania south to Alabama, and ranging west into the Appalachians, Ridge and Valley, the Cumberland Plateau, and in scattered locales of the Interior Low Plateau. The range of the alliance includes parts of Alabama, Delaware, Georgia, Kentucky, New Jersey, North Carolina, South Carolina, Tennessee, Maryland, Pennsylvania, West Virginia, Virginia, Ohio, and Indiana.

Subnations: AL, GA, IN, KY, MD, NC, NJ, OH, PA, SC, TN, VA, WV

TNC Ecoregions: 43:C, 44:C, 49:C, 50:C, 51:C, 52:C, 58:P, 59:C, 61:C

USFS Ecoregions: 221Da:CCP, 221Db:CCC, 221Ea:CC?, 221Eb:CCC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCC, 221Eg:CCC, 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 221Ja:CCC, 221Jb:CCC, 221Jc:CCC, 222Da:CCC, 222Dc:CCC, 222Dd:CCC, 222Dg:CCC, 222Dj:CCC, 222Eb:CCC, 222Eg:CCC, 222Eh:CCC, 222Ej:CCC, 222El:CCC, 222En:CCC, 222Eo:CCC, 222Fc:CCC, 222Fd:CCC, 222Ff:CCC, 231Aa:CCC, 231Ab:CCC, 231Ac:CCP, 231Ad:CCC, 231Ae:CCC, 231Af:CCP, 231Ag:CCP, 231Ah:CCP, 231Ai:CCP, 231Aj:CCP, 231Ak:CCP, 231Al:CCP, 231Am:CCP, 231An:CCP, 231Ao:CCP, 231Ap:CCP, 231Bc:CCC, 231Ca:CCP, 231Cb:CCP, 231Cc:CCP, 231Cd:CCC, 231Ce:CCP, 231Cf:CCP, 231Cg:CCP, 231Da:CCC, 231Dc:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ba:CC?, M221Bd:CCP, M221Be:CCP, M221Ca:CCP, M221Cb:CCP, M221Cc:CCC, M221Cd:CCC, M221Ce:CCC, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: DOD (Fort Jackson); NPS (Blue Ridge Parkway?, Chickamauga-Chattanooga, Great Smoky Mountains, Kennesaw Mountain, Kings Mountain, Little River Canyon?, Mammoth Cave, Shiloh); TVA (Land Between the Lakes?, Tellico); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Nantahala, Oconee, Pisgah, Sumter, Talladega, Uwharrie?)

ALLIANCE SOURCES

References: Allard 1990, Andreu and Tukman 1995, Barden 1977, Burns and Honkala 1990a, Chapman 1957, Cooper 1963, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Frothingham et al. 1926, Gettman 1974, Malter 1977, Nelson 1986, Pyne 1994, Racine 1966, Schafale and Weakley 1990, Whittaker 1956

I.A.8.N.c. Conical-crowned temperate or subpolar needle-leaved evergreen forest

I.A.8.N.C. *TSUGA CAROLINIANA* FOREST ALLIANCE (A.144) CAROLINA HEMLOCK FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: Stands of this alliance are forests with dense to open canopies dominated by *Tsuga caroliniana*. Trees may be wind-shorn, gnarled and twisted in exposed situations. Occurrences in gorges sometimes have a substantial admixture of *Tsuga canadensis*. Other associated species may include *Quercus prinus, Quercus rubra, Pinus rigida, Pinus virginiana,* and *Pinus pungens*. The shrub stratum is dense and dominated by ericaceous species, such as *Rhododendron maximum, Rhododendron catawbiense, Rhododendron carolinianum, Kalmia latifolia, Gaylussacia* spp., and *Vaccinium* spp. The herbaceous stratum is sparse, with typical species including *Gaultheria procumbens, Mitchella repens, Chimaphila maculata, Galax urceolata,* and *Xerophyllum asphodeloides*. Lichens, including *Cladina rangiferina* and *Cladina subtenuis,* can be abundant. Forests in this alliance occur mostly on cliffs, rocky slopes and ridges, and less commonly on more gentle slopes and flat areas in valleys. Soils are usually nutrient-poor and rocky, with much exposed rock surface. Occurrences of these forests tend to be small and have distinct boundaries. *Tsuga caroliniana* is an Appalachian endemic with a very limited range, scattered in the Southern Blue Ridge and occasional in the Piedmont and Ridge and Valley.

Related Concepts:

- Carolina Hemlock Bluff (Schafale and Weakley 1990) I
- IA6g. Carolina Hemlock Bluff Forest (Allard 1990) ?
- Oligotrophic Forest (Rawinski 1992) ?

Classification Comments: *Tsuga caroliniana* communities, in general, have a restricted range, occurring in the Southern Blue Ridge with scattered outliers in the upper Piedmont and Ridge and Valley. The main distribution is centered in North Carolina, with a few examples in adjacent states. Occurrences are typically small and restricted to rocky bluff habitats. All occurrences are threatened by fire suppression and the hemlock woolly adelgid (*Adelges tsugae*), an exotic pest which causes tree decline and ultimately death in *Tsuga canadensis* and *Tsuga caroliniana*.

ALLIANCE DISTRIBUTION

Range: This alliance is found in North Carolina, South Carolina, Tennessee, and Virginia. *Tsuga caroliniana* is a southern Appalachian endemic with a very limited range, scattered in the Southern Blue Ridge and occasional in the Piedmont.
Subnations: NC, SC, TN, VA
TNC Ecoregions: 51:C, 52:C, 59:C
USFS Ecoregions: 231Aa:CCC, 231Ae:CCP, M221Aa:CC?, M221Ab:CCC, M221Da:CCC, M221Db:CCP, M221Dc:CCC, M221Dd:CCC
Federal Lands: USFS (Cherokee, Jefferson, Nantahala, Pisgah)

ALLIANCE SOURCES

References: Allard 1990, Humphrey 1989, McLeod 1988, Newell and Peet 1995, Rawinski 1992, Schafale and Weakley 1990, Weakley et al. 1979

I.A.8.N.C. *TSUGA CANADENSIS* FOREST ALLIANCE (A.143)
EASTERN HEMLOCK FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance is found in the Great Lakes area, the southern Appalachians, and the Coastal Plain of Maryland. The overstory is strongly dominated by *Tsuga canadensis*, typically around 20 m tall in Canada. *Betula alleghaniensis* is often present in the canopy and subcanopy. Other species that may be present in small amounts in the Great Lakes region include *Abies balsamea, Acer rubrum, Acer saccharum, Pinus strobus, Tilia americana,* and *Thuja occidentalis*. *Abies balsamea* and *Thuja occidentalis* can be common as saplings, especially in canopy gaps. Shrubs are rare and herbaceous species only moderately abundant under the canopy in *Tsuga canadensis*-dominated forests. Where gaps occur in the canopy, however, *Acer spicatum, Amelanchier* spp., *Gaultheria procumbens*, and *Rubus idaeus* may be moderately abundant. Herbaceous species found in stands of this alliance include *Coptis trifolia, Cornus canadensis, Dicranum* spp., *Maianthemum canadense,* and *Pteridium aquilinum*. In the Southern Blue Ridge, common canopy/subcanopy associates include *Liriodendron tulipifera, Tilia americana var. heterophylla, Pinus strobus, Betula alleghaniensis, Betula lenta, Magnolia fraseri, Acer rubrum, Halesia tetraptera*, and *Fraxinus americana*. The density and composition of shrub and herbaceous strata vary with geography and habitat. In the south, shrub strata are often dense and dominated by a single species, such as *Rhododendron maximum* or *Leucothoe fontanesiana*, but other typical shrub species include *Ilex opaca, Clethra acuminata, Hydrangea arborescens,* and *Kalmia latifolia*. In some forests shrubs are sparse or absent and herbs diversity is low. Characteristic herbaceous species in Appalachian *Tsuga* forests include *Chimaphila maculata, Actaea racemosa (= Cimicifuga racemosa), Dennstaedtia punctilobula, Dryopteris intermedia, Galax urceolata, Goodyera pubescens, Hexastylis shuttleworthii, Medeola virginiana, Mitchella repens, Polystichum acrostichoides, Thalictrum clavatum, Thelypteris noveboracensis, Tiarella cordifolia,* and *Viola rotundifolia*.

Communities within this alliance are found on acidic soils that may be poorly drained. stands of this alliance occur on sandy loam and loam that averaged 115 cm deep and had a fragipan at 45-70 cm. Windthrow is the most common disturbance; surface fires and crown

fires occur rarely. In the Southern Blue Ridge, these forests are found on valley flats, narrow ravines, and north- to east-facing slopes, at elevations from 1800-3500 feet (550-1060 m).

Related Concepts:

- Canada Hemlock Forest (Schafale and Weakley 1990) I
- Eastern Hemlock: 23 (Eyre 1980) I
- Hemlock (white pine) - northern hardwood forest (Fike 1999) ?
- Hemlock - Yellow Birch: 24 (Eyre 1980) I
- Hemlock CUPL, BR (Pyne 1994) ?
- Hemlock Ravine Community (Swain and Kearsley 2001) ?
- Hemlock-mixed forest (Evans 1991) I
- Northern Hardwood - Conifer Forest (Smith 1991) ? habitat type 4 (Barnes 1991) ?

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in Michigan, southwestern Wisconsin, Connecticut, Maine, Maryland, Massachusetts, New York (?), New Hampshire, Pennsylvania, Virginia (?), West Virginia, Georgia, Kentucky, North Carolina, South Carolina, and Tennessee. It also occurs in Canada in southern Ontario.

Subnations: GA, KY, MI, NC, ON, SC, TN, VT, WI

TNC Ecoregions: 46:C, 47:C, 48:C, 50:C, 51:C, 52:C, 58:C, 59:C

USFS Ecoregions: 212Hb:CC?, 212Hh:CCP, 212Hl:CCC, 212Ia:CCC, 212Ja:CCC, 212Jb:CCC, 212Jc:CCC, 212Je:CCC, 212Jf:CCC, 212Jj:CCC, 212Jl:CCC, 212Jm:CCC, 212Jn:CCP, 212Jo:CCP, 212Js:CCC, 212K:CC, 221Ha:CCC, 221Hc:CCC, 221He:CCC, 221Ja:C??, 221Jb:C??, 221Jc:C??, 222D:C?, 222Ja:CCC, 222Je:CCC, 222Ka:CCC, 222Lb:CCC, 222Lc:CCC, 222Ld:CCC, 231Cd:CC?, 232Bt:PPP, M221Aa:CCC, M221Ba:CPP, M221Bb:CPP, M221Bd:CPP, M221Cc:CCC, M221Cd:CCC, M221Ce:CCC, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Cumberland Gap, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Daniel Boone, George Washington?, Jefferson?, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

References: Barnes 1991, Burns and Honkala 1990a, Coffman and Willis 1977, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Fike 1999, Frelich and Lorimer 1991a, Golden 1974, Golden 1981, Hinkle 1978, Lorimer 1980, Martin 1959a, McLeod 1988, Newell et al. 1997, Oosting and Bourdeau 1955, Patterson 1994, Pyne 1994, Racine and Hardin 1975, Rawinski et al. 1996, Rogers 1980, Schafale and Weakley 1990, Segars et al. 1951, Smith 1991, Swain and Kearsley 2001, Whittaker 1956

I.A.8.N.C. *ABIES FRASERI - PICEA RUBENS* FOREST ALLIANCE (A.136)
FRASER FIR - RED SPRUCE FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This forest alliance is restricted to the highest mountain systems of the Southern Blue Ridge Province, in eastern Tennessee, western North Carolina, and southwestern Virginia, within the distributional range of *Abies fraseri*. Canopies can be dominated by *Abies fraseri* or *Picea rubens*, or codominated by *Abies fraseri* and *Picea rubens*. Canopy/subcanopy species of minor importance can include *Acer spicatum*, *Acer pensylvanicum*, *Amelanchier laevis*, *Betula alleghaniensis*, *Prunus pensylvanica*, and *Sorbus americana*. Forests on extreme sites may have a stunted appearance and, in some communities, standing dead stems of *Abies fraseri* are common, with extensive patches of *Abies fraseri* seedlings in canopy gaps. The density and composition of the shrub and herbaceous strata vary between associations in this alliance. Forests in this alliance typically have a well-developed bryophyte layer. Mosses, liverworts, and lichens grow densely on fallen logs, tree trunks, and the forest floor, giving these forests a distinctive carpeted appearance. This alliance contains many species endemic to the Southern Blue Ridge or that have the bulk of their worldwide range in that region. The alliance is conceptually related to more northern spruce-fir alliances and shares many northern or boreal species (often occurring in communities of this alliance as disjuncts from their main distribution), but is considered a separate alliance because of its large component of southern Appalachian endemic species. Forests of this alliance occur on all topographic positions except the steepest rocky cliffs. Elevations range from 1370-2300 m (4500-6600 feet), with pure *Abies fraseri* associations best developed at above 1830 m (6000 feet). The dominant soils are Inceptisols with scattered occurrences of Spodosols at the highest elevations. Generally, soils can be described as shallow and rocky, with well-developed organic and A horizons. All soils in these high-elevation forests are low in base saturation, high in organic matter, and are acid in reaction (pH 3-5), with a high aluminum content. The moisture regimes of these areas are mesic to wet due to high rainfall, abundant cloud cover, fog deposition, and low temperatures. The climate has been classified as perhumid, with the temperature varying elevationally from mesothermal to microthermal. The regional geology is dominated by complexly folded metamorphic, sedimentary, and igneous rocks of the Precambrian and early Paleozoic age, including phyllites, slates, schists, sandstones, quartzites, granites, and gneisses. These forests are affected by debris avalanches, wind disturbance and lightning fire. Because of the shallow soils and extreme wind exposure, these forests are susceptible to large blowdowns, particularly in areas damaged by *Adelges piceae*, the Balsam Woolly Adelgid.

Related Concepts:
- *Abies fraseri* Alliance (Grossman and Goodin 1995) ?
- Fraser Fir Forest (Schafale and Weakley 1990) ?
- Fraser Fir Forest (Pyne 1994) ?
- IA4a. Red Spruce - Fraser Fir Forest (Allard 1990) ?
- IA4b. Fraser Fir Forest (Allard 1990) ?
- Oligotrophic Forest (Rawinski 1992) ?
- Red Spruce - Fraser Fir: 34 (Eyre 1980) I
- Red Spruce--Fraser Fir Forest (Schafale and Weakley 1990) ?
- Spruce - Fir, BR (Pyne 1994) ?

Classification Comments: This alliance exists in only a small portion of its original range due to the impact of early 20th century, post-logging fires and the ongoing outbreak of the Balsam Woolly Adelgid, an exotic pest that infests and kills mature *Abies fraseri*. Well-developed, undisturbed examples of this alliance are extremely rare. Present day *Picea rubens* and *Abies fraseri* vegetation in the southern Appalachians is estimated to cover only 48% (69 square kilometers) of the presettlement area (Cogbill and White 1991). These forests may grade into forests dominated by northern hardwood species (*Betula alleghaniensis, Fagus grandifolia, Acer saccharum*) and may also occur adjacent to montane grasslands, high-elevation shrublands, or high-elevation rock outcrop communities.

ALLIANCE DISTRIBUTION

Range: This alliance is found in North Carolina, Tennessee, and Virginia. This forest alliance is restricted to the highest mountain systems of the Southern Blue Ridge Province, in eastern Tennessee, western North Carolina, and southwestern Virginia, within the distributional range of *Abies fraseri*. These forests reach their northern range limit in southwestern Virginia, where they are confined to elevations above 1700 m (5400 feet) on Mount Rogers in Grayson and Smyth counties.
Subnations: NC, TN, VA
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Aa:CCC, M221Ba:CCC, M221Bc:CCP, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains); USFS (Cherokee, George Washington, Jefferson, Nantahala, Pisgah)

ALLIANCE SOURCES

References: Allard 1990, Brown 1941, Bruck 1988, Busing et al. 1988, Cogbill and White 1991, Crandall 1958, Crandall 1960, Davis 1930, Dull et al. 1988b, Eyre 1980, Grossman and Goodin 1995, Korstian 1937, McLeod 1988, NCNHP 1993, Nicholas et al. 1992, Oosting and Billings 1951, Pyne 1994, Ramseur 1960, Rawinski 1992, Schafale and Weakley 1990, Schofield 1960, Stephenson and Adams 1984, Stephenson and Clovis 1983, Wentworth et al. 1988, White 1984a, White and Cogbill 1992, White and Pickett 1985, White et al. 1993, Whittaker 1956, Zedaker et al. 1988

I.A.8.N.C. *PICEA RUBENS* FOREST ALLIANCE (A.138)
RED SPRUCE FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: Evergreen forests dominated by *Picea rubens* or codominated by *Picea rubens* and *Tsuga canadensis*, occurring in the Central Appalachians and Southern Blue Ridge, from West Virginia south to western North Carolina and eastern Tennessee. Other species that may occur with low coverage in the canopy or subcanopy are *Acer pensylvanicum, Acer spicatum, Aesculus flava, Amelanchier laevis, Betula alleghaniensis, Halesia tetraptera var. monticola, Prunus pensylvanica*, and *Sorbus americana*. Density and composition of shrub and herbaceous strata vary with association and geographic location. Exposed, drier sites, such as upper convex slopes or slopes with a southerly aspect, will often have high coverage of evergreen shrub species. Typical shrubs in this alliance include *Photinia melanocarpa (= Aronia melanocarpa), Crataegus* spp., *Ilex montana, Kalmia latifolia, Leucothoe fontanesiana, Rhododendron carolinianum, Rhododendron catawbiense, Rhododendron maximum, Smilax rotundifolia, Vaccinium angustifolium, Vaccinium erythrocarpum, Vaccinium simulatum, Viburnum lantanoides*, and *Viburnum nudum var. cassinoides*. Herbaceous cover is typically sparse, but where the shrub stratum is more open, a moderate herb stratum may develop. Characteristic herbaceous species include *Athyrium filix-femina, Clintonia borealis, Dryopteris campyloptera, Galax urceolata, Huperzia lucidula, Lycopodium clavatum, Lycopodium dendroideum, Lycopodium obscurum, Medeola virginiana, Mitchella repens, Oxalis montana, Rugelia nudicaulis, Schizachne purpurascens*, and *Trillium undulatum*. Nonvascular plants are common and often abundant, especially on moister sites, where they grow on branches and around the base of trees and shrubs. Bryophyte species include *Bazzania trilobata, Hylocomium splendens, Polytrichum ohioense, Ptilium crista-castrensis*, and *Sphagnum* spp. This alliance includes forests occurring on steep, seepy boulderfields, and on ridges and steep slopes with northeast to southwest exposures, above 1370 m (4500 feet) elevation. It descends to 1000 m (3100 feet) in the Central Appalachians. In local landscapes of the Southern Blue Ridge and Central Appalachians, this alliance tends to occur bimodally, on high ridges and summits and steep, rocky upper slopes, and at lower elevations in frost pocket situations, where *Picea rubens* apparently has a competitive advantage because of moist, acid, organic soils and/or cold air drainage.

Related Concepts:
- IA4a. Red Spruce - Fraser Fir Forest (Allard 1990) I
- Oligotrophic Forest (Rawinski 1992) ?
- Red Spruce--Fraser Fir Forest (Schafale and Weakley 1990) I
- Red Spruce: 32 (Eyre 1980) I
- Spruce - Fir, BR (Pyne 1994) ?

Classification Comments: Associations in this alliance occur in mountain ranges where *Abies fraseri* is absent or below the elevational range of *Abies fraseri*. *Picea rubens* forests in western Virginia and in eastern West Virginia may be more similar to forests in the I.A.8.N.c *Picea rubens - Abies balsamea* Forest Alliance (A.150) in the northern portion of the Appalachian range, where *Abies balsamea* replaces *Abies fraseri* and where other southern Appalachian endemics no longer occur. *Picea rubens* forests in West Virginia may be transitional between forests in these two alliances.

ALLIANCE DISTRIBUTION

Range: This alliance is found in North Carolina, Tennessee, Virginia, and West Virginia.
Subnations: NC, PA, TN, VA, WV
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Aa:CCC, M221Ba:CCC, M221Bb:CCP, M221Bc:CCC, M221Bd:CCP, M221Be:CCP, M221C:CC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Cherokee, George Washington, Jefferson, Monongahela, Nantahala, Pisgah)

ALLIANCE SOURCES

References: Allard 1990, Cogbill and White 1991, Eyre 1980, Fleming and Moorhead 1996, Pyne 1994, Rawinski 1992, Schafale and Weakley 1990, Stephenson and Adams 1984, Stephenson and Clovis 1983, White and Cogbill 1992, White et al. 1993
I.A.8.N.e. Temporarily flooded temperate or subpolar needle-leaved evergreen forest

I.A.8.N.E. *TSUGA CANADENSIS - (PINUS STROBUS)* TEMPORARILY FLOODED FOREST ALLIANCE (A.171)
EASTERN HEMLOCK - (EASTERN WHITE PINE) TEMPORARILY FLOODED FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This hemlock forested wetland is found along montane streams and terraces in the Southern Appalachians and Cumberland Mountains of the southeastern United States. Stands are dominated by *Tsuga canadensis* or codominated by *Tsuga canadensis* and *Pinus strobus*. Deciduous species, if present, form only a minor part of the canopy (generally less than 25%). Forests in this alliance often have dense ericaceous shrub layers dominated by *Rhododendron maximum* and/or *Leucothoe fontanesiana*. In some forests shrub strata are sparse or absent, with little or no herbaceous cover; the ground cover is mainly litter or bare soil. This alliance includes forests on floodplains and terraces, where surface water may be present for brief periods during growing season, but the water table usually lies well below the soil surface. Soils tend to be well-developed and silty. Currently this alliance is defined for montane alluvial forests in the Southern Blue Ridge and small streambottoms in Virginia's Ridge and Valley and northern Blue Ridge.
Related Concepts:
- Eastern Hemlock: 23 (Eyre 1980) I
- Montane Alluvial Forest (Schafale and Weakley 1990) I
- White Pine - Hemlock: 22 (Eyre 1980) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in Georgia, Kentucky (?), North Carolina, South Carolina, Tennessee, and Virginia. Currently this alliance is defined for montane alluvial forests in the Southern Blue Ridge, extending north into Virginia's Ridge and Valley and northern Blue Ridge.
Subnations: GA, KY, NC, SC, TN, VA
TNC Ecoregions: 50:C, 51:C, 59:C
USFS Ecoregions: 221Hc:CCC, M221Aa:CCC, M221Ab:CCC, M221Ce:CP?, M221Da:CCC, M221Db:CC?, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway?); USFS (Chattahoochee?, Cherokee?, Daniel Boone, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

References: Eyre 1980, Rawinski et al. 1996, Schafale and Weakley 1990
I.A.8.N.g. Saturated temperate or subpolar needle-leaved evergreen forest

I.A.8.N.G. *PICEA RUBENS* SATURATED FOREST ALLIANCE (A.198)
RED SPRUCE SATURATED FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: Wetland forests dominated by *Picea rubens* or mixtures of *Picea rubens* and *Tsuga canadensis*, occurring outside the main range of *Abies balsamea*. These forests often have a dense shrub layer dominated by *Rhododendron maximum* and may have coverage by *Sphagnum* species. Some occurrences have *Taxus canadensis* in the understory. *Listera smallii* is characteristic in the sparse herb stratum. Other characteristic herbs include *Oclemena acuminata (= Aster acuminatus), Huperzia lucidula*, and *Dryopteris campyloptera*. Forests in this alliance occur on saturated substrates, where surface water is seldom present, but the soil is saturated to surface for extended periods during the growing season. These forests are known from poorly drained bottomlands, above 3500 feet elevation (1070 m) in the Southern Blue Ridge, but also occur in the northern Ridge and Valley and central Appalachians. It historically occurred in Tennessee.

Related Concepts:

- Boreal Conifer Swamp (Smith 1991) I
- Red Spruce: 32 (Eyre 1980) I
- Red spruce palustrine forest (Fike 1999) ?
- Red spruce palustrine woodland (Fike 1999) ?
- Swamp Forest-Bog Complex, Spruce Subtype (Schafale and Weakley 1990) ?

Classification Comments: Forests in this alliance are distinguished by having a forest structure and lacking *Abies balsamea* and by having little herbaceous cover and low species richness. Examples from the Southern Blue Ridge include Alarka Laurel and Long Hope Valley, North Carolina.

ALLIANCE DISTRIBUTION

Range: This alliance is found in North Carolina, Tennessee, Maryland, Pennsylvania, Virginia, and West Virginia.
Subnations: MD, NC, PA, TN?, VA?, WV
TNC Ecoregions: 51:C, 59:C, 60:C
USFS Ecoregions: 212Fb:CCC, 212Fd:CCC, 212G:CC, 221Bd:CCP, M212Ea:CCC, M221Aa:CCC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Dc:CCC
Federal Lands: USFS (George Washington, Jefferson?, Nantahala, Pisgah)

ALLIANCE SOURCES

References: Eyre 1980, Fike 1999, Schafale and Weakley 1990, Smith 1991, Weakley and Schafale 1994

I.B.2.N.a. Lowland or submontane cold-deciduous forest

I.B.2.N.A. *QUERCUS VELUTINA - QUERCUS ALBA - (QUERCUS COCCINEA)* FOREST ALLIANCE (A.1911)
BLACK OAK - WHITE OAK - (SCARLET OAK) FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: Forests in this alliance represent the drier end of the white oak - red oak - black oak cover type and are difficult to identify easily. This alliance is distributed in the Ozark Highlands, Ouachita Mountains, Arkansas Valley, the Interior Highlands, Piedmont, Inner Coastal Plain, and Blue Ridge. Stands are codominated by some combination of *Quercus alba, Quercus coccinea, Quercus velutina*, and/or *Quercus rubra*. In addition, *Quercus stellata, Quercus prinus, Carya alba, Carya glabra, Carya ovata, Pinus virginiana*, and *Pinus echinata* are common associates. Other common associates can include *Nyssa sylvatica, Acer rubrum var. rubrum, Sassafras albidum, Quercus falcata, Quercus macrocarpa* (within its range), and *Prunus serotina var. serotina*. Typical shrubs and small trees include *Cornus florida, Corylus americana, Ostrya virginiana, Oxydendrum arboreum, Sassafras albidum, Kalmia latifolia, Rhododendron calendulaceum, Gaylussacia ursina, Vaccinium* spp., *Viburnum acerifolium*, and *Hamamelis virginiana*. The herbaceous composition varies considerably over the wide range of this alliance. Some common herbs include *Agrimonia rostellata, Amphicarpaea bracteata, Botrychium virginianum, Carex blanda, Danthonia spicata, Antennaria plantaginifolia, Desmodium nudiflorum, Thelypteris noveboracensis, Prenanthes altissima, Galium* spp., *Dioscorea villosa, Conopholis americana, Polygonatum biflorum, Medeola virginiana,* and *Maianthemum racemosum*. Stands can be found on mid to upper slopes and terraces where dry-mesic conditions persist and where soils are more sandy and/or rocky. Bedrock is sandstone, siltstone, chert, or shale. Disturbance in the form of wind and logging tends to favor *Quercus velutina* in these forests. These forests generally occur on slopes and sheltered ridgetops. One example from the Interior Low Plateau of Tennessee occurs on high, ancient, elevated terraces adjacent to river floodplains.

Related Concepts:

- Acidic sub-xeric forest (Evans 1991) I
- Black Oak - Scarlet Oak Forest / Woodland (Swain and Kearsley 2001) ?
- Coastal Forest/Woodland (Swain and Kearsley 2001) ?
- Montane Oak--Hickory Forest (Schafale and Weakley 1990) I

- Submesic Oak - Hickory Forest (Foti 1994b) ?
- T1B4aII4c. *Quercus alba - Quercus velutina - Quercus falcata* (Foti et al. 1994) ?
- White Oak - Black Oak - Northern Red Oak: 52 (Eyre 1980) I

Classification Comments: It is not clear (2001-08-19) what the Piedmont manifestations of this alliance are. It is attributed to Kings Mountain NMP, Sumter NF, etc. but no association captures these attributes. Is a "provisional" justified? A new association will be added from the Arkansas Field Office Ouachita Inventory. This alliance is also present in Virginia, at least in the Ridge and Valley; a new association is likely needed. Stands previously placed in this alliance that occur in what are called inland maritime situations in older mature stands in the Outer Coastal Plain of South Carolina (C. Aulbach-Smith pers. comm.) need to be accommodated elsewhere. In Kentucky, these forests lack *Quercus rubra* as a dominant and occur in the Shawnee Hills and on upper slopes and ridgetops in the Appalachian Plateaus, and are abundant in the Interior Low Plateau.

ALLIANCE DISTRIBUTION

Range: This alliance is distributed in the Ozark Highlands, Ouachita Mountains, Arkansas Valley, the Interior Highlands, Piedmont, upper Coastal Plain, and Blue Ridge. It is found in Arkansas, Georgia, North Carolina, Tennessee, Connecticut, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, Pennsylvania, Rhode Island, Virginia, West Virginia, Iowa, Illinois, Indiana, Michigan, Minnesota, Missouri, Ohio, and Wisconsin, and in Ontario, Canada, and possibly in Alabama (?), Delaware (?), Kentucky (?), Mississippi (?), Oklahoma (?), and South Carolina (?).

Subnations: AL?, AR, CT, DE?, GA, IA, IL, IN, KY?, MA, MD, ME, MI, MN, MO, MS?, NC, NH, NJ, NY, OH, ON, PA, RI, SC, TN, VA, WI, WV

TNC Ecoregions: 36:C, 38:C, 39:C, 43:C, 44:C, 45:C, 46:C, 48:C, 50:C, 51:C, 52:C, 53:C, 56:P, 58:C, 59:C, 60:C, 61:C, 62:C

USFS Ecoregions: 212Fa:CCP, 212Fb:CCP, 212Fd:CCP, 212Ga:CCP, 212Gb:CCP, 212Ht:CPP, 212Hu:CPP, 212Hw:CP?, 212Hx:CPP, 221Ab:CCC, 221Ac:CCP, 221Ad:CCP, 221Ae:CCC, 221Af:CCC, 221Ag:CCC, 221Ai:CCP, 221Ak:CCC, 221Bd:CCP, 221Dc:CPP, 221E:CP, 221F:CP, 221Jb:CCC, 222Aa:CCC, 222Ab:CCP, 222Ad:CCP, 222Ae:CCP, 222Af:CCP, 222Ag:CCP, 222Aj:CCP, 222Am:CCP, 222Ca:CCC, 222Cf:CCP, 222Cg:CCP, 222De:CCC, 222Df:CCC, 222Dh:CCP, 222Di:CCP, 222Eb:CCC, 222Eg:CCP, 222Eh:CCP, 222Ek:CCC, 222Em:CCC, 222Fe:CCC, 222Ga:CCC, 222Gb:CCC, 222Gd:CCC, 222Ha:CCC, 222Hb:CCP, 222Hf:CCP, 222Ig:CCC, 222Ja:CC?, 222Jb:CCP, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCP, 222Kj:CCC, 222Lc:CCC, 222Lf:CCC, 222Md:CCC, 222Me:CCC, 231A:CP, 231Bd:CPP, 231Gb:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CCP, 232Bq:CCC, 232Br:CCC, 232Bt:CCP, 232Ch:CCC, 251Cf:CCC, 251Ci:CCC, 251Cj:CCC, 251Ck:CCC, 251Dc:CCC, 251Dd:CCC, 251Df:CCC, 251Dg:CCC, 251Dh:CCP, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Bb:CCC, M221Bf:CCC, M221C:CP, M221Da:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: DOD (Arnold, Fort Benning); NPS (Blue Ridge Parkway?, Buffalo, Cape Cod, Fire Island, Great Smoky Mountains, Kings Mountain, Russell Cave, Shiloh?); TVA (Tellico); USFS (Cherokee?, Daniel Boone?, George Washington, Holly Springs?, Huron-Manistee?, Jefferson, Nantahala, Ouachita, Ozark, Pisgah, Sumter, Talladega, Tuskegee, Uwharrie)

ALLIANCE SOURCES

References: Aulbach-Smith pers. comm., Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Foti 1994b, Foti et al. 1994, Jones 1988a, Jones 1988b, Schafale and Weakley 1990, Swain and Kearsley 2001

I.B.2.N.A. *QUERCUS MUEHLENBERGII - (ACER SACCHARUM)* FOREST ALLIANCE (A.1912) CHINQUAPIN OAK - (SUGAR MAPLE) FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes a variety of dry, dry-mesic, and mesic forests, dominated by *Quercus muehlenbergii* and possibly *Acer saccharum*, the canopy often also including other hardwood species associated with high base substrates (e.g., limestone or dolomite) under a variety of moisture conditions. These include *Quercus alba, Quercus shumardii, Fraxinus americana, Fraxinus quadrangulata, Acer barbatum, Tilia americana, Carya* spp., *Juglans nigra*, and *Liriodendron tulipifera* (in the more interior portions of the alliance's distribution), and *Quercus sinuata var. sinuata* and *Carya myristiciformis* (in the southwestern, Coastal Plain portion of the alliance's distribution). The habitat of this alliance includes mesic and dry-mesic forests over limestones in the Nashville Basin of Tennessee, dry-mesic slopes associated with prairie openings in Louisiana, moist limestone slopes in the Edwards Plateau of Texas, blackland soils in the upper West Gulf Coastal Plain of Arkansas, lowlands and mesic slopes of Oklahoma and adjacent Arkansas, as well as related habitats in states farther east (e.g., Alleghenies and lower Cumberland Plateau escarpment). Forests in Kentucky and Tennessee have *Quercus shumardii* and *Frangula caroliniana* and occur over limestone on south-facing slopes. There are scattered occurrences on benches and clifftops on the Daniel Boone National Forest. In the Coastal Plain of Virginia, this alliance is represented by somewhat open canopy 'shell barren' forests dominated by *Quercus muehlenbergii* with *Acer barbatum*. On rare occurrences of limestone in the Southern Blue Ridge of North Carolina, *Quercus muehlenbergii* occurs with *Juglans nigra, Fraxinus americana*, and *Acer saccharum*. Understory species may include *Cornus florida, Cercis canadensis, Calycanthus floridus, Cornus alternifolia, Ostrya virginiana*, and *Hydrangea arborescens*. In the Northeast, the shrub layer is sparse and may contain *Hamamelis virginiana, Zanthoxylum americanum*, and *Cornus alternifolia*. In some more southerly examples, shrubs may include *Forestiera ligustrina, Frangula caroliniana*, and *Symphoricarpos orbiculatus*. The herbaceous layer may contain *Asclepias quadrifolia, Clematis occidentalis (= Clematis verticillaris)* (in northeastern examples), *Packera obovata (= Senecio obovatus), Phryma leptostachya,*

Saxifraga virginiensis, Arabis laevigata, and *Triosteum aurantiacum*. Two unusual communities of this alliance are lowland forests from the Upper West Gulf Coastal Plain of Arkansas. In the Northeast, the habitat is characterized as upper slopes or summits of limestone or marble ridges with dry soil-moisture regimes. Limestone outcrops or boulders may be present, as well as Karst collapse features. In the Southeast, mesic to dry limestone-derived soils may occur as well on flatter landforms, as in the Nashville Basin of Tennessee. In the Southeast, this vegetation is known from the Ridge and Valley, lower Cumberland Plateau escarpment, Highland Rim escarpment, and Nashville Basin in Tennessee; the Highland Rim, Bluegrass and Dripping Springs escarpment in Kentucky; the Cumberland Plateau in Alabama; as well as rarely in the Southern Blue Ridge and Coastal Plain. Isolated occurrences are reported in northern Arkansas on moderately shallow soils, often on glade margins. It also occurs in the Arbuckle Mountains of Oklahoma and the Edwards Plateau of Texas. If this alliance occurs in the Upper East Gulf Coastal Plain, stands would contain *Acer barbatum* instead of *Acer saccharum*.

Related Concepts:

- *Quercus muehlenbergii* forest alliance (Hoagland 1997) ?
- Basic Mesic Forest, Montane Calcareous Subtype (Schafale and Weakley 1990) ?
- Bigtooth Maple-Oak Series (Diamond 1993) I
- Calcareous Talus Forest / Woodland (Swain and Kearsley 2001) ?
- Calcareous mesophytic forest (Evans 1991) I
- Calcareous sub-xeric forest (Evans 1991) I
- Calcareous xeric forest (Evans 1991) I
- Dry-Mesic Calcareous Central Forest (Smith 1991) ?
- IA6j. Interior Calcareous Oak - Hickory Forest (Allard 1990) ?
- IA6k. Sugar Maple - Oak - Hickory Forest (Allard 1990) I
- Sugar Maple - Oak - Hickory Forest (Pyne 1994) I
- Sugar Maple: 27 (Eyre 1980) I
- Yellow Oak Dry Calcareous Forest (Swain and Kearsley 2001) ?
- Yellow oak - redbud woodland (Fike 1999) ?

Classification Comments: This alliance was created by the merger of the former *Acer saccharum - Quercus muehlenbergii* Forest Alliance and the former *Quercus muehlenbergii* Forest Alliance. MP 6-01: On the southern flank of the alliance's distribution, the sugar maple which is present is *Acer barbatum (= Acer saccharum var. floridanum)*, not *Acer saccharum var. saccharum*. Is this a problem?

ALLIANCE DISTRIBUTION

Range: This alliance may be found in Alabama, Arkansas, Kentucky, Louisiana, North Carolina, Oklahoma, South Carolina (?), Tennessee, Texas, Connecticut, Maryland, Massachusetts, New Jersey, New York, Pennsylvania, Vermont, Virginia, West Virginia, Illinois, Indiana, Michigan (?), Missouri, Nebraska (?), and Ohio, and in Canada in Ontario. In the Southeast, this vegetation is known from the Ridge and Valley, lower Cumberland Plateau escarpment, Highland Rim escarpment, and Central Basin in Tennessee; the Highland Rim, Bluegrass and Dripping Springs escarpment in Kentucky; the Cumberland Plateau in Alabama; as well as rarely in the Southern Blue Ridge and coastal plain. Isolated occurrences are reported in northern Arkansas on moderately shallow soils, often on glade margins. It also occurs in the Arbuckle Mountains of Oklahoma and the Edwards Plateau of Texas.

Subnations: AL, AR, CT, GA, IL, IN, KY, LA, MA, MD, MI?, MS?, NC, NJ, NY, OH, OK, ON, PA, SC?, TN, TX, VA, VT, WV

TNC Ecoregions: 29:C, 32:C, 33:C, 37:C, 38:C, 39:C, 40:C, 41:C, 43:C, 44:C, 45:C, 48:C, 49:C, 50:C, 51:C, 57:C, 58:C, 59:C, 60:?, 61:C, 63:C, 64:C

USFS Ecoregions: 212B:CC, 212E:CC, 212Fa:C??, 212Ga:C??, 212Gb:C??, 221Ae:CCC, 221B:CC, 221Dc:CC?, 221Ea:CCC, 221Hb:CCC, 221Hc:CCC, 221Hd:CCP, 221Ja:CCC, 221Jb:CCC, 221Jc:CCP, 222An:CC?, 222Cg:CCC, 222Df:CCP, 222Dg:CCC, 222Ea:CC?, 222Eb:CCC, 222Ec:CCC, 222Ed:CCC, 222Ee:CCC, 222Ef:CCC, 222Eg:CCC, 222Eh:CCC, 222Ej:CCC, 222En:CCC, 222Eo:CCP, 222Fa:CCP, 222Fb:CCC, 222Fc:CC?, 222Fd:CCC, 222Fe:CCP, 222Ff:CCP, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222I:CC, 231Ba:CP?, 231Be:CP?, 231Cc:CCP, 231Cd:CCC, 231Ce:CCP, 231Cf:CCP, 231Cg:CCP, 231Da:CCP, 231Dc:CCP, 231De:CCC, 231Ea:CCP, 231Eb:CCC, 231Gc:CCC, 232Br:CCC, 232Ch:C??, 232Fa:CCC, 251Ea:P??, 251Eb:P??, 251Ec:P??, 251Ed:P??, 255Af:CCC, 311A:CC, 315D:CC, M212B:CC, M212Cb:CCC, M212Cc:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Bd:CC?, M221Be:CCP, M221Ca:CC?, M221Cb:CCP, M221Cc:CC?, M221Ce:CCC, M221Da:CCC, M221Db:CC?, M221Dc:CCC, M221Dd:CCC

Federal Lands: COE (J. Percy Priest?, Lake Millwood); NPS (Colonial, Cumberland Gap?, Great Smoky Mountains?, Russell Cave?, Shiloh, Stones River); TVA (Columbia, Tellico); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Kisatchie, Ozark, Pisgah); USFWS (Wichita Mountains)

ALLIANCE SOURCES

References: Allard 1990, Andreu and Tukman 1995, Bowen et al. 1995, Campbell 1980, Crites and Clebsch 1986, Diamond 1993, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Fike 1999, Fowells 1965, Hoagland 1997, Hoagland 1998a, Pyne 1994, Schafale and Weakley 1990, Smith 1991, Swain and Kearsley 2001, Ware and Ware 1992

I.B.2.N.A. *QUERCUS RUBRA* MONTANE FOREST ALLIANCE (A.272)
NORTHERN RED OAK MONTANE FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes *Quercus rubra*-dominated forest vegetation of high elevations (over 1070 m or 3500 feet), montane landscapes in the central and southern Appalachians. A closed to very open canopy has trees that are often gnarled and stunted, especially on ridge crests. *Quercus rubra* is often the only canopy tree, but other species may have minor importance, including *Acer rubrum, Crataegus punctata, Crataegus flabellata, Betula alleghaniensis,* and *Betula lenta*. *Quercus alba* is a significant component of forests at high elevations in Virginia's Ridge and Valley and at the lower elevations of associations in the Southern Blue Ridge. Forests in this alliance have variable physiognomies, ranging from open herb-dominated understories to understories dominated by dense ericaceous shrubs. If a subcanopy is present, typical species include canopy species plus *Hamamelis virginiana, Amelanchier arborea, Acer pensylvanicum, Halesia tetraptera,* and *Ilex montana*. In forests with little or no shrub cover, herbaceous cover is dense and diverse, composed of sedges, ferns, and tall herbs, with dominance varying within and between occurrences. Where shrub cover is dense, the herbaceous stratum is not diverse and is typically very sparse with scattered forbs. Major compositional variation within these forests is related to a moisture gradient, which in turn is a function of topographic position and relative amount of solar radiation received. Forests typically occur over well-drained, loamy soils underlain by Precambrian gneisses, schists, and granites. These soils are classified as Typic, Umbric, or Lithic Dystrochrepts, and Typic Haplumbrepts. Soils supporting these forests tend to have relatively high base status. Forests occur on most of the major mountain ranges of the southern Appalachians at elevations of 1070-1525 m (3500-5000 feet) on broad ridges, mid to upper slope positions, and on steep rocky slopes at the heads of coves. Forests are also known from the central (on granitic crests) and northern Blue Ridge (on middle to upper convex slopes) and in the northern Ridge and Valley. Damage by ice storms is probably the most common form of natural disturbance in these montane forests. On exposed sites these forests commonly contain, as inclusions, acidic rock outcrop communities and montane shrublands, and may grade into forests dominated by *Tsuga caroliniana, Pinus rigida, Pinus pungens,* and *Quercus prinus*. At higher elevations these forests often occur adjacent to or grade into forests dominated by *Picea rubens, Abies fraseri,* or northern hardwood species (*Betula alleghaniensis, Fagus grandifolia, Aesculus flava*). In some areas, forests are found adjacent to montane shrublands and grasslands. At low elevations, on dry sites, these forests may grade into forests dominated by mixed *Quercus* species. Many *Quercus rubra*-dominated stands of today were, prior to the Chestnut Blight in the 1930s, dominated or codominated by *Castanea dentata* with scattered *Quercus rubra* and *Acer rubrum* in the canopy. The fungus *Cryphonectria parasitica (= Endothia parasitica)* eliminated *Castanea dentata* in the upper canopy, subsequently releasing the subcanopy *Quercus rubra*, which eventually resulted in a nearly pure upper canopy of large *Quercus rubra*.

Related Concepts:

- *Osmunda claytoniana* Subassociation (Rawinski et al. 1996) ?
- *Quercus rubra - Betula alleghaniensis / Rhododendron catawbiense / Angelica triquinata - Aster acuminatus* Association (Rawinski et al. 1996) ?
- *Quercus rubra - Carya ovata / Helianthus decapetalus* Association (Rawinski et al. 1996) ?
- *Quercus rubra / Ilex montana / Dennstaedtia punctilobula - Melanthium parviflorum* Association (Rawinski et al. 1996) ?
- High Elevation Red Oak Forest (Schafale and Weakley 1990) ?
- IA4g. High Elevation Northern Red Oak Forest (Allard 1990) ?
- Northern Red Oak, BR (Pyne 1994) ?
- Northern Red Oak: 55 (Eyre 1980) I Permesotrophic Forest (Rawinski 1992) I
- Submesic Oak Ridge Forest (Ambrose 1990a) ?
- Submesotrophic Forest (Rawinski 1992) I

Classification Comments: Associations yet to be defined in this alliance include forests of the central Appalachians and possibly a distinct amphibolite type in the North Carolina mountains. High-elevation *Quercus rubra - Quercus alba* forests also occur over greenstone in Virginia's Ridge and Valley (G. Fleming pers. comm.).

ALLIANCE DISTRIBUTION

Range: This alliance includes *Quercus rubra*-dominated forest vegetation of high elevations (over 3500 feet), montane landscapes in the central and southern Appalachians. It may possibly range into Kentucky's Cumberland Mountains. This alliance is found in Georgia, North Carolina, Tennessee, and Virginia, and may extend into Kentucky (?), South Carolina (?), and West Virginia (?).

Subnations: GA, KY?, NC, SC?, TN, VA, WV?

TNC Ecoregions: 50:C, 51:C, 59:C

USFS Ecoregions: M221Aa:CCC, M221Ba:CCC, M221Cc:C??, M221Da:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains, Shenandoah?); USFS (Chattahoochee, Cherokee, George Washington, Jefferson, Nantahala, Pisgah)

ALLIANCE SOURCES

References: Allard 1990, Ambrose 1990a, DeLapp 1978, Eyre 1980, Fleming pers. comm., Golden 1974, McLeod 1988, McNab and Browning 1993, Pyne 1994, Rawinski 1992, Rawinski et al. 1996, Schafale and Weakley 1990, Stephenson and Adams 1989, Weakley 1980, Wharton 1978, Whigham 1969, Whittaker 1956

I.B.2.N.A. *QUERCUS PRINUS - (QUERCUS COCCINEA, QUERCUS VELUTINA)* FOREST ALLIANCE (A.248)
ROCK CHESTNUT OAK - (SCARLET OAK, BLACK OAK) FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes xeric oak forests strongly dominated by *Quercus prinus* or *Quercus prinus* with admixtures of *Quercus coccinea* and/or *Quercus velutina*, occurring in the southern and central Appalachians, Ridge and Valley, Cumberland Plateau, Piedmont, Interior Low Plateau, and possibly in the northern Appalachians. In the Piedmont and Ridge and Valley, and in areas transitional to these provinces, *Quercus stellata* and *Quercus marilandica* may be canopy associates. Other canopy/subcanopy associates include *Acer rubrum, Amelanchier arborea, Carya alba, Carya glabra, Cornus florida, Hamamelis virginiana, Magnolia fraseri, Nyssa sylvatica, Oxydendrum arboreum, Pinus rigida, Pinus strobus, Quercus alba, Quercus rubra, Robinia pseudoacacia*, and *Sassafras albidum*. In the Appalachians, a dense ericaceous shrub layer is characteristic, with species such as *Gaylussacia baccata, Gaylussacia ursina, Kalmia latifolia, Leucothoe recurva, Rhododendron maximum, Vaccinium pallidum*, and *Vaccinium stamineum*. In the upper Piedmont *Kalmia latifolia, Vaccinium arboreum*, and *Vaccinium pallidum* are common. In the montane distribution of this alliance, forests of this alliance have replaced forests formerly dominated or codominated by *Castanea dentata*, and chestnut sprouts are common in the understory. Other shrub species found in forests of this alliance include *Chionanthus virginicus, Diospyros virginiana, Robinia hispida, Sassafras albidum, Styrax grandifolius, Symplocos tinctoria, Viburnum acerifolium, Viburnum prunifolium*, and *Viburnum rufidulum*. Herbaceous cover is typically sparse in these dry, rocky forests and species vary with geographic location. Some typical herbaceous species include *Antennaria plantaginifolia, Aureolaria laevigata, Chamaelirium luteum, Chimaphila maculata, Danthonia spicata, Dichanthelium commutatum, Dichanthelium dichotomum, Dioscorea quaternata, Epigaea repens, Galax urceolata, Galium latifolium, Gaultheria procumbens, Goodyera pubescens, Hieracium venosum, Lysimachia quadrifolia, Medeola virginiana, Monotropa uniflora, Potentilla canadensis, Pteridium aquilinum, Stenanthium gramineum, Uvularia puberula*, and *Uvularia sessilifolia*. These forests occur on convex, upper slopes and ridgetops, south-facing slopes, over thin, rocky, infertile soils in the Appalachians, typically below 3500 feet (1066 m), where windthrow and ice damage are common natural disturbances. In the Piedmont these forests occur on low mountains and hills, on rocky, well-drained, acidic soils, sometimes associated with outcrops of quartzite, or other resistant rock.

Related Concepts:

- *Quercus prinus - Quercus velutina / Vaccinium stamineum* Association (Fleming and Moorhead 1996) ?
- Appalachian sub-xeric forest (Evans 1991) I
- Chestnut Oak Forest (Schafale and Weakley 1990) I
- Chestnut Oak: 44 (Eyre 1980) I
- Dry oak - heath forest (Fike 1999) ?
- IA6d. Chestnut Oak Slope and Ridge Forest (Allard 1990) ?
- IA7d. Piedmont Monadnock Forest (Allard 1990) ?
- Mixed Oak Forest (Swain and Kearsley 2001) ?
- Oligotrophic Forest (Rawinski 1992) I
- Piedmont Monadnock Forests (Schafale and Weakley 1990) I
- Ridgetop Chestnut Oak (Swain and Kearsley 2001) ?
- Xeric Central Hardwood Forest (Smith 1991) ?

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance occurs in the southern and central Appalachians, Ridge and Valley, Cumberland Plateau, Piedmont, Interior Low Plateau, and possibly in the northern Appalachians. It is found in Illinois, Indiana, Ohio, Connecticut, Delaware, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, Alabama, Georgia, Kentucky, North Carolina, South Carolina, and Tennessee, and possibly Maine (?), Maryland (?), Mississippi (?), and West Virginia (?).
Subnations: AL, CT, DE, GA, IL, IN, KY, MA, MD, ME, NC, NH, NJ, NY, OH, PA, RI, SC, TN, VA, VT, WV
TNC Ecoregions: 38:C, 43:P, 44:C, 45:C, 48:C, 49:C, 50:C, 51:C, 52:C, 59:C, 60:C, 61:C, 63:C, 64:C
USFS Ecoregions: 212Ec:CCC, 212Fa:CCP, 212Fb:CCC, 212Fc:CCC, 212Fd:CCC, 212Ga:CCC, 212Gb:CCC, 221Aa:CC?, 221Ac:CCP, 221Ad:CCP, 221Ae:CCC, 221Af:CCC, 221Ag:CCC, 221Ah:CCC, 221Ai:CCP, 221Aj:CCP, 221Ak:CCP, 221Al:CC?, 221Am:CCC, 221Ba:CCC, 221Bb:CCC, 221Bc:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCP, 221Dc:CCC, 221Ea:CCC, 221Eb:CCC, 221Ec:CCC, 221Ed:CCC, 221Ee:CCC, 221Ef:CCC, 221Eg:CCC, 221Fa:CCC, 221Fb:CCP, 221Hc:CC?, 221I:CP, 221Ja:CCP, 221Jb:CCC, 221Jc:CCP, 222Aq:CCC, 222Cf:CCP, 222Cg:CCP, 222Da:CCP, 222Db:CCC, 222Dc:CCP, 222De:CCC, 222Dg:CCP, 222Dh:CCP, 222Dj:CCP, 222Eb:CCC, 222Eg:CCC, 222Ei:CCC, 222Ek:CCP, 222El:CCC, 222Em:CCC, 222Eo:CCC, 222Fd:CCC, 222Hb:CCC, 231Aa:CCP, 231Ad:CCC, 231Ae:CCC, 231Af:CCC, 231Ag:CCC, 231Aj:CCC, 231Ak:CCC, 231Al:CCC, 231Am:CCP, 231An:CCP, 231Ao:CCP, 231Ap:CCP, 231Be:CPP, 231Cd:CCC, 231Dc:CCC, 232Aa:PPP, 232Ac:PPP, 232Ad:PPP, 232Ba:PP?, 232Bc:PP?, 232Bd:PPP, 232Br:PPP, 232Ch:PPP, M212Ba:CPP, M212Bb:CPP, M212Ca:CCC, M212Cb:CCC, M212Cc:CCC, M212Cd:CCP, M212De:CCC, M212Ea:CCC, M212Eb:CCP, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC,

M221Ad:CCC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Bd:CCC, M221Be:CCC, M221Bf:CCC, M221Ca:CPP, M221Cb:CPP, M221Cc:CPP, M221Cd:CPP, M221Ce:CPP, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: DOD (Fort Knox); NPS (Blue Ridge Parkway?, Carl Sandburg Home, Chickamauga-Chattanooga, Great Smoky Mountains, Harpers Ferry, Kings Mountain, Little River Canyon?, Rock Creek, Russell Cave); TVA (Land Between the Lakes, Tellico); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Nantahala, Oconee?, Pisgah, Sumter, Talladega?, Uwharrie)

ALLIANCE SOURCES

References: Allard 1990, Arends 1981, Callaway et al. 1987, Cooper 1963, DuMond 1970, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Fike 1999, Fleming and Moorhead 1996, Gibbon 1966, Golden 1974, Martin 1989, McLeod 1988, Mowbray 1966, Nelson 1986, Newell and Peet 1996a, Patterson 1994, Peet and Christensen 1980, Rawinski 1992, Rawinski et al. 1996, Schafale and Weakley 1990, Schmalzer 1978, Smith 1991, Swain and Kearsley 2001, Tobe et al. 1992, Wells 1974, Wheat 1986, Whittaker 1956

I.B.2.N.A. *QUERCUS PRINUS - QUERCUS RUBRA* FOREST ALLIANCE (A.250) ROCK CHESTNUT OAK - NORTHERN RED OAK FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes dry-mesic oak forests, codominated by *Quercus prinus* and *Quercus rubra*, at moderate elevations in the Blue Ridge, Ridge and Valley, and High Alleghenies of Virginia, western North Carolina, eastern Tennessee, South Carolina, and Georgia. It also includes transitional oak - hickory forests of Lower New England and the Northern Piedmont. This alliance may possibly range into the upper Piedmont and into the eastern fringes of the Cumberland Mountains and Appalachian Plateau of Kentucky, but no associations have been defined for these regions. The majority of the forests in this alliance occur in areas previously dominated by *Castanea dentata*, and chestnut sprouts are common in the understory. The canopy of forests in this alliance tend to be dominated by *Quercus rubra* and/or *Quercus prinus*, although other mesic hardwood species can codominate or be present in the canopy and subcanopy. Typical tree associates include *Liriodendron tulipifera, Acer rubrum, Hamamelis virginiana, Acer pensylvanicum*, and *Oxydendrum arboreum*. In the Appalachian Mountains, shrub layers are often dense and dominated by ericaceous species, *Rhododendron maximum* (especially on northerly aspects), *Rhododendron minus, Kalmia latifolia, Gaylussacia* spp., and *Vaccinium* spp. Herbaceous coverage tends to be inversely proportional to the shrub coverage. *Galax urceolata* and *Gaultheria procumbens* are components in sparse herb strata. Other herbs typical of these forests include *Solidago curtisii, Lysimachia quadrifolia, Thelypteris noveboracensis, Gentiana decora, Sanicula trifoliata, Prenanthes altissima, Dichanthelium* spp. (*Dichanthelium boscii, Dichanthelium commutatum, Dichanthelium dichotomum), Carex pensylvanica, Polystichum acrostichoides, Chimaphila maculata, Desmodium nudiflorum, Galium latifolium, Houstonia purpurea*, and *Maianthemum racemosum ssp. racemosum*. In montane landscapes, these forest occur on intermediate positions of elevation and aspect, on protected, often rocky slopes. Forests in this alliance are also found on sandstone boulderfields and outcrops in Virginia's Ridge and Valley.
Related Concepts:
- *Quercus prinus - Quercus rubra / Acer pensylvanicum* Association (Fleming and Moorhead 1996) ?
- Appalachian sub-xeric forest (Evans 1991) I
- Chestnut Oak Forest (Schafale and Weakley 1990) I
- Chestnut Oak: 44 (Eyre 1980) I
- Dry-Mesic Oak--Hickory Forest (Schafale and Weakley 1990) I
- Oak - Chestnut - Hickory Forest (Ambrose 1990a) ?
- Oak--Hickory Forest (Nelson 1986) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance ranges from the southern Blue Ridge, north through the Ridge and Valley, and High Alleghenies of Virginia, and into some areas of Lower New England and the Northern Piedmont. This alliance may possibly range into the upper Piedmont and into the eastern fringes of the Cumberland Mountains and Appalachian Plateau of Kentucky, but no associations have been defined for these regions.
Subnations: GA, KY, MD, NC, NJ?, PA, SC, TN, VA, WV
TNC Ecoregions: 49:?, 50:P, 51:C, 52:C, 59:C, 61:C
USFS Ecoregions: 212G:P?, 221Am:CCP, 221Da:CCP, 221Db:CCP, 221Eb:C??, 221F:C?, 221H:C?, 221J:C?, 231Aa:PPP, 231Ag:PP?, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Bd:CCC, M221Bf:CCC, M221Ca:C??, M221Cb:C??, M221Cc:C??, M221Cd:C??, M221Ce:C??, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway?, C&O Canal, Carl Sandburg Home, Catoctin, Great Smoky Mountains, Harpers Ferry, Kings Mountain, Shenandoah); USFS (Chattahoochee, Cherokee, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

References: Ambrose 1990a, Evans 1991, Eyre 1980, Fleming and Moorhead 1996, Golden 1981, Livingston and Mitchell 1976, McLeod 1988, Mowbray 1966, Nelson 1986, Nowacki and Abrams 1992, Rheinhardt 1981, Schafale and Weakley 1990

I.B.2.N.A. *LIRIODENDRON TULIPIFERA - TILIA AMERICANA* VAR. *HETEROPHYLLA - AESCULUS FLAVA - ACER SACCHARUM* FOREST ALLIANCE (A.235) TULIPTREE - APPALACHIAN BASSWOOD - YELLOW BUCKEYE - SUGAR MAPLE FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance represents the mixed mesophytic forests of the Southern Blue Ridge and Appalachian Plateau, with highly variable canopies, often with no clear canopy dominant. These forests are locally referred to as 'Cove Forests.' Characteristic canopy species include *Liriodendron tulipifera, Tilia americana var. heterophylla, Aesculus flava,* and *Acer saccharum.* Other species that may occur in the canopy include *Prunus serotina var. serotina, Fraxinus americana, Acer rubrum, Quercus rubra, Fagus grandifolia, Carya cordiformis, Betula alleghaniensis, Halesia tetraptera var. monticola,* and *Magnolia fraseri.* Species composition will vary with geology and/or elevation. Shrub strata are open to sparse and can include *Hydrangea arborescens, Lindera benzoin, Calycanthus floridus,* and *Cornus alternifolia*. Herbaceous strata are typically lush and diverse. A partial list of typical species includes *Actaea racemosa (= Cimicifuga racemosa), Trillium erectum, Caulophyllum thalictroides, Impatiens pallida, Impatiens capensis, Laportea canadensis, Adiantum pedatum, Polystichum acrostichoides, Ageratina altissima var. roanensis, Hepatica nobilis var. acuta, Asarum canadense, Stellaria pubera, Tiarella cordifolia, Clintonia umbellulata, Sedum ternatum, Mitella diphylla, Osmorhiza claytonii, Dryopteris intermedia, Arisaema triphyllum, Cystopteris protrusa, Trillium grandiflorum, Viola canadensis, Dicentra canadensis, Dicentra cucullaria, Hydrophyllum canadense, Hydrophyllum virginianum, Phacelia bipinnatifida, Phacelia fimbriata, Delphinium tricorne, Carex austrocaroliniana, Carex manhartii, Carex plantaginea,* and *Carex platyphylla*. These forests mainly occur on protected, mesic, low to moderate elevation (2000-4500 feet, 610-1370 m) sites, primarily broad coves and lower slopes. Forests in this alliance are known from the Southern Blue Ridge of North Carolina, South Carolina, Georgia, Tennessee, Virginia, and the Cumberland Mountains of Kentucky. More information is needed to characterize forests provisionally assigned to this alliance that occur in the Allegheny Plateau of West Virginia and Ohio and in Indiana.

Related Concepts:

- Appalachian mesophytic forest (Evans 1991) I
- Beech - Sugar Maple: 60 (Eyre 1980) I
- IA5a. Southern Appalachian Mesophytic Cove Forest (Allard 1990) ?
- Mesic Central Forest (Smith 1991) I
- Mixed Mesophytic BR (Pyne 1994) ?
- Mixed mesophytic forest (Fike 1999) ?
- Rich Cove Forest (Schafale and Weakley 1990) ?
- Yellow-Poplar: 57 (Eyre 1980) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in southern Indiana, southern Ohio, West Virginia, Virginia (?), Georgia, Kentucky, North Carolina, South Carolina, and Tennessee. Forests in this alliance are known from the Southern Blue Ridge of North Carolina, South Carolina, Georgia, Tennessee, Virginia, and the Cumberland Mountains of Kentucky. More information is needed to characterize forests provisionally assigned to this alliance that occur in the Allegheny Plateau of West Virginia and Ohio and in Indiana.

Subnations: GA, IN, KY, NC, OH, PA, SC, TN, VA, WV

TNC Ecoregions: 44:C, 49:C, 50:C, 51:C, 52:C, 59:C

USFS Ecoregions: 221Ea:CCC, 221Eb:CCC, 221Ec:CCC, 221Ed:CCC, 221Ee:CCC, 221Ef:CCC, 221Eg:CCC, 221Ha:CPP, 221Hb:CPP, 221Hc:CPP, 221He:CPP, 222E:CC, 222F:CC, 231Ab:CCC, 231Ad:CCC, M221Aa:CCC, M221Ab:CCC, M221Bb:CCC, M221Bd:CCC, M221Be:CCC, M221Cc:CC?, M221Cd:CCC, M221Ce:CCC, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

References: Allard 1990, Boufford and Wood 1977, Chapman 1957, Cooper 1963, Cooper and Hardin 1970, Dellinger unpubl. data 1992, DuMond 1970, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Fike 1999, Golden 1974, Govus 1982, Greenlee 1974, Malter 1977, McLeod 1988, Newell et al. 1997, Patterson 1994, Pyne 1994, Rodgers and Shake 1965, Schafale and Weakley 1990, Smith 1991, Thomas 1966, Tobe et al. 1992, Tucker 1973, Weakley et al. 1979, Whigham 1969, Whittaker 1956

I.B.2.N.A. *LIRIODENDRON TULIPIFERA* FOREST ALLIANCE (A.236)
TULIPTREE FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes deciduous forests dominated by *Liriodendron tulipifera*, primarily in areas which were once clearcut, old fields, or cleared by fire or other natural disturbances. These non-wetland forests are also found along mesic stream terraces and on upland mountain benches. Forests in this alliance are abundant in the central and southern Appalachians, below 915 m (3000 feet) elevation, usually associated with disturbance and on the most productive sites, but also occur in the Coastal Plain, Piedmont, Ridge and Valley, and Cumberland Plateau. This alliance includes pure, often even-aged stands of *Liriodendron tulipifera* as well as forests with *Liriodendron tulipifera* associated with other species favored by canopy openings. Associated species vary with geographic location. Throughout most of the range of this alliance, *Acer rubrum, Robinia pseudoacacia, Betula lenta, Acer saccharum*, and *Acer negundo* are common components. In the Piedmont and Coastal Plain, *Liquidambar styraciflua* is a common associate. In the Appalachians, *Halesia tetraptera, Tsuga canadensis, Tilia americana var. heterophylla (= Tilia heterophylla), Prunus serotina var. serotina*, and *Magnolia fraseri* can be additional components. In the Ridge and Valley and Cumberland Plateau, additional species include *Quercus rubra, Magnolia acuminata, Carya alba, Carya glabra, Pinus virginiana, Sassafras albidum, Pinus strobus, Carpinus caroliniana, Asimina triloba*, and *Staphylea trifolia*. Herbaceous strata are not diverse and, in the southern Appalachians, this feature distinguishes these forests from rich cove forests in *Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235). Vines can be abundant including *Vitis* spp., *Smilax* spp., *Aristolochia macrophylla*, and *Parthenocissus quinquefolia*. Forests in this alliance occur on middle to lower slopes, sheltered coves and gentle concave slopes, and river terraces over various soils and geologies. Vegetation of this alliance is uncommon in Louisiana.

Related Concepts:

- Yellow-Poplar: 57 (Eyre 1980) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in Alabama, Georgia, Kentucky, Louisiana, Mississippi (?), North Carolina, South Carolina, Tennessee, Maryland, Pennsylvania, Virginia, and West Virginia. Forests in this alliance are abundant in the central and southern Appalachians, below 915 m (3000 feet) elevation, but also occur in the Coastal Plain, Piedmont, Ridge and Valley, and Cumberland Plateau.

Subnations: AL, GA, KY, LA, MD, MS?, NC, PA, SC, TN, VA, WV

TNC Ecoregions: 43:C, 44:C, 50:C, 51:C, 52:C, 53:P, 58:C, 59:C

USFS Ecoregions: 221Ha:CCC, 221Hc:CCC, 221He:CCC, 221Jb:CCC, 222C:CC, 222D:CC, 222Eb:CCC, 222Ed:CCP, 222En:CCC, 222Eo:CCC, 231Aa:CCP, 231Ae:CCC, 231Bc:CCC, 231Cd:CCC, 231Dc:CCC, 232B:CC, 232D:CP, 234Ab:CCC, M221Aa:CCC, M221Ab:CCP, M221Ac:CCC, M221Ad:CCC, M221Bb:CCC, M221Da:CCC, M221Db:CCP, M221Dc:CCC, M221Dd:CCC

Federal Lands: DOD (Arnold, Fort Benning); NPS (Blue Ridge Parkway, Cowpens, Fort Donelson, Great Smoky Mountains, Guilford Courthouse, Harpers Ferry, Kennesaw Mountain, Kings Mountain, Ninety Six, Rock Creek, Shenandoah, Shiloh); TVA (Tellico); USFS (Apalachicola, Bankhead, Bienville, Chattahoochee, Cherokee, Conecuh, Daniel Boone, De Soto, George Washington, Jefferson, Nantahala, Oconee?, Pisgah, St. Francis, Sumter, Talladega, Tombigbee, Tuskegee)

ALLIANCE SOURCES

References: Andreu and Tukman 1995, Eyre 1980, Gallyoun et al. 1996, Golden 1974, Horn 1980, McGee and Hooper 1970, Phillips and Shure 1990, Schmalzer 1978, Thomas 1966

I.B.2.N.A. *QUERCUS ALBA - (QUERCUS RUBRA, CARYA* SPP.) FOREST ALLIANCE (A.239)
WHITE OAK - (NORTHERN RED OAK, HICKORY SPECIES) FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance is widely distributed in the eastern United States and portions of adjacent Canada and includes dry mesic to mesic upland oak forests dominated by *Quercus alba* and/or *Quercus rubra*, with or without *Carya* species. Stands are 15-25 m tall, with a closed, deciduous canopy. The shrub and herbaceous strata are typically well-developed. *Quercus alba* usually dominates the stands, either alone or in combination with *Quercus rubra* (especially on moister sites) and sometimes *Quercus velutina* (especially on drier sites). Some associations in this alliance are dominated by *Quercus rubra*, although *Quercus alba* is usually also a canopy component. *Carya* species (particularly *Carya alba*, *Carya glabra* or *Carya ovata*) are typically common either in the canopy or subcanopy. In the southeastern United States, this alliance covers dry-mesic forests of the Piedmont, low Appalachian Mountains, and the Cumberland and Interior Low Plateau, and mesic oak-hickory forests of the Blue Ridge and the interior highlands of the Ozarks and Ouachita Mountains. Associated species include *Carya glabra, Carya ovata, Carya alba, Fraxinus americana, Acer rubrum, Acer leucoderme, Cornus florida, Nyssa sylvatica, Ostrya virginiana, Calycanthus floridus, Pyrularia pubera, Tilia americana var. caroliniana, Oxydendrum arboreum*, and others. This alliance is found throughout the midwestern United States on moderately rich,

upland sites. Typical associates include *Fraxinus americana, Ulmus americana, Tilia americana, Acer saccharum, Acer rubrum*, and more locally, *Quercus macrocarpa* and *Quercus ellipsoidalis*.

Stands are found on gentle to moderately steep slopes on uplands and on steep valley sides. The soils are moderately deep to deep and vary from silts to clays and loams. The parent material ranges from glaciated till to limestone, shale, sandstone and other bedrock types. In the midwestern United States, many stands are succeeding to types dominated by *Acer saccharum, Tilia americana, Acer rubrum*, and other mesic tree associates. This succession may be delayed by fire and grazing. In the eastern and southeastern United States, *Liriodendron tulipifera, Fraxinus americana, Acer rubrum*, and other mesic associates often increase after disturbances, such as clearcutting or windstorms, especially in the absence of fire.

Related Concepts:

- Acidic mesophytic forest (Evans 1991) I
- Basic Oak - Hickory Forest (Nelson 1986) ?
- Basic Oak--Hickory Forest, Mafic Substrate Variant (Schafale and Weakley 1990) I
- Calcareous mesophytic forest (Evans 1991) I
- Dry-Mesic Oak--Hickory Forest (Schafale and Weakley 1990) ?
- IA6j. Interior Calcareous Oak - Hickory Forest (Allard 1990) I
- Mesic Oak - Hickory Forest (Foti 1994b) I
- Montane Oak--Hickory Forest (Schafale and Weakley 1990) I
- Oak - Chestnut - Hickory Forest (Ambrose 1990a) I
- Oak - Hickory Forest (Swain and Kearsley 2001) ?
- Oak--Hickory Forest (Nelson 1986) I
- Permesotrophic Forest (Rawinski 1992) I
- Submesic broadleaf deciduous forest (Ambrose 1990a) I
- T1B4aIII. *Quercus rubra* - *Quercus* spp. (Foti et al. 1994) ?
- White Oak - Black Oak - Northern Red Oak: 52 (Eyre 1980) I
- White Oak: 53 (Eyre 1980) I

Classification Comments: None

Alliance Distribution

Range: This alliance ranges from Ontario, Canada, throughout the midwestern and eastern United States, south to the very northern edges of the Western and Eastern Gulf coastal plains.

Subnations: AL, AR, CT, DE, GA, IA, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, MS?, NC, NE, NH, NJ, NY, OH, OK, ON, PA, RI, SC, TN, VA, VT, WI, WV

TNC Ecoregions: 32:P, 35:C, 36:C, 37:C, 38:C, 39:C, 40:C, 43:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C, 51:C, 52:C, 53:?, 58:C, 59:C, 60:C, 61:C, 62:C, 64:C

USFS Ecoregions: 212Ec:CCC, 212Ed:CCC, 212Fb:CCP, 212Fc:CCC, 212Fd:CC?, 212Ga:CC?, 212Gb:CC?, 212Ht:CPP, 212Hx:CPP, 212Jj:C??, 212Ka:CC?, 212Kb:CCC, 212Mb:C??, 212Na:CCP, 212Nb:CC?, 212Nc:CCC, 212Nd:CC?, 221Ab:CCC, 221Ad:CCP, 221Ae:CCC, 221Af:CCC, 221Ag:CCC, 221Ah:CCC, 221Ai:CCC, 221Ak:CCC, 221Al:CCC, 221Am:CCC, 221Ba:CCC, 221Bb:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Dc:CCC, 221Ea:CCC, 221Eb:CCC, 221Ec:CCC, 221Ed:CCC, 221Ee:CCC, 221Ef:CCC, 221Eg:CCC, 221Fa:CCC, 221Fb:CCP, 221Fc:CCC, 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 221Hd:CCC, 221He:CCC, 221Ja:CCP, 221Jb:CCC, 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Ah:CCC, 222Aj:CCC, 222Ak:CCC, 222Al:CCP, 222Am:CCC, 222An:CCC, 222Ao:CCC, 222Ap:CCC, 222Aq:CCC, 222Cb:CCC, 222Cc:CCC, 222Cd:CCC, 222Ce:CCC, 222Cf:CCC, 222Cg:CCC, 222Ch:CCC, 222Da:CCP, 222Db:CCC, 222Dc:CCC, 222Dd:CCP, 222De:CCC, 222Df:CCC, 222Dg:CCP, 222Dh:CCC, 222Di:CCC, 222Dj:CCP, 222Ea:CCC, 222Eb:CCC, 222Ec:CCC, 222Ed:CCC, 222Ee:CCC, 222Ef:CCC, 222Eg:CCC, 222Eh:CCC, 222Ei:CCC, 222Ej:CCP, 222Ek:CCC, 222Em:CCC, 222En:CCC, 222Eo:CCC, 222Fa:CCP, 222Fb:CCC, 222Fd:CCC, 222Fe:CCC, 222Ff:CCC, 222Ga:CCC, 222Gb:CCC, 222Gc:CCC, 222Ha:CCC, 222Hb:CCC, 222Hf:CCC, 222Id:CCP, 222If:CCC, 222Ja:CCC, 222Jb:CCC, 222Jc:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 222Lb:CCC, 222Lc:CCC, 222Le:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 222Qb:CCC, 231Aa:CCC, 231Ab:CCC, 231Ac:CCC, 231Ad:CCC, 231Ae:CCC, 231Af:CCC, 231Ag:CCC, 231Ah:CCC, 231Ak:CCC, 231Al:CCC, 231Am:CCC, 231An:CCC, 231Ao:CCC, 231Ap:CCC, 231Ba:CCP, 231Bb:CCP, 231Bc:CCP, 231Bd:CCP, 231Be:CCC, 231Bg:CCP, 231Bh:CCP, 231Bk:CCP, 231Ca:CCC, 231Cb:CCC, 231Cc:CCC, 231Cd:CCC, 231Cf:CCC, 231Da:CCC, 231Dc:CCC, 231Dd:CCC, 231De:CCC, 231E:CC, 231Gb:CCC, 232Aa:CCC, 232Ac:CCP, 232Ad:CCC, 232Bq:CCC, 232Br:CCC, 232Bt:CCC, 232Bv:CCC, 232Bx:CCC, 232Ca:CCC, 232Cb:CCC, 234Ac:PPP, 251Aa:CCC, 251Ba:CCC, 251Be:CCC, 251Ca:CC?, 251Cb:CCC, 251Cc:CCC, 251Cd:CCC, 251Ce:CCC, 251Cf:CCC, 251Cg:CCC, 251Ch:CCC, 251Cj:CCC, 251Ck:CCC, 251Cn:CC?, 251Co:CC?, 251Cp:CCC, 251Cq:CCC, 251Dc:CCC, 251Dd:CCC, 251De:CCC, 251Df:CCC, 251Dh:CCP, 251Ea:CCC, M212Bd:CCC, M212Cb:CCC, M212Cc:CCC, M212Ea:CC?, M212Eb:CC?, M221Aa:CCC, M221Bd:C??, M221Cd:CCC, M221Da:CCC, M221Dc:CCC, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: COE (Dale Hollow?); DOD (Arnold, Fort Benning); DOE (Oak Ridge); NPS (Blue Ridge Parkway?, Cape Cod, Carl Sandburg Home, Chickamauga-Chattanooga, Cowpens, Effigy Mounds, Fort Donelson, Great Smoky Mountains, Guilford Courthouse, Kennesaw Mountain, Kings Mountain, Little River Canyon?, Natchez Trace, Ninety Six, Russell Cave, Shenandoah, Shiloh); TVA (Tellico); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Land Between the Lakes, Mark Twain, Nantahala, Oconee, Ouachita?, Ozark, Pisgah, Shawnee, St. Francis, Sumter, Uwharrie)

ALLIANCE SOURCES

References: Allard 1990, Ambrose 1990a, Andreu and Tukman 1995, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Foti 1994b, Foti et al. 1994, Fountain and Sweeney 1985, Fralish 1988b, Fralish et al. 1991, Golden 1979, Hoagland 1997, Jones 1988a, Jones 1988b, McLeod 1988, Monk et al. 1990, Nelson 1986, Oakley et al. 1995, Oosting 1942, Rawinski 1992, Robertson et al. 1984, Schafale and Weakley 1990, Swain and Kearsley 2001, Wharton 1978

I.B.2.N.A. *QUERCUS ALBA* MONTANE FOREST ALLIANCE (A.271)
WHITE OAK MONTANE FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes montane forests where *Quercus alba* is the main canopy dominant, contributing at least 75% of the canopy coverage. These forests are limited to areas where elevation is the primary gradient influencing vegetation. Associations currently defined for this alliance are naturally rare, being found in uncommon environmental situations. Forests in this alliance include *Quercus alba* forests of dry, sandstone ridges and south-facing slopes in the highest portions of the Ouachita Mountains, forests on exposed, rocky ridges and convex upper slopes at middle to high elevations in the southern Appalachians, and unique *Quercus alba* forests found in association with serpentine geology in the Southern Blue Ridge of western North Carolina. Associated species in the Ouachita Mountains association include *Quercus rubra, Quercus stellata, Carya texana, Quercus marilandica, Amelanchier arborea, Acer rubrum, Sassafras albidum, Vaccinium* spp., *Rubus* spp., *Nyssa sylvatica, Hamamelis virginiana, Liquidambar styraciflua, Rhus copallinum, Rhus glabra, Pinus echinata, Chionanthus virginicus, Ulmus alata, Smilax* spp., *Rubus* spp., *Carex pensylvanica, Carex albicans var. albicans, Carex nigromarginata,* and *Carex ouachitana*; in the southern Appalachian association, *Kalmia latifolia, Gaylussacia ursina, Carex pensylvanica, Chimaphila maculata, Euphorbia corollata, Galax urceolata, Galium latifolium, Goodyera pubescens, Hexastylis shuttleworthii, Iris verna, Medeola virginiana, Castanea dentata, Castanea pumila, Sassafras albidum, Oxydendrum arboreum, Nyssa sylvatica*; and over serpentine, *Pinus rigida, Tsuga canadensis, Acer rubrum, Amelanchier arborea, Magnolia acuminata, Kalmia latifolia, Viburnum nudum var. cassinoides, Vaccinium stamineum, Physocarpus opulifolius, Packera plattensis (= Senecio plattensis), Hexastylis arifolia var. ruthii, Polygala paucifolia, Epigaea repens, Mitchella repens, Pteridium aquilinum var. latiusculum, Thalictrum macrostylum, Poa saltuensis, Phlox stolonifera, Andropogon gerardii*, and *Zizia aptera*.

Related Concepts:

- *Quercus alba* forest association (Hoagland 1998a) ?
- IA4h. High Elevation White Oak Forest (Allard 1990) ?
- IB4a. Dwarf White Oak Woodland (Allard 1990) ?
- IE9b. Blue Ridge/Piedmont Ultramafic Barren (Allard 1990) I
- Montane White Oak Forest (Schafale and Weakley 1990) I
- Stunted White Oak Woodland (Foti 1994b) ?
- T1B4bI1a. *Quercus alba* (stunted) (Foti et al. 1994) ? Ultramafic Outcrop Barren (Schafale and Weakley 1990) I
- White Oak: 53 (Eyre 1980) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: Forests in this alliance occur in the highest portions of the Ouachita Mountains, at middle to high elevations in the southern Appalachians, and in association with serpentine geology in the Southern Blue Ridge of western North Carolina. This alliance is found in Arkansas, Georgia, North Carolina, Oklahoma, South Carolina, and Tennessee.
Subnations: AR, GA, NC, OK, SC, TN
TNC Ecoregions: 39:C, 51:C
USFS Ecoregions: M221Aa:C??, M221Dc:CCC, M221Dd:CCC, M231Aa:CCC
Federal Lands: NPS (Great Smoky Mountains?); USFS (Chattahoochee, Cherokee, Nantahala, Ouachita, Pisgah)

ALLIANCE SOURCES

References: Allard 1990, Eyre 1980, Foti 1994b, Foti et al. 1994, Glenn 1990, Hoagland 1998a, Kauffman pers. comm., Mansberg and Wentworth 1984, McCormick and Platt 1980, Newell and Peet 1995, Nuttall 1821, Palmer 1924, Patterson 1994, Pell and Rettig 1983, Schafale and Weakley 1990

I.B.2.N.A. *BETULA ALLEGHANIENSIS - FAGUS GRANDIFOLIA - AESCULUS FLAVA* FOREST ALLIANCE (A.266)
YELLOW BIRCH - AMERICAN BEECH - YELLOW BUCKEYE FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes montane forests, mainly of the southern and central Appalachians, dominated by *Fagus grandifolia, Betula alleghaniensis*, and *Aesculus flava*, occurring in combination or with strong dominance by one of these species. Other species that may form a typically minor canopy component include *Acer saccharum, Betula lenta, Halesia tetraptera var. monticola, Picea rubens, Prunus serotina var. serotina, Quercus rubra*, and *Tilia americana var. heterophylla*. Subcanopy species can include small stems of canopy species as well as *Acer spicatum, Acer pensylvanicum, Amelanchier laevis*, and *Sorbus americana*. Shrub density varies between associations, ranging from very high to entirely lacking. Common species in the shrub and sapling strata include *Acer pensylvanicum, Acer spicatum, Amelanchier arborea var. austromontana, Aristolochia macrophylla, Cornus alternifolia, Crataegus punctata, Hydrangea arborescens, Ilex montana, Ribes cynosbati, Ribes rotundifolium, Ribes glandulosum, Rubus allegheniensis, Rubus canadensis, Vaccinium erythrocarpum*, and *Viburnum lantanoides*. The composition of herbaceous strata varies between associations. Variability in the herbaceous stratum may be related to aspect, elevation, and soil-nutrient status. Forests on drier, south-facing sites (often open convex slopes) typically have dense herbaceous cover, often approaching 100% coverage, and dominated by species of *Carex* (*Carex aestivalis, Carex brunnescens ssp. sphaerostachya, Carex debilis var. rudgei, Carex intumescens, Carex pensylvanica*), while more mesic sites have herbaceous strata dominated by large forbs and patches of ferns, with lesser amounts of sedges. In some forests, seepage areas are common, producing wet microhabitats with unique species assemblages (*Chelone lyonii, Circaea alpina, Rudbeckia laciniata, Impatiens pallida*, and *Monarda didyma*). Woody vines, and vining shrubs, may be common, especially in boulderfield associations. Other typical herbaceous species for this alliance include *Ageratina altissima var. roanensis, Anemone quinquefolia, Angelica triquinata, Arisaema triphyllum, Eurybia chlorolepis (= Aster chlorolepis), Athyrium filix-femina ssp. asplenioides, Cardamine clematitis, Actaea podocarpa (= Cimicifuga americana), Actaea racemosa (= Cimicifuga racemosa), Circaea alpina, Claytonia caroliniana, Clintonia borealis, Prosartes lanuginosa (= Disporum lanuginosum), Dryopteris campyloptera, Dryopteris intermedia, Dryopteris marginalis, Erythronium umbilicatum ssp. monostolum, Hylocomium splendens, Luzula acuminata, Maianthemum canadense, Medeola virginiana, Oxalis montana, Phacelia bipinnatifida, Phacelia fimbriata, Poa alsodes, Prenanthes altissima, Prenanthes roanensis, Rugelia nudicaulis, Saxifraga micranthidifolia, Solidago curtisii (= Solidago caesia var. curtisii), Solidago glomerata, Stellaria corei, Stellaria pubera, Streptopus lanceolatus var. roseus (= Streptopus roseus), Tiarella cordifolia, Thelypteris noveboracensis*, and *Trillium erectum*. These forests occur in a cool, humid climate, typically at high elevations (3500-6000 feet; 1066-1828 m) on a variety of sites, from upper concave slopes and steep, periglacial boulderfields and talus slopes, to flat ridgetops and saddles between ridges. Associations will vary with elevation, latitude, and geology and occur as small to large patches surrounded by other forest types, montane grasslands, or shrublands.

Related Concepts:

- *Betula alleghaniensis/Rubus idaeus ssp. strigosus/Sedum telephioides* Association (Rawinski et al. 1994) ?
- Beech, BR (Pyne 1994) ?
- Boulderfield Forest (Ambrose 1990a) ?
- Boulderfield Forest (Schafale and Weakley 1990) ?
- Cumberland highlands forest (Evans 1991) ?
- IA4c. Yellow Birch Boulderfield Forest (Allard 1990) ?
- IA4d. Southern Appalachian Beech Gap (Allard 1990) ? IA4e. Southern Appalachian Northern Hardwoods Forest (Allard 1990) ?
- Northern Hardwoods Forest (Schafale and Weakley 1990) ? Oligotrophic Forest (Rawinski 1992) I
- Spruce - Hardwood, BR (Pyne 1994) I
- Sugar Maple - Beech - Yellow Birch: 25 (Eyre 1980) I Yellow Birch, BR (Pyne 1994) ?

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: Forests in this alliance are found in the high-elevation regions of the Blue Ridge from West Virginia south to northern Georgia and may extend into the adjacent Ridge and Valley and Appalachian Plateau provinces. This alliance is found in Georgia, Kentucky, North Carolina, Tennessee, Virginia, and West Virginia.

Subnations: GA, KY, NC, TN, VA, WV

TNC Ecoregions: 50:C, 51:C, 59:C

USFS Ecoregions: M221Aa:CCC, M221B:C?, M221Cc:CCC, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, George Washington, Jefferson, Nantahala, Pisgah, Sumter?)

ALLIANCE SOURCES

References: Allard 1990, Ambrose 1990a, Bratton 1975, Brown 1941, Chafin and Jones 1989, Davis 1930, Dellinger unpubl. data 1992, Evans 1991, Evans pers. comm., Eyre 1980, Fuller 1977, Golden 1974, Golden 1981, Malter 1977, McLeod 1988, Pittillo and Smathers 1979, Pyne 1994, Ramseur 1960, Rawinski 1992, Rawinski et al. 1994, Rheinhardt 1981, Russell 1953, Schafale and Weakley 1990, Schofield 1960, Singer et al. 1984, Stamper 1976, Wharton 1978, White et al. 1993, Whittaker 1956, Wood 1975

I.B.2.N.D. *PLATANUS OCCIDENTALIS - (LIQUIDAMBAR STYRACIFLUA, LIRIODENDRON TULIPIFERA)* TEMPORARILY FLOODED FOREST ALLIANCE (A.289)
SYCAMORE - (SWEETGUM, TULIPTREE) TEMPORARILY FLOODED FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: Forests in this alliance typically are dominated by *Platanus occidentalis* with *Liquidambar styraciflua* and/or *Liriodendron tulipifera*, and typically occur on rocky streambeds and alluvial deposits on relatively high-gradient rivers. The alliance is distributed in the upper Piedmont, Appalachian Mountains, Interior Low Plateau, Cumberland Mountains, and Cumberland Plateau regions. In the eastern part of the Interior Low Plateau, vegetation of this alliance may be in lower gradient situations. Other canopy and understory species that may be present include *Aesculus sylvatica* (within its range), *Asimina triloba, Cornus florida, Alnus serrulata, Fraxinus americana, Acer rubrum, Carpinus caroliniana, Ulmus americana*, and *Fagus grandifolia* in the non-montane part of the distribution. Species present in the montane occurrences include *Platanus occidentalis, Liriodendron tulipifera, Betula alleghaniensis*, and *Betula lenta*, with *Carpinus caroliniana, Hamamelis virginiana, Liquidambar styraciflua, Betula nigra, Fraxinus americana, Acer rubrum, Pinus virginiana, Pinus strobus*, and *Tsuga canadensis*. *Euonymus americana* is a typical shrub species in the lower elevation occurrences, while *Rhododendron maximum* and *Leucothoe fontanesiana* are common at higher elevations. Herbaceous species vary as well by geography and elevation, and may include *Arisaema triphyllum, Sanicula canadensis, Saururus cernuus, Campanula divaricata, Dichanthelium dichotomum var. dichotomum, Amphicarpaea bracteata, Actaea racemosa (= Cimicifuga racemosa), Polystichum acrostichoides, Eurybia divaricata (= Aster divaricatus), Viola sororia*, and *Viola blanda*. *Carex* species may be common (e.g., *Carex appalachica, Carex austrocaroliniana, Carex blanda, Carex crinita, Carex digitalis, Carex plantaginea, Carex swanii*, and/or *Carex torta*).

Related Concepts:

- Alluvial forest (Evans 1991) I
- Eutrophic Seasonally Flooded Forest (Rawinski 1992) I
- IIA7g. Sycamore - Sweetgum - American Elm Riverfront Forest (Allard 1990) I
- Piedmont/Low Mountain Alluvial Forest (Schafale and Weakley 1990) I
- Rocky Bar and Shore (Schafale and Weakley 1990) I
- Sycamore - Sweetgum - American Elm: 94 (Eyre 1980) I

Classification Comments: Vegetation of the Interior Low Plateau, where there is a distribution overlap of related alliances, may also be classified in the I.B.2.N.d *Platanus occidentalis - (Fraxinus pennsylvanica, Celtis laevigata, Acer saccharinum)* Temporarily Flooded Forest Alliance (A.288). Consider a new alliance for montane alluvial vegetation called *Liriodendron tulipifera - Fraxinus americana / Carpinus caroliniana* Temporarily Flooded Forest Alliance [see North Carolina Vegetation Survey Nantahala Data].

ALLIANCE DISTRIBUTION

Range: The alliance is distributed in the upper Piedmont, Appalachian Mountains, Interior Low Plateau, Cumberland Mountains, Cumberland Plateau, and Chesapeake Bay regions. In the eastern part of the Interior Low Plateau, vegetation of this alliance may be in lower gradient situations. This alliance is found in Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Maryland, Delaware, and Virginia, and possibly in Alabama (?) and Mississippi (?).

Subnations: AL?, DE, GA, KY, MD, MS?, NC, SC, TN, VA

TNC Ecoregions: 43:C, 44:C, 50:C, 51:C, 52:C, 58:C, 59:C

USFS Ecoregions: 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 221Ja:CP?, 221Jb:CP?, 221Jc:CP?, 222C:CP, 222D:CP, 222Eb:CCC, 222Ec:CCP, 222Ed:CC?, 222Eg:CC?, 222Eh:CCP, 222En:CCC, 222Eo:CCC, 231Aa:CCP, 231Ae:CCC, 231Ag:CCC, 231Aj:CCC, 231Al:CCC, 231Be:C??, 231Ca:CPP, 231Cb:CPP, 231Cc:CPP, 231Cd:CP?, 231Cf:CPP, 231Da:CCP, 231Db:CCP, 231Dd:CCC, 232Ad:CCC, 232Br:CCC, M221Cd:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: DOD (Arnold); NPS (Great Smoky Mountains, Kings Mountain); USFS (Chattahoochee, Cherokee, Daniel Boone, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

References: Allard 1990, Evans 1991, Eyre 1980, Flinchum 1977, McLeod 1988, Newell and Peet 1995, Rawinski 1992, Schafale and Weakley 1990

I.B.2.N.e. Seasonally flooded cold-deciduous forest

I.B.2.N.E. *ACER RUBRUM - FRAXINUS PENNSYLVANICA* SEASONALLY FLOODED FOREST ALLIANCE (A.316)
RED MAPLE - GREEN ASH SEASONALLY FLOODED FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance is widely distributed in the eastern United States. Stands are dominated by broad-leaved deciduous trees and well-developed shrub and herbaceous strata. They are characterized by dense growth and a great diversity of species. Basal area can

reach 40-42 m2/ha. *Acer rubrum* and *Fraxinus pennsylvanica* are consistently abundant overstory species, but *Fraxinus profunda* (in the southern parts of this alliance's range), *Liquidambar styraciflua, Quercus lyrata, Quercus bicolor,* and *Ulmus americana* occur almost as frequently, and *Nyssa aquatica* and *Taxodium distichum* occur sporadically in the southern parts of this alliance's range. *Acer saccharinum* may dominate in parts of the range. The shrub layer can include a diverse mixture including *Carpinus caroliniana, Cephalanthus occidentalis, Forestiera acuminata,* and *Ilex decidua,* but *Itea virginica* is characteristic of southern stands of this alliance. Even with dense shading, the herbaceous layer is usually well-developed, displaying a preponderance of *Boehmeria cylindrica, Carex* spp., *Glyceria* spp., *Juncus* spp., *Laportea canadensis, Leersia* spp., and *Pilea pumila*. *Vitis* spp. are characteristic vines of this community, but *Toxicodendron radicans* and *Campsis radicans* are also prominent.

Sites which support stands of this alliance have level or nearly level soils that formed in water-deposited clayey or loamy sediments on floodplains of the Mississippi and other rivers and large perennial streams in the Coastal Plain. These soils are flooded or saturated for a significant portion of the growing season, and water may be ponded for most of the year in shallow depressions. Flooding can reach 1 m. Flooding occurs during the winter and spring and often extends into the growing season.

Related Concepts:

- *Acer rubrum - Nyssa aquatica* forest (Robertson et al. 1984) ?
- *Acer rubrum* forest alliance (Hoagland 1998a) ? Alluvial Red Maple Swamp (Swain and Kearsley 2001) ?
- Black Ash Swamp (Swain and Kearsley 2001) ?
- Black Ash-Red Maple-Tamarack Calcareous Seepage Swamp (Swain and Kearsley 2001) ?
- Red maple-green ash (Wharton et al. 1982) ?
- Spruce-Fir Boreal Swamp (Swain and Kearsley 2001) ?

Classification Comments: Stands of this alliance support a diverse assemblage of bottomland hardwoods. Perhaps the most diagnostic is the mixture of bottomland hardwoods found there. Species typical of wetter and drier sites are commonly encountered, but the diagnostic environmental feature is shallow standing water or soil saturation for a significant portion of the growing season. Slight ridges within these flooded zones provide drier habitat for less flood-tolerant species.

ALLIANCE DISTRIBUTION

Range: This alliance is widely distributed in the eastern United States in southern Michigan, Ohio, Indiana, Illinois, Wisconsin, southeastern Missouri, eastern Arkansas (?), Georgia, Kentucky, Louisiana, Mississippi, Oklahoma, Tennessee (?), Texas, South Carolina (?), North Carolina, central-western New York and the Lake Erie Plain of Pennsylvania, West Virginia, Maryland, New Jersey, and Virginia; and in Canada in southern Ontario.

Subnations: AR, CT, DE, GA, IL, IN, KY, LA, MA, MD, ME, MI, MO, MS, NB, NC, NH, NJ, NY, OH, OK, ON, PA, QC?, RI, SC, TN?, TX, VA, VT, WI, WV

TNC Ecoregions: 31:C, 36:C, 38:C, 40:P, 42:C, 43:C, 44:C, 45:C, 46:C, 47:P, 48:C, 49:C, 50:C, 51:C, 52:C, 53:P, 56:P, 57:C, 58:C, 59:C, 60:C, 61:C, 62:C, 63:C, 64:C

USFS Ecoregions: 212Cb:CCC, 212Da:C??, 212Ea:CP?, 212Eb:CPP, 212Ec:CPP, 212Fa:CCP, 212Fb:CCP, 212Fc:CCP, 212Fd:CCP, 212Ga:CPP, 212Gb:CPP, 212Hb:CCP, 212Hd:CCC, 212He:CCC, 212Je:CPP, 212Ka:CPP, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ae:CCC, 221Af:CCC, 221Ag:CCC, 221Ah:CCP, 221Ai:CCC, 221Ak:CCC, 221Al:CCC, 221Ba:CCC, 221Bb:CCC, 221Bc:CCC, 221Bd:CCP, 221Da:CCC, 221Db:CCP, 221Dc:CCC, 221Ea:CCP, 221Eb:CCP, 221Ed:CC?, 221Ef:CCC, 221Fa:CCC, 221Fb:CCC, 222Ao:CPP, 222Ca:CCP, 222Cb:CCP, 222Cc:CCP, 222Cd:CCP, 222Ce:CCP, 222Cf:CCP, 222Cg:CCP, 222Ch:CCP, 222Db:CCC, 222Df:CCC, 222Eg:CCP, 222Ek:CCC, 222Ga:CCC, 222Ha:CCC, 222Hb:CCC, 222Ia:CCC, 222Ic:CCP, 222Id:CCP, 222Ie:CC?, 222If:CCC, 222Ig:CCC, 222Ja:CC?, 222Je:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ke:CCC, 222Kf:CCC, 231Aa:CCC, 231Ae:CCP, 231Af:CCP, 231Ak:CCP, 231Al:CCP, 231Am:CCP, 231An:CCP, 231Ao:CCP, 231Ap:CCP, 231Gb:CCC, 231Gc:CCC, 232Aa:CCP, 232Ad:CCC, 232Ba:CCP, 232Bb:CC?, 232Bc:CCP, 232Bd:CC?, 232Be:CC?, 232Bf:CC?, 232Bg:CC?, 232Bh:CC?, 232Bi:CC?, 232Bj:CC?, 232Bk:CC?, 232Bl:CC?, 232Bm:CC?, 232Bn:CC?, 232Bo:CC?, 232Bp:CC?, 232Bq:CC?, 232Br:CCC, 232Bs:CCC, 232Bt:CCC, 232Bu:CC?, 232Bv:CC?, 232Bx:CCC, 232Bz:CC?, 232Ca:CC?, 232Cb:CC?, 232Cd:CC?, 232Ce:CC?, 232Cf:CC?, 232Cg:CC?, 232Ch:CCC, 232Ci:CC?, 232Cj:CC?, 232Dc:CCC, 234Aa:CCC, 234Ac:CCC, 234Ad:CCP, 234Ae:CCP, 234Af:CCC, 234Ag:CCP, 234Ah:CCC, 234Ai:CC?, 234Aj:CCP, 234Ak:CCP, 234Al:CCP, 234Am:CCP, 234An:CCP, 251Dg:CCC, 255Db:CCC, M212Ad:CP?, M212Bb:CCP, M212Bc:CCC, M212Bd:CCC, M212Ca:CC?, M212Cb:CCC, M212Cc:CCC, M212Cd:CC?, M212D:CP, M221Aa:CCP, M221Ab:CCC, M221Bb:CCP, M221Bd:CCP, M221Be:CCC, M221Ca:CP?, M221Cb:CPP, M221Da:CCP, M221Dc:CCC, M222A:??, M231A:??

Federal Lands: NPS (Acadia, Congaree Swamp, Great Smoky Mountains); USFS (Daniel Boone?, Francis Marion?, Ouachita?, Ozark?, Pisgah); USFWS (Little River, Reelfoot?, San Bernard)

ALLIANCE SOURCES

References: Faber-Langendoen et al. 1996, Golet et al. 1993, Hoagland 1998a, Robertson et al. 1984, Swain and Kearsley 2001, Wharton et al. 1982

I.C.3.N.a. Mixed needle-leaved evergreen - cold-deciduous forest

I.C.3.N.A. *TSUGA CANADENSIS - LIRIODENDRON TULIPIFERA* FOREST ALLIANCE (A.413) EASTERN HEMLOCK - TULIPTREE FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: Forests in this alliance are dominated by *Tsuga canadensis*, occurring with various hardwood species of mesic forests, including *Liriodendron tulipifera, Tilia americana var. heterophylla, Magnolia acuminata, Quercus rubra, Fraxinus americana, Betula lenta, Fagus grandifolia, Halesia tetraptera*, and others. Common shrubs are *Rhododendron maximum, Kalmia latifolia*, and *Leucothoe fontanesiana*. Herbaceous cover is typically sparse and includes acid-loving species such as *Polystichum acrostichoides, Goodyera pubescens, Thelypteris noveboracensis, Galax urceolata, Hexastylis* sp., and *Tiarella cordifolia*. These forests occur in deep coves, moist flats, and ravines, but are occasionally found along larger stream bottoms, typically at elevations below 1060 m (3500 feet). Forests in this alliance include acidic cove forests and mesic successional forests, mostly of the southern and central Appalachians, but also occurring in the Cumberland Plateau and Cumberland Mountains of Kentucky, Tennessee, and Alabama, the Allegheny Plateau of West Virginia, and isolated occurrences in the Interior Low Plateau of Indiana and Tennessee.

Related Concepts:

- Acidic Cove Forest (Schafale and Weakley 1990) I
- Hemlock-Mixed Mesophytic HR (Pyne 1994) ?
- Yellow-Poplar - Eastern Hemlock: 58 (Eyre 1980) I

Classification Comments: Occurrences are threatened by the Hemlock Woolly Adelgid (*Adelges tsugae*), an exotic insect pest.

ALLIANCE DISTRIBUTION

Range: Forests in this alliance include acidic cove forests and mesic successional forests, mostly of the southern and central Appalachians, but also occurring in the Cumberland Plateau and Cumberland Mountains of Kentucky, Tennessee, and Alabama, the Allegheny Plateau of West Virginia, and isolated occurrences in the Interior Low Plateau of Indiana and Tennessee. This alliance is found in Alabama, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Maryland, Pennsylvania, Virginia, Indiana, Ohio, and West Virginia.

Subnations: AL, GA, IN, KY, MD, NC, NJ, OH, PA, SC, TN, VA, WV

TNC Ecoregions: 44:C, 45:C, 48:C, 49:C, 50:C, 51:C, 52:C, 58:C, 59:C, 61:C

USFS Ecoregions: 212:C, 221Db:CPP, 221Ea:CCC, 221Ec:CCC, 221Ed:CCC, 221Ee:CCC, 221Ef:CCC, 221Eg:CCC, 221Fa:CCC, 221Fb:CCC, 221Fc:CCC, 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 222De:C??, 222Eb:CCC, 222Ek:CCC, 222Em:CCC, 222Eo:CCC, 222Hb:CCC, 222Hf:CCC, 231Aa:CCC, 231Ap:CCP, 231Ca:CCC, 231Cc:CCP, 231Cd:CCC, 232Ad:CCC, 232Bt:CCC, M221Aa:CCC, M221Ab:CCC, M221Ca:CPP, M221Cb:CPP, M221Cc:CPP, M221Ce:CPP, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC, M231Ad:CCC

Federal Lands: NPS (Blue Ridge Parkway?, Carl Sandburg Home, Great Smoky Mountains, Mammoth Cave); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

References: Cooper and Hardin 1970, Eyre 1980, Fike 1999, Gettman 1974, Golden 1974, Malter 1977, McLeod 1988, Newell and Peet 1995, Newell et al. 1997, Patterson 1994, Pyne 1994, Schafale and Weakley 1990, Winstead and Nicely 1976

I.C.3.N.A. *PINUS STROBUS - QUERCUS (COCCINEA, PRINUS)* FOREST ALLIANCE (A.402) EASTERN WHITE PINE - (SCARLET OAK, ROCK CHESTNUT OAK) FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes dry pine - oak forests dominated by *Pinus strobus* occurring with *Quercus coccinea* and/or *Quercus prinus*. Typical species in the subcanopy are *Oxydendrum arboreum, Acer rubrum var. rubrum, Nyssa sylvatica,* and *Cornus florida*. These forests often have dense ericaceous shrub strata with species such as *Rhododendron maximum, Kalmia latifolia, Vaccinium* spp., or *Gaylussacia* spp. Herbaceous strata have low species richness and are composed of species typical of dry montane forests, such as *Galax urceolata, Viola hastata, Chimaphila maculata, Goodyera pubescens, Epigaea repens, Smilax glauca, Smilax rotundifolia*, and *Chamaelirium luteum*. These forests occur on dry topographic settings at low elevations (below 3000 feet) in the Blue Ridge escarpment region, on upper slopes and ridgetops. In the Ridge and Valley of Virginia, these forests are known from north-facing slopes over shale substrates and on lower to middle elevation knobs and side ridges.

Related Concepts:

- *Pinus strobus-Quercus coccinea* Forest (Patterson 1994) ?
- Hardwood - White Pine Forest (Ambrose 1990a) ?
- IA6f. Dry White Pine Ridge Forest (Allard 1990) I
- White Pine - Chestnut Oak: 51 (Eyre 1980) ?
- White Pine - Hardwoods, BR (Pyne 1994) ?
- White Pine Forest (Schafale and Weakley 1990) I
- White Pine, BR (Pyne 1994) ?

Classification Comments: Isolated stands with *Pinus strobus* are found in the vicinity of Clifty, Kentucky. These occur on sandstones of the Dripping Springs escarpment (Logan, Muhlenburg, Todd counties) and are presumably more xeric. Their placement is unclear.

ALLIANCE DISTRIBUTION

Range: This alliance is found in Georgia, North Carolina, South Carolina, Tennessee, and may also be found in Virginia (?).
Subnations: GA, MD?, NC, SC, TN, VA, WV
TNC Ecoregions: 50:C, 51:C, 52:C, 59:C
USFS Ecoregions: 221Hb:CCC, 221He:CCC, 222Eo:CCC, 231Aa:CC?, 231Ae:CCC, 231Ak:CCC, 231Al:CC?, 231Ap:CCC, M221Aa:CCC, M221Ab:CCC, M221Da:CCC, M221Db:CCP, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway?, Carl Sandburg Home, Great Smoky Mountains); USFS (Chattahoochee, Cherokee?, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

References: Allard 1990, Ambrose 1990a, DuMond 1970, Eyre 1980, Gattis 1992, Patterson 1994, Pyne 1994, Schafale and Weakley 1990

I.C.3.N.A. *PINUS STROBUS - QUERCUS (ALBA, RUBRA, VELUTINA)* FOREST ALLIANCE (A.401) EASTERN WHITE PINE - (WHITE OAK, NORTHERN RED OAK, BLACK OAK) FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance occurs from the western Great Lakes to the northeastern United States and south to the southern Appalachian Mountains. The overstory is a mix of evergreen and deciduous trees which form a moderately closed to closed canopy. *Pinus strobus* is a consistent constituent of the canopy and usually occurs as supercanopy trees, as well. *Quercus alba, Quercus rubra*, and *Quercus velutina* are also important canopy trees along with minor amounts of *Acer rubrum, Carya alba, Liriodendron tulipifera, Pinus resinosa, Pinus banksiana* (in Wisconsin), *Populus tremuloides* (in the northern parts of this alliance's range), *Quercus ellipsoidalis* (in the northwest), and *Tsuga canadensis*, and *Quercus prinus* (in the southeast). Subcanopy trees can include *Carpinus caroliniana, Cornus florida, Hamamelis virginiana, Halesia tetraptera, Oxydendrum arboreum*, and *Nyssa sylvatica*. The shrub layer is often well-developed with *Gaylussacia* spp., *Kalmia latifolia, Rubus* spp., and *Vaccinium* spp. most commonly dominant. Other shrubs can include *Corylus americana, Gaultheria procumbens, Rhododendron maximum*, and *Sassafras albidum*, and in the Ridge and Valley, *Viburnum rafinesquianum* and *Viburnum prunifolium*. The herb stratum is sparse to moderate, but can be quite species rich, especially in the Southern Blue Ridge and Ridge and Valley, where typical species include *Ageratina altissima, Amphicarpaea bracteata, Brachyelytrum erectum, Carex communis, Carex platyphylla, Carex woodii, Carex pensylvanica, Chimaphila maculata, Desmodium nudiflorum, Eupatorium purpureum, Galax urceolata, Galium latifolium, Galium circaezans, Geranium maculatum, Goodyera pubescens, Hexastylis shuttleworthii, Hieracium venosum, Houstonia purpurea, Maianthemum racemosum, Maianthemum canadense, Medeola virginiana, Mitchella repens, Monotropa uniflora, Poa cuspidata, Polygonatum biflorum, Polystichum acrostichoides, Trillium catesbaei*, and *Viola hastata*. Stands of this alliance are dry-mesic to mesic forests found on acidic, relatively nutrient-poor, sandy loam to sandy soil on a variety of topographic positions. In the upper Midwest, most stands are on flat to rolling topography on outwash plains or moraines. In the Southern Blue Ridge, they occur on mid to lower slopes in the lower elevations (below 3000 feet) on protected ridges, and in disturbed bottoms. In the Ridge and Valley of Virginia, these forests are found on protected ravines, with rocky soils developed over shale, sandstone, or other sedimentary rock.

Related Concepts:

- *Pinus strobus - Pinus resinosa* forest (No. 36) (Vankat 1990) I
- Coastal Forest/Woodland (Swain and Kearsley 2001) ?
- Dry - Mesic Acidic Central Forest (Smith 1991) ?
- Dry white pine (hemlock) - oak forest (Fike 1999) ?
- Dry-Mesic Oak--Hickory Forest (Schafale and Weakley 1990) I
- Eastern White Pine: 21 (Eyre 1980) I
- Hardwood - White Pine Forest (Ambrose 1990a) I
- Northern Dry-mesic Forest (Curtis 1959) I
- White Pine - Chestnut Oak: 51 (Eyre 1980) I
- White Pine - Northern Red Oak - Red Maple: 20 (Eyre 1980) ?

Classification Comments: In the Appalachians, these forests are typically transitional between the more mesic, protected cove forests and the more xeric, exposed pine - oak forests with *Quercus prinus* and *Quercus coccinea*. Stands of this alliance are mid-successional but long-lasting and require repeated disturbances to regenerate (MNNHP 1993). Isolated stands of *Pinus strobus* with *Quercus alba* and *Quercus velutina* and scattered *Fagus grandifolia* over *Kalmia latifolia* are found on steep slopes of the Western Highland Rim of (Cheatham and Dickson counties; Chester 1980). Similar isolated stands with *Pinus strobus* are found in the vicinity of Clifty, Kentucky. Their status is unclear as well. These occur on sandstones of the Dripping Springs escarpment (Logan, Muhlenburg, Todd counties). "These are along Clifty Creek Gorge and Rocky Creek/Lake Malone State Park area; no botanical person has reported from here for a long time. The environment is not necessarily more xeric." (Julian Campbell, TNC-KYFO).

ALLIANCE DISTRIBUTION

Range: This alliance is found in northern Minnesota, Wisconsin, Michigan, northern Illinois, Indiana, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Pennsylvania, Rhode Island, Virginia, West Virginia, northern Georgia, western North Carolina, western South Carolina, and eastern Tennessee (?). It is also found in Canada.
Subnations: GA, IL, IN, MA, MD, ME, MI, MN, NC, NH, NJ?, NY, ON, PA, QC?, RI, SC, TN?, VA?, VT, WI, WV
TNC Ecoregions: 44:P, 46:C, 47:C, 48:C, 49:C, 50:P, 51:C, 52:P, 59:C, 60:C, 61:C, 62:C, 63:C, 64:C
USFS Ecoregions: 212Aa:CPP, 212Ab:CPP, 212Ba:CPP, 212Bb:CPP, 212Ca:CCP, 212Cb:CCC, 212Da:CCC, 212Db:CCC, 212Dc:CCC, 212Eb:CCC, 212Ec:CCP, 212Ed:CCP, 212Fa:CCP, 212Fb:CCC, 212Fc:CCC, 212Fd:CCC, 212Ga:CCP, 212Gb:CCP, 212Hb:CCP, 212He:CCC, 212Hi:CCP, 212Hj:CCC, 212Hl:CCC, 212Hm:CCP, 212Ho:CCC, 212Hp:CCC, 212Hq:CCC, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hu:CCC, 212Hv:CCC, 212Hw:CCC, 212Hx:CCP, 212Hy:CCC, 212Ja:CCP, 212Jb:CCC, 212Jc:CCP, 212Jf:CCP, 212Jj:CCP, 212Jl:CCP, 212Jm:CCC, 212Jn:CCP, 212Jr:CCC, 212Ka:CCP, 212Kb:CCC, 212La:CPP, 212Lb:CP?, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 212Oa:CCC, 212Oc:CCC, 221Aa:CCC, 221Ab:CCP, 221Ac:CCC, 221Ae:CCC, 221Af:CCP, 221Ag:CCC, 221Ah:CCC, 221Ai:CCC, 221Aj:CCP, 221Ak:CCC, 221Al:CCC, 221Am:CCP, 221Ba:CCC, 221Bb:CCP, 221Bc:CCC, 221Bd:CCC, 221Db:CPP, 221Ea:CCC, 221Ec:CCC, 221Fa:CCC, 222Eg:CCC, 222Ic:CCP, 222Id:CCP, 222If:CCP, 222Ja:CCC, 222Jc:CCC, 222Jd:CCC, 222Je:CCC, 222Jg:CCC, 222Jj:CCC, 222Ka:CCC, 222Kh:CCC, 222Lc:CCC, 222Lf:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 232Aa:CCC, M212Ac:CC?, M212Ad:CCC, M212Ae:CCP, M212Ag:CCC, M212Ba:CCP, M212Bb:CCC, M212Bc:CCC, M212Bd:CCC, M212Ca:CCP, M212Cb:CCC, M212Cc:CCC, M212Cd:CCP, M212Db:CCP, M212Dc:CCC, M212De:CCC, M212Ea:CCC, M212Eb:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CC?, M221Bb:CCC, M221Bc:CC?, M221Bd:CCC, M221Be:CCC, M221Bf:CCC, M221Ca:CC?, M221Cb:CCP, M221Da:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Acadia, Blue Ridge Parkway?, Great Smoky Mountains?); USFS (Chattahoochee, Cherokee?, George Washington, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

References: Ambrose 1990a, Chester and Scott 1980, Curtis 1959, Eyre 1980, Faber-Langendoen et al. 1996, Fike 1999, MNNHP 1993, Rawinski et al. 1996, Schafale and Weakley 1990, Smith 1991, Swain and Kearsley 2001, Vankat 1990

I.C.3.N.A. *PICEA RUBENS - BETULA ALLEGHANIENSIS* FOREST ALLIANCE (A.384) RED SPRUCE - YELLOW BIRCH FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: Forests with mixed deciduous/evergreen canopies, dominated by *Picea rubens* and *Betula alleghaniensis*, occurring from the maritime provinces of Canada, through northern New England and eastern New York, south to the High Alleghenies, and high elevations in the northern Ridge and Valley and Southern Blue Ridge. This alliance includes forests transitional between northern hardwoods and spruce - fir forests, as well as successional forests resulting from the death of *Abies fraseri* due to the Balsam Woolly Adelgid. *Picea rubens* is usually the most abundant conifer, with lesser amounts of *Abies balsamea*, in the north, and *Abies fraseri*, in the southern portion of the range. *Betula alleghaniensis* is usually the most abundant deciduous tree, although other deciduous species, such as *Fagus grandifolia* and, in the southern Appalachians, *Aesculus flava*, can be prominent constituents. Associated species vary with geography, but include *Acer spicatum, Acer pensylvanicum, Acer saccharum, Oclemena acuminata (= Aster acuminatus), Clintonia borealis, Dryopteris carthusiana (= Dryopteris spinulosa), Dryopteris intermedia, Dryopteris campyloptera, Ilex montana, Menziesia pilosa, Oxalis montana, Rugelia nudicaulis, Rhododendron catawbiense, Sambucus racemosa var. racemosa (= Sambucus racemosa var. pubens), Solidago glomerata, Trillium undulatum, Vaccinium erythrocarpum,* and *Viburnum lantanoides (= Viburnum alnifolium)*. Forests of this alliance generally occur on midslopes, with soils ranging from somewhat poorly drained to well-drained. Forests of this alliance in the White Mountains and Green Mountains in New England were noted to occur on soils derived from compact till and ablational till consisting of metamorphic schist and gneiss. Forests in this alliance tend to be on moister sites than deciduous forests dominated by northern hardwood species.
Related Concepts:
- Red Spruce - Yellow Birch: 30 (Eyre 1980) I
- Red Spruce--Fraser Fir Forest (Schafale and Weakley 1990) I
- Spruce - Fir - Northern Hardwoods Forest (Swain and Kearsley 2001) ?

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in North Carolina, Tennessee, Massachusetts, Maine, New Hampshire, New York, Pennsylvania (?), Vermont, Virginia, and West Virginia.
Subnations: MA, MD, ME, NB, NC, NH, NS, NY, PA?, QC?, TN, VA?, VT, WV
TNC Ecoregions: 51:C, 59:C, 60:C, 61:C, 63:C, 64:C
USFS Ecoregions: 212Cb:CCC, 212Eb:CCC, 212Ed:CCC, 221Ah:CCC, 221Al:CCC, 221Bc:CCC, 222Ob:CCC, 232C:CC, M212Ad:CCC, M212Ae:CCC, M212Af:CCC, M212Ba:CCC, M212Bc:CCC, M212Bd:CCC, M212Ca:CCC, M212Cb:CCC, M212Cc:CCC, M212Cd:CCC, M212Da:CCC, M212Db:CCC, M212Dc:CCC, M212Dd:CCC, M212De:CCC, M212Df:CCC,

M212Ea:CCC, M212Fa:CCC, M212Fb:CCC, M221Aa:CCC, M221Ba:CCC, M221Bc:CCC, M221Cb:CP?, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Acadia, Blue Ridge Parkway?, Great Smoky Mountains); USFS (Cherokee?, Jefferson?, Nantahala?, Pisgah)

ALLIANCE SOURCES

References: Eyre 1980, Fincher 1991, Golden 1974, Golden 1981, Schafale and Weakley 1990, Swain and Kearsley 2001

I.C.3.N.A. *PINUS ECHINATA - QUERCUS (COCCINEA, PRINUS)* FOREST ALLIANCE (A.395) SHORTLEAF PINE - (SCARLET OAK, ROCK CHESTNUT OAK) FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes mixed *Pinus echinata - Quercus* spp. forests of the low mountains in the Blue Ridge/Piedmont transition, extending into the southern Ridge and Valley and Cumberland Plateau of the southeastern United States. *Pinus echinata* and some combination of the nominal oaks (*Quercus coccinea, Quercus prinus*) are dominant. Associated species include *Quercus falcata, Quercus stellata, Quercus marilandica, Carya pallida, Oxydendrum arboreum*, and *Cornus florida* in the canopy and subcanopy. *Pinus virginiana* may also be a component. *Gaylussacia baccata, Gaylussacia ursina, Vaccinium pallidum, Vaccinium stamineum*, and *Kalmia latifolia* are typical shrubs. Herbaceous species that are common to these forests include *Chimaphila maculata, Iris verna, Pteridium aquilinum var. latiusculum, Silphium compositum, Smilax glauca, Goodyera pubescens, Schizachyrium scoparium, Dichanthelium dichotomum*, and *Danthonia sericea*. These forests occur on exposed, rocky ridges and upper, convex slopes, as well as more protected sites. Species composition varies with bedrock geology and exposure.

Related Concepts:

- Appalachian pine-oak forest (Evans 1991) ?
- Dry Oak--Hickory Forest (Schafale and Weakley 1990) I
- IA6a. Dry Shortleaf Pine - Oak - Hickory Forest (Allard 1990) I
- Mixed Oaks-Shortleaf Pine HR (Pyne 1994) ?
- Shortleaf Pine - Oak: 76 (Eyre 1980) I

Classification Comments: Originally defined from the Chattooga Basin Project, where quantitative analysis showed this alliance concept to apply to a large percentage of the vegetation sampled in this tri-state watershed (S. Simon pers. comm.). This concept was later expanded in range and concept to include shortleaf pine - dry site oak forests of the greater southern Appalachian region (including the southern Ridge and Valley and Cumberland Plateau), and has an overall xerophytic species composition.

ALLIANCE DISTRIBUTION

Range: This alliance occurs in the low mountains of the Blue Ridge/Piedmont transition, extending into the southern Ridge and Valley and Cumberland Plateau of the southeastern United States. It is known from the states of Alabama, Georgia, Kentucky, North Carolina, and South Carolina, and may possibly occur in Tennessee.

Subnations: AL, GA, KY, NC, SC, TN?

TNC Ecoregions: 50:C, 51:C, 52:P

USFS Ecoregions: 221Hc:CCC, 221He:CCC, 221J:CP, 222Eo:PPP, 231Ag:CCC, 231C:CP, 231Dc:CCC, 231Dd:CCC, 234Ab:???, M221Cd:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains, Kings Mountain, Little River Canyon?); USFS (Bankhead?, Chattahoochee, Cherokee?, Daniel Boone, Nantahala, Sumter, Talladega)

ALLIANCE SOURCES

References: Allard 1990, Evans 1991, Eyre 1980, Pyne 1994, Schafale and Weakley 1990, Simon pers. comm.

I.C.3.N.d. Saturated mixed needle-leaved evergreen - cold-deciduous forest

I.C.3.N.D. *TSUGA CANADENSIS - ACER RUBRUM* SATURATED FOREST ALLIANCE (A.447) EASTERN HEMLOCK - RED MAPLE SATURATED FOREST ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes palustrine forests, often dominated by *Tsuga canadensis* and *Acer rubrum*, with closed to open canopies and an open to dense shrub layer, interspersed with small *Sphagnum* - herb-dominated depressions. Canopies are composed of various mixtures of evergreen and deciduous species, with canopy dominants varying with elevation. Occurrences at lower elevations tend to be dominated by *Acer rubrum, Liriodendron tulipifera*, and/or *Nyssa sylvatica*, while examples at higher elevations are usually dominated by *Tsuga canadensis* and *Betula alleghaniensis*. The dominant shrubs are usually *Rhododendron maximum, Kalmia latifolia*, and *Leucothoe fontanesiana*, but other shrubs include *Salix nigra, Alnus serrulata, Ilex montana, Cornus amomum, Viburnum nudum var. cassinoides*, and *Toxicodendron vernix*. Herbs in *Sphagnum* - herb-dominated openings include *Solidago patula var. patula, Symphyotrichum puniceum (= Aster puniceus), Dalibarda repens, Osmunda cinnamomea, Carex folliculata, Carex gynandra, Carex scabrata, Carex leptalea, Carex stricta, Sarracenia purpurea, Sagittaria latifolia (= Sagittaria latifolia var. pubescens)*, and *Leersia virginica*. Herbs in the forested areas include *Glyceria melicaria, Lycopodium obscurum, Onoclea sensibilis, Maianthemum canadense, Thelypteris noveboracensis*, and *Osmunda regalis var. spectabilis*. Forests in this alliance are typically at

elevations below 1200 m (4000 feet), in poorly drained bottomlands, generally with visible microtopography of ridges and sloughs or depressions. They often occur near streams and are undoubtedly occasionally flooded. These forests are found in the northeastern U.S. and throughout the Southern Blue Ridge, in the Cumberland Mountains and Cumberland Plateau, and in the central Appalachians.

Related Concepts:

- Appalachian acid seep (Evans 1991) I
- Broadleaf - Conifer Swamp (Smith 1991) ?
- Eastern Hemlock: 23 (Eyre 1980) I
- Hemlock - mixed hardwood palustrine forest (Fike 1999) ?
- IIE1a. Southern Appalachian Bog Complex (Allard 1990) I
- Swamp-Forest Bog Complex (Schafale and Weakley 1990) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: These forests are found in the northeastern U.S. and throughout the Southern Blue Ridge, in the Cumberland Mountains and Cumberland Plateau, and in the central Appalachians, in Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia, and possibly others.

Subnations: CT, GA, KY, MA, ME, NB, NC, NH, NJ, NY, PA, RI, SC, TN, VA, VT, WV?

TNC Ecoregions: 50:C, 51:C, 52:C, 59:C, 61:C, 62:C, 63:C

USFS Ecoregions: 212Cb:CCC, 212Da:CCC, 212Dc:CCC, 221Ae:CCC, 221Ag:CCP, 221Ai:CCC, 221Ak:CCC, 221Al:CCP, 221Hc:CCC, M212Ad:CCC, M212Bc:CCP, M212Bd:CCC, M221Aa:CCC, M221Ac:CCC, M221Ba:CCC, M221Bb:CCP, M221Bd:CCC, M221Bf:CCC, M221Cc:CCC, M221Cd:CCP, M221Ce:CCP, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Acadia, Blue Ridge Parkway?, Cumberland Gap, Shenandoah); USFS (Chattahoochee, Cherokee, Daniel Boone?, George Washington, Jefferson, Nantahala, Pisgah)

ALLIANCE SOURCES

References: Allard 1990, Evans 1991, Eyre 1980, Fike 1999, Schafale and Weakley 1990, Smith 1991, Weakley and Schafale 1994

II. Woodland

II.A.4.N.a. Rounded-crowned temperate or subpolar needle-leaved evergreen woodland

II.A.4.N.A. *PINUS PUNGENS - (PINUS RIGIDA)* WOODLAND ALLIANCE (A.521) TABLE MOUNTAIN PINE - (PITCH PINE) WOODLAND ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes woodland vegetation in the southern and central Appalachians, dominated or codominated by *Pinus pungens*, with or without some admixture of *Pinus rigida* and/or *Pinus virginiana*. This alliance also includes woodlands dominated by *Pinus rigida* that occur within the geographic area where *Pinus pungens* occurs as a canopy dominant. Common canopy and subcanopy associates include *Quercus prinus, Quercus coccinea, Castanea dentata, Nyssa sylvatica, Acer rubrum,* and *Oxydendrum arboreum*. Typical shrubs include *Gaylussacia baccata, Vaccinium pallidum, Vaccinium stamineum, Vaccinium corymbosum, Vaccinium simulatum, Gaylussacia ursina, Rhododendron maximum, Kalmia latifolia, Rhododendron carolinianum, Rhododendron catawbiense, Leucothoe recurva,* and *Leiophyllum buxifolium*. In the central Appalachians and in the Virginia portion of the Southern Blue Ridge, *Quercus ilicifolia* is a characteristic shrub. Herbaceous species composition will vary within the range of this alliance. Species commonly found in the sparse herb stratum include *Galax urceolata, Pteridium aquilinum var. latiusculum, Xerophyllum asphodeloides, Fothergilla major, Comptonia peregrina,* and the subshrubs *Gaultheria procumbens,* and *Epigaea repens*. These woodlands typically occur at elevations from 760-1220 m (2500-4000 feet), on xeric ridges and exposed, steep side-slopes over thin, excessively drained, nutrient-poor soils and are often associated with rock outcroppings. Without periodic fire, these woodlands will gradually succeed into forests dominated by *Quercus prinus* and *Quercus coccinea,* except on the most extreme sites, where this vegetation is self-perpetuating. The primary range of associations in this alliance is the Appalachian Mountains (within the range of *Pinus pungens*), although the nominal species, *Pinus pungens*, has insular occurrences in the Upper Piedmont.

Related Concepts:

- *Pinus pungens/Pinus rigida* (Pyne 1994) ?
- IA7b. Xeric Pitch Pine/Table Mountain Pine Ridge Forest (Allard 1990) I Pine--Oak/Heath (Nelson 1986) I
- Pine--Oak/Heath (Schafale and Weakley 1990) I

Classification Comments: Associations in this alliance generally have a woodland structure (open canopy), although locally vegetation may vary to a denser canopy.

ALLIANCE DISTRIBUTION

Range: The primary range of associations in this alliance is the Appalachian Mountains (within the range of *Pinus pungens*), although the nominal species, *Pinus pungens*, has insular occurrences in the Upper Piedmont. This alliance is found in Georgia, North Carolina, South Carolina, Tennessee, Maryland, Pennsylvania, Virginia, and West Virginia.
Subnations: GA, MD, NC, PA, SC, TN, VA, WV
TNC Ecoregions: 51:C, 52:C, 59:C, 61:C
USFS Ecoregions: 231Ak:CCC, 231Al:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ce:C??, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway?, Carl Sandburg Home, Great Smoky Mountains, Shenandoah); USFS (Chattahoochee, Cherokee, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

References: Allard 1990, Barden 1977, Golden 1981, McLeod 1988, Nelson 1986, Newell and Peet 1995, Pyne 1994, Racine 1966, Rawinski et al. 1996, Schafale and Weakley 1990, Sutherland et al. 1993, Thomas 1966, Turrill and Buckner 1995, Wharton 1978, Whittaker 1956, Williams 1991, Williams and Johnson 1990, Williams and Johnson 1992, Williams et al. 1990a, Zobel 1969

II.B.2.N.a. Cold-deciduous woodland

II.B.2.N.A. *QUERCUS RUBRA - QUERCUS PRINUS* WOODLAND ALLIANCE (A.624) NORTHERN RED OAK - ROCK CHESTNUT OAK WOODLAND ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes woodland communities occurring on acidic, talus slopes or rocky slopes of higher elevations (e.g., from 1000-2620 feet in New England and to 4500 feet in West Virginia). Soils are shallow and acidic. *Quercus rubra* is sometimes dominant but usually occurs in association with *Quercus alba*, *Acer rubrum*, *Betula lenta*, *Quercus prinus*, and others. Canopies are often stunted. The shrub layer may include, in the northern part of the range, *Acer spicatum*, *Sambucus racemosa var. racemosa (= Sambucus racemosa ssp. pubens)*, *Rhus typhina*, *Kalmia latifolia*, *Hamamelis virginiana*, while in the southern part of the range, *Rhododendron catawbiense*, *Rhododendron arborescens*, *Rhododendron calendulaceum*, *Rhododendron maximum*, *Menziesia pilosa*, *Gaylussacia ursina*, *Leucothoe recurva*, *Vaccinium simulatum*, and *Viburnum nudum var. cassinoides* are more typical. Herbs include *Pteridium aquilinum var. latiusculum*, *Aralia nudicaulis*, *Maianthemum canadense*, *Oclemena acuminata (= Aster acuminatus)*, *Corydalis sempervirens*, *Deschampsia flexuosa*, *Carex pensylvanica*, and *Polypodium virginianum*. Communities of this alliance are known from the Appalachian Mountains, from New York and New England, south to the Blue Ridge of North Carolina.
Related Concepts:
- Acidic Talus Forest / Woodland (Swain and Kearsley 2001) ?
- Chestnut Oak: 44 (Eyre 1980) I
- Circumneutral Rocky Summit/Rock Outcrop (Swain and Kearsley 2001) ?
- Dry oak - heath woodland (Fike 1999) ?
- Northern Red Oak: 55 (Eyre 1980) I
- Oak - Hemlock - White Pine Forest (Swain and Kearsley 2001) ?
- Ridgetop Dwarf-tree Forest (Smith 1991) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: Communities of this alliance are known from the Appalachian Mountains, from New York and New England, south to the Blue Ridge of North Carolina. This alliance is found in Connecticut, Georgia, North Carolina, Delaware, Maine, Massachusetts, New Hampshire, New York, Pennsylvania, Vermont, Virginia, and West Virginia, and possibly South Carolina (?).
Subnations: CT, GA, MA, MD?, ME, NB, NC, NH, NJ, NY, PA, SC?, TN, VA, VT, WV
TNC Ecoregions: 49:C, 50:?, 51:C, 52:?, 59:C, 60:C, 61:C, 62:C, 63:C, 64:C
USFS Ecoregions: 212Aa:CCC, 212Ab:CCC, 212Ba:CCC, 212Bb:CCC, 212Ca:CCC, 212Cb:CCC, 212Da:CCC, 212Db:CCP, 212Dc:CCC, 212Ec:CCC, 212Ed:CC?, 212Fa:CCP, 212Fb:CCP, 212Fc:CCC, 212Fd:CCC, 212Ga:CCP, 212Gb:CCP, 221Ae:CCC, 221Af:CCC, 221Ag:CCC, 221Ah:CCP, 221Ai:CCC, 221Ak:CCC, 221Al:CCC, 221Ba:CCC, 221Bb:CCC, 221Bc:CCC, 221Bd:CCC, 221Db:C??, 221Ea:CCC, 222Ic:PP?, 222Id:PP?, 222Ie:PP?, 222If:PPP, M212Ac:CCC, M212Ad:CCC, M212Ae:CCC, M212Af:CCC, M212Ag:CCC, M212Ba:CCC, M212Bb:CCC, M212Bc:CCC, M212Bd:CCC, M212Ca:CCP, M212Cb:CCC, M212Cc:CCP, M212Cd:CCP, M212Da:CCP, M212Db:CCP, M212Dc:CCC, M212De:CCC, M212Ea:CCP, M212Eb:CCP, M212Fa:CPP, M212Fb:CPP, M221Aa:CCC, M221Ab:CCP, M221Ac:CCC, M221Bb:CCP, M221Bd:CC?, M221Bf:CCC, M221Da:CCC, M221Db:CC?, M221Dc:CCC
Federal Lands: NPS (Acadia); USFS (Chattahoochee, George Washington, Jefferson, Nantahala, Pisgah)

ALLIANCE SOURCES

References: Eyre 1980, Fike 1999, Smith 1991, Swain and Kearsley 2001

II.B.2.N.A. *FRAXINUS AMERICANA - CARYA GLABRA - (JUNIPERUS VIRGINIANA)* WOODLAND ALLIANCE (A.604)
WHITE ASH - PIGNUT HICKORY - (EASTERN RED-CEDAR) WOODLAND ALLIANCE

ALLIANCE CONCEPT

Summary: Woodlands in this alliance have *Fraxinus americana* and *Carya glabra* as typical canopy dominants, although *Juniperus virginiana, Quercus prinus,* or other *Carya* spp. may have significant coverage in some associations. Some associations have a nearly closed or locally closed canopy, and could in some cases as readily be considered as forests, while others have an edaphically maintained woodland physiognomy. Other minor canopy species vary with geography, but may include *Quercus rubra var. rubra, Pinus virginiana, Ulmus alata, Quercus stellata, Carya ovata*, and *Carya pallida*. Subcanopy and shrub species are variable between associations, but can include *Amelanchier sanguinea, Ceanothus americanus, Celtis tenuifolia, Cercis canadensis, Chionanthus virginicus, Crataegus* sp., *Hypericum prolificum, Juniperus virginiana var. virginiana, Lonicera flava, Ostrya virginiana, Philadelphus hirsutus, Physocarpus opulifolius, Ptelea trifoliata, Rhus aromatica var. aromatica, Rhus typhina, Rosa carolina, Spiraea betulifolia var. corymbosa, Symphoricarpos orbiculatus, Toxicodendron radicans, Vaccinium arboreum, Vaccinium pallidum, Vaccinium stamineum, Viburnum rafinesquianum (= var. rafinesquianum),* and *Viburnum rufidulum*. Herbaceous species vary among associations, but species known from these woodlands include *Allium cuthbertii, Andropogon gerardii, Andropogon gyrans, Andropogon ternarius, Anemone berlandieri, Anemone virginiana, Antennaria virginica, Aquilegia canadensis, Arabis canadensis, Arabis hirsuta var. pycnocarpa (= Arabis hirsuta var. adpressipilis), Arabis laevigata, Aristida purpurascens, Aristolochia serpentaria, Asclepias quadrifolia, Asplenium platyneuron, Symphyotrichum oblongifolium (= Aster oblongifolius), Symphyotrichum patens var. patens (= Aster patens var. patens), Campanula divaricata, Cardamine parviflora var. arenicola, Carex pensylvanica, Cheilanthes lanosa, Claytonia virginica, Coreopsis major, Coreopsis pubescens, Cunila origanoides, Danthonia compressa, Danthonia sericea, Danthonia spicata, Desmodium rotundifolium, Dichanthelium boscii, Dichanthelium scoparium, Dodecatheon meadia, Draba ramosissima, Elymus hystrix, Erigeron pulchellus, Helianthus divaricatus, Helianthus microcephalus, Houstonia longifolia, Hypericum gentianoides, Hypericum punctatum, Melica mutica, Muhlenbergia tenuiflora, Phacelia dubia, Phlox nivalis ssp. hentzii, Piptochaetium avenaceum, Polygala paucifolia, Polygonum tenue, Pycnanthemum incanum, Pycnanthemum montanum, Saxifraga michauxii, Schizachyrium scoparium, Sedum glaucophyllum, Selaginella rupestris, Packera millefolia (= Senecio millefolium), Packera obovata (= Senecio obovatus), Solidago arguta var. harrisii (= Solidago harrisii), Solidago juncea, Solidago nemoralis, Sorghastrum nutans, Tradescantia ohiensis, Verbesina occidentalis, Woodsia ilvensis*, and *Woodsia obtusa*. These woodlands are often a physiognomic complex of woodland, grassland, and rock outcropping, often associated with granitic domes or rocky summits. Soils are circumneutral and derived from such base-rich rocks as greenstone, plagioclase-rich granite, hornblende gneiss, amphibole gneiss, limestones, or calcareous shales. Woodlands in this alliance are currently defined from 1000-3800 feet elevation in the southern and central Blue Ridge, the Ridge and Valley of Virginia, and the upper Piedmont of Georgia, North Carolina, and Virginia.

Related Concepts:

- Appalachian Shale Barren, Central Appalachian subtype (Smith 1991) ?
- Low Elevation Granitic Dome, Basic Variant (Schafale and Weakley 1990) I
- Piedmont / Mountain Basic Woodland (Fleming et al. 2001) I
- Red-cedar - mixed hardwood rich shale woodland (Fike 1999) ?

Classification Comments: Most associations in this alliance are thought to be inherently rare because of their unusual geology and topographic position. Fleming (1999) discusses classification questions related to this alliance in Virginia and in the Nashville Basin of Tennessee: "In a study of woody vegetation in the Tennessee Central Basin, Crites and Clebsch (1986) found communities sorted along a topographic-moisture gradient. A '*Carya - Juniperus - Quercus* Community' that may be similar to the *Fraxinus americana - Carya ovata / Frangula caroliniana / Helianthus hirsutus* Woodland (CEGL008458) (*sensu* Fleming 1999) was classified from subxeric upland habitats. The dominants of the Tennessee community (based on the importance values of woody species >2.5 cm dbh) were *Fraxinus americana*, either *Carya ovata* or *Carya glabra* (pignut hickory), and *Juniperus virginiana*. *Fraxinus americana* was considered a 'local successional species,' the densities of which were 'masking' the importance values of oaks (Crites and Clebsch 1986). Implicit (but not directly stated) in this assessment is the concept that *Quercus muehlenbergii* and other oaks represent a more advanced successional stage on the subxeric uplands. Of course, without data on shrub and herbaceous composition, it is impossible to accurately evaluate the similarity of the Virginia and Tennessee communities" (Fleming 1999). In relation to the possible presence of this alliance in the Central Basin of Tennessee, see the *Fraxinus quadrangulata - (Juniperus virginiana)* Woodland Alliance (A.1913).

ALLIANCE DISTRIBUTION

Range: Woodlands in this alliance are currently defined from 1000-3800 feet elevation in the southern and central Blue Ridge and in the upper Piedmont of the United States.

Subnations: AL?, GA, MD, NC, PA, SC?, TN, VA, WV?

TNC Ecoregions: 50:C, 51:C, 52:C, 59:C, 60:P, 61:?

USFS Ecoregions: 212A:CC, 212B:CC, 221A:CC, 221Bd:CCP, 231Aa:CCC, 231Ae:CCC, 231Ak:CCC, 231Al:CCC, 231Ap:CCC, M221Aa:CCC, M221Ab:CC?, M221B:C?, M221Ca:CC?, M221Cb:CC?, M221Cc:CC?, M221Ce:CCC, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains, Shenandoah); USFS (Cherokee, George Washington, Jefferson, Nantahala, Oconee, Pisgah); USFWS (Piedmont?)

ALLIANCE SOURCES

References: Crites and Clebsch 1986, Dellinger unpubl. data 1992, Fike 1999, Fleming 1999, Fleming et al. 2001, Schafale and Weakley 1990, Small 1996, Smith 1991

II.C.3.N.a. Mixed needle-leaved evergreen - cold-deciduous woodland

II.C.3.N.A. *PINUS (RIGIDA, PUNGENS, VIRGINIANA) - QUERCUS PRINUS* WOODLAND ALLIANCE (A.677) (PITCH PINE, TABLE MOUNTAIN PINE, VIRGINIA PINE) - ROCK CHESTNUT OAK WOODLAND ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes woodland vegetation dominated by *Pinus virginiana*, possibly with a mixture of *Pinus rigida*, *Pinus pungens*, and/or *Quercus prinus*. Associations in this alliance are possible from central Pennsylvania southwest to Virginia and Tennessee, but tend to occur under extreme conditions (such as steep, shaley slopes) that maintain the open structure of the vegetation.

Related Concepts:

- Virginia Pine: 79 (Eyre 1980) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in North Carolina, Tennessee, Maryland, Pennsylvania, Virginia, West Virginia, and possibly South Carolina (?).

Subnations: MD, NC, NJ, PA, SC?, TN, VA, WV

TNC Ecoregions: 44:P, 50:C, 51:C, 52:?, 59:C

USFS Ecoregions: 221Jb:PPP, 231Aa:???, M221Aa:CCC, M221Ab:CCC, M221Ba:CCP, M221Bd:CCC, M221Da:CCC, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains?, Little River Canyon?); USFS (Cherokee, Daniel Boone?, George Washington, Jefferson, Pisgah)

ALLIANCE SOURCES

References: Eyre 1980

II.C.3.N.A. *PINUS RIGIDA - QUERCUS (ALBA, STELLATA)* WOODLAND ALLIANCE (A.681) PITCH PINE - (WHITE OAK, POST OAK) WOODLAND ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes open woodland vegetation dominated by *Pinus rigida* and either *Quercus alba* or *Quercus stellata*. This alliance currently contains three associations, each very restricted in occurrence, and occurring over ultramafic rocks in the Southern Blue Ridge Mountains. These *Pinus rigida - Quercus alba* woodlands typically occur over a cespitose graminoid-dominated understory with little shrub cover. Other canopy and subcanopy trees may include *Pinus virginiana, Tsuga canadensis, Acer rubrum*, and *Oxydendrum arboreum*. The dense herbaceous stratum is dominated by *Andropogon gerardii, Sporobolus heterolepis*, and *Schizachyrium scoparium*. Common forbs include *Packera plattensis (= Senecio plattensis), Hexastylis arifolia var. ruthii*, and *Thalictrum macrostylum*. These woodlands are known from shallow, rocky soils associated with outcrops of serpentinized olivine in the Southern Blue Ridge. These communities are unique and have a restricted range and few known occurrences. Other characteristic species include *Physocarpus opulifolius, Viburnum nudum var. cassinoides, Vaccinium stamineum, Kalmia latifolia, Rhododendron viscosum, Poa saltuensis, Muhlenbergia glomerata, Danthonia spicata, Danthonia compressa, Sorghastrum nutans, Panicum virgatum, Dichanthelium dichotomum, Dichanthelium boscii, Elymus trachycaulus ssp. trachycaulus, Deschampsia caespitosa, Castilleja coccinea, Carex woodii, Symphyotrichum undulatum (= Aster undulatus), Symphyotrichum laeve (= Aster laevis), Oenothera fruticosa, Thaspium trifoliatum*, and *Phlox stolonifera*.

Related Concepts:

- IE9b. Blue Ridge/Piedmont Ultramafic Barren (Allard 1990) I
- Pitch Pine - Oak Forest / Woodland (Swain and Kearsley 2001) ?
- Pitch Pine: 45 (Eyre 1980) I
- Ultramafic Outcrop Barren (Schafale and Weakley 1990) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance contains three associations, each very restricted in occurrence, and occurring over ultramafic rocks in the Southern Blue Ridge Mountains. These communities are unique and have a restricted range and few known occurrences. This alliance is found in Georgia, North Carolina, and Virginia.
Subnations: GA, NC, TN, VA
TNC Ecoregions: 51:C
USFS Ecoregions: M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: USFS (Chattahoochee, Nantahala)

ALLIANCE SOURCES

References: Allard 1990, Eyre 1980, Mansberg and Wentworth 1984, Schafale and Weakley 1990, Swain and Kearsley 2001

III. Shrubland

III.A.2.N.b. Hemi-sclerophyllous temperate broad-leaved evergreen shrubland

III.A.2.N.B. *RHODODENDRON (CATAWBIENSE, CAROLINIANUM) - KALMIA LATIFOLIA* SHRUBLAND ALLIANCE (A.744) (CATAWBA RHODODENDRON, CAROLINA RHODODENDRON) - MOUNTAIN LAUREL SHRUBLAND ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes evergreen shrublands occurring on steep, exposed slopes, ridges, and rock outcrops in the southern Appalachian Mountains. These shrublands are dominated by evergreen ericaceous species, most often *Rhododendron catawbiense, Rhododendron carolinianum*, or *Kalmia latifolia*. Deciduous shrubs may be present and even locally dominant. The occurrence and relative abundance of associated shrub species vary with elevation and adjacent vegetation. These shrublands are subject to extremes in moisture due to extreme cold, high precipitation, frequent fog, and desiccating winds in combination with shallow, nutrient-poor soils. Windfall, landslides, and small, localized, lightning-caused fires are important in the establishment and maintenance of these shrublands.

Related Concepts:

- Blue Ridge Shrub Bald (Ambrose 1990a) I
- Heath Bald (Schafale and Weakley 1990) I
- Heath Bald (Pyne 1994) I
- IC4a. Heath Bald Shrubland (Allard 1990) I
- Oligotrophic Scrub (Rawinski 1992) I

Classification Comments: Similar, but floristically different, ericaceous shrublands occur in the Mahoosuc Mountains of Maine (Fahey 1976). The taxonomic distinctions between *Rhododendron minus* and *Rhododendron carolinianum* are currently uncertain; some of what is treated here as *Rhododendron carolinianum* may prove to be *Rhododendron minus*.

ALLIANCE DISTRIBUTION

Range: This alliance is found in Georgia, Kentucky, North Carolina, Tennessee, and Virginia
Subnations: GA, KY, NC, TN, VA
TNC Ecoregions: 50:C, 51:C, 59:C
USFS Ecoregions: M221Aa:CPP, M221Be:CPP, M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Jefferson, Nantahala, Pisgah)

ALLIANCE SOURCES

References: Allard 1990, Ambrose 1990a, Brown 1941, Cain 1930a, Fahey 1976, Gant 1978, McLeod 1988, Newell and Peet 1995, Newell and Peet 1996a, Pyne 1994, Ramseur 1958, Rawinski 1992, Risk 1993, Schafale and Weakley 1990, Whittaker 1979

III.A.2.N.B. *RHODODENDRON MAXIMUM* SHRUBLAND ALLIANCE (A.745) GREAT RHODODENDRON SHRUBLAND ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes riparian shrublands and shrub thickets of mesic slopes dominated by *Rhododendron maximum*, without a significant tree canopy. *Rhododendron maximum*-dominated shrublands are less frequently found on more xeric ridges and sideslopes, on sites which have been subjected to extreme crown fires. Shrublands in this alliance are typically tall (over 2 m) and occur over acidic soils. These shrublands can occur as the result of disturbance and will succeed to forest with an ericaceous

understory without some form of disturbance. *Rhododendron maximum* shrublands frequently occur adjacent to wet herbaceous cliff vegetation, wetland riparian shrublands, or within forests dominated by *Tsuga canadensis, Quercus rubra, Liriodendron tulipifera, Pinus strobus, Quercus prinus, Picea rubens*, or *Abies fraseri*.

Related Concepts:

- *Rhododendron maximum*/Acidophil Herbs (McLeod 1981) ?
- IC4b. Montane Rhododendron Thicket (Allard 1990) ? Rhododendron Thicket (Nelson 1986) ?
- Rhododendron-Mountain Laurel/Xeric Herbs (McLeod 1981) ?
- Submesotrophic Scrub (Rawinski 1992) ?

Classification Comments: Shrublands in this alliance may have scattered woody species that are greater than 5 m tall but with generally less than 10% total cover. Some of what were thought to be examples of this vegetation type are actually *Rhododendron* stands under a canopy of evergreen and/or deciduous trees.

ALLIANCE DISTRIBUTION

Range: Shrublands in this alliance occur in the Appalachian Mountains, Ridge and Valley, Appalachian Plateaus, and Cumberland Mountains. This alliance is found in Georgia, North Carolina, South Carolina, Tennessee, and West Virginia, and possibly Virginia (?).

Subnations: GA, NC, SC, TN, VA?, WV

TNC Ecoregions: 49:P, 51:C

USFS Ecoregions: 221Eb:PP?, M221Ab:CC?, M221Bd:CC?, M221Be:CC?, M221Cc:CC?, M221Cd:CC?, M221Ce:CC?, M221Db:CCP, M221Dc:CCC, M221Dd:CCC

Federal Lands: USFS (Chattahoochee, Cherokee, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

References: Allard 1990, Core 1966, Gant 1978, Hodgdon and Pike 1961, McGee and Smith 1967, McLeod 1981, Monk et al. 1985, Nelson 1986, Phillips and Murdy 1985, Plocher and Carvell 1987, Rawinski 1992

III.B.2.N.b. Subalpine or subpolar cold-deciduous shrubland

III.B.2.N.B. *RUBUS ALLEGHENIENSIS - RUBUS CANADENSIS* SHRUBLAND ALLIANCE (A.930) ALLEGHENY BLACKBERRY - SMOOTH BLACKBERRY SHRUBLAND ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance encompasses *Rubus*-dominated areas at high elevations in the Southern Blue Ridge. This includes grassy balds (open montane grasslands), areas where the Balsam Woolly Adelgid has caused *Abies fraseri* death, or other disturbed areas such as landslide scars that create open conditions.

Related Concepts:

- Grass Balds, BR (Pyne 1994) I
- Grassy Bald (Schafale and Weakley 1990) I
- ID9a. Grass Bald (Allard 1990) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in North Carolina, Tennessee, and Virginia.

Subnations: NC, TN, VA

TNC Ecoregions: 51:C, 59:C

USFS Ecoregions: M221Bd:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Cherokee, Jefferson, Nantahala, Pisgah)

ALLIANCE SOURCES

References: Allard 1990, Crandall 1958, Feldcamp 1984, Pyne 1994, Schafale and Weakley 1990

III.B.2.N.B. *ALNUS VIRIDIS* SHRUBLAND ALLIANCE (A.929) GREEN ALDER SHRUBLAND ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes montane, mainly deciduous shrublands dominated by *Alnus viridis*. These shrubs are typically 1.5-2 m in height, rarely producing a closed canopy but typically occurring as uniformly spaced clumps about 1 m apart. *Rubus allegheniensis* is often a codominant with *Alnus viridis ssp. crispa*. Other shrub species occur with low coverage and include *Rhododendron catawbiense, Vaccinium corymbosum,* and *Crataegus* spp. Openings in the shrub canopy are dominated by herbs, mainly *Carex pensylvanica* and *Carex debilis var. rudgei* but also may include *Danthonia compressa, Deschampsia flexuosa, Viola blanda, Rumex acetosella* (exotic), and *Athyrium filix-femina ssp. asplenioides*. In moister areas, bryophyte cover can be up to 75%, with *Polytrichum commune* typical.

Related Concepts:
- Heath Bald (Schafale and Weakley 1990) I
- IC4a. Heath Bald Shrubland (Allard 1990) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is very limited in the Southeast, occurring only in the Roan Mountain massif, Avery and Mitchell counties, North Carolina, and Carter County, Tennessee, where it occupies hundreds of hectares. The alliance likely also occurs in Alaska, Canada, and possibly in other (northern or montane) parts of the East and West.
Subnations: ME, NC, NH, TN
TNC Ecoregions: 51:C, 63:C
USFS Ecoregions: M212Ac:CCC, M212Ad:CCC, M221Dc:CCC
Federal Lands: USFS (Cherokee, Pisgah)

ALLIANCE SOURCES

References: Allard 1990, Brown 1941, Schafale and Weakley 1990

III.B.2.N.d. Temporarily flooded cold-deciduous shrubland

III.B.2.N.D. *ALNUS SERRULATA* TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.943) SMOOTH ALDER TEMPORARILY FLOODED SHRUBLAND ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes temporarily flooded shrub thickets dominated by *Alnus serrulata* along rivers and streams on rocky shoals and gravel bars. Other common species include *Cephalanthus occidentalis, Cornus amomum, Cornus obliqua (= Cornus amomum ssp. obliqua), Cornus foemina, Hypericum prolificum, Lyonia ligustrina, Viburnum nudum, Physocarpus opulifolius, Amorpha fruticosa, Xanthorhiza simplicissima*, and others.

Related Concepts:
- *Alnus serrulata* shrubland alliance (Hoagland 1998a) ?
- *Alnus/Xanthorhiza* rocky stream margin (Newell and Peet 1995) ?
- Alder - ninebark wetland (Fike 1999) ?
- Circumneutral Shrub Swamp (Smith 1991) I
- IIE3a. Riverside Shoal and Stream Bar Complex (Allard 1990) ?
- Mountain River (Wharton 1978) I
- Mountain stream-edge shrub/scrub vegetation (Ambrose 1990a) ?
- Rocky Bar and Shore (Schafale and Weakley 1990) ?
- Sand and Mud Bar (Schafale and Weakley 1990) ?
- Shoal and Stream Bar (Nelson 1986) ?

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: Currently this alliance is defined for the Chesapeake Bay Lowlands, Southern Blue Ridge, Ozarks, Ouachitas, Cumberland Plateau, the southern Alleghenies, and the northern Ridge and Valley. It is possible in the upper West and East Gulf coastal plains. This alliance is found in Alabama, Arkansas, Georgia, Kentucky, North Carolina, Oklahoma, South Carolina, Tennessee, Louisiana, Maryland, Delaware, Virginia, West Virginia, and possibly Missouri (?).
Subnations: AL, AR, DE, GA, KY, LA, MD, MO, NC, NY, OK, PA, SC, TN, VA?, WV
TNC Ecoregions: 32:P, 38:C, 39:C, 40:?, 43:P, 44:P, 49:P, 50:C, 51:C, 52:P, 53:P, 58:C, 59:C, 60:P, 64:P
USFS Ecoregions: 212F:CP, 212G:CP, 221Bd:CCP, 221Eb:CC?, 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 221He:CC?, 222E:PP, 231B:CP, 231Cd:CCC, 231Dc:CCC, 231E:CP, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232B:CP, 234Ab:CCC, 255Ac:CCP, 255Ad:CCP, M212Ea:CCP, M212Eb:CCP, M221Aa:CCP, M221Ba:CP?, M221Bd:CP?, M221Cb:CC?, M221Dc:CCC, M221Dd:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC
Federal Lands: DOD (Fort Benning); NPS (Great Smoky Mountains, Little River Canyon?); USFS (Bankhead, Chattahoochee, Daniel Boone, Jefferson, Mark Twain, Nantahala, Ouachita, Ozark, Pisgah, Sumter); USFWS (Cahaba River, Little River)

ALLIANCE SOURCES

References: Allard 1990, Ambrose 1990a, Cooper 1963, DuMond 1970, Fike 1999, Hoagland 1998a, Nelson 1986, Newell and Peet 1995, Rodgers 1965, Schafale and Weakley 1990, Smith 1991, Tiner 1985a, Tobe et al. 1992, Wharton 1978

III.C.2.N.e. Saturated mixed evergreen - cold-deciduous shrubland

III.C.2.N.E. *ALNUS SERRULATA - SALIX SERICEA - RHODODENDRON (CATAWBIENSE, MAXIMUM)* SATURATED SHRUBLAND ALLIANCE (A.1880)
SMOOTH ALDER - SILKY WILLOW - (CATAWBA RHODODENDRON, GREAT RHODODENDRON) SATURATED SHRUBLAND ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes mostly montane, non-alluvial, palustrine vegetation dominated by shrubs and often, but not always, with substantial *Sphagnum* cover. Occurrences of this alliance can have small to moderately large herbaceous openings, as well, but where open herbaceous patches are large and well-developed, communities in V.A.5.N.m. should be considered. Communities in this alliance are saturated shrublands with *Alnus serrulata* as a nearly constant component, but many other shrub species are typical and may dominate or codominate, including *Salix sericea, Salix humilis, Spiraea alba, Spiraea tomentosa, Ilex verticillata, Ilex collina, Ilex montana, Rhododendron catawbiense, Rhododendron maximum, Rhododendron viscosum, Rhododendron arborescens, Lyonia ligustrina var. ligustrina, Kalmia latifolia, Menziesia pilosa, Kalmia carolina, Viburnum nudum var. nudum, Viburnum nudum var. cassinoides, Lonicera canadensis,* and *Lonicera dioica*. This alliance includes shrub bogs and bogs with well-developed shrub zones, scattered in the southern Blue Ridge, and may possibly extend to the Cumberland Mountains and northern Ridge and Valley.

Related Concepts:

- IIE1b. Southern Appalachian Bog Complex (Allard 1990) I
- Scrub/Shrub Swamp (Smith 1996a) I
- Southern Appalachian Bog, Northern Subtype (Schafale and Weakley 1990) I
- Southern Appalachian Bog, Southern Subtype (Schafale and Weakley 1990) I
- mountain bog/seep herbaceous vegetation (Ambrose 1990a) ?
- mountain bog/seep shrub/scrub vegetation (Ambrose 1990a) ?

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance includes shrub bogs and bogs with well-developed shrub zones, scattered in the southern Blue Ridge, and may possibly extend to the Cumberland Mountains and northern Ridge and Valley. This alliance is found in Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia. It could potentially range into Alabama (?) and West Virginia (?).

Subnations: AL?, GA, KY, NC, SC, TN, VA, WV?

TNC Ecoregions: 50:C, 51:C, 59:C

USFS Ecoregions: 221:C, M221Aa:CCC, M221Ba:CCP, M221Bd:CCP, M221Be:CCP, M221Db:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains?, Little River Canyon?); USFS (Chattahoochee, Cherokee, Jefferson, Nantahala, Pisgah?, Sumter?)

ALLIANCE SOURCES

References: Allard 1990, Ambrose 1990a, Schafale and Weakley 1990, Smith 1996a, Weakley and Schafale 1994

IV. Dwarf-shrubland

IV.A.1.N.a. Cespitose needle-leaved or microphyllous evergreen dwarf-shrubland

IV.A.1.N.A. *LEIOPHYLLUM BUXIFOLIUM* DWARF-SHRUBLAND ALLIANCE (A.1063)
SAND-MYRTLE DWARF-SHRUBLAND ALLIANCE

ALLIANCE CONCEPT

Summary: Associations in this alliance occur as fairly sparse to essentially continuous mats in thin soils around high-elevation rock outcrops in the Southern Blue Ridge (largest occurrences to 1-2 hectares). This shrubland has a matted krummholz structure and occurs in northern parts of North Carolina. Dense *Leiophyllum* occurs also in New Jersey and North Carolina Coastal Plain, but probably only as part of woodland communities.

Related Concepts:

- *Picea rubens/Leiophyllum buxifolium* outcrop community (Wiser et al. 1996) ?
- *Picea rubens/Leiophyllum buxifolium* outcrop community (Wiser 1993) ?
- Heath Bald (Schafale and Weakley 1990) I
- IC4a. Heath Bald Shrubland (Allard 1990) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in the Southern Blue Ridge of northern North Carolina.

Subnations: GA?, NC, SC?, TN

TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee?, Cherokee?, Nantahala, Pisgah)

ALLIANCE SOURCES

References: Allard 1990, Newell and Peet 1995, Risk 1993, Schafale and Weakley 1990, Whittaker 1979, Wiser 1993, Wiser et al. 1996

V. Herbaceous Vegetation

V.A.5.N.c. Medium-tall sod temperate or subpolar grassland

V.A.5.N.C. *PHLEUM PRATENSE* HERBACEOUS ALLIANCE (A.1195) TIMOTHY HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes grasslands primarily dominated by alien species not native to North America, presumably originally planted or introduced by grazing animals. Vegetation of this alliance is widely distributed in the northeastern United States, as well as in montane and higher-elevation areas of the southeastern United States. *Phleum pratense*, a native of Europe, is characteristic. Occurrences are variable and patchy, often with local dominance of tall forbs. Other characteristic species include *Hieracium caespitosum (= Hieracium pratense)* (alien), *Potentilla canadensis*, and *Ranunculus acris* (alien). These grasslands are maintained by periodic mowing or, in some instances, prescribed burning. This alliance is currently known throughout the northeastern United States and from high elevation pastures or grass balds in the southern Appalachians. It is possible throughout the United States and in southern Canada.

Related Concepts:

- Grass Balds (Pyne 1994) I
- Grassy Bald (Schafale and Weakley 1990) I
- ID9a. Grass Bald (Allard 1990) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is currently known from high-elevation pastures or grass balds in the southern Appalachians, but is possible throughout the United States and in southern Canada. It is found in North Carolina, Tennessee, and possibly Virginia (?) and Canada (?).
Subnations: IL, MI, MN, NC, OH, ON, TN, VA?, WI
TNC Ecoregions: 46:P, 48:P, 51:C, 59:C
USFS Ecoregions: 212:P, 222:P, M221Dc:CCP, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains?, Isle Royale); USFS (Cherokee, Pisgah)

ALLIANCE SOURCES

References: Allard 1990, Pyne 1994, Schafale and Weakley 1990

V.A.5.N.e. Short sod temperate or subpolar grassland

V.A.5.N.E. *CAREX BILTMOREANA* HERBACEOUS ALLIANCE (A.1277) BILTMORE SEDGE HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: These are graminoid-dominated communities of often steeply sloping outcrops of felsic to mafic rock in the southern Appalachians, primarily south of the Asheville Basin, North Carolina. The substrate is rocks which are typically small exfoliated (spalled) outcrops surrounded by forests or woodlands, and shrubs and trees may be rooted within an occurrence. Stands are typically strongly dominated by *Carex biltmoreana*. Associated species can include *Krigia montana, Houstonia longifolia (= Houstonia longifolia var. glabra), Schizachyrium scoparium, Diervilla sessilifolia, Melampyrum lineare, Ambrosia artemisiifolia, Coreopsis pubescens, Coreopsis major, Dichanthelium dichotomum var. dichotomum (= var. ramulosum),* and *Dichanthelium acuminatum var. lindheimeri*.

Related Concepts:

- High Elevation Granitic Dome (Schafale and Weakley 1990) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in North Carolina, South Carolina, and Georgia.
Subnations: GA, NC, SC

TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC
Federal Lands: NPS (Blue Ridge Parkway); USFS (Chattahoochee, Nantahala, Pisgah)

ALLIANCE SOURCES

References: Schafale and Weakley 1990

V.A.5.N.E. *DANTHONIA COMPRESSA* HERBACEOUS ALLIANCE (A.1280) MOUNTAIN OATGRASS HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes montane grasslands dominated by *Danthonia compressa* often with significant cover by the dwarf-shrub *Sibbaldiopsis tridentata* or by *Rhododendron calendulaceum*. Species dominance is highly variable from occurrence to occurrence and within occurrences. Associated species can include *Carex brunnescens, Carex pensylvanica, Carex debilis, Oclemena acuminata (= Aster acuminatus), Deschampsia flexuosa, Stachys clingmanii, Solidago glomerata, Prenanthes roanensis, Smilax herbacea*, and *Houstonia serpyllifolia*. Typical shrubs are *Rhododendron calendulaceum, Rhododendron catawbiense, Menziesia pilosa, Pieris floribunda, Vaccinium corymbosum, Vaccinium simulatum*, and *Rubus canadensis*. These grasslands occur on high-elevation (usually above 1500 m or 5000 feet), often south- to southwest-facing domes, ridgetops and gentle slopes. Strong winds, high rainfall, frequent fog, shallow, rocky soils, and extremes of temperature and moisture are characteristic of these environments. Grasslands in this alliance occur at the highest elevations of the southern Appalachian Mountains, often adjacent to montane shrublands or dwarfed forests dominated by *Fagus grandifolia* or *Quercus rubra*.

Related Concepts:
- Grass Balds, BR (Pyne 1994) ?
- Grassy Bald (Schafale and Weakley 1990) I
- ID9a. Grass Bald (Allard 1990) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in North Carolina, Tennessee, and Virginia.
Subnations: NC, TN, VA
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Aa:C??, M221Ab:C??, M221Ba:CCC, M221Bd:CC?, M221Be:CC?, M221Db:CC?, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains); USFS (Cherokee, Jefferson, Pisgah)

ALLIANCE SOURCES

References: Allard 1990, Billings and Mark 1957, Gersmehl 1973, Lindsay and Bratton 1979a, Mark 1958, Mark 1959, Pyne 1994, Schafale and Weakley 1990

V.A.5.N.E. *CAREX PENSYLVANICA* HERBACEOUS ALLIANCE (A.1278) PENNSYLVANIA SEDGE HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes montane grasslands strongly dominated by *Carex pensylvanica*. In the Southern Blue Ridge these grasslands are ungrazed grass balds with deep soil. Associated species include *Rumex acetosella* (exotic), *Carex debilis, Polytrichum commune, Helenium autumnale, Danthonia compressa, Sibbaldiopsis tridentata, Fragaria virginiana, Ageratina altissima var. roanensis, Angelica triquinata, Oclemena acuminata (= Aster acuminatus), Bromus pubescens*, and *Dennstaedtia punctilobula*. These grasslands typically occur over 1220 m (4000 feet) elevation in the Southern Blue Ridge. In the Central Appalachians, these communities are found on acid shale.

Related Concepts:
- Grass Balds (Pyne 1994) I
- Grassy Bald (Schafale and Weakley 1990) I
- ID9a. Grass Bald (Allard 1990) I

Classification Comments: The affinities of this community are northern; it might be better placed in V.A.5.N.g short alpine or subalpine sod grassland.

ALLIANCE DISTRIBUTION

Range: This alliance is found in North Carolina, Tennessee, Virginia, and West Virginia.
Subnations: MD?, NC, TN
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CC?

Federal Lands: USFS (Cherokee, Pisgah)

ALLIANCE SOURCES

References: Allard 1990, Pyne 1994, Schafale and Weakley 1990

V.A.5.N.j. Temporarily flooded temperate or subpolar grassland

V.A.5.N.J. *CAREX TORTA* TEMPORARILY FLOODED HERBACEOUS ALLIANCE (A.1340) TWISTED SEDGE TEMPORARILY FLOODED HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes sedge-dominated alluvial wetlands on sand, gravel, and rock bars in valleys and gorges in the southern Appalachians, ranging west into the Cumberland Plateau and Interior Low Plateau, and north into central Appalachians and Allegheny Mountains. Associations in this alliance are characterized by light-demanding, tough-rooted herbaceous perennials tolerant of frequent inundation and flood-scouring. *Carex torta* often forms dense, extensive colonies. Associated species vary with geography. In the Allegheny Mountains, associated species include *Doellingeria umbellata (= Aster umbellatus), Dichanthelium clandestinum, Solidago rugosa ssp. aspera, Juncus effusus var. solutus, Scirpus expansus, Scirpus cyperinus (= var. pelius), Equisetum arvense, Onoclea sensibilis, Vernonia noveboracensis, Lycopus virginicus, Scutellaria lateriflora*, and *Salix sericea*. In southern Appalachian gorges this vegetation often is associated with *Alnus serrulata - Xanthorhiza simplicissima* Shrubland (CEGL003895). In the Cumberland Plateau of Alabama, herbaceous components may include *Lobelia cardinalis, Symphyotrichum dumosum (= Aster dumosus), Lycopus virginicus, Osmunda regalis*, and *Hypericum mutilum*.

Related Concepts:

- IIE3a. Riverside Shoal and Stream Bar Complex (Allard 1990) I
- Rocky Bar and Shore (Schafale and Weakley 1990) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is known from the southern Appalachians, and ranges west into the Cumberland Plateau and Interior Low Plateau, and north into the central Appalachians and Allegheny Mountains.

Subnations: AL, CT, DE, GA, KY, MA, ME, NC, NH, NY, PA, RI?, SC, TN, VA, VT, WV

TNC Ecoregions: 44:C, 50:C, 51:C, 58:C, 59:C, 60:C, 61:C, 63:C

USFS Ecoregions: 212Fa:CCP, 212Fb:CCP, 212Fc:CCP, 212Fd:CCP, 212Ga:CCP, 212Gb:CCP, 221Ae:CCC, 221Af:CCC, 221Ag:CCC, 221Ah:CCC, 221Ai:CCC, 221Al:CCC, 221Ba:CCC, 221Bd:CCP, 221Ha:CC?, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 222Eg:CCC, 222En:CCC, 222Eo:CCC, 231Cd:CCC, M212Bb:CCC, M212Bc:CCC, M212Bd:CCC, M212Cb:CCC, M212Cc:CCC, M212Ea:CCP, M212Eb:CCP, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCP, M221Ba:CCC, M221Bb:CCC, M221Bd:CCC, M221Be:CCC, M221Cd:CCP, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

References: Allard 1990, Fleming and Moorhead 1996, Hupp 1982, Palmer-Ball et al. 1988, Schafale and Weakley 1990, Tobe et al. 1992

V.A.5.N.k. Seasonally flooded temperate or subpolar grassland

V.A.5.N.K. *SPARGANIUM AMERICANUM* SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1388) AMERICAN BUR-REED SEASONALLY FLOODED HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes vegetation of wet, bog-like areas in the southern Appalachian Mountains, with seasonal flooding, especially areas formerly flooded by beavers, as well as shoreline vegetation of artificial impoundments of the East Gulf Coastal Plain (and likely other coastal regions as well). Other species that may be present in the montane examples, in addition to *Sparganium americanum*, include *Epilobium leptophyllum, Epilobium coloratum, Polygonum punctatum, Potamogeton* sp., *Ludwigia palustris*, and others. Other species in the Coastal Plain community include *Saccharum giganteum, Morella cerifera (= Myrica cerifera), Rhynchospora corniculata, Lycopus rubellus, Woodwardia areolata*, and others.

Related Concepts:

- Freshwater Marsh (Wieland 1994b) I
- Piedmont/Mountain Semipermanent Impoundment (Schafale and Weakley 1990) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance includes vegetation in the southern Appalachian Mountains, the East Gulf Coastal Plain, and likely other coastal regions as well. It is found in Georgia, Mississippi, and North Carolina, and possibly in Alabama (?), Florida (?), Louisiana (?), Virginia (?), and others.
Subnations: AL?, FL?, GA, LA?, MS, NC, TN, VA, WV
TNC Ecoregions: 43:P, 50:P, 51:C, 52:P, 53:C, 59:C
USFS Ecoregions: 232Bb:CCC, M221Aa:CPP, M221Ba:CCC, M221Dc:CCC
Federal Lands: DOD (Fort Gordon); USFS (George Washington, Homochitto, Pisgah)

ALLIANCE SOURCES

References: Schafale and Weakley 1990, Wieland 1994b

V.A.5.N.K. *SCIRPUS CYPERINUS* SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1386) WOOLGRASS BULRUSH SEASONALLY FLOODED HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance, which is found in the eastern and southeastern United States, inhabits seasonally flooded marshes or emergent zones of upland depression ponds. The vegetation is dominated by *Scirpus cyperinus*, or at least with substantial cover of this species. The habitat of this alliance may have a pronounced seasonal fluctuation in water level, becoming saturated to ponded in the winter and often drying completely in the summer. The vegetation is typically dominated by patches or zones of *Scirpus cyperinus*; other species present may include *Carex* spp., *Dichanthelium* spp., *Dulichium arundinaceum, Glyceria* spp., *Juncus* spp., *Leersia* spp., *Panicum rigidulum, Rhynchospora* spp., and *Thelypteris palustris*, as well as other species of *Scirpus* including *Scirpus microcarpus (= Scirpus rubrotinctus)* and *Scirpus atrovirens*. The vegetation may consist of monospecific clumps of the component species, either scattered in the marsh or around the pond margin. Mats of *Sphagnum* mosses may be prominent in some examples (e.g., *Sphagnum lescurii, Sphagnum pylaesii, Sphagnum cuspidatum, Sphagnum palustre,* and *Sphagnum recurvum*. Some examples may have scattered woody plants, including shrubs and small trees such as *Acer rubrum, Alnus serrulata, Cephalanthus occidentalis, Rosa palustris,* and *Nyssa sylvatica*. To the north, *Vaccinium corymbosum* is a typical associate, while *Hibiscus moscheutos, Itea virginica, Liquidambar styraciflua, Pinus taeda,* and *Quercus phellos* occur more frequently in the southern portion of the range. Sparsely distributed shrubs in montane examples may include *Vaccinium* spp. and *Leucothoe racemosa*. The floristics and physiognomic expression may vary with context and management. In a burned or mowed context, examples of this vegetation type may grade down into other wetland herbaceous types, but in a more forested context may grade into upland depression forests.
Related Concepts:
- *Scirpus cyperinus-Dulichium* Pond (Newell and Peet 1995) ?
- IIE1g. Interior Vernal Pool Complex (Allard 1990) I
- Shallow emergent marsh (Cowardin et al. 1979) ?
- Upland Pool (Schafale and Weakley 1990) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is documented from the Southern Blue Ridge of North Carolina, the Interior Low Plateau of Tennessee and other states, the Atlantic Coastal Plain, the East Gulf Coastal Plain, Upper East Gulf Coastal Plain, Lower New England, the North Atlantic Coast, and from the Chesapeake Bay Lowlands (Delmarva Peninsula of Virginia, Chincoteague NWR). It could occur in adjacent provinces (e.g., Central Appalachians, High Allegheny Plateau, Piedmont, Ridge and Valley).
Subnations: AL, AR?, CT, DE, FL?, GA, IN, KY, LA?, MA, MD?, ME, MS?, NC, NH, NJ, NY, PA, RI, SC, TN, VA, VT, WV
TNC Ecoregions: 42:P, 43:C, 44:C, 50:P, 51:C, 52:P, 53:C, 56:P, 57:C, 58:C, 59:C, 60:?, 61:C, 62:C, 64:C
USFS Ecoregions: 221Ab:CCC, 221H:CP, 221J:CP, 222Cf:CCP, 222Cg:CCP, 222Eb:CCC, 222Eg:CCP, 222Eh:CCP, 231A:CP, 231Bc:CCC, 232B:CC, 232C:CP, 232D:CP, 234A:PP, M221Dc:CCC
Federal Lands: DOD (Arnold, Fort Benning); NPS (Cape Cod); USFS (Chattahoochee?, Francis Marion, Oconee?, Pisgah, Talladega, Tuskegee?); USFWS (Chincoteague)

ALLIANCE SOURCES

References: Allard 1990, Cowardin et al. 1979, Glitzenstein and Streng 2004, Newell and Peet 1995, Schafale and Weakley 1990, Weakley and Schafale 1994

V.A.5.N.m. Saturated temperate or subpolar grassland

V.A.5.N.M. *CAREX (ATLANTICA, ECHINATA) - ERIOPHORUM VIRGINICUM - RHYNCHOSPORA CAPITELLATA - SOLIDAGO PATULA* SATURATED HERBACEOUS ALLIANCE (A.1450) (PRICKLY BOG SEDGE, STAR SEDGE) - TAWNY COTTON-GRASS - NORTHERN BEAKSEDGE - ROUGHLEAF GOLDENROD SATURATED HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes non-alluvial, palustrine vegetation of the unglaciated southern highlands of the eastern United States. Stands are dominated by mixtures of graminoids and forbs, with substantial *Sphagnum* cover and occasional shrubs. The nominal species are characteristic and nearly constant. Typical species include *Carex atlantica, Carex echinata, Carex folliculata, Carex leptalea, Carex lurida, Eriophorum virginicum, Houstonia serpyllifolia, Lysimachia terrestris, Osmunda cinnamomea, Oxypolis rigidior, Parnassia asarifolia, Polytrichum commune, Rhynchospora alba, Rhynchospora capitellata, Scirpus atrovirens, Scirpus cyperinus, Scirpus expansus, Scirpus polyphyllus, Packera aurea (= Senecio aureus), Solidago patula var. patula*, and *Vaccinium macrocarpon*. Typical mosses are *Sphagnum palustre, Sphagnum affine (= Sphagnum imbricatum), Sphagnum bartlettianum, Sphagnum recurvum*, and *Aulacomnium palustre*. Scattered shrubs are typically present, and in some cases are patchy dominants. Typical shrub species include *Alnus serrulata, Rosa palustris, Salix sericea, Spiraea tomentosa, Ilex verticillata, Kalmia latifolia, Lyonia ligustrina var. ligustrina,* and *Rhododendron maximum*. These seepage-fed communities occur in the unglaciated southern highlands of the eastern United States, on flat to slightly sloping topography, often associated with small streams and rivers.

Related Concepts:

- High Elevation Seep (Schafale and Weakley 1990) I
- IIE1b. Southern Appalachian Bog Complex (Allard 1990) I
- Southern Appalachian Bog, Long Hope Valley Variant (Weakley and Schafale 1994) I
- Southern Appalachian Bog, Northern Subtype (Schafale and Weakley 1990) I
- Southern Appalachian Bog, Typic Variant (Weakley and Schafale 1994) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in Georgia, North Carolina and Tennessee, and possibly in South Carolina (?), Virginia (?), and West Virginia (?).

Subnations: GA, NC, SC?, TN, VA, WV?

TNC Ecoregions: 50:C, 51:C, 59:C

USFS Ecoregions: M221Aa:C??, M221Ab:C??, M221Ba:CCC, M221Bd:CC?, M221Be:CC?, M221Da:CC?, M221Db:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway?); USFS (Chattahoochee, Cherokee, George Washington, Jefferson?, Nantahala?, Pisgah)

ALLIANCE SOURCES

References: Allard 1990, Schafale and Weakley 1990, Weakley and Schafale 1994

V.A.5.N.M. *SYMPHYOTRICHUM PUNICEUM - VERNONIA NOVEBORACENSIS - SOLIDAGO (PATULA, RUGOSA)* SATURATED HERBACEOUS ALLIANCE (A.2016)
PURPLE-STEM ASTER - NEW YORK IRONWEED - (ROUGHLEAF GOLDENROD, WRINKLELEAF GOLDENROD) SATURATED HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: This fen / wet meadow alliance occurs at low elevations in the Southern Appalachians, where relatively nutrient-rich groundwater seeps to the surface, creating saturated conditions. Typical species are *Symphyotrichum puniceum, Solidago patula var. patula, Solidago rugosa, Vernonia noveboracensis, Amphicarpaea bracteata, Apios americana, Eupatorium fistulosum, Impatiens capensis, Juncus effusus*, and *Carex lurida*. *Sphagnum* cover is usually minimal.

Related Concepts: No information

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in North Carolina and Tennessee, and is likely considerably more widespread.

Subnations: AL?, GA, NC, SC?, TN

TNC Ecoregions: 50:P, 51:C

USFS Ecoregions: 231Dc:CCC, 231De:CCP, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala?)

ALLIANCE SOURCES

References: No information

V.A.5.N.M. *CAREX RUTHII - CAREX GYNANDRA* SATURATED HERBACEOUS ALLIANCE (A.1898)
RUTH'S SEDGE - MOUNTAIN FRINGED SEDGE SATURATED HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes high-elevation, herb-dominated seepage slopes of the southern Blue Ridge. This alliance is currently defined for North Carolina and Tennessee but may extend into Virginia. Associations in this alliance are perennial wetlands on pronounced slopes at elevations over 5000 feet. The vegetation is graminoid-dominated and has coverage by *Sphagnum* sp. These seeps are open, although trees and shrubs can be present, particularly around the seep margins. Associations in this alliance are surrounded by, or were formerly surrounded by, forests dominated by *Abies fraseri* and *Picea rubens* or by the highest northern hardwood forests (forests dominated by *Fagus grandifolia, Betula alleghaniensis*, and *Aesculus flava*). They are influenced by the high rainfall and low evaporation rates in these high mountain landscapes.

Related Concepts:

- *Carex gynandra* Wetland (Newell and Peet 1996a) ?
- *Carex ruthii* Wetland (Newell and Peet 1996a) ?
- Southern Blue Ridge High Elevation Boggy Seep (Schafale pers. comm.) ?

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in North Carolina and Tennessee but may extend into Virginia (?).
Subnations: NC, TN, VA?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Pisgah)

ALLIANCE SOURCES

References: Feldcamp 1984, Newell and Peet 1996a, Schafale and Weakley 1990, Schafale pers. comm.

V.A.6.N.q. Bedrock temperate or subpolar grassland with a sparse tree layer

V.A.6.N.Q. *(QUERCUS STELLATA, QUERCUS MARILANDICA) / SCHIZACHYRIUM SCOPARIUM* WOODED HERBACEOUS ALLIANCE (A.1920) (POST OAK, BLACKJACK OAK) / LITTLE BLUESTEM WOODED HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes *Schizachyrium scoparium*-dominated grasslands with scattered broad-leaved deciduous trees, or mixed broad-leaved deciduous trees with needle-leaved evergreen trees such as *Juniperus virginiana var. virginiana*. Graminoids dominate stands of this alliance with scattered trees and shrubs. Various combinations of *Quercus* spp. and *Juniperus virginiana* may be present, with *Quercus stellata* and *Quercus marilandica* being the most common trees, although *Quercus velutina* may often be present. Some montane associations may contain *Quercus prinus*. *Andropogon virginicus, Schizachyrium scoparium, Danthonia spicata,* and *Dichanthelium* spp. are the most abundant herbs. Some other herbs which may be found include *Castilleja coccinea, Coreopsis tripteris, Liatris* spp., *Rudbeckia* spp., *Silphium* spp., *Carex* spp., and *Asclepias amplexicaulis*. *Smilax glauca, Smilax bona-nox, Rhus aromatica, Toxicodendron radicans, Ulmus alata,* and *Vaccinium arboreum* make up the sparse to moderate shrub layer. Lichens (e.g., *Cladonia* spp. and *Cladina* spp.) and mosses are prominent on exposed rock. Stands occur on exposed slopes throughout the range of this alliance. In Missouri, they occur on moderate to steep slopes of dissected drainages along major streams and mounds. The soil is absent to thin (0-40 cm) and somewhat rapidly to very rapidly drained. The parent material is variable; it is most typically shale or sandstone, with siltstone present in Indiana occurrences. Exposed bedrock or fragments of parent material are common on or at the surface. In Virginia's Blue Ridge, an association occurs over amphibolite, which weathers to produce high base status soils. Some associations are over various igneous materials, e.g., nepheline syenite in Arkansas. Most associations in this alliance occur over soils that are stony, shallow, and typically acidic, primarily consisting of weathered mineral matter, loess, and organic debris which collects in cracks and crevices of the bedrock. Organic matter is low, and clay content can be quite high. These soils are extremely susceptible to erosion and downslope migration, especially on steeper slopes and during periods of freeze-thaw. All these factors contribute to poor productivity and provide only shallow root penetration for vegetation. Although predominantly droughty and excessively drained, these sites can be seasonally wet; water is occasionally ponded in shallow depressions.

Related Concepts:

- *Schizachyrium scoparium* herbaceous series (Hoagland 1997) I
- ID4g. Sandstone Prairie (Allard 1990) I
- IE6c. Ouachita Novaculite Glade/Outcrop (Allard 1990) ?
- Novaculite Glade/Outcrop (Foti 1994b) ?
- Shawnee Hills sandstone glade (Evans 1991) ? Siltstone/shale glade (Evans 1991) I

Classification Comments: Potentially very widespread in the southeastern U.S. Includes communities in Arkansas's glade/outcrop complexes and prairies. In Kentucky's Daniel Boone National Forest, this vegetation occurs near Cave Run Lake with *Fraxinus quadrangulata*. The relative placement of some associations has been called into question.

ALLIANCE DISTRIBUTION

Range: This alliance is found in Alabama, Arkansas, Georgia, Kentucky, Oklahoma, Kansas, Louisiana, North Carolina, South Carolina, Tennessee, Virginia, West Virginia (?), Illinois, Indiana, Kansas, Missouri, and Ohio.
Subnations: AL, AR, GA, IL, IN, KS, KY, LA, MO, NC, OH, OK, SC, TN, VA, WV?
TNC Ecoregions: 36:C, 37:C, 38:C, 39:C, 40:C, 42:C, 43:C, 44:C, 45:C, 49:?, 50:C, 51:C, 52:C, 59:?
USFS Ecoregions: 221Ed:CPP, 221Ef:CPP, 221Ha:CCP, 221Hc:CCC, 221He:CCP, 221J:CP, 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Ah:CCC, 222Aj:CCC, 222Ak:CCC, 222Am:CCC, 222An:CCC, 222Aq:CCC, 222Ca:CCC, 222Db:CCC, 222De:CCC, 222Df:CCC, 222Dh:CCC, 222Di:CCC, 222Eg:CCC, 222Ei:CCC, 222Ek:CCC, 222El:CCC, 222Em:CCP, 222Fd:CCC, 222Ff:CCC, 222Ga:CCC, 222Ge:CCC, 222Hc:CCC, 231Aa:CCC, 231Ad:CCC, 231Ae:CCC, 231Af:CCC, 231B:CP, 231Ca:CCP, 231Cb:CCP, 231Cc:CCC, 231Cd:CCC, 231D:CP, 231Ea:CCC, 231G:CP, 234Ac:CCC, 251Ce:CCC, 251Eb:CCC, M221A:C?, M221Db:CCC, M222A:PP, M231Ab:CCC, M231Ac:CCC
Federal Lands: DOD (Fort Chaffee); NPS (Big South Fork); USFS (Bankhead, Chattahoochee, Daniel Boone, Mark Twain, Nantahala?, Ouachita, Ozark)

ALLIANCE SOURCES

References: Allard 1990, Evans 1991, Faber-Langendoen et al. 1996, Fehrenbacher et al. 1982, Foti 1994b, Hoagland 1997, Nelson 1985, White and Madany 1978

V.B.2.N.b. Low temperate or subpolar perennial forb vegetation

V.B.2.N.B. *(HYDRANGEA* SPP., *PHILADELPHUS* SPP.) / *HEUCHERA* SPP. HERBACEOUS ALLIANCE (A.1905)
(HYDRANGEA SPECIES, MOCK-ORANGE SPECIES) / ALUMROOT SPECIES HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance contains vegetated, dry to moist, basic cliffs of variable geology, with vegetation composition variable and often with a mixed and variable physiognomy. Individual occurrences may be herb-dominated, shrub-dominated, or sparsely vegetated with vascular plants (though sometimes with dense patchy cover of mosses, hepatics, or lichens). Characteristic shrubs are *Hydrangea* spp. (*Hydrangea arborescens, Hydrangea cinerea, Hydrangea radiata), Philadelphus* spp. (*Philadelphus hirsutus, Philadelphus inodorus, Philadelphus pubescens), Toxicodendron radicans, Physocarpus opulifolius*, and *Ribes* spp. (*Ribes cynosbati)*. Characteristic herbs are *Heuchera* spp. (*Heuchera americana var. americana, Heuchera americana var. hirsuticaulis, Heuchera americana var. hispida, Heuchera caroliniana, Heuchera villosa var. arkansana, Heuchera villosa var. villosa*). Other species which are typical include *Dichanthelium* spp., *Woodsia obtusa, Dryopteris* spp., *Cystopteris* spp., *Danthonia spicata, Deschampsia flexuosa*, and others. Characteristic mosses include *Anomodon attenuatus* and *Anomodon rostratus*. The alliance is potentially widespread in the Southern Blue Ridge, Cumberlands and Southern Ridge and Valley, Interior Low Plateau, and Interior Highlands. This alliance is known from vertical and near-vertical exposures of limestone, siltstone, mudstone, calcareous sandstones, and may also occur on mafic metamorphic and igneous rocks.
Related Concepts: No information
Classification Comments: None

ALLIANCE DISTRIBUTION

Range: The alliance is potentially widespread in the Southern Blue Ridge, Cumberlands and Southern Ridge and Valley, Interior Low Plateau, and Interior Highlands. It is found in Alabama, Arkansas, Kentucky, North Carolina, Tennessee, and possibly Georgia (?), Mississippi (?), Oklahoma (?), and Virginia (?).
Subnations: AL, AR, GA?, KY, MS?, NC, OK?, TN, VA?
TNC Ecoregions: 38:C, 39:C, 43:P, 44:C, 50:C, 51:C, 52:C, 59:P
USFS Ecoregions: 221Hb:CCC, 221Hc:CCC, 222Ea:CCC, 222Eb:CCC, 222Ee:CC?, 222Ef:CC?, 222Eg:CCC, 222Eh:CCC, 222Eo:CCC, 231Be:CPP, 231Gb:CCC, M221Dc:CCC, M221Dd:CCC, M222Ab:CCC
Federal Lands: NPS (Natchez Trace, Russell Cave); USFS (Chattahoochee?, Cherokee, Jefferson, Ouachita, Ozark, Pisgah)

ALLIANCE SOURCES

References: No information

V.B.2.N.B. *SELAGINELLA (TORTIPILA, RUPESTRIS)* HERBACEOUS ALLIANCE (A.1985)
(TWISTED-HAIR SPIKE-MOSS, ROCK SPIKE-MOSS) HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes vegetation characterized by shallow vegetation mats of mosses, lichens, and shallow-rooted vascular plants occurring on smooth rock substrates or rock with few crevices or fractures (e.g., granitic exfoliation domes). It includes communities found in the Blue Ridge and Piedmont of the Carolinas and Georgia. Associations in this alliance can be found

at elevations up to 5000 feet (1525 m) in the Blue Ridge, but occur below 3000 feet (915 m) in the Piedmont. This alliance has sparse to dense (10-90%) coverage by *Selaginella tortipila* or *Selaginella rupestris* and physiognomically complex zones with many other dominants. Woody species from adjacent woodlands and shrublands may be scattered components in these associations, especially in marginal zones between open rock and forested vegetation. The vegetation of associations in this alliance has few deep-rooted forbs, shrubs, or trees and is dominated by shallow-rooted perennials and annuals growing in established vegetation mats. Associated species vary with elevation, exposure, and geology. Species characteristic of high-elevation associations include *Hypericum buckleii, Packera millefolia (= Senecio millefolium), Carex biltmoreana, Carex umbellata, Solidago simulans, Danthonia epilis (= Danthonia sericea var. epilis), Trichophorum caespitosum (= Scirpus cespitosus), Rhododendron catawbiense,* and *Leiophyllum buxifolium*. Lower elevation associations typically include *Grimmia laevigata, Andropogon virginicus, Coreopsis major, Danthonia spicata, Schizachyrium scoparium,* and *Talinum teretifolium*. Some unique associations with circumneutral influence include species indicative of high pH soils such as *Arabis laevigata, Cheilanthes lanosa, Dodecatheon meadia, Sedum glaucophyllum,* and *Hylotelephium telephioides (= Sedum telephioides).* Granitic domes, in general, are uncommon, especially at high elevations in the Blue Ridge, where they are threatened by heavy recreational use. Granitic dome communities are also known from the Piedmont of North Carolina and Georgia, where the associations are more xeric and differ floristically from the montane associations.

Related Concepts:

- *Selaginella tortipila/Carex umbellata* outcrop community (Wiser et al. 1996) ?
- *Selaginella tortipila/Carex umbellata* outcrop community (Wiser 1993) ?
- Granitic Dome (Nelson 1986) I
- High Elevation Granitic Dome (Schafale and Weakley 1990) I IE4c. Southern Appalachian High Elevation Granitic Dome (Allard 1990) I
- Low Elevation Granitic Dome (Schafale and Weakley 1990) I

Classification Comments: This alliance contains the former alliance *Selaginella tortipila* Herbaceous Alliance (A.1622) which was expanded to include vegetation of lower elevations and characterized by *Selaginella rupestris* (KP).

ALLIANCE DISTRIBUTION

Range: This alliance includes communities found in the Blue Ridge and Piedmont of the Carolinas and Georgia, and may extend into Virginia (?).

Subnations: GA, NC, SC, TN?, VA?

TNC Ecoregions: 51:C, 52:C

USFS Ecoregions: 231Ad:CCC, M221Dc:CCC

Federal Lands: NPS (Blue Ridge Parkway?, Carl Sandburg Home); USFS (Chattahoochee, Nantahala, Oconee, Pisgah, Sumter)

ALLIANCE SOURCES

References: Allard 1990, DuMond 1970, Nelson 1986, Schafale and Weakley 1990, Wiser 1993, Wiser et al. 1996

V.B.2.N.B. *SAXIFRAGA MICHAUXII* HERBACEOUS ALLIANCE (A.1621) CLIFF SAXIFRAGE HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance consists of moderate- to high-elevation rocky summit communities of the southern and central Blue Ridge (metamorphic rock portions of the southern and central Appalachians), on various rock types, including amphibolite, metabasalt (greenstone), gneiss, and others. There are several globally rare communities contained in this alliance. More common vegetation in this alliance will have *Saxifraga michauxii* as a characteristic component; other species are variable, but may include *Saxifraga virginiensis, Saxifraga micranthidifolia*, *Carex* spp., *Schizachyrium scoparium*, and others. Examples at high elevation exhibit a sparse vegetative cover of grasses, forbs and shrubs rooted in rock fissures and occur in a matrix of *Picea rubens - Abies fraseri* Forest. On rock outcrops of highly fractured felsic to mafic bedrock (over 1980 m), typical species include *Carex misera, Abies fraseri, Menziesia pilosa, Heuchera villosa, Rhododendron catawbiense, Saxifraga michauxii, Sorbus americana, Oclemena acuminata (= Aster acuminatus), Solidago glomerata*. Other characteristic species are *Minuartia groenlandica* and *Polypodium appalachianum*. On rock outcrops of felsic Anakeesta slate in the Great Smoky Mountains (from 1646-1987 m), typical species include *Saxifraga michauxii, Carex misera, Calamagrostis cainii, Rhododendron carolinianum, Solidago glomerata, Oclemena acuminata, Abies fraseri*, and *Leiophyllum buxifolium*. Other characteristic species are *Gentiana linearis* and *Calamagrostis cainii*. At low to middle elevations (1256-1713 m) in the southern Appalachians on outcrops of mafic rock, or on felsic rock where perennial seepage exists, the sparse vegetation consists of graminoids, forbs, and shrubs. It is surrounded by deciduous forests dominated by *Quercus rubra, Acer rubrum var. rubrum,* and occasionally *Tsuga caroliniana*. Typical species here include *Saxifraga michauxii, Coreopsis major, Schizachyrium scoparium, Kalmia latifolia, Dichanthelium acuminatum, Danthonia spicata,* and *Paronychia argyrocoma*. Other characteristic species include *Campanula divaricata, Solidago bicolor,* and *Allium cernuum (= Allium allegheniense).* On amphibolite, metabasalt, metagabbro, or metagraywacke bedrock from 1350-1870 m elevation within a matrix of *Quercus rubra* Forest or high elevation grasslands and shrublands, the vegetation includes *Saxifraga michauxii, Danthonia spicata, Krigia montana, Carex misera, Angelica triquinata, Athyrium filix-femina ssp. asplenioides, Rhododendron catawbiense,* and *Heuchera villosa*. Other characteristic species are *Sanguisorba canadensis, Sibbaldiopsis tridentata, Hylotelephium telephioides (=*

Sedum telephioides), Houstonia purpurea var. montana, Geum radiatum, Solidago spithamaea, and *Huperzia appalachiana*. In the central Blue Ridge mountains of Virginia, at elevations of 850-1200 m, this alliance occurs on greenstone (metabasalt, a mafic metamorphic rock). Characteristic herbaceous species include *Hylotelephium telephioides, Solidago simplex var. randii, Heuchera pubescens, Deschampsia flexuosa, Houstonia longifolia (= Houstonia longifolia var. compacta), Dennstaedtia punctilobula, Campanula divaricata, Agrostis perennans, Carex pensylvanica, Saxifraga michauxii, Arabis lyrata, Allium allegheniense*?, *Phlox subulata ssp. brittonii, Sibbaldiopsis tridentata, Liatris turgida, Huperzia appalachiana, Polypodium appalachianum, Gymnocarpium appalachianum*, and *Oclemena acuminata*. Shrubs include *Physocarpus opulifolius, Sorbus americana, Betula alleghaniensis, Quercus rubra, Ribes rotundifolium, Diervilla lonicera, Hamamelis virginiana, Ilex montana, Kalmia latifolia, Menziesia pilosa*, and *Abies balsamea*. Rare alpine disjunct species are sometimes present, including *Juncus trifidus* and *Trisetum spicatum*.

Related Concepts:

- *Aster acuminatus / Menziesia pilosa* outcrop community (Wiser et al. 1996) ?
- *Aster acuminatus / Menziesia pilosa* outcrop community (Wiser 1993) ?
- *Calamagrostis cainii / Rhododendron carolinianum* outcrop community (Wiser et al. 1996) ?
- *Calamagrostis cainii / Rhododendron carolinianum* outcrop community (Wiser 1993) ?
- *Coreopsis major / Schizachyrium scoparium* outcrop community (Wiser et al. 1996) ?
- *Coreopsis major / Schizachyrium scoparium* outcrop community (Wiser 1993) ?
- *Deschampsia flexuosa / Angelica triquinata* outcrop community (Wiser et al. 1996) ?
- *Deschampsia flexuosa / Angelica triquinata* outcrop community (Wiser 1993) ?
- *Paronychia argycoma (sic) / Polypodium appalachianum* outcrop community (Wiser et al. 1996) ?
- *Paronychia argycoma (sic) / Polypodium appalachianum* outcrop community (Wiser 1993) ?
- *Paronychia argyrocoma - Potentilla tridentata - Arenaria groenlandica* Association (Rawinski and Wieboldt 1993) ?
- High Elevation Rocky Summit (Schafale and Weakley 1990) I
- IE4a. Southern Appalachian High Elevation Acidic Rocky Summit (Allard 1990) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in the southern and central Blue Ridge (metamorphic rock portions of the southern and central Appalachians), in Georgia, North Carolina, South Carolina, Tennessee, and Virginia.

Subnations: GA, NC, SC, TN, VA

TNC Ecoregions: 51:C, 52:C, 59:C

USFS Ecoregions: M221Aa:CCP, M221Ab:CCC, M221Ad:CCC, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains, Shenandoah); USFS (Chattahoochee, Cherokee, George Washington, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

References: Allard 1990, Feldcamp 1984, Rawinski and Wieboldt 1993, Schafale and Weakley 1990, Wiser 1993, Wiser et al. 1996

V.B.2.N.d. Temporarily flooded temperate perennial forb vegetation

V.B.2.N.D. *JUSTICIA AMERICANA* TEMPORARILY FLOODED HERBACEOUS ALLIANCE (A.1657)
COMMON WATER-WILLOW TEMPORARILY FLOODED HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance covers rocky river shoals dominated by *Justicia americana* with *Orontium aquaticum, Podostemum ceratophyllum, Leersia* spp., *Lemna minor, Saururus cernuus*, and others. A sparse canopy may be present, and species may include *Carpinus caroliniana ssp. caroliniana, Fagus grandifolia*, and *Fraxinus pennsylvanica*. There is some apparent regional variation in the associated species. More Appalachian examples may contain *Orontium aquaticum* as a codominant. In parts of the Ridge and Valley and Piedmont, *Hymenocallis caroliniana (= Hymenocallis coronaria)* is codominant. In the Edwards Plateau of central Texas, associated with *Justicia americana* are *Bacopa monnieri, Fuirena simplex, Eleocharis geniculata (= Eleocharis caribaea), Eleocharis montevidensis*, and *Cyperus* spp.

Related Concepts:

- *Justicia americana* herbaceous alliance (Hoagland 2000) ?
- IIE3a. Riverside Shoal and Stream Bar Complex (Allard 1990) I Rocky Bar and Shore (Schafale and Weakley 1990) I
- Shoal and Stream Bar (Nelson 1986) I
- Water-willow (*Justicia americana*) - smart-weed riverbed community (Fike 1999) ?

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is distributed in the Edwards Plateau of Texas, Ozark Highlands, Boston Mountains, Ouachita Mountains, Interior Low Plateau, Cumberland Plateau, Piedmont, and Arkansas Valley. It is found in Ohio, Alabama, Arkansas, Georgia, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and possibly Virginia (?).
Subnations: AL, AR, GA, KY, MD?, NC, OH, OK, PA, SC, TN, TX, VA?, WV
TNC Ecoregions: 29:C, 38:C, 39:C, 43:C, 44:C, 45:C, 48:C, 49:C, 50:C, 51:C, 52:C, 59:C, 60:C, 61:C
USFS Ecoregions: 212Fa:CCP, 212Fb:CCC, 212Ga:CCP, 212Gb:CCP, 221Am:CCP, 221Ba:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCP, 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Eb:CCC, 222Eg:CCC, 222Ej:CCP, 222En:CCC, 222Eo:CCC, 222Ha:CCC, 231Af:CCC, 231B:CC, 231Cd:CCC, 231Dc:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 315D:CC, 321B:PP, M221Aa:CCC, M221Ac:CCC, M221Ad:CCC, M221Bb:CCC, M221Bd:CCC, M221Be:CCC, M221Bf:CCC, M221Cd:CCC, M221Da:CCC, M221Dc:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC
Federal Lands: NPS (Little River Canyon?, Natchez Trace, Stones River); USFS (Bankhead, Cherokee, Daniel Boone, Oconee?, Ouachita, Ozark, Pisgah, Sumter, Uwharrie); USFWS (Cahaba River)

ALLIANCE SOURCES

References: Allard 1990, Faber-Langendoen et al. 1996, Fike 1999, Foti et al. 1994, Hoagland 2000, Nelson 1986, Schafale and Weakley 1990, Schmalzer and DeSelm 1982

V.B.2.N.D. *EUPATORIUM SEROTINUM - DIODIA VIRGINIANA* TEMPORARILY FLOODED HERBACEOUS ALLIANCE (A.2017)
LATE THOROUGHWORT - VIRGINIA BUTTONWEED TEMPORARILY FLOODED HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance consists of drawdown zones around artificial impoundments in the Southern Appalachians and likely adjacent provinces. Physiognomy and composition are highly variable. A scattering to sometimes well-developed stratum of woody trees and saplings is sometime present, and often includes species such as *Diospyros virginiana, Betula nigra,* and *Platanus occidentalis*. Characteristic herbs are weedy colonizers, such as *Eupatorium serotinum, Diodia virginiana, Juncus effusus, Ambrosia artemisiifolia, Juncus tenuis, Scirpus cyperinus, Lobelia inflata, Lobelia cardinalis, Apocynum cannabinum, Polygonum hydropiperoides, Acalypha virginica, Andropogon virginicus, Panicum* spp., *Hypericum mutilum, Hypericum punctatum, Plantago* spp., *Pseudognaphalium* spp., and others.
Related Concepts: No information
Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in the Southern Blue Ridge of Georgia, North Carolina and Tennessee. It probably occurs in adjacent states, as well.
Subnations: GA, NC, SC?, TN, VA?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Nantahala)

ALLIANCE SOURCES

References: No information
V.B.2.N.f. Saturated temperate perennial forb vegetation

V.B.2.N.F. *IMPATIENS (CAPENSIS, PALLIDA) - MONARDA DIDYMA* SATURATED HERBACEOUS ALLIANCE (A.1690)
(ORANGE JEWELWEED, YELLOW JEWELWEED) - BEEBALM SATURATED HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: High-elevation, open seeps in the Southern Blue Ridge dominated by tall forbs. This palustrine vegetation occurs as small wetlands at high elevations (greater than 1200 m or 4000 feet), on upper slopes and ridgetops. These areas lack extensive *Sphagnum* and are typically open, without shading from a forest canopy. Other characteristic species include *Aconitum reclinatum, Cardamine clematitis, Carex leptonervia, Carex debilis var. rudgei (= Carex flexuosa), Carex ruthii, Chelone lyonii, Cicuta maculata, Claytonia caroliniana, Conioselinum chinense, Euonymus obovata, Geum geniculatum, Helenium autumnale, Houstonia serpyllifolia, Lilium superbum, Lilium grayi, Packera aurea (= Senecio aureus), Solidago patula, Thalictrum clavatum, Trautvetteria caroliniensis, Veratrum viride, Viola cucullata,* and *Viola macloskeyi ssp. pallens.*

Related Concepts:
- High Elevation Seep (Nelson 1986) I
- High Elevation Seep (Schafale and Weakley 1990) I
- IID3a. Herbaceous High Elevation Seepage Slope (Allard 1990) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in Georgia, North Carolina, South Carolina, Tennessee, Virginia, and possibly others in the Appalachians.
Subnations: GA, NC, SC, TN, VA, WV?
TNC Ecoregions: 51:C, 59:P
USFS Ecoregions: M221Ba:CCC, M221Bb:CCP, M221Bc:CCC, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee, George Washington, Jefferson, Nantahala, Pisgah)

ALLIANCE SOURCES

References: Allard 1990, Nelson 1986, Schafale and Weakley 1990, Weakley 1980

V.B.2.N.F. *VITTARIA APPALACHIANA - HEUCHERA PARVIFLORA* SATURATED HERBACEOUS ALLIANCE (A.1696)
APPALACHIAN SHOESTRING FERN - CAVE ALUMROOT SATURATED HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance accommodates saturated communities associated with overhanging to vertical rocks and a seasonal to perennial waterfall as a source of aqueous aerosol. One association includes sparse to moderately dense vegetation of sandstone rockhouses in portions of the Cumberland Plateau, where seasonal waterfalls and strongly overhanging erosion features called rockhouses provide moist conditions. *Vittaria appalachiana* and *Heuchera parviflora* are dominant and characteristic. Endemics such as *Ageratina luciae-brauniae* and *Solidago albopilosa* are associated with the floors of the rockhouses and often dominate the vegetative cover, and the endemic *Minuartia cumberlandensis* also sometimes occupies the floor but is more characteristic of somewhat drier sandstone exposures. *Thalictrum mirabile* is also endemic to this community but is more characteristic of seepages on the rockhouse walls. In the Southern Blue Ridge escarpment region, this alliance includes herbaceous vegetation on rock substrates associated with waterfalls, on nearly vertical rock surfaces and ledges, slopes, and crevices with shallow soils which are constantly saturated. Other characteristic species include *Huperzia porophila, Asplenium montanum, Asplenium trichomanes ssp. trichomanes, Asplenium monanthes, Cystopteris protrusa, Polypodium virginianum, Trichomanes boschianum, Grammitis nimbata (= Micropolypodium nimbatum), Hymenophyllum tayloriae, Trichomanes intricatum, Phegopteris connectilis, Adiantum pedatum, Saxifraga careyana, Saxifraga caroliniana, Impatiens capensis, Hydrocotyle americana, Thalictrum* spp., *Oxalis montana, Carex biltmoreana, Galax urceolata, Sphagnum quinquefarium, Sphagnum girgensohnii, Plagiomnium carolinianum, Plagiomnium affine, Mnium marginatum, Pseudotaxiphyllum distichaceum, Bryocrumia vivicolor, Thamnobryum alleghaniense, Oncophorus raui, Hyophila involuta, Dichodontium pellucidum, Plagiochila sharpii ssp. sharpii, Plagiochila caduciloba, Plagiochila sullivantii, Plagiochila austini, Fissidens osmundioides, Bazzania denudata, Conocephalum conicum, Pellia epiphylla, Pellia neesiana,* and *Riccardia multifida.*

Related Concepts:
- Cumberland Plateau sandstone glade (Evans 1991) I
- IID5a. Wet Acidic Cliff (Allard 1990) I
- Moist sandstone cliff (Evans 1991) I
- Spray Cliff (Nelson 1986) I
- Spray Cliff (Schafale and Weakley 1990) ?

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in Georgia, Kentucky, North Carolina, South Carolina, and Tennessee, and Alabama.
Subnations: AL, GA, KY, NC, SC, TN
TNC Ecoregions: 43:C, 50:C, 51:C, 52:C
USFS Ecoregions: 221Hb:CCC, 221Hc:CCC, 222Eo:CCC, 231Cd:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Big South Fork, Great Smoky Mountains); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

References: Allard 1990, Dellinger unpubl. data 1992, Evans 1991, Farrar 1998, Nelson 1986, Schafale and Weakley 1990, Walck et al. 1996, Weakley and Schafale 1994, Wharton 1978

V.B.2.N.F. *DIPHYLLEIA CYMOSA - SAXIFRAGA MICRANTHIDIFOLIA* SATURATED HERBACEOUS ALLIANCE (A.1688)
UMBRELLA-LEAF - BRANCH-LETTUCE SATURATED HERBACEOUS ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance consists of moderate- to high-elevation, forested (shaded) seeps in the Southern Blue Ridge. *Diphylleia cymosa* and *Saxifraga micranthidifolia* are characteristic and often dominant. Other characteristic species include *Laportea canadensis, Cardamine clematitis, Chelone lyonii, Chelone glabra, Chrysosplenium americanum, Boykinia aconitifolia, Cicuta maculata, Houstonia serpyllifolia, Viola cucullata, Viola macloskeyi ssp. pallens, Lilium grayi, Oxypolis rigidior, Parnassia asarifolia, Tiarella cordifolia, Thalictrum clavatum, Trautvetteria caroliniensis, Stellaria corei,* and *Geum geniculatum*. Occurrences are typically small, but can be extensive (to more than a hectare in size). Vegetation of this alliance has a strong component of species endemic to the Southern Blue Ridge.

Related Concepts:

- High Elevation Seep (Nelson 1986) I
- High Elevation Seep (Schafale and Weakley 1990) I
- IID3a. Herbaceous High Elevation Seepage Slope (Allard 1990) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in the Southern Blue Ridge of Georgia, North Carolina, Tennessee, and Virginia, and possibly South Carolina (?).
Subnations: GA, NC, SC?, TN, VA
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Db:CCP, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Jefferson, Nantahala, Pisgah, Sumter?)

ALLIANCE SOURCES

References: Allard 1990, Dellinger unpubl. data 1992, Nelson 1986, Schafale and Weakley 1990

VI. Nonvascular Vegetation

VI.B.1.N.b. Montane/submontane temperate or subpolar lichen vegetation

VI.B.1.N.B. *UMBILICARIA MAMMULATA* NONVASCULAR ALLIANCE (A.1827)
COMMON ROCKTRIPE NONVASCULAR ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance consists of vegetation dominated by *Umbilicaria mammulata*, of relatively moist rock outcrops. This vegetation occurs where periodic seepage occurs on acidic rock outcrops. Individual occurrences can be as large as an acre. Vascular plants are generally sparse or absent, though trees of adjacent forest communities often shade the outcrop community for much of the day.

Related Concepts:

- Acidic Rock Cliff Community (Swain and Kearsley 2001) ?

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in Georgia, North Carolina, South Carolina, Tennessee, Virginia, West Virginia, and others. Potentially very widespread in the Southeast and beyond.
Subnations: GA, NC, SC, TN, VA, WV
TNC Ecoregions: 51:C, 52:C, 59:C
USFS Ecoregions: 231Aa:CCC, 231Ab:CCC, 231Ac:CCC, 231Ad:CCC, 231Ag:CCC, 231Ak:CCC, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: USFS (Cherokee?, George Washington, Jefferson, Monongahela?, Nantahala, Pisgah)

ALLIANCE SOURCES

References: Swain and Kearsley 2001

VI.B.1.N.B. *LASALLIA PAPULOSA - UMBILICARIA CAROLINIANA* NONVASCULAR ALLIANCE (A.1826)
TOADSKIN LICHEN - CAROLINA ROCKTRIPE NONVASCULAR ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance consists of xeric lichen-dominated vegetation, codominated by *Lasallia papulosa* and *Umbilicaria caroliniana*. This alliance is known from moderate to high elevations of the Southern Blue Ridge of Tennessee and North Carolina, where it occurs on steeply sloping exfoliation outcrops of felsic metamorphic rocks.

Related Concepts:

- High Elevation Granitic Dome (Schafale and Weakley 1990) I
- High Elevation Rocky Summit (Schafale and Weakley 1990) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in the Southern Blue Ridge of North Carolina and Tennessee.
Subnations: NC, TN
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC
Federal Lands: USFS (Cherokee, Nantahala, Pisgah)

ALLIANCE SOURCES

References: Schafale and Weakley 1990

VII. Sparse Vegetation

VII.A.1.N.a. Cliffs with sparse vascular vegetation

VII.A.1.N.A. *ASPLENIUM MONTANUM* SPARSELY VEGETATED ALLIANCE (A.1831) MOUNTAIN SPLEENWORT SPARSELY VEGETATED ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes near-vertical to overhanging cliffs, dry to moist, with crevices, generally with very little vascular vegetation, and little nonvascular vegetation, with *Asplenium montanum* as a characteristic component. This community occurs on a number of different rock types, including sandstone, quartzite, gneiss, schist, phyllite, but all are acidic (pH of soils in crevices is usually less than 4.0). *Asplenium montanum* is a characteristic species in stands of this type, although it may not have high cover and will not necessarily even be present. *Heuchera parviflora* and *Silene rotundifolia* are equally characteristic and diagnostic.

Related Concepts:

- Acidic Rock Cliff Community (Swain and Kearsley 2001) ?
- Dry sandstone cliff (Evans 1991) I
- Montane Acidic Cliff (Schafale and Weakley 1990) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in Alabama, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia, West Virginia, and elsewhere.
Subnations: AL, GA, KY, NC, SC, TN, VA?, WV
TNC Ecoregions: 43:C, 44:C, 50:C, 51:C, 52:C, 59:C
USFS Ecoregions: 212D:CP, 221A:CP, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 222Eb:CCC, 222En:CCC, 222Eo:CCC, 231Aa:CCC, 231Cd:CCC, M221Aa:CCC, M221Ab:CCC, M221Ca:CCC, M221Cb:CCC, M221Cc:CCC, M221Cd:CCC, M221Ce:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Big South Fork, Chickamauga-Chattanooga, Great Smoky Mountains); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

References: Evans 1991, Schafale and Weakley 1990, Swain and Kearsley 2001

VII.A.1.N.A. *ASPLENIUM RUTA-MURARIA - PELLAEA ATROPURPUREA* SPARSELY VEGETATED ALLIANCE (A.1832) WALL-RUE - PURPLE CLIFFBRAKE SPARSELY VEGETATED ALLIANCE

ALLIANCE CONCEPT

Summary: This alliance includes dry to rather moist limestone and dolomite outcrops, usually shaded by trees rooted in adjacent forested communities. Vascular and nonvascular vegetation are sparse in stands of this alliance. Calciphilic herbs, such as *Asplenium ruta-muraria, Pellaea atropurpurea, Pellaea glabella ssp. glabella, Asplenium resiliens, Aquilegia canadensis,* and others occupy suitable crevices. Moister microhabitats of the crevice may have mosses such as *Anomodon rostratus* and *Anomodon attenuatus*.

Related Concepts:
- Montane Calcareous Cliff (Schafale and Weakley 1990) I

Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in Alabama, Kentucky, North Carolina, South Carolina, Tennessee, Maryland, Pennsylvania, Virginia, and West Virginia, and possibly Georgia (?).
Subnations: AL, GA?, KY, MD, NC, NH, NY, PA, SC, TN, VA, VT, WV
TNC Ecoregions: 48:P, 50:C, 51:C, 59:C, 60:P, 61:C, 63:C, 64:P
USFS Ecoregions: 212Ec:CCC, 221A:CC, 221B:CC, 221Hb:CCC, 221Hc:CCC, 221Ja:CCC, 222Eo:CCC, 231Ak:C??, 231Ca:CPP, 231Cb:CPP, 231Cc:CPP, 231Cd:CPP, 231Ce:CPP, 231Cf:CPP, 231Cg:CPP, 231Da:CPP, 231Db:CPP, 231Dc:CPP, 231Dd:CPP, 231De:CPP, M212B:CP, M212C:CC, M221Aa:CCC, M221Ac:CCC, M221Bb:CCP, M221Be:CCC, M221Dc:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Pisgah)

ALLIANCE SOURCES

References: Schafale and Weakley 1990

VII.B.1.N.a. Lowland or submontane talus/scree

VII.B.1.N.A. LOWLAND TALUS SPARSELY VEGETATED ALLIANCE (A.1847)
LOWLAND TALUS SPARSELY VEGETATED ALLIANCE

ALLIANCE CONCEPT

Summary: This is technically not an alliance. It is a placeholder for a group of sparsely vegetated associations that do not have adequate vegetation descriptions, but do share certain substrate characteristics.
Related Concepts: No information
Classification Comments: None

ALLIANCE DISTRIBUTION

Range: This alliance is found in Arkansas, Illinois (?), Iowa, Michigan, Minnesota, Missouri, North Carolina, North Dakota, Oklahoma, South Dakota, Tennessee, Virginia, West Virginia, Wisconsin, and Manitoba and Ontario, Canada.
Subnations: AR, IA, IL, MB, MI, MN, MO, NC, ND, NY, OK, ON, QC?, SD, TN, VA?, VT, WI, WV?
TNC Ecoregions: 25:C, 36:C, 38:C, 39:C, 44:C, 45:C, 46:C, 47:C, 48:C, 50:?, 51:C, 59:P, 61:C, 63:C, 64:C
USFS Ecoregions: 212Cb:CCC, 212Ec:CCC, 212F:CP, 212Ja:CCP, 212Jb:CCP, 212Jf:CC?, 212Jj:CCP, 212Jn:CC?, 212K:CC, 212La:CC?, 212Lb:CC?, 221Fa:CCC, 222Aa:CCP, 222Ac:CCC, 222Ae:CCC, 222Af:CCP, 222Ag:CCC, 222Ga:CCC, 222Gb:CCC, 222Hf:CCC, 222I:CP, 222Kh:CCC, 222Lc:CCC, 222Lf:CCC, 251Ce:CCC, 251Cf:CCC, 251Ch:CCC, 251Cj:CCC, 251De:CCC, 331:P, 332:?, M212Cb:CCC, M212F:CC, M221Dd:CCC, M231Ac:CCC, M334A:CC
Federal Lands: NPS (Acadia, Theodore Roosevelt); USFS (Cherokee, Nantahala, Ouachita, Ozark)

ALLIANCE SOURCES

References: No information

ASSOCIATIONS GROUPED BY ECOLOGICAL SYSTEM

UPLANDS, VEGETATED

APPALACHIAN HEMLOCK-HARDWOOD FOREST

CAROLINA HEMLOCK - (EASTERN HEMLOCK) / GREAT RHODODENDRON FOREST

ELEMENT IDENTIFIERS

NVC association: *Tsuga caroliniana - (Tsuga canadensis) / Rhododendron maximum* Forest
Database Code: CEGL007138
Formation: Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c)
Alliance: *Tsuga caroliniana* Forest Alliance (A.144)

ELEMENT CONCEPT

Summary: This association encompasses *Tsuga caroliniana* forests on valley bottoms, gorge slopes, or other protected landforms. *Tsuga canadensis* or *Pinus strobus* may share the canopy with *Tsuga caroliniana*. The shrub stratum is typically dense and dominated by *Rhododendron maximum*. *Galax urceolata* is a common understory component.
Environment: Stands of this association are found on valley bottoms, gorge slopes, or other protected landforms.

Vegetation: Stands are dominated by *Tsuga caroliniana*, but *Tsuga canadensis* or *Pinus strobus* may share canopy dominance. The shrub stratum is typically dense and dominated by *Rhododendron maximum*. *Galax urceolata* is a common understory component. *Tsuga canadensis* or *Pinus strobus* may share the canopy with *Tsuga caroliniana*. The shrub stratum is typically dense and dominated by *Rhododendron maximum*. *Galax urceolata* is a common understory component.
Dynamics: No information
Similar Associations:
Related Concepts:
- Carolina Hemlock Forest (Mesic Subtype) (Schafale 1998b) ?
- IA6g. Carolina Hemlock Bluff Forest (Allard 1990) B

Classification Comments: Examples are known from the Toe River Valley, Linville Gorge, Hanging Rock State Park (ravines), and the Kelsey Tract.

CONSERVATION RANKING & RARE SPECIES

GRank: G1G2 (2002-5-15): *Tsuga caroliniana* communities, in general, have a restricted range, occurring only in the Southern Blue Ridge and upper Piedmont and are probably endemic to North Carolina and Tennessee. Occurrences are typically small and restricted to rocky bluff habitats. All occurrences are threatened by fire suppression and the Hemlock Woolly Adelgid (*Adelges tsugae*), an exotic pest which causes tree decline and ultimate death in *Tsuga canadensis* and *Tsuga caroliniana*. The taxonomy of *Tsuga caroliniana* communities needs further assessment.
High-ranked species: *Tsuga caroliniana* (G3)

ELEMENT DISTRIBUTION

Range: This type is primarily found in the Southern Blue Ridge of North Carolina and Tennessee. There is at least one disjunct occurrence in the upper Piedmont of North Carolina (M. Schafale pers. comm.).
Subnations: NC, TN
TNC Ecoregions: 51:C, 52:C
USFS Ecoregions: 231Aa:CCC, M221Db:CCP, M221Dc:CCC, M221Dd:CCC
Federal Lands: USFS (Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Newell and Peet 1995, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Southeastern Ecology Working Group n.d.

EASTERN HEMLOCK / GREAT RHODODENDRON - (MOUNTAIN SWEET-PEPPERBUSH, MOUNTAIN DOGHOBBLE) FOREST

ELEMENT IDENTIFIERS

NVC association: *Tsuga canadensis / Rhododendron maximum - (Clethra acuminata, Leucothoe fontanesiana)* Forest
Database Code: CEGL007136
Formation: Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c)
Alliance: *Tsuga canadensis* Forest Alliance (A.143)

ELEMENT CONCEPT

Summary: Forests of lower or protected slopes and terraces with *Tsuga canadensis* occurring over a dense to patchy shrub stratum of *Rhododendron maximum*. Other canopy species of minor importance may include *Liriodendron tulipifera, Tilia americana var. heterophylla, Pinus strobus, Betula lenta, Magnolia fraseri, Acer rubrum,* and *Fraxinus americana*; these would total less than 25% of the canopy cover. In the Southern Blue Ridge, *Leucothoe fontanesiana* is often a shrub component, and sometimes occurs densely. Other typical shrubs can include *Ilex opaca, Clethra acuminata,* and *Kalmia latifolia*. Herbs are sparse to moderate, depending on the shrub cover. Typical herbs include *Chimaphila maculata, Goodyera pubescens, Medeola virginiana, Hexastylis shuttleworthii, Mitchella repens, Polystichum acrostichoides, Viola blanda,* and *Galax urceolata*. Bryophyte cover is often dense. In the southern Appalachians, this forest occurs at elevations greater than 1800 feet. In Kentucky, disturbed areas may have abundant *Betula lenta* and *Betula alleghaniensis* in the subcanopy. Stands in the southern Cumberlands of Kentucky and Tennessee would lack *Leucothoe fontanesiana*; instead, *Clethra acuminata* is a characteristic shrub of these stands.
Environment: Forests of lower or protected slopes and terraces with *Tsuga canadensis* occurring over a dense to patchy shrub stratum of *Rhododendron maximum*. In the southern Appalachians, this forest occurs at elevations greater than 1800 feet.
Vegetation: Forests with *Tsuga canadensis* occurring over a dense to patchy shrub stratum of *Rhododendron maximum*. Other canopy species of minor importance may include *Liriodendron tulipifera, Tilia americana var. heterophylla, Pinus strobus, Betula lenta, Magnolia fraseri, Acer rubrum,* and *Fraxinus americana*; these would total less than 25% of the canopy cover. *Leucothoe fontanesiana* is often a shrub component, and sometimes occurs densely. Other typical shrubs include *Ilex opaca, Clethra acuminata,* and *Kalmia latifolia*. Herbs are sparse to moderate, depending on the shrub cover. Typical herbs include *Chimaphila maculata, Goodyera pubescens, Medeola virginiana, Hexastylis shuttleworthii, Mitchella repens, Polystichum acrostichoides,* and *Galax*

urceolata. Bryophyte cover is often dense. In Kentucky, disturbed areas may have abundant *Betula lenta* and *Betula alleghaniensis* in the subcanopy. Stands in the southern Cumberlands of Tennessee would lack *Leucothoe fontanesiana*.

Dynamics: No information

Similar Associations:

- *Pinus strobus - Tsuga canadensis / Rhododendron maximum - (Leucothoe fontanesiana)* Forest (CEGL007102) -- dominated by *Pinus strobus* or codominated by *Pinus strobus* and *Tsuga canadensis*.

Related Concepts:

- Canada Hemlock Forest (Typic Subtype) (Schafale 1998b) ?
- Eastern Hemlock: 23 (Eyre 1980) B
- Hemlock Community (Caplenor 1965) ?
- Hemlock, BR (Pyne 1994) B
- Hemlock, CUPL (Fleming and Coulling 2001) B
- IA5b. Southern Appalachian Hemlock Cove Forest (Allard 1990) B

Classification Comments: In Kentucky, this association occurs in the eastern part of the state (Appalachian plateaus, Cumberland Mountains).

CONSERVATION RANKING & RARE SPECIES

GRank: G3G4 (1998-4-30): No information

High-ranked species: *Monotropsis odorata* (G3)

ELEMENT DISTRIBUTION

Range: This community is found in the Southern Appalachians, from North Carolina west into Kentucky.

Subnations: GA, KY, NC, SC, TN

TNC Ecoregions: 50:C, 51:C, 52:C

USFS Ecoregions: 221Ha:CCC, 221Hc:CCC, 221He:CCC, 222D:??, M221Cc:CCC, M221Cd:CCC, M221Ce:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Cumberland Gap, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Daniel Boone, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, Caplenor 1965, Evans 1991, Eyre 1980, Fleming and Coulling 2001, Golden 1974, Golden 1981, Lorimer 1980, McLeod 1988, Newell et al. 1997, Oosting and Bourdeau 1955, Patterson 1994, Peet et al. unpubl. data 2002, Pyne 1994, Quarterman et al. 1972, Racine and Hardin 1975, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Whittaker 1956

EASTERN WHITE PINE - EASTERN HEMLOCK / GREAT RHODODENDRON - (MOUNTAIN DOGHOBBLE) FOREST

ELEMENT IDENTIFIERS

NVC association: *Pinus strobus - Tsuga canadensis / Rhododendron maximum - (Leucothoe fontanesiana)* Forest

Database Code: CEGL007102

Formation: Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b)

Alliance: *Pinus strobus - Tsuga canadensis* Forest Alliance (A.127)

ELEMENT CONCEPT

Summary: This forest vegetation has a canopy dominated by *Pinus strobus*, sometimes codominating with *Tsuga canadensis*, occurring over a shrub stratum dominated by *Rhododendron maximum*. This is an evergreen forest, but deciduous trees may form a minor part of the canopy. Other minor canopy species may include *Liriodendron tulipifera, Betula lenta, Magnolia fraseri* (within its range), *Acer rubrum*, and *Tilia americana var. heterophylla*. Other shrub species may include *Kalmia latifolia, Leucothoe fontanesiana, Lindera benzoin*, and *Ilex opaca var. opaca*. Herbaceous cover is typically sparse. This community occurs on creek and river margins and on lower or protected slopes. This association occurs in the Southern Blue Ridge and may extend into adjacent ecoregions, such as the Cumberlands of Kentucky. These Kentucky examples lack *Leucothoe fontanesiana* and have *Magnolia macrophylla* rather than *Magnolia fraseri*. Large stems of *Smilax rotundifolia* may be present in stands of this vegetation.

Environment: This community occurs on creek and river margins and on lower or protected slopes in the Southern Blue Ridge; it may extend into adjacent ecoregions, such as the Cumberlands of Kentucky.

Vegetation: This forest vegetation has a canopy dominated by *Pinus strobus*, sometimes codominating with *Tsuga canadensis*, occurring over a shrub stratum dominated by *Rhododendron maximum*. This is an evergreen forest, but deciduous trees may form a minor part of the canopy. Other minor canopy species may include *Liriodendron tulipifera, Betula lenta, Magnolia fraseri* (within its range), *Acer rubrum*, and *Tilia americana var. heterophylla*. Other shrub species may include *Kalmia latifolia, Leucothoe fontanesiana, Lindera benzoin*, and *Ilex opaca var. opaca*. Herbaceous cover is typically sparse. Typical herbs include *Thelypteris noveboracensis, Chimaphila maculata, Mitchella repens, Polystichum acrostichoides, Medeola virginiana*, and *Tiarella cordifolia*.

Kentucky Cumberland examples lack *Leucothoe fontanesiana* and have *Magnolia macrophylla* rather than *Magnolia fraseri*. Large stems of *Smilax rotundifolia* may be present in stands of this vegetation.

Dynamics: No information

Similar Associations:

- *Tsuga canadensis / Rhododendron maximum - (Clethra acuminata, Leucothoe fontanesiana)* Forest (CEGL007136) -- dominated by *Tsuga canadensis*.

Related Concepts:

- Canada Hemlock Forest (White Pine Subtype) (Schafale 1998b) ?
- Eastern Hemlock: 23 (Eyre 1980) B
- IA5b. Southern Appalachian Hemlock Cove Forest (Allard 1990) B
- White Pine - Hemlock: 22 (Eyre 1980) B
- White pine-eastern hemlock/great laurel dry forest: southern type (CAP pers. comm. 1998) ?

Classification Comments: Similar forests in the Cumberlands of Kentucky lack *Leucothoe fontanesiana*, and have *Magnolia macrophylla* rather than *Magnolia fraseri*. This forest is common in the Chattooga River basin of South Carolina and Georgia.

CONSERVATION RANKING & RARE SPECIES

GRank: G4 (1997-12-1): No information

High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge, but extends into adjacent Cumberland Plateau or Ridge and Valley (?) ecoregions.

Subnations: GA, KY, NC, SC, TN, VA?

TNC Ecoregions: 50:C, 51:C, 59:C

USFS Ecoregions: 221Hc:CCC, 221He:CCC, 222Eo:CCC, M221Be:CPP, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Daniel Boone, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, CAP pers. comm. 1998, Eyre 1980, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

GREAT RHODODENDRON UPLAND SHRUBLAND

ELEMENT IDENTIFIERS

NVC association: *Rhododendron maximum* Upland Shrubland

Database Code: CEGL003819

Formation: Hemi-sclerophyllous temperate broad-leaved evergreen shrubland (III.A.2.N.b)

Alliance: *Rhododendron maximum* Shrubland Alliance (A.745)

ELEMENT CONCEPT

Summary: This community occurs along streams and on protected slopes in the mountains of North Carolina, Tennessee, South Carolina, Georgia, West Virginia, and Kentucky. It is a broad-leaved, evergreen shrubland which forms a continuous, dense shrub canopy up to 5 m tall. *Kalmia latifolia, Rhododendron minus*, and *Rhododendron catawbiense* may also occur as components of the shrub stratum. Shrub vegetation beneath the upper shrub canopy may be open to dense depending on the stand's age and topographic setting. The ground layer is dominated by leaf litter or bare soil, although scattered herbs and woody seedlings do occur. Seedlings and saplings of *Rhododendron maximum, Acer rubrum, Betula lenta, Betula alleghaniensis,* and *Tsuga canadensis* are common and typical herbs include *Dryopteris intermedia, Heuchera villosa, Viola* spp., *Thelypteris noveboracensis, Listera smallii*, and *Galax urceolata*. This shrubland is typical along streams and on mesic, unexposed, often north-facing slopes at elevations of approximately 300-1100 m (1000-3000 feet). Soils supporting this community are typically acid. Occurrences at edges of streams may flood during rainy seasons. This community can occur as the result of disturbance and will succeed to forest with an ericaceous understory without some form of disturbance. This community may have scattered woody species that are greater than 5 m tall but with generally less than 10% total cover.

Environment: This community occurs along streams and on mesic, unexposed, often north-facing slopes at elevations of approximately 300-1100 m (1000-3000 feet). Soils supporting this community are typically acid. Occurrences at edges of streams may flood during rainy seasons.

Vegetation: This evergreen, sclerophyllous shrubland is dominated by *Rhododendron maximum* which forms a continuous, dense shrub canopy up to 5 m tall. *Kalmia latifolia, Rhododendron minus*, and *Rhododendron catawbiense* may also occur as components of the shrub stratum. Shrub vegetation beneath the upper shrub canopy may be open to dense depending on the stand's age and topographic setting. Species such as *Tsuga canadensis, Pinus strobus, Acer rubrum, Betula lenta*, and *Liriodendron tulipifera* in the tree canopy stratum make up less than 10% cover. The ground layer is dominated by leaf litter or bare soil although scattered herbs

and woody seedlings do occur. Seedlings and saplings of *Rhododendron maximum, Acer rubrum, Betula lenta, Betula alleghaniensis,* and *Tsuga canadensis* are common, and typical herbs include *Dryopteris intermedia, Heuchera villosa, Viola* spp., *Thelypteris noveboracensis, Listera smallii,* and *Galax urceolata*.

Dynamics: *Rhododendron maximum* sprouts vigorously after disturbance, and this community often results from logging, fire, chestnut blight, or cessation of grazing. Stems greater than 4 cm in diameter survive hot fires, and fire generally stimulates basal sprouting, although intense annual fires may suppress reestablishment (Core 1966). Drastic overstory removal, heavy shading, and disease have been found to decrease the density of or kill *Rhododendron* (Hodgdon and Pike 1961).

This shrubland will become established by invading disturbed or cleared lands if there is adequate moisture and lack of direct sunlight. This community can also result from secondary succession when a forest's canopy is removed (by logging, disease, etc.) and the *Rhododendron* understory closes, forming a dense shrubland. The reestablishment of woody competitors is inhibited by the shade of the dense shrub canopy as well as by phytotoxins in the litter and soil (Gant 1978). *Rhododendron maximum* Shrubland may persist for over 60 years on a site (Ploucher and Carvell 1987) but will succeed to a forested community as trees that become established in thicket openings mature.

Similar Associations:

Related Concepts:

- IC4b. Montane Rhododendron Thicket (Allard 1990) ?
- Low Elevation Heath Bluff (Montane Rhododendron Subtype) (Schafale 1998b) ?
- Submesotrophic Scrub (Rawinski 1992) ?

Classification Comments: *Rhododendron maximum* Shrubland frequently occurs adjacent to wet herbaceous cliff vegetation, riparian shrublands, or within forests dominated by *Tsuga canadensis, Quercus rubra, Liriodendron tulipifera, Pinus strobus, Quercus prinus, Picea rubens*, or *Abies fraseri*. Similar ericaceous shrublands occur at higher elevations, over 1100 meters (3500 feet), in the southern Appalachian Mountains. These high-elevation "heath balds" are distinguished from *Rhododendron maximum* Upland Shrubland by the dominance of *Rhododendron catawbiense* or by the occurrence of ericaceous shrubs typical of high-elevation environments such as *Leiophyllum buxifolium, Menziesia pilosa*, and *Photinia melanocarpa (= Aronia melanocarpa).* Disjunct populations of *Rhododendron maximum* are found in Maine and New Hampshire, but these populations may represent a different community (Hodgdon and Pike 1961).

CONSERVATION RANKING & RARE SPECIES

GRank: G3?Q (1998-12-14): This association is of uncertain validity and, even if valid, is of uncertain circumscription.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge, but may be possible throughout the range of *Rhododendron maximum*.
Subnations: GA, NC, SC, TN, VA?, WV
TNC Ecoregions: 49:P, 51:C
USFS Ecoregions: 221E:PP, M221A:CC, M221B:CC, M221C:CC, M221Dc:CCC, M221Dd:CCC
Federal Lands: USFS (Chattahoochee?, Cherokee, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, Core 1966, Gant 1978, Hodgdon and Pike 1961, McGee and Smith 1967, Monk et al. 1985, Nelson 1986, Phillips and Murdy 1985, Plocher and Carvell 1987, Rawinski 1992, Schafale 1998b, Southeastern Ecology Working Group n.d.

TULIPTREE - SWEET BIRCH - EASTERN HEMLOCK / GREAT RHODODENDRON FOREST

ELEMENT IDENTIFIERS

NVC association: *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest
Database Code: CEGL007543
Formation: Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a)
Alliance: *Tsuga canadensis - Liriodendron tulipifera* Forest Alliance (A.413)

ELEMENT CONCEPT

Summary: This association includes hemlock-hardwood forests of lower to intermediate elevations in the Southern Blue Ridge and upper Piedmont, ranging from southwestern Virginia, south and west to northwestern Georgia. These communities occur at low to middle elevations (1300-3500 feet) in the mountains and foothills, generally in coves, gorges, or sheltered slopes, over acid soils. The canopy is usually dominated by *Liriodendron tulipifera* or *Betula lenta*, but substantial portions of this community may be comprised mainly of *Tsuga canadensis* and the occasional *Acer rubrum*. Other deciduous species more typical of "rich" coves may occur as scattered individuals; *Tilia americana var. heterophylla, Fraxinus americana*, and *Fagus grandifolia*. Other canopy/subcanopy species often include *Quercus alba, Quercus rubra, Magnolia fraseri, Ilex opaca var. opaca, Calycanthus floridus, Halesia tetraptera var. tetraptera*, and *Pinus strobus*. *Rhododendron maximum* is scattered to dominant in the shrub stratum. Other typical shrubs include *Kalmia latifolia* and *Leucothoe fontanesiana*. Herbaceous cover is sparse but can be diverse and is composed of acid-loving

species. Typical herbs include *Polystichum acrostichoides, Dennstaedtia punctilobula, Goodyera pubescens, Mitchella repens, Thelypteris noveboracensis, Galax urceolata, Viola rotundifolia, Hexastylis* sp., and *Tiarella cordifolia*.

Environment: Over its full geographic range, this association is typically found at lower to intermediate elevations (400-1060 m or 1300-3500 feet) in the southern Appalachians and adjacent foothills. Habitats are located on gentle to steep, lower slopes and in coves or gorges with acidic soils. In situations where mid-slopes are in protected north-facing positions, this community can range very high up straight or even convex slopes. The type often occurs in linear patches along stream bottoms and in steep ravines in complexes with rich cove communities. Although frequently associated with streams, it is not a wetland. Habitats in the Virginia part of the range are similar and are mostly situated below 900 m (3000 feet) elevation. Soils collected from plots are extremely acidic (mean pH = 3.9) and infertile, with high iron and aluminum levels and very low total base saturation.

Vegetation: This association encompasses hemlock - hardwood forests with canopies dominated by mixtures of *Tsuga canadensis, Liriodendron tulipifera, Betula lenta*, and *Acer rubrum*. Other deciduous species more typical of fertile coves, including *Tilia americana var. heterophylla, Fraxinus americana*, and *Fagus grandifolia*, may occur as scattered individuals. Minor overstory and understory species include *Quercus alba, Quercus rubra, Magnolia fraseri, Ilex opaca, Calycanthus floridus, Halesia tetraptera*, and *Pinus strobus*. *Rhododendron maximum* is scattered to dominant in the shrub stratum. Other typical shrubs include *Kalmia latifolia* and *Leucothoe fontanesiana*. Herbaceous cover is sparse but can be diverse and is composed of acid-loving species. Typical herbs include *Polystichum acrostichoides, Goodyera pubescens, Mitchella repens, Thelypteris noveboracensis, Galax urceolata, Hexastylis* spp., and *Tiarella cordifolia*.

Virginia examples of this association are similar to those further south but generally lack *Ilex opaca, Calycanthus floridus, Halesia tetraptera*, and *Leucothoe fontanesiana*. Presumably because of past logging, *Tsuga canadensis* is absent or confined to the understory in some stands, which have mixed canopies of *Liriodendron tulipifera, Betula lenta, Acer rubrum, Magnolia acuminata, Quercus rubra*, and/or *Nyssa sylvatica*. *Hamamelis virginiana* and *Acer pensylvanicum* are additional, frequent understory species. The shrub layers of Virginia occurrences are consistently dominated by dense (usually >50% cover), often nearly impenetrable colonies of *Rhododendron maximum*. Frequent low-cover species of sparse herb layers include *Galax urceolata, Chimaphila maculata, Eurybia divaricata (= Aster divaricatus), Arisaema triphyllum, Monotropa uniflora, Mitchella repens,* and *Medeola virginiana*. The spectacular sedge *Cymophyllus fraserianus* is often associated with this forest.

Dynamics: No information

Similar Associations:

- *Acer rubrum var. rubrum - Betula (alleghaniensis, lenta) - Magnolia fraseri / (Rhododendron maximum, Kalmia latifolia)* Forest (CEGL008558)
- *Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / Leucothoe fontanesiana* Forest (CEGL007861)
- *Tsuga canadensis - (Fagus grandifolia, Tilia americana var. heterophylla) / Magnolia tripetala* Forest (CEGL008407)

Related Concepts:

- *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (Fleming and Coulling 2001) ?
- Acidic Cove Forest (Typic Subtype) (Schafale 1998b) ?
- Cove Forest (Patterson et al. 1994) B
- IA5b. Southern Appalachian Hemlock Cove Forest (Allard 1990) B
- Mixed Mesophytic Coves (Gettman 1974) ?
- Type 5 (Newell and Peet 1995) ?
- Yellow-poplar - Eastern Hemlock: 58 (Eyre 1980) B

Classification Comments: Deciduous trees more typical of 'rich' coves, such as *Aesculus flava, Tilia americana var. heterophylla*, and *Acer saccharum*, are present in this forest only as minor components, if at all. Likewise, rich-site herbs, such as *Actaea racemosa (= Cimicifuga racemosa), Caulophyllum thalictroides, Actaea pachypoda*, and *Adiantum pedatum*, are absent or nearly so. This forest is distinguished from "northern hardwood forests" by the lack of or near absence of *Fagus grandifolia, Betula alleghaniensis, Aesculus flava*, and the presence of low-elevation species, such as *Betula lenta* and *Liriodendron tulipifera*, and generally by a more depauperate herb layer. An interesting example from the Piedmont/Blue Ridge transition of Georgia (Cedar Creek Canyon, Chattahoochee National Forest) has high coverage of *Rhododendron minus* and other foothills/Piedmont species such as *Liquidambar styraciflua* and *Aesculus sylvatica*.

This community type is grossly under-represented by plot data considering its extensive distribution in southwestern Virginia. In the 900-1060 m (3000-3500 feet) elevation range, the type becomes transitional to *Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / Leucothoe fontanesiana* Forest (CEGL007861), which lacks lower-elevation species such as *Liriodendron tulipifera* and *Galax urceolata*, and contains many species characteristic of higher elevations and northern latitudes.

Similar vegetation has been observed in coves of the Cumberland Mountains of southwestern Virginia (e.g., Clinch Ranger District: Dark Hollow, Roaring Branch, Pick Breeches and Flannery Ridges,) but comprehensive data are needed to determine whether these stands are part of this forest types or transitional to *Tsuga canadensis - (Fagus grandifolia, Tilia americana var. heterophylla) / Magnolia tripetala* Forest (CEGL008407). The latter unit apparently has an extensive distribution in the Cumberland Plateau of

Kentucky and Tennessee, the Southern Ridge and Valley of Tennessee, and the Central Appalachians of West Virginia and southwestern Pennsylvania.

CONSERVATION RANKING & RARE SPECIES

GRank: G5 (2001-9-28): Within its range, this community type occurs extensively in suitable mesic habitats. Occurrences are subject to compositional modification by outbreaks of hemlock woolly adelgid (*Adelges tsugae*), an exotic insect pest that causes decline and eventual mortality of *Tsuga canadensis*.
High-ranked species: *Betula uber* (G1Q), *Botrychium jenmanii* (G3G4), *Diervilla rivularis* (G3), *Hexastylis contracta* (G3), *Hexastylis naniflora* (G3), *Hexastylis rhombiformis* (G2), *Isotria medeoloides* (G2), *Malaxis bayardii* (G2), *Monotropsis odorata* (G3), *Trillium persistens* (G1), *Waldsteinia lobata* (G2)

ELEMENT DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge and peripherally in the upper Piedmont, ranging from southwestern Virginia, south and west to northwestern Georgia.
Subnations: GA, NC, SC, TN, VA, WV
TNC Ecoregions: 50:P, 51:C, 52:C, 59:C
USFS Ecoregions: 231Aa:CCC, M221Aa:CCC, M221Ab:CCC, M221Ca:CPP, M221Cb:CPP, M221Cc:CPP, M221Ce:CPP, M221Da:CC?, M221Db:CCC, M221Dc:CCC, M221Dd:CCC, M231Ad:CCC
Federal Lands: NPS (Blue Ridge Parkway?, Carl Sandburg Home, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Jefferson, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, Eyre 1980, Fleming and Coulling 2001, Fleming et al. 2001, Gettman 1974, NatureServe Ecology - Southeastern U.S. unpubl. data, Newell and Peet 1995, Patterson 1994, Patterson et al. 1994, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

APPALACHIAN SERPENTINE WOODLAND

PITCH PINE - WHITE OAK / PRAIRIE DROPSEED - BIG BLUESTEM WOODLAND

ELEMENT IDENTIFIERS

NVC association: *Pinus rigida - Quercus alba / Sporobolus heterolepis - Andropogon gerardii* Woodland
Database Code: CEGL003768
Formation: Mixed needle-leaved evergreen - cold-deciduous woodland (II.C.3.N.a)
Alliance: *Pinus rigida - Quercus (alba, stellata)* Woodland Alliance (A.681)

ELEMENT CONCEPT

Summary: This community includes open woodland vegetation dominated by stunted *Pinus rigida* and *Quercus alba*, occurring over a cespitose graminoid-dominated understory with little shrub cover. Although the relative basal area for the two canopy species is the same, *Pinus rigida* is twice as dense as *Quercus alba*. Other canopy and subcanopy trees may include *Tsuga canadensis, Acer rubrum*, and *Oxydendrum arboreum*. The dense herbaceous stratum is dominated by *Andropogon gerardii, Sporobolus heterolepis*, and *Schizachyrium scoparium*. Common forbs include *Packera plattensis (= Senecio plattensis), Hexastylis arifolia var. ruthii*, and *Thalictrum macrostylum*. This community occurs on shallow, rocky soils associated with outcrops of serpentinized olivine in the Southern Blue Ridge. It is a unique community with a restricted range and few known occurrences.
Environment: This community occurs on shallow, rocky soils associated with outcrops of serpentinized olivine in the Southern Blue Ridge. These circumneutral soils are high in magnesium and have low water-holding capacity (Mansberg and Wentworth 1984). This woodland is found at moderate elevations (1015 m) on gentle to steep slopes with a western or southwestern exposure.
Vegetation: These open woodlands have canopies dominated by stunted *Pinus rigida* and *Quercus alba*. Although the relative basal area for the two species is the same, *Pinus rigida* is twice as dense as *Quercus alba*. Other canopy and subcanopy trees may include *Tsuga canadensis, Acer rubrum*, and *Oxydendrum arboreum*. Shrub cover is sparse, typically forming less than 10% coverage and occurring in clumps. Shrub species include *Physocarpus opulifolius, Viburnum nudum var. cassinoides, Vaccinium stamineum, Kalmia latifolia*, and a low, stoloniferous form of *Rhododendron viscosum*. *Smilax glauca* is a common vine. The dense herbaceous stratum is dominated by cespitose graminoids, most commonly *Andropogon gerardii, Sporobolus heterolepis*, and *Schizachyrium scoparium*. Common forbs include *Packera plattensis (= Senecio plattensis), Hexastylis arifolia var. ruthii*, and *Thalictrum macrostylum*. Other herbaceous species known to occur in this community include *Poa saltuensis, Muhlenbergia glomerata, Danthonia spicata, Danthonia compressa, Sorghastrum nutans, Panicum virgatum, Dichanthelium dichotomum, Dichanthelium boscii, Elymus trachycaulus ssp. trachycaulus, Deschampsia caespitosa, Castilleja coccinea, Carex woodii, Symphyotrichum undulatum (= Aster undulatus), Symphyotrichum laeve (= Aster laevis), Oenothera fruticosa, Thaspium trifoliatum*, and *Phlox stolonifera*.

Dynamics: The open, grassy woodland structure of this community is probably determined by a combination of site conditions and periodic disturbances. The dry grassy vegetation is flammable and recovery of woody species following a fire may be slow. The natural fire frequency for this woodland is not known. In the absence of occasional fire, shrub density increases and herbaceous cover decreases. However, the overstory composition and structure is likely maintained, at least in part, by the harsh soil conditions. Within the past 30 years, the overstory in this community has been significantly reduced because of infestations of southern pine beetle. Periodic fire will help maintain the graminoid-dominated understory. Fire should be applied with the objective of maintaining a physiognomic complex of woodland, forest, and grass-dominated areas.

Similar Associations:

- *Pinus rigida - Quercus stellata / Andropogon gerardii - Packera paupercula* Woodland (CEGL004968) -- of Virginia.
- *Pinus virginiana - Pinus rigida - Quercus stellata / Ceanothus americanus - Kalmia latifolia / Thalictrum revolutum* Woodland (CEGL007721) -- of Georgia and North Carolina.
- *Quercus alba / Physocarpus opulifolius / Packera plattensis - Hexastylis arifolia var. ruthii* Forest (CEGL007296)

Related Concepts:

- IE9b. Blue Ridge/Piedmont Ultramafic Barren (Allard 1990) B
- Pitch Pine - Oak (15) (USFS 1988) ?
- Ultramafic Outcrop Barren (Pitch Pine Subtype) (Schafale 1998b) ?

Classification Comments: Seepage areas dominated by *Osmunda regalis var. spectabilis* and *Parnassia grandifolia*, with *Sanguisorba canadensis, Oxypolis rigidior*, and *Panicum virgatum*, occur as inclusions in this woodland. This community is endemic to Buck Creek, Clay County, North Carolina.

Similar vegetation occurs in association with serpentine soils in the southwestern Piedmont of Virginia (Rawinski 1992) and is distinguished by the dominance of *Pinus virginiana* and other significant differences in floristic composition. Physiognomically similar vegetation occurs on serpentine in the northwestern United States as well as in Maryland and Pennsylvania.

CONSERVATION RANKING & RARE SPECIES

GRank: G1 (2002-10-22): This community occurs on shallow, rocky soils associated with outcrops of serpentinized olivine in the Southern Blue Ridge. It is a unique community with a restricted range and few known occurrences. There is little or no potential for the discovery of additional occurrences. Periodic fire is needed to help maintain the graminoid-dominated understory. Fire should be applied with the objective of maintaining a physiognomic complex of woodland, forest, and grass-dominated areas.

High-ranked species: *Parnassia grandifolia* (G3), *Thalictrum macrostylum* (G3G4)

ELEMENT DISTRIBUTION

Range: This community is endemic to Buck Creek, Clay County, North Carolina, in the Southern Blue Ridge.

Subnations: NC, TN

TNC Ecoregions: 51:C

USFS Ecoregions: M221Dd:CCC

Federal Lands: USFS (Nantahala)

ELEMENT SOURCES

References: Allard 1990, Kauffman pers. comm., Mansberg and Wentworth 1984, Peet et al. unpubl. data 2002, Rawinski 1992, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., USFS 1988

WHITE OAK / EASTERN NINEBARK / PRAIRIE RAGWORT - APPALACHIAN ARROWLEAF HEARTLEAF FOREST

ELEMENT IDENTIFIERS

NVC association: *Quercus alba / Physocarpus opulifolius / Packera plattensis - Hexastylis arifolia* var. *ruthii* Forest

Database Code: CEGL007296

Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)

Alliance: *Quercus alba* Montane Forest Alliance (A.271)

ELEMENT CONCEPT

Summary: This community includes *Quercus alba*-dominated forest vegetation occurring in association with serpentine geology in the Southern Blue Ridge. *Quercus alba* makes up 50-75% of the canopy, with lesser amounts (less than 25%) of *Pinus rigida* and *Tsuga canadensis*. The subcanopy is primarily *Acer rubrum, Amelanchier arborea*, and *Magnolia acuminata*. Shrub cover can exceed 80% or be as low as 15%. *Kalmia latifolia* is a typical shrub, but other common shrubs include *Viburnum nudum var. cassinoides, Vaccinium stamineum*, and *Physocarpus opulifolius*. The herbaceous stratum is dominated by *Packera plattensis (= Senecio plattensis)*. Other typical herbs include *Hexastylis arifolia var. ruthii, Polygala paucifolia, Epigaea repens, Mitchella repens, Pteridium aquilinum var. latiusculum, Thalictrum macrostylum, Poa saltuensis, Phlox stolonifera, Andropogon gerardii*, and *Zizia aptera*. This community occurs on rocky soils associated with serpentine geology. It is found at moderate elevations (1015 m) on gentle to steep concave slopes with an eastern to northwestern exposure.

Environment: This community occurs on rocky soils associated with serpentine geology. It is found at moderate elevations (1015 m) on gentle to steep concave slopes with a east to northwest exposure.
Vegetation: *Quercus alba* makes up 50-75% of the canopy in this forest, with lesser amounts (less than 25%) of *Pinus rigida* and *Tsuga canadensis*. The subcanopy is primarily *Acer rubrum, Amelanchier arborea*, and *Magnolia acuminata*. Shrub cover can exceed 80% or be as low as 15%. *Kalmia latifolia* is a typical shrub, often occurring in dense patches. Other common shrub species include *Viburnum nudum var. cassinoides, Vaccinium stamineum*, and *Physocarpus opulifolius*. The herbaceous stratum is dominated by *Packera plattensis (= Senecio plattensis).* Other typical herbs include *Hexastylis arifolia var. ruthii, Polygala paucifolia, Epigaea repens, Mitchella repens, Pteridium aquilinum, Thalictrum macrostylum, Poa saltuensis, Phlox stolonifera, Andropogon gerardii*, and *Zizia aptera*. *Smilax glauca* is a common vine that occurs throughout this forest.
Dynamics: Natural disturbances in this community include infestations of southern pine beetle and periodic fire. The natural fire frequency for this forest is not known. This forest is thought to be a late successional community. Periodic fire will likely increase the *Pinus rigida* and graminoid component.
Similar Associations:
Related Concepts:
- IE9b. Blue Ridge/Piedmont Ultramafic Barren (Allard 1990) B
- Ultramafic Outcrop Barren (White Oak Subtype) (Schafale 1998b) ?
- White Oak (54) (USFS 1988) ?
- White Oak: 53 (Eyre 1980) B

Classification Comments: This forest at Buck Creek Barrens, Clay County, North Carolina, forms a matrix in which *Pinus rigida - Quercus alba / Sporobolus heterolepis - Andropogon gerardii* Woodland (CEGL003768) and its seepage inclusions occur. This forest occurs in a
physiognomically complex landscape. Fire should be applied with the objective of maintaining a physiognomic complex of woodland,
forest, and grass-dominated areas.

CONSERVATION RANKING & RARE SPECIES

GRank: G1 (1997-12-31): This community has a very restricted range and only a few small occurrences are known to exist. It is associated with serpentine, dunite and peridotite, all rock types with restricted occurrence in the Southern Blue Ridge ecoregion. There is little or no potential for the
discovery of additional occurrences.
High-ranked species: *Carex manhartii* (G3), *Parnassia grandifolia* (G3), *Thalictrum macrostylum* (G3G4), *Viola appalachiensis* (G3)

ELEMENT DISTRIBUTION

Range: This community occurs on rocky soils associated with serpentine geology in the Southern Blue Ridge of North Carolina.
Subnations: NC
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dd:CCC
Federal Lands: USFS (Nantahala)

ELEMENT SOURCES

References: Allard 1990, Eyre 1980, Kauffman pers. comm., Mansberg and Wentworth 1984, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., USFS 1988

CENTRAL AND SOUTHERN APPALACHIAN MONTANE OAK FOREST

NORTHERN RED OAK / (MOUNTAIN HIGHBUSH BLUEBERRY, FLAME AZALEA) / (HAY-SCENTED FERN, NEW YORK FERN) FOREST

ELEMENT IDENTIFIERS

NVC association: *Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis)* Forest
Database Code: CEGL007300
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Quercus rubra* Montane Forest Alliance (A.272)

ELEMENT CONCEPT

Summary: This community includes forest vegetation with *Quercus rubra* making up at least 75% of the tree canopy and with greater than 20% shrub cover, which may be continuous to patchy. More than 50% of the total shrub cover is deciduous, although evergreen shrubs may be present. Typical shrub dominants include *Rhododendron calendulaceum, Vaccinium simulatum, Vaccinium*

erythrocarpum, Ilex montana, Gaylussacia ursina, Rubus canadensis, Corylus cornuta, and *Lyonia ligustrina*. The herbaceous stratum is diverse and is predominantly a mix of sedges, ferns, and tall herbs (*Ageratina altissima var. roanensis, Eurybia divaricata (= Aster divaricatus), Oclemena acuminata (= Aster acuminatus), Athyrium filix-femina ssp. asplenioides, Clintonia umbellulata, Collinsonia canadensis, Conopholis americana, Dennstaedtia punctilobula, Dioscorea villosa, Laportea canadensis, Lysimachia quadrifolia, Medeola virginiana, Monarda fistulosa, Potentilla canadensis, Prenanthes roanensis, Silene stellata, Solidago curtisii (= Solidago caesia var. curtisii), Thelypteris noveboracensis*). Herbaceous dominance varies within and between occurrences. This community occurs on most of the major mountain ranges of the southern Appalachians at elevations of 1070-1525 m (3500-5000 feet) on broad ridges and mid to upper slope positions, commonly with southeastern and southern exposures. At higher elevations this forest often occurs adjacent to or grades into forests dominated by *Picea rubens, Abies fraseri*, or northern hardwood species (*Betula alleghaniensis, Fagus grandifolia, Aesculus flava)*. In some areas, this community is found adjacent to montane shrublands and grasslands. At low elevations, on dry sites, this community may grade into forests dominated by mixed *Quercus* species.

Environment: This community occurs at elevations of 1070-1525 m (3500-5000 feet) on broad ridges and mid- to upper-slope positions. DeLapp (1978) found that this community occurs on most slope aspects but was most commonly found on southeast and south exposures. This community occurs over well-drained soils underlain by Precambrian gneisses, schists, and granites. These soils are classified as Typic, Umbric, or Lithic Dystrochrepts, and Typic Haplumbrepts (Golden 1974). Soils supporting this forest with a mainly deciduous shrub understory are slightly less acidic than *Quercus rubra*-dominated forests with evergreen shrub understories (DeLapp 1978).

Vegetation: This forest is dominated by *Quercus rubra* with other species making up less than 25% of the canopy cover. Other canopy and subcanopy trees may include *Acer rubrum, Betula alleghaniensis, Betula lenta, Castanea dentata* (root sprouts), *Hamamelis virginiana, Fagus grandifolia, Ilex montana, Acer pensylvanicum, Halesia tetraptera*, and on more exposed sites, *Quercus prinus*. At higher elevations, this community may contain *Picea rubens*. The shrub layer may be continuous to patchy but has at least 20% cover and more than 50% of the total shrub cover is deciduous, although evergreen shrubs may be present. Typical shrub dominants include *Rhododendron calendulaceum, Vaccinium simulatum, Vaccinium erythrocarpum, Ilex montana, Gaylussacia ursina, Rubus canadensis, Corylus cornuta*, and *Lyonia ligustrina*. Other shrubs occur with low frequency and may include *Kalmia latifolia, Rhododendron catawbiense, Rhododendron maximum*. *Rubus allegheniensis* occurs in disturbed openings and in seeps. The herbaceous stratum is diverse and is predominantly a mix of sedges, ferns, and tall herbs. Herbaceous dominance varies within and among occurrences. Typical herbaceous species include *Ageratina altissima var. roanensis, Eurybia divaricata (= Aster divaricatus), Oclemena acuminata (= Aster acuminatus), Athyrium filix-femina ssp. asplenioides, Clintonia umbellulata, Collinsonia canadensis, Conopholis americana, Dennstaedtia punctilobula, Dioscorea villosa, Laportea canadensis, Lysimachia quadrifolia, Medeola virginiana, Monarda fistulosa, Potentilla canadensis, Prenanthes roanensis, Silene stellata, Solidago curtisii (= Solidago caesia var. curtisii)*, and *Thelypteris noveboracensis*.

Dynamics: The canopy is probably rarely removed completely by natural disturbance however, small canopy gaps are caused by individual tree death. Occurrences of this community on exposed slopes and south- and west-facing ridges are subject to lightening-caused fires and damage by ice and wind. Damage by ice storms is probably the most common form of natural disturbance.

Quercus rubra reproduction and survival are optimal in canopy gaps with little regeneration under the forest canopy, hence these forests will eventually succeed to forests with mixed canopy composition of *Quercus rubra, Betula alleghaniensis, Acer rubrum*, and *Fagus grandifolia*. Many *Quercus rubra*-dominated stands of today were, prior to the chestnut blight in the 1930s, dominated or codominated by *Castanea dentata* with scattered *Quercus rubra* and *Acer rubrum* in the canopy (Golden 1974). The fungus *Endothia parasitica* eliminated *Castanea dentata* in the upper canopy, subsequently releasing the subcanopy *Quercus rubra*, which eventually resulted in a nearly pure upper canopy of large *Quercus rubra*.

Similar Associations:

- *Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata* Forest (CEGL007299) -- has greater than 20% shrub cover but with more than 50% of the shrub cover composed of evergreen species.
- *Quercus rubra / Carex pensylvanica - Ageratina altissima* var. *roanensis* Forest (CEGL007298) -- has less than 20% shrub cover and an herb stratum dominated by ferns, tall forbs, and sedges.

Related Concepts:

- *Corylus cornuta* Phase (DeLapp 1978) ?
- Deciduous Heath Phase (DeLapp 1978) ?
- High Elevation Red Oak Forest (Herb Subtype) (Schafale 1998b) ?
- High elevation red oak/blueberry-flame azalea forest (CAP pers. comm. 1998) ?
- IA4g. High Elevation Northern Red Oak Forest (Allard 1990) B
- Mixed Fern Phase (DeLapp 1978) B
- Northern Red Oak (55) (USFS 1988) ?
- Northern Red Oak, BR (Pyne 1994) B
- Northern Red Oak: 55 (Eyre 1980) B
- Oligotrophic Forest (Rawinski 1992) B
- Submesic Oak Ridge Forest (Ambrose 1990a) B
- Tall Herb Phase (DeLapp 1978) B

Classification Comments: This community includes forest vegetation with *Quercus rubra* making up at least 75% of the tree canopy and with greater than 20% shrub cover. More than 50% of the total shrub cover is deciduous, although evergreen shrubs may be present. Typical deciduous shrub species in this community include *Rhododendron calendulaceum, Vaccinium simulatum, Vaccinium erythrocarpum, Ilex montana, Gaylussacia ursina, Rubus canadensis, Corylus cornuta*, and *Lyonia ligustrina*.

Two varieties of *Quercus rubra* occur within the range of this community, *Quercus rubra var. ambigua* and *Quercus rubra var. rubra* (Kartesz 1999). Although the two varieties are known to occur together (Rohrer 1983), *Quercus rubra var. ambigua* occurs mostly at elevations greater than 1000 m (3300 feet), while *Quercus rubra var. rubra* occurs at elevations less than 1000 m (3300 feet) (Weakley 1997). The two varieties are based upon morphological differences in the leaves and acorns (Fernald 1950, Coker and Totten 1945); however, studies of foliar flavonoid composition in different *Quercus rubra* populations suggest that varietal distinction may not be warranted (McDougal and Parks 1984). Even though most studies of *Quercus rubra*-dominated vegetation do not distinguish *Quercus rubra* at the varietal level, it is likely, given the elevational range of this community, that the dominant species in this forest is *Quercus rubra var. ambigua*.

Similar vegetation may occur in the Cumberland Mountains (Black Mountain, Cumberland Mountain, Kentucky); for more information see Braun 1950 book and Black Mountain paper (Braun 1940). Kentucky occurrences lack *Gaylussacia ursina, Corylus cornuta, Prenanthes roanensis*, and occur at 3500-3800 feet (M. Evans pers. comm.).

CONSERVATION RANKING & RARE SPECIES

GRank: G4 (1997-12-31): This community is uncommon but not rare. It is secure within its range.
High-ranked species: *Abies fraseri* (G2), *Calystegia catesbeiana* (G3), *Carex roanensis* (G2), *Delphinium exaltatum* (G3), *Euphorbia purpurea* (G3), *Helianthus glaucophyllus* (G3), *Prenanthes roanensis* (G3), *Rhododendron vaseyi* (G3), *Silene ovata* (G2G3)

ELEMENT DISTRIBUTION

Range: This community occurs on most of the major mountain ranges of the southern Appalachians in North Carolina, Tennessee, and Georgia. It may possibly range into Kentucky's Cumberland Mountains and into Virginia and West Virginia.
Subnations: GA, KY?, NC, TN, VA?, WV?
TNC Ecoregions: 51:C, 59:?
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Ambrose 1990a, Braun 1940, Braun 1950, CAP pers. comm. 1998, Coker and Totten 1945, DeLapp 1978, Evans 1991, Evans pers. comm., Eyre 1980, Fernald 1950, Golden 1974, Kartesz 1999, McDougal and Parks 1984, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Pyne 1994, Rawinski 1992, Rohrer 1983, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Stephenson and Adams 1989, USFS 1988, Weakley 1997, Whigham 1969, Whittaker 1956

NORTHERN RED OAK / (MOUNTAIN LAUREL, GREAT RHODODENDRON) / GALAX FOREST

ELEMENT IDENTIFIERS

NVC association: *Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata* Forest
Database Code: CEGL007299
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Quercus rubra* Montane Forest Alliance (A.272)

ELEMENT CONCEPT

Summary: This montane community of the southern Appalachians includes forest vegetation with *Quercus rubra* making up at least 75% of the tree canopy and with greater than 20% shrub cover, which may be continuous to patchy. More than 50% of the total shrub cover is evergreen, although deciduous shrubs may be present. Typical shrub dominants include *Kalmia latifolia, Rhododendron catawbiense*, and *Rhododendron maximum*. The herbaceous stratum is not diverse and is typically very sparse with scattered forbs including *Galax urceolata, Solidago curtisii (= Solidago caesia var. curtisii), Epigaea repens, Dennstaedtia punctilobula, Conopholis americana, Thelypteris noveboracensis, Clintonia umbellulata, Eurybia divaricata (= Aster divaricatus), Dioscorea villosa*. This community occurs on most of the major mountain ranges of the southern Appalachians at elevations of 1070-1525 m (3500-5000 feet) on ridges and mid to upper slope positions, commonly with southern and southeastern exposures. On exposed sites this community commonly contains, as inclusions, acidic rock outcrop communities and montane shrublands, and may grade into forests dominated by *Tsuga caroliniana, Pinus rigida, Pinus pungens*, and *Quercus prinus*. At higher elevations this forest often occurs adjacent to or grades into forests dominated by *Picea rubens, Abies fraseri*, or northern hardwood species (*Betula alleghaniensis, Fagus grandifolia, Aesculus flava).*

Environment: This community occurs on most of the major mountain ranges of the southern Appalachians at elevations of 1070-1525 m (3500-5000 feet) on ridges and mid- to upper-slope positions, commonly with south and southeast exposures. DeLapp (1978) found that this community type occurs on most slope aspects but was most commonly found on southeast and south exposures. This community occurs over well-drained soils underlain by Precambrian gneisses, schists, and granites. These soils are classified as Typic, Umbric, or Lithic Dystrochrepts, and Typic Haplumbrepts (Golden 1974). Soils supporting this forest with a mainly evergreen shrub understory are slightly more acidic than *Quercus rubra*-dominated forests with deciduous shrub understories (DeLapp 1978).
Vegetation: Stands of this montane community of the southern Appalachians are dominated by *Quercus rubra* which makes up at least 75% of the tree canopy. Stands typically have greater than 20% shrub cover, which may be continuous to patchy. More than 50% of the total shrub cover is evergreen, although deciduous shrubs may be present. Typical shrub dominants include *Kalmia latifolia, Rhododendron catawbiense,* and *Rhododendron maximum*. The herbaceous stratum is not diverse and is typically very sparse with scattered forbs including *Galax urceolata, Solidago curtisii (= Solidago caesia var. curtisii), Epigaea repens, Dennstaedtia punctilobula, Conopholis americana, Thelypteris noveboracensis, Clintonia umbellulata, Eurybia divaricata (= Aster divaricatus),* and *Dioscorea villosa*.
Dynamics: The canopy is probably rarely removed completely by natural disturbance however, small canopy gaps are caused by individual tree death. Occurrences of this community on exposed slopes and south and west facing ridges are subject to lightening-caused fires and damage by ice and wind. Damage by ice storms is probably the most common form of natural disturbance.

Quercus rubra reproduction and survival are optimal in canopy gaps with little regeneration under the forest canopy, hence these forests will eventually succeed to forests with mixed canopy composition of *Quercus rubra, Betula alleghaniensis, Acer rubrum,* and *Fagus grandifolia*. Many *Quercus rubra*-dominated stands of today were, prior to the chestnut blight in the 1930s, dominated or codominated by *Castanea dentata* with scattered *Quercus rubra* and *Acer rubrum* in the canopy (Golden 1974). The fungus *Endothia parasitica* eliminated *Castanea dentata* in the upper canopy, subsequently releasing the subcanopy *Quercus rubra,* which eventually resulted in a nearly pure upper canopy of large *Quercus rubra*.
Similar Associations:
- *Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis)* Forest (CEGL007300) -- has greater than 20% shrub cover but with more than 50% of the shrub cover composed of deciduous species.
- *Quercus rubra / Carex pensylvanica - Ageratina altissima var. roanensis* Forest (CEGL007298) -- has less than 20% shrub cover and a herb stratum dominated by ferns, tall forbs, and sedges.
- *Quercus rubra / Rhododendron catawbiense - Rhododendron arborescens* Woodland (CEGL004503) -- occurs at higher elevations, in more extreme environments, sometimes adjacent to CEGL007299.

Related Concepts:
- *Kalmia latifolia* Phase (DeLapp 1978) ?
- *Rhododendron catawbiense* Phase (DeLapp 1978) ?
- *Rhododendron maximum* Phase (DeLapp 1978) ?
- High Elevation Red Oak Forest (Heath Subtype) (Schafale 1998b) ? High elevation red oak /mt. laurel-great laurel forest (CAP pers. comm. 1998) ?
- IA4g. High Elevation Northern Red Oak Forest (Allard 1990) B
- Northern Red Oak (55) (USFS 1988) ?
- Northern Red Oak, BR (Pyne 1994) B
- Northern Red Oak: 55 (Eyre 1980) B
- Submesic Oak Ridge Forest (Ambrose 1990a) B

Classification Comments: This community includes forest vegetation with *Quercus rubra* making up at least 75% of the tree canopy and with greater than 20% shrub cover. More than 50% of the total shrub cover is evergreen, although deciduous shrubs may be present. Typical evergreen shrub species in this community include *Kalmia latifolia, Rhododendron catawbiense,* and *Rhododendron maximum*.

Two varieties of *Quercus rubra* occur within the range of this community, *Quercus rubra var. ambigua* and *Quercus rubra var. rubra* (Kartesz 1999). Although the two varieties are known to occur together (Rohrer 1983), *Quercus rubra var. ambigua* occurs mostly at elevations greater than 1000 m (3300 feet), while *Quercus rubra var. rubra* occurs at elevations less than 1000 m (3300 feet) (Weakley 1997). The two varieties are based upon morphological differences in the leaves and acorns (Fernald 1950, Coker and Totten 1945); however, studies of foliar flavonoid composition in different *Quercus rubra* populations suggest that varietal distinction may not be warranted (McDougal and Parks 1984). Even though most studies of *Quercus rubra*-dominated vegetation do not distinguish *Quercus rubra* at the varietal level, it is likely, given the elevation range of this community, that the dominant species in this forest is *Quercus rubra var. ambigua*.

Similar *Quercus rubra*-dominated forests occur in the southern Appalachian Mountains. Forests with less than 75% *Quercus rubra* in the canopy are classified in other forest alliances. In Georgia this type occurs on the north side of Rabun Bald, where it grades into *Quercus rubra / Rhododendron catawbiense - Rhododendron arborescens* Woodland (CEGL004503) in more extreme areas.

CONSERVATION RANKING & RARE SPECIES

GRank: G4 (2000-1-4): This community is uncommon but not rare. It is secure within its range.
High-ranked species: *Abies fraseri* (G2), *Calystegia catesbeiana* (G3), *Carex roanensis* (G2), *Euphorbia purpurea* (G3), *Prenanthes roanensis* (G3), *Rhododendron vaseyi* (G3), *Silene ovata* (G2G3), *Vaccinium hirsutum* (G3)

ELEMENT DISTRIBUTION

Range: This community occurs on most of the major mountain ranges of the southern Appalachians in North Carolina, Tennessee, and Georgia. This community could possibly range into South Carolina.
Subnations: GA, NC, SC?, TN
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Ambrose 1990a, CAP pers. comm. 1998, Coker and Totten 1945, DeLapp 1978, Eyre 1980, Fernald 1950, Golden 1974, Kartesz 1999, McDougal and Parks 1984, McNab and Browning 1993, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Pittillo and Smathers 1979, Pyne 1994, Rawinski 1992, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Stephenson and Adams 1989, USFS 1988, Weakley 1997, Whigham 1969, Whittaker 1956

NORTHERN RED OAK / PENNSYLVANIA SEDGE - APPALACHIAN WHITE SNAKEROOT FOREST

ELEMENT IDENTIFIERS

NVC association: *Quercus rubra / Carex pensylvanica - Ageratina altissima* var. *roanensis* Forest
Database Code: CEGL007298
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Quercus rubra* Montane Forest Alliance (A.272)

ELEMENT CONCEPT

Summary: This community includes forest vegetation, with a closed to very open canopy, where *Quercus rubra* makes up at least 75% of the tree canopy and with less than 20% shrub cover. Canopy trees may be gnarled and stunted, especially on ridge crests. Other canopy species may include *Acer rubrum, Crataegus punctata, Crataegus flabellata, Betula alleghaniensis, Betula lenta*, and, at high elevations, *Picea rubens*. An open subcanopy contains canopy species plus *Hamamelis virginiana, Amelanchier arborea, Acer pensylvanicum, Halesia tetraptera*, and *Ilex montana*. Herbaceous cover is dense and diverse, composed of sedges, ferns, and tall herbs, with dominance varying within and between occurrences. Typical herbaceous dominants include *Carex pensylvanica, Ageratina altissima var. roanensis, Thelypteris noveboracensis, Dennstaedtia punctilobula, Eurybia chlorolepis (= Aster chlorolepis), Oclemena acuminata (= Aster acuminatus),* and *Laportea canadensis*. This type occurs on most of the major mountain ranges of the southern Appalachians in North Carolina and Tennessee, at elevations over 1400 m (4500 feet) on broad ridges, and on steep rocky slopes at the heads of coves, often with northern or southeastern aspects. This forest often occurs adjacent to or grades into forests dominated by *Picea rubens, Abies fraseri*, or northern hardwood species (*Betula alleghaniensis, Fagus grandifolia, Aesculus flava)*. In some areas, this community is found adjacent to montane shrublands and grasslands. This community is often referred to as a 'Subalpine Oak Orchard Forest.'
Environment: This community occurs at elevations over 1400 m (4500 feet) on broad ridges and on steep rocky slopes at the heads of coves, often with north or southeast aspects. Occurrences of this community on exposed slopes and south- and west-facing ridges are subject to lightening-caused fires and damage by ice and wind. Damage by ice storms is probably the most common form of natural disturbance. This community occurs over well-drained, loamy soils underlain by Precambrian gneisses, schists, and granites. These soils are classified as Typic, Umbric, or Lithic Dystrochrepts, and Typic Haplumbrepts (Golden 1974). Soils supporting this community tend to have relatively high base status.
Vegetation: This community includes forest vegetation, with a closed to very open canopy, where *Quercus rubra* makes up at least 75% of the tree canopy and with less than 20% shrub cover. Canopy trees may be gnarled and stunted, especially on ridge crests. Other canopy species may include *Acer rubrum, Crataegus punctata, Crataegus flabellata, Betula alleghaniensis, Betula lenta*, and, at high elevations, *Picea rubens*. An open subcanopy contains canopy species plus *Hamamelis virginiana, Amelanchier arborea, Acer pensylvanicum, Halesia tetraptera*, and *Ilex montana*. Herbaceous cover is dense and diverse, composed of sedges, ferns, and tall herbs, with dominance varying within and among occurrences. Typical herbaceous dominants include *Carex pensylvanica, Ageratina altissima var. roanensis, Thelypteris noveboracensis, Dennstaedtia punctilobula, Eurybia chlorolepis (= Aster chlorolepis), Oclemena acuminata (= Aster acuminatus),* and *Laportea canadensis*.
Dynamics: The canopy is probably rarely removed completely by natural disturbance; however, small canopy gaps are caused by individual tree death. Occurrences of this community on exposed slopes and south- and west-facing ridges are subject to lightening-caused fires and damage by ice and wind. Damage by ice storms is probably the most common form of natural disturbance.

Quercus rubra reproduction and survival is optimal in canopy gaps with little regeneration under the forest canopy, hence these forests will eventually succeed to forests with mixed canopy composition of *Quercus rubra, Betula alleghaniensis, Acer rubrum,* and *Fagus grandifolia*. Many *Quercus rubra*-dominated stands of today were, prior to the chestnut blight in the 1930s, dominated or codominated by *Castanea dentata* with scattered *Quercus rubra* and *Acer rubrum* in the canopy (Golden 1974). The fungus *Endothia parasitica* eliminated *Castanea dentata* in the upper canopy, subsequently releasing the subcanopy *Quercus rubra,* which eventually resulted in a nearly pure upper canopy of large *Quercus rubra*.

Similar Associations:

- *Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata* Forest (CEGL007299) -- has greater than 20% shrub cover but with more than 50% of the shrub cover composed of evergreen species.
- *Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis)* Forest (CEGL007300) -- has greater than 20% shrub cover but with more than 50% of the shrub cover composed of deciduous species.

Related Concepts:

- High Elevation Red Oak Forest (Orchard Forest Subtype) (Schafale 1998b) ?
- High elevation red oak/Pennsylvania sedge forest (CAP pers. comm. 1998) ?
- IA4g. High Elevation Northern Red Oak Forest (Allard 1990) B
- Mixed Fern Phase, Tall Herb Phase (DeLapp 1978) B
- Northern Red Oak (55) (USFS 1988) ?
- Northern Red Oak, BR (Pyne 1994) B
- Northern Red Oak: 55 (Eyre 1980) B

Classification Comments: This community includes forest vegetation with *Quercus rubra* making up at least 75% of the tree canopy and with less than 20% shrub cover. Herbaceous stratum dominance varies within and between occurrences but is composed of sedges, ferns, and tall herbs. Typical herbaceous dominants include *Carex pensylvanica, Ageratina altissima var. roanensis, Thelypteris noveboracensis, Dennstaedtia punctilobula, Eurybia chlorolepis, Oclemena acuminata,* and *Laportea canadensis*.

Two varieties of *Quercus rubra* occur within the range of this community, *Quercus rubra var. ambigua* and *Quercus rubra var. rubra* (Kartesz 1999). Although the two varieties are known to occur together (Rohrer 1983), *Quercus rubra var. ambigua* occurs mostly at elevations greater than 1000 m (3300 feet), while *Quercus rubra var. rubra* occurs at elevations less than 1000 m (3300 feet) (Weakley 1997). The two varieties are based upon morphological differences in the leaves and acorns (Fernald 1950, Coker and Totten 1945); however, studies of foliar flavonoid composition in different *Quercus rubra* populations suggest that varietal distinction may not be warranted (McDougal and Parks 1984). Even though most studies of *Quercus rubra*-dominated vegetation do not distinguish *Quercus rubra* at the varietal level, it is likely, given the elevational range of this community, that the dominant species in this forest is *Quercus rubra var. ambigua*.

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (1998-4-30): This community is relatively secure within its range, but has a naturally restricted habitat. Red oak decline is affecting occurrences of this community; fire may be needed for stand establishment.

High-ranked species: *Abies fraseri* (G2), *Calystegia catesbeiana* (G3), *Carex roanensis* (G2), *Euphorbia purpurea* (G3), *Gentiana austromontana* (G3), *Prenanthes roanensis* (G3), *Rhododendron vaseyi* (G3), *Silene ovata* (G2G3)

ELEMENT DISTRIBUTION

Range:

Subnations: NC, TN, VA

TNC Ecoregions: 50:P, 51:C, 59:?

USFS Ecoregions: M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Cherokee?, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, CAP pers. comm. 1998, Coker and Totten 1945, DeLapp 1978, Eyre 1980, Fernald 1950, Fleming et al. 2001, Golden 1974, Kartesz 1999, McDougal and Parks 1984, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Pyne 1994, Rohrer 1983, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., USFS 1988, Weakley 1980, Weakley 1997, Whittaker 1956

WHITE OAK / MOUNTAIN LAUREL FOREST

ELEMENT IDENTIFIERS

NVC association: *Quercus alba / Kalmia latifolia* Forest

Database Code: CEGL007295

Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)

Alliance: *Quercus alba* Montane Forest Alliance (A.271)

ELEMENT CONCEPT

Summary: *Quercus alba*-dominated forests on exposed, rocky ridges and convex upper slopes at high elevations (>3000 feet). The shrub stratum is dominated by *Kalmia latifolia*, occurring as patches or with continuous cover (>25%). In some parts of this forest's range, *Gaylussacia ursina* is dominant in the often dense low-shrub stratum. Herbaceous cover is typical of xeric *Quercus*-and-*Carya*-dominated forests in the area, with *Carex pensylvanica, Chimaphila maculata, Euphorbia corollata, Galax urceolata, Galium latifolium, Goodyera pubescens, Hexastylis shuttleworthii, Iris verna var. smalliana, Medeola virginiana* typical. The shrub/sapling stratum often has a high coverage of *Castanea* stump sprouts and also includes *Castanea pumila, Sassafras albidum, Oxydendrum arboreum*, and *Nyssa sylvatica*.

Environment: These *Quercus alba*-dominated forests occur on exposed, rocky ridges and convex upper slopes at high elevations (>3000 feet).

Vegetation: These forests are dominated by *Quercus alba* in the canopy. The shrub stratum is dominated by *Kalmia latifolia*, occurring as patches or with continuous cover (>25%). In some parts of this forest's range, *Gaylussacia ursina* is dominant in the often dense low-shrub stratum. Herbaceous cover is typical of xeric *Quercus*-and-*Carya*-dominated forests in the area, with *Carex pensylvanica, Chimaphila maculata, Euphorbia corollata, Galax urceolata, Galium latifolium, Goodyera pubescens, Hexastylis shuttleworthii, Iris verna var. smalliana, Medeola virginiana* typical. The shrub/sapling stratum often has a high coverage of *Castanea* stump sprouts and also includes *Castanea pumila, Sassafras albidum, Oxydendrum arboreum*, and *Nyssa sylvatica*.

Dynamics: No information

Similar Associations:

- *Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina)* Forest (CEGL007230)
- *Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata* Forest (CEGL007299)
- *Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis)* Forest (CEGL007300)

Related Concepts:

- High Elevation White Oak Forest (Schafale 1998b) ?
- IA4h. High Elevation White Oak Forest (Allard 1990) ?

Classification Comments: These forests are related to oak - hickory forests and may be best considered as a variant of them. Similar associations include *Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata* Forest (CEGL007299), *Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis)* Forest (CEGL007300), and *Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina)* Forest (CEGL007230). On some sites these forests are transitional to *Quercus rubra*-dominated forests (High Elevation Red Oak Forest).

CONSERVATION RANKING & RARE SPECIES

GRank: G2Q (1999-12-29): This forest is restricted geographically, and if considered distinct, it is naturally rare within its range. It is floristically related to other, more common associations and may be better considered a subassociation of one of these communities.

High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge of western North Carolina, eastern Tennessee, northwestern South Carolina, and northeastern Georgia.

Subnations: GA, NC, SC, TN

TNC Ecoregions: 51:C

USFS Ecoregions: M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, McCormick and Platt 1980, Newell and Peet 1995, Patterson 1994, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

CENTRAL AND SOUTHERN APPALACHIAN NORTHERN HARDWOOD FOREST

AMERICAN BEECH / APPALACHIAN WHITE SNAKEROOT FOREST

ELEMENT IDENTIFIERS

NVC association: *Fagus grandifolia / Ageratina altissima* var. *roanensis* Forest

Database Code: CEGL006246

Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)

Alliance: *Betula alleghaniensis - Fagus grandifolia - Aesculus flava* Forest Alliance (A.266)

ELEMENT CONCEPT

Summary: This association includes stunted beech forests of the southern Appalachians, occurring on north-facing upper slopes and in gaps in scattered, higher elevation (1370 m) sites. This community is a stunted, broad-leaved deciduous forest with a canopy dominated by *Fagus grandifolia*, with lesser amounts of *Aesculus flava* and *Betula alleghaniensis*. The subcanopy may include small stems of canopy species, as well as *Acer spicatum, Acer pensylvanicum, Amelanchier laevis*, and *Sorbus americana*. Typically there is little shrub development (2-10%) with such species as *Crataegus punctata, Ribes* spp., *Viburnum lantanoides, Rubus canadensis, Hydrangea arborescens*, and *Cornus alternifolia*. The herbaceous stratum is moderately dense (40-60% cover), dominated by large herbs and patches of ferns, with lesser amounts of sedges. Typical herbs include *Athyrium filix-femina ssp. asplenioides, Ageratina altissima var. roanensis, Eurybia chlorolepis (= Aster chlorolepis)*, and *Actaea racemosa (= Cimicifuga racemosa)*. This community commonly occurs as small patches surrounded by other forest types.

Environment: This community typically occurs on north-facing, steep, upper slopes and on the north and northeast side of gaps, at elevations greater than 1370 m (4500 feet) (Whittaker 1956, Crandall 1958). High rainfall and low temperatures create mesic conditions. Strong winds and ice storms periodically damage these forests, creating canopy gaps and contributing to its stunted appearance. The soil is generally greater than 20 cm deep, with pH values ranging from 4.5-6.0, considerably less acidic than soils of the adjacent spruce-and-fir-dominated forests (Russell 1953). This community commonly occurs as small patches surrounded by other forest types.

Vegetation: This community is a broad-leaved deciduous forest with a canopy dominated by low-stature, small-stemmed (<38 cm) *Fagus grandifolia*, with lesser amounts of *Aesculus flava* and *Betula alleghaniensis*. The subcanopy may include small stems of canopy species as well as *Acer spicatum, Acer pensylvanicum, Amelanchier laevis*, and *Sorbus americana*. Typically there is little shrub development (2-10%) with such species as *Crataegus punctata, Ribes* spp., *Viburnum lantanoides, Rubus canadensis, Hydrangea arborescens*, and *Cornus alternifolia*. The herbaceous stratum is moderately dense (40-60% cover) and is dominated by large herbs and patches of ferns, with lesser amounts of sedges (Bratton 1975, Crandall 1958, Whittaker 1956). Herbaceous species in this community are typical of rich southern Appalachian forests and may include *Ageratina altissima var. roanensis, Anemone quinquefolia, Arisaema triphyllum, Eurybia chlorolepis (= Aster chlorolepis), Athyrium filix-femina ssp. asplenioides, Carex aestivalis, Carex brunnescens, Carex debilis, Carex intumescens, Carex pensylvanica, Actaea racemosa (= Cimicifuga racemosa), Dryopteris campyloptera, Epifagus virginiana, Impatiens pallida, Oxalis montana, Laportea canadensis, Luzula acuminata, Phacelia bipinnatifida, Poa alsodes, Prenanthes altissima, Prenanthes roanensis, Stellaria pubera, Thelypteris noveboracensis*, and *Trillium erectum*.

Dynamics: Due to the extreme environment, growth and reproduction of *Fagus grandifolia* are relatively slow in this mid- to late-successional community. Despite their small size, canopy trees may be quite old. Although beech nuts may be produced by the larger trees, reproduction of beech appears to be almost entirely vegetative from root or stump sprouts (Russell 1953). Small canopy gaps within this type are commonly invaded by a dense thicket of *Rubus canadensis*.

The origin and maintenance of this community has been debated by ecologists. It has been proposed that beech gaps became established during warmer climates of 7000-900 BC, and that they were once more extensive than today (Flint 1957 in Schofield 1960). Russell (1953) concluded that cold and high winds were responsible for the occurrence of these forests. Fuller (1977) suggested that the allelopathic effects of beech litter may be a factor in maintaining this community.

Similar Associations:

- *Fagus grandifolia / Carex pensylvanica - Carex brunnescens* Forest (CEGL006130)

Related Concepts:

- Beech, BR (Pyne 1994) B
- IA4d. Southern Appalachian Beech Gap (Allard 1990) B
- Northern Hardwood Forest (Forb Beech Gap Subtype) (Schafale 1998b) ?
- Permesotrophic Forest (Rawinski 1992) ?
- Sugar Maple - Beech - Yellow Birch: 25 (Eyre 1980) B
- Sugar Maple-Beech Yellow Birch (81) (USFS 1988) ?

Classification Comments: This mesic north-slope community is thought to be more similar to northern hardwood forests, having a more diverse canopy and subcanopy, and to extend farther into the southwestern mountain ranges than does the south-slope, sedge-dominated variant, *Fagus grandifolia / Carex pensylvanica - Carex brunnescens* Forest (CEGL006130). *Ageratina altissima var. roanensis* was chosen as a nominal to represent the tall forbs that dominate the herbaceous stratum, and is not necessarily the dominant species in this stratum.

CONSERVATION RANKING & RARE SPECIES

GRank: G1 (2002-11-1): This community has a very restricted range with scattered occurrences of small acreage. Many occurrences have been, and continue to be, severely damaged by the European wild boar (*Sus scrofa*). Grazing and soil disturbance by this animal reduces understory herb cover to 10-30 percent of undisturbed levels and may affect tree growth and nutrient cycling (Singer et al. 1984). Beech bark disease, a complex made up of the Beech scale insect (*Cryptococcus fagisuga*) and a closely associated fungus (*Nectria coccinea var. faginata*) poses a serious threat to this community. Another potential threat to this high-elevation community is atmospheric deposition of air pollutants, which may result in tree growth decline. Most all of the beech gap

communities in the Great Smoky Mountains had succumbed to the beech bark disease or a combination of the beech bark disease and pollution by 2002 (R. White pers. comm.). Presumably this trend is being seen throughout the southern Appalachians, resulting in the possible extinction of this community in the next few years. Therefore, this community was assigned a rank of G1.
High-ranked species: *Geum geniculatum* (G2), *Hypericum graveolens* (G3), *Hypericum mitchellianum* (G3), *Lilium grayi* (G3), *Prenanthes roanensis* (G3), *Rugelia nudicaulis* (G3)

ELEMENT DISTRIBUTION

Range: This community is found in scattered sites on high elevations of the southern Appalachian Mountains. The majority of this community is distributed within the mountains of North Carolina, but it also occurs in Tennessee and may extend into Georgia and Virginia.
Subnations: GA?, NC, TN, VA?
TNC Ecoregions: 51:C
USFS Ecoregions: M221A:C?, M221B:C?, M221C:C?, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee?, Cherokee, Jefferson?, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1984, Allard 1990, Allard et al. 1990, Bratton 1975, Churchill and Wolfe 1993, Crandall 1958, Eyre 1980, Fuller 1977, Golden 1981, McLeod 1988, Peet et al. unpubl. data 2002, Pittillo and Smathers 1979, Pyne 1994, Ramseur 1960, Rawinski 1992, Rheinhardt 1981, Russell 1953, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Schofield 1960, Singer et al. 1984, Southeastern Ecology Working Group n.d., USFS 1988, White et al. 1993, White pers. comm., Whittaker 1956

AMERICAN BEECH / PENNSYLVANIA SEDGE - BROWN SEDGE FOREST

ELEMENT IDENTIFIERS

NVC association: *Fagus grandifolia / Carex pensylvanica - Carex brunnescens* Forest
Database Code: CEGL006130
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Betula alleghaniensis - Fagus grandifolia - Aesculus flava* Forest Alliance (A.266)

ELEMENT CONCEPT

Summary: This association is often referred to as a classic "beech gap" forest and includes vegetation with short-statured canopies dominated by *Fagus grandifolia*, occurring over a dense, graminoid-dominated herbaceous stratum. This forest is thought to be limited to the range of *Picea rubens* and *Abies fraseri* (Whittaker 1956) and occurs on concave slopes, flat ridgetops, or upper south- to southwest-facing slopes, at elevations of greater than 1370 m (4500 feet) in the southern Blue Ridge. The majority of this community is distributed within the mountains of North Carolina, but it also occurs in Tennessee and possibly in Virginia. This community is a broad-leaved deciduous forest with a canopy dominated by stunted, gnarled *Fagus grandifolia*, often with lesser amounts of *Halesia tetraptera var. monticola* or *Betula alleghaniensis*. Typically, there are not significant understory or shrub strata, but scattered shrubs such as *Hydrangea arborescens* may occur. Herbaceous cover is dense, often approaching 100% coverage, and dominated by species of *Carex* (*Carex aestivalis, Carex brunnescens, Carex debilis, Carex intumescens, Carex pensylvanica*). Ferns and other herbs form 5-20% of the herbaceous cover and may include *Ageratina altissima var. roanensis, Anemone quinquefolia, Angelica triquinata, Arisaema triphyllum, Eurybia chlorolepis (= Aster chlorolepis), Athyrium filix-femina ssp. asplenioides, Dryopteris campyloptera, Epifagus virginiana, Erythronium umbilicatum ssp. monostolum, Impatiens pallida, Medeola virginiana, Oxalis montana, Laportea canadensis, Luzula acuminata, Phacelia bipinnatifida, Phacelia fimbriata, Poa alsodes, Prenanthes altissima, Prenanthes roanensis, Rugelia nudicaulis, Solidago glomerata, Stellaria corei, Thelypteris noveboracensis*, and *Trillium erectum*. This community commonly occurs as small patches surrounded by other forest types, montane grasslands and shrublands.
Environment: This community typically occurs on concave slopes, flat ridgetops, or upper south- to southwest-facing slopes, at elevations of greater than 1370 m (4500 feet) (Russell 1953, Whittaker 1956). High rainfall and low temperatures create mesic conditions. Strong winds and ice storms periodically damage these forests, creating canopy gaps and contributing to its stunted appearance. This community commonly occurs as small patches surrounded by other forest types, montane grasslands and shrublands.
Vegetation: This community is a broad-leaved deciduous forest with a canopy dominated by stunted, gnarled *Fagus grandifolia*, often with lesser amounts of *Halesia tetraptera var. monticola*. Typically, there are not significant understory or shrub strata, but scattered shrubs such as *Hydrangea arborescens* may occur. Herbaceous cover is dense, often approaching 100% coverage, and dominated by species of *Carex* including *Carex aestivalis, Carex brunnescens, Carex debilis, Carex intumescens*, and *Carex pensylvanica*. Ferns and other herbs form 5-20% of the herbaceous cover and may include *Ageratina altissima var. roanensis, Anemone quinquefolia, Arisaema triphyllum, Eurybia chlorolepis (= Aster chlorolepis), Athyrium filix-femina ssp. asplenioides, Dryopteris campyloptera, Epifagus virginiana, Impatiens pallida, Medeola virginiana, Oxalis montana, Laportea canadensis, Luzula acuminata, Phacelia bipinnatifida, Poa alsodes, Prenanthes altissima, Prenanthes roanensis, Stellaria pubera, Thelypteris noveboracensis*, and *Trillium erectum* (Whittaker 1956, Crandall 1958, Schafale and Weakley 1990).
Dynamics: The origin and maintenance of this community has been debated by ecologists. It has been proposed that beech gaps became established during warmer climates of 7000-900 BC, and that they were once more extensive than today (Flint 1957 in

Schofield 1960). Russell (1953) concluded that cold and high winds were responsible for the occurrence of these forests. Fuller (1977) suggested that the allelopathic effects of beech litter may be a factor in maintaining this community.

Due to the extreme environment, growth and reproduction of *Fagus grandifolia* are relatively slow in this mid to late successional community. Despite their small size, canopy trees may be quite old. Although beech nuts may be produced by the larger trees, reproduction of beech appears to be almost entirely vegetative from root or stump sprouts (Russell 1953). Small canopy gaps within this type are commonly invaded by a dense thicket of *Rubus canadensis*.

Similar Associations:

- *Fagus grandifolia / Ageratina altissima* var. *roanensis* Forest (CEGL006246) -- is dominated by short-stature *Fagus grandifolia*, occurring with *Betula alleghaniensis* and *Aesculus flava*, and occurs on mesic, north-facing slopes in the southern Appalachian Mountains of North Carolina, Tennessee, and Virginia. This mesic north slope community is thought to be more similar to northern hardwood forests, having a more diverse canopy and subcanopy, and to extend farther into the southwest mountain ranges than does the south slope, sedge-dominated variant described here (Whittaker 1956).

Related Concepts:

- Beech, BR (Pyne 1994) B
- IA4d. Southern Appalachian Beech Gap (Allard 1990) B
- Northern Hardwood Forest (Sedge Beech Gap Subtype) (Schafale 1998b) ?
- Permesotrophic Forest (Rawinski 1992) ?
- Sugar Maple - Beech - Yellow Birch: 25 (Eyre 1980) B
- Sugar Maple-Beech Yellow Birch (81) (USFS 1988) ?

Classification Comments: This community includes forest vegetation with short-statured canopies dominated by *Fagus grandifolia*, occurring over a dense, graminoid-dominated herbaceous stratum. This community is thought to be limited to the range of *Picea rubens* and *Abies*
***fraseri* (Whittaker 1958).**

CONSERVATION RANKING & RARE SPECIES

GRank: G1 (2002-11-1): This community has a very restricted range with scattered occurrences of small acreage. Many occurrences have been, and continue to be, severely damaged by the European wild boar (*Sus scrofa*). Grazing and soil disturbance by this animal reduces understory herb cover to 10-30 percent of undisturbed levels and may affect tree growth and nutrient cycling (Singer et al. 1984). Beech bark disease, a complex made up of the Beech scale insect (*Cryptococcus fagisuga*) and a closely associated fungus (*Nectria coccinea var. faginata*) poses a severe threat to this community. Most all of the beech gap communities in the Great Smoky Mountains had succumbed to the beech bark disease or a combination of the beech bark disease and pollution by 2002 (R. White pers. comm.). Presumably this trend is being seen throughout the southern Appalachians, resulting in the possible extinction of this community in the next few years. Therefore, this community was assigned a rank of G1.

High-ranked species: *Gentiana austromontana* (G3), *Glyceria nubigena* (G2), *Hypericum graveolens* (G3), *Hypericum mitchellianum* (G3), *Lilium grayi* (G3), *Prenanthes roanensis* (G3), *Rugelia nudicaulis* (G3), *Solidago glomerata* (G3)

ELEMENT DISTRIBUTION

Range: The majority of this community is distributed within the mountains of North Carolina, but it also occurs in Tennessee and possibly in Virginia.

Subnations: NC, TN, VA?

TNC Ecoregions: 51:C

USFS Ecoregions: M221A:C?, M221B:C?, M221C:C?, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Cherokee, Jefferson?, Pisgah)

ELEMENT SOURCES

References: Allard 1984, Allard 1990, Allard et al. 1990, Bratton 1975, Crandall 1958, Davis 1930, Eyre 1980, Fuller 1977, Golden 1981, Lindsay and Bratton 1979a, McLeod 1988, Peet et al. unpubl. data 2002, Pittillo and Smathers 1979, Pyne 1994, Ramseur 1960, Rawinski 1992, Rheinhardt 1981, Russell 1953, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Schofield 1960, Singer et al. 1984, Southeastern Ecology Working Group n.d., USFS 1988, White et al. 1993, White pers. comm., Whittaker 1956

NORTHERN RED OAK / (MOUNTAIN HIGHBUSH BLUEBERRY, FLAME AZALEA) / (HAY-SCENTED FERN, NEW YORK FERN) FOREST

ELEMENT IDENTIFIERS

NVC association: *Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis)* Forest

Database Code: CEGL007300

Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)

Alliance: *Quercus rubra* Montane Forest Alliance (A.272)

ELEMENT CONCEPT

Summary: This community includes forest vegetation with *Quercus rubra* making up at least 75% of the tree canopy and with greater than 20% shrub cover, which may be continuous to patchy. More than 50% of the total shrub cover is deciduous, although evergreen shrubs may be present. Typical shrub dominants include *Rhododendron calendulaceum, Vaccinium simulatum, Vaccinium erythrocarpum, Ilex montana, Gaylussacia ursina, Rubus canadensis, Corylus cornuta*, and *Lyonia ligustrina*. The herbaceous stratum is diverse and is predominantly a mix of sedges, ferns, and tall herbs (*Ageratina altissima var. roanensis, Eurybia divaricata (= Aster divaricatus), Oclemena acuminata (= Aster acuminatus), Athyrium filix-femina ssp. asplenioides, Clintonia umbellulata, Collinsonia canadensis, Conopholis americana, Dennstaedtia punctilobula, Dioscorea villosa, Laportea canadensis, Lysimachia quadrifolia, Medeola virginiana, Monarda fistulosa, Potentilla canadensis, Prenanthes roanensis, Silene stellata, Solidago curtisii (= Solidago caesia var. curtisii), Thelypteris noveboracensis*). Herbaceous dominance varies within and between occurrences. This community occurs on most of the major mountain ranges of the southern Appalachians at elevations of 1070-1525 m (3500-5000 feet) on broad ridges and mid to upper slope positions, commonly with southeastern and southern exposures. At higher elevations this forest often occurs adjacent to or grades into forests dominated by *Picea rubens, Abies fraseri*, or northern hardwood species (*Betula alleghaniensis, Fagus grandifolia, Aesculus flava)*. In some areas, this community is found adjacent to montane shrublands and grasslands. At low elevations, on dry sites, this community may grade into forests dominated by mixed *Quercus* species.

Environment: This community occurs at elevations of 1070-1525 m (3500-5000 feet) on broad ridges and mid- to upper-slope positions. DeLapp (1978) found that this community occurs on most slope aspects but was most commonly found on southeast and south exposures. This community occurs over well-drained soils underlain by Precambrian gneisses, schists, and granites. These soils are classified as Typic, Umbric, or Lithic Dystrochrepts, and Typic Haplumbrepts (Golden 1974). Soils supporting this forest with a mainly deciduous shrub understory are slightly less acidic than *Quercus rubra*-dominated forests with evergreen shrub understories (DeLapp 1978).

Vegetation: This forest is dominated by *Quercus rubra* with other species making up less than 25% of the canopy cover. Other canopy and subcanopy trees may include *Acer rubrum, Betula alleghaniensis, Betula lenta, Castanea dentata* (root sprouts), *Hamamelis virginiana, Fagus grandifolia, Ilex montana, Acer pensylvanicum, Halesia tetraptera*, and on more exposed sites, *Quercus prinus*. At higher elevations, this community may contain *Picea rubens*. The shrub layer may be continuous to patchy but has at least 20% cover and more than 50% of the total shrub cover is deciduous, although evergreen shrubs may be present. Typical shrub dominants include *Rhododendron calendulaceum, Vaccinium simulatum, Vaccinium erythrocarpum, Ilex montana, Gaylussacia ursina, Rubus canadensis, Corylus cornuta*, and *Lyonia ligustrina*. Other shrubs occur with low frequency and may include *Kalmia latifolia, Rhododendron catawbiense, Rhododendron maximum*. *Rubus allegheniensis* occurs in disturbed openings and in seeps. The herbaceous stratum is diverse and is predominantly a mix of sedges, ferns, and tall herbs. Herbaceous dominance varies within and among occurrences. Typical herbaceous species include *Ageratina altissima var. roanensis, Eurybia divaricata (= Aster divaricatus), Oclemena acuminata (= Aster acuminatus), Athyrium filix-femina ssp. asplenioides, Clintonia umbellulata, Collinsonia canadensis, Conopholis americana, Dennstaedtia punctilobula, Dioscorea villosa, Laportea canadensis, Lysimachia quadrifolia, Medeola virginiana, Monarda fistulosa, Potentilla canadensis, Prenanthes roanensis, Silene stellata, Solidago curtisii (= Solidago caesia var. curtisii)*, and *Thelypteris noveboracensis*.

Dynamics: The canopy is probably rarely removed completely by natural disturbance however, small canopy gaps are caused by individual tree death. Occurrences of this community on exposed slopes and south- and west-facing ridges are subject to lightening-caused fires and damage by ice and wind. Damage by ice storms is probably the most common form of natural disturbance.

Quercus rubra reproduction and survival are optimal in canopy gaps with little regeneration under the forest canopy, hence these forests will eventually succeed to forests with mixed canopy composition of *Quercus rubra, Betula alleghaniensis, Acer rubrum*, and *Fagus grandifolia*. Many *Quercus rubra*-dominated stands of today were, prior to the chestnut blight in the 1930s, dominated or codominated by *Castanea dentata* with scattered *Quercus rubra* and *Acer rubrum* in the canopy (Golden 1974). The fungus *Endothia parasitica* eliminated *Castanea dentata* in the upper canopy, subsequently releasing the subcanopy *Quercus rubra*, which eventually resulted in a nearly pure upper canopy of large *Quercus rubra*.

Similar Associations:

- *Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata* Forest (CEGL007299) -- has greater than 20% shrub cover but with more than 50% of the shrub cover composed of evergreen species.
- *Quercus rubra / Carex pensylvanica - Ageratina altissima* var. *roanensis* Forest (CEGL007298) -- has less than 20% shrub cover and an herb stratum dominated by ferns, tall forbs, and sedges.

Related Concepts:

- *Corylus cornuta* Phase (DeLapp 1978) ?
- Deciduous Heath Phase (DeLapp 1978) ?
- High Elevation Red Oak Forest (Herb Subtype) (Schafale 1998b) ?
- High elevation red oak/blueberry-flame azalea forest (CAP pers. comm. 1998) ?
- IA4g. High Elevation Northern Red Oak Forest (Allard 1990) B
- Mixed Fern Phase (DeLapp 1978) B

- Northern Red Oak (55) (USFS 1988) ?
- Northern Red Oak, BR (Pyne 1994) B
- Northern Red Oak: 55 (Eyre 1980) B
- Oligotrophic Forest (Rawinski 1992) B
- Submesic Oak Ridge Forest (Ambrose 1990a) B
- Tall Herb Phase (DeLapp 1978) B

Classification Comments: This community includes forest vegetation with *Quercus rubra* making up at least 75% of the tree canopy and with greater than 20% shrub cover. More than 50% of the total shrub cover is deciduous, although evergreen shrubs may be present. Typical deciduous shrub species in this community include *Rhododendron calendulaceum, Vaccinium simulatum, Vaccinium erythrocarpum, Ilex montana, Gaylussacia ursina, Rubus canadensis, Corylus cornuta*, and *Lyonia ligustrina*.

Two varieties of *Quercus rubra* occur within the range of this community, *Quercus rubra var. ambigua* and *Quercus rubra var. rubra* (Kartesz 1999). Although the two varieties are known to occur together (Rohrer 1983), *Quercus rubra var. ambigua* occurs mostly at elevations greater than 1000 m (3300 feet), while *Quercus rubra var. rubra* occurs at elevations less than 1000 m (3300 feet) (Weakley 1997). The two varieties are based upon morphological differences in the leaves and acorns (Fernald 1950, Coker and Totten 1945); however, studies of foliar flavonoid composition in different *Quercus rubra* populations suggest that varietal distinction may not be warranted (McDougal and Parks 1984). Even though most studies of *Quercus rubra*-dominated vegetation do not distinguish *Quercus rubra* at the varietal level, it is likely, given the elevational range of this community, that the dominant species in this forest is *Quercus rubra var. ambigua*.

Similar vegetation may occur in the Cumberland Mountains (Black Mountain, Cumberland Mountain, Kentucky); for more information see Braun 1950 book and Black Mountain paper (Braun 1940). Kentucky occurrences lack *Gaylussacia ursina, Corylus cornuta, Prenanthes roanensis*, and occur at 3500-3800 feet (M. Evans pers. comm.).

CONSERVATION RANKING & RARE SPECIES

GRank: G4 (1997-12-31): This community is uncommon but not rare. It is secure within its range.
High-ranked species: *Abies fraseri* (G2), *Calystegia catesbeiana* (G3), *Carex roanensis* (G2), *Delphinium exaltatum* (G3), *Euphorbia purpurea* (G3), *Helianthus glaucophyllus* (G3), *Prenanthes roanensis* (G3), *Rhododendron vaseyi* (G3), *Silene ovata* (G2G3)

ELEMENT DISTRIBUTION

Range: This community occurs on most of the major mountain ranges of the southern Appalachians in North Carolina, Tennessee, and Georgia. It may possibly range into Kentucky's Cumberland Mountains and into Virginia and West Virginia.
Subnations: GA, KY?, NC, TN, VA?, WV?
TNC Ecoregions: 51:C, 59:?
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Ambrose 1990a, Braun 1940, Braun 1950, CAP pers. comm. 1998, Coker and Totten 1945, DeLapp 1978, Evans 1991, Evans pers. comm., Eyre 1980, Fernald 1950, Golden 1974, Kartesz 1999, McDougal and Parks 1984, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Pyne 1994, Rawinski 1992, Rohrer 1983, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Stephenson and Adams 1989, USFS 1988, Weakley 1997, Whigham 1969, Whittaker 1956

NORTHERN RED OAK / (MOUNTAIN LAUREL, GREAT RHODODENDRON) / GALAX FOREST

ELEMENT IDENTIFIERS

NVC association: *Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata* Forest
Database Code: CEGL007299
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Quercus rubra* Montane Forest Alliance (A.272)

ELEMENT CONCEPT

Summary: This montane community of the southern Appalachians includes forest vegetation with *Quercus rubra* making up at least 75% of the tree canopy and with greater than 20% shrub cover, which may be continuous to patchy. More than 50% of the total shrub cover is evergreen, although deciduous shrubs may be present. Typical shrub dominants include *Kalmia latifolia, Rhododendron catawbiense*, and *Rhododendron maximum*. The herbaceous stratum is not diverse and is typically very sparse with scattered forbs including *Galax urceolata, Solidago curtisii (= Solidago caesia var. curtisii), Epigaea repens, Dennstaedtia punctilobula, Conopholis americana, Thelypteris noveboracensis, Clintonia umbellulata, Eurybia divaricata (= Aster divaricatus), Dioscorea villosa*. This community occurs on most of the major mountain ranges of the southern Appalachians at elevations of 1070-1525 m

(3500-5000 feet) on ridges and mid to upper slope positions, commonly with southern and southeastern exposures. On exposed sites this community commonly contains, as inclusions, acidic rock outcrop communities and montane shrublands, and may grade into forests dominated by *Tsuga caroliniana, Pinus rigida, Pinus pungens*, and *Quercus prinus*. At higher elevations this forest often occurs adjacent to or grades into forests dominated by *Picea rubens, Abies fraseri*, or northern hardwood species (*Betula alleghaniensis, Fagus grandifolia, Aesculus flava)*.

Environment: This community occurs on most of the major mountain ranges of the southern Appalachians at elevations of 1070-1525 m (3500-5000 feet) on ridges and mid- to upper-slope positions, commonly with south and southeast exposures. DeLapp (1978) found that this community type occurs on most slope aspects but was most commonly found on southeast and south exposures. This community occurs over well-drained soils underlain by Precambrian gneisses, schists, and granites. These soils are classified as Typic, Umbric, or Lithic Dystrochrepts, and Typic Haplumbrepts (Golden 1974). Soils supporting this forest with a mainly evergreen shrub understory are slightly more acidic than *Quercus rubra*-dominated forests with deciduous shrub understories (DeLapp 1978).

Vegetation: Stands of this montane community of the southern Appalachians are dominated by *Quercus rubra* which makes up at least 75% of the tree canopy. Stands typically have greater than 20% shrub cover, which may be continuous to patchy. More than 50% of the total shrub cover is evergreen, although deciduous shrubs may be present. Typical shrub dominants include *Kalmia latifolia, Rhododendron catawbiense*, and *Rhododendron maximum*. The herbaceous stratum is not diverse and is typically very sparse with scattered forbs including *Galax urceolata, Solidago curtisii (= Solidago caesia var. curtisii), Epigaea repens, Dennstaedtia punctilobula, Conopholis americana, Thelypteris noveboracensis, Clintonia umbellulata, Eurybia divaricata (= Aster divaricatus)*, and *Dioscorea villosa*.

Dynamics: The canopy is probably rarely removed completely by natural disturbance however, small canopy gaps are caused by individual tree death. Occurrences of this community on exposed slopes and south and west facing ridges are subject to lightening-caused fires and damage by ice and wind. Damage by ice storms is probably the most common form of natural disturbance.

Quercus rubra reproduction and survival are optimal in canopy gaps with little regeneration under the forest canopy, hence these forests will eventually succeed to forests with mixed canopy composition of *Quercus rubra, Betula alleghaniensis, Acer rubrum*, and *Fagus grandifolia*. Many *Quercus rubra*-dominated stands of today were, prior to the chestnut blight in the 1930s, dominated or codominated by *Castanea dentata* with scattered *Quercus rubra* and *Acer rubrum* in the canopy (Golden 1974). The fungus *Endothia parasitica* eliminated *Castanea dentata* in the upper canopy, subsequently releasing the subcanopy *Quercus rubra*, which eventually resulted in a nearly pure upper canopy of large *Quercus rubra*.

Similar Associations:

- *Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis)* Forest (CEGL007300) -- has greater than 20% shrub cover but with more than 50% of the shrub cover composed of deciduous species.
- *Quercus rubra / Carex pensylvanica - Ageratina altissima var. roanensis* Forest (CEGL007298) -- has less than 20% shrub cover and a herb stratum dominated by ferns, tall forbs, and sedges.
- *Quercus rubra / Rhododendron catawbiense - Rhododendron arborescens* Woodland (CEGL004503) -- occurs at higher elevations, in more extreme environments, sometimes adjacent to CEGL007299.

Related Concepts:

- *Kalmia latifolia* Phase (DeLapp 1978) ?
- *Rhododendron catawbiense* Phase (DeLapp 1978) ?
- *Rhododendron maximum* Phase (DeLapp 1978) ?
- High Elevation Red Oak Forest (Heath Subtype) (Schafale 1998b) ? High elevation red oak /mt. laurel-great laurel forest (CAP pers. comm. 1998) ?
- IA4g. High Elevation Northern Red Oak Forest (Allard 1990) B
- Northern Red Oak (55) (USFS 1988) ?
- Northern Red Oak, BR (Pyne 1994) B
- Northern Red Oak: 55 (Eyre 1980) B
- Submesic Oak Ridge Forest (Ambrose 1990a) B

Classification Comments: This community includes forest vegetation with *Quercus rubra* making up at least 75% of the tree canopy and with greater than 20% shrub cover. More than 50% of the total shrub cover is evergreen, although deciduous shrubs may be present. Typical evergreen shrub species in this community include *Kalmia latifolia, Rhododendron catawbiense*, and *Rhododendron maximum*.

Two varieties of *Quercus rubra* occur within the range of this community, *Quercus rubra var. ambigua* and *Quercus rubra var. rubra* (Kartesz 1999). Although the two varieties are known to occur together (Rohrer 1983), *Quercus rubra var. ambigua* occurs mostly at elevations greater than 1000 m (3300 feet), while *Quercus rubra var. rubra* occurs at elevations less than 1000 m (3300 feet) (Weakley 1997). The two varieties are based upon morphological differences in the leaves and acorns (Fernald 1950, Coker and Totten 1945); however, studies of foliar flavonoid composition in different *Quercus rubra* populations suggest that varietal distinction may not be warranted (McDougal and Parks 1984). Even though most studies of *Quercus rubra*-dominated vegetation do not

distinguish *Quercus rubra* at the varietal level, it is likely, given the elevation range of this community, that the dominant species in this forest is *Quercus rubra var. ambigua*.

Similar *Quercus rubra*-dominated forests occur in the southern Appalachian Mountains. Forests with less than 75% *Quercus rubra* in the canopy are classified in other forest alliances. In Georgia this type occurs on the north side of Rabun Bald, where it grades into *Quercus rubra / Rhododendron catawbiense - Rhododendron arborescens* Woodland (CEGL004503) in more extreme areas.

CONSERVATION RANKING & RARE SPECIES

GRank: G4 (2000-1-4): This community is uncommon but not rare. It is secure within its range.
High-ranked species: *Abies fraseri* (G2), *Calystegia catesbeiana* (G3), *Carex roanensis* (G2), *Euphorbia purpurea* (G3), *Prenanthes roanensis* (G3), *Rhododendron vaseyi* (G3), *Silene ovata* (G2G3), *Vaccinium hirsutum* (G3)

ELEMENT DISTRIBUTION

Range: This community occurs on most of the major mountain ranges of the southern Appalachians in North Carolina, Tennessee, and Georgia. This community could possibly range into South Carolina.
Subnations: GA, NC, SC?, TN
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Ambrose 1990a, CAP pers. comm. 1998, Coker and Totten 1945, DeLapp 1978, Eyre 1980, Fernald 1950, Golden 1974, Kartesz 1999, McDougal and Parks 1984, McNab and Browning 1993, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Pittillo and Smathers 1979, Pyne 1994, Rawinski 1992, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Stephenson and Adams 1989, USFS 1988, Weakley 1997, Whigham 1969, Whittaker 1956

NORTHERN RED OAK / PENNSYLVANIA SEDGE - APPALACHIAN WHITE SNAKEROOT FOREST

ELEMENT IDENTIFIERS

NVC association: *Quercus rubra / Carex pensylvanica - Ageratina altissima* var. *roanensis* Forest
Database Code: CEGL007298
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Quercus rubra* Montane Forest Alliance (A.272)

ELEMENT CONCEPT

Summary: This community includes forest vegetation, with a closed to very open canopy, where *Quercus rubra* makes up at least 75% of the tree canopy and with less than 20% shrub cover. Canopy trees may be gnarled and stunted, especially on ridge crests. Other canopy species may include *Acer rubrum, Crataegus punctata, Crataegus flabellata, Betula alleghaniensis, Betula lenta*, and, at high elevations, *Picea rubens*. An open subcanopy contains canopy species plus *Hamamelis virginiana, Amelanchier arborea, Acer pensylvanicum, Halesia tetraptera*, and *Ilex montana*. Herbaceous cover is dense and diverse, composed of sedges, ferns, and tall herbs, with dominance varying within and between occurrences. Typical herbaceous dominants include *Carex pensylvanica, Ageratina altissima var. roanensis, Thelypteris noveboracensis, Dennstaedtia punctilobula, Eurybia chlorolepis (= Aster chlorolepis), Oclemena acuminata (= Aster acuminatus),* and *Laportea canadensis*. This type occurs on most of the major mountain ranges of the southern Appalachians in North Carolina and Tennessee, at elevations over 1400 m (4500 feet) on broad ridges, and on steep rocky slopes at the heads of coves, often with northern or southeastern aspects. This forest often occurs adjacent to or grades into forests dominated by *Picea rubens, Abies fraseri*, or northern hardwood species (*Betula alleghaniensis, Fagus grandifolia, Aesculus flava)*. In some areas, this community is found adjacent to montane shrublands and grasslands. This community is often referred to as a 'Subalpine Oak Orchard Forest.'
Environment: This community occurs at elevations over 1400 m (4500 feet) on broad ridges and on steep rocky slopes at the heads of coves, often with north or southeast aspects. Occurrences of this community on exposed slopes and south- and west-facing ridges are subject to lightening-caused fires and damage by ice and wind. Damage by ice storms is probably the most common form of natural disturbance. This community occurs over well-drained, loamy soils underlain by Precambrian gneisses, schists, and granites. These soils are classified as Typic, Umbric, or Lithic Dystrochrepts, and Typic Haplumbrepts (Golden 1974). Soils supporting this community tend to have relatively high base status.
Vegetation: This community includes forest vegetation, with a closed to very open canopy, where *Quercus rubra* makes up at least 75% of the tree canopy and with less than 20% shrub cover. Canopy trees may be gnarled and stunted, especially on ridge crests. Other canopy species may include *Acer rubrum, Crataegus punctata, Crataegus flabellata, Betula alleghaniensis, Betula lenta*, and, at high elevations, *Picea rubens*. An open subcanopy contains canopy species plus *Hamamelis virginiana, Amelanchier arborea, Acer pensylvanicum, Halesia tetraptera*, and *Ilex montana*. Herbaceous cover is dense and diverse, composed of sedges, ferns, and tall herbs, with dominance varying within and among occurrences. Typical herbaceous dominants include *Carex pensylvanica, Ageratina*

altissima var. roanensis, Thelypteris noveboracensis, Dennstaedtia punctilobula, Eurybia chlorolepis (= Aster chlorolepis), Oclemena acuminata (= Aster acuminatus), and *Laportea canadensis*.

Dynamics: The canopy is probably rarely removed completely by natural disturbance; however, small canopy gaps are caused by individual tree death. Occurrences of this community on exposed slopes and south- and west-facing ridges are subject to lightening-caused fires and damage by ice and wind. Damage by ice storms is probably the most common form of natural disturbance.

Quercus rubra reproduction and survival is optimal in canopy gaps with little regeneration under the forest canopy, hence these forests will eventually succeed to forests with mixed canopy composition of *Quercus rubra, Betula alleghaniensis, Acer rubrum*, and *Fagus grandifolia*. Many *Quercus rubra*-dominated stands of today were, prior to the chestnut blight in the 1930s, dominated or codominated by *Castanea dentata* with scattered *Quercus rubra* and *Acer rubrum* in the canopy (Golden 1974). The fungus *Endothia parasitica* eliminated *Castanea dentata* in the upper canopy, subsequently releasing the subcanopy *Quercus rubra*, which eventually resulted in a nearly pure upper canopy of large *Quercus rubra*.

Similar Associations:

- *Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata* Forest (CEGL007299) -- has greater than 20% shrub cover but with more than 50% of the shrub cover composed of evergreen species.
- *Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis)* Forest (CEGL007300) -- has greater than 20% shrub cover but with more than 50% of the shrub cover composed of deciduous species.

Related Concepts:

- High Elevation Red Oak Forest (Orchard Forest Subtype) (Schafale 1998b) ?
- High elevation red oak/Pennsylvania sedge forest (CAP pers. comm. 1998) ?
- IA4g. High Elevation Northern Red Oak Forest (Allard 1990) B
- Mixed Fern Phase, Tall Herb Phase (DeLapp 1978) B
- Northern Red Oak (55) (USFS 1988) ?
- Northern Red Oak, BR (Pyne 1994) B
- Northern Red Oak: 55 (Eyre 1980) B

Classification Comments: This community includes forest vegetation with *Quercus rubra* making up at least 75% of the tree canopy and with less than 20% shrub cover. Herbaceous stratum dominance varies within and between occurrences but is composed of sedges, ferns, and tall herbs. Typical herbaceous dominants include *Carex pensylvanica, Ageratina altissima var. roanensis, Thelypteris noveboracensis, Dennstaedtia punctilobula, Eurybia chlorolepis, Oclemena acuminata*, and *Laportea canadensis*.

Two varieties of *Quercus rubra* occur within the range of this community, *Quercus rubra var. ambigua* and *Quercus rubra var. rubra* (Kartesz 1999). Although the two varieties are known to occur together (Rohrer 1983), *Quercus rubra var. ambigua* occurs mostly at elevations greater than 1000 m (3300 feet), while *Quercus rubra var. rubra* occurs at elevations less than 1000 m (3300 feet) (Weakley 1997). The two varieties are based upon morphological differences in the leaves and acorns (Fernald 1950, Coker and Totten 1945); however, studies of foliar flavonoid composition in different *Quercus rubra* populations suggest that varietal distinction may not be warranted (McDougal and Parks 1984). Even though most studies of *Quercus rubra*-dominated vegetation do not distinguish *Quercus rubra* at the varietal level, it is likely, given the elevational range of this community, that the dominant species in this forest is *Quercus rubra var. ambigua*.

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (1998-4-30): This community is relatively secure within its range, but has a naturally restricted habitat. Red oak decline is affecting occurrences of this community; fire may be needed for stand establishment.

High-ranked species: *Abies fraseri* (G2), *Calystegia catesbeiana* (G3), *Carex roanensis* (G2), *Euphorbia purpurea* (G3), *Gentiana austromontana* (G3), *Prenanthes roanensis* (G3), *Rhododendron vaseyi* (G3), *Silene ovata* (G2G3)

ELEMENT DISTRIBUTION

Range:

Subnations: NC, TN, VA

TNC Ecoregions: 50:P, 51:C, 59:?

USFS Ecoregions: M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Cherokee?, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, CAP pers. comm. 1998, Coker and Totten 1945, DeLapp 1978, Eyre 1980, Fernald 1950, Fleming et al. 2001, Golden 1974, Kartesz 1999, McDougal and Parks 1984, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Pyne 1994, Rohrer 1983, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., USFS 1988, Weakley 1980, Weakley 1997, Whittaker 1956

YELLOW BIRCH - AMERICAN BEECH - YELLOW BUCKEYE / HOBBLEBUSH / APPALACHIAN HEARTLEAF ASTER - FANCY FERN FOREST

ELEMENT IDENTIFIERS

NVC association: *Betula alleghaniensis - Fagus grandifolia - Aesculus flava / Viburnum lantanoides / Eurybia chlorolepis - Dryopteris intermedia* Forest
Database Code: CEGL007285
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Betula alleghaniensis - Fagus grandifolia - Aesculus flava* Forest Alliance (A.266)

ELEMENT CONCEPT

Summary: This is a broadly defined association meant to cover typical 'northern hardwood forests' over 4000 feet in elevation of the Southern Blue Ridge. This deciduous forest association occurs on exposed landforms such as open, north-facing slopes. The canopy is dominated by various mixtures of *Betula alleghaniensis, Fagus grandifolia,* and sometimes *Aesculus flava*. Other canopy trees may be present but are of minor importance (e.g., *Acer saccharum, Prunus serotina, Quercus rubra, Halesia tetraptera var. monticola*). Common subcanopy trees include *Acer pensylvanicum, Acer spicatum,* and *Acer saccharum*. A shrub stratum may be absent to moderately dense. *Viburnum lantanoides* is a common shrub. Other possible shrub species include, but are not limited to, *Hydrangea arborescens, Ilex montana, Rubus canadensis,* and *Sambucus racemosa var. racemosa (= Sambucus racemosa var. pubens).* Herbaceous cover can be dominated by sedges or ferns or be comprised of a mixture of sedges, ferns, and other forbs. Typical herbaceous species include *Ageratina altissima var. roanensis, Eurybia chlorolepis (= Aster chlorolepis), Athyrium filix-femina ssp. asplenioides (= Athyrium asplenioides), Carex pensylvanica, Dryopteris intermedia, Solidago curtisii (= Solidago caesia var. curtisii), Stellaria pubera, Stellaria corei,* and *Streptopus lanceolatus var. roseus (= Streptopus roseus).*
Environment: This deciduous forest association occurs at high elevations (typically over 1220 m [4000 feet]) in the Southern Blue Ridge, on exposed landforms such as open, north-facing slopes. Virginia examples of the type occur at elevations from 1100-1585 m (3600-5200 feet). Mean elevation of 28 plot-sampled Virginia stands is 1340 m (4400 feet). Habitats include a wide range of slope positions and aspects. Surface cover of bedrock and boulders is typically less than 25%, but occasionally higher. Soil samples collected from plot-sampling sites are consistently extremely acidic (mean pH = 3.8) with low base status.
Vegetation: Over most of this community's range, the canopy is dominated by various mixtures of *Betula alleghaniensis, Fagus grandifolia* and, less commonly, *Aesculus flava*. Other canopy trees, including *Acer saccharum, Prunus serotina, Quercus rubra,* and *Halesia tetraptera var. monticola,* may be present but are of minor importance. Common subcanopy trees include *Acer pensylvanicum, Acer spicatum,* and *Acer saccharum*. The shrub stratum may vary from nearly undeveloped to moderately dense. *Viburnum lantanoides* is a common shrub throughout the range. Other potential shrub components include, but are not limited to, *Hydrangea arborescens, Ilex montana, Rubus canadensis,* and *Sambucus racemosa (= Sambucus pubens).* Herbaceous cover is variably dominated by sedges, ferns, and forbs. Typical herbaceous species include *Ageratina altissima var. roanensis, Eurybia chlorolepis (= Aster chlorolepis), Athyrium filix-femina ssp. asplenioides (= Athyrium asplenioides), Carex pensylvanica, Dryopteris intermedia, Solidago curtisii, Stellaria pubera, Stellaria corei,* and *Streptopus lanceolatus var. roseus (= Streptopus roseus).*

Dynamics: No information
Similar Associations:
- *Aesculus flava - Betula alleghaniensis - Acer saccharum / Acer spicatum / Caulophyllum thalictroides - Laportea canadensis* Forest (CEGL004973)

Related Concepts:
- *Acer saccharum - Aesculus flava - Betula alleghaniensis / Athyrium filix-femina ssp. asplenioides - Ageratina altissima var. roanensis* Forest (Fleming and Coulling 2001) F
- *Fagus grandifolia - Betula alleghaniensis - Acer saccharum / Viburnum lantanoides / Carex lucorum var. austrolucorum - Viola rotundifolia* Forest (Fleming and Coulling 2001) F
- IA4e. Southern Appalachian Northern Hardwoods Forest (Allard 1990) B
- Northern Hardwood Forest (Typic Subtype) (Schafale 1998b) ?
- Northern Hardwoods Community: Beech - Maple Subtype (Rheinhardt and Ware 1984) ?
- Sugar Maple - Beech - Yellow Birch: 25 (Eyre 1980) B

Classification Comments: High dominance by *Tilia* and *Fraxinus* in stands of this association may be an artifact of disturbance (K. Patterson pers. comm.).

CONSERVATION RANKING & RARE SPECIES

GRank: G3G4 (1998-12-14): This is a broadly defined association meant to cover typical "northern hardwood forests" of the Southern Blue Ridge. If needed, more subassociations may be recognized based on differences related to geology and other environmental variables. Even if broadly defined, this type is limited in distribution to western North Carolina, eastern Tennessee, and southwestern Virginia, and in extent by its requirement for higher elevations (typically over 1220 m [4000 feet]). Most of the area of this community type is on public lands administered by the U.S. Forest Service (Pisgah, Nantahala, Cherokee, and Jefferson national forests) and National Park Service (Great Smoky Mountains National Park and Blue Ridge Parkway). Most sites for this community

are relatively secure from most threats. Exotics plants and animals, such as garlic mustard (*Alliaria petiolata*) and the gypsy moth may represent significant threats to this community.
High-ranked species: *Abies fraseri* (G2), *Carex manhartii* (G3), *Gentiana austromontana* (G3), *Hypericum graveolens* (G3), *Hypericum mitchellianum* (G3), *Ilex collina* (G3), *Prenanthes roanensis* (G3), *Rugelia nudicaulis* (G3), *Solidago glomerata* (G3)

ELEMENT DISTRIBUTION

Range: The type is nearly endemic to high elevations of the Southern Blue Ridge in eastern Tennessee, western North Carolina, and southwestern Virginia. In the Virginia Blue Ridge, it is prevalent in the Mount Rogers - Whitetop Mountain area and at high elevations of the Iron Mountains. Local outliers also occur at the highest elevations of Clinch Mountain in the adjacent Ridge and Valley province.
Subnations: NC, TN, VA
TNC Ecoregions: 51:C, 59:P
USFS Ecoregions: M221Da:CCP, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Cherokee, Jefferson, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Brown 1941, Eyre 1980, Fleming and Coulling 2001, Fleming et al. 2001, McLeod 1988, NatureServe Ecology - Southeastern U.S. unpubl. data, Newell et al. 1997, Peet et al. unpubl. data 2002, Rheinhardt and Ware 1984, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

YELLOW BIRCH / SKUNK CURRANT / APPALACHIAN ROCKCAP FERN FOREST

ELEMENT IDENTIFIERS

NVC association: *Betula alleghaniensis / Ribes glandulosum / Polypodium appalachianum* Forest
Database Code: CEGL006124
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Betula alleghaniensis - Fagus grandifolia - Aesculus flava* Forest Alliance (A.266)

ELEMENT CONCEPT

Summary: This association includes high-elevation boulderfield forests of the southern Appalachians, strongly dominated by *Betula alleghaniensis*, with few or no other species in the canopy, and with other species indicative of high elevations. This community occurs in a cool, humid climate, on steep, rocky, northwest- to northeast-facing, middle to upper concave slopes, or in saddles between ridges, at elevations of 1370-1615 m (4500-5300 feet). It is known from the high elevations of the Blue Ridge from West Virginia south to eastern Tennessee and western North Carolina. This forest is distinguished by a closed to somewhat open canopy dominated by *Betula alleghaniensis*, occurring over angular rocks (0.25-1 m diameter) covered by thin soil, lichens, mosses or vines. The rocks may be almost totally covered by moss. *Betula alleghaniensis* in the canopy are often stunted and gnarled, with roots that may have grown to encircle the boulders. Tree density is typically less than that of the surrounding forests. Other species that may form a minor canopy component include *Aesculus flava, Prunus pensylvanica, Sorbus americana, Acer spicatum, Picea rubens, Tilia americana var. heterophylla, Sambucus racemosa var. racemosa (= Sambucus racemosa var. pubens)*, or *Quercus rubra*. Tree windthrow is common, leaving patches of exposed mineral soil and gaps in the canopy. The shrub density is typically high but may vary between occurrences. Herbaceous cover is generally sparse because of thin, rocky soil, but herbs and mosses may cover the rocks and boulders. Characteristic species include, in the herb stratum, *Oclemena acuminata (= Aster acuminatus), Eurybia chlorolepis (= Aster chlorolepis), Aconitum reclinatum, Cardamine clematitis, Carex aestivalis, Actaea podocarpa (= Cimicifuga americana), Claytonia caroliniana, Clintonia borealis, Dryopteris campyloptera, Dryopteris marginalis, Huperzia lucidula, Oxalis montana, Polypodium appalachianum, Streptopus amplexifolius*, and in the shrub stratum, *Acer pensylvanicum, Acer spicatum, Amelanchier arborea var. austromontana, Diervilla sessilifolia, Hydrangea arborescens, Ilex montana, Lonicera canadensis, Ribes glandulosum, Ribes rotundifolium, Rubus canadensis, Sambucus racemosa var. racemosa, Vaccinium erythrocarpum*, and *Viburnum lantanoides*. Seepage areas are common, producing wet microhabitats with unique species assemblages (*Chelone lyonii, Chrysosplenium americanum, Circaea alpina, Rudbeckia laciniata, Impatiens pallida*, and *Monarda didyma*). This association is distinguished by being strongly dominated by *Betula alleghaniensis*, with few or no other species in the canopy, and with other species indicative of high elevations (e.g., *Abies fraseri, Dryopteris campyloptera, Ribes glandulosum, Rugelia nudicaulis, Streptopus amplexifolius, Prunus pensylvanica*, and *Sorbus americana*. On less extreme sites, generally at lower elevations in the Blue Ridge and adjacent montane ecoregions, a similar boulderfield forest is *Betula alleghaniensis / Acer spicatum / Hydrangea arborescens - Ribes cynosbati / Dryopteris marginalis* Forest (CEGL004982). Similar *Betula alleghaniensis*-dominated forests occur on glaciated rocky slopes in the upper mid-Atlantic and in the northeastern United States. The *Betula alleghaniensis*-dominated periglacial boulderfields of the southern Appalachian Mountains are distinguished from the northern forests by the occurrence of southern Appalachian endemic species, better developed shrub layers and slightly less species diversity.
Environment: This community occurs in rocky habitats with cool, humid microclimates. Typical sites are steep, boulder-strewn slopes; northwest- to northeast-facing, middle to upper concave slopes; or in saddles between ridges. Elevations typically range from 1370-1615 m (4500-5300 feet), but may vary somewhat. Surface substrate is characterized by angular boulders (0.25-1 m diameter)

derived from various bedrock types and covered by thin soil, lichens, mosses or vines. The rocks may be almost totally covered by moss. Seepage areas are frequent, producing wet microhabitats with unique species assemblages. Extreme winter temperatures, high winds, and ice storms periodically affect these forests.

Mean elevation of plot-sampled Virginia sites is 1450 m (4760 feet) and aspect ranges from northwest to north. Mean surface cover of exposed bedrock and boulders is 42% and mean cover of bryophytes and lichens is 37%. Soil samples collected from these sites are extremely acidic (mean pH = 3.5), with high organic matter content (mean = 40%) and low base saturation (mean = 10%).
Vegetation: Stands of this association are distinguished by a closed to somewhat open canopy overwhelmingly dominated by *Betula alleghaniensis*. Canopy trees are often stunted and gnarled, with roots that have grown to encircle the boulders. Tree density is typically less than that of the surrounding forests. Minor canopy associates include *Aesculus flava, Prunus pensylvanica, Sorbus americana, Acer spicatum, Picea rubens, Tilia americana var. heterophylla*, and *Quercus rubra*. Tree windthrow is common, creating canopy gaps and patches of exposed mineral soil. Shrub density is typically high but varies between occurrences. Characteristic shrubs are *Acer pensylvanicum, Acer spicatum, Amelanchier arborea var. austromontana, Diervilla sessilifolia, Hydrangea arborescens, Ilex montana, Lonicera canadensis, Ribes glandulosum, Ribes rotundifolium, Rubus canadensis, Sambucus racemosa var. racemosa (= var. pubens), Vaccinium erythrocarpum*, and *Viburnum lantanoides*. Herbaceous cover is generally sparse because of the rocky substrate, but specially adapted herbs and mosses may cover the rocks and boulders. Characteristic herbs over the range of this community include *Oclemena acuminata (= Aster acuminatus), Eurybia chlorolepis (= Aster chlorolepis), Aconitum reclinatum, Cardamine clematitis, Carex aestivalis, Actaea podocarpa (= Cimicifuga americana), Claytonia caroliniana, Clintonia borealis, Dryopteris campyloptera, Dryopteris marginalis, Huperzia lucidula, Oxalis montana, Polypodium appalachianum*, and *Streptopus amplexifolius*. Local seepage areas may support *Chelone lyonii, Chrysosplenium americanum, Circaea alpina, Rudbeckia laciniata, Impatiens pallida*, and *Monarda didyma*.

Virginia occurrences of this association appear to be similar to those of the Blue Ridge further south. In plot-sampled stands, *Acer spicatum, Acer pensylvanicum, Viburnum lantanoides, Ribes glandulosum*, and *Rubus canadensis* are the most constant and abundant lower woody species, while *Oclemena acuminata* and *Dryopteris intermedia* are the most important herbs. Mean species richness in these samples is 21 taxa per 400 m2.
Dynamics: Windthrow of trees and damage to the canopy caused by lightning strikes and ice storms are common phenomena in boulderfields. The ice-fractured boulderfields that characterize this community in the upper elevations of the Southern Appalachians are believed to be remnants of Pleistocene periglacial activity. During this time, the high elevations (1120-1525 m; 4000-5000 feet) of the Southern Appalachians were covered by treeless snow fields and exposed rock. Frost and ice action resulted in the accumulation of boulders that persist on the upper slopes (King and Stupka 1950). Farther north, such as in Pennsylvania, boulderfields are on flat surfaces and are the result of glacial deposition (Allard 1984).

Betula alleghaniensis is well-adapted to the environmental dynamics of boulderfields and can perpetuate because it takes advantage of canopy gaps formed during periodic natural disturbances. This species produces a large number of seeds and is able to germinate on logs and rocks in a minimum amount of soil. The roots of trees develop to form false trunks that encircle the rocks. It is possible that over time, due to soil formation and weathering, these forests may succeed to forests dominated by a mixture of northern hardwood species (*Betula alleghaniensis, Fagus grandifolia, Acer saccharum, Aesculus flava*). However, many *Betula alleghaniensis* forests and the boulderfields on which they occur appear fairly stable. Chafin and Jones (1989) found that despite large trees growing on top of boulders, there is no evidence of rock shattering.
Similar Associations:
- *Betula alleghaniensis - Tilia americana var. heterophylla / Acer spicatum / Ribes cynosbati / Dryopteris marginalis* Forest (CEGL004982)
- *Betula alleghaniensis / Sorbus americana - Acer spicatum / Polypodium appalachianum* Forest (CEGL008504)

Related Concepts:
- *Betula alleghaniensis / Acer spicatum / Viburnum lantanoides - Ribes glandulosum* Forest (Fleming and Coulling 2001) ?
- Boulderfield Forest (Ambrose 1990a) ?
- Hemlock - Yellow Birch: 24 (Eyre 1980) B
- High Elevation Birch Boulderfield Forest (Schafale 1998b) ?
- IA4c. Yellow Birch Boulderfield Forest (Allard 1990) B
- Oligotrophic Forest (Rawinski 1992) B
- Red Spruce - Yellow Birch: 30 (Eyre 1980) B
- Sugar Maple - Beech - Yellow Birch: 81 (Eyre 1980) B
- Yellow Birch Community: Boulder Field Subtype (Rheinhardt and Ware 1984) ?
- Yellow Birch, BR (Pyne 1994) B
- Yellow birch-skunk current/polypody forest (CAP pers. comm. 1998) ?

Classification Comments: Unlike many other forest types in the Southern Appalachians, this community has not been threatened by logging because of the stunted nature of the trees and the inaccessibility of boulderfields to loggers.

This association is similar to *Betula alleghaniensis / Sorbus americana - Acer spicatum / Polypodium appalachianum* Forest (CEGL008504) of the Central Appalachians, but appears to occupy more mesic boulderfields and contains a number of Southern Appalachian species (e.g., *Ribes glandulosum, Eurybia chlorolepis, Heuchera villosa, Abies fraseri, Prenanthes roanensis, Vaccinium erythrocarpum, Aesculus flava*, etc.) that are generally absent from CEGL008504.

CONSERVATION RANKING & RARE SPECIES

GRank: G2G3 (2003-10-27): This community is scattered throughout the high elevations of the Southern Blue Ridge with highly localized outliers also found at the highest elevations of Clinch Mountain in the adjacent Ridge and Valley province. Examples are further confined to boulder strewn substrates which are relatively uncommon. Unlike many other forest types in the southern Appalachians, this community has been less impacted by logging due to the stunted nature of the trees and the relative inaccessibility of these boulderfield sites. As of 2003, North Carolina has 12 (principal) Element Occurrences, and given their proportion of the total occurrences and their protection status, a rank of G2G3 is probably justified (M. Schafale pers. comm.).
High-ranked species: *Abies fraseri* (G2), *Aconitum reclinatum* (G3), *Cardamine clematitis* (G2G3), *Geum geniculatum* (G2), *Lilium grayi* (G3), *Prenanthes roanensis* (G3), *Prosartes maculata* (G3G4), *Stachys clingmanii* (G2Q)

ELEMENT DISTRIBUTION

Range: This community type ranges at high elevations of the Blue Ridge from eastern Tennessee and western North Carolina north to southwestern Virginia. In the southern Virginia Blue Ridge, it occurs frequently on steep, north-facing slopes of Mount Rogers, Whitetop, and Pine Mountain. Small, highly localized outliers also occur at the highest elevations of Clinch Mountain in the adjacent Ridge and Valley province.
Subnations: GA?, NC, TN, VA, WV
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Aa:CCC, M221B:C?, M221C:C?, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Cherokee, Jefferson, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1984, Allard 1990, Ambrose 1990a, CAP pers. comm. 1998, Chafin and Jones 1989, Dellinger unpubl. data 1992, Eyre 1980, Fleming and Coulling 2001, Fleming et al. 2001, Golden 1981, King and Stupka 1950, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Pittillo and Smathers 1979, Pyne 1994, Rawinski 1992, Rheinhardt and Ware 1984, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Southeastern Ecology Working Group n.d., Stamper 1976, Wharton 1978, Wood 1975

YELLOW BUCKEYE - YELLOW BIRCH - SUGAR MAPLE / MOUNTAIN MAPLE / BLUE COHOSH - WOOD NETTLE FOREST

ELEMENT IDENTIFIERS

NVC association: *Aesculus flava - Betula alleghaniensis - Acer saccharum / Acer spicatum / Caulophyllum thalictroides - Laportea canadensis* Forest
Database Code: CEGL004973
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Betula alleghaniensis - Fagus grandifolia - Aesculus flava* Forest Alliance (A.266)

ELEMENT CONCEPT

Summary: This association includes forests on high but sheltered slopes in the Southern Blue Ridge, with canopies dominated by species typically known as northern hardwoods (*Aesculus flava, Fagus grandifolia, Betula alleghaniensis, Acer saccharum*), but with a rich herbaceous flora dominated by forbs and more typical of lower elevation 'cove' forests. This forest occurs on deep, rocky soils on the upper slopes of coves, and on other protected landforms, at elevations of 1070-1525 m (3500-5000 feet), and can be associated with mafic substrates. Other canopy species can include *Tilia americana var. heterophylla* and *Quercus rubra*. In the Great Smoky Mountains, *Halesia tetraptera var. monticola* is an important canopy component. The shrub stratum is typically open, but small trees such as *Acer spicatum, Acer pensylvanicum*, and *Amelanchier laevis* are common. Herbaceous cover can be lush, quite diverse, and is typically dominated and characterized by large forbs such as *Caulophyllum thalictroides, Actaea racemosa (= Cimicifuga racemosa), Collinsonia canadensis, Ageratina altissima var. roanensis, Laportea canadensis, Campanulastrum americanum*, and *Tiarella cordifolia*. The canopy of these forests always has a component of *Betula alleghaniensis* and/or *Fagus grandifolia*, occurring with *Acer saccharum*, over a lush and diverse herbaceous stratum.
Environment: This association includes forests on high but sheltered slopes in the Southern Blue Ridge. This forest occurs on deep, rocky soils on the upper slopes of coves, and on other protected landforms, at elevations of 1070-1525 m (3500-5000 feet), and can be associated with mafic substrates.
Vegetation: The canopy of these forests always has a component of *Betula alleghaniensis* and/or *Fagus grandifolia*, occurring with *Acer saccharum*, over a lush and diverse herbaceous stratum. The canopies of stands are dominated by species typically known as 'northern hardwoods' (*Aesculus flava, Fagus grandifolia, Betula alleghaniensis, Acer saccharum*), but with a rich herbaceous flora dominated by forbs and more typical of lower elevation 'cove' forests. Other canopy species can include *Tilia americana var.*

heterophylla and *Quercus rubra*. In the Great Smoky Mountains, *Halesia tetraptera var. monticola* is an important canopy component. The shrub stratum is typically open, but small trees such as *Acer spicatum, Acer pensylvanicum*, and *Amelanchier laevis* are common. Herbaceous cover can be lush, quite diverse, and is typically dominated and characterized by large forbs such as *Caulophyllum thalictroides, Actaea racemosa (= Cimicifuga racemosa), Collinsonia canadensis, Ageratina altissima var. roanensis, Laportea canadensis, Campanulastrum americanum*, and *Tiarella cordifolia*.

Dynamics: No information

Similar Associations:

- *Aesculus flava - Acer saccharum - (Fraxinus americana, Tilia americana var. heterophylla) / Hydrophyllum canadense - Solidago flexicaulis* Forest (CEGL007695)

Related Concepts:

- Northern Hardwood Forest (Rich Subtype) (Schafale 1998b) ?

Classification Comments: These forests occur above the elevational limit of some of the typical "cove" canopy species [see I.B.2.N.a *Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235)] such as *Fraxinus americana, Liriodendron tulipifera*, and *Carya cordiformis*.

CONSERVATION RANKING & RARE SPECIES

GRank: G3 (2003-10-27): This community is naturally uncommon due to specific habitat requirements and a restricted geographic range. It only occurs at moderate to high elevations, on protected landforms, in the Southern Blue Ridge. Most documented occurrences are of moderate to high quality, although destructive silvicultural practices could threaten remaining occurrences. The European gypsy moth (*Lymantria dispar*) is predicted to spread within the range of this community by 2005 and poses a threat to this community. There are potential difficulties in assigning plots or occurrences to this association (Southern Appalachian Northern Hardwood Forest [Rich Type] (CEGL004973)) versus Southern Appalachian Cove Forest (Rich Montane Type) (CEGL007695). The current (2003) understanding of the differences would dictate leaving the rank at G3.

High-ranked species: *Aconitum reclinatum* (G3), *Gentiana austromontana* (G3), *Geum geniculatum* (G2), *Lilium grayi* (G3)

ELEMENT DISTRIBUTION

Range: This community is a regional endemic, found only in the high-mountain areas of the Southern Blue Ridge, south through western North Carolina, eastern Tennessee, and northeastern Georgia.

Subnations: GA, NC, TN

TNC Ecoregions: 51:C

USFS Ecoregions: M221Db:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

References: Major et al. 1999, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

CENTRAL AND SOUTHERN APPALACHIAN SPRUCE-FIR FOREST

FRASER FIR / (CATAWBA RHODODENDRON, CAROLINA RHODODENDRON) FOREST

ELEMENT IDENTIFIERS

NVC association: *Abies fraseri / (Rhododendron catawbiense, Rhododendron carolinianum)* Forest

Database Code: CEGL006308

Formation: Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c)

Alliance: *Abies fraseri - Picea rubens* Forest Alliance (A.136)

ELEMENT CONCEPT

Summary: This community occurs as island-like stands in the southern Appalachian Mountains of eastern Tennessee, and western North Carolina. It occurs on rocky spurs, steep ridges, and south-facing slopes above 1830 m (6000 feet) elevation, often adjacent to montane shrublands. This forest has a canopy strongly dominated by *Abies fraseri*, occurring over a shrub stratum dominated by evergreen species, typically *Rhododendron catawbiense*, *Rhododendron carolinianum*, or *Rhododendron maximum*. *Abies fraseri* in the canopy are 17-23 cm in diameter and 10-11 m tall, giving these forests a stunted appearance. Other species that may occur with low coverage in the canopy or subcanopy are *Picea rubens, Sorbus americana, Betula alleghaniensis, Prunus pensylvanica*. Herbaceous cover is typically sparse. On steep, rocky, northerly slopes, coverage by mosses, liverworts, and lichens can approach 100%. Bryophyte species include *Hylocomium splendens, Ptilium crista-castrensis, Sphagnum* spp., and *Polytrichum ohioense*. This forest may grade into forests dominated by *Picea rubens* and *Abies fraseri*, montane grasslands, high-elevation shrublands, or high-elevation rock outcrop communities.

Environment: These forests occur on rocky spurs, steep ridges, and south-facing slopes above 6000 feet (1830 m) elevation, often adjacent to montane shrublands. These forests occur on all topographic positions except the steepest rocky cliffs of the highest

summits. Soils that support this community are classified as Inceptisols and are shallow, rocky, and often have a thick organic layer. Moisture regimes are mesic to wet, due to high rainfall, abundant cloud cover, fog deposition, and low temperatures. This forest may grade into forests dominated by *Picea rubens* and *Abies fraseri*, montane grasslands, high elevation shrublands, or high elevation rock outcrop communities.

Vegetation: This needle-leaved evergreen forest has greater than 75% canopy coverage by *Abies fraseri*. *Abies fraseri* in the canopy are 17-23 cm in diameter and 10-11 m tall, giving these forests a stunted appearance. Other species that may occur with low coverage in the canopy or subcanopy are *Picea rubens, Sorbus americana, Betula alleghaniensis, Prunus pensylvanica*. The tall-shrub stratum is dominated by evergreen species and, although there may be considerable variation, is usually quite dense. Typical shrub dominants include *Rhododendron catawbiense, Rhododendron carolinianum*, and *Rhododendron maximum*. Herbaceous cover is typically sparse. On steep, rocky, northerly slopes, coverage by mosses, liverworts, and lichens can approach 100%. Bryophyte species include *Hylocomium splendens, Ptilium crista-castrensis, Sphagnum* spp., and *Polytrichum ohioense*.

Dynamics: This community is affected by debris avalanches, wind disturbance and lightning fire. Because of the shallow soils and extreme wind exposure, this forest is susceptible to large blowdowns. Logging and damage by the Balsam Woolly Adelgid has greatly increased the effect of natural windfall.

This community is a late-successional type, but it is subject to repeated disturbance. *Prunus pensylvanica* is a dominant species immediately following disturbance. In later successional stages, *Betula alleghaniensis* increases in dominance. In areas where mature *Abies fraseri* has been lost to woolly adelgid infestation, thickets of *Rubus* spp., *Abies fraseri* seedlings and saplings, *Betula alleghaniensis*, and *Sorbus americana* are dominant. Over time, *Picea rubens, Betula alleghaniensis, Abies fraseri, Acer spicatum*, and *Sorbus americana* increase in the tree layer, while *Abies fraseri, Menziesia pilosa, Rubus idaeus ssp. strigosus*, and *Sambucus racemosa* increase in the shrub layer (White et al. 1993). Succession is especially slow after severe disturbance such as logging and slash fires. The most severely disturbed sites are predominately *Prunus pensylvanica* and *Rubus* spp. and may remain in a non-forested stage of succession for 60 years or more.

Similar Associations:

- *Abies fraseri / Viburnum lantanoides / Dryopteris campyloptera - Oxalis montana / Hylocomium splendens* Forest (CEGL006049) -- is a similar forest with a canopy dominated by *Abies fraseri* but lacking an evergreen-dominated shrub stratum.
- *Picea rubens - (Abies fraseri) / (Rhododendron catawbiense, Rhododendron maximum)* Forest (CEGL007130) -- *Abies fraseri* can codominate with *Picea rubens*.
- *Picea rubens - (Abies fraseri) / Vaccinium erythrocarpum / Oxalis montana - Dryopteris campyloptera / Hylocomium splendens* Forest (CEGL007131) -- *Abies fraseri* can codominate with *Picea rubens*.

Related Concepts:

- Fraser Fir (6) (USFS 1988) ?
- Fraser Fir Forest (Rhododendron Subtype) (Schafale 1998b) ?
- Fraser Fir Forest, Evergreen Shrub Type (Pyne 1994) ?
- IA4b. Fraser Fir Forest (Allard 1990) B
- Red Spruce - Fraser Fir: 34 (Eyre 1980) B

Classification Comments:

CONSERVATION RANKING & RARE SPECIES

GRank: G1 (2000-1-4): This community has a naturally restricted distribution, occurring only on the highest elevation peaks of the southern Appalachian Mountains. It exists in only a small portion of its original range due to the impact of early 20th century, post-logging fires and the ongoing outbreak of the Balsam Woolly Adelgid, an exotic pest that infests and kills mature *Abies fraseri*. Well-developed, undisturbed examples of this community are extremely rare. Most remaining examples of this community exist as patches of dense young trees or dense *Rubus* thickets beneath forests of dead snags or tangles of fallen logs.

High-ranked species: *Abies fraseri* (G2), *Bazzania nudicaulis* (G2G3), *Brachydontium trichodes* (G2G4), *Cardamine clematitis* (G2G3), *Glyceria nubigena* (G2), *Leptodontium excelsum* (G2), *Microhexura montivaga* (G1), *Plethodon welleri* (G3), *Rhododendron vaseyi* (G3), *Solidago glomerata* (G3), *Sphenolobopsis pearsonii* (G2?), *Stachys clingmanii* (G2Q)

ELEMENT DISTRIBUTION

Range: This community occurs as island-like stands on the highest areas, above 1830 m (6000 feet), in the southern Appalachian Mountains of eastern Tennessee, western North Carolina, and southwestern Virginia. It is extremely limited in distribution and is restricted to the following mountain areas: Great Smoky Mountains, Black Mountains, Balsam Mountains, Plott Balsams, Grandfather Mountain, and Mount Rogers (Ramseur 1960).

Subnations: NC, TN

TNC Ecoregions: 51:C

USFS Ecoregions: M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Anderson et al. 1990, Braun 1950, Brown 1941, Bruck 1988, Busing et al. 1988, Crandall 1958, Davis 1930, Eyre 1980, McLeod 1988, NCNHP 1993, Nicholas et al. 1992, Oosting and Billings 1951, Pyne 1994, Ramseur 1960, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., USFS 1988, Weakley 1993, White 1984a, White 1984b, White and Pickett 1985, White et al. 1993, Whittaker 1956

FRASER FIR / HOBBLEBUSH / MOUNTAIN WOODFERN - COMMON WOOD SORREL / STAIRSTEP MOSS FOREST

ELEMENT IDENTIFIERS

NVC association: *Abies fraseri / Viburnum lantanoides / Dryopteris campyloptera - Oxalis montana / Hylocomium splendens* Forest
Database Code: CEGL006049
Formation: Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c)
Alliance: *Abies fraseri - Picea rubens* Forest Alliance (A.136)

ELEMENT CONCEPT

Summary: This community occurs as island-like stands in the southern Appalachian Mountains. It occurs on steep ridges and mesic, north-facing slopes above 1830 m (6000 feet) elevation, although it may extend lower on some sites. Occurrences of this community have shallow, rocky soils and are often steep and bouldery with seepage areas. This forest has at least 75% of the canopy coverage composed of *Abies fraseri*, occurring over a sparse to moderate shrub stratum dominated by deciduous species, a diverse herb stratum, and, typically, a well-developed bryophyte layer. The tree canopy has standing dead stems of *Abies fraseri* and extensive patches of *Abies fraseri* saplings in canopy gaps. *Oxalis montana, Dryopteris campyloptera,* and *Athyrium filix-femina* are often dominant in the herbaceous stratum. Other characteristic species include *Vaccinium erythrocarpum, Sambucus racemosa var. racemosa (= Sambucus racemosa var. pubens), Rubus allegheniensis, Rubus idaeus ssp. strigosus, Oclemena acuminata (= Aster acuminatus), Eurybia chlorolepis (= Aster chlorolepis), Clintonia borealis, Solidago glomerata, Rugelia nudicaulis, Ageratina altissima var. roanensis, Chelone lyonii, Circaea alpina ssp. alpina, Streptopus lanceolatus var. roseus (= Streptopus roseus), Viola macloskeyi ssp. pallens, Geum radiatum, Huperzia lucidula, Ptilium crista-castrensis, Rhytidiadelphus triquetrus,* and *Hylocomium splendens*. This is a relatively broadly defined community element with much structural and compositional variation.
Environment: This community typically occurs on steep ridges and north-facing slopes above 1830 m (6000 feet) elevation, although it may extend lower on some sites. These forests occur on all topographic positions except the steepest rocky cliffs of the highest summits. Soils that support this community are classified as Inceptisols and are shallow, rocky, and often have a thick organic layer. Moisture regimes are mesic to wet, due to high rainfall, abundant cloud cover, fog deposition, and low temperatures.
Vegetation: This needle-leaved evergreen forest has greater than 75% canopy coverage by *Abies fraseri*, typically with many standing dead stems. Canopy trees are of small diameter (less than 20 cm) and short stature (less than 10 m tall), giving these forests a stunted appearance. Other species that may occur in the canopy or subcanopy with low coverage are *Picea rubens, Sorbus americana, Betula alleghaniensis, Prunus pensylvanica,* and *Acer spicatum*. There may be considerable variation in the density of shrub cover, but it is typically low (<20%) and dominated by deciduous species. Typical shrub species include *Viburnum lantanoides, Vaccinium erythrocarpum, Sambucus racemosa var. racemosa (= Sambucus racemosa var. pubens), Menziesia pilosa, Rubus allegheniensis,* and *Rubus idaeus ssp. strigosus*. Where shrubs are sparse, herb cover is usually dense, with *Oxalis montana, Athyrium filix-femina ssp. asplenioides,* and *Dryopteris campyloptera* often dominant. Other common herbs include *Oclemena acuminata (= Aster acuminatus), Eurybia chlorolepis (= Aster chlorolepis), Clintonia borealis, Solidago glomerata, Rugelia nudicaulis, Ageratina altissima var. roanensis, Chelone lyonii, Circaea alpina ssp. alpina, Streptopus lanceolatus (= Streptopus roseus), Viola macloskeyi ssp. pallens, Geum radiatum,* and *Huperzia lucidula*. Mosses, liverworts, and lichens grow densely on fallen logs, tree trunks, and the forest floor, giving the community a distinctive carpeted appearance. Characteristic bryophyte species include *Hylocomium splendens, Ptilium crista-castrensis, Rhytidiadelphus triquetrus,* and *Hylocomiastrum umbratum*.
Dynamics: This community is affected by debris avalanches, wind disturbance and lightning fire. Because of the shallow soils and extreme wind exposure, this forest is susceptible to large blowdowns. Logging and damage by the Balsam Woolly Adelgid has greatly increased the effect of natural windfall.

This community is a late successional type, but it is subject to repeated disturbance. *Prunus pensylvanica* is a dominant species immediately following disturbance. In later successional stages, *Betula alleghaniensis* increases in dominance. In areas where mature *Abies fraseri* has been lost to woolly adelgid infestation, thickets of *Rubus* spp., *Abies fraseri* seedlings and saplings, *Betula alleghaniensis,* and *Sorbus americana* are dominant. Over time, *Picea rubens, Betula alleghaniensis, Abies fraseri, Acer spicatum,* and *Sorbus americana* increase in the tree layer, while *Abies fraseri, Menziesia pilosa, Rubus idaeus ssp. strigosus,* and *Sambucus racemosa* increase in the shrub layer (White et al. 1993). Succession is especially slow after severe disturbance such as logging and slash fires. The most severely disturbed sites are predominately *Prunus pensylvanica* and *Rubus* spp. and may remain in a non-forested stage of succession for 60 years or more.
Similar Associations:

- *Abies fraseri / (Rhododendron catawbiense, Rhododendron carolinianum)* Forest (CEGL006308) -- is a similar forest with a canopy dominated by *Abies fraseri* but with a shrub stratum dominated by evergreen species.

- *Picea rubens - (Abies fraseri) / (Rhododendron catawbiense, Rhododendron maximum)* Forest (CEGL007130) -- *Abies fraseri* can codominate with *Picea rubens*.
- *Picea rubens - (Abies fraseri) / Vaccinium erythrocarpum / Oxalis montana - Dryopteris campyloptera / Hylocomium splendens* Forest (CEGL007131) -- *Abies fraseri* can codominate with *Picea rubens*.

Related Concepts:
- *Abies fraseri / Dryopteris campyloptera - Oxalis montana* Forest (Fleming and Coulling 2001) ?
- Fraser Fir (6) (USFS 1988) ?
- Fraser Fir Forest (Pyne 1994) ?
- Fraser Fir Forest (Herb Subtype) (Schafale 1998b) ?
- IA4b. Fraser Fir Forest (Allard 1990) B
- Oligotrophic Forest (Rawinski 1992) ?
- Red Spruce - Fraser Fir: 34 (Eyre 1980) B

Classification Comments:

CONSERVATION RANKING & RARE SPECIES

GRank: G1 (1994-7-15): This community occurs as island-like stands in the southern Appalachian Mountains. It has a naturally restricted distribution and exists in only a small portion of its original range due to the impact of early 20th century, post-logging fires and the ongoing outbreak of the Balsam Woolly Adelgid (*Adelges piceae*). Well-developed, undisturbed examples of this community are extremely rare.

High-ranked species: *Abies fraseri* (G2), *Bazzania nudicaulis* (G2*G*3), *Brachydontium trichodes* (G2*G*4), *Cardamine clematitis* (G2*G*3), *Desmognathus wrighti* (G3*G*4), *Geum radiatum* (G1), *Glyceria nubigena* (G2), *Leptodontium excelsum* (G2), *Microhexura montivaga* (G1), *Plethodon welleri* (G3), *Rhododendron vaseyi* (G3), *Rugelia nudicaulis* (G3), *Solidago glomerata* (G3), *Sphenolobopsis pearsonii* (G2?), *Stachys clingmanii* (G2Q)

ELEMENT DISTRIBUTION

Range: This community occurs as island-like stands on the highest areas (>6000 feet) in the southern Appalachian Mountains of eastern Tennessee, western North Carolina, and southwestern Virginia. It is extremely limited in distribution and is restricted to the following mountain areas: Great Smoky Mountains, Black Mountains, Balsam Mountains, Plott Balsams, Grandfather Mountain, and Mount Rogers (Ramseur 1960).

Subnations: NC, TN, VA

TNC Ecoregions: 51:C

USFS Ecoregions: M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee, Jefferson, Pisgah)

ELEMENT SOURCES

References: Adams and Stephenson 1991, Adams et al. 1985, Allard 1990, Anderson et al. 1990, Belden et al. 1994, Braun 1950, Brown 1941, Bruck 1988, Busing et al. 1988, Crandall 1958, Davis 1930, Dull et al. 1988a, Eyre 1980, Fleming and Coulling 2001, Fleming et al. 2001, McLeod 1988, NCNHP 1993, Nicholas et al. 1992, Oosting and Billings 1951, Peet et al. unpubl. data 2002, Pyne 1994, Ramseur 1960, Rawinski 1992, Rheinhardt and Ware 1984, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Stephenson and Adams 1984, USFS 1988, Weakley 1993, White 1984a, White 1984b, White and Pickett 1985, White et al. 1993, Whittaker 1956

RED SPRUCE - (FRASER FIR) / (CATAWBA RHODODENDRON, GREAT RHODODENDRON) FOREST

ELEMENT IDENTIFIERS

NVC association: *Picea rubens - (Abies fraseri) / (Rhododendron catawbiense, Rhododendron maximum)* Forest

Database Code: CEGL007130

Formation: Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c)

Alliance: *Abies fraseri - Picea rubens* Forest Alliance (A.136)

ELEMENT CONCEPT

Summary: This community is restricted to the highest mountain systems of the southern Appalachians in eastern Tennessee and western North Carolina. These forests are typically found on moderately steep to steep, convex slopes at elevations between 1550 and 1830 m (5100-6000 feet). This association includes forests of the southern Appalachians, within the range of *Abies fraseri*, dominated by *Picea rubens* with or without *Abies fraseri*, over a shrub stratum dominated by evergreen species, typically *Rhododendron catawbiense* and *Rhododendron maximum*. Herb coverage is characteristically low, but on moist north-facing sites mosses, ferns, and forbs may be dense beneath the shrub stratum.

Environment: This forest is best developed between 1550-1830 m elevation (5100-6000 feet) but may occur at lower elevations and is typically found on moderately steep to steep, convex slopes. Soils are highly variable, from deep mineral soils to well-developed boulderfields, where a thin organic layer and moss mat overlie the rocks and there are pockets of mineral soil in deep crevices between boulders. The dominant soils are Inceptisols with scattered occurrences of Spodosols at the highest elevations (White et al.

1993). Generally, soils can be described as shallow and rocky, with well-developed organic and A horizons. All soils in these high elevation forests are low in base saturation, high in organic matter, and are acid in reaction (pH 3-5), with a high aluminum content. The moisture regimes of these areas are mesic to wet due to high rainfall, abundant cloud cover, fog deposition, and low temperatures. The climate has been classified as perhumid, with the temperature varying elevationally from mesothermal to microthermal. The regional geology is dominated by complexly folded metamorphic, sedimentary, and igneous rocks of the Precambrian and early Paleozoic age, including phyllites, slates, schists, sandstones, quartzites, granites, and gneisses.

Vegetation: This association includes forests of the southern Appalachians, within the range of *Abies fraseri*, dominated by *Picea rubens* with or without *Abies fraseri*. Other species may occur in the canopy/subcanopy but with low coverage. The shrub stratum is moderate to dense and dominated by evergreen species such as *Rhododendron catawbiense, Rhododendron maximum*, and *Rhododendron carolinianum*. Shrub coverage is most dense on drier, convex slopes. Other shrub species with minor coverage may include *Vaccinium simulatum, Vaccinium erythrocarpum, Viburnum nudum var. cassinoides, Diervilla sessilifolia*, and *Viburnum lantanoides*. Extensive patches of *Abies fraseri* seedlings and standing dead stems of *Abies fraseri* may be common. Herb coverage is typically low, but moist, north-facing sites may have *Oxalis montana, Athyrium filix-femina ssp. asplenioides, Dryopteris campyloptera*, and mosses dominating beneath the shrub stratum.

Dynamics: Natural disturbances in this community include lightning fire, debris avalanches, wind disturbance, and ice storms (White and Pickett 1985, Nicholas and Zedaker 1989). The natural fire regime is estimated at longer than 500-1000 years. Human-initiated disturbances have included logging, slash fires, livestock grazing, damage by the Balsam Woolly Adelgid (*Adelges piceae*), and atmospheric pollutants.

Similar Associations:

- *Picea rubens - (Abies fraseri) / Vaccinium erythrocarpum / Oxalis montana - Dryopteris campyloptera / Hylocomium splendens* Forest (CEGL007131) -- is a similar forest that has an understory dominated by deciduous shrubs, herbs, and bryophtyes and occurs on more mesic sites than the one described here. Similar forests occur in the central and northern Appalachians, but have Abies balsamea as the fir component, less dense herb and bryophyte cover, and lack a Rhododendron-dominated understory (Oosting and Billings 1951, Whittaker 1956, Crandall 1958).
- *Picea rubens - Tsuga canadensis / Rhododendron maximum* Forest (CEGL006272) -- is a similar forest that has a shrub stratum dominated by evergreen species, mostly *Rhododendron maximum*. In addition, the canopy includes a mix of *Picea rubens* and other northern hardwood species and *Tsuga canadensis*.

Related Concepts:

- IA4a. Red Spruce - Fraser Fir Forest (Allard 1990) B
- Red Spruce - Fraser Fir (7) (USFS 1988) ?
- Red Spruce - Fraser Fir: 34 (Eyre 1980) B
- Red Spruce--Fraser Fir Forest (Rhododendron Subtype) (Schafale 1998b) ?
- Spruce - Fir, BR (Pyne 1994) B

Classification Comments: This community includes forest vegetation where *Picea rubens* and *Abies fraseri* make up 75% of the canopy cover, each contributing 25-75% to the total canopy cover and occurring over a shrub stratum dominated by evergreen species. Other species total less than 25% of the canopy.

CONSERVATION RANKING & RARE SPECIES

GRank: G1 (1999-2-23): This community has a naturally restricted distribution and has been subject to major acreage reduction during the early part of the 20th century and rapid condition decline in the past 30 years. Modern threats include atmospheric pollution deposition and damage by *Adelges piceae*, the exotic Balsam Woolly Adelgid. Well-developed, undisturbed examples of this community are extremely rare.

High-ranked species: *Abies fraseri* (G2), *Bazzania nudicaulis* (G2G3), *Brachydontium trichodes* (G2G4), *Cardamine clematitis* (G2G3), *Carex ruthii* (G3), *Geum geniculatum* (G2), *Glyceria nubigena* (G2), *Gymnoderma lineare* (G2), *Leptodontium excelsum* (G2), *Microhexura montivaga* (G1), *Plethodon welleri* (G3), *Prenanthes roanensis* (G3), *Rugelia nudicaulis* (G3), *Solidago glomerata* (G3), *Sphenolobopsis pearsonii* (G2?), *Stachys clingmanii* (G2Q)

ELEMENT DISTRIBUTION

Range: This community is restricted to the highest mountain systems of the southern Appalachians in eastern Tennessee and western North Carolina.

Subnations: NC, TN

TNC Ecoregions: 51:C

USFS Ecoregions: M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains); USFS (Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Anderson et al. 1990, Brown 1941, Bruck 1988, Busing et al. 1988, Cogbill and White 1991, Crandall 1958, Crandall 1960, Davis 1930, Dull et al. 1988b, Eagar and Adams 1992, Eyre 1980, Korstian 1937, McLeod 1988, NCNHP 1993, NatureServe Ecology - Southeastern U.S. unpubl. data, Nicholas and Zedaker 1989, Nicholas et al. 1992, Oosting and Billings 1951, Peet et al. unpubl. data 2002, Pyne 1994, Ramseur 1960, Rawinski 1992, Schafale 1998b, Schafale and Weakley 1990, Schofield

1960, Southeastern Ecology Working Group n.d., Stephenson and Adams 1984, Stephenson and Clovis 1983, Stotler and Crandall-Stotler 1977, USFS 1988, Wentworth et al. 1988, White 1984a, White 1984b, White and Cogbill 1992, White and Pickett 1985, White et al. 1993, Whittaker 1956, Zedaker et al. 1988

RED SPRUCE - (FRASER FIR) / HIGHBUSH CRANBERRY / COMMON WOOD SORREL - MOUNTAIN WOODFERN / STAIRSTEP MOSS FOREST

ELEMENT IDENTIFIERS

NVC association: *Picea rubens - (Abies fraseri) / Vaccinium erythrocarpum / Oxalis montana - Dryopteris campyloptera / Hylocomium splendens* Forest
Database Code: CEGL007131
Formation: Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c)
Alliance: *Abies fraseri - Picea rubens* Forest Alliance (A.136)

ELEMENT CONCEPT

Summary: This community is restricted to the highest mountain systems of the southern Appalachians in eastern Tennessee, western North Carolina, and southwestern Virginia. It is found on all topographic positions and is best developed between 1680-1990 m elevation (5500-6200 feet). This association includes forests of the southern Appalachians, within the range of *Abies fraseri*, dominated by *Picea rubens*, with or without *Abies fraseri*, occurring over deciduous shrubs, herbs, and bryophytes. This community has a characteristic understory of southern Appalachian endemic species and a conspicuous bryophyte layer. The tree canopy may have standing dead stems of *Abies fraseri* and extensive patches of *Abies fraseri* seedlings in canopy gaps. Characteristic species include *Sorbus americana, Acer spicatum, Viburnum lantanoides, Athyrium filix-femina ssp. asplenioides, Eurybia chlorolepis (= Aster chlorolepis), Rugelia nudicaulis, Houstonia serpyllifolia, Solidago glomerata, Ptilium crista-castrensis*, and *Bazzania trilobata*.
Environment: Over much of its range, this forest community reaches its best development between 1680 and 1990 m (5500-6200 feet) elevation, but it is also found at somewhat lower elevations. Stands occur on all topographic positions. Soils are highly variable, from deep mineral soils to well-developed boulderfields, where a thin organic layer and moss mat overlie the rocks, and there are pockets of mineral soil in deep crevices between boulders. The dominant soils are Inceptisols with scattered occurrences of Spodosols at the highest elevations. Generally, soils are shallow and rocky, with well-developed organic and A horizons. All soils in these high-elevation forests are low in base saturation, high in organic matter, and are acid in reaction (pH 3.0-5.0), with high aluminum content. The moisture regimes of these areas are mesic to wet due to high rainfall, abundant cloud cover, fog deposition, and low temperatures. The climate has been classified as perhumid, with the temperature varying elevationally from mesothermal to microthermal. The regional geology is dominated by complexly folded metamorphic, sedimentary, and igneous rocks of Precambrian and early Paleozoic age, including phyllites, slates, schists, sandstones, quartzites, granites, and gneisses.
Vegetation: These forests are dominated by needle-leaved evergreen trees and have a characteristic understory of southern Appalachian endemic species and a conspicuous bryophyte layer. Canopies are dominated by *Picea rubens*, with or without *Abies fraseri*, sometimes with lesser amounts of *Betula alleghaniensis* and *Sorbus americana*. The subcanopy contains canopy species as well as *Acer spicatum* and *Amelanchier laevis*. The shrub strata are dominated by deciduous species and can be sparse to dense. Typical shrub species include *Viburnum lantanoides, Vaccinium erythrocarpum, Vaccinium simulatum, Sambucus racemosa var. racemosa (= Sambucus racemosa var. pubens), Rubus allegheniensis, Ilex montana, Rhododendron catawbiense*, and *Rubus canadensis*. Extensive patches of *Abies fraseri* seedlings and standing dead stems of *Abies fraseri* are common. Herb density can be high but is inversely related to the density of the shrub layer. Common herbaceous species include *Oxalis montana, Athyrium filix-femina ssp. asplenioides, Dryopteris campyloptera*, and *Clintonia borealis*. Other herbs include *Oclemena acuminata (= Aster acuminatus), Eurybia chlorolepis (= Aster chlorolepis), Carex gynandra, Carex pensylvanica, Chelone lyonii, Circaea alpina ssp. alpina, Houstonia serpyllifolia, Huperzia lucidula, Maianthemum canadense, Rugelia nudicaulis, Solidago glomerata, Solidago glomerata, Streptopus lanceolatus var. roseus (= Streptopus roseus var. roseus)*, and *Viola macloskeyi ssp. pallens*. Bryophytes and lichens make up a considerable percent of the vegetative coverage in this community, occurring on the surface of the soil, trees, and fallen logs. Characteristic nonvascular species include *Hylocomium splendens, Ptilium crista-castrensis, Leptodontium excelsum, Bazzania trilobata, Bazzania nudicaulis, Alectoria fallacina, Hypotrachyna virginica, Dicranum scoparium*, and *Dicranum fuscescens*.
Dynamics: Natural disturbances in this community include lightning fire, debris avalanches, wind disturbance, and ice storms (White and Pickett 1985, Nicholas and Zedaker 1989). The natural fire regime is estimated at longer than 500-1000 years. Human-initiated disturbances have included logging, slash fires, livestock grazing, damage by the Balsam Woolly Adelgid (*Adelges piceae*), and atmospheric pollutants.
Similar Associations:

- *Picea rubens - (Abies fraseri) / (Rhododendron catawbiense, Rhododendron maximum)* Forest (CEGL007130) -- is a similar forest that has a shrub stratum dominated by evergreen species and occurs on less mesic sites than the one described here. Similar forests occur in the central and northern Appalachians, but have *Abies balsamea* as the fir component and less dense herb and bryophyte cover (Oosting and Billings 1951, Whittaker 1956, Crandall 1958).

- *Picea rubens - Tsuga canadensis / Rhododendron maximum* Forest (CEGL006272) -- is a similar forest that has a shrub stratum dominated by evergreen species, especially *Rhododendron maximum* and occurs with other northern hardwood species and *Tsuga canadensis*.

Related Concepts:
- *Picea rubens / Viburnum lantanoides - Vaccinium erythrocarpum / Huperzia lucidula - Clintonia borealis* Forest (Fleming and Coulling 2001) ?
- IA4a. Red Spruce - Fraser Fir Forest (Allard 1990) B
- Oligotrophic Forest (Rawinski 1992) ?
- Red Spruce - Fraser Fir (7) (USFS 1988) ?
- Red Spruce - Fraser Fir: 34 (Eyre 1980) B
- Red Spruce--Fraser Fir Forest (Herb Subtype) (Schafale 1998b) ?
- Spruce - Fir, BR (Pyne 1994) B
- Spruce Community (Rheinhardt and Ware 1984) ?

Classification Comments: An occurrence on the edge of the Ridge and Valley province in southwestern Virginia occurs over sandstone on Clinch Mountain.

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (1998-4-30): This community is restricted to the highest mountain systems of the southern Appalachians in eastern Tennessee, western North Carolina, and southwestern Virginia. It has a naturally restricted distribution and has been subject to major acreage reduction during the early part of the 20th century and rapid condition decline in the past 30 years. Modern threats include atmospheric pollution deposition and damage by *Adelges piceae*, the exotic Balsam Woolly Adelgid. Well-developed, undisturbed examples of this community are extremely rare.

High-ranked species: *Abies fraseri* (G2), *Alectoria fallacina* (G2), *Bazzania nudicaulis* (G2G3), *Brachydontium trichodes* (G2G4), *Cardamine clematitis* (G2G3), *Carex ruthii* (G3), *Desmognathus wrighti* (G3G4), *Geum geniculatum* (G2), *Glyceria nubigena* (G2), *Gymnoderma lineare* (G2), *Hypotrachyna virginica* (G1G2), *Leptodontium excelsum* (G2), *Microhexura montivaga* (G1), *Plethodon welleri* (G3), *Prenanthes roanensis* (G3), *Rugelia nudicaulis* (G3), *Solidago glomerata* (G3), *Sphenolobopsis pearsonii* (G2?), *Stachys clingmanii* (G2Q)

ELEMENT DISTRIBUTION

Range: This community is restricted to the highest mountain systems of the southern Appalachians in eastern Tennessee, western North Carolina, and southwestern Virginia.

Subnations: NC, TN, VA

TNC Ecoregions: 51:C, 59:C

USFS Ecoregions: M221Aa:CCC, M221Ba:CCC, M221Bc:CCP, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains); USFS (Cherokee, Jefferson, Nantahala, Pisgah)

ELEMENT SOURCES

References: Adams and Stephenson 1991, Allard 1990, Anderson et al. 1990, Belden et al. 1994, Brown 1941, Bruck 1988, Busing et al. 1988, Cogbill and White 1991, Crandall 1958, Crandall 1960, Davis 1930, Dull et al. 1988b, Eagar and Adams 1992, Eyre 1980, Fleming and Coulling 2001, Fleming et al. 2001, Golden 1974, Korstian 1937, McLaughlin et al. 1987, McLeod 1988, NCNHP 1993, NatureServe Ecology - Southeastern U.S. unpubl. data, Nicholas and Zedaker 1989, Nicholas et al. 1992, Oosting and Billings 1951, Peet et al. unpubl. data 2002, Pyne 1994, Ramseur 1960, Rawinski 1992, Rheinhardt and Ware 1984, Schafale 1998b, Schafale and Weakley 1990, Schofield 1960, Southeastern Ecology Working Group n.d., Stephenson and Adams 1984, Stephenson and Clovis 1983, USFS 1988, Wentworth et al. 1988, White 1984a, White 1984b, White and Cogbill 1992, White and Pickett 1985, White et al. 1993, Whittaker 1956, Zedaker et al. 1988

RED SPRUCE - (YELLOW BIRCH, YELLOW BUCKEYE) / (GREAT RHODODENDRON, CATAWBA RHODODENDRON) FOREST

ELEMENT IDENTIFIERS

NVC association: *Picea rubens - (Betula alleghaniensis, Aesculus flava) / Rhododendron (maximum, catawbiense)* Forest

Database Code: CEGL004983

Formation: Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a)

Alliance: *Picea rubens - Betula alleghaniensis* Forest Alliance (A.384)

ELEMENT CONCEPT

Summary: This association occurs in the broad elevational transition zone between spruce-fir and northern hardwoods in the Southern Blue Ridge (approx. 4600-5100 feet). Sites are steep to very steep, slopes often associated with cliff faces, rock outcroppings, or bouldery situations, and subject to disturbance by wind, ice, and landslides. The canopy is comprised of *Picea rubens* codominating with deciduous species *Betula alleghaniensis*, *Fagus grandifolia*, and *Aesculus flava*, occurring singly or in combination. At higher elevations, *Abies fraseri* may be a minor canopy component. The shrub layer is well-developed and dominated

by *Rhododendron maximum* or *Rhododendron catawbiense*. In the Great Smoky Mountains, *Leucothoe fontanesiana* can be the dominant shrub. Other minor shrubs include *Ilex montana, Viburnum lantanoides, Vaccinium erythrocarpum,* and *Rubus allegheniensis*. The thick, evergreen shrub layer precludes the establishment of seedlings or herbaceous plants and creates a heavy, slowly decomposing litter layer. Bryophyte cover can be high (over 50%), and the ground is covered with downed and decaying logs.
Environment: No information
Vegetation: No information
Dynamics: No information
Similar Associations:
Related Concepts: No information
Classification Comments: This association is known from the Great Smoky Mountains of Tennessee but may possibly occur in the Blue Ridge of North Carolina and Virginia. This association should be compared with other vegetation farther north in the Appalachians. Examples of this community on more exposed, rocky sites may transition to heath shrublands. At high elevations, this community grades into *Picea rubens*-dominated forests.

CONSERVATION RANKING & RARE SPECIES

GRank: G1? (1998-4-30): The community is geographically and environmentally restricted to the highest elevations of the Southern Blue Ridge. Very few occurrences are known to exist, and it has only been described from the Great Smoky Mountains.
High-ranked species: *Abies fraseri* (G2), *Solidago glomerata* (G3)

ELEMENT DISTRIBUTION

Range:
Subnations: NC?, TN, VA?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Pisgah?)

ELEMENT SOURCES

References: Golden 1974, Golden 1981, Livingston and Mitchell 1976, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Southeastern Ecology Working Group n.d.

RED SPRUCE - (YELLOW BIRCH, YELLOW BUCKEYE) / HOBBLEBUSH / COMMON WOOD SORREL - SKUNK GOLDENROD FOREST

ELEMENT IDENTIFIERS

NVC association: *Picea rubens - (Betula alleghaniensis, Aesculus flava) / Viburnum lantanoides / Oxalis montana - Solidago glomerata* Forest
Database Code: CEGL006256
Formation: Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a)
Alliance: *Picea rubens - Betula alleghaniensis* Forest Alliance (A.384)

ELEMENT CONCEPT

Summary: This association occurs in the broad elevational transition zone between spruce - fir and northern hardwoods in the Southern Blue Ridge (approx. 4600-5100 feet). The canopy is comprised of *Picea rubens* codominating with the deciduous species *Betula alleghaniensis, Fagus grandifolia*, and *Aesculus flava*, occurring singly or in combination. At higher elevations, *Abies fraseri* may be a minor canopy component. The shrub stratum is open to absent. *Viburnum lantanoides* is a common shrub, and *Acer pensylvanicum* and *Amelanchier laevis* often occur as small trees. The herbaceous stratum is lush and diverse. Typical herbs include *Oclemena acuminata (= Aster acuminatus), Carex pensylvanica, Dryopteris campyloptera, Dryopteris intermedia, Maianthemum canadense, Oxalis montana, Solidago glomerata*, and *Rugelia nudicaulis* (in the Great Smoky Mountains). This association occurs on steep slopes and protected ridges, over shallow, stony soils.
Environment: No information
Vegetation: No information
Dynamics: No information
Similar Associations:
- *Picea rubens - (Betula alleghaniensis, Aesculus flava) / Rhododendron (maximum, catawbiense)* Forest (CEGL004983)

Related Concepts:
- IA4e. Southern Appalachian Northern Hardwoods Forest (Allard 1990) B

Classification Comments: Original type was split into two forest associations [see also *Picea rubens - (Betula alleghaniensis, Aesculus flava) / Rhododendron (maximum, catawbiense)* Forest (CEGL004983)].

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (2000-1-4): The community is geographically and environmentally restricted to the highest elevations of the Southern Blue Ridge. Very few occurrences are known to exist.
High-ranked species: *Rugelia nudicaulis* (G3), *Solidago glomerata* (G3)

ELEMENT DISTRIBUTION

Range: This community is restricted to the southern Blue Ridge of North Carolina and Tennessee. It may occur at high elevations (above 4000 feet) in Virginia and Georgia.
Subnations: NC, TN
TNC Ecoregions: 51:C
USFS Ecoregions: M221A:CP, M221B:CP, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains); USFS (Cherokee?, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Golden 1974, Golden 1981, Livingston and Mitchell 1976, McLeod pers. comm., NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

RED SPRUCE - EASTERN HEMLOCK / GREAT RHODODENDRON FOREST

ELEMENT IDENTIFIERS

NVC association: *Picea rubens - Tsuga canadensis / Rhododendron maximum* Forest
Database Code: CEGL006272
Formation: Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c)
Alliance: *Picea rubens* Forest Alliance (A.138)

ELEMENT CONCEPT

Summary: This needle-leaved evergreen forest has a canopy dominated by mixtures of *Picea rubens* and *Tsuga canadensis*. *Betula alleghaniensis, Acer rubrum*, or *Prunus pensylvanica* may form a minor part of the canopy or subcanopy. Typically, there is a dense subcanopy/tall-shrub stratum of *Rhododendron maximum*. Other shrub species can include *Rhododendron catawbiense, Ilex montana, Rubus canadensis*, and *Amelanchier laevis*. The herb stratum is typically very sparse with scattered ferns and other forbs. The ground cover is dominated by leaf litter and may have scattered large rocks or exposed bedrock. This community is known to occur in the Great Smoky Mountains in the vicinity of Mount Le Conte on steep, middle to high slopes between 4500 and 5000 feet elevation. Sites may be relatively exposed and rocky and subject to disturbance by wind and ice. Soils are well-drained and high in organic matter.
Environment: This community is known to occur in the Great Smoky Mountains in the vicinity of Mt. LeConte on steep, middle to high slopes between 4500 and 5000 feet elevation. Sites may be relatively exposed and rocky and subject to disturbance by wind and ice. Soils are well-drained and high in organic matter.
Vegetation: This needle-leaved evergreen forest has a canopy dominated by mixtures of *Picea rubens* and *Tsuga canadensis*. *Betula alleghaniensis, Acer rubrum*, or *Prunus pensylvanica* may form a minor part of the canopy or subcanopy. Typically, there is a dense subcanopy/tall-shrub stratum of *Rhododendron maximum*. Other shrub species can include *Rhododendron catawbiense, Ilex montana, Rubus canadensis*, and *Amelanchier laevis*. The herb stratum is typically very sparse with scattered ferns and other forbs. The ground cover is dominated by leaf litter and may have scattered large rocks or exposed bedrock.
Dynamics: No information
Similar Associations:
- *Picea rubens / Rhododendron maximum* Forest (CEGL006152)

Related Concepts:
- IA4a. Red Spruce - Fraser Fir Forest (Allard 1990) B
- Red Spruce--Fraser Fir Forest (Hemlock Subtype) (Schafale 1998b) ?
- Spruce - Fir, BR (Pyne 1994) B

Classification Comments: These forests are known from the steep upper slopes of Mount LeConte in the Great Smoky Mountains. Forests with *Picea rubens* and *Tsuga canadensis* occur in Virginia, but in a different topographic and hydrologic situation than this association. Gary Fleming describes occurrences at Salt Pond Mountain that are in valley bottoms, within streamheads, and have an unclear hydrology. This association may not be distinct enough from *Picea rubens / Rhododendron maximum* Forest (CEGL006152) to warrant recognition from it.

CONSERVATION RANKING & RARE SPECIES

GRank: G2? (1999-2-15): In the Southern Blue Ridge, this forest is nearly or entirely restricted to Great Smoky Mountains National Park. While the total distribution of this community is uncertain, the total acreage is certainly small, less than 10,000 hectares. The only known location with substantial, high-quality occurrences is Great Smoky Mountains National Park.
High-ranked species: *Rugelia nudicaulis* (G3), *Solidago glomerata* (G3)

ELEMENT DISTRIBUTION

Range: This community is known to occur in the Great Smoky Mountains in the vicinity of Mount Le Conte.
Subnations: NC, TN
TNC Ecoregions: 51:C
USFS Ecoregions: M221Aa:CPP, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains); USFS (Cherokee?, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Peet et al. unpubl. data 2002, Pyne 1994, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

RED SPRUCE / GREAT RHODODENDRON FOREST

ELEMENT IDENTIFIERS

NVC association: *Picea rubens / Rhododendron maximum* Forest
Database Code: CEGL006152
Formation: Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c)
Alliance: *Picea rubens* Forest Alliance (A.138)

ELEMENT CONCEPT

Summary: Moist slope forest of central and southern Appalachians. *Abies fraseri* is a minor component or entirely absent. This association occurs in the lower elevations of the range of *Picea rubens* on protected landforms. In the Central Appalachians these are closed-canopy conifer forests dominated by *Picea rubens* with associates *Tsuga canadensis, Acer pensylvanicum, Amelanchier* spp., *Betula alleghaniensis, Sorbus americana*. The variable shrub layer is dominated by *Rhododendron maximum,* with associates of *Ilex montana, Kalmia latifolia, Viburnum lantanoides, Viburnum nudum*. The sparse herbaceous cover includes *Clintonia borealis, Dryopteris campyloptera, Huperzia lucidula, Lycopodium* spp., *Medeola virginiana, Mitchella repens, Oxalis montana*. Abundant mosses are present and include *Bazzania trilobata, Hylocomium splendens, Polytrichum ohioense, Ptilium crista-castrensis,* and *Sphagnum* spp. These communities occur on high-elevation boulderfields, ridges and steep slopes with shallow soils above 3500 feet.
Environment: No information
Vegetation: No information
Dynamics: No information
Similar Associations:
- *Picea rubens - Tsuga canadensis / Rhododendron maximum* Forest (CEGL006272)
- *Picea rubens / Acer rubrum / Maianthemum canadense - (Lycopodium clavatum, Lycopodium dendroideum)* Forest (CEGL008501)

Related Concepts:
- IA4a. Red Spruce - Fraser Fir Forest (Allard 1990) B
- Red Spruce--Fraser Fir Forest (Low Rhododendron Subtype) (Schafale 1998b) ?
- Red spruce-great laurel forest (CAP pers. comm. 1998) ?

Classification Comments: This association may not be distinct from *Picea rubens - Tsuga canadensis / Rhododendron maximum* Forest (CEGL006272); consider merging these two associations.

CONSERVATION RANKING & RARE SPECIES

GRank: G2? (1998-4-30): No information
High-ranked species: *Solidago glomerata* (G3)

ELEMENT DISTRIBUTION

Range:
Subnations: NC, PA, TN, WV
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Ba:CCC, M221Bb:CCP, M221Bc:CCC, M221C:CC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, CAP pers. comm. 1998, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

RED SPRUCE / SKUNK CURRANT FOREST

ELEMENT IDENTIFIERS

NVC association: *Picea rubens / Ribes glandulosum* Forest

Database Code: CEGL007128
Formation: Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c)
Alliance: *Picea rubens* Forest Alliance (A.138)

ELEMENT CONCEPT

Summary: This association includes steep, seepy boulderfields dominated by *Picea rubens*, found at slightly higher elevations than *Betula alleghaniensis / Ribes glandulosum / Polypodium appalachianum* Forest (CEGL006124).
Environment: Stands of this association are found at slightly higher elevations than *Betula alleghaniensis / Ribes glandulosum / Polypodium appalachianum* Forest (CEGL006124). It is restricted to steep periglacial coves at high elevations.
Vegetation: Stands of this association are dominated by *Picea rubens* and contain *Ribes glandulosum*.
Dynamics: No information
Similar Associations:
- *Picea rubens / Ribes glandulosum* Woodland (CEGL006250) -- of the northeastern United States.

Related Concepts:
- IA4a. Red Spruce - Fraser Fir Forest (Allard 1990) B
- Red Spruce--Fraser Fir Forest (Boulderfield Subtype) (Schafale 1998b) ?
- Red spruce-skunk current boulderfield forest (CAP pers. comm. 1998) ?

Classification Comments: Known from Grandfather Mountain, North Carolina. Compare with *Picea rubens / Ribes glandulosum* Woodland (CEGL006250) of the northeastern United States.

CONSERVATION RANKING & RARE SPECIES

GRank: G1 (1997-12-31): This community has a highly restricted range, occurring only within the spruce-fir zone of the southern Appalachians. It is restricted to steep periglacial coves at high elevations. The total acreage of this community is small, and individual occurrences are generally less than five acres. This community occurs in areas that are generally inaccessible to logging operations and is currently relatively stable.
High-ranked species: *Solidago glomerata* (G3)

ELEMENT DISTRIBUTION

Range:
Subnations: NC, TN?, VA?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: USFS (Pisgah)

ELEMENT SOURCES

References: Allard 1990, CAP pers. comm. 1998, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

SMOOTH BLACKBERRY - (AMERICAN RED RASPBERRY) / LADY FERN - SKUNK GOLDENROD SHRUBLAND

ELEMENT IDENTIFIERS

NVC association: *Rubus canadensis - (Rubus idaeus* ssp. *strigosus) / Athyrium filix-femina - Solidago glomerata* Shrubland
Database Code: CEGL003893
Formation: Subalpine or subpolar cold-deciduous shrubland (III.B.2.N.b)
Alliance: *Rubus allegheniensis - Rubus canadensis* Shrubland Alliance (A.930)

ELEMENT CONCEPT

Summary: This vegetation occurs at high elevations in the southern Appalachian Mountains of North Carolina and Tennessee. It is successional vegetation resulting from severe disturbance of spruce-fir forests (including Balsam Woolly Adelgid-affected stands and stands which were severely burned after logging), as well as exposed sites with other frequent, natural disturbance (such as shrub invasion of grazed fire meadows). It occurs on exposed summits and high slopes, typically at elevations over 6000 feet. This community includes high-elevation Appalachian *Rubus* thickets and differs from *Rubus* thickets on grassy balds by predominance of forbs rather than sedges and by frequent presence of *Rubus idaeus*. Vegetation is variously dominated by dense *Rubus canadensis* or by dense *Athyrium filix-femina ssp. asplenioides* and *Solidago glomerata* (on more protected sites). Standing dead *Abies fraseri* often tower above the shrubs and herbs, and there is usually much downed woody debris. Other species present include *Agrostis perennans, Angelica triquinata, Oclemena acuminata (= Aster acuminatus), Carex brunnescens, Carex crinita, Carex intumescens, Carex debilis, Cinna latifolia, Clintonia borealis, Danthonia compressa, Diervilla sessilifolia, Oxalis montana, Prunus pensylvanica, Sorbus americana*, and *Rugelia nudicaulis*. Scattered living *Picea rubens, Betula alleghaniensis,* and *Amelanchier laevis* may occur. The long-term future of this community is uncertain, but it appears to be fairly stable over periods of several decades. A variation of this community occurs in areas such as Shining Rock Wilderness and parts of the Great Smoky Mountains where fires were started after logging had taken place and the intensity of the fires due to the accumulated slash burned down nearly to mineral soil. These areas do

not have as much coarse woody debris from downed spruce or fir and often have a canopy approaching that of a woodland with sparse coverage of *Sorbus americana* and *Prunus pensylvanica*.
Environment: This vegetation occurs at high elevations in the southern Appalachian Mountains of North Carolina and Tennessee. It is successional vegetation resulting from severe disturbance of spruce-fir forests (including Balsam Woolly Adelgid-affected stands and stands which were severely burned after logging), as well as exposed sites with other frequent, natural disturbance (such as shrub invasion of grazed fire meadows). It occurs on exposed summits and high slopes, typically at elevations over 6000 feet.
Vegetation: Vegetation is variously dominated by dense *Rubus canadensis* or by dense *Athyrium filix-femina ssp. asplenioides* and *Solidago glomerata* (on more protected sites). Standing dead *Abies fraseri* tower above the shrubs and herbs, and there is much downed woody debris. Other species present include *Agrostis perennans, Angelica triquinata, Oclemena acuminata (= Aster acuminatus), Carex brunnescens, Carex crinita, Carex intumescens, Carex debilis, Cinna latifolia, Clintonia borealis, Danthonia compressa, Diervilla sessilifolia, Oxalis montana, Prunus pensylvanica, Sorbus americana,* and *Rugelia nudicaulis*. Scattered living *Picea rubens, Betula alleghaniensis,* and *Amelanchier laevis* may occur. A variation of this community occurs in areas such as Shining Rock Wilderness and parts of the Great Smoky Mountains where fires were started after logging had taken place and the intensity of the fires due to the accumulated slash burned down nearly to mineral soil. These areas do not have as much coarse woody debris from downed spruce or fir and often have a canopy approaching that of a woodland with sparse coverage of *Sorbus americana* and *Prunus pensylvanica*.
Dynamics: No information
Similar Associations:
Related Concepts:
- Bramble-goldenrod thicket (CAP pers. comm. 1998) ?

Classification Comments: This community differs from *Rubus* thickets on grassy balds by predominance of forbs rather than sedges and by frequent presence of *Rubus idaeus*.

CONSERVATION RANKING & RARE SPECIES

GRank: GNA (modified/managed) (2002-8-20): This community represents an altered vegetation type, modified by the effects of an alien pest species and/or the effects of past land use. Examples of this vegetation once represented what is now a globally rare and critically imperiled community that has an uncertain future. This modified vegetation is now a natural part of high-elevation landscapes in the Southern Blue Ridge and an important part of the functioning landscape, providing habitat for many southern Appalachian species. For conservation planning purposes, examples of this community may be best considered low-quality occurrences of forests in the *Abies fraseri - Picea rubens* Forest Alliance (A.136).
High-ranked species: *Rugelia nudicaulis* (G3), *Solidago glomerata* (G3)

ELEMENT DISTRIBUTION

Range: This vegetation occurs at high elevations in the southern Appalachians of North Carolina and Tennessee.
Subnations: NC, TN
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Bd:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

References: CAP pers. comm. 1998, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Southeastern Ecology Working Group n.d.

CULTIVATED FOREST

EASTERN WHITE PINE PLANTED FOREST

ELEMENT IDENTIFIERS

NVC association: *Pinus strobus* Planted Forest
Database Code: CEGL007178
Formation: Planted/cultivated temperate or subpolar needle-leaved evergreen forest (I.A.8.C.x)
Alliance: *Pinus strobus* Planted Forest Alliance (A.98)

ELEMENT CONCEPT

Summary: This white pine plantation type is found throughout the northeastern and midwestern United States and adjacent Canada. Stands contain plantations of *Pinus strobus* that are maintained for the extraction of forest products. At maturity, the tree canopy is usually dense and contains a monospecific layer of *Pinus strobus*. The field layer may be sparse to absent. In some stands, mosses may be abundant. Susceptibility to a variety of pests or diseases, including White Pine Blister Rust (*Cronartium ribicola*) and Southern Pine Beetle (*Dendroctonus frontalis*), has had some impact on its commercial use.

Environment: Stands contain plantations of *Pinus strobus* that are maintained for the extraction of forest products. The type does well on a variety of soils.
Vegetation: The tree canopy at maturity is usually dense and contains a mono-specific layer of *Pinus strobus*. The field layer may be sparse to absent. In some stands, mosses may be abundant.
Dynamics: *Pinus strobus* is susceptible to a variety of pests and diseases, including White Pine Blister Rust (*Cronartium ribicola*) and Southern Pine Beetle (*Dendroctonus frontalis*), which have had some impact on its commercial use. Blister rust was a problem on young plantations but is not much of a problem in larger trees in the east (P. Manion pers. comm. 2001).
Similar Associations:
Related Concepts:
- IF3b. Plantation (Hardwood or Conifer) (Allard 1990) B
- Unclassified Clearcut Regeneration (Fleming and Moorhead 2000) ?

Classification Comments: There was a lot of planting of white pine from the 1930s into the1950s, but there has been very little planting since then (P. Manion pers. comm. 2001). On the Daniel Boone National Forest of Kentucky, *Pinus strobus* plantings are of limited extent, and are related to wildlife plantings. There has been some damage from the Southern Pine Beetle (*Dendroctonus frontalis*).

These plantations have been observed in the Peters Mountain area (James River Ranger District) and various other sites in the George Washington and Jefferson national forests.

CONSERVATION RANKING & RARE SPECIES

GRank: GNA (cultural) (2000-8-8): This community represents vegetation which has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation. It is not a conservation priority and does not receive a conservation rank.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This white pine plantation type is found throughout the northeastern and midwestern United States and adjacent Canada.
Subnations: GA, KY, MD, NC, NH, NY, PA, SC, TN, VA
TNC Ecoregions: 47:C, 48:C, 51:C, 61:C, 63:C
USFS Ecoregions: 212:C, 221Ai:CCC, 221He:CCC, M212:C, M221Aa:CCC, M221Ce:CCC, M221Dc:CCC, M221Dd:CCP
Federal Lands: USFS (Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, Fleming and Coulling 2001, Fleming and Moorhead 2000, Southeastern Ecology Working Group n.d.

VIRGINIA PINE PLANTED FOREST

ELEMENT IDENTIFIERS

NVC association: *Pinus virginiana* Planted Forest
Database Code: CEGL004730
Formation: Planted/cultivated temperate or subpolar needle-leaved evergreen forest (I.A.8.C.x)
Alliance: *Pinus virginiana* Planted Forest Alliance (A.100)

ELEMENT CONCEPT

Summary: This association includes planted stands of *Pinus virginiana* which have little understory, but they may have admixtures of other native or off-site pines (e.g., *Pinus echinata, Pinus strobus, Pinus taeda*). These are cultivated forests and are not considered natural or near-natural vegetation. They are maintained as plantations for the harvest of forest products, or for production of Christmas trees and on strip-mined sites. Stands have suffered some damage from the Southern Pine Beetle (*Dendroctonus frontalis*). Stands are planted in the Inner Coastal Plain for Christmas tree production.
Environment: These are cultivated forests and are not considered natural or near-natural vegetation. They are maintained as plantations for the harvest of forest products. Stands are planted in the Inner Coastal Plain for Christmas tree production.
Vegetation: his association includes planted stands of *Pinus virginiana* with little understory, but may have admixtures of other native or off-site pines (e.g., *Pinus echinata, Pinus strobus, Pinus taeda*). At Arnold Air Force Base, Coffee and Franklin counties, Tennessee, *Pinus virginiana* is dominant in dry-mesic, low to mid-slope forests. *Pinus strobus* is scattered throughout, with *Juniperus virginiana var. virginiana* occurring in patches. The subcanopy contains *Acer rubrum, Cornus florida*, and *Liquidambar styraciflua*. The tall-shrub layer includes *Sassafras albidum, Cornus florida, Cercis canadensis, Liquidambar styraciflua*, and *Quercus stellata*. The herbaceous layer is sparse or nearly absent, and contains *Polystichum acrostichoides*, Asteraceae sp., *Carex* spp., *Botrychium biternatum*, and exotic *Lonicera japonica*.
Dynamics: Stands have suffered some damage from the Southern Pine Beetle (*Dendroctonus frontalis*).
Similar Associations:
Related Concepts:

- IF3b. Plantation (Hardwood or Conifer) (Allard 1990) B
- Virginia Pine: 79 (Eyre 1980) B

Classification Comments: Stands have suffered some damage from the Southern Pine Beetle (*Dendroctonus frontalis*).

CONSERVATION RANKING & RARE SPECIES

GRank: GNA (cultural) (2000-8-8): This community represents vegetation which has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation. It is not a conservation priority and does not receive a conservation rank.

High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This alliance is found throughout the Piedmont of the southeastern United States and ranges into part of the Cumberland Plateau, Interior Low Plateau, Inner Coastal Plain, and the Southern Blue Ridge. It is known to occur in Alabama, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia, and may possibly range into Mississippi.

Subnations: AL, GA, KY, MS?, NC, SC, TN, VA

TNC Ecoregions: 43:C, 44:P, 50:C, 51:C, 52:C

USFS Ecoregions: 221Hc:CCC, 221He:CCC, 222Eb:CCC, 231B:CC, 232:?, M221Dc:???, M221Dd:???

Federal Lands: DOD (Arnold, Fort Gordon, Fort Stewart?); USFS (Chattahoochee, Cherokee, Daniel Boone, Land Between the Lakes?, Nantahala?, Pisgah?, Uwharrie?)

ELEMENT SOURCES

References: Allard 1990, Eyre 1980, Southeastern Ecology Working Group n.d.

EXOTIC-DOMINATED COMMUNITY

TIMOTHY - COMMON EASTERN BROME - AUTUMN SNEEZEWEED HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Phleum pratense* - *Bromus pubescens* - *Helenium autumnale* Herbaceous Vegetation

Database Code: CEGL004018

Formation: Medium-tall sod temperate or subpolar grassland (V.A.5.N.c)

Alliance: *Phleum pratense* Herbaceous Alliance (A.1195)

ELEMENT CONCEPT

Summary: Montane grasslands with many alien species, presumably planted or introduced by grazing animals. *Phleum pratense*, a native of Europe, is characteristic. Occurrences are variable and patchy, often with local dominance of tall forbs. Other characteristic species include *Hieracium caespitosum (= Hieracium pratense)* (alien), *Potentilla canadensis*, and *Ranunculus acris* (alien). Stands of this type are maintained by periodic mowing or, in some instances, prescribed burning. This vegetation type is currently known from high-elevation pastures or grass balds in the southern Appalachians but is possible throughout the United States and in southern Canada.

Environment: This vegetation type is currently known from high-elevation pastures or grass balds in the southern Appalachians but is possible throughout the United States and in southern Canada.

Vegetation: Stands of this type are maintained by periodic mowing or, in some instances, prescribed burning. The nominals *Bromus pubescens* and *Helenium autumnale* are indicative of grazing.

Dynamics: No information

Similar Associations:

- *Dactylis glomerata* - *Rumex acetosella* Herbaceous Vegetation (CEGL006107)

Related Concepts:

- Grass Balds (Pyne 1994) B
- ID9a. Grass Bald (Allard 1990) B

Classification Comments: The nominals *Bromus pubescens* and *Helenium autumnale* are indicative of grazing.

CONSERVATION RANKING & RARE SPECIES

GRank: GNA (modified/managed) (2001-11-8): This vegetation type includes pasture and post-agricultural fields, and is largely composed of non-native grasses and herbs (generally of European origin).

High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This vegetation type is currently known from high-elevation pastures or grass balds in the southern Appalachians but is possible throughout the United States and in southern Canada.

Subnations: NC, TN, VA?

TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Dc:CCP, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway?); USFS (Cherokee, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Pyne 1994, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

SEMI-NATURAL FOREST

TULIPTREE - BLACK LOCUST FOREST

ELEMENT IDENTIFIERS

NVC association: *Liriodendron tulipifera - Robinia pseudoacacia* Forest
Database Code: CEGL007219
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Liriodendron tulipifera* Forest Alliance (A.236)

ELEMENT CONCEPT

Summary: This early-successional or semi-natural vegetation occurs in the southern Appalachian Mountains and Appalachian Plateaus. Examples are typical of areas which were once clearcut, old fields, strip-mined, graded for road construction, or otherwise cleared. Stands are typically revegetated from root and stump sprouts and wind dispersed seeds. Canopies are typically dominated by *Liriodendron tulipifera,* although other species may also be present. *Robinia pseudoacacia* is listed as a nominal to indicate the Appalachian distribution of this type. Associated species may vary. Tall shrubs (*Rhododendron periclymenoides, Rhododendron calendulaceum, Kalmia latifolia, Calycanthus floridus*) sprout from root stocks and occur as scattered, dense clumps, while shorter shrubs (*Gaylussacia ursina, Leucothoe fontanesiana, Rubus* spp., *Vaccinium* spp.) can have dense, continuous cover. Composition of the herbaceous stratum varies with site conditions and moisture regime and may contain field-adapted species, tolerant of high light intensities, as well as many shade-tolerant forest herbs. *Lycopodium digitatum* may also form dense cover.
Environment: This community occurs on gentle to moderately steep, middle to upper slopes at approximately 700-1220 m (2300-4000 feet) elevation. Important environmental factors, such as solar irradiation, soil moisture/temperature, and air temperature, vary within and between sites and are related to the size of the opening, age of the stand, and slope direction (Phillips and Shure 1990). Soils are primarily Hapludults and Dystrochrepts. This successional forest occurs on upland areas in the southern Appalachian Mountains and Appalachian Plateaus. It typically occurs as 8- to 16-ha patches in the landscape. These forests are typical of areas which were once clearcut, old fields, strip-mined, or cleared by fire or other natural disturbances.
Vegetation: Stands of this successional vegetation have canopies which are typically dominated by *Liriodendron tulipifera* and *Acer rubrum,* with lesser amounts of *Robinia pseudoacacia*. Some examples may contain *Pinus virginiana*. Associated species vary. The relative absence of *Quercus* species in these stands indicates more severe disturbance to this type in contrast to *Liriodendron tulipifera - Acer rubrum - Quercus* spp. Forest (CEGL007221). Taller shrubs include *Rhododendron periclymenoides, Rhododendron calendulaceum, Kalmia latifolia,* and *Calycanthus floridus*; shorter shrubs include *Gaylussacia ursina, Leucothoe fontanesiana, Rubus* spp., and *Vaccinium* spp. Composition of the herbaceous stratum varies with site conditions and moisture regime and may contain field-adapted species which are tolerant of high light intensities, as well as many shade-tolerant forest herbs. *Lycopodium digitatum* may also form dense cover.

This mainly deciduous forest has a canopy dominated by *Liriodendron tulipifera, Acer rubrum,* and *Robinia pseudoacacia* and may contain lesser amounts of *Betula lenta, Cornus florida, Nyssa sylvatica,* and *Magnolia fraseri*. Most of the regeneration is from stump and root sprouts, however, *Liriodendron tulipifera* establishment is primarily from seedlings. The upper canopy ranges from 5-9 m, but most of the regeneration is in a shrub/sapling layer at 1-3 m. Cover of woody species may be patchy to dense and is characterized by clumps of *Robinia pseudoacacia* and *Acer rubrum,* occurring as stump sprouts. Scattered thickets of evergreen ericads (*Rhododendron* and *Kalmia*) are also typical. Other species occurring as shrubs/saplings include *Calycanthus floridus, Halesia carolina, Pinus strobus, Castanea dentata, Prunus serotina, Pyrularia pubera, Sassafras albidum, Castanea pumila, Hydrangea arborescens, Viburnum acerifolium, Gaylussacia ursina, Rubus* spp., and *Vaccinium* ssp. Short shrubs (<2 m), such as *Gaylussacia ursina, Rubus* spp. and, *Vaccinium* ssp., often form a dense, continuous vegetation layer. Herbaceous species and tree seedlings occur in openings and beneath the shrub cover and include ferns (*Thelypteris noveboracensis, Dennstaedtia punctilobula, Polystichum acrostichoides,* and *Pteridium aquilinum*), other forests forbs (*Potentilla* spp., *Viola* spp., *Ageratina altissima,* Asteraceae spp., *Solidago* spp., *Galium latifolium, Lysimachia quadrifolia,* and *Desmodium* spp.) and grasses (*Arundinaria gigantea, Panicum* spp., and *Dichanthelium* spp.). Vines are also an important component in these forests with *Vitis* spp., *Smilax* spp., *Parthenocissus quinquefolia,* and *Dioscorea villosa* typical.
Dynamics: Presumably, individuals arising from sprouts are more susceptible to wind breakage because of constricted vascular tissue at the stump attachment (Phillips and Shure 1990). This is an early-successional forest, on recently cut-over land, dominated by

pioneer species. Prior to cutting these areas were dominated by *Pinus strobus* and/or *Quercus* spp. (*Quercus alba, Quercus prinus, Quercus rubra*), occurring with other upland hardwood species such as *Carya* spp. and *Liriodendron tulipifera*. Canopy closure occurs rapidly after time of harvest, and by the fourth year, little unshaded, unvegetated area remains. Mid- and late-successional species will slowly re-establish dominance. Considerable competition of tree species with *Vitis* spp. and *Rhododendron* spp. may affect future stand development on some sites (McGee and Hooper 1970).

Similar Associations:

- *Liriodendron tulipifera - Quercus* spp. Forest (CEGL007221) -- resulting from less severe disturbance.

Related Concepts:

- IF3a. Recently Harvested Timberland (Allard 1990) B
- Yellow Poplar (50) (USFS 1988) ?
- Yellow-Poplar: 57 (Eyre 1980) B

Classification Comments: This community differs from *Liriodendron tulipifera - Acer rubrum - Quercus* spp. Forest (CEGL007221) by its lack or relative lack of *Quercus* spp. It differs from other successional *Liriodendron tulipifera* types by the presence of *Robinia pseudoacacia*.

CONSERVATION RANKING & RARE SPECIES

GRank: GNA (ruderal) (2000-12-7): This forest represents early successional vegetation or vegetation resulting from anthropogenic activities and is thus not a conservation priority. These forests are typical of areas which were once clearcut, old fields, strip-mined, or cleared by fire or other natural disturbances.

High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community occurs in upland areas of the Blue Ridge escarpment where there has been removal of the above-ground portion of canopy trees within the past ten years. It occurs in North Carolina, South Carolina, Georgia, and Tennessee, in the Blue Ridge Physiographic Province and is likely in the Cumberland Plateau and Ridge and Valley Province.

Subnations: GA, KY, NC, SC, TN

TNC Ecoregions: 50:C, 51:C

USFS Ecoregions: 221Ha:CCC, 221He:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Daniel Boone, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, Eyre 1980, Golden 1974, Govus 1982, Horn 1976, Horn 1980, McGee and Hooper 1970, NatureServe Ecology - Southeastern U.S. unpubl. data, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Phillips and Shure 1990, Schmalzer 1978, Southeastern Ecology Working Group n.d., Thomas 1966, USFS 1988

SOUTHERN APPALACHIAN GRASS AND SHRUB BALD

ALLEGHENY BLACKBERRY - SMOOTH BLACKBERRY / PENNSYLVANIA SEDGE SHRUBLAND

ELEMENT IDENTIFIERS

NVC association: *Rubus allegheniensis - Rubus canadensis / Carex pensylvanica* Shrubland

Database Code: CEGL003892

Formation: Subalpine or subpolar cold-deciduous shrubland (III.B.2.N.b)

Alliance: *Rubus allegheniensis - Rubus canadensis* Shrubland Alliance (A.930)

ELEMENT CONCEPT

Summary: Areas within open montane grasslands dominated by *Rubus* spp. (*Rubus allegheniensis* and/or *Rubus canadensis*) at high elevations in the Southern Blue Ridge. These shrublands also contain trace amounts of other species from the surrounding grassland, such as *Athyrium filix-femina ssp. asplenioides, Agrostis perennans, Angelica triquinata, Carex debilis var. rudgei, Carex brunnescens, Carex intumescens (= var. fernaldii)*, and *Rumex acetosella* (exotic).

Environment: This deciduous shrubland typically occurs at elevations from 1500-1980 m (5000-6500 feet). The developmental and ecological dynamics of this vegetation are poorly understood. Occurrences are thought to result from successional processes on natural grass balds following grazing and other disturbances, or following the cessation of natural disturbance regimes (e.g., periodic fires). Habitats are in exposed, upper-slope to crest positions, where low winter temperatures, high winds, and ice storms are characteristic. Stands occur both on edges of the natural bald on Whitetop Mountain, and in artificial balds that resulted from intensive logging, fires, and grazing on Mount Rogers and Wilburn Ridge.

Vegetation: These shrublands are dominated by *Rubus allegheniensis* and *Rubus canadensis*, usually occurring within and on the edges of open montane grasslands at high elevations in the Southern Blue Ridge. Stands may contain large colonies of *Carex pensylvanica* under the dominant shrubs, as well as scattered individuals of other species from the surrounding grassland, such as

Athyrium filix-femina ssp. asplenioides, Agrostis perennans, Angelica triquinata, Carex debilis var. rudgei, Carex brunnescens ssp. sphaerostachya, Carex intumescens, and *Rumex acetosella*. Virginia examples of this community are heavily dominated by *Rubus canadensis* and contain a wide variety of minor associates.
Dynamics: No information
Similar Associations:
Related Concepts:
- *Rubus canadensis* Shrubland (Fleming and Coulling 2001) =
- Grass Balds, BR (Pyne 1994) B
- ID9a. Grass Bald (Allard 1990) B

Classification Comments:

CONSERVATION RANKING & RARE SPECIES

GRank: GNA (modified/managed) (1998-1-30): This community is known from the highest elevations of the southern Appalachian Mountains. It has a small range, few occurrences, and is rapidly disappearing due to vegetational succession. This community supports a diverse flora with many rare, unusual, and threatened species. It is threatened by high levels of recreational use, by the introduction of exotic plant and animal species, and by successional trends of uncertain cause. Sometimes this montane shrubland is regarded as a more advanced successional stage of *Carex pensylvanica* Herbaceous Vegetation (CEGL004094) or *Danthonia compressa - (Sibbaldiopsis tridentata)* Herbaceous Vegetation (CEGL004242). This modified vegetation is now a natural part of high-elevation landscapes in the Southern Blue Ridge and an important part of the functioning landscape, providing habitat for many southern Appalachian species. For conservation planning purposes, examples of this community may be best considered lower quality occurrences of CEGL004094 or CEGL004242.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community occurs only at the highest elevations of the Southern Appalachians in North Carolina, Tennessee, and Virginia. Occurrences in Virginia are known only from the upper slopes of Whitetop Mountain, Mount Rogers, and Wilburn Ridge in the Southern Blue Ridge.
Subnations: NC, TN, VA
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: USFS (Cherokee, Jefferson, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Fleming and Coulling 2001, Fleming et al. 2001, Pyne 1994, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

CAROLINA RHODODENDRON SHRUBLAND

ELEMENT IDENTIFIERS

NVC association: *Rhododendron carolinianum* Shrubland
Database Code: CEGL003816
Formation: Hemi-sclerophyllous temperate broad-leaved evergreen shrubland (III.A.2.N.b)
Alliance: *Rhododendron (catawbiense, carolinianum) - Kalmia latifolia* Shrubland Alliance (A.744)

ELEMENT CONCEPT

Summary: This mainly evergreen shrubland occurs on steep ridges and rock outcroppings, typically at 1040-1280 m (3400-4200 feet) elevation, in the mountains of western North Carolina. This community has at least 25% shrub cover and may occur as a dense shrubland, 2-4 m tall, or as a shorter, more open shrubland with areas of exposed rock with fruticose and crustose lichens, scattered mats of prostrate vegetation, and isolated clumps of herbaceous species. At least 50% of the total shrub cover is made up of *Rhododendron carolinianum*. Associated shrub species vary among occurrences, but can include *Kalmia latifolia, Lyonia ligustrina var. ligustrina, Vaccinium corymbosum, Vaccinium pallidum, Fothergilla major, Acer rubrum, Ilex montana,* and low-growing *Gaylussacia baccata* and *Leiophyllum buxifolium*. Some occurrences may have occasional stunted trees of *Pinus pungens* or *Pinus rigida*. More open occurrences have significant cover by mats of *Selaginella tortipila* and scattered herbaceous species such as *Galax urceolata, Hypericum densiflorum, Carex umbellata, Danthonia sericea, Coreopsis major, Liatris pilosa (= Liatris graminifolia), Xerophyllum asphodeloides,* and *Schizachyrium scoparium*. High solar irradiation and desiccating winds, in combination with the shallow, nutrient-poor soils, are key environmental factors influencing this community. This community often occurs adjacent to or grades into xeric forests and woodlands dominated by *Pinus pungens, Tsuga caroliniana,* or *Quercus prinus*. This community is known from areas of quartzite and meta-arkose geology in Linville Gorge Wilderness (Newell and Peet 1994).
Environment: This community occurs on steep ridges and rock outcroppings typically at 1040-1280 m (3400-4200 feet) elevation but may occur as low as 610 m (2000 feet) (Newell and Peet 1995) or as high as 1980 m (6500 feet) (Whittaker 1979). Aspects range from southeast to northwest, and topographic positions vary from flat bluff ledges to moderate slopes and steep bluff faces. This

community is known from areas of exposed slate on the steep ridges of Mount Le Conte (Ramseur 1958) and areas of quartzite and meta-arkose geology in Linville Gorge Wilderness (Newell and Peet 1995). High solar irradiation and desiccating winds, in combination with the shallow, nutrient-poor soils, are key environmental factors influencing this community.
Vegetation: This community may occur as a dense shrubland, 2-4 m tall, or as a shorter, more open shrubland with areas of exposed rock with fruticose and crustose lichens, scattered mats of prostrate vegetation, and isolated clumps of herbaceous species. The dominant shrub species is *Rhododendron carolinianum*. Associated shrubs may include *Kalmia latifolia, Lyonia ligustrina, Vaccinium corymbosum, Vaccinium pallidum, Fothergilla major, Acer rubrum, Ilex montana,* and low-growing *Gaylussacia baccata* and *Leiophyllum buxifolium.* Some occurrences may have occasional stunted trees of *Pinus pungens* or *Pinus rigida*. More open occurrences have significant cover by mats of *Selaginella tortipila* and scattered herbaceous species such as *Galax urceolata, Hypericum densiflorum, Carex umbellata, Danthonia sericea, Coreopsis major, Liatris pilosa (= Liatris graminifolia), Xerophyllum asphodeloides,* and *Schizachyrium scoparium*.
Dynamics: Fire may be important in the maintenance of this community but the fire regime is not known. This community can result from the successional development of *Leiophyllum buxifolium* Dwarf-shrubland (CEGL003951). It is often maintained in an early successional stage by limited soil development and limited moisture availability. Where this community occurs on less exposed sites with greater soil development it may succeed to xeric *Pinus*-dominated woodlands or forests.
Similar Associations:
Related Concepts:
- *Rhododendron minus/Selaginella tortipila* Outcrops (Newell and Peet 1995) B
- Heath Bald (Carolina Rhododendron Subtype) (Schafale 1998b) ?
- IC4a. Heath Bald Shrubland (Allard 1990) B

Classification Comments: Associated shrub species vary among occurrences. This shrubland may have significant areas of bare rock and non-woody vegetation but generally has at least 25% shrub cover. Similar shrublands in the southern Appalachian Mountains may contain *Rhododendron carolinianum* but comprising less than 50% of the total shrub cover. This community is known from areas of quartzite and meta-arkose geology in Linville Gorge Wilderness (Newell and Peet 1994).

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (1997-12-31): This community is limited in extent, occurring as scattered pockets in the southern Appalachian Mountains. This fragile community is threatened by heavy recreational use. In particular, occurrences on rock faces and bluff ledges are threatened by the activities of rock climbers.
High-ranked species: *Fothergilla major* (G3), *Hudsonia montana* (G1), *Hypericum buckleii* (G3), *Liatris helleri* (G2)

ELEMENT DISTRIBUTION

Range: This shrubland occurs in the mountains of western North Carolina.
Subnations: NC, TN
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC
Federal Lands: USFS (Pisgah)

ELEMENT SOURCES

References: Allard 1990, Cain 1930b, Newell and Peet 1995, Peet et al. unpubl. data 2002, Ramseur 1958, Risk 1993, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Whittaker 1979

CATAWBA RHODODENDRON - MOUNTAIN FETTERBUSH SHRUBLAND

ELEMENT IDENTIFIERS

NVC association: *Rhododendron catawbiense - Pieris floribunda* Shrubland
Database Code: CEGL004516
Formation: Hemi-sclerophyllous temperate broad-leaved evergreen shrubland (III.A.2.N.b)
Alliance: *Rhododendron (catawbiense, carolinianum) - Kalmia latifolia* Shrubland Alliance (A.744)

ELEMENT CONCEPT

Summary: Dense, montane shrub thickets dominated by *Rhododendron catawbiense* and *Pieris floribunda,* typically at elevations over 1670 m (5500 feet), on steep, rocky, dry, southwestern to southeastern exposures. This shrubland does not occur north of the Asheville Basin and is known from occurrences in the Balsam Mountains (Devils Courthouse, Silvermine Bald, Shining Rock, Tanasee Bald, Mt. Pisgah). Other shrub species can include *Photinia melanocarpa (= Aronia melanocarpa), Kalmia latifolia, Amelanchier laevis, Ilex montana, Prunus serotina, Sorbus americana, Vaccinium stamineum, Vaccinium pallidum,* and *Vaccinium erythrocarpum*. Herb cover is sparse beneath the dense shrub canopy but may include such species as *Dennstaedtia punctilobula, Oclemena acuminata (= Aster acuminatus), Eurybia chlorolepis (= Aster chlorolepis), Eurybia macrophylla (= Aster macrophyllus), Carex pensylvanica, Galax urceolata, Listera smallii,* and *Prenanthes* sp. (Newell and Peet 1996). This community occurs adjacent to spruce - fir and Northern hardwood forests and montane grasslands dominated by *Danthonia compressa* and *Carex pensylvanica*. This community typically is of shorter stature on the most exposed sites over 1830 m (6000 feet) elevation.

Environment: No information
Vegetation: No information
Dynamics: No information
Similar Associations:
Related Concepts:
- *Rhododendron catawbiense-Pieris* Shrubland (Newell and Peet 1996a) ?
- Heath Bald (Southern Mixed Subtype) (Schafale 1998b) ?
- IC4a. Heath Bald Shrubland (Allard 1990) B

Classification Comments: The species *Pieris floribunda* occurs without *Rhododendron catawbiense* in the Ridge and Valley and Allegheny front range of Virginia.

CONSERVATION RANKING & RARE SPECIES

GRank: G1 (1997-12-31): This community has a very restricted range, found primarily in the Balsam Mountains, south of Asheville, North Carolina. The total acreage of this community is limited since it occurs as scattered islands of shrubland in the highest elevations. Since this community generally occurs in inaccessible, well-protected sites, it is not highly threatened. Occurrences in areas of high recreation use may be threatened by trampling, while natural succession may threaten other sites.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range:
Subnations: NC, TN
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC
Federal Lands: USFS (Pisgah)

ELEMENT SOURCES

References: Allard 1990, Newell and Peet 1996a, Risk 1993, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

CATAWBA RHODODENDRON SHRUBLAND

ELEMENT IDENTIFIERS

NVC association: *Rhododendron catawbiense* Shrubland
Database Code: CEGL003818
Formation: Hemi-sclerophyllous temperate broad-leaved evergreen shrubland (III.A.2.N.b)
Alliance: *Rhododendron (catawbiense, carolinianum) - Kalmia latifolia* Shrubland Alliance (A.744)

ELEMENT CONCEPT

Summary: This evergreen shrubland occurs at the highest elevations, typically 1500-1980 m (5000-6500 feet), in the southern Appalachian Mountains on steep, exposed slopes, ridges, and rock outcrops. It occurs primarily in the northern portion of the southern Appalachians, north of the Asheville Basin, in mountain ranges lacking *Pieris floribunda* and *Rhododendron carolinianum*. Greater than 75% of the shrub cover is comprised of evergreen species, and the predominant shrub is *Rhododendron catawbiense*. Scattered trees contribute less than 1% cover, typically *Photinia melanocarpa (= Aronia melanocarpa), Abies fraseri*, and *Picea rubens*. Small openings in the shrub canopy are dominated by rock or herbs. Herb cover beneath the shrub canopy is absent or very sparse (<5%) and may include *Gaultheria procumbens, Galax urceolata, Epigaea repens, Medeola virginiana, Trillium undulatum, Melampyrum lineare, Dryopteris campyloptera, Houstonia serpyllifolia, Viola* spp., and *Carex debilis var. rudgei*. Mosses may be locally dominant at the base of *Rhododendron* clumps, often *Polytrichum commune* or bryophytes from adjacent *Picea - Abies* communities. This community can result from secondary succession after fire or logging or can occur as a topo-edaphic climax on steep, exposed sites. Occurrences may range in size from 0.5-200 hectares. This community can grade into or occur adjacent to high-elevation rock outcrop communities, montane grass-dominated communities, or forests dominated by *Picea rubens, Abies fraseri*, and northern hardwood species such as *Fagus grandifolia, Acer saccharum*, and *Betula alleghaniensis*.
Environment: This evergreen shrubland occurs at the highest elevations, typically 1500-1980 m (5000-6500 feet), in the southern Appalachian Mountains on steep, exposed slopes, ridges, and rock outcrops. It occurs primarily in the northern portion of the southern Appalachians, north of the Asheville Basin, in mountain ranges lacking *Pieris floribunda* and *Rhododendron carolinianum*. This community can result from secondary succession after fire or logging or can occur as a topo-edaphic climax on steep, exposed sites. Occurrences may range in size from 0.5-200 hectares. This community can grade into or occur adjacent to high-elevation rock outcrop communities, montane grass-dominated communities, or forests dominated by *Picea rubens, Abies fraseri*, and northern hardwood species such as *Fagus grandifolia, Acer saccharum*, and *Betula alleghaniensis*.
Vegetation: Greater than 75% of the shrub cover is comprised of evergreen species, and the predominant shrub is *Rhododendron catawbiense*, which forms a continuous, dense shrub canopy from 1-4 m tall. On the most rugged, windswept sites, shrubs are stunted and gnarled. The occurrence and relative abundance of associated shrub species vary with elevation and adjacent vegetation. Scattered

trees contribute less than 1% cover, typically *Photinia melanocarpa (= Aronia melanocarpa), Abies fraseri*, and *Picea rubens*. Small openings in the shrub canopy are dominated by rock or herbs. Herb cover beneath the shrub canopy is absent or very sparse (<5%) and may include *Gaultheria procumbens, Galax urceolata, Epigaea repens, Medeola virginiana, Trillium undulatum, Melampyrum lineare, Dryopteris campyloptera, Houstonia serpyllifolia, Viola* spp., and *Carex debilis var. rudgei*. Mosses may be locally dominant at the base of *Rhododendron* clumps, often *Polytrichum commune* or bryophytes from adjacent *Picea - Abies* communities.
Dynamics: Windfall, landslides, and small, localized and lightning-caused fires are important in the establishment and maintenance of this community. This community can result from secondary succession after fire or logging, in which case it is unstable and will eventually succeed to a forest community with a *Rhododendron* understory (e.g., *Picea rubens - (Abies fraseri) / (Rhododendron catawbiense, Rhododendron maximum)* Forest (CEGL007130)). When this community occurs on steep, exposed sites, where wind exposure, soil infertility, and drought maintain a scrubby shrub community, it is a topo-edaphic climax. According to Gant (1978) *Rhododendron catawbiense* heath balds represent stable communities that employ allelopathic interference to arrest succession and maintain themselves.
Similar Associations:
Related Concepts:
- *Rhododendron catawbiense - Menziesia pilosa* Subtype (Fleming and Coulling 2001) F
- *Sorbus americana / Menziesia pilosa - Vaccinium erythrocarpum - Rubus canadensis* Subtype (Fleming and Coulling 2001) F
- Blue Ridge Shrub Bald (Ambrose 1990a) B
- Heath Bald (Pyne 1994) B
- Heath Bald (Catawba Rhododendron Subtype) (Schafale 1998b) ? IC4a. Heath Bald Shrubland (Allard 1990) B

Classification Comments: This community can grade into or occur adjacent to high-elevation rock outcrop communities, montane grass-dominated communities, or forests dominated by *Picea rubens, Abies fraseri*, and northern hardwood species such as *Fagus grandifolia, Acer saccharum*, and *Betula alleghaniensis*. A more open, low-growing, evergreen shrubland, IV.A.1.N.a *Leiophyllum buxifolium* Dwarf-shrubland Alliance (A.1063), is restricted to areas where *Leiophyllum buxifolium* dominates areas greater than 0.1 hectare. However, the species may be locally dominant as inclusions in this shrubland. Similar, but floristically different, ericaceous shrublands occur in the Mahoosuc Mountains of Maine (Fahey 1976). Exemplary occurrences are known from the Roan Mountain Massif, North Carolina and Tennessee, and Mount Rogers, Virginia.

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (1997-12-31): This community occurs at the highest elevations (1500-1980 m, 5000-6500 feet) of the southern Appalachian Mountains in Virginia, North Carolina, and Tennessee. Although there are hundreds of occurrences, the total acreage of this community is limited since it occurs as scattered islands of shrubland at the highest elevations. Since this community generally occurs in inaccessible, well-protected sites, it is not highly threatened. Occurrences in areas of high recreation use may be threatened by trampling, while natural succession may threaten other sites.
High-ranked species: *Abies fraseri* (G2), *Fothergilla major* (G3), *Geum radiatum* (G1), *Hudsonia montana* (G1), *Hypericum buckleii* (G3), *Liatris helleri* (G2), *Lilium grayi* (G3), *Prenanthes roanensis* (G3), *Rhododendron vaseyi* (G3)

ELEMENT DISTRIBUTION

Range: This community occurs primarily in the northern portion of the southern Appalachians, north of the Asheville Basin, in North Carolina, Tennessee, and Virginia.
Subnations: GA?, NC, TN, VA
TNC Ecoregions: 51:C
USFS Ecoregions: M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: USFS (Chattahoochee?, Cherokee, Jefferson, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Ambrose 1990a, Brown 1941, Fahey 1976, Fleming and Coulling 2001, Fleming et al. 2001, Gant 1978, Pyne 1994, Ramseur 1958, Rawinski 1992, Risk 1993, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Weakley 1993, Whittaker 1979

MOUNTAIN ALDER / PENNSYLVANIA SEDGE SHRUBLAND

ELEMENT IDENTIFIERS

NVC association: *Alnus viridis* ssp. *crispa / Carex pensylvanica* Shrubland
Database Code: CEGL003891
Formation: Subalpine or subpolar cold-deciduous shrubland (III.B.2.N.b)
Alliance: *Alnus viridis* Shrubland Alliance (A.929)

ELEMENT CONCEPT

Summary: This mainly deciduous shrubland occurs at the highest elevations, greater than 1750 m (5800 feet) in the southern Appalachian Mountains on summit ridges of the Roan Mountain massif. It is dominated by *Alnus viridis ssp. crispa*, typically 1.5-2 m in height, rarely producing a closed canopy but typically occurring as uniformly spaced clumps about 1 m apart. *Rubus allegheniensis*

is often a codominant with *Alnus viridis ssp. crispa*. Other shrub species occur with low coverage and include *Rhododendron catawbiense, Vaccinium corymbosum*, and *Crataegus* spp. Openings in the shrub canopy are dominated by herbs, mainly *Carex pensylvanica* and *Carex debilis var. rudgei* but also may include *Danthonia compressa, Deschampsia flexuosa, Viola blanda, Rumex acetosella* (exotic), and *Athyrium filix-femina ssp. asplenioides*. In moister areas, bryophyte cover can be up to 75%, with *Polytrichum commune* typical. This community can grade into or occur adjacent to high elevation rock outcrop communities, montane grass-dominated communities, high elevation herbaceous seeps, or forests dominated by stunted *Fagus grandifolia*. It often invades montane grass-dominated communities and may eventually succeed to *Rhododendron catawbiense* Shrubland (CEGL003818).

Environment: This community occurs on ridges and exposed slopes at elevations of 1770-1800 m (5800-5900 feet). Slope gradients range from 8 to 15 degrees. Extreme cold, high precipitation, frequent fog, and desiccating winds in combination with the shallow, nutrient-poor soils are the key environmental factors influencing this community. This community occurs as disconnected patches on summit ridges, interrupted by grass-dominated vegetation. It can grade into or occur adjacent to high-elevation rock outcrop communities, montane grass-dominated communities, high-elevation herbaceous seeps, or forests dominated by stunted *Fagus grandifolia*. It often invades montane grass-dominated communities and may eventually succeed to *Rhododendron catawbiense* Shrubland (CEGL003818).

Vegetation: These montane, mainly deciduous shrublands are dominated by *Alnus viridis* typically 1.5-2 m in height, rarely producing a closed canopy but typically occurring as uniformly spaced clumps about 1 m apart. *Rubus allegheniensis* is often a codominant with *Alnus viridis ssp. crispa*. Other shrub species occur with low coverage and include *Rhododendron catawbiense, Vaccinium corymbosum*, and *Crataegus* spp. Openings in the shrub canopy are dominated by herbs, mainly *Carex pensylvanica* and *Carex debilis var. rudgei* but also may include *Danthonia compressa, Deschampsia flexuosa, Viola blanda, Rumex acetosella* (exotic), and *Athyrium filix-femina ssp. asplenioides*. In moister areas, bryophyte cover can be up to 75%, with *Polytrichum commune* typical.

Dynamics: This community may be damaged by lightning-caused fire or defoliating insects (Brown 1941). Montane, herb-dominated vegetation may be invaded by *Alnus viridis ssp. crispa* and succeed to this community. This shrubland may experience invasion by *Rhododendron catawbiense, Abies fraseri*, and *Picea rubens* and may succeed to vegetation dominated by these species.

Similar Associations:

- *Rhododendron catawbiense* Shrubland (CEGL003818) -- may have up to 25% of the total shrub cover made up of *Alnus viridis ssp crispa*.

Related Concepts:

- Heath Bald (Alder Subtype) (Schafale 1998b) ?
- Heath Bald, BR (Pyne 1994) B
- IC4a. Heath Bald Shrubland (Allard 1990) B

Classification Comments: Other communities dominated by *Alnus viridis ssp. crispa* may occur in the western and northeastern United States as well as in Canada. This community occurs as disconnected patches on summit ridges, interrupted by grass-dominated vegetation such as *Danthonia compressa - (Sibbaldiopsis tridentata)* Herbaceous Vegetation (CEGL004242) or *Carex pensylvanica* Herbaceous Vegetation (CEGL004094). Additionally, this community can grade into or occur adjacent to high-elevation rock outcrop communities, high-elevation herbaceous seeps, or forests dominated by stunted *Fagus grandifolia*.

CONSERVATION RANKING & RARE SPECIES

GRank: G1 (1994-8-15): This community occurs only in the Roan Mountain massif, Avery and Mitchell counties, North Carolina and Carter County, Tennessee, where it occupies hundreds of hectares. It a narrow endemic, naturally rare, but stable, occupying a total acreage of less than 500 hectares.

High-ranked species: *Krigia montana* (G3), *Lilium grayi* (G3), *Prenanthes roanensis* (G3)

ELEMENT DISTRIBUTION

Range: This community occurs only in the Roan Mountain massif of the Southern Blue Ridge of North Carolina and Tennessee.

Subnations: NC, TN

TNC Ecoregions: 51:C

USFS Ecoregions: M221Dc:CCC

Federal Lands: USFS (Cherokee, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Anderson et al. 1990, Brown 1941, Pyne 1994, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

MOUNTAIN LAUREL - CATAWBA RHODODENDRON - (BLACK HUCKLEBERRY, MOUNTAIN FETTERBUSH, HIGHBUSH BLUEBERRY) SHRUBLAND

ELEMENT IDENTIFIERS

NVC association: *Kalmia latifolia - Rhododendron catawbiense - (Gaylussacia baccata, Pieris floribunda, Vaccinium corymbosum)* Shrubland

Database Code: CEGL003814
Formation: Hemi-sclerophyllous temperate broad-leaved evergreen shrubland (III.A.2.N.b)
Alliance: *Rhododendron (catawbiense, carolinianum) - Kalmia latifolia* Shrubland Alliance (A.744)

ELEMENT CONCEPT

Summary: This community occurs in the mountains of Georgia, North Carolina, and Tennessee, on ridges, and steep, rocky slopes at intermediate elevations (4000-5000 feet). It is a mostly evergreen shrubland, although deciduous shrubs may be present and even locally dominant. Shrubs form a dense, sometimes impenetrable thicket, 1-4 m tall. The most typical shrub dominants are *Kalmia latifolia* and *Rhododendron catawbiense*, although *Gaylussacia baccata, Leiophyllum buxifolium, Pieris floribunda, Rhododendron carolinianum, Rhododendron maximum,* and *Vaccinium corymbosum* are dominant or have high coverage in some occurrences. Other shrubs include *Photinia melanocarpa (= Aronia melanocarpa), Clethra acuminata, Ilex montana, Vaccinium stamineum, Leucothoe recurva,* and *Viburnum nudum var. cassinoides*. Small openings in the shrub canopy are dominated by lichens, bare rock or herbs, with some occurrences having up to 60% exposed rock. Herb cover beneath the shrub canopy is absent or very sparse (<5%) and may include *Galax urceolata, Gaultheria procumbens, Goodyera pubescens, Melampyrum lineare, Mitchella repens,* and *Pteridium aquilinum*. *Smilax rotundifolia* is a common vine. Small, scattered trees are possible (*Acer rubrum, Amelanchier laevis, Betula alleghaniensis, Ilex montana, Magnolia fraseri, Nyssa sylvatica, Oxydendrum arboreum, Prunus pensylvanica, Quercus rubra*) and may be more typical of shrublands resulting from intense fires on less exposed sites. Windfall, landslides, and small, localized, lightning-caused fires are important in the establishment and maintenance of these shrublands. This community can result from secondary succession after fire or logging or can occur as a topo-edaphic climax on steep or exposed sites.
Environment: This community occurs in the mountains of Georgia, North Carolina, and Tennessee, on ridges, and steep, rocky slopes at intermediate elevations (4000-5000 feet).
Vegetation: This association typically manifests as a mostly evergreen shrubland, although deciduous shrubs may be present and even locally dominant. These shrubs form a dense, sometimes impenetrable thicket, 1-4 m tall. The most typical shrub dominants are *Kalmia latifolia* and *Rhododendron catawbiense*, although *Gaylussacia baccata, Leiophyllum buxifolium, Pieris floribunda, Rhododendron carolinianum, Rhododendron maximum,* and *Vaccinium corymbosum* are dominant or have high coverage in some occurrences. Other shrubs include *Photinia melanocarpa (= Aronia melanocarpa), Clethra acuminata, Ilex montana, Vaccinium simulatum, Vaccinium stamineum, Leucothoe recurva*, and *Viburnum nudum var. cassinoides*. Small openings in the shrub canopy are dominated by lichens, bare rock or herbs, with some occurrences having up to 60% exposed rock. Herb cover beneath the shrub canopy is absent or very sparse (<5%) and may include *Galax urceolata, Gaultheria procumbens, Goodyera pubescens, Melampyrum lineare, Mitchella repens,* and *Pteridium aquilinum*. *Smilax rotundifolia* is a common vine. Small, scattered trees are possible (*Acer rubrum, Amelanchier laevis, Betula alleghaniensis, Ilex montana, Magnolia fraseri, Nyssa sylvatica, Oxydendrum arboreum, Prunus pensylvanica, Picea rubens,* and *Quercus rubra*) and may be more typical of shrublands resulting from intense fires on less exposed sites.
Dynamics: Windfall, landslides, and small, localized, lightning-caused fires are important in the establishment and maintenance of these shrublands. This community can result from secondary succession after fire or logging or can occur as a topo-edaphic climax on steep or exposed sites.
Similar Associations:
- *Rhododendron carolinianum - Rhododendron catawbiense - Leiophyllum buxifolium* Shrubland (CEGL007876)

Related Concepts:
- Blue Ridge Shrub Bald (Ambrose 1990a) B
- Heath Bald (Pyne 1994) B
- Heath Bald (Blueberry Subtype) (Schafale 1998b) ?
- Heath Bald (Low Elevation Subtype) (Schafale 1998b) ?
- IC4a. Heath Bald Shrubland (Allard 1990) B
- Mountain laurel-great laurel summits (CAP pers. comm. 1998) ?

Classification Comments: These shrublands possibly have a broader distribution and typically occur at lower elevations than other montane shrublands in the *Rhododendron (catawbiense, carolinianum) - Kalmia latifolia* Shrubland Alliance (A.744). In the Southern Blue Ridge, this shrubland generally occurs at elevations over 1200 meters (4000 feet) and grades into forests dominated by *Quercus coccinea, Pinus rigida, Pinus pungens,* and/or *Quercus rubra*. High-elevation occurrences may be compositionally similar to another heath bald community, *Rhododendron carolinianum - Rhododendron catawbiense - Leiophyllum buxifolium* Shrubland (CEGL007876).

CONSERVATION RANKING & RARE SPECIES

GRank: G2G3 (1999-2-15): This is a locally common heath bald type in parts of the Southern Blue Ridge. Some occurrences represent a topo-edaphic climax, while other areas require fire to maintain the physiognomy. Fire-maintained occurrences are threatened by general fire prevention in the mountains.
High-ranked species: *Glyceria nubigena* (G2)

ELEMENT DISTRIBUTION

Range: This community is found in the Blue Ridge Mountains of Georgia, North Carolina, and Tennessee. Examples in the Cumberlands of Kentucky are rare and of limited extent.
Subnations: GA, KY, NC, TN
TNC Ecoregions: 50:C, 51:C, 59:C
USFS Ecoregions: M221Aa:CPP, M221Be:CPP, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala)

ELEMENT SOURCES

References: Allard 1990, Ambrose 1990a, CAP pers. comm. 1998, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Pyne 1994, Risk 1993, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

MOUNTAIN OATGRASS - (MOUNTAIN-CINQUEFOIL) HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Danthonia compressa - (Sibbaldiopsis tridentata)* Herbaceous Vegetation
Database Code: CEGL004242
Formation: Short sod temperate or subpolar grassland (V.A.5.N.e)
Alliance: *Danthonia compressa* Herbaceous Alliance (A.1280)

ELEMENT CONCEPT

Summary: This community consists of graminoid-dominated vegetation with scattered shrubs, occurring on moderate to high elevation peaks and saddles in the Southern Blue Ridge. Characteristically, this vegetation is strongly dominated by *Danthonia compressa*, or in some areas codominated by the subshrub *Sibbaldiopsis tridentata (= Potentilla tridentata)*. Other characteristic herbaceous species are *Angelica triquinata, Oclemena acuminata (= Aster acuminatus), Carex pensylvanica, Carex debilis, Carex intumescens, Carex brunnescens, Deschampsia flexuosa, Erythronium umbilicatum ssp. monostolum, Gentiana austromontana, Gentianella quinquefolia, Houstonia serpyllifolia, Ionactis linariifolius (= Aster linariifolius), Lysimachia quadrifolia, Potentilla canadensis, Prenanthes roanensis, Smilax herbacea, Solidago bicolor, Solidago glomerata, Stachys clingmanii, Trautvetteria caroliniensis var. caroliniensis*. The floristic composition is a mixture of widespread species, northern disjunct species (such as *Agrostis mertensii, Carex siccata (= Carex aenea), Minuartia groenlandica, Packera schweinitziana (= Senecio schweinitzianus), Sibbaldiopsis tridentata*), and Southern Appalachian endemics (such as *Erythronium umbilicatum ssp. monostolum, Geum geniculatum, Geum radiatum, Houstonia serpyllifolia, Lilium grayi, Prenanthes roanensis, Solidago glomerata, Stachys clingmanii*). Typical shrubs (which may occur as scattered individuals or as patches) are *Rhododendron calendulaceum, Rhododendron catawbiense, Menziesia pilosa, Vaccinium corymbosum*, and *Rubus canadensis*. Species indicative of past grazing include *Phleum pratense, Agrostis gigantea, Hieracium scabrum, Rumex acetosella, Prunella vulgaris*. This community occurs on high-elevation (usually above 1350 m or 4500 feet), often south- to southwest-facing domes, ridgetops, and gentle slopes. Strong winds, high rainfall, frequent fog, shallow rocky soils, and extremes of temperature and moisture are characteristic of these environments. It is known from the highest elevations of the southern Appalachian Mountains. It is typically surrounded by dwarfed forests dominated by *Fagus grandifolia* or *Quercus rubra*.
Environment: This community occurs on high-elevation (usually above 1350 m or 4500 feet), often south- to southwest-facing domes, ridgetops, and gentle slopes. Strong winds, high rainfall, frequent fog, shallow rocky soils, and extremes of temperature and moisture are characteristic of these environments. In North Carolina and Tennessee, this grassland vegetation is typically surrounded by dwarfed forests dominated by *Fagus grandifolia* or *Quercus rubra*. On Whitetop Mountain, Virginia, the type occurs at elevations from 1525-1655 m (5000-5430 feet), adjacent to both well-developed *Picea rubens*-dominated forests and stunted northern hardwoods. Soils are extremely acidic (pH = 3.8), with low (5%) base saturation, high aluminum levels (1600 ppm), and relatively high (27%) organic matter content.
Vegetation: This vegetation is graminoid-dominated with scattered shrubs. Most occurrences are strongly dominated by *Danthonia compressa*, but some sites are codominated by the subshrub *Sibbaldiopsis tridentata (= Potentilla tridentata)*. Other characteristic herbaceous species are *Angelica triquinata, Oclemena acuminata (= Aster acuminatus), Carex pensylvanica, Carex debilis var. rudgei, Carex intumescens, Carex brunnescens ssp. sphaerostachya, Deschampsia flexuosa, Erythronium umbilicatum ssp. monostolum, Gentiana austromontana, Gentianella quinquefolia, Houstonia serpyllifolia, Ionactis linariifolius (= Aster linariifolius), Lysimachia quadrifolia, Potentilla canadensis, Prenanthes roanensis, Smilax herbacea, Solidago bicolor, Solidago glomerata, Stachys clingmanii*, and *Trautvetteria caroliniensis var. caroliniensis*. The floristic composition is a mixture of widespread species, northern disjunct species such as *Sibbaldiopsis tridentata*; and Southern Appalachian endemics such as *Houstonia serpyllifolia, Lilium grayi*, and *Prenanthes roanensis*. Typical shrubs, which may occur as scattered individuals or patches are *Rhododendron calendulaceum, Rhododendron catawbiense, Menziesia pilosa, Vaccinium corymbosum*, and *Rubus canadensis*. Invasive, introduced species indicative of past grazing include *Phleum pratense, Agrostis gigantea, Hieracium caespitosum, Rumex acetosella*, and *Prunella vulgaris*.

In the least disturbed, most natural areas, the most abundant or characteristic herbaceous associates are *Carex brunnescens ssp. sphaerostachya, Carex debilis var. rudgei, Lysimachia quadrifolia, Dennstaedtia punctilobula, Carex pensylvanica, Potentilla canadensis, Prenanthes roanensis, Solidago rugosa, Ageratina altissima var. roanensis*, and *Hypericum mitchellianum*. Despite the exposed topography, atmospheric conditions create a very moist microclimate, as evidenced by large populations of species often associated with wetlands, including *Helenium autumnale, Packera aurea, Houstonia serpyllifolia, Solidago patula*, and *Carex intumescens*.

Dynamics: The origin and ecological dynamics of this vegetation type are not clear. Several disturbance mechanisms, both natural and anthropogenic, have been hypothesized, including fire, grazing, trampling, clearing, climatic change, windthrow, or some combination of these influences. The importance of megaherbivores in long-term bald maintenance has recently been proposed (Wiegl and Knowles 1999). It appears that new occurrences of this community are not being created, and that many existing ones are being encroached by shrub and tree species. The presence of northern disjunct species requiring open habitat suggests that some of these areas have been open since the Pleistocene. This is the case at Whitetop Mountain, Virginia, although there is little question that the original openings were greatly expanded during a long history of grazing and the development of a 19th century resort. A. Weakley (pers. comm. 2001) suggests that the balds of Roan Mountain, Tennessee, are primarily natural, whereas those farther north are of anthropogenic origin.

Similar Associations:

Related Concepts:

- *Danthonia compressa - Carex brunnescens ssp. sphaerostachya - Sibbaldiopsis tridentata* Herbaceous Vegetation (Fleming and Coulling 2001) =
- Grass Balds, BR (Pyne 1994) B
- Grassy Bald (Northern Grass Subtype) (Schafale 1998b) ?
- Grassy Bald (Southern Grass Subtype) (Schafale 1998b) ?
- ID9a. Grass Bald (Allard 1990) B

Classification Comments: Notable examples include various peaks of the Roan Mountain complex, Long Hope Valley, Shining Rock Wilderness, and Great Smoky Mountains National Park. The origin of this community is not clear, and in fact, several mechanisms, both natural and anthropogenic, have been proposed including fire, grazing, trampling, clearing, climatic change, windthrow, or some combination of these influences. The presence of northern disjunct species requiring open habitat may suggest that some of these areas have been open since the Ice Age. A. Weakley (pers. comm.) suggests that the balds of Roan Mountain, Tennessee, are primarily natural, whereas those farther north are of anthropogenic origin. It appears that new occurrences of this community are not being created, and those that exist are being encroached by shrub and tree species. Lindsay (1976) reported that examples of this community in Great Smoky Mountains National Park will have disappeared by the end of the century if management is not undertaken to halt invasion by woody plants. However, these balds are among those most likely to be of anthropogenic origin.

CONSERVATION RANKING & RARE SPECIES

GRank: G1 (1998-12-14): This community has small range, few occurrences, and is rapidly disappearing due to vegetational succession. This community is threatened by high levels of recreational use and the introduction of exotic plant and animal species, as well as by successional trends of uncertain cause.

High-ranked species: *Allium allegheniense* (G3?), *Carex misera* (G3), *Delphinium exaltatum* (G3), *Gentiana austromontana* (G3), *Geum geniculatum* (G2), *Geum radiatum* (G1), *Hypericum buckleii* (G3), *Hypericum graveolens* (G3), *Hypericum mitchellianum* (G3), *Lilium grayi* (G3), *Prenanthes roanensis* (G3), *Rhododendron vaseyi* (G3), *Solidago glomerata* (G3), *Stachys clingmanii* (G2Q)

ELEMENT DISTRIBUTION

Range: This montane sparse dwarf-shrubland is found in the high mountain areas of the Southern Appalachians. While the majority of examples occur in North Carolina, this community is also known from Tennessee and Virginia.

Subnations: NC, TN, VA

TNC Ecoregions: 51:C

USFS Ecoregions: M221Db:CC?, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains); USFS (Cherokee, Jefferson, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Allard et al. 1990, Billings and Mark 1957, Bratton 1975, Cain 1931, DeSelm and Murdock 1993, Fleming and Coulling 2001, Fleming et al. 2001, Gersmehl 1969, Gersmehl 1971, Gersmehl 1973, Lindsay 1976, Lindsay 1977, Lindsay 1978, Lindsay and Bratton 1979a, Lindsay and Bratton 1979b, Lindsay and Bratton 1980, Mark 1958, Mark 1959, NCNHP 1993, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Pyne 1994, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Stratton and White 1982, Weakley pers. comm., Wiegl and Knowles 1999

PENNSYLVANIA SEDGE HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Carex pensylvanica* Herbaceous Vegetation

Database Code: CEGL004094
Formation: Short sod temperate or subpolar grassland (V.A.5.N.e)
Alliance: *Carex pensylvanica* Herbaceous Alliance (A.1278)

ELEMENT CONCEPT

Summary: Montane grasslands over 1220 m (4000 feet) elevation in the southern Appalachian Mountains dominated by *Carex pensylvanica*. Associated species include *Rumex acetosella* (exotic), *Carex debilis, Polytrichum commune, Helenium autumnale, Danthonia compressa, Sibbaldiopsis tridentata, Fragaria virginiana, Ageratina altissima var. roanensis, Angelica triquinata, Oclemena acuminata (= Aster acuminatus), Bromus pubescens*, and *Dennstaedtia punctilobula*. Woody species, such as *Rhododendron catawbiense, Pieris floribunda, Rubus canadensis*, and *Robinia hispida*, may have sparse coverage in some occurrences.
Environment: No information
Vegetation: No information
Dynamics: No information
Similar Associations:
Related Concepts:
- Grass Balds (Pyne 1994) B
- Grassy Bald (Sedge Subtype) (Schafale 1998b) ?
- ID9a. Grass Bald (Allard 1990) B

Classification Comments: This concept needs to be modified to better describe occurrences at Whitetop Mountain, Virginia (G. Fleming pers. comm.).

CONSERVATION RANKING & RARE SPECIES

GRank: G1 (1994-12-15): This community is known from the highest elevations of the southern Appalachian Mountains. It has a small range, few occurrences, and is rapidly disappearing due to vegetational succession. This community supports a diverse flora with many rare, unusual, and threatened species. It is threatened by high levels of recreational use and the introduction of exotic plant and animal species, and by successional trends of uncertain cause.
High-ranked species: *Gentiana austromontana* (G3), *Geum geniculatum* (G2), *Hypericum graveolens* (G3), *Hypericum mitchellianum* (G3), *Krigia montana* (G3), *Lilium grayi* (G3), *Prenanthes roanensis* (G3)

ELEMENT DISTRIBUTION

Range:
Subnations: NC, TN
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CC?
Federal Lands: USFS (Cherokee, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Fleming pers. comm., Peet et al. unpubl. data 2002, Pyne 1994, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

SAND-MYRTLE DWARF-SHRUBLAND

ELEMENT IDENTIFIERS

NVC association: *Leiophyllum buxifolium* Dwarf-shrubland
Database Code: CEGL003951
Formation: Cespitose needle-leaved or microphyllous evergreen dwarf-shrubland (IV.A.1.N.a)
Alliance: *Leiophyllum buxifolium* Dwarf-shrubland Alliance (A.1063)

ELEMENT CONCEPT

Summary: This evergreen, sclerophyllous dwarf-shrubland occurs at the highest elevations in the southern Appalachian Mountains on steep, exposed slopes. It is typically found at elevations over 1770 m (5800 feet) in northwestern North Carolina. This dwarf-shrubland may occur as inclusions in other communities or as extensive mats. It is dominated by *Leiophyllum buxifolium* growing in dense mats with a krummholz structure. Occurrences of this community may have significant areas of bare rock but are at least 25% vegetated with at least 75% of the total shrub cover comprised of *Leiophyllum buxifolium*. Openings in the shrub stratum may contain sparse herbaceous cover including *Selaginella tortipila, Zigadenus leimanthoides* and *Deschampsia flexuosa*. Other shrub species that may occur include *Rhododendron catawbiense* and *Vaccinium corymbosum*. Mosses and lichens are also typical in more open occurrences. The largest occurrences of this shrubland are 1-2 hectares. An extreme environment with steep topography, high solar irradiation, desiccating winds in combination with shallow, nutrient-poor soils maintains this community as a topo-edaphic climax. This community often occurs adjacent to or grades into high-elevation rock outcrop communities and other montane shrublands.

Environment: This community occurs on exposed slopes and sharp ridges, typically above 1770 m (5800 feet) elevation, although it may occur at lower elevations. Shrubs root in shallow soils associated with rock outcrops or in coarse, sandy soils and organic matter accumulations in crevices. High solar irradiation and desiccating winds in combination with the shallow, nutrient-poor soils are the key environmental factors influencing this community.
Vegetation: This community is dominated by a low-growing (<0.5 m), evergreen, ericaceous shrub, *Leiophyllum buxifolium*, which may occur as scattered patches or as extensive, dense shrub mats. Openings in the shrub stratum may contain sparse herbaceous cover including *Selaginella tortipila*, *Deschampsia flexuosa*, *Hypericum densiflorum*, *Carex umbellata*, and *Danthonia sericea*. Other shrub species that may occur include *Rhododendron carolinianum* and *Vaccinium pallidum*. Mosses and lichens are also typical in more open occurrences. The largest occurrences of this shrubland are 1-2 hectares.
Dynamics: Windfall, landslides, and small, localized lightning-cause fires are important in the establishment and maintenance of this community. This community may result from primary succession or from secondary succession when lichens, mosses, and eventually *Leiophyllum* invade rock exposed by landslides or catastrophic fires. On steep, exposed sites, wind exposure, soil infertility and drought help maintain this community as a topo-edaphic climax. If soil development is sufficient and the environment is not too extreme, this community may succeed to *Rhododendron carolinianum*- or *Rhododendron catawbiense*-dominated shrublands.
Similar Associations:
Related Concepts:
- *Picea rubens / Leiophyllum buxifolium* outcrop community (Wiser et al. 1996) ?
- *Picea rubens / Leiophyllum buxifolium* outcrop community (Wiser 1993) ?
- Blue Ridge Shrub Bald (Ambrose 1990a) B
- Heath Bald (Pyne 1994) B Heath Bald (Sand Myrtle Subtype) (Schafale 1998b) ?
- IC4a. Heath Bald Shrubland (Allard 1990) B

Classification Comments: The species *Leiophyllum buxifolium* may be locally dominant in other southern Appalachian heath shrublands. This association is restricted to areas where *Leiophyllum buxifolium* dominates areas greater than 0.1 hectare. In the southern part of this community's range, the dominant species, *Leiophyllum buxifolium*, occurs on as an upright shrub (30-50 cm tall), in narrow vegetated zones on granitic domes. In the northwestern part of North Carolina and in eastern Tennessee, on steep, high-elevation areas, this community occurs as low shrub mats with a krummholz structure. Further study may reveal floristic differences between these two situations that may warrant recognition of two community elements.

Similar shrublands in the southern Appalachian Mountains (*Rhododendron carolinianum* Shrubland (CEGL003816), *Rhododendron catawbiense* Shrubland (CEGL003818)) may contain *Leiophyllum buxifolium*, but comprising less than 75% of the total shrub cover. In the Coastal Plain of New Jersey and North Carolina *Leiophyllum buxifolium* occurs as a dense shrub component in *Pinus*-dominated woodlands and sparse woodlands. It is not known if this species occurs in the Coastal Plain as a shrubland without a significant tree canopy.

CONSERVATION RANKING & RARE SPECIES

GRank: G1 (1994-8-15): One of the most restricted heath bald types, in terms of distribution and acreage, it is known from Grandfather Mountain, North Carolina. The total acreage of this community is limited (<100 hectares) since it occurs as scattered islands of shrubland in the highest elevations. Since this community generally occurs in inaccessible, well-protected sites, it is not highly threatened. Occurrences in areas of high recreation use may be threatened by trampling, while natural succession may threaten other sites.
High-ranked species: *Glyceria nubigena* (G2), *Hudsonia montana* (G1), *Hypericum buckleii* (G3), *Liatris helleri* (G2)

ELEMENT DISTRIBUTION

Range: This community occurs on rock outcrops in the southern Appalachian Mountains. It is typically found at elevations over 1770 m (5800 feet) in northwestern North Carolina and northeastern Tennessee. It may also occur at lower elevations in western North Carolina, northeastern Georgia, and northwestern South Carolina, in association with granitic domes and gneissic outcrops.
Subnations: GA?, NC, SC?, TN
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCP, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee?, Cherokee?, Nantahala?, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Ambrose 1990a, Newell and Peet 1995, Peet et al. unpubl. data 2002, Pyne 1994, Risk 1993, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Weakley 1993, Whittaker 1956, Whittaker 1979, Wiser 1993, Wiser et al. 1996

SMOOTH BLACKBERRY - (AMERICAN RED RASPBERRY) / LADY FERN - SKUNK GOLDENROD SHRUBLAND

ELEMENT IDENTIFIERS

NVC association: *Rubus canadensis - (Rubus idaeus* ssp. *strigosus) / Athyrium filix-femina - Solidago glomerata* Shrubland

Database Code: CEGL003893
Formation: Subalpine or subpolar cold-deciduous shrubland (III.B.2.N.b)
Alliance: *Rubus allegheniensis - Rubus canadensis* Shrubland Alliance (A.930)

ELEMENT CONCEPT

Summary: This vegetation occurs at high elevations in the southern Appalachian Mountains of North Carolina and Tennessee. It is successional vegetation resulting from severe disturbance of spruce-fir forests (including Balsam Woolly Adelgid-affected stands and stands which were severely burned after logging), as well as exposed sites with other frequent, natural disturbance (such as shrub invasion of grazed fire meadows). It occurs on exposed summits and high slopes, typically at elevations over 6000 feet. This community includes high-elevation Appalachian *Rubus* thickets and differs from *Rubus* thickets on grassy balds by predominance of forbs rather than sedges and by frequent presence of *Rubus idaeus*. Vegetation is variously dominated by dense *Rubus canadensis* or by dense *Athyrium filix-femina ssp. asplenioides* and *Solidago glomerata* (on more protected sites). Standing dead *Abies fraseri* often tower above the shrubs and herbs, and there is usually much downed woody debris. Other species present include *Agrostis perennans, Angelica triquinata, Oclemena acuminata (= Aster acuminatus), Carex brunnescens, Carex crinita, Carex intumescens, Carex debilis, Cinna latifolia, Clintonia borealis, Danthonia compressa, Diervilla sessilifolia, Oxalis montana, Prunus pensylvanica, Sorbus americana*, and *Rugelia nudicaulis*. Scattered living *Picea rubens, Betula alleghaniensis*, and *Amelanchier laevis* may occur. The long-term future of this community is uncertain, but it appears to be fairly stable over periods of several decades. A variation of this community occurs in areas such as Shining Rock Wilderness and parts of the Great Smoky Mountains where fires were started after logging had taken place and the intensity of the fires due to the accumulated slash burned down nearly to mineral soil. These areas do not have as much coarse woody debris from downed spruce or fir and often have a canopy approaching that of a woodland with sparse coverage of *Sorbus americana* and *Prunus pensylvanica*.
Environment: This vegetation occurs at high elevations in the southern Appalachian Mountains of North Carolina and Tennessee. It is successional vegetation resulting from severe disturbance of spruce-fir forests (including Balsam Woolly Adelgid-affected stands and stands which were severely burned after logging), as well as exposed sites with other frequent, natural disturbance (such as shrub invasion of grazed fire meadows). It occurs on exposed summits and high slopes, typically at elevations over 6000 feet.
Vegetation: Vegetation is variously dominated by dense *Rubus canadensis* or by dense *Athyrium filix-femina ssp. asplenioides* and *Solidago glomerata* (on more protected sites). Standing dead *Abies fraseri* tower above the shrubs and herbs, and there is much downed woody debris. Other species present include *Agrostis perennans, Angelica triquinata, Oclemena acuminata (= Aster acuminatus), Carex brunnescens, Carex crinita, Carex intumescens, Carex debilis, Cinna latifolia, Clintonia borealis, Danthonia compressa, Diervilla sessilifolia, Oxalis montana, Prunus pensylvanica, Sorbus americana*, and *Rugelia nudicaulis*. Scattered living *Picea rubens, Betula alleghaniensis*, and *Amelanchier laevis* may occur. A variation of this community occurs in areas such as Shining Rock Wilderness and parts of the Great Smoky Mountains where fires were started after logging had taken place and the intensity of the fires due to the accumulated slash burned down nearly to mineral soil. These areas do not have as much coarse woody debris from downed spruce or fir and often have a canopy approaching that of a woodland with sparse coverage of *Sorbus americana* and *Prunus pensylvanica*.
Dynamics: No information
Similar Associations:
Related Concepts:
- Bramble-goldenrod thicket (CAP pers. comm. 1998) ?

Classification Comments: This community differs from *Rubus* thickets on grassy balds by predominance of forbs rather than sedges and by frequent presence of *Rubus idaeus*.

CONSERVATION RANKING & RARE SPECIES

GRank: GNA (modified/managed) (2002-8-20): This community represents an altered vegetation type, modified by the effects of an alien pest species and/or the effects of past land use. Examples of this vegetation once represented what is now a globally rare and critically imperiled community that has an uncertain future. This modified vegetation is now a natural part of high-elevation landscapes in the Southern Blue Ridge and an important part of the functioning landscape, providing habitat for many southern Appalachian species. For conservation planning purposes, examples of this community may be best considered low-quality occurrences of forests in the *Abies fraseri - Picea rubens* Forest Alliance (A.136).
High-ranked species: *Rugelia nudicaulis* (G3), *Solidago glomerata* (G3)

ELEMENT DISTRIBUTION

Range: This vegetation occurs at high elevations in the southern Appalachians of North Carolina and Tennessee.
Subnations: NC, TN
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Bd:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

References: CAP pers. comm. 1998, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Southeastern Ecology Working Group n.d.

EASTERN WHITE PINE / MOUNTAIN LAUREL - (DEERBERRY, BEAR HUCKLEBERRY) FOREST

ELEMENT IDENTIFIERS

NVC association: *Pinus strobus / Kalmia latifolia - (Vaccinium stamineum, Gaylussacia ursina)* Forest
Database Code: CEGL007100
Formation: Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b)
Alliance: *Pinus strobus* Forest Alliance (A.128)

ELEMENT CONCEPT

Summary: This association includes natural stands of forest vegetation with a canopy dominated by *Pinus strobus*. This community occurs at lower elevations (below 900 m) in the Southern Blue Ridge region of the southern Appalachians on upper slopes and ridgetops protected by higher landforms. Other minor canopy species may include *Pinus rigida, Quercus coccinea,* and *Acer rubrum*. These forests often have open subcanopies composed of *Oxydendrum arboreum, Acer rubrum, Nyssa sylvatica,* and *Cornus florida*. The shrub stratum is patchy to continuous and dominated by ericaceous species, typically *Gaylussacia ursina,* or *Vaccinium stamineum,* and *Kalmia latifolia*. Other common species in the shrub/sapling stratum may include *Gaylussacia baccata, Vaccinium pallidum, Acer rubrum,* and *Castanea dentata*. Typical herbaceous species include *Galax urceolata, Chimaphila maculata, Goodyera pubescens, Epigaea repens, Medeola virginiana, Lysimachia quadrifolia, Uvularia puberula,* and *Chamaelirium luteum*.
Environment: This community occurs at lower elevations (below 900 m) in the Southern Blue Ridge region of the southern Appalachians on upper slopes and ridgetops protected by higher landforms.
Vegetation: This association includes natural stands of forest vegetation with a canopy dominated by *Pinus strobus*. Other minor canopy species may include *Pinus rigida, Quercus coccinea,* and *Acer rubrum*. These forests often have open subcanopies composed of *Oxydendrum arboreum, Acer rubrum, Nyssa sylvatica,* and *Cornus florida*. The shrub stratum is patchy to continuous and dominated by ericaceous species, typically *Gaylussacia ursina* or *Vaccinium stamineum,* and *Kalmia latifolia*. Other common species in the shrub/sapling stratum may include *Gaylussacia baccata, Vaccinium pallidum, Acer rubrum,* and *Castanea dentata*. Typical herbaceous species include *Galax urceolata, Chimaphila maculata, Goodyera pubescens, Epigaea repens, Medeola virginiana, Lysimachia quadrifolia, Uvularia puberula,* and *Chamaelirium luteum*.
Dynamics: No information
Similar Associations:
Related Concepts:
- IA6f. Dry White Pine Ridge Forest (Allard 1990) B
- White Pine Forest (Schafale 1998b) ?
- White Pine, BR (Pyne 1994) ?

Classification Comments:

CONSERVATION RANKING & RARE SPECIES

GRank: G2G3 (2000-1-4): This community is geographically restricted and uncommon within its range.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community is known from the escarpment region of the Southern Blue Ridge and the Great Smoky Mountains of Tennessee.
Subnations: GA, NC, SC, TN
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Nantahala, Sumter)

ELEMENT SOURCES

References: Allard 1990, DeYoung 1979, Govus 1982, NatureServe Ecology - Southeastern U.S. unpubl. data, Patterson 1994, Peet et al. unpubl. data 2002, Pyne 1994, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

SHORTLEAF PINE - (ROCK CHESTNUT OAK, SOUTHERN RED OAK) / SOURWOOD / HILLSIDE BLUEBERRY FOREST

ELEMENT IDENTIFIERS

NVC association: *Pinus echinata - Quercus (prinus, falcata) / Oxydendrum arboreum / Vaccinium pallidum* Forest
Database Code: CEGL007493
Formation: Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a)
Alliance: *Pinus echinata - Quercus (coccinea, prinus)* Forest Alliance (A.395)

ELEMENT CONCEPT

Summary: This association includes crests of low-elevation slopes and ridges on the fringes of the Southern Blue Ridge, extending into the southern Ridge and Valley and Cumberland Plateau, where *Pinus echinata* and dry-site oaks characteristic of lower elevations codominate in association with other Appalachian flora. This forest is known from the southern Blue Ridge Escarpment region of North Carolina, South Carolina, and Georgia, particularly in the Blue Ridge/Piedmont transition, where it occurs on exposed, rocky ridges and upper, convex slopes, at elevations at or below 2200 feet. It also extends into the southern Ridge and Valley and Cumberland Plateau, but more information is needed to characterize the variation in that part of the range. Canopies are codominated by *Pinus echinata* and combinations of dry-site oaks that may include *Quercus falcata, Quercus coccinea, Quercus prinus, Quercus stellata,* and *Quercus velutina*. On rocky sites, canopies may be slightly stunted. Mid-canopy trees can be scattered or form a well-developed subcanopy. Common subcanopy trees can include *Oxydendrum arboreum, Ilex opaca var. opaca, Cornus florida, Quercus marilandica, Quercus stellata,* and *Carya pallida*. The shrub stratum varies in composition and density but is typically dominated by *Vaccinium pallidum*. Other shrubs may include *Vaccinium stamineum, Gaylussacia ursina, Gaylussacia baccata, Rhododendron calendulaceum, Rhododendron minus, Castanea pumila,* and *Kalmia latifolia*. On some sites *Symplocos tinctoria* can be important. *Vitis rotundifolia* and *Smilax glauca* are common vines. The herb stratum is poorly developed with scattered species such as *Chimaphila maculata, Iris verna, Pteridium aquilinum var. latiusculum, Goodyera pubescens, Hexastylis arifolia, Coreopsis major (= var. rigida), Tipularia discolor, Schizachyrium scoparium, Pityopsis graminifolia var. latifolia, Tephrosia virginiana, Silphium compositum, Dichanthelium* spp., and *Galax urceolata*.

Environment: This association includes crests of low-elevation slopes and ridges on the fringes of the Southern Blue Ridge, extending into the southern Ridge and Valley and Cumberland Plateau, where *Pinus echinata* and dry-site oaks characteristic of lower elevations codominate in association with other Appalachian flora. This forest is known from the southern Blue Ridge Escarpment region of North Carolina, South Carolina, and Georgia, particularly in the Blue Ridge/Piedmont transition, where it occurs on exposed, rocky ridges and upper, convex slopes, at elevations at or below 2200 feet. It also extends into the southern Ridge and Valley and Cumberland Plateau, but more information is needed to characterize the variation in that part of the range.

Vegetation: Canopies are codominated by *Pinus echinata* and combinations of dry-site oaks that may include *Quercus falcata, Quercus coccinea, Quercus prinus, Quercus stellata,* and *Quercus velutina*. On rocky sites, canopies may be slightly stunted. Mid-canopy trees can be scattered or form a well-developed subcanopy. Common subcanopy trees can include *Oxydendrum arboreum, Ilex opaca var. opaca, Cornus florida, Quercus marilandica, Quercus stellata,* and *Carya pallida*. The shrub stratum varies in composition and density but is typically dominated by *Vaccinium pallidum*. Other shrubs may include *Vaccinium stamineum, Gaylussacia ursina, Gaylussacia baccata, Rhododendron calendulaceum, Rhododendron minus, Castanea pumila,* and *Kalmia latifolia*. On some sites *Symplocos tinctoria* can be important. *Vitis rotundifolia* and *Smilax glauca* are common vines. The herb stratum is poorly developed with scattered species such as *Chimaphila maculata, Iris verna, Pteridium aquilinum var. latiusculum, Goodyera pubescens, Hexastylis arifolia, Coreopsis major (= var. rigida), Tipularia discolor, Schizachyrium scoparium, Pityopsis graminifolia var. latifolia, Tephrosia virginiana, Silphium compositum, Dichanthelium* spp., and *Galax urceolata*.

Dynamics: No information

Similar Associations:

- *Pinus echinata - Quercus alba / Vaccinium pallidum / Hexastylis arifolia - Chimaphila maculata* Forest (CEGL008427)
- *Pinus echinata - Quercus prinus / Rhododendron minus / Vaccinium pallidum* Forest (CEGL007496)
- *Pinus echinata - Quercus stellata - Quercus prinus - Carya glabra / (Danthonia spicata, Piptochaetium avenaceum)* Forest (CEGL007500) -- a more open, grassy variant.

Related Concepts:

- IA7a. Xeric Shortleaf Pine - Oak Forest (Allard 1990) B
- Southern Mountain Pine-Oak Forest (Schafale 1998b) ?

Classification Comments: These communities are distinguished by canopies codominated by *Pinus echinata* and combinations of dry-site oaks that may include *Quercus falcata, Quercus coccinea, Quercus prinus, Quercus stellata,* and *Quercus velutina*. These communities are not well known. In North Carolina they are apparently largely confined to Cherokee County. Examples are also known from the southern portion of the Chattooga River Basin watershed in South Carolina and Georgia. This forest is probably fire-dependent to some extent, and fire (prescribed or natural) will stimulate regeneration of *Pinus echinata*. Many occurrences of this community are highly disturbed and contain exotic species such as *Ligustrum japonicum, Dioscorea oppositifolia,* and *Lonicera japonica*. *Pinus echinata*, in many occurrences, has been attacked by the Southern Pine Bark Beetle, which will eventually kill the trees. The concepts of the former associations *Pinus echinata - Quercus falcata / Vaccinium pallidum* Forest (CEGL007494) and *Pinus echinata - Quercus prinus / Oxydendrum arboreum / Vaccinium pallidum* Forest (CEGL007495) were merged into this association and should be considered variants of this community. *Pinus echinata - Quercus alba / Vaccinium pallidum / Hexastylis arifolia - Chimaphila maculata* Forest (CEGL008427) includes shortleaf pine - mesic oak forests of the non-coastal plain, non-Ozark/Ouachita portion of the *Pinus echinata* range, with an overall more mesophytic species composition than the association described here.

CONSERVATION RANKING & RARE SPECIES

GRank: G3G4 (2000-1-12): This community occurs within a restricted geographic range and is uncommon within this range. Because this community is poorly known and essentially uninventoried throughout its range, there remain questions regarding its

taxonomic distinctiveness and geographic extent. Further inventory and more detailed field information may expand the current range and concept of this type.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This association occurs in the southern fringes of the Southern Blue Ridge, extending into the southern Ridge and Valley and Cumberland Plateau. It could possibly range into the upper Piedmont.
Subnations: GA, KY, NC, SC, TN?
TNC Ecoregions: 50:C, 51:C, 52:?
USFS Ecoregions: 231Ag:CCC, 231Dc:CCC, M221Cd:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains, Kings Mountain, Little River Canyon?); USFS (Chattahoochee, Cherokee?, Daniel Boone, Nantahala, Sumter)

ELEMENT SOURCES

References: Allard 1990, Evans 1991, NatureServe Ecology - Southeastern U.S. unpubl. data, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Schafale 1998b, Southeastern Ecology Working Group n.d.

SHORTLEAF PINE / (HILLSIDE BLUEBERRY, DEERBERRY) - MOUNTAIN LAUREL FOREST

ELEMENT IDENTIFIERS

NVC association: *Pinus echinata / Vaccinium (pallidum, stamineum)* - *Kalmia latifolia* Forest
Database Code: CEGL007078
Formation: Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b)
Alliance: *Pinus echinata* Forest Alliance (A.119)

ELEMENT CONCEPT

Summary: This association includes forest vegetation with greater than 75% of the canopy cover of *Pinus echinata*, occurring over a shrub stratum dominated by ericaceous species, typically *Vaccinium pallidum, Vaccinium stamineum*, and *Kalmia latifolia*. Deciduous species make-up less than 25% of the canopy coverage and may include *Quercus falcata, Quercus coccinea*, or, in the southern part of this association's range, *Quercus stellata* and *Quercus marilandica*. This community often has a midstory tree stratum with *Oxydendrum arboreum, Carya pallida, Cornus florida*, or *Diospyros virginiana*. Other characteristic species include *Smilax glauca, Silphium compositum, Pteridium aquilinum var. latiusculum, Scleria oligantha, Piptochaetium avenaceum*, and *Tephrosia virginiana*. These forests occur in the lower elevations (below 2400 feet) of the southern Appalachian Mountains on ridges and upper slopes, typically with southern to western exposures.
Environment: These forests occur in the lower elevations (below 2400 feet) of the southern Appalachian Mountains on ridges and upper slopes, typically with southern to western exposures.
Vegetation: The closed canopy is dominated by *Pinus echinata*. Deciduous species make up less than 25% of the canopy coverage and may include *Quercus falcata, Quercus coccinea*, or, in the southern part of this association's range, *Quercus stellata* and *Quercus marilandica*. This community often has a midstory tree stratum with *Oxydendrum arboreum, Carya pallida, Cornus florida*, or *Diospyros virginiana*. The shrub stratum is dominated by ericaceous species, typically *Vaccinium pallidum, Vaccinium stamineum*, and *Kalmia latifolia*. Other characteristic species include *Smilax glauca, Silphium compositum, Pteridium aquilinum var. latiusculum, Scleria oligantha, Piptochaetium avenaceum*, and *Tephrosia virginiana*. In a sample from the Southern Blue Ridge in Union County, Georgia (Chattahoochee National Forest), *Pinus echinata* occupies 75-95% of the canopy which also occasionally includes *Quercus falcata, Quercus coccinea*, and *Pinus strobus*. The subcanopy is codominated by *Acer rubrum, Oxydendrum arboreum*, and *Cornus florida*. The open shrub layer is characterized by *Ilex opaca, Cornus florida, Vaccinium pallidum, Diospyros virginiana, Prunus serotina, Sassafras albidum*, and *Viburnum dentatum*. The sparse herb layer includes *Coreopsis major, Chimaphila maculata, Maianthemum racemosum, Lespedeza violacea (= Lespedeza intermedia)*, and *Trillium catesbaei*.
Dynamics: No information
Similar Associations:
Related Concepts:
- IA6a. Dry Shortleaf Pine - Oak - Hickory Forest (Allard 1990) B
- Low Mountain Pine Forest (Shortleaf Pine Subtype) (Schafale 1998b) ?
- Shortleaf Pine, BR (Pyne 1994) ?
- Shortleaf pine/heath forest of dry, acidic steep slopes (CAP pers. comm. 1998) ?

Classification Comments: Includes successional forests with a hardwood shrub/sapling stratum.

CONSERVATION RANKING & RARE SPECIES

GRank: G4? (1997-12-1): No information
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: These forests occur in the lower elevations of the southern Appalachian Mountains.
Subnations: GA, KY, MD, NC, SC, TN
TNC Ecoregions: 51:C, 52:P
USFS Ecoregions: 222Hc:CCC, M221A:CC, M221Ce:CCC, M221Dc:CCC, M221Dd:CCP
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee?, Nantahala, Sumter)

ELEMENT SOURCES

References: Allard 1990, CAP pers. comm. 1998, Evans 1991, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Pyne 1994, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

VIRGINIA PINE - (PITCH PINE, SHORTLEAF PINE) - (ROCK CHESTNUT OAK) / HILLSIDE BLUEBERRY FOREST

ELEMENT IDENTIFIERS

NVC association: *Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum* Forest
Database Code: CEGL007119
Formation: Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b)
Alliance: *Pinus virginiana* Forest Alliance (A.131)

ELEMENT CONCEPT

Summary: This community includes *Pinus virginiana*-dominated forests of low-elevation ridges and steep upper slopes, occurring primarily in the Appalachian provinces of the eastern United States, from central Pennsylvania, south and west to northern Georgia and northern Alabama. This community occurs on narrow ridges, steep slopes, and other exposed topographic positions, over shallow, infertile soils. This mainly evergreen forest is often of low stature, with a somewhat open to closed canopy, sparse to very dense shrub cover dominated by ericaceous species, and a sparse herb stratum. *Pinus virginiana* is the canopy dominant throughout the range of the type. In some parts of the range, other *Pinus* species may be canopy associates, as well as dry site *Quercus* species (e.g., *Quercus prinus, Quercus coccinea*). Deciduous species may form a subcanopy or sapling stratum, particularly in areas where fire has been excluded. Common shrub dominants include *Vaccinium pallidum, Vaccinium stamineum*, and *Kalmia latifolia*. Herbs vary with geography but are typical of infertile, xeric habitats. Some typical herbs in this forest are *Baptisia tinctoria, Chimaphila maculata, Dichanthelium commutatum, Epigaea repens, Euphorbia corollata, Galax urceolata, Hypoxis hirsuta, Iris verna, Pityopsis graminifolia var. latifolia, Pteridium aquilinum var. latiusculum*, and *Schizachyrium scoparium*.
Environment: Stands of this forest occur on narrow ridges and knobs, steep, upper slopes, bluff and cliff tops, and other exposed sites throughout the range of the type. They are found primarily on south-, southeast- or southwest-facing aspects on excessively drained, shallow soils. In the Blue Ridge Escarpment region, the western margin of the Blue Ridge, and west into the Ridge and Valley and Cumberland Mountains, this xeric forest occurs on convex slopes and ridges below 610 meters (2000 feet) elevation, over soils classed as Inceptisols, typically Lithic Dystrochrepts originating from sandstone, shale and other noncalcareous parent material. Its environmental situation in the western Alleghenies is not known. In the Interior Low Plateau of Kentucky, Tennessee, and Indiana, this association occurs in edaphically extreme situations, including bluff tops and narrow ridges in thin soils weathered from relatively acidic caprocks with southern and western aspects, as well as other similar slopes, over cherty limestone, siltstones, sandstones, and shales. In particular, in the Knobstone Escarpment Subsection (a few Indiana counties just north of Louisville, Kentucky) it occurs in glade-like situations on steep slopes with thin soils.
Vegetation: This community is a needle-leaved evergreen forest with a somewhat open to closed canopy. A deciduous subcanopy may be present, especially in areas where fire has been excluded. The shrub layers can be sparse to very dense and are composed of tall and short shrubs, predominantly ericaceous species. Herb cover is sparse, and leaf litter often dominates the ground layer. *Pinus virginiana* is the canopy dominant throughout the range of the type. In the southern Appalachians and southern Ridge and Valley it may occur with mixes of *Pinus rigida, Pinus echinata*, or *Pinus strobus*. Within its range, *Pinus pungens* may be present as a very minor component. Small stems of *Quercus prinus, Quercus coccinea, Acer rubrum, Nyssa sylvatica*, and *Oxydendrum arboreum* are common in the subcanopy and sapling strata, particularly in areas where fire has been excluded. In the southern Blue Ridge/Piedmont and southern Blue Ridge/Ridge and Valley transition regions, *Quercus marilandica, Quercus falcata*, and *Quercus stellata* can be deciduous components. Common shrub dominants include *Vaccinium pallidum, Vaccinium stamineum*, and *Kalmia latifolia*. Other typical shrubs can include *Gaylussacia ursina, Gaylussacia baccata, Sassafras albidum*, and *Vaccinium hirsutum* (southwestern North Carolina and southeastern Tennessee only). *Smilax glauca* and *Smilax rotundifolia* can be common vines. Characteristic herbaceous species from the southern Blue Ridge and southern Ridge and Valley include *Baptisia tinctoria, Chimaphila maculata, Dichanthelium commutatum, Epigaea repens, Euphorbia corollata, Galax urceolata, Hypoxis hirsuta, Iris verna, Pityopsis graminifolia var. latifolia, Pteridium aquilinum var. latiusculum*, and *Schizachyrium scoparium*. Typical herbs from examples in the western portion of the range (Interior Low Plateau) include *Antennaria plantaginifolia, Antennaria solitaria, Carex albicans var. albicans (= Carex artitecta), Danthonia spicata, Dichanthelium dichotomum, Lespedeza violacea (= Lespedeza intermedia), Hieracium gronovii, Hieracium venosum, Krigia biflora, Solidago erecta*, and *Tephrosia virginiana* (M. Homoya pers. comm. 1999). In some of these examples *Opuntia humifusa, Calamagrostis porteri ssp. insperata*, and *Solidago squarrosa* may occur locally.

Dynamics: This xeric, evergreen forest community will be maintained on sites where local soil conditions, topographic extremes, or occasional fire function to retard hardwood invasion. Infestations of southern pine beetle (*Dendroctonus frontalis*) can cause mortality of canopy trees. Examples affected by southern pine beetle in the Great Smoky Mountains can have up to 80-90% standing dead pine. Throughout most of its range, this community occurs as linear features along ridge tops and may be adjacent to or grade into xeric forests dominated by *Quercus coccinea* or *Quercus prinus* or more mesic forests dominated by *Quercus alba, Quercus rubra, Quercus velutina, Carya glabra*, and *Carya alba*. In the Interior Low Plateau, individual stands can be small in size, occurring in a matrix of *Quercus prinus* or *Quercus prinus - Quercus alba* forest (e.g., *Quercus prinus / Smilax* spp. Forest (CEGL005022) or *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023)), but in more edaphically extreme circumstances.

Similar Associations:
- *Pinus pungens - Pinus rigida - (Quercus prinus) / Kalmia latifolia - Vaccinium pallidum* Woodland (CEGL007097)
- *Pinus virginiana - Quercus (coccinea, prinus)* Forest (CEGL005040)
- *Pinus virginiana - Quercus falcata - Carya pallida* Forest (CEGL006354)
- *Pinus virginiana / Quercus marilandica* Serpentine Forest (CEGL006266)
- *Pinus virginiana* Successional Forest (CEGL002591)
- *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271)

Related Concepts:
- IA7c. Xeric Virginia Pine Ridge Forest (Allard 1990) B
- Low Mountain Pine Forest (Montane Pine Subtype) (Schafale 1998b) ?
- Oligotrophic Forest (Rawinski 1992) B
- Virginia Pine - Mixed Oaks, HR (Pyne 1994) B
- Virginia Pine - Oak: 78 (Eyre 1980) B
- Virginia Pine, BR, R&V, CUPL (Pyne 1994) B
- Virginia Pine: 79 (Eyre 1980) B
- Virginia pine forest (CAP pers. comm. 1998) ?
- Xeric Pine Forest, Pine - Heath Ridge Forest (Ambrose 1990a) B

Classification Comments: Some vegetation formerly placed (at least conceptually) in the *Pinus virginiana - Quercus (coccinea, prinus)* Forest Alliance (A.408) and its provisional association *Pinus virginiana - Quercus (coccinea, prinus)* Forest (CEGL005040), has been transferred here, with this association (CEGL007119) becoming more geographically inclusive. In Indiana examples, the substrate is primarily a matrix of acidic siltstone, shale, and sandstone. Rarely are cliffs formed; instead the setting is mostly very steep slopes with high hills and deep ravines. This association also includes vegetation from the transition between the Cumberland Plateau / Southern Ridge and Valley and the Upper East Gulf Coastal Plain in Alabama. Though located in the Coastal Plain, these occurrences are physiographically and floristically similar to this montane association.

Early successional vegetation associated with old fields, old pastures, clearcuts, and burned or eroded areas and dominated by *Pinus virginiana* is classified as *Pinus virginiana* Successional Forest (CEGL002591). Appalachian xeric oak forests with similar floristics, but with a mainly deciduous canopy are classed in *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271). Appalachian shale forests and woodlands with *Pinus virginiana* occur on steep, shaley slopes and have a stunted canopies and sparse herb and shrub strata, characterized by species adapted to shaley substrates. These shale communities are classed in *Pinus virginiana - Quercus (coccinea, prinus)* Forest Alliance (A.408) and *Pinus (rigida, pungens, virginiana) - Quercus prinus* Woodland Alliance (A.677).

CONSERVATION RANKING & RARE SPECIES

GRank: G4? (2001-2-11): This xeric evergreen forest community will be maintained on sites where local soil conditions, topographic extremes, or occasional fire function to retard hardwood invasion. Infestations of southern pine beetle (*Dendroctonus frontalis*) can cause mortality of canopy trees. Examples affected by southern pine beetle in the Great Smoky Mountains can have up to 80-90% standing dead pine.

High-ranked species: *Buckleya distichophylla* (G2), *Penstemon deamii* (G1), *Thermopsis villosa* (G3?), *Vaccinium hirsutum* (G3)

ELEMENT DISTRIBUTION

Range: This community occurs primarily in the Appalachian region of the United States, ranging from central Pennsylvania, south and west through the Ridge and Valley, Blue Ridge, and Cumberland Plateau to northern Georgia and Alabama, extending westward to scattered areas in the Interior Low Plateau and eastward into the upper Piedmont. It is reported from the states of Georgia, North Carolina, South Carolina, Tennessee, Kentucky, Pennsylvania, Indiana, Ohio, and is probably in Maryland, Virginia, and West Virginia.

Subnations: AL, GA, IN, KY, MD?, NC, OH, PA, SC, TN, VA?, WV

TNC Ecoregions: 43:C, 44:C, 49:C, 50:C, 51:C, 52:C, 59:C, 61:P

USFS Ecoregions: 221Ea:CC?, 221Eb:CCC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCC, 221Eg:CCC, 221Ha:CCC, 221Hb:CCC, 221Hc:CCP, 221He:CCC, 221Ja:CCC, 221Jb:CCC, 222Da:CCC, 222Dc:CCC, 222Dg:CCC, 222Dj:CCC, 222Eg:CCC, 222Ej:CCC, 222El:CCC, 222En:CCC, 222Eo:CCC, 222Fd:CCC, 222Ff:CCC, 231Aa:CCC, 231Ab:CCC, 231Ae:CCC, 231Bc:CCC, 231Cd:CCC,

231Da:CCC, 231Dc:CCC, M221Aa:CCP, M221Ab:CCC, M221Ac:CCC, M221Bd:CCP, M221Be:CCP, M221Cd:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway?, Chickamauga-Chattanooga, Great Smoky Mountains, Kennesaw Mountain, Kings Mountain, Little River Canyon?, Mammoth Cave); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, Land Between the Lakes?, Nantahala, Pisgah, Sumter, Talladega)

ELEMENT SOURCES

References: Allard 1990, Ambrose 1990a, Barden 1977, Burns and Honkala 1990a, CAP pers. comm. 1998, Cooper 1963, Core 1966, Evans 1991, Eyre 1980, Fike 1999, Gettman 1974, Homoya pers. comm., Malter 1977, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Patterson et al. 1999, Peet et al. unpubl. data 2002, Pyne 1994, Racine 1966, Rawinski 1992, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Walton et al. 1997, Whittaker 1956

SOUTHERN APPALACHIAN MONTANE CLIFF AND TALUS

COMMON ROCKTRIPE NONVASCULAR VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Umbilicaria mammulata* Nonvascular Vegetation
Database Code: CEGL004387
Formation: Montane/submontane temperate or subpolar lichen vegetation (VI.B.1.N.b)
Alliance: *Umbilicaria mammulata* Nonvascular Alliance (A.1827)

ELEMENT CONCEPT

Summary: Vegetation strongly dominated by *Umbilicaria mammulata*, on relatively moist, shaded, rock outcrops. This vegetation occurs where periodic seepage occurs on acidic rock outcrops. Individual occurrences can be as large as an acre. Vascular plants are generally sparse or absent, though trees of adjacent forest communities often shade the outcrop community for much of the day. Other umbilicate lichens may also occur. Associates include *Dryopteris intermedia, Polypodium virginianum (= Polypodium vulgare).* Typically found on northeast-facing slopes.
Environment: No information
Vegetation: No information
Dynamics: No information
Similar Associations:
Related Concepts:

- IE2a. Southern Appalachian Acidic Cliff (Allard 1990) ?
- Lichen-dominated shaded outcrops (CAP pers. comm. 1998) ?
- Montane Cliff (Carolina Rocktripe Subtype) (Schafale 1998b) ?
- SNE acidic cliff community (Rawinski 1984) ?

Classification Comments: Potentially very widespread in Southeast and beyond.

CONSERVATION RANKING & RARE SPECIES

GRank: G4? (1994-8-15): No information
High-ranked species: No information

ELEMENT DISTRIBUTION

Range:
Subnations: GA, NC, SC, TN, VA, WV
TNC Ecoregions: 51:C, 52:C, 59:C
USFS Ecoregions: 231Aa:CCC, 231Ab:CCC, 231Ac:CCC, 231Ad:CCC, 231Ag:CCC, 231Ak:CCC, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: USFS (Cherokee?, George Washington, Jefferson, Monongahela?, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, CAP pers. comm. 1998, Rawinski 1984, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Swain and Kearsley 2001

MOUNTAIN SPLEENWORT - ROCK ALUMROOT FELSIC CLIFF SPARSE VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Asplenium montanum - Heuchera villosa* Felsic Cliff Sparse Vegetation
Database Code: CEGL004980
Formation: Cliffs with sparse vascular vegetation (VII.A.1.N.a)

Alliance: *Asplenium montanum* Sparsely Vegetated Alliance (A.1831)

ELEMENT CONCEPT

Summary: This community occurs in the Blue Ridge and upper Piedmont of Georgia, North Carolina, South Carolina, Tennessee, and Virginia. It includes vertical rock faces associated with felsic, metamorphic and igneous geologies. This community generally has little vegetative cover, often with 90% of the rock surface unvegetated. Mosses (e.g., *Thuidium* spp., *Fissidens* spp., *Campylium* sp., *Bryoandersonia* sp., *Plagiomnium* sp.) and lichens can have moderate coverage, and vascular plants occur on ledges and rooted in cracks. *Asplenium montanum* and *Heuchera villosa* are characteristic components. Other typical species include *Agrostis perennans, Arisaema triphyllum, Aristolochia macrophylla, Asplenium trichomanes, Eurybia divaricata (= Aster divaricatus), Cystopteris protrusa, Dryopteris marginalis, Hydrangea arborescens, Parthenocissus quinquefolia, Polypodium appalachianum,* and *Rubus canadensis*. These cliffs are typically dry, although small seepages may occur. They are usually shaded by trees rooted on ledges and by the surrounding forest.

Environment: This community includes vertical rock faces associated with felsic, metamorphic and igneous geologies. Some occurrences attributed to this type appear to be on subcalcareous substrates. These cliffs are typically dry, although small seepages may occur. They are usually shaded by trees rooted on ledges and by the surrounding forest.

Vegetation: This community has little vegetative cover, often with 90% of the rock surface unvegetated. Mosses (e.g., *Thuidium* spp., *Fissidens* spp., *Campylium* sp., *Bryoandersonia* sp., *Plagiomnium* sp.) and lichens can have moderate coverage, and vascular plants occur on ledges and rooted in cracks. *Asplenium montanum* and *Heuchera villosa* are characteristic components. Other typical species include *Agrostis perennans, Arisaema triphyllum, Aristolochia macrophylla, Asplenium trichomanes, Eurybia divaricata (= Aster divaricatus), Cystopteris protrusa, Dryopteris marginalis, Hydrangea arborescens, Parthenocissus quinquefolia, Polypodium appalachianum,* and *Rubus canadensis*. An example of a shaded rock outcrop from the Chattahoochee National Forest (Georgia) which is assigned here contains low coverages of the woody plants *Hydrangea arborescens, Kalmia latifolia, Vaccinium arboreum,* and *Vaccinium simulatum,* along with the herbs *Campanula divaricata, Dryopteris marginalis, Galax urceolata, Iris cristata, Muhlenbergia tenuiflora, Polygonatum biflorum, Silene stellata,* and *Solidago sphacelata*. An example in Great Smoky Mountains National Park (Tennessee) consisted of *Heuchera villosa, Pilea pumila, Impatiens pallida, Sedum ternatum*, and various moss species but did not contain *Asplenium montanum*.

Dynamics: These cliffs are typically dry, although small seepages may occur. They are usually shaded by trees rooted on ledges and by the surrounding forest.

Similar Associations:

Related Concepts:

- Montane Cliff (Acidic Herb Subtype) (Schafale 1998b) ?

Classification Comments:

CONSERVATION RANKING & RARE SPECIES

GRank: G3G4 (1998-1-4): No information

High-ranked species: *Cardamine clematitis* (G2G3), *Hymenophyllum tayloriae* (G2), *Krigia montana* (G3), *Saxifraga careyana* (G3), *Saxifraga caroliniana* (G2), *Trichomanes intricatum* (G3G4)

ELEMENT DISTRIBUTION

Range: This community occurs in the Blue Ridge and upper Piedmont of Georgia, North Carolina, South Carolina, Tennessee, and Virginia.

Subnations: GA, NC, SC, TN, VA?

TNC Ecoregions: 51:C, 52:C

USFS Ecoregions: 231Aa:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

POISON-IVY / COMMON ALUMROOT - (STARVED WITCHGRASS, COMMON CLIFF FERN) HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Toxicodendron radicans / Heuchera americana - (Dichanthelium depauperatum, Woodsia obtusa)* Herbaceous Vegetation

Database Code: CEGL004395

Formation: Low temperate or subpolar perennial forb vegetation (V.B.2.N.b)

Alliance: (*Hydrangea* spp., *Philadelphus* spp.) / *Heuchera* spp. Herbaceous Alliance (A.1905)

ELEMENT CONCEPT

Summary: This association is variable in composition and vegetative cover, but includes a range of dry, basic cliffs of variable geology characterized by the presence of scattered to moderately dense vines and forbs. Characteristic vines, shrubs, and scattered shrubs may include *Hydrangea arborescens, Toxicodendron radicans ssp. radicans, Parthenocissus quinquefolia, Philadelphus hirsutus, Philadelphus inodorus*, and *Cercis canadensis*. Characteristic herbaceous species (very variable from occurrence to occurrence) include *Heuchera americana, Dichanthelium depauperatum, Woodsia obtusa, Viola triloba (= Viola X palmata var. triloba), Oxalis violacea, Carex* sp., *Dichanthelium depauperatum, Toxicodendron radicans ssp. radicans, Parietaria pensylvanica, Danthonia spicata*, and *Dichanthelium dichotomum*. The association, as broadly defined, is widespread in the Southern Blue Ridge, Cumberlands and Southern Ridge and Valley, and Interior Low Plateau(?). It is peripheral in the western Piedmont (e.g., the South Mountains?). The exotic *Microstegium vimineum* may be present.
Environment: No information
Vegetation: No information
Dynamics: No information
Similar Associations:
Related Concepts:
- IE3a. Southern Appalachian Mafic Cliff (Allard 1990) ?

Classification Comments: Originally created from NPS small parks project data from Russell Cave plot 10. Reworked based on NC element occurrence data.

CONSERVATION RANKING & RARE SPECIES

GRank: GNR (1998-4-20): There are maybe ten occurrences in NC.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: The association, as broadly defined, is widespread in the Southern Blue Ridge, Cumberlands and Southern Ridge and Valley, and Interior Low Plateau(?). It is peripheral in the western Piedmont.
Subnations: AL, GA?, NC, TN?, VA?
TNC Ecoregions: 44:?, 50:C, 51:C, 52:C, 59:P
USFS Ecoregions: 221:C, 231:C, M221Dc:CCC
Federal Lands: NPS (Russell Cave); USFS (Pisgah)

ELEMENT SOURCES

References: Allard 1990, Southeastern Ecology Working Group n.d.

VIRGINIA CREEPER / APPALACHIAN BLEEDING-HEART SPARSE VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Parthenocissus quinquefolia / Dicentra eximia* Sparse Vegetation
Database Code: CEGL004454
Formation: Lowland or submontane talus/scree (VII.B.1.N.a)
Alliance: Lowland Talus Sparsely Vegetated Alliance (A.1847)

ELEMENT CONCEPT

Summary: Talus slopes varying from very sparse to sometimes with substantial cover of *Toxicodendron radicans* and *Parthenocissus quinquefolia*, and with scattered herbs including *Dicentra eximia, Dryopteris marginalis, Polymnia canadensis*, and *Dioscorea quaternata*. Known from low elevations (below 2500 feet) in the Appalachians (e.g., Nantahala Gorge, North Carolina, and Neddy Mountain, Tennessee).
Environment: Known from talus slopes at low elevations (below 2500 feet) in the Appalachians (e.g., Nantahala Gorge, North Carolina, and Neddy Mountain, Tennessee).
Vegetation: Stands of this vegetation vary from very sparse to sometimes with substantial cover of *Toxicodendron radicans* and *Parthenocissus quinquefolia*, and with scattered herbs including *Dicentra eximia, Dryopteris marginalis, Dioscorea quaternata*. An (apparent) example of this vegetation in the Cherokee National Forest, Tennessee (Neddy Mountain #1) has coverage by *Toxicodendron radicans, Parthenocissus quinquefolia, Dryopteris marginalis, Polymnia canadensis, Vitis rotundifolia,* and foliose lichens.
Dynamics: No information
Similar Associations:
Related Concepts:
- Talus Vineland (Schafale 1998b) ?

Classification Comments:

CONSERVATION RANKING & RARE SPECIES

GRank: G2G3Q (1998-12-14): This community is of uncertain circumscription. Its global rank is dependent on its circumscription. As defined, it is definitely known to occur in North Carolina, and a stand attributed to this type has been found in Tennessee. It may also be found in other Appalachian states. It is unlikely to be common, since unforested talus slopes are limited in this region.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: As defined, this type is definitely known to occur in North Carolina, and a stand attributed to this type has been found in Tennessee. It may also be found in other Appalachian states.
Subnations: NC, TN, VA?, WV?
TNC Ecoregions: 51:C, 59:P
USFS Ecoregions: M221Dd:CCC
Federal Lands: USFS (Cherokee, Nantahala)

ELEMENT SOURCES

References: Peet et al. unpubl. data 2002, Schafale 1998b, Southeastern Ecology Working Group n.d.

SOUTHERN APPALACHIAN MONTANE PINE FOREST AND WOODLAND

CAROLINA HEMLOCK - (PITCH PINE, TABLE MOUNTAIN PINE, VIRGINIA PINE) FOREST

ELEMENT IDENTIFIERS

NVC association: *Tsuga caroliniana - Pinus (rigida, pungens, virginiana)* Forest
Database Code: CEGL006178
Formation: Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c)
Alliance: *Tsuga caroliniana* Forest Alliance (A.144)

ELEMENT CONCEPT

Summary: This xeric forest community is dominated by a mixture of *Tsuga caroliniana* and any or all of the following pine species: *Pinus rigida, Pinus virginiana*, and/or *Pinus pungens*. Additional canopy species may include *Quercus prinus, Quercus rubra*, and *Carya glabra*. This association is known from shallow soils over sedimentary and metasedimentary rock strata on exposed ridges and southwest-facing slopes above 2000 feet in the Southern Blue Ridge and upper Piedmont of North Carolina and Tennessee. The structure of the canopy varies from closed to open depending on disturbance history and environment. The patchy to open shrub layer of Tennessee occurrences is characterized by *Buckleya distichophylla* and *Rhododendron minus* in the upper shrub layer, and *Vaccinium pallidum* and *Gaultheria procumbens* in the lower shrub layer. The patchy to open herbaceous layer is characterized by *Schizachyrium scoparium*. As much as 25% of the ground cover may contain lichens, including *Cladina rangiferina* and *Cladina subtenuis*.
Environment: This association is known from shallow soils over sedimentary and metasedimentary rock strata on exposed ridges and southwest-facing slopes above 2000 feet in the Southern Blue Ridge and upper Piedmont of North Carolina and Tennessee.
Vegetation: This xeric forest community is dominated by a mixture of *Tsuga caroliniana* and any or all of the following pine species: *Pinus rigida, Pinus virginiana*, and/or *Pinus pungens*. Additional canopy species may include *Quercus prinus, Quercus rubra*, and *Carya glabra*. The structure of the canopy varies from closed to open depending on disturbance history and environment. The patchy to open shrub layer of Tennessee occurrences is characterized by *Buckleya distichophylla* and *Rhododendron minus* in the upper shrub layer, and *Vaccinium pallidum* and *Gaultheria procumbens* in the lower shrub layer. The patchy to open herbaceous layer is characterized by *Schizachyrium scoparium*. As much as 25% of the ground cover may contain lichens, including *Cladina rangiferina* and *Cladina subtenuis*.
Dynamics: No information
Similar Associations:
- *Tsuga caroliniana / Kalmia latifolia - Rhododendron catawbiense* Forest (CEGL007139)

Related Concepts:
- Carolina Hemlock Forest (Pine Subtype) (Schafale 1998b) ?
- IA6g. Carolina Hemlock Bluff Forest (Allard 1990) B

Classification Comments: This association is currently recognized as distinct from *Tsuga caroliniana / Kalmia latifolia - Rhododendron catawbiense* Forest (CEGL007139), due to the presence of *Pinus* species, which may be related to landform and exposure or past fire history or both. The long-term impact of hemlock woolly adelgid on *Tsuga caroliniana* needs systematic study. The role of fires in the ecology of *Tsuga caroliniana* communities is also unclear, since evidence of stand expansion following both fires and periods of fire exclusion have been noted (Schafale and Weakley 1990).

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (1997-12-31): *Tsuga caroliniana* communities, in general, have a restricted range, occurring only in the southern Blue Ridge and upper Piedmont and are probably endemic to North Carolina and Tennessee. Occurrences are typically small and restricted to rocky, bluff habitats. All occurrences are threatened by fire suppression and the Hemlock Woolly Adelgid (*Adelges tsugae*), an exotic pest which causes tree decline and ultimately death in *Tsuga canadensis* and *Tsuga caroliniana*.
High-ranked species: *Buckleya distichophylla* (G2), *Tsuga caroliniana* (G3)

ELEMENT DISTRIBUTION

Range: This association is known to occur in the Southern Blue Ridge of North Carolina and Tennessee. It may also range into Virginia, but its presence there is not currently verified.
Subnations: NC, TN
TNC Ecoregions: 51:C, 52:C
USFS Ecoregions: 231Aa:CCC, M221Db:CCP, M221Dc:CCC, M221Dd:CCC
Federal Lands: USFS (Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

CAROLINA HEMLOCK / MOUNTAIN LAUREL - CATAWBA RHODODENDRON FOREST

ELEMENT IDENTIFIERS

NVC association: *Tsuga caroliniana / Kalmia latifolia - Rhododendron catawbiense* Forest
Database Code: CEGL007139
Formation: Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c)
Alliance: *Tsuga caroliniana* Forest Alliance (A.144)

ELEMENT CONCEPT

Summary: These forests occur with canopies dominated by *Tsuga caroliniana*, without admixtures of *Pinus* species, although *Quercus prinus* may be present as a minor component. Shrub strata tend to be dense and dominated by ericaceous species such as *Kalmia latifolia, Rhododendron catawbiense*, and *Rhododendron minus*. Other minor components may include *Pinus virginiana, Pinus rigida, Pinus pungens, Nyssa sylvatica*, and *Quercus coccinea*. Other characteristic species can include *Xerophyllum asphodeloides, Leucothoe recurva, Polypodium appalachianum, Smilax rotundifolia*. This forest occurs in the upper Piedmont and Southern Blue Ridge, on narrow ridges and upper north-facing rocky slopes.
Environment: Over the full range of this type, stands typically occur on narrow ridges and upper, north-facing rocky slopes. Four documented Virginia stands, including three plot-sampled by DCR-DNH ecologists and one studied intensively by Rentch et al. (2000), occurred at elevations from 591-1075 m (1940-3525 feet). Sites include a narrow spur ridge crest, one upper slope, and two middle slopes, with south, southwest, and north aspects. Slopes are strongly convex. Two sites have substantial surface cover of rocks (70% and 31%), while the other two sites have negligible rock cover. Soils are extremely acidic (mean pH = 3.8), with very low calcium and magnesium levels and high iron and aluminum levels.
Vegetation: These forests occur with canopies dominated by *Tsuga caroliniana*, without admixtures of *Pinus* species, although *Quercus prinus* may be present as a minor component. Shrub strata tend to be dense and dominated by ericaceous species such as *Kalmia latifolia, Rhododendron catawbiense*, and *Rhododendron minus*. Other minor components may include *Pinus virginiana, Pinus rigida, Pinus pungens, Nyssa sylvatica*, and *Quercus coccinea*. Other characteristic species can include *Xerophyllum asphodeloides, Leucothoe recurva, Polypodium appalachianum*, and *Smilax rotundifolia*.

Virginia stands are strongly dominated by *Tsuga caroliniana*, with *Quercus prinus* the most important canopy associate. *Quercus rubra, Quercus alba*, several *Pinus* spp., *Nyssa sylvatica*, and *Acer rubrum* are minor canopy associates. *Acer rubrum, Amelanchier arborea*, and *Sassafras albidum* are common understory trees, while *Rhododendron catawbiense, Kalmia latifolia*, and *Hamamelis virginiana* are dominant shrubs. Additional shrubs include *Pieris floribunda, Vaccinium pallidum, Rhododendron periclymenoides*, and *Gaylussacia baccata*. The herb layer is generally sparse with scattered individuals or patches of *Aralia nudicaulis, Carex pensylvanica, Chimaphila maculata, Cunila origanoides*, and *Hexastylis virginica*. Species richness ranges from 12 to 19 taxa per 400 m2 (mean = 16).
Dynamics: No information
Similar Associations:
Related Concepts:

- *Tsuga caroliniana / Kalmia latifolia - Rhododendron catawbiense* Forest (Fleming and Coulling 2001) ?
- Carolina Hemlock Forest (Typic Subtype) (Schafale 1998b) ?
- IA6g. Carolina Hemlock Bluff Forest (Allard 1990) B

Classification Comments: Although no doubt a rare, small-patch community type in Virginia, additional examples are likely and should be sought. The long-term impact of hemlock woolly adelgid on *Tsuga caroliniana* needs systematic study. The role of fires in the ecology of *Tsuga caroliniana* communities is also unclear, since evidence of stand expansion following both following fires and periods of fire exclusion have been noted (Schafale and Weakley 1990). Rentch et al. (2000) found that *Tsuga caroliniana* dominating a site in Bottom Creek Gorge (Montgomery County, Virginia) was long-lived, very tolerant of drought stresses, and had reproduced episodically over the past 200 years. No evidence of fire is mentioned in this paper.

Examples include Hickorynut Gorge, Linville Gorge, Hanging Rock State Park, all in North Carolina.

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (1997-12-31): *Tsuga caroliniana* communities, in general, have a restricted range, occurring primarily in the Southern Blue Ridge, with scattered occurrences in the upper Piedmont and Ridge and Valley of North Carolina, Tennessee, South Carolina, and Virginia. Occurrences are typically small and restricted to rocky bluff habitats. All occurrences are threatened by fire suppression and the exotic pest the hemlock woolly adelgid (*Adelges tsugae*) which causes tree decline and ultimately death in *Tsuga canadensis* and *Tsuga caroliniana*. The taxonomy of *Tsuga caroliniana* communities needs further assessment.
High-ranked species: *Tsuga caroliniana* (G3)

ELEMENT DISTRIBUTION

Range: *Tsuga caroliniana* communities, in general, have a restricted range, occurring primarily in the Southern Blue Ridge, with scattered occurrences in the upper Piedmont and Ridge and Valley of North Carolina, Tennessee, South Carolina, and Virginia.
Subnations: NC, SC, TN?, VA
TNC Ecoregions: 51:C, 52:C, 59:C
USFS Ecoregions: 231Aa:CCC, 231Ae:CCP, M221Aa:CC?, M221Ab:CCC, M221Da:CCC, M221Db:CCP, M221Dc:CCC, M221Dd:CCC
Federal Lands: USFS (Jefferson, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Fleming and Coulling 2001, Fleming et al. 2001, Peet et al. unpubl. data 2002, Rentch et al. 2000, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Weakley et al. 1979

PITCH PINE - (TABLE MOUNTAIN PINE) / CATAWBA RHODODENDRON - MOUNTAIN LAUREL / GALAX WOODLAND

ELEMENT IDENTIFIERS

NVC association: *Pinus rigida - (Pinus pungens) / Rhododendron catawbiense - Kalmia latifolia / Galax urceolata* Woodland
Database Code: CEGL004985
Formation: Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a)
Alliance: *Pinus pungens - (Pinus rigida)* Woodland Alliance (A.521)

ELEMENT CONCEPT

Summary: High-elevation (4000-5100 feet) woodland dominated by *Pinus rigida* with a dense, ericaceous shrub stratum, occurring on narrow ridge crests in the Southern Blue Ridge. Other tree species can include *Quercus rubra, Tsuga canadensis, Picea rubens* (rarely), and *Populus grandidentata* (rarely). Typical shrubs include *Kalmia latifolia, Leucothoe recurva, Rhododendron catawbiense, Rhododendron calendulaceum, Gaylussacia baccata*, and *Vaccinium corymbosum*. *Galax urceolata* is often dominant in the herbaceous stratum, but other species may be present. Characteristic herbs include *Pteridium aquilinum, Epigaea repens*, and *Melampyrum lineare*. Fire-suppressed examples tend to have coverage of *Pinus strobus, Acer rubrum*, and *Nyssa sylvatica*. This community is distinct from the more typical *Pinus pungens - Pinus rigida - (Quercus prinus) / Kalmia latifolia - Vaccinium pallidum* Woodland (CEGL007097) because of the presence of high-elevation species such as *Rhododendron catawbiense*.
Environment: No information
Vegetation: No information
Dynamics: No information
Similar Associations:
- *Pinus pungens - Pinus rigida - (Quercus prinus) / Kalmia latifolia - Vaccinium pallidum* Woodland (CEGL007097)

Related Concepts:
- Ridge Pine Heath (High Elevation Subtype) (Schafale 1998b) ?

Classification Comments: This association was developed from North Carolina Vegetation Survey data. Known North Carolina examples include Blackrock Mountain, Piney Knob Fork, Whiteside Mountain, and Fodderstacks.

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (2000-1-21): This community is endemic to the southern Blue Ridge where it occurs on high-elevation ridges (over 4000 feet). It is maintained by periodic fire or extreme site conditions. It is only known from a few occurrences in North Carolina, where many examples are in poor condition due to long-term, widespread fire suppression. In recent years, outbreaks of Southern

Pine Beetle (*Dendroctonus frontalis*) have resulted in extensive mortality of the dominant pines and changed physiognomies of some stands to a shrubland condition.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community is endemic to the southern Blue Ridge and is known only from high elevations (over 4000 feet) in North Carolina.
Subnations: NC, TN?, VA?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Db:CCP, M221Dc:CCC, M221Dd:CCC
Federal Lands: USFS (Nantahala, Pisgah)

ELEMENT SOURCES

References: Peet et al. unpubl. data 2002, Schafale 1998b, Schafale pers. comm., Southeastern Ecology Working Group n.d.

TABLE MOUNTAIN PINE - PITCH PINE - (ROCK CHESTNUT OAK) / MOUNTAIN LAUREL - HILLSIDE BLUEBERRY WOODLAND

ELEMENT IDENTIFIERS

NVC association: *Pinus pungens - Pinus rigida - (Quercus prinus) / Kalmia latifolia - Vaccinium pallidum* Woodland
Database Code: CEGL007097
Formation: Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a)
Alliance: *Pinus pungens - (Pinus rigida)* Woodland Alliance (A.521)

ELEMENT CONCEPT

Summary: This association includes mostly evergreen woodlands dominated by *Pinus pungens* and/or *Pinus rigida*, occurring over a dense ericaceous shrub stratum, on sharp ridges, mostly above 2000 feet elevation in the Southern Blue Ridge. This type is also found in limited areas of the inner Piedmont. This woodland occurs across a wide elevational range (1600-4000 feet), on exposed ridges and upper slopes with southerly and westerly exposures, over thin, excessively drained, nutrient-poor soils, and can be associated with rock outcroppings. Canopy coverage can often approach that of a forest, especially in areas where fire has been excluded and deciduous species have significant coverage. Deciduous species that can be important, particularly in the subcanopy, include *Quercus prinus, Quercus coccinea, Quercus stellata, Nyssa sylvatica, Acer rubrum,* and *Oxydendrum arboreum*. *Pinus virginiana* and *Pinus strobus* can have high coverage and even codominate on some sites. The shrub stratum is dominated by ericaceous species, typically *Kalmia latifolia* and *Leucothoe recurva* in the tall-shrub stratum and *Vaccinium pallidum* as a low shrub. Other shrub species vary with location, but include *Vaccinium stamineum, Vaccinium simulatum, Vaccinium pallidum, Vaccinium hirsutum, Vaccinium corymbosum, Rhododendron maximum, Rhododendron minus, Gaylussacia ursina, Gaylussacia baccata, Buckleya distichophylla, Pyrularia pubera*, and *Fothergilla major*. Species commonly found in the sparse herb stratum include *Chimaphila maculata, Galax urceolata, Pteridium aquilinum var. latiusculum, Xerophyllum asphodeloides, Chamaelirium luteum, Comptonia peregrina, Leiophyllum buxifolium, Gaultheria procumbens, Iris verna, Dichanthelium* spp., and *Epigaea repens*, although herbaceous species composition will vary within the range of this community. *Smilax glauca* is a common vine. Without periodic fire, this community will gradually succeed into forests dominated by *Quercus prinus* and *Quercus coccinea*, except on the most extreme sites, where this vegetation is self-perpetuating. It is thought that woodlands dominated by *Pinus pungens* are associated with more xeric conditions than woodlands dominated by *Pinus pungens* in combination with other tree species.
Environment: This association is typically found on sharp ridges mostly above 2000 feet elevation in the Southern Blue Ridge. This woodland occurs across a wide elevation range (1600-4000 feet) in the southern Appalachians, on exposed ridges and upper slopes with southerly and westerly exposures, over thin, excessively drained, nutrient-poor soils, and can be associated with rock outcroppings. It is thought that woodlands dominated by *Pinus pungens* are associated with more xeric conditions than woodlands dominated by *Pinus pungens* in combination with other tree species (Zobel 1969, Barden 1977).
Vegetation: These mostly evergreen woodlands are characteristically dominated by *Pinus pungens* and/or *Pinus rigida,* occurring over a dense ericaceous shrub stratum. Deciduous species that can be important, particularly in the subcanopy, include *Quercus prinus, Quercus coccinea, Quercus stellata* (in lower elevation occurrences), *Nyssa sylvatica, Acer rubrum,* and *Oxydendrum arboreum*. *Pinus virginiana* and *Pinus strobus* can have high coverage and even codominate on some sites. The shrub stratum is dominated by ericaceous species, typically *Kalmia latifolia* and *Leucothoe recurva* in the tall-shrub stratum and *Vaccinium pallidum* as a low shrub. Other shrub species vary with location, but include *Vaccinium stamineum, Vaccinium simulatum, Vaccinium pallidum, Vaccinium hirsutum, Vaccinium corymbosum, Rhododendron maximum, Rhododendron minus, Gaylussacia ursina, Gaylussacia baccata, Buckleya distichophylla, Pyrularia pubera, Castanea dentata, Castanea pumila*, and *Fothergilla major*. Species commonly found in the sparse herb stratum include *Chimaphila maculata, Galax urceolata, Pteridium aquilinum var. latiusculum, Xerophyllum asphodeloides, Chamaelirium luteum, Comptonia peregrina, Leiophyllum buxifolium, Gaultheria procumbens, Iris verna, Melampyrum lineare, Dichanthelium* spp., and *Epigaea repens*, although herbaceous species composition will vary within the range of this community. *Smilax glauca* is a common vine.

Dynamics: Canopy coverage in stands of this association can often approach that of a forest, especially in areas where fire has been excluded and deciduous species have significant coverage. Without periodic fire, this community will gradually succeed into forests dominated by *Quercus prinus* and *Quercus coccinea*, except on the most extreme sites, where this vegetation is self-perpetuating. However, recent regional pine beetle kills throughout large areas of the Southeast have accelerated the rate of succession in most of these stands. This acceleration of succession may lead to conversion of these forests to hardwoods in the long term (M. Jenkins pers. comm.).

Similar Associations:

- *Pinus (pungens, rigida) / Quercus ilicifolia / Gaylussacia baccata* Woodland (CEGL004996)

Related Concepts:

- IA7b. Xeric Pitch Pine/Table Mountain Pine Ridge Forest (Allard 1990) B
- Ridge Pine Heath (Typic Subtype) (Schafale 1998b) ?
- Table Mountain Pine type (Golden 1974) ?
- Xeric Pine Forest (McLeod 1988) ?

Classification Comments: Other communities with *Pinus pungens* occur in central Pennsylvania and in Virginia. These northern types are thought to have a different species composition and geology than the forests described here. Species associated with *Pinus pungens* in the northern part of its range that do not occur in this community include *Quercus ilicifolia, Viburnum acerifolium*, and *Vaccinium angustifolium.* [See *Pinus (pungens, rigida) / Quercus ilicifolia / Gaylussacia baccata* Woodland (CEGL004996).]

CONSERVATION RANKING & RARE SPECIES

GRank: G3 (1998-4-30): This community is endemic to the southern Appalachian Mountains where it is maintained by periodic fire or extreme site conditions. Recent studies show that acreage of this community has decreased due to fire suppression (Turrill and Buckner 1995) and that many remaining examples have substantial hardwood invasion. Lightning-set and high-intensity controlled burns are necessary to maintain and re-establish this community type. In addition, recent pine beetle outbreaks have killed off large areas of this community type in the past five years (1998-2003) in the Southeast. Due to this, the global rank may soon need to be adjusted to G2.

High-ranked species: *Buckleya distichophylla* (G2), *Fothergilla major* (G3), *Vaccinium hirsutum* (G3)

ELEMENT DISTRIBUTION

Range: This community ranges throughout the Southern Blue Ridge, from southwestern Virginia, south through western North Carolina and eastern Tennessee, into northeastern Georgia and northwestern South Carolina.

Subnations: GA, NC, SC, TN, VA?

TNC Ecoregions: 51:C, 52:C, 59:?

USFS Ecoregions: M221Aa:CCP, M221Ab:CCP, M221Ac:CCC, M221Da:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway?, Carl Sandburg Home, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, Barden 1977, Golden 1974, Golden 1981, Hedlin et al. 1981, McLeod 1988, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Newell and Peet 1995, Peet et al. unpubl. data 2002, Pyne 1994, Racine 1966, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Turrill and Buckner 1995, Wharton 1978, Whittaker 1956, Williams 1991, Williams and Johnson 1990, Williams and Johnson 1992, Williams et al. 1990a, Zobel 1969

SOUTHERN AND CENTRAL APPALACHIAN COVE FOREST

(ORANGE JEWELWEED, YELLOW JEWELWEED) - BEEBALM - APPALACHIAN BLACK-EYED-SUSAN HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata* var. *humilis* Herbaceous Vegetation

Database Code: CEGL004293

Formation: Saturated temperate perennial forb vegetation (V.B.2.N.f)

Alliance: *Impatiens (capensis, pallida) - Monarda didyma* Saturated Herbaceous Alliance (A.1690)

ELEMENT CONCEPT

Summary: This association covers forb-dominated palustrine vegetation occurring as small wetlands at high elevations (greater than 1200 m or 4000 feet), on upper slopes and ridgetops in the Southern Blue Ridge ecoregion. These areas lack extensive *Sphagnum* and are typically open, without shading from a forest canopy. Typical dominant species include *Impatiens capensis, Impatiens pallida, Monarda didyma*, and *Rudbeckia laciniata var. humilis.* Other characteristic species include *Aconitum reclinatum, Cardamine clematitis, Carex leptonervia, Carex debilis var. rudgei (= Carex flexuosa), Carex ruthii, Chelone lyonii, Cicuta maculata, Claytonia caroliniana, Conioselinum chinense, Euonymus obovata, Geum geniculatum, Helenium autumnale, Houstonia serpyllifolia, Lilium*

superbum, Lilium grayi, Packera aurea (= Senecio aureus), Solidago patula, Thalictrum clavatum, Trautvetteria caroliniensis, Veratrum viride, Viola cucullata, and *Viola macloskeyi ssp. pallens*. This vegetation is often associated with boulderfield forests or other northern hardwood forests [see *Betula alleghaniensis - Fagus grandifolia - Aesculus flava* Forest Alliance (A.266)].

Environment: Stands of this association are forb-dominated palustrine vegetation occurring as small wetlands at high elevations (greater than 1200 m or 4000 feet), on upper slopes and ridgetops in the Southern Blue Ridge ecoregion. These areas lack extensive *Sphagnum* and are typically open, without shading from a forest canopy. This vegetation is often associated with boulderfield forests or other northern hardwood forests.

Vegetation: Typical dominant species include *Impatiens capensis, Impatiens pallida, Monarda didyma,* and *Rudbeckia laciniata var. humilis*. Other characteristic species include *Aconitum reclinatum, Cardamine clematitis, Carex leptonervia, Carex debilis var. rudgei (= Carex flexuosa), Carex ruthii, Chelone lyonii, Cicuta maculata, Claytonia caroliniana, Conioselinum chinense, Euonymus obovata, Geum geniculatum, Helenium autumnale, Houstonia serpyllifolia, Lilium superbum, Lilium grayi, Packera aurea (= Senecio aureus), Solidago patula, Thalictrum clavatum, Trautvetteria caroliniensis, Veratrum viride, Viola cucullata*, and *Viola macloskeyi ssp. pallens*. These stands lack extensive cover by *Sphagnum* spp., and are typically open, without shading from a forest canopy.

Dynamics: No information

Similar Associations:

- *Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis* Herbaceous Vegetation (CEGL004296) -- typically occurs at lower elevations and is associated with cove forests.

Related Concepts:

- IID3a. Herbaceous High Elevation Seepage Slope (Allard 1990) B
- Jewelweed-beebalm-coneflower seep (CAP pers. comm. 1998) ?
- Rich Montane Seep (High Elevation Subtype) (Schafale 1998b) ?

Classification Comments: Another high-elevation herbaceous seep association known from the southern Appalachians, *Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis* Herbaceous Vegetation (CEGL004296), typically occurs at lower elevations and is associated with cove forests.

CONSERVATION RANKING & RARE SPECIES

GRank: G3 (1998-12-14): This community occurs at moderate to high elevations of the southern Blue Ridge Mountains of western North Carolina, eastern Tennessee, southwestern Virginia, northern Georgia, and probably northwestern South Carolina. It occurs as a small patch community, embedded in a variety of regional forest types. While restricted in range and of small size, the community is relatively frequent within its range, many examples are protected, and threats are relatively few and minor.

High-ranked species: *Aconitum reclinatum* (G3), *Cardamine clematitis* (G2G3), *Carex ruthii* (G3), *Geum geniculatum* (G2), *Lilium grayi* (G3)

ELEMENT DISTRIBUTION

Range: This community occurs at moderate to high elevations in the southern Blue Ridge Mountains of western North Carolina, eastern Tennessee, southwestern Virginia, northern Georgia, and northwestern South Carolina.

Subnations: GA, NC, SC, TN, VA, WV?

TNC Ecoregions: 51:C, 59:P

USFS Ecoregions: M221Ba:CCC, M221Bb:CCP, M221Bc:CCC, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee, Jefferson, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, CAP pers. comm. 1998, Fleming et al. 2001, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

APPALACHIAN BASSWOOD - WHITE ASH - (SLIPPERY ELM) / BLOODROOT - (EASTERN COLUMBINE, WALKING FERN) FOREST

ELEMENT IDENTIFIERS

NVC association: *Tilia americana* var. *heterophylla - Fraxinus americana - (Ulmus rubra) / Sanguinaria canadensis - (Aquilegia canadensis, Asplenium rhizophyllum)* Forest

Database Code: CEGL007711

Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)

Alliance: *Liriodendron tulipifera - Tilia americana* var. *heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235)

ELEMENT CONCEPT

Summary: Forests of steep, protected coves and slopes at the lower elevations (below 610 m [2000 feet]) of the southern Appalachians and upper Piedmont, containing a significant component of species associated with high-base status substrates. These forests share species in common with other southern Appalachian cove forests, but are distinguished by occurring at relatively low elevations ((305-760 m [1000-2500 feet])) and by the presence of strongly calciphilic species such as *Asplenium rhizophyllum, Aquilegia canadensis, Cystopteris protrusa, Diplazium pycnocarpon, Trillium simile, Trillium discolor,* and *Collinsonia verticillata*.

Common canopy species include *Tilia americana var. heterophylla, Liriodendron tulipifera, Fraxinus americana, Quercus rubra*, and *Aesculus flava*. Other species in the canopy and subcanopy include *Ulmus rubra, Juglans nigra, Betula lenta, Carya cordiformis, Halesia tetraptera*, and *Cornus florida*. *Acer saccharum* is generally not a constant component in these forests. The shrub stratum can be diverse, but the coverage is often quite sparse. Typical shrubs include *Hydrangea arborescens, Lindera benzoin, Calycanthus floridus, Philadelphus hirsutus, Philadelphus inodorus*, and *Rhododendron maximum*. The herbaceous stratum is dense, lush, and diverse. Some of the more characteristic species include *Sanguinaria canadensis, Cystopteris protrusa, Viola canadensis, Caulophyllum thalictroides, Hydrophyllum canadense, Trillium cuneatum, Asplenium rhizophyllum, Dicentra cucullaria, Tradescantia subaspera, Asarum canadense, Carex plantaginea, Hybanthus concolor, Trillium simile, Aquilegia canadensis, Carex austrocaroliniana, Deparia acrostichoides (= Athyrium thelypterioides), Diplazium pycnocarpon (= Athyrium pycnocarpon), Trillium rugelii*, and *Trillium luteum*.

Environment: This association covers forests of steep, protected coves and slopes at the lower elevations (below 610 m [2000 feet]) of the southern Appalachians and upper Piedmont. These forests share species in common with other southern Appalachian cove forests, but are distinguished by occurring at relatively low elevations ((305-760 m [1000-2500 feet])).

Vegetation: Common canopy species in stands of this type include *Tilia americana var. heterophylla, Liriodendron tulipifera, Fraxinus americana, Quercus rubra*, and *Aesculus flava*. Other species in the canopy and subcanopy include *Ulmus rubra, Juglans nigra, Betula lenta, Carya cordiformis, Halesia tetraptera*, and *Cornus florida*. *Acer saccharum* is generally not a constant component in these forests. The shrub stratum can be diverse, but the coverage is often quite sparse. Typical shrubs include *Hydrangea arborescens, Lindera benzoin, Calycanthus floridus, Philadelphus hirsutus, Philadelphus inodorus*, and *Rhododendron maximum*. The herbaceous stratum is dense, lush, and diverse. Some of the more characteristic species include *Sanguinaria canadensis, Cystopteris protrusa, Viola canadensis, Caulophyllum thalictroides, Hydrophyllum canadense, Trillium cuneatum, Asplenium rhizophyllum, Dicentra cucullaria, Tradescantia subaspera, Asarum canadense, Carex plantaginea, Hybanthus concolor, Trillium simile, Aquilegia canadensis, Carex austrocaroliniana, Deparia acrostichoides (= Athyrium thelypterioides), Diplazium pycnocarpon (= Athyrium pycnocarpon), Trillium rugelii*, and *Trillium luteum*. These forests are distinguished by the presence of strongly calciphilic species such as *Asplenium rhizophyllum, Aquilegia canadensis, Cystopteris protrusa, Diplazium pycnocarpon, Trillium simile, Trillium discolor*, and *Collinsonia verticillata*.

Dynamics: No information

Similar Associations:

Related Concepts:

- Rich Cove Forest (Foothills Rich Subtype) (Schafale 1998b) ?

Classification Comments: These forests are distinguished by occurring at relatively low elevations ((305-760 m [1000-2500 feet])) and by the presence of strongly calciphilic species such as *Asplenium rhizophyllum, Aquilegia canadensis, Cystopteris protrusa, Diplazium pycnocarpon, Trillium simile, Trillium discolor*, and *Collinsonia verticillata*. Deciduous cove forests are perhaps the most complex group of communities to classify in the Southern Blue Ridge, due to a combination of wide environmental range, high species richness, and high biogeographic variability. The recognition of associations based on fertility and elevation is provisional and will likely need further refinement.

CONSERVATION RANKING & RARE SPECIES

GRank: G2G3 (1998-12-14): This Southern Blue Ridge cove forest is naturally uncommon because of its limitation to mafic substrates. It is threatened by logging, second home development, and forest fragmentation. Very few old-growth sites remain. Deciduous cove forests are perhaps the most complex group of communities to classify in the Southern Blue Ridge, due to a combination of wide environmental range, high species richness, and high biogeographic variability. The recognition of associations based on fertility and elevation is provisional and will likely need further refinement; global conservation rank is unlikely to change significantly, however.

High-ranked species: *Cardamine flagellifera* (G3), *Carex radfordii* (G2), *Collinsonia verticillata* (G3), *Coreopsis latifolia* (G3), *Helianthus glaucophyllus* (G3), *Prosartes maculata* (G3G4), *Trillium discolor* (G2), *Trillium rugelii* (G3), *Trillium simile* (G3)

ELEMENT DISTRIBUTION

Range: This community occurs in the escarpment region of the Southern Blue Ridge in western North Carolina, northern South Carolina, and Georgia, possibly ranging into Tennessee.

Subnations: GA, NC, SC, TN?

TNC Ecoregions: 51:C, 52:C

USFS Ecoregions: 231Ab:CCC, 231Ad:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: USFS (Chattahoochee, Cherokee, Pisgah, Sumter?)

ELEMENT SOURCES

References: Major et al. 1999, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

EASTERN HEMLOCK - MOUNTAIN SILVERBELL - (AMERICAN BEECH, FRASER MAGNOLIA) / GREAT RHODODENDRON / FANCY FERN FOREST

ELEMENT IDENTIFIERS

NVC association: *Tsuga canadensis - Halesia tetraptera - (Fagus grandifolia, Magnolia fraseri) / Rhododendron maximum / Dryopteris intermedia* Forest
Database Code: CEGL007693
Formation: Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a)
Alliance: *Tsuga canadensis - Liriodendron tulipifera* Forest Alliance (A.413)

ELEMENT CONCEPT

Summary: This association includes forests dominated by *Tsuga canadensis* and *Halesia tetraptera var. monticola*, occurring in restricted montane areas of western North Carolina and eastern Tennessee. This forest is found on protected, lower slopes and coves at elevations of 2800-4600 feet. The most important canopy trees are *Tsuga canadensis* and *Halesia tetraptera var. monticola*, although *Magnolia fraseri* or *Fagus grandifolia* can have high canopy coverage in some examples. Some occurrences have dense, tall-shrub strata dominated by *Rhododendron maximum*, while other occurrences have a more open shrub stratum with greater herbaceous cover, often dominated by *Dryopteris intermedia*. Other subcanopy/shrub species may include *Acer pensylvanicum, Acer saccharum, Acer rubrum, Amelanchier laevis, Betula alleghaniensis, Betula lenta*, and *Prunus pensylvanica*. Other common herbaceous species include *Mitchella repens, Medeola virginiana, Polystichum acrostichoides, Solidago curtisii (= Solidago caesia var. curtisii), Viola blanda*, and *Viola hastata*. *Rubus canadensis* is also common. This community is distinguished from *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543) by not having *Liriodendron tulipifera* as an important component and by generally occurring at higher elevations (over 3000 feet). This community is distinguished from *Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / Leucothoe fontanesiana* Forest (CEGL007861) by occurring on more protected sites and having more diverse tree and herb strata.
Environment: No information
Vegetation: No information
Dynamics: No information
Similar Associations:
- *Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / Leucothoe fontanesiana* Forest (CEGL007861)
- *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543)

Related Concepts:
- *Tsuga canadensis-Halesia/Dryopteris intermedia* Forest (Newell et al. 1997) ?
- *Tsuga canadensis-Magnolia fraseri* Forest, *Tsuga canadensis-Fagus-Halesia* subtype (Newell et al. 1997) ?
- Acidic Cove Forest (Silverbell Subtype) (Schafale 1998b) ?
- Silverbell-hemlock (Golden 1974) ?

Classification Comments:

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (2000-1-4): This community is uncommon and geographically restricted to the Great Smoky Mountains, Tennessee, and to Joyce Kilmer Wilderness in western North Carolina. Occurrences are threatened by the Hemlock Woolly Adelgid (*Adelges tsugae*), an exotic insect pest.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This association occurs in restricted montane areas of western North Carolina and eastern Tennessee.
Subnations: NC, TN
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Pisgah)

ELEMENT SOURCES

References: Golden 1974, Newell et al. 1997, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Southeastern Ecology Working Group n.d.

TULIPTREE - APPALACHIAN BASSWOOD - (YELLOW BUCKEYE) / BLACK COHOSH FOREST

ELEMENT IDENTIFIERS

NVC association: *Liriodendron tulipifera - Tilia americana* var. *heterophylla - (Aesculus flava) / Actaea racemosa* Forest
Database Code: CEGL007291
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Liriodendron tulipifera - Tilia americana* var. *heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235)

ELEMENT CONCEPT

Summary: This association encompasses mixed mesophytic forests of the low mountains and foothills, mostly below 610 m (2000 feet) elevation in the Southern Blue Ridge escarpment and adjacent Piedmont. This forest is dominated by *Liriodendron tulipifera*, but other canopy species typically include *Tilia americana var. heterophylla, Fraxinus americana, Carya alba, Aesculus flava, Halesia tetraptera, Fagus grandifolia, Quercus alba,* and *Acer rubrum*. *Tsuga canadensis* is not dominant, shrubs are sparse, if present. In the vicinity of the Chauga River, South Carolina, *Acer leucoderme* may dominate the understory. Ferns are often locally dominant, typically *Thelypteris noveboracensis, Polystichum acrostichoides, Adiantum pedatum, Phegopteris hexagonoptera,* and *Athyrium filix-femina ssp. asplenioides*. The herb stratum is diverse and coverage is often scattered. Typical species include *Actaea pachypoda, Asarum canadense, Carex plantaginea, Carex austrocaroliniana, Actaea racemosa (= Cimicifuga racemosa), Collinsonia canadensis, Goodyera pubescens, Hepatica nobilis var. acuta, Viola blanda, Galium latifolium, Galium circaezans, Trillium catesbaei, Maianthemum racemosum, Sanguinaria canadensis, Thalictrum thalictroides,* and *Monarda clinopodia*. This forest occurs on moderately steep, protected slopes and in coves, over nutrient-rich soils formed from colluvium. This association can have species with Piedmont affinities and lacks species typical of higher elevation cove forests, such as *Acer saccharum, Impatiens pallida, Clintonia umbellulata, Prosartes maculata (= Disporum maculatum), Polygonatum pubescens, Streptopus lanceolatus var. roseus (= Streptopus roseus), Astilbe biternata, Veratrum viride,* and *Maianthemum canadense*.

Environment: This association encompasses mixed mesophytic forests of the low mountains and foothills, mostly below 610 m (2000 feet) elevation in the Southern Blue Ridge escarpment and adjacent Piedmont. This forest occurs on moderately steep, protected slopes and in coves, over nutrient-rich soils formed from colluvium.

Vegetation: The canopy of stands of this forest is dominated by *Liriodendron tulipifera*, but other canopy species typically include *Tilia americana var. heterophylla, Fraxinus americana, Carya alba, Aesculus flava, Halesia tetraptera, Fagus grandifolia, Quercus alba,* and *Acer rubrum*. *Tsuga canadensis* is not dominant; shrubs are sparse, if present. In the vicinity of the Chauga River, South Carolina, *Acer leucoderme* may dominate the understory. Ferns are often locally dominant, typically *Thelypteris noveboracensis, Polystichum acrostichoides, Adiantum pedatum, Phegopteris hexagonoptera,* and *Athyrium filix-femina ssp. asplenioides*. The herb stratum is diverse and coverage is often scattered. Typical species include *Actaea pachypoda, Asarum canadense, Carex plantaginea, Carex austrocaroliniana, Actaea racemosa (= Cimicifuga racemosa), Collinsonia canadensis, Goodyera pubescens, Hepatica nobilis var. acuta, Viola blanda, Galium latifolium, Galium circaezans, Trillium catesbaei, Maianthemum racemosum, Sanguinaria canadensis, Thalictrum thalictroides,* and *Monarda clinopodia*.

Dynamics: No information

Similar Associations:

- *Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum / Magnolia tripetala* Forest (CEGL005222) -- of the Cumberland Mountains and Plateau.

FOREST

Related Concepts:

- Cove Hardwood Forest (Ambrose 1990a) ?
- IA5a. Southern Appalachian Mesophytic Cove Forest (Allard 1990) B
- Rich Cove Forest (Foothills Intermediate Subtype) (Schafale 1998b) ?

Classification Comments: This association was originally defined from the Chattooga Basin Project data (S. Simon pers. comm.). Additional examples are known from low escarpment and foothills areas of the Southern Blue Ridge, including the Brushy Mountains (Wilkes County, North Carolina), Linville Gorge (Burke County, North Carolina), and the Highland Ranger District, Nantahala National Forest (Jackson and Macon counties, North Carolina). Similar vegetation in the Cumberland Mountains and Plateau is distinguished by the lack of such species as *Carex austrocaroliniana* and *Trillium catesbaei*. [See *Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum / Magnolia tripetala* Forest (CEGL005222).] Deciduous cove forests are perhaps the most complex group of communities to classify in the Southern Blue Ridge, due to a combination of wide environmental range, high species richness, and high biogeographic variability. The recognition of associations based on fertility and elevation is provisional and will likely need further refinement.

CONSERVATION RANKING & RARE SPECIES

GRank: G4? (1997-8-14): No information

High-ranked species: *Calystegia catesbeiana* (G3), *Collinsonia verticillata* (G3)

ELEMENT DISTRIBUTION

Range: This community occurs in the escarpment region of the Southern Blue Ridge in western North Carolina, northern South Carolina, and Georgia.

Subnations: GA, NC, SC, TN?, VA?

TNC Ecoregions: 51:C, 52:C

USFS Ecoregions: M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains?); USFS (Chattahoochee, Cherokee?, Nantahala, Pisgah?, Sumter)

ELEMENT SOURCES

References: Allard 1990, Ambrose 1990a, Nelson 1986, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Simon pers. comm., Southeastern Ecology Working Group n.d.

TULIPTREE - SWEET BIRCH - EASTERN HEMLOCK / GREAT RHODODENDRON FOREST

ELEMENT IDENTIFIERS

NVC association: *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest
Database Code: CEGL007543
Formation: Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a)
Alliance: *Tsuga canadensis - Liriodendron tulipifera* Forest Alliance (A.413)

ELEMENT CONCEPT

Summary: This association includes hemlock-hardwood forests of lower to intermediate elevations in the Southern Blue Ridge and upper Piedmont, ranging from southwestern Virginia, south and west to northwestern Georgia. These communities occur at low to middle elevations (1300-3500 feet) in the mountains and foothills, generally in coves, gorges, or sheltered slopes, over acid soils. The canopy is usually dominated by *Liriodendron tulipifera* or *Betula lenta*, but substantial portions of this community may be comprised mainly of *Tsuga canadensis* and the occasional *Acer rubrum*. Other deciduous species more typical of "rich" coves may occur as scattered individuals; *Tilia americana var. heterophylla, Fraxinus americana*, and *Fagus grandifolia*. Other canopy/subcanopy species often include *Quercus alba, Quercus rubra, Magnolia fraseri, Ilex opaca var. opaca, Calycanthus floridus, Halesia tetraptera var. tetraptera*, and *Pinus strobus*. *Rhododendron maximum* is scattered to dominant in the shrub stratum. Other typical shrubs include *Kalmia latifolia* and *Leucothoe fontanesiana*. Herbaceous cover is sparse but can be diverse and is composed of acid-loving species. Typical herbs include *Polystichum acrostichoides, Dennstaedtia punctilobula, Goodyera pubescens, Mitchella repens, Thelypteris noveboracensis, Galax urceolata, Viola rotundifolia, Hexastylis* sp., and *Tiarella cordifolia*.
Environment: Over its full geographic range, this association is typically found at lower to intermediate elevations (400-1060 m or 1300-3500 feet) in the southern Appalachians and adjacent foothills. Habitats are located on gentle to steep, lower slopes and in coves or gorges with acidic soils. In situations where mid-slopes are in protected north-facing positions, this community can range very high up straight or even convex slopes. The type often occurs in linear patches along stream bottoms and in steep ravines in complexes with rich cove communities. Although frequently associated with streams, it is not a wetland. Habitats in the Virginia part of the range are similar and are mostly situated below 900 m (3000 feet) elevation. Soils collected from plots are extremely acidic (mean pH = 3.9) and infertile, with high iron and aluminum levels and very low total base saturation.
Vegetation: This association encompasses hemlock - hardwood forests with canopies dominated by mixtures of *Tsuga canadensis, Liriodendron tulipifera, Betula lenta*, and *Acer rubrum*. Other deciduous species more typical of fertile coves, including *Tilia americana var. heterophylla, Fraxinus americana*, and *Fagus grandifolia*, may occur as scattered individuals. Minor overstory and understory species include *Quercus alba, Quercus rubra, Magnolia fraseri, Ilex opaca, Calycanthus floridus, Halesia tetraptera*, and *Pinus strobus*. *Rhododendron maximum* is scattered to dominant in the shrub stratum. Other typical shrubs include *Kalmia latifolia* and *Leucothoe fontanesiana*. Herbaceous cover is sparse but can be diverse and is composed of acid-loving species. Typical herbs include *Polystichum acrostichoides, Goodyera pubescens, Mitchella repens, Thelypteris noveboracensis, Galax urceolata, Hexastylis* spp., and *Tiarella cordifolia*.

Virginia examples of this association are similar to those further south but generally lack *Ilex opaca, Calycanthus floridus, Halesia tetraptera*, and *Leucothoe fontanesiana*. Presumably because of past logging, *Tsuga canadensis* is absent or confined to the understory in some stands, which have mixed canopies of *Liriodendron tulipifera, Betula lenta, Acer rubrum, Magnolia acuminata, Quercus rubra*, and/or *Nyssa sylvatica*. *Hamamelis virginiana* and *Acer pensylvanicum* are additional, frequent understory species. The shrub layers of Virginia occurrences are consistently dominated by dense (usually >50% cover), often nearly impenetrable colonies of *Rhododendron maximum*. Frequent low-cover species of sparse herb layers include *Galax urceolata, Chimaphila maculata, Eurybia divaricata (= Aster divaricatus), Arisaema triphyllum, Monotropa uniflora, Mitchella repens*, and *Medeola virginiana*. The spectacular sedge *Cymophyllus fraserianus* is often associated with this forest.
Dynamics: No information
Similar Associations:
- *Acer rubrum var. rubrum - Betula (alleghaniensis, lenta) - Magnolia fraseri / (Rhododendron maximum, Kalmia latifolia)* Forest (CEGL008558)
- *Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / Leucothoe fontanesiana* Forest (CEGL007861)
- *Tsuga canadensis - (Fagus grandifolia, Tilia americana var. heterophylla) / Magnolia tripetala* Forest (CEGL008407)

Related Concepts:
- *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (Fleming and Coulling 2001) ?
- Acidic Cove Forest (Typic Subtype) (Schafale 1998b) ?
- Cove Forest (Patterson et al. 1994) B
- IA5b. Southern Appalachian Hemlock Cove Forest (Allard 1990) B

- Mixed Mesophytic Coves (Gettman 1974) ?
- Type 5 (Newell and Peet 1995) ?
- Yellow-poplar - Eastern Hemlock: 58 (Eyre 1980) B

Classification Comments: Deciduous trees more typical of 'rich' coves, such as *Aesculus flava, Tilia americana var. heterophylla*, and *Acer saccharum*, are present in this forest only as minor components, if at all. Likewise, rich-site herbs, such as *Actaea racemosa (= Cimicifuga racemosa), Caulophyllum thalictroides, Actaea pachypoda*, and *Adiantum pedatum*, are absent or nearly so. This forest is distinguished from "northern hardwood forests" by the lack of or near absence of *Fagus grandifolia, Betula alleghaniensis, Aesculus flava*, and the presence of low-elevation species, such as *Betula lenta* and *Liriodendron tulipifera*, and generally by a more depauperate herb layer. An interesting example from the Piedmont/Blue Ridge transition of Georgia (Cedar Creek Canyon, Chattahoochee National Forest) has high coverage of *Rhododendron minus* and other foothills/Piedmont species such as *Liquidambar styraciflua* and *Aesculus sylvatica*.

This community type is grossly under-represented by plot data considering its extensive distribution in southwestern Virginia. In the 900-1060 m (3000-3500 feet) elevation range, the type becomes transitional to *Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / Leucothoe fontanesiana* Forest (CEGL007861), which lacks lower-elevation species such as *Liriodendron tulipifera* and *Galax urceolata*, and contains many species characteristic of higher elevations and northern latitudes.

Similar vegetation has been observed in coves of the Cumberland Mountains of southwestern Virginia (e.g., Clinch Ranger District: Dark Hollow, Roaring Branch, Pick Breeches and Flannery Ridges,) but comprehensive data are needed to determine whether these stands are part of this forest types or transitional to *Tsuga canadensis - (Fagus grandifolia, Tilia americana var. heterophylla) / Magnolia tripetala* Forest (CEGL008407). The latter unit apparently has an extensive distribution in the Cumberland Plateau of Kentucky and Tennessee, the Southern Ridge and Valley of Tennessee, and the Central Appalachians of West Virginia and southwestern Pennsylvania.

CONSERVATION RANKING & RARE SPECIES

GRank: G5 (2001-9-28): Within its range, this community type occurs extensively in suitable mesic habitats. Occurrences are subject to compositional modification by outbreaks of hemlock woolly adelgid (*Adelges tsugae*), an exotic insect pest that causes decline and eventual mortality of *Tsuga canadensis*.

High-ranked species: *Betula uber* (G1Q), *Botrychium jenmanii* (G3G4), *Diervilla rivularis* (G3), *Hexastylis contracta* (G3), *Hexastylis naniflora* (G3), *Hexastylis rhombiformis* (G2), *Isotria medeoloides* (G2), *Malaxis bayardii* (G2), *Monotropsis odorata* (G3), *Trillium persistens* (G1), *Waldsteinia lobata* (G2)

ELEMENT DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge and peripherally in the upper Piedmont, ranging from southwestern Virginia, south and west to northwestern Georgia.

Subnations: GA, NC, SC, TN, VA, WV

TNC Ecoregions: 50:P, 51:C, 52:C, 59:C

USFS Ecoregions: 231Aa:CCC, M221Aa:CCC, M221Ab:CCC, M221Ca:CPP, M221Cb:CPP, M221Cc:CPP, M221Ce:CPP, M221Da:CC?, M221Db:CCC, M221Dc:CCC, M221Dd:CCC, M231Ad:CCC

Federal Lands: NPS (Blue Ridge Parkway?, Carl Sandburg Home, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Jefferson, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, Eyre 1980, Fleming and Coulling 2001, Fleming et al. 2001, Gettman 1974, NatureServe Ecology - Southeastern U.S. unpubl. data, Newell and Peet 1995, Patterson 1994, Patterson et al. 1994, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

TULIPTREE - YELLOW BUCKEYE - (WHITE ASH, APPALACHIAN BASSWOOD) / BLACK COHOSH - WOOD NETTLE FOREST

ELEMENT IDENTIFIERS

NVC association: *Liriodendron tulipifera - Aesculus flava - (Fraxinus americana, Tilia americana* var. *heterophylla) / Actaea racemosa - Laportea canadensis* Forest

Database Code: CEGL007710

Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)

Alliance: *Liriodendron tulipifera - Tilia americana* var. *heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235)

ELEMENT CONCEPT

Summary: This association represents deciduous forests of concave lower slopes and flats at middle elevations (610-1370 m [2000-4500 feet]) in the Southern Blue Ridge. The canopy is dominated by some mixture of rich site mesophytic species such as *Aesculus flava, Fraxinus americana, Tilia americana var. heterophylla*, and *Magnolia acuminata*, occurring with more widely tolerant tree

species such as *Liriodendron tulipifera, Acer rubrum, Tsuga canadensis*, and *Betula lenta*. The herbaceous stratum is diverse and often very lush. Typical herbaceous species include *Actaea racemosa (= Cimicifuga racemosa), Caulophyllum thalictroides, Prosartes lanuginosa (= Disporum lanuginosum), Aruncus dioicus, Adiantum pedatum, Collinsonia canadensis, Osmorhiza claytonii*, and *Laportea canadensis*. This association is distinguished by the absence or scarcity of calciphilic species, such as *Diplazium pycnocarpon, Asplenium rhizophyllum, Dryopteris goldiana, Aquilegia canadensis, Solidago flexicaulis, Deparia acrostichoides*, and *Cystopteris protrusa*, by generally occurring at elevations above 2000 feet, and by lacking species typical of lower elevation forests.
Environment: This association is characteristic of concave lower slopes and flats at middle elevations (610-1370 m or 2000-4500 feet) in the Southern Blue Ridge. At the northern end of the range in Virginia, elevation of the few known occurrences decreases from 760 m (2500 feet) in the Southern Blue Ridge to as low as 305 m (1000 feet) at the extreme north end of the Blue Ridge in Clarke County. Five plot-sampled stands occupy sites underlain by base-rich substrates, including metabasalt (greenstone), amphibolite, and dolomite. These sites are mostly situated on moderately steep (mean slope = 17 degrees), straight or concave slopes with east to northeast aspects. Soils are deep, dark, and fertile, with the highest mean pH (6.3), calcium (2466 ppm), and magnesium (296 ppm) levels among strictly montane cove forests in Virginia.
Vegetation: In the heart of its Southern Blue Ridge range, canopies of this community type are dominated by variable mixtures of nutrient-demanding mesophytic species such as *Aesculus flava, Fraxinus americana*, and *Tilia americana var. heterophylla*, in association with more wide-ranging tree species such as *Liriodendron tulipifera, Acer rubrum, Tsuga canadensis*, and *Betula lenta*. Herb layers are diverse and often very lush. Typical herbaceous species include *Actaea racemosa (= Cimicifuga racemosa), Caulophyllum thalictroides, Aruncus dioicus, Adiantum pedatum, Collinsonia canadensis, Laportea canadensis, Osmorhiza claytonii*, and *Prosartes lanuginosa (= Disporum lanuginosum)*. In the Southern Blue Ridge, this association is distinguished by the scarcity of calciphilic species such as *Diplazium pycnocarpon, Asplenium rhizophyllum, Dryopteris goldiana, Aquilegia canadensis, Solidago flexicaulis, Deparia acrostichoides*, and *Cystopteris protrusa*; by generally occurring at elevations above 610 m (2000 feet); and by lacking species typical of lower-elevation forests.

Virginia examples may represent somewhat transitional or depauperate variants in the northern periphery of the association's range. *Aesculus sylvatica* is entirely absent from the documented stands, in which *Liriodendron tulipifera, Fraxinus americana, Tilia americana*, and *Quercus rubra* are the most important canopy species. *Acer saccharum, Betula lenta, Carya glabra*, and *Carya cordiformis* are minor canopy associates. *Ulmus rubra* is constant understory tree that occasionally reaches the overstory. All occurrences have a moderately dense shrub layer dominated exclusively by *Lindera benzoin* (25-50% cover in plots). The herbaceous flora is extremely lush and forb-rich throughout the entire growing season, with constantly changing suites of patch-dominants flowering, fruiting, and evanescing. *Trillium grandiflorum* is characteristically abundant in the vernal herbaceous complex, which also includes *Arisaema triphyllum, Maianthemum racemosum, Galearis spectabilis, Viola pubescens, Sanguinaria canadensis, Stellaria pubera, Podophyllum peltatum, Asarum canadense, Hybanthus concolor*, and *Thalictrum dioicum*. During the summer, prevalent herbs are *Actaea racemosa, Impatiens pallida, Circaea lutetiana ssp. canadensis, Monarda clinopodia, Sanicula odorata*, and *Collinsonia canadensis*. Species richness of plot-sampled stands ranges from 46 to 59 taxa per 400 m2 (mean = 52).
Dynamics: No information
Similar Associations:
Related Concepts:
- *Liriodendron tulipifera - Tilia americana - Fraxinus americana / Lindera benzoin / Trillium grandiflorum - Impatiens pallida* Forest (Fleming and Coulling 2001) ?
- Rich Cove Forest (Montane Intermediate Subtype) (Schafale 1998b) ? Yellow-poplar - White Oak - Northern Red Oak: 59 (Eyre 1980) B

Classification Comments: Deciduous cove forests are perhaps the most complex group of communities to classify in the Southern Blue Ridge, due to a combination of wide environmental range, high species richness, and high biogeographic variability. The recognition of associations based on fertility and elevation is provisional and will likely need further refinement. This association is distinguished by the absence or scarcity of calciphilic species, such as *Diplazium pycnocarpon, Asplenium rhizophyllum, Dryopteris goldiana, Aquilegia canadensis, Solidago flexicaulis, Deparia acrostichoides*, and *Cystopteris protrusa*, by generally occurring at elevations above 610 m (2000 feet), and by lacking species typical of lower elevation forests.

Although represented only by a few geographically disparate examples, this community type seems to have a remarkably consistent composition over nearly the entire length of the Blue Ridge in Virginia. These stands have all recovered from logging in the past, but remain threatened by future timber harvests because of excellent site productivity. Shade-tolerant, invasive exotics, especially *Alliaria petiolata*, pose a serious threat to the integrity of this community's herbaceous flora.

CONSERVATION RANKING & RARE SPECIES

GRank: G4 (1998-4-30): This community is uncommon due to specialized habitat requirements, but it is not rare. It is secure throughout its range, but susceptible to impacts by logging due to its location in accessible topographic positions.
High-ranked species: *Aconitum reclinatum* (G3), *Cardamine flagellifera* (G3)

ELEMENT DISTRIBUTION

Range: This association occurs in the southern Appalachian Mountains of eastern Tennessee, western North Carolina, northeastern Georgia, and southwestern Virginia. Scattered outliers occur on the northern Virginia Blue Ridge and in the southwestern Virginia Ridge and Valley region adjacent to the Blue Ridge.
Subnations: GA, NC, TN, VA
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Ab:CCC, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Jefferson, Nantahala, Pisgah)

ELEMENT SOURCES

References: Eyre 1980, Fleming and Coulling 2001, Fleming et al. 2001, Major et al. 1999, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Southeastern Ecology Working Group n.d.

UMBRELLA-LEAF - BRANCH-LETTUCE - WOOD NETTLE HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis* Herbaceous Vegetation
Database Code: CEGL004296
Formation: Saturated temperate perennial forb vegetation (V.B.2.N.f)
Alliance: *Diphylleia cymosa - Saxifraga micranthidifolia* Saturated Herbaceous Alliance (A.1688)

ELEMENT CONCEPT

Summary: A characteristic association of shaded seeps of the southern Appalachian Mountains, usually with overhanging canopies though trees not rooted in the seep itself. Often not large enough to be readily mappable, but a distinctive habitat for many plants, invertebrate and vertebrate animals. Stands typically contain *Diphylleia cymosa, Saxifraga micranthidifolia,* and *Laportea canadensis*. Other characteristic species include *Cardamine clematitis, Chelone lyonii, Chelone glabra, Chrysosplenium americanum, Boykinia aconitifolia, Cicuta maculata, Houstonia serpyllifolia, Viola cucullata, Viola macloskeyi ssp. pallens, Lilium grayi, Oxypolis rigidior, Parnassia asarifolia, Tiarella cordifolia, Thalictrum clavatum, Trautvetteria caroliniensis, Stellaria corei,* and *Geum geniculatum.* Occurrences associated with more acidic soil conditions often contain *Juncus gymnocarpus*. This association often occurs in cove forests.
Environment: This association often occurs in cove forests. It is a characteristic association of shaded seeps of the southern Appalachian Mountains, usually with overhanging canopies though trees not rooted in the seep itself. Often not large enough to be readily mappable, but a distinctive habitat for many plants, invertebrate and vertebrate animals.
Vegetation: Stands typically contain *Diphylleia cymosa, Saxifraga micranthidifolia,* and *Laportea canadensis*. Other characteristic species include *Cardamine clematitis, Chelone lyonii, Chelone glabra, Chrysosplenium americanum, Boykinia aconitifolia, Cicuta maculata, Houstonia serpyllifolia, Viola cucullata, Viola macloskeyi ssp. pallens, Lilium grayi, Oxypolis rigidior, Parnassia asarifolia, Tiarella cordifolia, Thalictrum clavatum, Trautvetteria caroliniensis, Stellaria corei,* and *Geum geniculatum*. Occurrences associated with more acidic soil conditions often contain *Juncus gymnocarpus* (G. Kauffman pers. comm.).
Dynamics: No information
Similar Associations:
- *Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata var. humilis* Herbaceous Vegetation (CEGL004293)

Related Concepts:
- IID3a. Herbaceous High Elevation Seepage Slope (Allard 1990) B
- Rich Montane Seep (Cove Subtype) (Schafale 1998b) ?

Classification Comments: The nominal species *Diphylleia cymosa*, is a conspicuous component of this association, but may also be found in seeps of varying canopy closure at middle and high elevations. The associated nominal species, *Saxifraga micranthidifolia* and *Laportea canadensis*, are indicative of shaded seeps (G. Kauffman pers. comm.). Another high-elevation herbaceous seep association known from the southern Appalachians, *Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata var. humilis* Herbaceous Vegetation (CEGL004293), often occurs on boulder fields or in northern hardwood forests, at higher elevations than the association defined here.

CONSERVATION RANKING & RARE SPECIES

GRank: G3 (1998-12-14): This community occurs at moderate to high elevations of the southern Blue Ridge Mountains of western North Carolina, eastern Tennessee, southwestern Virginia, northern Georgia, and probably northwestern South Carolina. It occurs as a small patch community, embedded in a variety of regional forest types. While restricted in range and of small size, the community is relatively frequent within its range, many examples are protected, and threats are relatively few and minor.
High-ranked species: *Aconitum reclinatum* (G3), *Cardamine clematitis* (G2G3), *Geum geniculatum* (G2), *Lilium grayi* (G3)

ELEMENT DISTRIBUTION

Range: This community is found at moderate to high elevations of the southern Blue Ridge Mountains of western North Carolina, eastern Tennessee, southwestern Virginia, northern Georgia, and probably northwestern South Carolina.
Subnations: GA, NC, SC?, TN, VA
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Jefferson, Nantahala, Pisgah, Sumter?)

ELEMENT SOURCES

References: Allard 1990, Fleming et al. 2001, Kauffman pers. comm., Nelson 1986, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

YELLOW BIRCH - APPALACHIAN BASSWOOD / MOUNTAIN MAPLE / EASTERN PRICKLY GOOSEBERRY / MARGINAL WOODFERN FOREST

ELEMENT IDENTIFIERS

NVC association: *Betula alleghaniensis - Tilia americana* var. *heterophylla / Acer spicatum / Ribes cynosbati / Dryopteris marginalis* Forest
Database Code: CEGL004982
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Betula alleghaniensis - Fagus grandifolia - Aesculus flava* Forest Alliance (A.266)

ELEMENT CONCEPT

Summary: This association includes boulderfield forests of the southern Appalachians, with abundant *Betula alleghaniensis*, but in habitats that allow for more diverse canopies, including other species such as *Aesculus flava, Betula lenta,* and *Tilia americana var. heterophylla*. This community occurs in a cool, humid climate, on steep, rocky, northwest- to northeast-facing, middle to upper concave slopes, or in saddles between ridges, at moderate to high elevations (610-1220 m [2000-4000 feet]) of the Blue Ridge and possibly ranging into the Cumberland Mountains and adjacent Ridge and Valley and Appalachian Plateau provinces. It grows on bouldery talus and is often associated with small streams and seepage. *Betula alleghaniensis* in the canopy are often stunted and gnarled, with roots that may have grown to encircle the boulders. The canopy is much more open than the surrounding forest and tree windthrow is common, leaving patches of exposed mineral soil and gaps in the canopy. A woody layer of shrubs and vines is usually well-developed. Rooting opportunities for most herbaceous plants is limited because of the development of this community on periglacial boulderfields of blocky talus, thus herbaceous cover is only sparse to moderate. Typical shrubs and vines which are more abundant in this type than in other associations in this alliance include *Acer spicatum, Aristolochia macrophylla, Hydrangea arborescens, Parthenocissus quinquefolia, Ribes cynosbati*, and *Ribes rotundifolium*. *Dryopteris marginalis* is often an abundant herb. This type is conceptually similar to *Betula alleghaniensis / Ribes glandulosum / Polypodium appalachianum* Forest (CEGL006124), which is more restricted to more extreme boulderfield situations at high elevations (1370-1615 m [4500-5300 feet]). The association described here generally occurs at lower elevations in less extreme environmental situations and lacks species characteristic of high elevations. Similar *Betula alleghaniensis*-dominated forests occur on glaciated rocky slopes in the upper mid-Atlantic and in the northeastern United States. The *Betula alleghaniensis*-dominated periglacial boulderfields of the southern Appalachian Mountains are distinguished from the northern forests by the occurrence of southern Appalachian endemic species, better developed shrub layers and slightly less species diversity.
Environment: This community occurs in a cool, humid climate, on steep, rocky, northwest- to northeast-facing, middle to upper concave slopes, or in saddles between ridges, at moderate to high elevation (610-1220 m [2000-4000 feet]). These forests grow over bouldery talus and are often associated with small streams and seepage.
Vegetation: This association includes boulderfield forests of the southern Appalachians, with abundant *Betula alleghaniensis*, but in habitats that allow for more diverse canopies, including other species such as *Aesculus flava, Betula lenta,* and *Tilia americana var. heterophylla*. *Betula alleghaniensis* in the canopy are often stunted and gnarled, with roots that may have grown to encircle the boulders. The canopy is much more open than the surrounding forest and tree windthrow is common, leaving patches of exposed mineral soil and gaps in the canopy. A woody layer of shrubs and vines is usually well-developed. Rooting opportunities for most herbaceous plants is limited because of the development of this community on periglacial boulderfields of blocky talus, thus herbaceous cover is only sparse to moderate. Typical shrubs and vines which are more abundant in this type than in other associations in this alliance include *Acer spicatum, Aristolochia macrophylla, Hydrangea arborescens, Parthenocissus quinquefolia, Ribes cynosbati*, and *Ribes rotundifolium*. *Dryopteris marginalis* is often an abundant herb.
Dynamics: No information
Similar Associations:
- *Betula alleghaniensis / Ribes glandulosum / Polypodium appalachianum* Forest (CEGL006124) -- more affiliated with northern hardwoods.

Related Concepts:
- IA4c. Yellow Birch Boulderfield Forest (Allard 1990) B

- Oligotrophic Forest (Rawinski 1992) B
- Rich Cove Forest (Boulderfield Subtype) (Schafale 1998b) ?
- Yellow Birch, BR (Pyne 1994) B

Classification Comments:

CONSERVATION RANKING & RARE SPECIES

GRank: G3 (1999-2-15): This community is scattered throughout the high mountains but is fairly uncommon. Unlike many other forest types in the Southern Appalachians, this community has not historically been threatened by logging as much as other types because of the stunted nature of the trees and the relative inaccessibility to loggers of these boulderfields.

High-ranked species: *Aconitum reclinatum* (G3), *Cardamine clematitis* (G2G3), *Geum geniculatum* (G2), *Scutellaria saxatilis* (G3), *Stachys clingmanii* (G2Q)

ELEMENT DISTRIBUTION

Range: This community occurs in the southern Appalachian Mountains of the eastern United States.

Subnations: GA, KY?, NC, TN, VA?

TNC Ecoregions: 50:?, 51:C

USFS Ecoregions: M221C:CC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Chafin and Jones 1989, Evans 1991, Major et al. 1999, Peet et al. unpubl. data 2002, Pyne 1994, Rawinski 1992, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Southeastern Ecology Working Group n.d.

YELLOW BUCKEYE - SUGAR MAPLE - (WHITE ASH, APPALACHIAN BASSWOOD) / MAPLELEAF WATERLEAF - ZIGZAG GOLDENROD FOREST

ELEMENT IDENTIFIERS

NVC association: *Aesculus flava - Acer saccharum - (Fraxinus americana, Tilia americana* var. *heterophylla) / Hydrophyllum canadense - Solidago flexicaulis* Forest

Database Code: CEGL007695

Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)

Alliance: *Liriodendron tulipifera - Tilia americana* var. *heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235)

ELEMENT CONCEPT

Summary: This association includes forests of protected coves in the southern Appalachian Mountains of eastern Tennessee, western North Carolina, and southwest Virginia. This type extends peripherally into the Cumberland Mountains of southwestern Virginia. These forests are associated with nutrient-rich soils and, often, mafic geologies, and occur on steep, middle to low protected slopes and coves at 610-1400 m (2000-4600 feet) elevation. Examples of this association have deciduous forest canopies dominated by either *Acer saccharum, Aesculus flava, Fraxinus americana, Halesia tetraptera var. monticola,* or *Tilia americana var. heterophylla,* or by various combinations of these species. Other common canopy species can include *Carya cordiformis* and *Quercus rubra*. A shrub stratum is vary sparse or absent, and the herbaceous stratum is dense and luxurious, with high species richness. The defining feature of this association is the lush herbaceous flora with many calciphilic species indicative of high pH or circumneutral soils. Characteristic species include *Asarum canadense, Carex plantaginea, Cymophyllus fraserianus, Cystopteris protrusa, Deparia acrostichoides, Diplazium pycnocarpon, Prosartes lanuginosa (= Disporum lanuginosum), Dryopteris goldiana, Hepatica nobilis var. acuta, Hydrophyllum canadense, Osmorhiza claytonii, Solidago flexicaulis,* and *Viola canadensis*. The herbaceous stratum can have local dominance by *Laportea canadensis, Viola canadensis, Dryopteris intermedia, Actaea podocarpa (= Cimicifuga americana), Actaea racemosa (= Cimicifuga racemosa),* and *Caulophyllum thalictroides*. This forest lacks dominance by *Betula alleghaniensis* and *Fagus grandifolia,* and has an herbaceous flora indicative of high-base status soils. This association typically has a much more diverse herbaceous stratum than other deciduous cove forests of the Southern Blue Ridge.

Environment: In the southern part of its range, this vegetation type occurs on protected, concave, landforms, at elevations ranging from 610-1400 m (2000-4600 feet). It is associated with nutrient-rich soils and often with mafic substrates, occurring on steep, middle to lower, protected slopes and in coves. In Virginia, the type is restricted to an elevation range from 1100-1400 m (3600-4600 feet). Virginia sites supporting this community are on strongly concave, moderately steep (mean = 17 degrees) slopes with north to east aspects. Underlying bedrock includes igneous metamorphic formations, shale, mudstone, and calcareous sandstone. Surface cover of bedrock and boulders ranges from 0-40%. Dark, apparently fertile, loamy soils at plot sampling sites are very strongly acidic (mean pH = 4.7) but have high levels of calcium, magnesium, and manganese.

Vegetation: This association represents forests of medium- to high-elevation protected coves in the southern Appalachian Mountains. Tree canopies are dominated by variable mixtures of *Acer saccharum, Aesculus flava, Fraxinus americana, Halesia tetraptera var. monticola,* and *Tilia americana var. heterophylla*. In the Great Smoky Mountains of North Carolina and Tennessee, relative dominance of canopy species varies from site to site, with some stands strongly dominated by *Halesia tetraptera var. monticola*. Other common canopy species are *Carya cordiformis* and *Quercus rubra*. The shrub layer is very sparse or absent, but the

herb layer is dense and luxuriant, with relatively high species richness. A defining feature of this association is the lush herbaceous flora with many calciphilic species indicative of high pH or base-rich soils. Characteristic herbs include *Asarum canadense, Carex plantaginea, Cymophyllus fraserianus, Cystopteris protrusa, Deparia acrostichoides, Diplazium pycnocarpon, Prosartes lanuginosa (= Disporum lanuginosum), Dryopteris goldiana, Hepatica nobilis var. acuta, Hydrophyllum canadense, Osmorhiza claytonii, Solidago flexicaulis*, and *Viola canadensis*. The herb layer can also have local dominance by *Laportea canadensis, Dryopteris intermedia, Actaea podocarpa (= Cimicifuga americana), Actaea racemosa (= Cimicifuga racemosa), Ageratina altissima*, and *Caulophyllum thalictroides*. This association typically has a much more diverse herbaceous stratum than other deciduous cove forests of the Southern Blue Ridge.

Virginia stands of this association entirely lack *Halesia tetraptera var. monticola* and are dominated by *Acer saccharum, Tilia americana var. heterophylla, Fraxinus americana*, and *Aesculus flava*. The most abundant herbs, at least locally, are *Actaea podocarpa, Caulophyllum thalictroides, Deparia acrostichoides, Dryopteris intermedia, Geranium maculatum, Hydrophyllum canadense, Hydrophyllum virginianum, Impatiens pallida, Laportea canadensis, Phacelia fimbriata, Sanicula odorata, Solidago flexicaulis, Uvularia grandiflora, Viola canadensis*, and *Viola pubescens*. Many additional herbs occur at low cover. Mean species richness of plot-sampled stands is 51 taxa per 400 m2.

Dynamics: No information

Similar Associations:

Related Concepts:

- *Acer saccharum - Tilia americana var. heterophylla - Fraxinus americana / Actaea podocarpa - Sanicula odorata - (Phacelia fimbriata)* Forest (Fleming and Coulling 2001) ?
- Open Slope Mesophytic Forest (Rheinhardt and Ware 1984) ?
- Rich Cove Forest (Montane Rich Subtype) (Schafale 1998b) ?
- Sugar Maple - Basswood: 26 (Eyre 1980) B

Classification Comments: This association was originally defined for the richest cove forests in the Great Smoky Mountains and may need revision to apply more generally to similar forests in the Southern Blue Ridge. In the Smokies, relative dominance of canopy species varies among examples of this association. Some examples may have canopies strongly dominated by *Halesia tetraptera var. monticola*, while others have major canopy dominance by either *Acer saccharum, Aesculus flava, Tilia americana var. heterophylla*, or *Fraxinus americana*. Deciduous cove forests are perhaps the most complex group of communities to classify in the Southern Blue Ridge, due to a combination of wide environmental range, high species richness, and high biogeographic variability. The recognition of associations based on fertility and elevation is provisional and will likely need further refinement.

CONSERVATION RANKING & RARE SPECIES

GRank: G3G4 (1999-12-29): This community is naturally uncommon within its range due to specific habitat requirements. It only occurs in protected, concave, topographic positions over high-base status soils in the Southern Blue Ridge, a region of predominantly nutrient-poor (acidic) soils. Although relatively secure and not highly threatened today, most remaining examples of this community have been affected by past logging, thus much of the remaining acreage is not of high quality.

High-ranked species: *Aconitum reclinatum* (G3), *Cardamine flagellifera* (G3)

ELEMENT DISTRIBUTION

Range: This association occurs in the southern Appalachian Mountains of eastern Tennessee, western North Carolina and southwestern Virginia. It likely ranges into the Blue Ridge of Georgia and extends peripherally into Virginia's Cumberland Mountains.

Subnations: GA?, NC, TN, VA

TNC Ecoregions: 50:C, 51:C

USFS Ecoregions: M221Aa:CCC, M221Bd:C??, M221Cc:CC?, M221Ce:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains); USFS (Cherokee, Jefferson, Nantahala, Pisgah)

ELEMENT SOURCES

References: Eyre 1980, Fleming and Coulling 2001, Fleming et al. 2001, NatureServe Ecology - Southeastern U.S. unpubl. data, Patterson et al. 1999, Peet et al. unpubl. data 2002, Rheinhardt and Ware 1984, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

SOUTHERN AND CENTRAL APPALACHIAN MAFIC GLADE AND BARRENS

(PIGNUT HICKORY, MOCKERNUT HICKORY) - WHITE ASH - EASTERN RED-CEDAR WOODLAND

ELEMENT IDENTIFIERS

NVC association: *Carya (glabra, alba) - Fraxinus americana - Juniperus virginiana* var. *virginiana* Woodland

Database Code: CEGL003752

Formation: Cold-deciduous woodland (II.B.2.N.a)

Alliance: *Fraxinus americana - Carya glabra - (Juniperus virginiana)* Woodland Alliance (A.604)

ELEMENT CONCEPT

Summary: Montane woodlands of the Southern Blue Ridge with open and stunted (3-5 m) canopies, with gnarly *Juniperus virginiana var. virginiana*, and various deciduous species, typically *Carya glabra, Fraxinus americana, Quercus prinus, Ostrya virginiana*, and *Chionanthus virginicus*. Occurrences are often physiognomic complexes of woodland, grassland, and rock outcropping, and are often associated with southern or eastern exposures on granitic domes or rocky summits. Shrubs are scattered or locally abundant and may include *Ptelea trifoliata, Physocarpus opulifolius, Hypericum prolificum, Vaccinium stamineum, Vaccinium pallidum, Lonicera flava, Amelanchier sanguinea*, and *Rosa carolina*. A dense, grassy herb layer can occur beneath the canopy or in open areas, interspersed with bare rock. Typical dominants include *Carex pensylvanica, Dichanthelium scoparium, Danthonia compressa, Danthonia sericea, Andropogon gyrans, Andropogon ternarius, Andropogon gerardii, Sorghastrum nutans, Schizachyrium scoparium var. scoparium, Aristida purpurascens*, and *Melica mutica*. Other herbaceous species include *Dodecatheon meadia, Solidago nemoralis, Pycnanthemum montanum, Hypericum punctatum, Hypericum gentianoides, Desmodium rotundifolium, Antennaria virginica, Piptochaetium avenaceum, Packera millefolia (= Senecio millefolium), Helianthus microcephalus, Claytonia virginica, Coreopsis major*, and *Coreopsis pubescens*. The steepest areas may have patches of *Sedum glaucophyllum, Houstonia longifolia*, and *Saxifraga michauxii*. These woodlands are currently known from the lower mountains of North Carolina and Virginia, 750-1150 m (2500-3800 feet) elevation, on sites with biotite gneiss geology with veins of base-rich hornblende gneiss.

Environment: Occurrences are often physiognomic complexes of woodland, grassland, and rock outcropping, and are often associated with southern or eastern exposures on granitic domes or rocky summits. These woodlands are currently known from the lower mountains of North Carolina and Virginia, 750-1150 m (2500-3800 feet) elevation, on sites with biotite gneiss geology with veins of base-rich hornblende gneiss.

Vegetation: The open and stunted (3-5 m) canopy of stands is dominated by gnarly *Juniperus virginiana var. virginiana*, and various deciduous species, typically *Carya glabra, Fraxinus americana, Quercus prinus, Ostrya virginiana*, and *Chionanthus virginicus*. Shrubs are scattered or locally abundant and may include *Ptelea trifoliata, Physocarpus opulifolius, Hypericum prolificum, Vaccinium stamineum, Vaccinium pallidum, Lonicera flava, Amelanchier sanguinea*, and *Rosa carolina*. A dense, grassy herb layer can occur beneath the canopy or in open areas, interspersed with bare rock. Typical dominants include *Carex pensylvanica, Dichanthelium scoparium, Danthonia compressa, Danthonia sericea, Andropogon gyrans, Andropogon ternarius, Andropogon gerardii, Sorghastrum nutans, Schizachyrium scoparium var. scoparium, Aristida purpurascens*, and *Melica mutica*. Other herbaceous species include *Dodecatheon meadia, Solidago nemoralis, Pycnanthemum montanum, Hypericum punctatum, Hypericum gentianoides, Desmodium rotundifolium, Antennaria virginica, Piptochaetium avenaceum, Packera millefolia (= Senecio millefolium), Helianthus microcephalus, Claytonia virginica, Coreopsis major*, and *Coreopsis pubescens*. The steepest areas may have patches of *Sedum glaucophyllum, Houstonia longifolia*, and *Saxifraga michauxii*.

Dynamics: No information

Similar Associations:

- *Fraxinus americana - Carya glabra / Symphoricarpos orbiculatus - Rhus aromatica / Piptochaetium avenaceum* Woodland (CEGL003684) -- a related Piedmont type.

Related Concepts:

- Eastern Redcedar: 46 (Eyre 1980) B
- Montane Red Cedar-Hardwood Woodland (Schafale 1998b) ?
- Montane Red-cedar - Hardwood Woodland, Montane Subtype (Schafale pers. comm.) ?

Classification Comments: Some sites grade into forests dominated by *Quercus prinus*.

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (1998-12-14): This community is limited to regionally uncommon and small exposures of moderately nutrient-rich rock in the Southern Blue Ridge, and is thought to be inherently rare because of its unusual geology and topographic position. Total acreage of this community may be less than 1000 acres. Threats are few, although logging in adjacent areas can cause unnatural disturbance, along with alteration of light and seepage flow.

High-ranked species: *Arabis patens* (G3), *Berberis canadensis* (G3), *Calystegia catesbeiana* (G3), *Carex biltmoreana* (G3), *Packera millefolia* (G2), *Solidago simulans* (G1)

ELEMENT DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge of western North Carolina, but likely extends into Virginia and Georgia.

Subnations: GA?, NC, TN, VA?

TNC Ecoregions: 51:C

USFS Ecoregions: 221A:CC, M221Dc:CCC

Federal Lands: USFS (Nantahala, Pisgah)

ELEMENT SOURCES

References: Dellinger unpubl. data 1992, Eyre 1980, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Small 1996, Southeastern Ecology Working Group n.d.

ROCK SPIKE-MOSS - LITTLE BLUESTEM - APPALACHIAN LIVE-FOREVER - NODDING ONION HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Selaginella rupestris - Schizachyrium scoparium - Hylotelephium telephioides - Allium cernuum* Herbaceous Vegetation
Database Code: CEGL004991
Formation: Low temperate or subpolar perennial forb vegetation (V.B.2.N.b)
Alliance: *Selaginella (tortipila, rupestris)* Herbaceous Alliance (A.1985)

ELEMENT CONCEPT

Summary: This community includes vegetation of North Carolina's upper Piedmont and Blue Ridge, on gently to moderately sloping, low-elevation outcrops, with irregular or undulating surfaces but few crevices, and containing plants characteristic of higher pH conditions. This community occurs as small patches (approx. 5-50 acres) at elevations below 1220 m (4000 feet). Vegetation consists of shallow mats dominated by *Selaginella rupestris* and deeper grassy mats, interspersed with areas of smooth rock or rock with few crevices or fractures. This community has few deep-rooted forbs, shrubs, or trees. The flora is diverse and characterized by the presence of plants indicative of higher pH soils, such as *Hylotelephium telephioides (= Sedum telephioides), Dodecatheon meadia, Sedum glaucophyllum, Cheilanthes lanosa, Arabis laevigata var. laevigata*, and *Penstemon canescens*. Graminoids in this community include *Danthonia sericea, Andropogon virginicus, Carex biltmoreana, Andropogon gerardii*, and *Sorghastrum nutans*. Woody species may be scattered, rooted in crevices or in marginal zones between exposed rock and adjacent forests. Typical woody plants include *Philadelphus inodorus, Philadelphus hirsutus, Chionanthus virginicus, Quercus prinus, Juniperus virginiana, Fraxinus americana*, and *Physocarpus opulifolius*.
Environment: No information
Vegetation: Vegetation consists of shallow mats dominated by *Selaginella rupestris* and deeper grassy mats, interspersed with areas of smooth rock or rock with few crevices or fractures. This community has few deep-rooted forbs, shrubs, or trees. The flora is diverse and characterized by the presence of plants indicative of higher pH soils, such as *Hylotelephium telephioides (= Sedum telephioides), Dodecatheon meadia, Sedum glaucophyllum, Cheilanthes lanosa, Arabis laevigata var. laevigata*, and *Penstemon canescens*. Graminoids in this community include *Danthonia sericea, Andropogon virginicus, Carex biltmoreana, Andropogon gerardii*, and *Sorghastrum nutans*. Typical woody plants include *Philadelphus inodorus, Philadelphus hirsutus, Chionanthus virginicus, Quercus prinus, Juniperus virginiana, Fraxinus americana*, and *Physocarpus opulifolius*.
Dynamics: No information
Similar Associations:
Related Concepts:
- Low Elevation Basic Glade (Brushy Mountain Subtype) (Schafale 1998b) ?
- Low Elevation Basic Glade (Montane Subtype) (Schafale 1998b) ?

Classification Comments: A subtype of this association, known from the Brushy Mountains of North Carolina, is distinguished by a suite of distinctive plant species, including *Croton willdenowii (= Crotonopsis elliptica), Allium cuthbertii, Cheilanthes tomentosa, Coreopsis pubescens, Hypericum denticulatum* (actually an unnamed taxon), *Senna marilandica (= Cassia marilandica)*, and *Diodia teres* (M. Schafale pers. comm.). This community often grades into woodlands dominated by *Juniperus virginiana* and deciduous trees (*Quercus prinus, Carya* spp., *Fraxinus* spp.) [see *Carya (glabra, alba) - Fraxinus americana - Juniperus virginiana var. virginiana* Woodland (CEGL003752)].

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (2001-1-31): This community type is limited to exposures of granitic rocks in the upper Piedmont of North Carolina, and possibly South Carolina and Virginia. Fewer than 20 occurrences are known, and most are of 50 acres or less. This community is naturally rare, but is somewhat self-protecting. Some occurrences have been negatively impacted by recreational use (off-road vehicles), trash dumping, grazing by cattle, logging of adjacent forests, and mining.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community type is limited to exposures of granitic rocks in the upper Piedmont of North Carolina, and possibly South Carolina and Virginia.
Subnations: NC, SC?, VA?
TNC Ecoregions: 51:C, 52:C
USFS Ecoregions: M221:C
Federal Lands: USFS (Nantahala, Pisgah, Sumter?)

ELEMENT SOURCES

References: Dellinger unpubl. data 1992, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale pers. comm., Southeastern Ecology Working Group n.d.

(ROCK CHESTNUT OAK, SCARLET OAK) / MOUNTAIN LAUREL / (GALAX, WINTERGREEN) FOREST

ELEMENT IDENTIFIERS

NVC association: *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest
Database Code: CEGL006271
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Quercus prinus - (Quercus coccinea, Quercus velutina)* Forest Alliance (A.248)

ELEMENT CONCEPT

Summary: This community includes xeric ridgetop forests in the Southern Blue Ridge, ranging south and east into the upper Piedmont, north into the Central Appalachians, and possibly west into the Ridge and Valley. This community occurs over shallow, rocky soils, primarily on south- to west-facing slopes and ridgetops. The community description includes forests with canopies strongly dominated by *Quercus prinus* and/or *Quercus coccinea*, with lesser amounts of *Quercus velutina, Quercus rubra, Quercus falcata, Oxydendrum arboreum, Nyssa sylvatica*, and *Acer rubrum var. rubrum*, occurring over a typically dense shrub stratum dominated by ericaceous species. The shrub layer may vary between evergreen and deciduous dominance. Typical shrub species include *Kalmia latifolia, Rhododendron maximum, Vaccinium stamineum, Vaccinium pallidum, Gaylussacia ursina, Gaylussacia baccata*, and *Leucothoe recurva*. *Castanea dentata* may occur abundantly as root sprouts. The herb layer is typically sparse and includes subshrubs such as *Epigaea repens* and *Gaultheria procumbens*. Other common species include *Chamaelirium luteum, Chimaphila maculata, Galax urceolata, Magnolia fraseri, Sassafras albidum, Symplocos tinctoria, Smilax rotundifolia*, and *Smilax glauca*. This community is distinguished by its overall floristic composition, with a high abundance of acid-loving ericaceous species, which are indicative of this community's extremely infertile, acid soils.
Environment: This community occurs over shallow, rocky soils, primarily on south- to west-facing slopes and ridgetops. This community includes xeric ridgetop forests in the Southern Blue Ridge, ranging south and east into the upper Piedmont and north into the Central Appalachians, and possibly west into the Ridge and Valley.
Vegetation: Stands of this association are forests with canopies strongly dominated by *Quercus prinus* and/or *Quercus coccinea*, with lesser amounts of *Quercus velutina, Quercus rubra, Quercus falcata, Oxydendrum arboreum, Nyssa sylvatica*, and *Acer rubrum var. rubrum*, occurring over a typically dense shrub stratum dominated by ericaceous species. The shrub layer may vary between evergreen and deciduous dominance. Typical shrub species include *Kalmia latifolia, Rhododendron maximum, Vaccinium stamineum, Vaccinium pallidum, Gaylussacia ursina, Gaylussacia baccata*, and *Leucothoe recurva*. *Castanea dentata* may occur abundantly as root sprouts. The herb layer is typically sparse and includes subshrubs such as *Epigaea repens* and *Gaultheria procumbens*. Other common species include *Chamaelirium luteum, Chimaphila maculata, Galax urceolata, Magnolia fraseri, Sassafras albidum, Symplocos tinctoria, Smilax rotundifolia*, and *Smilax glauca*. This community is distinguished by its overall floristic composition, with a high abundance of acid-loving ericaceous species, which are indicative of this community's extremely infertile, acid soils. In the Great Smoky Mountains *Acer rubrum* is often dominant or codominant in these forests, presumably on former American Chestnut (*Castanea dentata*) sites. In the Blue Ridge-Piedmont transition, below 2800 feet elevation, where this community is often associated with *Pinus rigida* forests and woodlands, *Quercus falcata* may be a component of the canopy, and the shrub stratum is strongly dominated by *Vaccinium pallidum*.
Dynamics: No information
Similar Associations:
- *Quercus prinus - (Quercus coccinea) / Carya pallida / Vaccinium arboreum - Vaccinium pallidum* Forest (CEGL008431) -- defined for the southern Cumberland Plateau and western fringe of the southern Blue Ridge, with more diverse shrubs.
- *Quercus prinus - Carya* spp. - *Quercus velutina / Vaccinium arboreum / Iris verna* var. *smalliana* Forest (CEGL007261) -- defined for the lower Piedmont of Alabama and has Coastal Plain affinities.
- *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023) -- broadly defined type for the Appalachian Plateau and Interior Low Plateau.
- *Quercus prinus - Quercus (rubra, velutina) / Vaccinium angustifolium* Forest (CEGL006282) -- defined for the Northern Piedmont, Central Appalachians; occurs on granite monadnocks.
- *Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata* Forest (CEGL006286) -- is more mesic and has a higher component of *Rhododendron maximum* and relatively little *Kalmia latifolia*.

Related Concepts:
- *Quercus montana - Quercus coccinea / Vaccinium pallidum* Forest (Fleming and Moorhead 2000) ?
- *Quercus montana / Kalmia latifolia / Vaccinium pallidum* Association, *pro parte* (Rawinski et al. 1996) ?
- *Quercus prinus - Quercus coccinea / Kalmia latifolia / Vaccinium pallidum* Forest (Fleming and Coulling 2001) ?
- Chestnut Oak Forest (Dry Heath Subtype) (Schafale 1998b) ?
- Chestnut Oak Forests (McLeod 1988) ?
- Chestnut Oak type (Golden 1974) ?
- Chestnut Oak, BR, CUPL (Pyne 1994) ?

- Chestnut Oak-Chestnut Heath (Whittaker 1956) ?
- Chestnut Oak: 44 (Eyre 1980) B
- Chestnut oak-scarlet oak/ericad forest: (matrix) xeric, S- & SW-facing slopes (CAP pers. comm. 1998) ?
- IA6d. Chestnut Oak Slope and Ridge Forest (Allard 1990) B

Classification Comments: In the Great Smoky Mountains *Acer rubrum* is often dominant or codominant in these forests, presumably on former American chestnut (*Castanea dentata*) sites. In the Blue Ridge-Piedmont transition, below 2800 feet elevation, where this community is often associated with *Pinus rigida* forests and woodlands, *Quercus falcata* may be a component of the canopy, and the shrub stratum is strongly dominated by *Vaccinium pallidum*. A similar association defined for the southern Cumberland Plateau, *Quercus prinus - (Quercus coccinea) / Carya pallida / Vaccinium arboreum - Vaccinium pallidum* Forest (CEGL008431), occurs over sandstone or other geologies not as acid as the Blue Ridge type and lacks species indicative of the Blue Ridge association, such as *Kalmia latifolia, Gaylussacia ursina, Gaylussacia baccata*, and *Gaultheria procumbens*.

CONSERVATION RANKING & RARE SPECIES

GRank: G5 (1997-12-31): No information

High-ranked species: *Monotropsis odorata* (G3), *Thermopsis fraxinifolia* (G3?), *Vaccinium hirsutum* (G3)

ELEMENT DISTRIBUTION

Range: The center of distribution for this community is the Southern Blue Ridge of southwestern Virginia, western North Carolina, eastern Tennessee, northeastern Georgia and northwestern South Carolina. It ranges south and east into the upper Piedmont and north into the Central Appalachians, and could possibly extend west into the Ridge and Valley and the Cumberlands of Kentucky.

Subnations: GA, KY, NC, SC, TN, VA

TNC Ecoregions: 50:C, 51:C, 52:P, 59:C

USFS Ecoregions: 231Ag:CCC, M221Aa:CCC, M221Ab:CCC, M221Bd:CCC, M221Be:CCC, M221Ca:CPP, M221Cb:CPP, M221Cc:CPP, M221Ce:CPP, M221Da:CCC, M221Db:CCP, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway?, Carl Sandburg Home, Great Smoky Mountains, Kings Mountain); USFS (Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, CAP pers. comm. 1998, Evans 1991, Eyre 1980, Fleming and Coulling 2001, Fleming and Moorhead 2000, Fleming et al. 2001, Golden 1974, Major et al. 1999, McLeod 1988, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Peet et al. unpubl. data 2002, Pyne 1994, Rawinski et al. 1996, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Whittaker 1956

EASTERN WHITE PINE - (SCARLET OAK, ROCK CHESTNUT OAK) / (BEAR HUCKLEBERRY, DEERBERRY FOREST

ELEMENT IDENTIFIERS

NVC association: *Pinus strobus - Quercus (coccinea, prinus) / (Gaylussacia ursina, Vaccinium stamineum)* Forest

Database Code: CEGL007519

Formation: Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a)

Alliance: *Pinus strobus - Quercus (coccinea, prinus)* Forest Alliance (A.402)

ELEMENT CONCEPT

Summary: This association represents mixed forests of the southern Appalachian Mountains with *Pinus strobus, Quercus prinus*, and *Quercus coccinea*, occurring singly or in combination, each contributing 25-75% of the total canopy coverage. Open subcanopies are composed of *Oxydendrum arboreum, Acer rubrum var. rubrum, Nyssa sylvatica*, and *Cornus florida*. The shrub stratum is dominated by deciduous heath species, typically *Gaylussacia ursina* or *Vaccinium stamineum*. Other species in the shrub/sapling stratum may include *Vaccinium pallidum, Leucothoe recurva, Kalmia latifolia, Castanea dentata*, or *Acer rubrum var. rubrum*. On rocky sites, *Deschampsia flexuosa* may be common. This community occurs on exposed upper slopes and ridgetops at elevations below 920 m (3000 feet) in the southern Appalachian Mountains.

Environment: This community occurs on exposed upper slopes and ridgetops at elevations below 920 m (3000 feet) in the southern Appalachian Mountains. The presence of *Pinus strobus* in these forests may be a product of disturbance and subsequent fire suppression. It may have increased its abundance since about 1900.

Vegetation: Stands of this forest association typically contain *Pinus strobus* (contributing 25-75% of the canopy coverage) and *Quercus prinus* and/or *Quercus coccinea* (occurring singly or in combination) as 25-75% of the canopy coverage. Open subcanopies are composed of *Oxydendrum arboreum, Acer rubrum var. rubrum, Nyssa sylvatica*, and *Cornus florida*. The shrub stratum is dominated by deciduous heath species, typically *Gaylussacia ursina* or *Vaccinium stamineum*. Other species in the shrub/sapling stratum may include *Vaccinium pallidum, Leucothoe recurva, Kalmia latifolia, Castanea dentata*, or *Acer rubrum var. rubrum*. On rocky sites, *Deschampsia flexuosa* may be common.

Dynamics: No information

Similar Associations:

Related Concepts:

- *Pinus strobus - Quercus coccinea* Forest (Patterson 1994) ?
- Chestnut Oak Forest (White Pine Subtype) (Schafale 1998b) ?
- Hardwood - White Pine Forest (Ambrose 1990a) B
- IA6f. Dry White Pine Ridge Forest (Allard 1990) B
- White Pine - Hardwoods, BR (Pyne 1994) B
- White Pine, BR (Pyne 1994) B

Classification Comments:

CONSERVATION RANKING & RARE SPECIES

GRank: G4 (2003-10-23): This community has a restricted range and is uncommon. It is not threatened or particularly vulnerable. Grank changed to G4 on the recommendation of Gary Kauffman, USDA Forest Service.
High-ranked species: *Monotropsis odorata* (G3), *Thermopsis fraxinifolia* (G3?)

ELEMENT DISTRIBUTION

Range: This community is known from the escarpment region of the Southern Blue Ridge and may extend into Virginia.
Subnations: GA, NC, SC, TN, VA?
TNC Ecoregions: 51:C, 52:C
USFS Ecoregions: 221Hb:CCC, 221He:CCC, 222Eo:CCC, M221Db:CCP, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway?, Carl Sandburg Home, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, Ambrose 1990a, Patterson 1994, Peet et al. unpubl. data 2002, Pyne 1994, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

EASTERN WHITE PINE - WHITE OAK - (MOCKERNUT HICKORY) / BEAR HUCKLEBERRY FOREST

ELEMENT IDENTIFIERS

NVC association: *Pinus strobus - Quercus alba - (Carya alba) / Gaylussacia ursina* Forest
Database Code: CEGL007517
Formation: Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a)
Alliance: *Pinus strobus - Quercus (alba, rubra, velutina)* Forest Alliance (A.401)

ELEMENT CONCEPT

Summary: This association covers mesic pine-oak-hickory in the Southern Blue Ridge Escarpment and in the Piedmont transition, found below 2900 feet elevation, on protected ridges, mid to upper slopes, and in disturbed bottoms. Canopies are dominated by variable mixtures of *Pinus strobus, Quercus alba, Quercus velutina, Carya alba*, and *Acer rubrum*. Other canopy species may include *Liriodendron tulipifera, Tsuga canadensis, Quercus rubra, Quercus falcata, Quercus prinus*, and *Magnolia fraseri*. Subcanopy and saplings include canopy species and *Cornus florida, Halesia tetraptera, Oxydendrum arboreum*, and *Nyssa sylvatica*. Shrub layers are moderate to dense, with *Gaylussacia ursina* and *Kalmia latifolia* most commonly dominating. Other shrubs include *Rhododendron minus, Rhododendron maximum, Symplocos tinctoria, Arundinaria gigantea, Castanea dentata, Sassafras albidum, Amelanchier arborea, Pyrularia pubera,* and *Hydrangea radiata*. The herb stratum is sparse, although ferns (*Thelypteris noveboracensis, Dennstaedtia punctilobula* and *Polystichum acrostichoides*) may occasionally dominate. Common herbs include *Chimaphila maculata, Viola hastata, Goodyera pubescens, Maianthemum racemosum, Polygonatum biflorum, Monotropa uniflora, Trillium catesbaei, Desmodium nudiflorum, Eupatorium purpureum, Galium circaezans, Galium latifolium, Galax urceolata, Hexastylis shuttleworthii, Medeola virginiana, Mitchella repens*, and *Houstonia purpurea*.
Environment: Stands of this association are found below 2900 feet elevation, on protected ridges, mid to upper slopes, and in disturbed bottoms in the Southern Blue Ridge Escarpment and in the Piedmont transition region. The presence of *Pinus strobus* in these forests may be a product of disturbance and subsequent fire suppression. It may have increased its abundance since about 1900.
Vegetation: Canopies are dominated by variable mixtures of *Pinus strobus, Quercus alba, Carya alba*, and *Acer rubrum*. Other canopy species may include *Liriodendron tulipifera, Tsuga canadensis, Quercus rubra, Quercus prinus*, and *Magnolia fraseri*. Subcanopy and saplings include canopy species and *Cornus florida, Halesia tetraptera, Oxydendrum arboreum*, and *Nyssa sylvatica*. Shrub layers are moderate to dense, with *Gaylussacia ursina* and *Kalmia latifolia* most commonly dominating. Other shrubs include *Rhododendron minus, Rhododendron maximum, Symplocos tinctoria, Arundinaria gigantea, Castanea dentata, Sassafras albidum, Amelanchier arborea, Pyrularia pubera,* and *Hydrangea radiata*. The herb stratum is sparse, although ferns (*Thelypteris noveboracensis, Dennstaedtia punctilobula*, and *Polystichum acrostichoides*) may occasionally dominate. Common herbs include *Chimaphila maculata, Viola hastata, Goodyera pubescens, Maianthemum racemosum, Polygonatum biflorum, Monotropa uniflora, Trillium catesbaei, Desmodium nudiflorum, Eupatorium purpureum, Galium circaezans, Galium latifolium, Galax urceolata, Hexastylis shuttleworthii, Medeola virginiana, Mitchella repens,* and *Houstonia purpurea*.
Dynamics: No information
Similar Associations:

Related Concepts:
- Hardwood - White Pine Forest (Ambrose 1990a) B
- IA6f. Dry White Pine Ridge Forest (Allard 1990) B
- Montane Oak-Hickory Forest (White Pine Subtype) (Schafale 1998b) ?

Classification Comments:

CONSERVATION RANKING & RARE SPECIES

GRank: G3G4 (2003-10-23): This community is geographically restricted and uncommon within its range. Grank changed to G4 on the recommendation of Gary Kauffman, USDA Forest Service.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community is known from the escarpment region of the Southern Blue Ridge.
Subnations: GA, NC, SC, TN?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, Ambrose 1990a, NatureServe Ecology - Southeastern U.S. unpubl. data, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

NORTHERN RED OAK - CHINQUAPIN OAK / WITCH-HAZEL / CANADA LEAFCUP FOREST

ELEMENT IDENTIFIERS

NVC association: *Quercus rubra - Quercus muehlenbergii / Hamamelis virginiana / Polymnia canadensis* Forest
Database Code: CEGL007215
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Quercus muehlenbergii - (Acer saccharum)* Forest Alliance (A.1912)

ELEMENT CONCEPT

Summary: This association represents forests on sheltered dolomite slopes in the Southern Blue Ridge with canopies dominated by *Quercus* spp., *Juglans nigra*, and *Magnolia acuminata*. However, a small amount of the canopy and understory is always composed of calciphilic canopy species more characteristic of areas west of the Blue Ridge, including *Quercus muehlenbergii* and *Juglans cinerea*. The dominant shrub is *Hamamelis virginiana*, but other shrubs include *Calycanthus floridus, Cornus alternifolia*, and *Hydrangea arborescens*. The herbaceous layer is lush and diverse, with typical species including *Impatiens* spp., *Hybanthus concolor, Polymnia canadensis, Laportea canadensis, Aquilegia canadensis, Adiantum pedatum, Sanguinaria canadensis*, and *Asarum canadense*.
Environment: This association represents forests on sheltered dolomite slopes in the Southern Blue Ridge. This type of geology is extremely uncommon this far east in the southern Appalachians, so this community is isolated from other patches of similar geology.
Vegetation: Canopies of this community are dominated by *Quercus* spp., *Juglans nigra*, and *Magnolia acuminata*. However, a small amount of the canopy and understory is always composed of calciphilic canopy species more characteristic of areas west of the Blue Ridge, including *Quercus muehlenbergii* and *Juglans cinerea*. The dominant shrub is *Hamamelis virginiana*, but other shrubs include *Calycanthus floridus, Cornus alternifolia*, and *Hydrangea arborescens*. The herbaceous layer is lush and diverse, with typical species including *Impatiens* spp., *Hybanthus concolor, Polymnia canadensis, Laportea canadensis, Aquilegia canadensis, Adiantum pedatum, Sanguinaria canadensis*, and *Asarum canadense*. Due to the isolated nature of this type of geology in this part of the Appalachians, the species composition tends to be very different than the surrounding matrix. It is not clear at this point whether this community is indeed its own type or whether there is enough similarity to other types in the Ridge and Valley to warrant lumping it with them.
Dynamics: No information
Similar Associations:
Related Concepts:
- Calcareous Oak-Walnut Forest (Schafale 1998b) ?
- IA5e. Calcareous Mesophytic Forest (Allard 1990) ?

Classification Comments: Name of association based on North Carolina occurrence over limestone on North Fork Catawba River (McDowell County). Name and concept may need modification with additional information. Similar vegetation may occur in the Ridge and Valley of Virginia (G. Fleming pers. comm.). Documented by plots gathered by the North Carolina Vegetation Survey near Linville Caverns, North Carolina (Plots 4-303 and 5-304 from PULSE 1995).

CONSERVATION RANKING & RARE SPECIES

GRank: G1Q (2004-2-25): This community is only known to occur in one location in the vicinity of Linville Caverns on the North Fork of the Catawba River. There are still no documented occurrences elsewhere, although there is still a small possibility that it may exist in adjacent states such as Virginia and South Carolina. Until these range and classification issues are answered this type will continue to be ranked G1Q. Once this is reviewed, the community should most likely continue to be a G1 or be removed altogether, depending upon whether it is a distinct association.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community is currently only known to occur in North Carolina.
Subnations: NC, SC?, VA?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Aa:CPP, M221Dc:CCC
Federal Lands: USFS (Pisgah)

ELEMENT SOURCES

References: Allard 1990, Fleming pers. comm., Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

NORTHERN RED OAK - RED MAPLE / SWEET-SHRUB - BUFFALO-NUT / NEW YORK FERN FOREST

ELEMENT IDENTIFIERS

NVC association: *Quercus rubra - Acer rubrum / Calycanthus floridus - Pyrularia pubera / Thelypteris noveboracensis* Forest
Database Code: CEGL006192
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Quercus alba - (Quercus rubra, Carya* spp.) Forest Alliance (A.239)

ELEMENT CONCEPT

Summary: This association includes *Quercus rubra* forests at intermediate elevations (mostly below 3500 feet, ranging from 2000-4000 feet) in the Southern Blue Ridge Escarpment, and may possibly range into adjacent areas of the Central Appalachians and Cumberland Plateau. These forests occur on mostly northern to eastern and southeastern, mid to upper, moderately steep slopes of intermediate exposure over acidic soils. The canopy is dominated by *Quercus rubra*, often with *Acer rubrum* and/or *Liriodendron tulipifera* codominating, and occasionally with a high component of *Quercus alba* in the canopy. Other minor canopy species may include *Betula lenta, Carya alba, Carya glabra, Halesia tetraptera, Quercus prinus*, and *Magnolia fraseri*. The subcanopy and sapling strata include the canopy species, as well as *Halesia tetraptera, Betula lenta, Tsuga canadensis, Cornus florida, Acer pensylvanicum*, and *Oxydendrum arboreum*. The shrub stratum is typically sparse but may have local dominance by *Gaylussacia ursina* or *Rhododendron maximum*. Other typical species in the shrub stratum include *Castanea dentata, Calycanthus floridus, Pyrularia pubera, Rhododendron calendulaceum, Vaccinium corymbosum*, and *Viburnum acerifolium*. Herbaceous cover is sparse to moderate but can be species rich. Ferns can be locally dominant, typically *Thelypteris noveboracensis* and *Athyrium filix-femina ssp. asplenioides*. Other typical species include *Eurybia divaricata (= Aster divaricatus), Carex* spp. (e.g., *Carex aestivalis, Carex debilis, Carex digitalis, Carex laxiflora var. laxiflora, Carex pensylvanica), Chimaphila maculata (= var. maculata), Desmodium nudiflorum, Dioscorea quaternata, Eupatorium purpureum, Galium latifolium, Galax urceolata, Goodyera pubescens, Houstonia purpurea var. purpurea, Lysimachia quadrifolia, Maianthemum racemosum ssp. racemosum, Medeola virginiana, Polygonatum biflorum, Polystichum acrostichoides, Solidago curtisii (= Solidago caesia var. curtisii)*, and *Uvularia puberula*. Common vines are *Smilax rotundifolia, Smilax glauca*, and *Vitis aestivalis*. This forest is distinguished from High Elevation Red Oak forests [see associations in I.B.2.N.a *Quercus rubra* Montane Forest Alliance (A.272)] by lack of species such as *Betula alleghaniensis, Ilex montana, Vaccinium simulatum*, and by lacking abundant *Hamamelis virginiana*, as well as its occurrence at lower elevations. In the Southern Blue Ridge Escarpment region, these montane oak - hickory forests seem to occupy environments intermediate between more protected forests dominated by *Quercus alba* and drier, more exposed *Quercus prinus* forests.
Environment: This association includes *Quercus rubra* forests at intermediate elevations (mostly below 3500 feet, ranging from 2000-4000 feet) in the Southern Blue Ridge Escarpment, and may possibly range into adjacent areas of the Central Appalachians and Cumberland Plateau. These forests occur on mostly northern to eastern and southeastern, mid to upper, moderately steep slopes of intermediate exposure over acidic soils.
Vegetation: The canopy is dominated by *Quercus rubra*, often with *Acer rubrum* and/or *Liriodendron tulipifera* codominating, and occasionally with a high component of *Quercus alba* in the canopy. Other minor canopy species may include *Betula lenta, Carya alba, Carya glabra, Halesia tetraptera, Quercus prinus*, and *Magnolia fraseri*. The subcanopy and sapling strata include the canopy species, as well as *Halesia tetraptera, Betula lenta, Tsuga canadensis, Cornus florida, Acer pensylvanicum*, and *Oxydendrum arboreum*. The shrub stratum is typically sparse but may have local dominance by *Gaylussacia ursina* or *Rhododendron maximum*. Other typical species in the shrub stratum include *Castanea dentata, Calycanthus floridus, Pyrularia pubera, Rhododendron calendulaceum, Vaccinium corymbosum*, and *Viburnum acerifolium*. Herbaceous cover is sparse to moderate but can be species rich.

Ferns can be locally dominant, typically *Thelypteris noveboracensis* and *Athyrium filix-femina ssp. asplenioides*. Other typical species include *Eurybia divaricata (= Aster divaricatus), Carex* spp. (e.g., *Carex aestivalis, Carex debilis, Carex digitalis, Carex laxiflora var. laxiflora, Carex pensylvanica), Chimaphila maculata (= var. maculata), Desmodium nudiflorum, Dioscorea quaternata, Eupatorium purpureum, Galium latifolium, Galax urceolata, Goodyera pubescens, Houstonia purpurea var. purpurea, Lysimachia quadrifolia, Maianthemum racemosum ssp. racemosum, Medeola virginiana, Polygonatum biflorum, Polystichum acrostichoides, Solidago curtisii (= Solidago caesia var. curtisii),* and *Uvularia puberula*. Common vines are *Smilax rotundifolia, Smilax glauca,* and *Vitis aestivalis*. This forest is distinguished from High Elevation Red Oak forests [see associations in I.B.2.N.a *Quercus rubra* Montane Forest Alliance (A.272)] by lack of species such as *Betula alleghaniensis, Ilex montana, Vaccinium simulatum,* and by lacking abundant *Hamamelis virginiana,* as well as its occurrence at lower elevations. In the Southern Blue Ridge Escarpment region, these montane oak - hickory forests seem to occupy environments intermediate between more protected forests dominated by *Quercus alba* and drier, more exposed *Quercus prinus* forests.

Dynamics: No information

Similar Associations:

- *Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina)* Forest (CEGL007230) -- contains more than 50% Quercus alba in the canopy.
- *Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis)* Forest (CEGL007300) -- is a high-elevation forest.

Related Concepts:

- IA6h. Montane Oak - Hickory Forest (Allard 1990) B
- Montane Red Oak-Hickory Forest (Schafale 1998b) ?
- Oak - Chestnut - Hickory Forest (Ambrose 1990a) B

Classification Comments: This association was originally defined from the Chattooga Basin Project (S. Simon pers. comm.) and later refined with information from the Great Smoky Mountains. Global name and concept may need revision as more information becomes available. This association may be a subset of the more broadly defined *Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina)* Forest (CEGL007230) but is distinguished by the dominance of *Quercus rubra,* generally protected topographic setting, and may represent areas formerly dominated by *Quercus rubra* and *Castanea dentata*. This type replaced *Castanea dentata* in Virginia (G. Fleming pers. comm.).

CONSERVATION RANKING & RARE SPECIES

GRank: G4? (2000-1-3): This community is uncommon but secure within its range. It is often overlooked in surveys or not recognized as distinct, thus it is much more common than the number of documented occurrences suggests. Resolution of taxonomic issues that distinguish this community from similar associations may lead to a range extension.

High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This association is found in the Southern Blue Ridge Escarpment and may possibly range into adjacent areas of the Central Appalachians and Cumberland Plateau.

Subnations: GA, NC, SC, TN, VA?

TNC Ecoregions: 50:?, 51:C, 59:?

USFS Ecoregions: M221Dc:CCP, M221Dd:CCC

Federal Lands: NPS (Carl Sandburg Home, Great Smoky Mountains); USFS (Chattahoochee, Nantahala, Sumter)

ELEMENT SOURCES

References: Allard 1990, Ambrose 1990a, Nelson 1986, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Simon pers. comm., Southeastern Ecology Working Group n.d.

ROCK CHESTNUT OAK - (NORTHERN RED OAK) - HICKORY SPECIES / SOURWOOD - FLOWERING DOGWOOD FOREST

ELEMENT IDENTIFIERS

NVC association: *Quercus prinus - (Quercus rubra) - Carya* spp. / *Oxydendrum arboreum - Cornus florida* Forest

Database Code: CEGL007267

Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)

Alliance: *Quercus prinus - Quercus rubra* Forest Alliance (A.250)

ELEMENT CONCEPT

Summary: This community is known from low to intermediate elevations of the Southern Blue Ridge escarpment and Piedmont transition areas. It occurs on relatively exposed landforms below 3000 feet elevation (1200-2900 feet), on moderately steep to steep, convex, middle to upper slopes and ridges, with mostly northern to southwestern aspects. Canopies are dominated by *Quercus prinus,* with *Acer rubrum* often codominating. Other species that can have significant canopy coverage include *Carya glabra, Liriodendron tulipifera,* and *Quercus rubra*. The subcanopy is commonly dominated by *Cornus florida*. Additional canopy and subcanopy species

can include *Quercus velutina, Carya alba, Halesia tetraptera var. monticola, Nyssa sylvatica, Robinia pseudoacacia, Magnolia fraseri,* and *Oxydendrum arboreum*. The shrub stratum is sparse with no clear dominant. Some typical shrub species include *Gaylussacia ursina, Hydrangea arborescens, Hydrangea radiata, Kalmia latifolia, Magnolia fraseri, Sassafras albidum*, and, *Vaccinium pallidum*. Common vines are *Smilax rotundifolia, Smilax glauca, Vitis aestivalis, Vitis rotundifolia*, and *Vitis vulpina*. Herb cover is sparse, but diversity and species composition vary among occurrences. Some of the more typical species include *Eurybia divaricata (= Aster divaricatus), Chimaphila maculata, Desmodium nudiflorum, Dichanthelium* spp. (e.g., *Dichanthelium boscii, Dichanthelium commutatum, Dichanthelium dichotomum), Dioscorea quaternata, Galium latifolium, Houstonia purpurea, Lysimachia quadrifolia, Maianthemum racemosum ssp. racemosum, Polystichum acrostichoides, Prenanthes* spp., *Thalictrum thalictroides, Thelypteris noveboracensis, Uvularia perfoliata, Uvularia puberula, Uvularia sessilifolia*, and *Viola* spp. (e.g., *Viola blanda, Viola hastata, Viola X palmata, Viola tripartita*). Some occurrences may have areas of exposed rock.

Environment: This community is known from low to intermediate elevations of the Southern Blue Ridge escarpment and Piedmont transition areas. It occurs on relatively exposed landforms below 3000 feet elevation (1200-2900 feet), on moderately steep to steep, convex, middle to upper slopes and ridges, with mostly northern to southwestern aspects.

Vegetation: The canopies of stands of this type are dominated by *Quercus prinus*, with *Acer rubrum* often codominating. Other species that can have significant canopy coverage include *Carya glabra, Liriodendron tulipifera,* and *Quercus rubra*. The subcanopy is commonly dominated by *Cornus florida*. Additional canopy and subcanopy species can include *Quercus velutina, Carya alba, Halesia tetraptera var. monticola, Nyssa sylvatica, Robinia pseudoacacia, Magnolia fraseri,* and *Oxydendrum arboreum*. The shrub stratum is sparse with no clear dominant. Some typical shrub species include *Gaylussacia ursina, Hydrangea arborescens, Hydrangea radiata, Kalmia latifolia, Magnolia fraseri, Sassafras albidum*, and, *Vaccinium pallidum*. Common vines are *Smilax rotundifolia, Smilax glauca, Vitis aestivalis, Vitis rotundifolia*, and *Vitis vulpina*. Herb cover is sparse, but diversity and species composition vary among occurrences. Some of the more typical species include *Eurybia divaricata (= Aster divaricatus), Chimaphila maculata, Desmodium nudiflorum, Dichanthelium* spp. (e.g., *Dichanthelium boscii, Dichanthelium commutatum, Dichanthelium dichotomum), Dioscorea quaternata, Galium latifolium, Houstonia purpurea, Lysimachia quadrifolia, Maianthemum racemosum ssp. racemosum, Polystichum acrostichoides, Prenanthes* spp., *Thalictrum thalictroides, Thelypteris noveboracensis, Uvularia perfoliata, Uvularia puberula, Uvularia sessilifolia*, and *Viola* spp. (e.g., *Viola blanda, Viola hastata, Viola X palmata, Viola tripartita*).

Dynamics: No information

Similar Associations:

- *Quercus prinus - Quercus rubra / Hamamelis virginiana* Forest (CEGL006057)

Related Concepts:

- Chestnut Oak Forest (Herb Subtype) (Schafale 1998b) ?
- IA6h. Montane Oak - Hickory Forest (Allard 1990) B
- Oak - Chestnut - Hickory Forest (Ambrose 1990a) B

Classification Comments: This forest lacks the dense ericaceous shrub layer typical of other *Quercus prinus*-dominated forests in the Blue Ridge escarpment region and commonly has diverse herbaceous composition. It is distinguished from similar forests in the Ridge and Valley by lacking *Acer saccharum* and from Piedmont forests by the lack of *Quercus falcata* and *Quercus stellata*, and by the presence of species more typical of the southern Appalachians (*Magnolia fraseri, Halesia tetraptera,* and *Castanea dentata*). This association was originally defined from the Chattooga Basin Project (S. Simon pers. comm.) and later refined with information from the Great Smoky Mountains. The North Carolina Piedmont examples of this association are only montane transition areas, such as the Sauratown Mountains and Hanging Rock. It may become more widespread in the Piedmont of Virginia.

CONSERVATION RANKING & RARE SPECIES

GRank: G4G5 (1997-8-15): No information

High-ranked species: *Monotropsis odorata* (G3)

ELEMENT DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge and Piedmont transition areas of western North Carolina, eastern Tennessee, northwestern South Carolina, and northeastern Georgia. It may possibly extend into Virginia.

Subnations: GA, NC, SC, TN, VA?

TNC Ecoregions: 51:C, 52:C

USFS Ecoregions: 231Aa:PPP, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway?, Carl Sandburg Home, Great Smoky Mountains, Kings Mountain); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, Ambrose 1990a, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Simon pers. comm., Southeastern Ecology Working Group n.d.

ELEMENT IDENTIFIERS

NVC association: *Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata* Forest
Database Code: CEGL006286
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Quercus prinus - Quercus rubra* Forest Alliance (A.250)

ELEMENT CONCEPT

Summary: This montane deciduous forest is known from protected, steep north-facing slopes in the Southern Blue Ridge and ranges into adjacent areas of the upper Piedmont. It is dominated by *Quercus prinus*, usually with lesser amounts of *Quercus rubra* and/or *Acer rubrum*, and always occurring over a dense, very tall shrub stratum (2-6 m) of *Rhododendron maximum*. In some areas *Rhododendron minus* may dominate or *Tsuga canadensis* may have dense understory regeneration. Other common shrubs can include *Gaylussacia ursina* and *Kalmia latifolia*. Herbs are sparse. The ground cover is dominated by leaf litter, but *Galax urceolata* is in most occurrences. Other herb species than can be typical include *Chimaphila maculata, Goodyera pubescens*, and *Polystichum acrostichoides*. Some examples may have sparse (woodland-like) canopies and occur in association with rock outcroppings. This forest is found on moderate to very steep slopes with northerly exposures, on lower slope positions, typically at elevations between 2500 and 4000 feet. In the Great Smoky Mountains it was found consistently as a transitional band of vegetation, downslope from drier *Quercus prinus* ridgetop forests, *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271), and grading into acidic cove forests, *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543) on the steep ravines below.
Environment: This is typically a mid-slope to lower slope type, but it can be found on upper slopes in a more sheltered position (M. Schafale pers. comm.).
Vegetation: The canopy can contain *Betula alleghaniensis (= Betula lutea), Pinus strobus, Quercus alba, Nyssa sylvatica, Magnolia fraseri*, and *Oxydendrum arboreum*. It is intermediate between acidic cove forest and Chestnut Oak (*Quercus prinus*) forest (M. Schafale pers. comm.).
Dynamics: No information
Similar Associations:
- *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271)
- *Quercus prinus - (Quercus rubra) - Carya* spp. / *Oxydendrum arboreum - Cornus florida* Forest (CEGL007267)
- *Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata* Forest (CEGL007299)

Related Concepts:
- Chestnut Oak Forest (Rhododendron Subtype) (Schafale 1998b) ?
- IA6d. Chestnut Oak Slope and Ridge Forest (Allard 1990)

Classification Comments: This association is more protected and more mesic than *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271). It occurs at lower elevations and on more protected topographic positions than *Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata* Forest (CEGL007299). It is much less diverse than *Quercus prinus - (Quercus rubra) - Carya* spp. / *Oxydendrum arboreum - Cornus florida* Forest (CEGL007267), lacking the diverse herbaceous and woody components found in that association.

CONSERVATION RANKING & RARE SPECIES

GRank: G4 (1999-12-21): This community is uncommon, but not rare, throughout most of its range. As currently defined, it is a regional endemic, found only in the Southern Blue Ridge. This community is often overlooked or not distinguished separately in inventories, thus it is more common than the number of documented occurrences suggests.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge of northeastern Georgia, northwestern South Carolina, north through eastern Tennessee and western North Carolina. Its range extends into the upper Piedmont of North Carolina and possibly into Virginia's Blue Ridge.
Subnations: GA, NC, SC, TN, VA?
TNC Ecoregions: 51:C, 52:C, 59:?
USFS Ecoregions: M221A:C?, M221B:C?, M221C:C?, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway?, Carl Sandburg Home, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Sumter)

ELEMENT SOURCES

References: Allard 1990, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Simon pers. comm., Southeastern Ecology Working Group n.d.

WHITE OAK - (NORTHERN RED OAK, ROCK CHESTNUT OAK) / FLAME AZALEA - MOUNTAIN LAUREL - (BEAR HUCKLEBERRY) FOREST

ELEMENT IDENTIFIERS

NVC association: *Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina)* Forest
Database Code: CEGL007230
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Quercus alba - (Quercus rubra, Carya* spp.) Forest Alliance (A.239)

ELEMENT CONCEPT

Summary: These forests occur in a wide elevation range (2000-4500 feet) in the Southern Blue Ridge and in the Blue Ridge/Piedmont transition, on protected sites, typically lower slopes, bottoms, and coves. Stands of this deciduous forest association are dominated or codominated by *Quercus alba*, occurring with other *Quercus* species (*Quercus rubra, Quercus prinus, Quercus coccinea*). Associated species are characteristically montane, and typical of acidic forests. This association lacks indicators of circumneutral soils and also lacks low elevation dry sites species such as *Pinus echinata, Quercus falcata, Quercus stellata*, and *Quercus marilandica*. Species other than oaks that can be important in the canopy include *Carya alba, Carya glabra, Liriodendron tulipifera, Acer rubrum*, and *Magnolia fraseri*. Common species in the subcanopy/sapling strata include *Cornus florida, Acer rubrum, Carya* spp., *Liriodendron tulipifera, Magnolia fraseri, Nyssa sylvatica, Oxydendrum arboreum, Pinus strobus*, and *Halesia tetraptera*. Shrub cover is sparse to very dense, and is often dominated by deciduous heaths. *Kalmia latifolia* and *Gaylussacia ursina* are usually present, but other shrub species can include *Euonymus americana, Rhododendron calendulaceum, Vaccinium stamineum, Vaccinium pallidum, Viburnum acerifolium, Calycanthus floridus, Pyrularia pubera, Ilex montana, Halesia tetraptera*, and *Hamamelis virginiana*. *Smilax glauca* and *Vitis rotundifolia* are common vines. The herbaceous stratum is sparse to moderate in coverage, but often rich in species, approaching the diversity but not the coverage of rich cove forests. Associated herbaceous species vary with elevation. Often there is a dominant fern stratum, with *Thelypteris noveboracensis* and *Polystichum acrostichoides* most typically dominant.

Environment: These forests occur in a wide elevation range (2000-4500 feet) in the Southern Blue Ridge and in the Blue Ridge/Piedmont transition, on protected sites, typically lower slopes, bottoms, and coves.

Vegetation: The canopies of stands of this association are dominated or codominated by *Quercus alba*, occurring with other *Quercus* species (*Quercus rubra, Quercus prinus, Quercus coccinea*). Species other than oaks that can be important in the canopy include *Carya alba, Carya glabra, Liriodendron tulipifera, Acer rubrum*, and *Magnolia fraseri*. Stands lack indicators of circumneutral soils and also lack low elevation dry sites species such as *Pinus echinata, Quercus falcata, Quercus stellata*, and *Quercus marilandica*. Common species in the subcanopy/sapling strata include *Cornus florida, Acer rubrum, Carya* spp., *Liriodendron tulipifera, Magnolia fraseri, Nyssa sylvatica, Oxydendrum arboreum, Pinus strobus*, and *Halesia tetraptera*. Shrub cover is sparse to very dense, and is often dominated by deciduous heaths, including *Kalmia latifolia* and *Gaylussacia ursina*. Other shrub species can include *Euonymus americana, Rhododendron calendulaceum, Vaccinium stamineum, Vaccinium pallidum, Viburnum acerifolium, Calycanthus floridus, Pyrularia pubera, Ilex montana, Halesia tetraptera*, and *Hamamelis virginiana*. *Smilax glauca* and *Vitis rotundifolia* are common vines. The herbaceous stratum is sparse to moderate in coverage, but often rich in species, approaching that of rich cove forests (but with a different composition). Associated herbaceous species vary with elevation. Some of the more constant species include *Parthenocissus quinquefolia, Dioscorea quaternata, Dichanthelium* spp., *Carex pensylvanica, Chimaphila maculata, Desmodium nudiflorum, Goodyera pubescens, Maianthemum racemosum ssp. racemosum*, and *Trillium catesbaei*. Other species include *Dichanthelium laxiflorum, Oclemena acuminata (= Aster acuminatus), Eurybia divaricata (= Aster divaricatus), Galax urceolata, Galium latifolium, Lysimachia quadrifolia, Mitchella repens, Viola hastata* and *Melanthium parviflorum*. Often there is a dominant fern stratum, with *Thelypteris noveboracensis* and *Polystichum acrostichoides* most typically dominant. Other ferns include *Athyrium filix-femina ssp. asplenioides*, *Dennstaedtia punctilobula*, and *Dryopteris intermedia*.

Dynamics: No information

Similar Associations:
- *Quercus prinus - (Quercus rubra) - Carya* spp. */ Oxydendrum arboreum - Cornus florida* Forest (CEGL007267) -- is drier and less diverse.

Related Concepts:
- IA6h. Montane Oak - Hickory Forest (Allard 1990) B
- Montane Oak-Hickory Forest (Acidic Subtype) (Schafale 1998b) ?
- Oak - Chestnut - Hickory Forest (Ambrose 1990a) B

Classification Comments: This association is meant to cover the typical acidic, oak-hickory forests of the Southern Blue Ridge Mountains. It has a broad concept, and there is potential for subdividing this type by moisture, elevation, or undergrowth. It can be distinguished from *Quercus prinus - (Quercus rubra) - Carya* spp. / *Oxydendrum arboreum - Cornus florida* Forest (CEGL007267) by higher species diversity and the presence of a substantial amount of *Quercus alba*.

CONSERVATION RANKING & RARE SPECIES

GRank: G5 (1998-4-30): No information

High-ranked species: *Carex manhartii* (G3), *Sisyrinchium dichotomum* (G2)

ELEMENT DISTRIBUTION

Range: This community is found in the Southern Blue Ridge and the Blue Ridge/Piedmont transition of the eastern United States.
Subnations: GA, NC, SC, TN
TNC Ecoregions: 51:C, 52:P
USFS Ecoregions: 231Ag:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway?, Carl Sandburg Home, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, Ambrose 1990a, Major et al. 1999, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

WHITE OAK - NORTHERN RED OAK - ROCK CHESTNUT OAK / RICHWEED - MAY-APPLE - HOG-PEANUT FOREST

ELEMENT IDENTIFIERS

NVC association: *Quercus alba - Quercus rubra - Quercus prinus / Collinsonia canadensis - Podophyllum peltatum - Amphicarpaea bracteata* Forest
Database Code: CEGL007692
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Quercus alba - (Quercus rubra, Carya* spp.) Forest Alliance (A.239)

ELEMENT CONCEPT

Summary: This association includes forests dominated by *Quercus alba*, occurring over circumneutral soils in the Southern Blue Ridge and adjacent inner Piedmont. Other species that can be important in the canopy include *Quercus rubra, Quercus coccinea, Quercus prinus, Quercus velutina, Carya glabra*, and *Carya alba*. On some sites, species more typical of 'cove forests,' such as *Fraxinus americana* or *Magnolia acuminata*, may form a very minor component. *Oxydendrum arboreum* and *Cornus florida* are common in the subcanopy. Heath species (*Rhododendron maximum* or *Kalmia latifolia*) are absent or very minor in the shrub stratum. On very high-base status soils, *Philadelphus hirsutus* or *Lindera benzoin* may be in the shrub stratum. The herbaceous stratum can be quite diverse and is characterized by mesic herbs and species associated with circumneutral soils, such as *Podophyllum peltatum, Arisaema triphyllum, Amphicarpaea bracteata, Adiantum pedatum, Collinsonia canadensis, Asplenium platyneuron, Actaea racemosa (= Cimicifuga racemosa), Caulophyllum thalictroides, Sanguinaria canadensis, Tradescantia subaspera, Euphorbia purpurea, Phegopteris hexagonoptera, Polystichum acrostichoides, Athyrium filix-femina ssp. asplenioides, Dennstaedtia punctilobula*, and *Dryopteris intermedia*. These forests can occur across a broad elevation range (2000-4500 feet), and can occur in exposed topographic settings (upper slopes), as well as on more protected sites (edges of coves). Presumed upper Piedmont examples may be at lower elevations (e.g., below 1000 feet).
Environment: This association includes forests dominated by *Quercus alba*, occurring over circumneutral soils in the Southern Blue Ridge and adjacent Piedmont. These forests can occur across a broad elevation range (2000-4500 feet), and can occur in exposed topographic settings (upper slopes), as well as on more protected sites (edges of coves). Presumed upper Piedmont examples may be at lower elevations (e.g., below 1000 feet).
Vegetation: This association includes forests dominated by *Quercus alba*. Other species that can be important in the canopy include *Quercus rubra, Quercus coccinea, Quercus prinus, Quercus velutina, Carya glabra*, and *Carya alba*. On some sites, species more typical of 'cove forests,' such as *Fraxinus americana* or *Magnolia acuminata*, may form a very minor component. *Oxydendrum arboreum* and *Cornus florida* are common in the subcanopy. Heath species (*Rhododendron maximum* or *Kalmia latifolia*) are absent or very minor in the shrub stratum. On very high-base status soils, *Philadelphus hirsutus* or *Lindera benzoin* may be in the shrub stratum. Other woody species may include *Cercis canadensis, Viburnum acerifolium*, and *Ulmus alata*. The herbaceous stratum can be quite diverse and is characterized by mesic herbs and species associated with circumneutral soils, such as *Podophyllum peltatum, Arisaema triphyllum, Amphicarpaea bracteata, Adiantum pedatum, Collinsonia canadensis, Asplenium platyneuron, Actaea racemosa (= Cimicifuga racemosa), Caulophyllum thalictroides, Sanguinaria canadensis, Tradescantia subaspera, Euphorbia purpurea, Phegopteris hexagonoptera, Polystichum acrostichoides, Athyrium filix-femina ssp. asplenioides, Dennstaedtia punctilobula*, and *Dryopteris intermedia*. A stand included here from Chilhowee Mountain in the Cherokee National Forest also includes *Ageratina altissima var. altissima, Arabis canadensis, Aristolochia serpentaria, Asplenium platyneuron, Desmodium nudiflorum, Hepatica nobilis var. obtusa, Monarda fistulosa, Sanicula canadensis, Scutellaria elliptica, Silene stellata, Smallanthus uvedalius, Solidago curtisii, Solidago simplex var. spathulata (= Solidago spathulata), Spigelia marilandica, Tradescantia subaspera*, and *Uvularia perfoliata*.
Dynamics: No information
Similar Associations:
- *Quercus rubra - Tilia americana var. heterophylla - Halesia tetraptera var. monticola / Collinsonia canadensis - Tradescantia subaspera* Forest (CEGL007878)

Related Concepts:
- Montane Oak-Hickory Forest (Basic Subtype) (Schafale 1998b) ?

Classification Comments: This association was originally defined based on occurrence information in the North Carolina Blue Ridge. More information is needed to better describe and define this association and its geographic distribution. Additional data on apparent occurrences have been collected in the Chattahoochee and Cherokee national forests.

CONSERVATION RANKING & RARE SPECIES

GRank: G3 (2002-5-17): This montane oak-hickory forest is naturally limited to richer sites in the Southern Blue Ridge mountains and adjacent inner Piedmont. Later successional, unaltered occurrences are rare. Some stands have been impacted by removal of more valuable timber species (e.g., *Quercus alba*, other *Quercus* species) and the loss of herbaceous species diversity from the disturbance effects of logging.

High-ranked species: *Carex manhartii* (G3), *Carex radfordii* (G2), *Euphorbia purpurea* (G3), *Helianthus glaucophyllus* (G3), *Prosartes maculata* (G3G4), *Silene ovata* (G2G3), *Sisyrinchium dichotomum* (G2), *Trillium rugelii* (G3)

ELEMENT DISTRIBUTION

Range: This community occurs in the southern Blue Ridge of the Carolinas, Georgia, and Tennessee in the eastern United States.
Subnations: GA, NC, SC, TN
TNC Ecoregions: 51:C, 52:C
USFS Ecoregions: 231Ad:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Pisgah)

ELEMENT SOURCES

References: NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Southeastern Ecology Working Group n.d.

WHITE OAK - SCARLET OAK - SOUTHERN RED OAK / MOUNTAIN LAUREL - HILLSIDE BLUEBERRY FOREST

ELEMENT IDENTIFIERS

NVC association: *Quercus alba - Quercus coccinea - Quercus falcata / Kalmia latifolia - Vaccinium pallidum* Forest
Database Code: CEGL007691
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Quercus velutina - Quercus alba - (Quercus coccinea)* Forest Alliance (A.1911)

ELEMENT CONCEPT

Summary: This association includes dry, deciduous forests of low elevations (below 3000 feet) in the Southern Blue Ridge, associated with sandy, dry soils derived from granitic gneiss and other acid substrates. These forests have canopies dominated by *Quercus alba, Quercus coccinea, Quercus falcata*, and sometimes *Quercus prinus*, although other species can be present, including *Pinus rigida*. This forest is characterized by having associated species more typical of lower, non-montane areas, such as *Quercus falcata, Schizachyrium scoparium, Silphium compositum, Baptisia tinctoria, Piptochaetium avenaceum*, and by the absence of species more typical in mesic, montane oak forests (*Medeola virginiana, Maianthemum racemosum, Thelypteris noveboracensis, Athyrium filix-femina ssp. asplenioides, Dennstaedtia punctilobula, Dryopteris intermedia).* The shrub stratum can be quite open, with *Rhododendron calendulaceum* typical. *Kalmia latifolia* and *Vaccinium pallidum* are usually present in moderate abundance. *Solidago odora var. odora* and *Pteridium aquilinum var. latiusculum* are typical herb components. This association is known as a matrix forest type in the area of Brevard, North Carolina, where it occurs on open slopes and broad ridges, in a landscape of a low, rolling plateau. It may extend south into South Carolina.

Environment: This association includes dry, deciduous forests of low elevations (below 3000 feet) in the Southern Blue Ridge, associated with sandy, dry soils derived from granitic gneiss. This association is known as a matrix forest type in the area of Brevard, North Carolina, where it occurs on open slopes and broad ridges, in a landscape of a low, rolling plateau.

Vegetation: These forests have canopies dominated by *Quercus alba* and *Quercus coccinea* and sometimes *Quercus prinus*, although other species can be present, including *Quercus falcata, Quercus velutina,* and *Pinus rigida*. This forest is characterized by having associated species more typical of lower, non-montane areas, such as *Quercus falcata, Schizachyrium scoparium, Silphium compositum, Baptisia tinctoria, Piptochaetium avenaceum*, and by the absence of species more typical in mesic, montane oak forests (*Medeola virginiana, Maianthemum racemosum, Thelypteris noveboracensis, Athyrium filix-femina ssp. asplenioides, Dennstaedtia punctilobula, Dryopteris intermedia*). The shrub stratum can be quite open, with *Rhododendron calendulaceum* typical. *Solidago odora var. odora* and *Pteridium aquilinum var. latiusculum* are typical herb components.

Dynamics: No information
Similar Associations:
Related Concepts:
- Montane Oak-Hickory Forest (Low Dry Subtype) (Schafale 1998b) ?

Classification Comments: This association was defined based on North Carolina occurrences. More information is needed to better describe this association and define its geographic distribution.

CONSERVATION RANKING & RARE SPECIES

GRank: G2G3 (1998-4-30): No information
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This association is known as a matrix forest type in the area of Brevard, North Carolina. It may extend south into South Carolina. Its full range may not be known (status in Tennessee unclear).
Subnations: NC, SC?, TN?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway?, Great Smoky Mountains); USFS (Cherokee?, Nantahala)

ELEMENT SOURCES

References: NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Schafale 1998b, Southeastern Ecology Working Group n.d.

WHITE OAK / MOUNTAIN LAUREL FOREST

ELEMENT IDENTIFIERS

NVC association: *Quercus alba / Kalmia latifolia* Forest
Database Code: CEGL007295
Formation: Lowland or submontane cold-deciduous forest (I.B.2.N.a)
Alliance: *Quercus alba* Montane Forest Alliance (A.271)

ELEMENT CONCEPT

Summary: *Quercus alba*-dominated forests on exposed, rocky ridges and convex upper slopes at high elevations (>3000 feet). The shrub stratum is dominated by *Kalmia latifolia*, occurring as patches or with continuous cover (>25%). In some parts of this forest's range, *Gaylussacia ursina* is dominant in the often dense low-shrub stratum. Herbaceous cover is typical of xeric *Quercus*-and-*Carya*-dominated forests in the area, with *Carex pensylvanica, Chimaphila maculata, Euphorbia corollata, Galax urceolata, Galium latifolium, Goodyera pubescens, Hexastylis shuttleworthii, Iris verna var. smalliana, Medeola virginiana* typical. The shrub/sapling stratum often has a high coverage of *Castanea* stump sprouts and also includes *Castanea pumila, Sassafras albidum, Oxydendrum arboreum*, and *Nyssa sylvatica*.
Environment: These *Quercus alba*-dominated forests occur on exposed, rocky ridges and convex upper slopes at high elevations (>3000 feet).
Vegetation: These forests are dominated by *Quercus alba* in the canopy. The shrub stratum is dominated by *Kalmia latifolia*, occurring as patches or with continuous cover (>25%). In some parts of this forest's range, *Gaylussacia ursina* is dominant in the often dense low-shrub stratum. Herbaceous cover is typical of xeric *Quercus*-and-*Carya*-dominated forests in the area, with *Carex pensylvanica, Chimaphila maculata, Euphorbia corollata, Galax urceolata, Galium latifolium, Goodyera pubescens, Hexastylis shuttleworthii, Iris verna var. smalliana, Medeola virginiana* typical. The shrub/sapling stratum often has a high coverage of *Castanea* stump sprouts and also includes *Castanea pumila, Sassafras albidum, Oxydendrum arboreum*, and *Nyssa sylvatica*.
Dynamics: No information
Similar Associations:
- *Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina)* Forest (CEGL007230)
- *Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata* Forest (CEGL007299)
- *Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis)* Forest (CEGL007300)

Related Concepts:
- High Elevation White Oak Forest (Schafale 1998b) ?
- IA4h. High Elevation White Oak Forest (Allard 1990) ?

Classification Comments: These forests are related to oak - hickory forests and may be best considered as a variant of them. Similar associations include *Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata* Forest (CEGL007299), *Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis)* Forest (CEGL007300), and *Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina)* Forest (CEGL007230). On some sites these forests are transitional to *Quercus rubra*-dominated forests (High Elevation Red Oak Forest).

CONSERVATION RANKING & RARE SPECIES

GRank: G2Q (1999-12-29): This forest is restricted geographically, and if considered distinct, it is naturally rare within its range. It is floristically related to other, more common associations and may be better considered a subassociation of one of these communities.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge of western North Carolina, eastern Tennessee, northwestern South Carolina, and northeastern Georgia.
Subnations: GA, NC, SC, TN
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, McCormick and Platt 1980, Newell and Peet 1995, Patterson 1994, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

UPLANDS, UNVEGETATED

APPALACHIAN SHALE BARRENS

ROCK CHESTNUT OAK - EASTERN RED-CEDAR - (VIRGINIA PINE) / HAIRY MOCK-ORANGE - NORTHERN HACKBERRY FOREST

ELEMENT IDENTIFIERS

NVC association: *Quercus prinus - Juniperus virginiana - (Pinus virginiana) / Philadelphus hirsutus - Celtis occidentalis* Woodland
Database Code: CEGL007720
Formation: Cold-deciduous woodland (II.B.2.N.a)
Alliance: *Fraxinus americana - Carya glabra - (Juniperus virginiana)* Woodland Alliance (A.604)

ELEMENT CONCEPT

Summary: This association occurs on rocky slopes, some parts with thin soil over bedrock, other parts covered with loose gravel-sized shale fragments. Trees are sparse and stunted, generally 2-6 m tall. Primary species include *Quercus prinus, Juniperus virginiana var. virginiana, Pinus virginiana*, and *Acer rubrum*. Shrubs include *Philadelphus hirsutus, Cercis canadensis var. canadensis, Celtis occidentalis*, and *Rhus copallinum var. latifolia*. *Toxicodendron radicans ssp. radicans* and *Parthenocissus quinquefolia* are common. Herbs include Sedum ternatum, Asteraceae spp., *Solidago* spp., *Danthonia sericea, Danthonia spicata, Andropogon virginicus, Carex pensylvanica, Paronychia argyrocoma, Selaginella rupestris, Houstonia longifolia (= var. compacta),* and *Amsonia tabernaemontana*. Some openings are very grassy, and include species such as *Sorghastrum nutans, Andropogon gerardii, Muhlenbergia capillaris, Panicum* sp., *Coreopsis major, Baptisia tinctoria, Lechea racemulosa, Liatris* sp., and *Penstemon* sp. This community occurs on calcareous shales and interbedded siltstones in sedimentary windows in the Southern Blue Ridge. It may also occur in the sedimentary provinces further west.
Environment: Stands included from shale slopes above the French Broad River (Cherokee National Forest, Tennessee) seem to fit the concept of CEGL007720 as renamed and moved to woodland. These are open stands on "sub-calcareous" shales. The vegetation has an open canopy of *Quercus prinus* with scattered examples of other woody plants. Other trees include *Ostrya virginiana, Ulmus alata, Quercus rubra, Carya pallida,* and *Pinus virginiana*. These are primarily deciduous stands, but with some pine.
Vegetation: No information
Dynamics: No information
Similar Associations:
- *Carya glabra - Fraxinus americana - Quercus prinus / Ostrya virginiana / Philadelphus hirsutus* Woodland (CEGL004995) -- related but shrubby and not as floristically diverse.

Related Concepts: No information
Classification Comments: Moved to *Fraxinus americana - Carya glabra - (Juniperus virginiana)* Woodland Alliance (A.604) by MP 2001-06-16; formerly placed in a forest alliance.

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (2001-1-31): This Southern Blue Ridge shale barren community is limited in occurrence to steep riverine bluffs with exposed and eroding shale. This community is also apparently maintained by periodic fires. Fewer than 10 occurrences totaling less than 1000 acres are known.
High-ranked species: *Thaspium pinnatifidum* (G2G3)

ELEMENT DISTRIBUTION

Range: This shale barren community is limited to the Southern Blue Ridge of North Carolina and Tennessee.
Subnations: NC, TN
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dd:CCC

Federal Lands: NPS (Blue Ridge Parkway?); USFS (Cherokee, Pisgah)

ELEMENT SOURCES

References: NatureServe Ecology - Southeastern U.S. unpubl. data, Southeastern Ecology Working Group n.d.

VIRGINIA PINE / HILLSIDE BLUEBERRY / LITTLE BLUESTEM - PENNSYLVANIA SEDGE WOODLAND

ELEMENT IDENTIFIERS

NVC association: *Pinus virginiana / Vaccinium pallidum / Schizachyrium scoparium - Carex pensylvanica* Woodland
Database Code: CEGL003624
Formation: Mixed needle-leaved evergreen - cold-deciduous woodland (II.C.3.N.a)
Alliance: *Pinus (rigida, pungens, virginiana) - Quercus prinus* Woodland Alliance (A.677)

ELEMENT CONCEPT

Summary: This community occurs on steep, shaley slopes in the southern Appalachians and has an open to closed, stunted canopy and sparse herb and shrub strata characterized by species able to grow in loose shale fragments. It is known from the Hot Springs Window, in the Blue Ridge Mountains, and occurs elsewhere in the southern Appalachians, such as the Chauga Basin, South Carolina, and from Chilhowee Mountain, Tennessee. The canopy (5-25 m tall, 25-75% cover) is dominated by *Pinus virginiana*, with *Quercus prinus* and *Quercus rubra* sometimes present in substantial numbers in less extreme habitats. The shrub layer is very sparse, and may include scattered individuals of *Kalmia latifolia, Vaccinium stamineum*, and *Vaccinium pallidum*. The herb layer is very sparse to patchy, and is dominated by *Schizachyrium scoparium, Carex pensylvanica, Danthonia spicata, Dichanthelium linearifolium*, with scattered individuals of *Coreopsis major, Houstonia longifolia (= Houstonia tenuifolia), Hieracium venosum*, and *Euphorbia corollata*. Lichens are frequent, particularly on in-place outcrops, and include *Cladina rangiferina* and *Cladonia* spp. Loose shale fragments cover 50-90% of the ground surface. It is apparently a long-lived community, maintained by harsh edaphic conditions of steep slopes and shifting shale substrate. The community can vary quite widely from a very open canopy to one that is almost closed in cases where the slope is less steep and/or the rock underlying the stand is more stable.
Environment: This community occurs on steep, shaley slopes in the southern Appalachians and has a sparse herb and shrub strata characterized by species able to grow in loose shale fragments. Loose shale fragments cover 50-90% of the ground surface. It is apparently a long-lived community, maintained by harsh edaphic conditions of steep slopes and shifting shale substrate. The community can vary quite widely from a very open canopy to one that is almost closed in cases where the slope is less steep and/or the rock underlying the stand is more stable.
Vegetation: The stunted open to closed canopy (5-25 m tall, 25-75% cover) of stands of this type is dominated by *Pinus virginiana*, with *Quercus prinus* and *Quercus rubra* sometimes present in substantial numbers in less extreme versions of this habitat. The shrub layer is very sparse, and may include scattered individuals of *Kalmia latifolia, Vaccinium stamineum*, and *Vaccinium pallidum*. The herb layer is very sparse to patchy, and is dominated by *Schizachyrium scoparium, Carex pensylvanica, Danthonia spicata, Dichanthelium linearifolium*, with scattered individuals of *Coreopsis major, Houstonia longifolia (= Houstonia tenuifolia), Hieracium venosum*, and *Euphorbia corollata*. Lichens are frequent, particularly on in-place outcrops, and include *Cladina rangiferina* and *Cladonia* spp.
Dynamics: No information
Similar Associations:
Related Concepts:

- Acidic Shale Slope Woodland (Schafale 1998b) ?
- IE6a. Southern Appalachian Shale Barren (Allard 1990) B

Classification Comments: This type is distinguished from the various shale barren types of western Virginia, eastern West Virginia, western Maryland, and south-central Pennsylvania by the complete absence of the distinctive endemic flora of that region. L.L. Gaddy (pers. comm.) reports this association from the Chauga Basin, South Carolina, and it is known from Chilhowee Mountain, Tennessee.

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (2004-2-19): As defined, this community is limited to the rare outcrops of shale in the Blue Ridge and in the transition between the Blue Ridge and Ridge and Valley physiographic provinces in extreme western North Carolina and eastern Tennessee. There is some possibility that this type may be somewhat more widespread in the Ridge and Valley of Tennessee, southwestern Virginia, and northern Alabama, although no new locations have been found to date (Feb 2004). It is distinguished from the various shale barren types of western Virginia, eastern West Virginia, western Maryland, and south-central Pennsylvania by the complete absence of the distinctive endemic flora of that region. Most examples are not highly threatened by development or timber harvesting because of their occurrence on steep slopes and the low value/poor quality timber present. This community type is threatened by the invasive exotic *Paulownia tomentosa*, which can colonize this community type where it is near a seed source. Although the current condition of the examples of this type are good, the fact that there are only three known Element Occurrences requires us to give this a high priority Global Rank.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This forest is found in the southern Appalachians of the Carolinas and Tennessee. It is reported from somewhat calcareous shales in the Hot Springs Window, in the Blue Ridge of North Carolina and Tennessee, from the Chauga Basin, South Carolina, and from Chilhowee Mountain, Tennessee.
Subnations: NC, SC?, TN
TNC Ecoregions: 50:P, 51:C
USFS Ecoregions: 221Jb:PPP, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains?); USFS (Cherokee, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Peet et al. unpubl. data 2002, Schafale 1998b, Southeastern Ecology Working Group n.d.

SOUTHERN APPALACHIAN GRANITIC DOME

(ROCK CHESTNUT OAK) / HILLSIDE BLUEBERRY / LITTLE BLUESTEM - POVERTY OATGRASS / REINDEER LICHEN SPECIES HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *(Quercus prinus) / Vaccinium pallidum / Schizachyrium scoparium - Danthonia spicata / Cladonia* spp. Herbaceous Vegetation
Database Code: CEGL004990
Formation: Bedrock temperate or subpolar grassland with a sparse tree layer (V.A.6.N.q)
Alliance: *(Quercus stellata, Quercus marilandica) / Schizachyrium scoparium* Wooded Herbaceous Alliance (A.1920)

ELEMENT CONCEPT

Summary: This type covers vegetation on gently to moderately sloping outcrops of felsic rocks with irregular or undulating surfaces but few crevices, and characterized predominantly by graminoids and low shrubs in fairly shallow soil mats. It includes drier examples where *Schizachyrium scoparium, Danthonia* spp., or other dry-site grasses predominate. This community is distinguished by the predominance of somewhat deeper soil mats, capable of supporting grasses. Lichen-covered bare rock and thin mats dominated by *Selaginella* spp. are often present but are less prominent than in granitic dome communities, while grassy mats and low-shrub patches are more prominent. Trees may be dispersed throughout the community rather than largely confined to the edge. This is similar to a granitic dome. Most occurrences are in DuPont State Forest, Transylvania and Henderson counties, North Carolina (M221Dc). It may also occur in the Nantahala National Forest.
Environment: No information
Vegetation: Stands of this association are characterized predominantly by graminoids and low shrubs. In drier examples, *Schizachyrium scoparium, Danthonia* spp., and other dry-site grasses predominate. Lichen-covered bare rock and thin mats dominated by *Selaginella* spp. are also often present. Scattered woody plants may include *Quercus prinus* and *Vaccinium pallidum*. Lichens may include *Cladonia* spp.
Dynamics: No information
Similar Associations:
- *Selaginella rupestris - Schizachyrium scoparium - Hypericum gentianoides - Bulbostylis capillaris* Herbaceous Vegetation (CEGL007690) -- with greater vegetative cover.

Related Concepts:
- Low Elevation Acidic Glade (Grass Subtype) (Schafale 1998b) ?

Classification Comments: Most occurrences are in DuPont State Forest, Transylvania and Henderson counties, North Carolina. It may occur in the Nantahala National Forest (M. Schafale pers. comm.). This association is distinguished from Low Elevation Mafic Glades by the absence of plant species characteristic of higher pH conditions, such as *Hylotelephium telephioides (= Sedum telephioides), Dodecatheon meadia, Sedum glaucophyllum, Cheilanthes lanosa, Arabis laevigata,* and *Penstemon canescens*. Low Elevation Acidic Glades are distinguished from Low Elevation Rocky Summits by having few crevices and having abundant grassy mats and low shrub mats in shallow soil but relatively few forbs or woody plants rooted in crevices. The Grass Type is distinguished from the Biltmore Sedge Type by have grassy mats predominantly consisting of *Schizachyrium scoparium, Danthonia spicata,* or other dry-site grasses or herbs rather than *Carex biltmoreana* or other *Carex* spp.

CONSERVATION RANKING & RARE SPECIES

GRank: G1G2 (2004-2-20): Stands of this type are limited to gently to moderately sloping outcrops of felsic rocks in the Southern Blue Ridge of North Carolina. Most occurrences are in DuPont State Forest, Transylvania and Henderson counties, North Carolina. It may occur in the Nantahala National Forest. The degree of formal protection of these examples on public land is unknown. Examples, especially any not on public land, would be most likely threatened by ridgetop roads, communication towers or other developments, as well as by lack of fire management.

High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This type is restricted to the Southern Blue Ridge of North Carolina and possibly South Carolina.
Subnations: NC, SC?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CC?
Federal Lands: USFS (Nantahala?)

ELEMENT SOURCES

References: Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Southeastern Ecology Working Group n.d.

BILTMORE SEDGE - MOUNTAIN-MINT SPECIES - MOUNTAIN CYNTHIA HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Carex biltmoreana - Pycnanthemum* spp. - *Krigia montana* Herbaceous Vegetation
Database Code: CEGL004523
Formation: Short sod temperate or subpolar grassland (V.A.5.N.e)
Alliance: *Carex biltmoreana* Herbaceous Alliance (A.1277)

ELEMENT CONCEPT

Summary: This association is found on sloping exfoliation surfaces with generally 10-80% cover of vascular plants. Stands are dominated by *Carex biltmoreana*. Scattered woody plants may be within an occurrence. Other characteristic species include *Krigia montana, Houstonia longifolia (= var. glabra), Schizachyrium scoparium, Diervilla sessilifolia, Melampyrum lineare, Ambrosia artemisiifolia, Coreopsis pubescens, Coreopsis major, Dichanthelium dichotomum var. dichotomum (= var. ramulosum), Dichanthelium acuminatum var. lindheimeri, Pycnanthemum beadlei, Symphyotrichum patens var. patens (= Aster patens var. patens), Heuchera villosa, Fraxinus americana, Sassafras albidum*, and *Saxifraga michauxii*. This community occupies seasonal or temporary seepage over rock, and is moister than *Selaginella tortipila* communities, which can occur on the same mountains, or sometimes, even in juxtaposition. This community occurs as small patches (typically less than 10 acres) within a forested matrix.
Environment: No information
Vegetation: Stands of this association are dominated by *Carex biltmoreana*. Scattered woody plants may be within an occurrence. Other characteristic species include *Krigia montana, Houstonia longifolia (= var. glabra), Schizachyrium scoparium, Diervilla sessilifolia, Melampyrum lineare, Ambrosia artemisiifolia, Coreopsis pubescens, Coreopsis major, Dichanthelium dichotomum var. dichotomum (= var. ramulosum), Dichanthelium acuminatum var. lindheimeri, Pycnanthemum beadlei, Symphyotrichum patens var. patens (= Aster patens var. patens), Heuchera villosa, Fraxinus americana, Sassafras albidum*, and *Saxifraga michauxii*.

A stand in the Chattahoochee National Forest (Georgia) which is assigned here is dominated by *Carex biltmoreana, Pycnanthemum* sp., *Saxifraga michauxii*, and *Coreopsis pubescens*. Other herbs include *Elymus virginicus, Thalictrum revolutum, Symphyotrichum* sp. (= *Aster* sp.), *Andropogon gerardii, Dichanthelium dichotomum var. dichotomum, Eryngium yuccifolium var. yuccifolium, Heuchera americana, Oenothera fruticosa, Ambrosia artemisiifolia, Tradescantia* sp., *Euphorbia corollata, Krigia virginica, Penstemon* sp., *Cheilanthes lanosa*, and *Galactia regularis*. Scattered woody plants include *Pinus virginiana, Quercus alba, Quercus prinus, Prunus angustifolia, Fraxinus americana, Mimosa microphylla (= Schrankia microphylla)*, and *Hypericum hypericoides ssp. multicaule*.
Dynamics: No information
Similar Associations:
- *Selaginella tortipila - Krigia montana - Houstonia longifolia* Herbaceous Vegetation (CEGL004283) -- of granitic domes.

Related Concepts:
- IE4c. Southern Appalachian High Elevation Granitic Dome (Allard 1990) B
- Low Elevation Acidic Glade (Biltmore Sedge Subtype) (Schafale 1998b) ?

Classification Comments: Some occurrences of this association may be floristically similar to communities on granitic domes, such as *Selaginella tortipila - Krigia montana - Houstonia longifolia* Herbaceous Vegetation (CEGL004283), but this community is smaller, more vegetated, and occurs within a forested matrix. It is often overlooked in community inventories.

CONSERVATION RANKING & RARE SPECIES

GRank: G2G3 (1996-9-8): This community is restricted to granitic outcrops in the southern Appalachians, south of Asheville, North Carolina. Total acreage of occurrences is small. It is a fairly stable, but fragile community and may be threatened by trampling in areas of heavy recreational use.
High-ranked species: *Carex biltmoreana* (G3), *Hypericum buckleii* (G3), *Krigia montana* (G3), *Packera millefolia* (G2), *Pycnanthemum beadlei* (G2G4), *Selaginella tortipila* (G3), Solidago simulans (G1)

ELEMENT DISTRIBUTION

Range: This community is restricted to granitic outcrops in the southern Appalachians, south of Asheville, North Carolina. It ranges south to Georgia.
Subnations: GA, NC, SC
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC
Federal Lands: NPS (Blue Ridge Parkway); USFS (Chattahoochee, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Hoagland pers. comm., NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

NORTHERN RED OAK / CATAWBA RHODODENDRON - SMOOTH AZALEA WOODLAND

ELEMENT IDENTIFIERS

NVC association: *Quercus rubra / Rhododendron catawbiense - Rhododendron arborescens* Woodland
Database Code: CEGL004503
Formation: Cold-deciduous woodland (II.B.2.N.a)
Alliance: *Quercus rubra - Quercus prinus* Woodland Alliance (A.624)

ELEMENT CONCEPT

Summary: This association consists of stunted high-elevation (>4000 feet), open red oak woodlands, with a stunted (3-8 m) canopy of *Quercus rubra, Quercus alba, Amelanchier laevis*, and *Sorbus americana*, over a dense shrub layer of *Rhododendron catawbiense, Rhododendron arborescens, Rhododendron calendulaceum, Rhododendron maximum, Menziesia pilosa, Gaylussacia ursina, Leucothoe recurva, Vaccinium simulatum*, and *Viburnum nudum var. cassinoides*. These woodlands are typically very open, and their lower strata are dominated by heath species.
Environment: This stunted, open, red oak woodland is found in association with the higher elevation granitic domes in the vicinity of Highlands, North Carolina.
Vegetation: These red oak woodlands are typically very open, and their lower strata are dominated by heath species. Stands of this association have a stunted (3-8 m) canopies of *Quercus rubra, Quercus alba, Amelanchier laevis*, and *Sorbus americana*, over a dense shrub layer of *Rhododendron catawbiense, Rhododendron arborescens, Rhododendron calendulaceum, Rhododendron maximum, Menziesia pilosa, Gaylussacia ursina, Leucothoe recurva, Vaccinium simulatum*, and *Viburnum nudum var. cassinoides*.
Dynamics: No information
Similar Associations:
Related Concepts:
- High Elevation Red Oak Forest (Stunted Heath Subtype) (Schafale 1998b) ?
- IE4c. Southern Appalachian High Elevation Granitic Dome (Allard 1990) B

Classification Comments: This community is found in association with the higher elevation granitic domes in the vicinity of Highlands, North Carolina. Examples are known from Scaly and Yellow mountains, North Carolina, and are possibly on Satulah Mountain, North Carolina. Georgia examples include Rabun Bald and Brasstown Bald. This community is naturally restricted and occupies a very small total acreage.

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (1998-4-30): This community has a restricted distribution, found in association with the higher elevation granitic domes in southeastern escarpment region of the southern Blue Ridge. The environmental conditions that support this community are naturally rare and the total acreage of this community is very small.
High-ranked species: *Rhododendron vaseyi* (G3)

ELEMENT DISTRIBUTION

Range: This community is found in the Blue Ridge Mountains of Georgia and North Carolina.
Subnations: GA, NC, SC?, TN
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC
Federal Lands: USFS (Chattahoochee, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Peet et al. unpubl. data 2002, Schafale 1998b, Southeastern Ecology Working Group n.d.

ELEMENT IDENTIFIERS

NVC association: *Selaginella rupestris - Schizachyrium scoparium - Hypericum gentianoides - Bulbostylis capillaris* Herbaceous Vegetation
Database Code: CEGL007690
Formation: Low temperate or subpolar perennial forb vegetation (V.B.2.N.b)
Alliance: *Selaginella (tortipila, rupestris)* Herbaceous Alliance (A.1985)

ELEMENT CONCEPT

Summary: This association includes vegetation found on granitic exfoliation domes of the Piedmont and lower elevation portions of the Blue Ridge. It occurs on gently sloping to steep exposures of smooth, exfoliating granite or similar massive igneous or metamorphic rock, such as granitic gneiss. The substrate has few cracks or irregularities for soil accumulation, and most of the areal extent is bare rock. This association typically occurs at elevations below 3000 feet (914 m), but may be found at slightly higher elevations. This community occurs in large patches, ranging in size from a few acres to over 100 acres. Vegetation consists primarily of lichens on bare rock or of shallow mats generally dominated by *Selaginella rupestris* occurring with other distinctive species. Woody species from adjacent woodlands and shrublands may be scattered components, rooted in deeper soil pockets, older stable vegetation mats, and in marginal zones between the exposed rock and adjacent forests. *Selaginella rupestris* is almost always a major dominant of the vegetation mats. However, distribution of *Selaginella rupestris* can be spotty, so there are examples of this association that do not contain this species. Other characteristic herbaceous species are *Baptisia tinctoria, Cheilanthes lanosa, Coreopsis major, Corydalis sempervirens, Danthonia sericea, Lindernia monticola, Phlox nivalis, Schizachyrium scoparium, Scleria triglomerata,* and *Talinum teretifolium*. Common woody species include *Carya pallida, Chionanthus virginicus, Fraxinus americana, Juniperus virginiana, Kalmia latifolia, Pinus echinata, Pinus rigida, Quercus prinus (= Quercus montana), Rhododendron minus, Ulmus alata,* and *Vaccinium stamineum*.
Environment: This association occurs on gently sloping to steep exposures of smooth, exfoliating granite or similar massive igneous or metamorphic rock, such as granitic gneiss. The substrate has few cracks or irregularities for soil accumulation, and most of the areal extent is bare rock. This association typically occurs at elevations below 3000 feet (914 m), but may be found at slightly higher ones.
Vegetation: In stands of this type, the vegetation consists primarily of lichens on bare rock, or of shallow mats generally dominated by *Selaginella rupestris* occurring with other distinctive species. Woody species from adjacent woodlands and shrublands may be scattered components, rooted in deeper soil pockets, older stable vegetation mats, and in marginal zones between the exposed rock and adjacent forests. *Selaginella rupestris* is almost always a major dominant of the vegetation mats. However, distribution of *Selaginella rupestris* can be spotty, so there are examples of this association that do not contain this species. Other characteristic herbaceous species are *Baptisia tinctoria, Cheilanthes lanosa, Coreopsis major, Corydalis sempervirens, Danthonia sericea, Lindernia monticola, Phlox nivalis, Schizachyrium scoparium, Scleria triglomerata,* and *Talinum teretifolium*. Common woody species include *Carya pallida, Chionanthus virginicus, Fraxinus americana, Juniperus virginiana, Kalmia latifolia, Pinus rigida, Quercus prinus (= Quercus montana), Rhododendron minus, Ulmus alata,* and *Vaccinium stamineum*.

In an example of this association in the Chattahoochee National Forest (upper Piedmont of Stephens County, Georgia, 231Ad34, ca. 303-350 m elev.), mats of *Selaginella rupestris* dominate the stand. Widely scattered trees include *Pinus virginiana* and *Quercus prinus*. A prevalent shrub is *Rhus aromatica*. Other herbs include *Ageratina aromatica, Agrostis perennans, Andropogon* sp. *Cheilanthes lanosa, Packera anonyma (= Senecio anonymus), Solanum ptychanthum*?, and the characteristic *Talinum teretifolium*. Examples of this association on granite gneiss at Carl Sandburg Home National Historic Site also contained patches of *Amelanchier laevis* and *Pinus virginiana* scattered in pockets of deeper soil.
Dynamics: No information
Similar Associations:
- *Selaginella rupestris - Schizachyrium scoparium - Hylotelephium telephioides - Allium cernuum* Herbaceous Vegetation (CEGL004991)
- *Selaginella tortipila - Krigia montana - Houstonia longifolia* Herbaceous Vegetation (CEGL004283)

Related Concepts:
- Low Elevation Granitic Dome (Schafale 1998b) ?

Classification Comments: Occurrences of this community have structural and compositional similarities to *Selaginella tortipila - Krigia montana - Houstonia longifolia* Herbaceous Vegetation (CEGL004283), which is typically at higher elevations (over 3000 feet) and contains a suite of species not found at lower elevations. Occurrences vary locally based on slope steepness, aspect, age of vegetation mats, and smoothness of rock substrate. Some occurrences may be difficult to distinguish from *Selaginella rupestris - Schizachyrium scoparium - Hylotelephium telephioides - Allium cernuum* Herbaceous Vegetation (CEGL004991), which is characterized by the presence of plants characteristic of higher pH conditions, better developed soils, and flat to gently sloping rock surfaces. This community is floristically similar to granitic flatrock communities which are scattered throughout the Piedmont from Virginia to Alabama. However, the steep domes described here lack the shallow pools and other microhabitats characteristic of the fractured rock in granitic flatrock communities, and thus have different vegetative components.

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (1998-4-30): Granitic domes are uncommon communities. Only 20 percent of the Piedmont Plateau is granite (Radford and Martin 1975), and only a small percentage of this granite occurs as massive, unweathered bodies that produce flatrocks and domes. Past quarrying has leveled many former granite domes (McVaugh 1943). This community provides open vistas that are attractive to humans, thus these fragile areas are threatened by pressures of recreational use. Given the island-like nature of this community, it is the habitat for many rare and endemic species and provides a unique contribution to biodiversity.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community is known from the Piedmont region of Georgia and North Carolina, and lower elevations of the Blue Ridge Mountains, where steep, dome-shaped outcrops of granitic rock occur. Notable examples are in DeKalb County, Georgia, and in Alexander County, North Carolina.
Subnations: GA, NC, SC?
TNC Ecoregions: 51:C, 52:C
USFS Ecoregions: 231Ad:CCC, M221Dc:CCC
Federal Lands: NPS (Carl Sandburg Home); USFS (Chattahoochee, Nantahala, Pisgah)

ELEMENT SOURCES

References: Keever 1942, Keever et al. 1951, McVaugh 1943, Peet et al. unpubl. data 2002, Quarterman et al. 1993, Radford and Martin 1975, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Southeastern Ecology Working Group n.d., Taggart 1973, Wharton 1978

TOADSKIN LICHEN - CAROLINA ROCKTRIPE NONVASCULAR VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Lasallia papulosa - Umbilicaria caroliniana* Nonvascular Vegetation
Database Code: CEGL004386
Formation: Montane/submontane temperate or subpolar lichen vegetation (VI.B.1.N.b)
Alliance: *Lasallia papulosa - Umbilicaria caroliniana* Nonvascular Alliance (A.1826)

ELEMENT CONCEPT

Summary: As defined, this alliance and association are intended to cover vertical cliffs and sometimes more gently sloping large outcrops (often to as large as 1 hectare) which have extremely few or no vascular plants and are relatively dry. In the southern Appalachians, these generally occur because of a combination of outcrop geometry (few or no suitable crevices, as in exfoliation domes) and hydrology (inadequate seepage moisture to support vascular plants). A few crevice vascular plants are allowed. Moister cliffs without crevices support *Umbilicaria mammulata* Nonvascular Vegetation (CEGL004387). This association is known from the steeply sloping exfoliation domes faces on Grandfather Mountain, North Carolina, and probably at Roan Mountain, Tennessee and North Carolina.
Environment: No information
Vegetation: No information
Dynamics: No information
Similar Associations:
- *Umbilicaria mammulata* Nonvascular Vegetation (CEGL004387) -- of moister crevices.

Related Concepts:
- High Elevation Granitic Dome (High Peak Lichen Subtype) (Schafale 1998b) ?
- IE4c. Southern Appalachian High Elevation Granitic Dome (Allard 1990) B

Classification Comments:

CONSERVATION RANKING & RARE SPECIES

GRank: G2? (1994-8-15): Rare; restricted by codominance of *Umbilicaria caroliniana* to North Carolina and Tennessee.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This association is known from the steeply sloping exfoliation domes faces on Grandfather Mountain, North Carolina, and probably at Roan Mountain, Tennessee and North Carolina.
Subnations: NC, TN
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC
Federal Lands: USFS (Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

TWISTED-HAIR SPIKE-MOSS - MOUNTAIN CYNTHIA - LONGLEAF SUMMER BLUET HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Selaginella tortipila - Krigia montana - Houstonia longifolia* Herbaceous Vegetation
Database Code: CEGL004283
Formation: Low temperate or subpolar perennial forb vegetation (V.B.2.N.b)
Alliance: *Selaginella (tortipila, rupestris)* Herbaceous Alliance (A.1985)

ELEMENT CONCEPT

Summary: This association is found on granitic exfoliation domes and rock faces at intermediate to high elevations in the southern Blue Ridge of the Carolinas and Georgia. This association occurs on exposed, often south-facing sites, with smooth, exfoliation surfaces and few cracks or crevices for soil accumulation. These rock surfaces are typically steep to vertical but may include flat areas. This association typically occurs at elevations from 1067-1372 m (3500-4500 feet), but may be found at slightly higher or lower elevations. This community occurs in large patches, ranging in size from 10 to over 100 acres, with vegetation strongly dominated by shallow-soil herb mats over solid rock. These shallow mats can have 10-90% coverage and are interspersed with areas of bare rock, patches of lichens (e.g., *Cladina* spp., *Cladonia furcata*), and mosses (e.g., *Grimmia laevigata*). Woody species from adjacent woodlands and shrublands may be scattered components, rooted in deeper soil pockets, older stable vegetation mats, and around the outcrop margins. *Selaginella tortipila* is almost always a major dominant of the vegetation mats. Other characteristic herbaceous species are *Hypericum buckleii, Packera millefolia (= Senecio millefolium), Carex biltmoreana, Carex umbellata, Solidago simulans, Danthonia epilis (= Danthonia sericea var. epilis), Danthonia compressa, Deschampsia flexuosa, Schizachyrium scoparium, Krigia montana, Trichophorum caespitosum (= Scirpus cespitosus), Houstonia longifolia (= var. glabra),* and *Saxifraga michauxii*. Woody species can include *Leiophyllum buxifolium, Quercus rubra, Pinus virginiana, Pinus rigida, Kalmia latifolia, Vaccinium* spp., *Gaylussacia baccata, Rhododendron catawbiense, Kalmia latifolia*, and *Rhododendron carolinianum.*
Environment: No information
Vegetation: No information
Dynamics: No information
Similar Associations:
- *Carex biltmoreana - Pycnanthemum* spp. - *Krigia montana* Herbaceous Vegetation (CEGL004523)
- *Selaginella rupestris - Schizachyrium scoparium - Hypericum gentianoides - Bulbostylis capillaris* Herbaceous Vegetation (CEGL007690)

Related Concepts:
- *Selaginella tortipila / Carex umbellata* outcrop community (Wiser et al. 1996) ?
- *Selaginella tortipila / Carex umbellata* outcrop community (Wiser 1993) ?
- High Elevation Granitic Dome (Typic Subtype) (Schafale 1998b) ?
- IE4c. Southern Appalachian High Elevation Granitic Dome (Allard 1990) B

Classification Comments: Granitic dome communities are also known from the Piedmont of North Carolina and Georgia. The Piedmont communities are more xeric and differ floristically from those described here, lacking species characteristic of the mountains such as *Carex misera, Carex biltmoreana, Trichophorum caespitosum (= Scirpus cespitosus), Hypericum buckleii, Packera millefolia (= Senecio millefolium),* and *Leiophyllum buxifolium.* Occurrences of this community may have structural and floristic similarities to *Selaginella rupestris - Schizachyrium scoparium - Hypericum gentianoides - Bulbostylis capillaris* Herbaceous Vegetation (CEGL007690) which typically occurs at lower elevations (below 3000 feet) and contains a suite of species not found at higher elevations. *Carex biltmoreana - Pycnanthemum* spp. - *Krigia montana* Herbaceous Vegetation (CEGL004523) may be compositionally similar to this association but is more vegetated and occurs as small patches (less than 10 acres) within a forested matrix.

CONSERVATION RANKING & RARE SPECIES

GRank: G2G3 (1998-1-4): Granitic Domes, in general, are uncommon, especially at high elevations in the Blue Ridge, where they represent a tiny fraction of the moderate to high mountain landscape. Heavy recreational use in these fragile communities has damaged, and continues to threaten, many examples. Additionally, atmospheric deposition of air pollutants may have an adverse effect on these high-elevation communities.
High-ranked species: *Carex biltmoreana* (G3), *Danthonia epilis* (G3G4), *Hypericum buckleii* (G3), *Krigia montana* (G3*), Packera millefolia* (G2), *Selaginella tortipila* (G3), *Solidago simulans* (G1)

ELEMENT DISTRIBUTION

Range: This community occurs at intermediate to high elevations in the Southern Blue Ridge of the Carolinas and Georgia.
Subnations: GA, NC, SC, TN?

TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC
Federal Lands: NPS (Blue Ridge Parkway?); USFS (Chattahoochee, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Southeastern Ecology Working Group n.d., Wiser 1993, Wiser et al. 1996

SOUTHERN APPALACHIAN ROCKY SUMMIT

CLIFF SAXIFRAGE - WRETCHED SEDGE - POVERTY OATGRASS - MOUNTAIN CYNTHIA HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Saxifraga michauxii - Carex misera - Danthonia spicata - Krigia montana* Herbaceous Vegetation
Database Code: CEGL004279
Formation: Low temperate or subpolar perennial forb vegetation (V.B.2.N.b)
Alliance: *Saxifraga michauxii* Herbaceous Alliance (A.1621)

ELEMENT CONCEPT

Summary: This association consists of rock outcrops with sparse vegetative cover of forbs, grasses and shrubs which are rooted in rock fissures. Typical species include *Saxifraga michauxii, Danthonia spicata, Krigia montana, Carex misera, Angelica triquinata, Athyrium filix-femina ssp. asplenioides, Rhododendron catawbiense,* and *Heuchera villosa*. This vegetation occurs at 1350-1870 m elevation within a matrix of *Quercus rubra* forest or high-elevation grasslands and shrublands. Other characteristic species are *Sanguisorba canadensis, Sibbaldiopsis tridentata, Hylotelephium telephioides (= Sedum telephioides), Houstonia purpurea var. montana, Geum radiatum, Solidago spithamaea*, and *Huperzia appalachiana*.
Environment: This association consists of rock outcrops with sparse vegetative cover of forbs, grasses and shrubs which are rooted in rock fissures. It occurs at 1350-1870 m elevation within a matrix of *Quercus rubra* forest or high-elevation grasslands and shrublands. The rock types on which it may occur include amphibolite, metabasalt, metagabbro, and metagraywacke.
Vegetation: Typical species in stands of this type include *Saxifraga michauxii, Danthonia spicata, Krigia montana, Carex misera, Angelica triquinata, Athyrium filix-femina ssp. asplenioides, Rhododendron catawbiense,* and *Heuchera villosa*. Other characteristic species are *Sanguisorba canadensis, Sibbaldiopsis tridentata, Hylotelephium telephioides (= Sedum telephioides), Houstonia purpurea var. montana, Geum radiatum, Solidago spithamaea*, and *Huperzia appalachiana*.
Dynamics: No information
Similar Associations:
Related Concepts:
- *Deschampsia flexuosa / Angelica triquinata* outcrop community (Wiser et al. 1996) ?
- *Deschampsia flexuosa / Angelica triquinata* outcrop community (Wiser 1993) ?
- *Paronychia argycoma (sic) / Polypodium appalachianum* outcrop community (Wiser et al. 1996) ?
- *Paronychia argycoma (sic) / Polypodium appalachianum* outcrop community (Wiser 1993) ?
- High Elevation Rocky Summit (Typic Subtype) (Schafale 1998b) ?
- IE4a. Southern Appalachian High Elevation Acidic Rocky Summit (Allard 1990) B

Classification Comments: Associated with amphibolite, metabasalt, metagabbro, or metagraywacke bedrock.

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (1998-4-30): This high-elevation community is associated with amphibolite, metabasalt, metagabbro, or metagraywacke bedrock outcrops in the southern Appalachians of Tennessee and North Carolina. This community is naturally rare, representing a tiny fraction of the high-mountain landscape. It is known from scattered, small acreage occurrences. Heavy recreational use in these fragile communities has damaged, and continues to threaten, many examples. Additionally, atmospheric deposition of air pollutants may have an adverse effect on these high-elevation communities.
High-ranked species: *Allium allegheniense* (G3?), *Carex misera* (G3), *Geum radiatum* (G1), *Gymnocarpium appalachianum* (G3), *Krigia montana* (G3), *Liatris helleri* (G2), *Solidago spithamaea* (G1)

ELEMENT DISTRIBUTION

Range: This high-elevation community is restricted to the southern Appalachians of Tennessee and North Carolina.
Subnations: NC, TN
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: USFS (Pisgah)

ELEMENT SOURCES

References: Allard 1990, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Wiser 1993, Wiser et al. 1996

CLIFF SAXIFRAGE - WRETCHED SEDGE - WHORLED WOOD ASTER - SKUNK GOLDENROD HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Saxifraga michauxii - Carex misera - Oclemena acuminata - Solidago glomerata* Herbaceous Vegetation
Database Code: CEGL004277
Formation: Low temperate or subpolar perennial forb vegetation (V.B.2.N.b)
Alliance: *Saxifraga michauxii* Herbaceous Alliance (A.1621)

ELEMENT CONCEPT

Summary: This association covers high-elevation (greater than 1980 m) vegetated rock outcrops of highly fractured felsic to mafic bedrock. The vegetative cover is sparse with grasses, forbs and shrubs rooted in rock fissures. Typical species in stands of this type are *Carex misera, Abies fraseri, Menziesia pilosa, Heuchera villosa, Rhododendron catawbiense, Saxifraga michauxii, Sorbus americana, Oclemena acuminata (= Aster acuminatus),* and *Solidago glomerata*. This community occurs in a matrix of *Picea rubens - Abies fraseri* forest. Other characteristic species are *Minuartia glabra* and *Polypodium appalachianum*.
Environment: This association covers high-elevation (greater than 1980 m) on rock outcrops of highly fractured felsic to mafic bedrock. This community occurs in a matrix of *Picea rubens - Abies fraseri* forest.
Vegetation: Typical species in stands of this type are *Carex misera, Abies fraseri, Menziesia pilosa, Heuchera villosa, Rhododendron catawbiense, Saxifraga michauxii, Sorbus americana, Oclemena acuminata (= Aster acuminatus),* and *Solidago glomerata*. Other characteristic species are *Minuartia glabra* and *Polypodium appalachianum*.
Dynamics: No information
Similar Associations:
Related Concepts:
- *Aster acuminatus / Menziesia pilosa* outcrop community (Wiser et al. 1996) ?
- *Aster acuminatus / Menziesia pilosa* outcrop community (Wiser 1993) ?
- High Elevation Rocky Summit (High Peak Subtype) (Schafale 1998b) ?
- IE4a. Southern Appalachian High Elevation Acidic Rocky Summit (Allard 1990) B

Classification Comments: Occurs on the highest summits of Grandfather Mountain, Mount Craig, Roan High Bluff, Mount Buckley (Great Smoky Mountains National Park), Craggy Pinnacle.

CONSERVATION RANKING & RARE SPECIES

GRank: G1 (1995-1-15): This community is naturally rare, representing a tiny fraction of the high-mountain landscape. It is known from scattered, small acreage occurrences. Heavy recreational use in these fragile communities has damaged, and continues to threaten, many examples. Additionally, atmospheric deposition of air pollutants may have an adverse effect on these high-elevation communities.
High-ranked species: *Abies fraseri* (G2), *Anaptychia setifera* (G3G4), *Calamagrostis cainii* (G1), *Carex misera* (G3), *Geum radiatum* (G1), *Rhododendron vaseyi* (G3), *Selaginella tortipila* (G3), *Solidago glomerata* (G3), *Solidago spithamaea* (G1)

ELEMENT DISTRIBUTION

Range: Occurs on high summits of the southern Appalachian Mountains in North Carolina and Tennessee.
Subnations: NC, TN
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Wiser 1993, Wiser et al. 1996

CLIFF SAXIFRAGE HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Saxifraga michauxii* Herbaceous Vegetation
Database Code: CEGL004524
Formation: Low temperate or subpolar perennial forb vegetation (V.B.2.N.b)
Alliance: *Saxifraga michauxii* Herbaceous Alliance (A.1621)

ELEMENT CONCEPT

Summary: This is a broadly defined type which encompasses a diversity of sloping rock outcrops at low to medium elevations in the southern and central Appalachians, with *Saxifraga michauxii* as a characteristic component. Other species are variable, but may include *Saxifraga virginiensis, Saxifraga micranthidifolia, Carex* spp., *Schizachyrium scoparium*, and others. This community shows some relationship to the others in this alliance, *Saxifraga michauxii* Herbaceous Alliance (A.1621), but it lacks most or all of the rare endemic species which are important components of the other types in this alliance.

Environment: No information

Vegetation: A stand in the Chattahoochee National Forest (Almond Bald, M221Dc38) contains the herbaceous species *Carex pensylvanica, Danthonia sericea, Schizachyrium scoparium, Heuchera villosa, Packera anonyma (= Senecio anonymus), Saxifraga michauxii, Asplenium platyneuron, Houstonia longifolia var. glabra, Solidago* sp., *Hypericum gentianoides, Ambrosia artemisiifolia, Asclepias incarnata, Symphyotrichum patens (= Aster patens), Danthonia compressa, Dichanthelium* sp., *Dryopteris marginalis, Polygonatum biflorum*, and *Tradescantia* sp. Small trees and shrubs are scattered in the stand or appear on the margins. They include *Amelanchier laevis, Prunus angustifolia, Prunus serotina, Carya alba, Quercus alba, Quercus prinus, Robinia pseudoacacia, Diospyros virginiana, Quercus velutina, Vaccinium stamineum, Arundinaria gigantea, Rhus copallinum,* and *Vaccinium pallidum*. Vines include *Toxicodendron radicans, Smilax bona-nox,* and *Smilax rotundifolia*. Trees on the margin of the stand include *Quercus rubra, Carya glabra,* and *Juniperus virginiana var. virginiana*.

Dynamics: No information

Similar Associations:

- *Saxifraga michauxii - Cheilanthes lanosa - Hylotelephium telephioides* Herbaceous Vegetation (CEGL004989) -- the related basic type.

Related Concepts:

- Blue Ridge Noncalcareous Outcrop Herbaceous Vegetation (Ambrose 1990a) B
- IE4b. Blue Ridge/Piedmont Low Elevation Acidic Rocky Summit (Allard 1990) ?
- Low Elevation Rocky Summit (Acidic Subtype) (Schafale 1998b) ?

Classification Comments: North Carolina recognizes a Low Elevation Rocky Summit (Basic Subtype), a variant on mafic or basic metasedimentary rocks or felsic rocks influenced by base-rich seepage, containing plants that prefer higher pH conditions. It was formerly classified as a state nonstandard type, *Saxifraga michauxii - Cheilanthes lanosa - Hylotelephium telephioides* Herbaceous Vegetation (CEGL004989).

CONSERVATION RANKING & RARE SPECIES

GRank: G3? (1996-9-8): No information

High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge from southwestern Virginia south into Georgia. It may extend north into the Ridge and Valley. It is also reported from the Piedmont (M. Schafale pers. comm. 2001).

Subnations: GA, NC, SC, TN, VA?

TNC Ecoregions: 51:C, 52:C, 59:?

USFS Ecoregions: M221Aa:CPP, M221Dc:CCC, M221Dd:CCC

Federal Lands: USFS (Chattahoochee, Cherokee, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, Ambrose 1990a, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

MOUNTAIN GOLDEN-HEATHER - SAND-MYRTLE DWARF-SHRUBLAND

ELEMENT IDENTIFIERS

NVC association: *Hudsonia montana - Leiophyllum buxifolium* Dwarf-shrubland

Database Code: CEGL003948

Formation: Cespitose needle-leaved or microphyllous evergreen dwarf-shrubland (IV.A.1.N.a)

Alliance: *Leiophyllum buxifolium* Dwarf-shrubland Alliance (A.1063)

ELEMENT CONCEPT

Summary: On ledges of quartzite in Linville Gorge; now essentially extinct because of fire suppression, but in process of restoration by U.S. Forest Service, U.S. Fish and Wildlife Service, and N.C. Plant Conservation Program.

Environment: No information

Vegetation: No information

Dynamics: No information

Similar Associations:

Related Concepts:

- IE4a. Southern Appalachian High Elevation Acidic Rocky Summit (Allard 1990) ?

Classification Comments: See Nuttall's descriptions of Table Rock Mountain in the 1830s.

CONSERVATION RANKING & RARE SPECIES

GRank: GH (1994-11-15): This community is restricted to ledges of quartzite in Linville Gorge, North Carolina, where it historically covered many acres. It is now essentially extinct because of fire suppression, but it is also in process of restoration by the U.S. Forest Service, U.S. Fish and Wildlife Service, and N.C. Plant Conservation Program.
High-ranked species: *Hudsonia montana* (G1)

ELEMENT DISTRIBUTION

Range:
Subnations: NC
TNC Ecoregions: 51:X
USFS Ecoregions: M221Dc:XXX
Federal Lands: USFS (Pisgah)

ELEMENT SOURCES

References: Allard 1990, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

SOUTHERN APPALACHIAN SPRAY CLIFF

APPALACHIAN SHOESTRING FERN - CAVE ALUMROOT - APPALACHIAN BLUET / LIVERWORT SPECIES HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Vittaria appalachiana - Heuchera parviflora* var. *parviflora - Houstonia serpyllifolia / Plagiochila* spp. Herbaceous Vegetation
Database Code: CEGL004302
Formation: Saturated temperate perennial forb vegetation (V.B.2.N.f)
Alliance: *Vittaria appalachiana - Heuchera parviflora* Saturated Herbaceous Alliance (A.1696)

ELEMENT CONCEPT

Summary: This community includes herbaceous vegetation on rock substrates associated with the spray of cascades and waterfalls in the Southern Blue Ridge and adjacent portions of the Piedmont. It is found in southwestern North Carolina, northwestern South Carolina, and northeastern Georgia, in the escarpment gorges of the Southern Blue Ridge and west of the escarpment in eastern Tennessee. It occurs on saturated rock outcrops, on nearly vertical rock surfaces and ledges, slopes, and crevices with shallow soils which are constantly saturated. Vegetative coverage is sparse to moderate with 50-75% unvegetated surface (bedrock) possible. Vegetation grows in cracks and on organic accumulations on ledges. It is characterized by a variable but unique assemblage of vascular herbs, algae, and bryophytes, many of which are endemic to this community. Composition of this community varies from location to location, in part due to its insular nature. Characteristic species include liverworts (*Bazzania denudata, Conocephalum conicum, Oxalis montana, Pellia epiphylla, Pellia neesiana, Plagiochila austini, Plagiochila caduciloba, Plagiochila sharpii ssp. sharpii, Plagiochila* spp., *Plagiochila sullivantii, Riccardia multifida*); mosses (*Bryocrumia vivicolor, Dichodontium pellucidum, Fissidens osmundioides, Hyophila involuta, Mnium marginatum, Oncophorus raui, Plagiomnium affine, Plagiomnium carolinianum, Pseudotaxiphyllum distichaceum, Sphagnum girgensohnii, Sphagnum quinquefarium, Thalictrum* spp., *Thamnobryum alleghaniense*); ferns (*Adiantum pedatum, Asplenium monanthes, Asplenium montanum, Asplenium trichomanes ssp. trichomanes, Cystopteris protrusa, Grammitis nimbata (= Micropolypodium nimbatum), Hymenophyllum tayloriae, Polypodium virginianum, Trichomanes boschianum, Trichomanes intricatum, Vittaria appalachiana*); and other vascular species (*Galax urceolata, Heuchera parviflora var. parviflora, Houstonia serpyllifolia, Huperzia porophila, Hydrocotyle americana, Impatiens capensis, Phegopteris connectilis, Saxifraga careyana, Saxifraga caroliniana, Carex biltmoreana*). This community varies in composition with no consistent dominant species. Nominal species are either constant or regional endemics. South and west of the Blue Ridge Escarpment, this association is less diverse than those occurrences in the central portion of the range.
Environment: The hydrology of this community is supplied by constant spray from waterfalls. The community consists of nearly vertical rock surfaces and ledges, slopes, and crevices with shallow soils which are constantly saturated by spray from adjacent waterfalls. Freezing occurs very rarely, and flooding damage very seldom or never. Small pockets or mats of mineral or organic matter are interspersed with bare rock, and may or may not have seepage as well.
Vegetation: This association consists of a variable collection of mosses, liverworts, algae, vascular herbs, and occasional shrubs (generally less than 10%), most of them requiring constantly moist substrate and very high relative humidity. Many of the typical species of this community are bryophytes and ferns disjunct from tropical regions, endemic bryophytes, and ferns disjunct from boreal regions. Shrubs include *Rhododendron maximum* and *Kalmia latifolia*. Herb species include *Huperzia porophila, Asplenium montanum, Asplenium trichomanes, Asplenium rhizophyllum, Asplenium monanthes, Cystopteris protrusa, Polypodium appalachianum, Trichomanes boschianum, Grammitis nimbata, Vittaria appalachiana, Hymenophyllum tayloriae, Trichomanes*

intricatum, Phegopteris connectilis, Adiantum pedatum, Saxifraga careyana, Saxifraga caroliniana, Heuchera parviflora var. parviflora, Circaea alpina ssp. alpina, Impatiens capensis, Houstonia serpyllifolia, Hydrocotyle americana, Thalictrum spp., *Oxalis montana, Carex biltmoreana,* and *Galax urceolata*. Bryophyte species, many of them nearly or entirely limited to this community, include *Sphagnum quinquefarium, Sphagnum girgensohnii, Plagiomnium carolinianum, Plagiomnium affine (= Mnium affine), Mnium marginatum, Pseudotaxiphyllum distichaceum (= Isopterygium distichaceum), Bryocrumia vivicolor, Flakea papillosa, Hookeria acutifolia, Thamnobryum alleghaniense, Oncophorus raui, Hyophila involuta, Dichodontium pellucidum, Radula* spp., *Plagiochila sharpii, Plagiochila caduciloba, Plagiochila sullivantii, Plagiochila austini, Fissidens osmundioides, Bazzania denudata, Conocephalum conicum, Pellia epiphylla, Pellia neesiana,* and *Riccardia multifida*.

Dynamics: These communities occur in unusually stable and equitable environments. The humidity is high and moisture supply is essentially constant. Temperatures are moderated by water, rock, and sheltering from sun and wind, resulting in only rare freezes or high temperatures. Potential disturbances include extreme droughts or freezes that may result in some die-off of sensitive species. Floods or rock falls may damage some parts, but in general this community is well sheltered from physical disturbance.

Similar Associations:

Related Concepts:

- IID5a. Wet Acidic Cliff (Allard 1990) B
- Spray Cliff (Schafale 1998b) ?

Classification Comments: Zartman and Pittillo (1998) found *Thuidium delicatulum, Atrichum oerstedianum, Houstonia serpyllifolia,* and *Plagiomnium ciliare* to be the most constant species in spray cliff communities sampled from the Chattooga River Watershed, in northern Georgia, western North Carolina, and northwestern South Carolina.

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (1998-4-30): This community is very limited, known only from a few dozen occurrences, most of which are less than one acre in size; the largest are only about two acres in size. Most examples are in rugged montane areas and have escaped direct disturbance, though many may have been affected by logging or development on surrounding lands. Water-quality declines may have detrimental impacts on this very delicate and easily impacted community. Even limited human visitation has degraded some occurrences.

High-ranked species: *Acrobolbus ciliatus* (G3?), *Aneura sharpii* (G1G2), *Bryocrumia vivicolor* (G1G2), *Carex biltmoreana* (G3), *Hymenophyllum tayloriae* (G2), *Krigia montana* (G3), *Oncophorus raui* (G3), *Plagiochila austinii* (G3), *Plagiochila caduciloba* (G2), *Plagiochila sullivantii* (G2), *Plagiomnium carolinianum* (G3), *Saxifraga careyana* (G3), *Saxifraga caroliniana* (G2), *Trichomanes intricatum* (G3G4)

ELEMENT DISTRIBUTION

Range: It is found in southwestern North Carolina, northwestern South Carolina, and northeastern Georgia, in the escarpment gorges of the Southern Blue Ridge and west of the escarpment in eastern Tennessee.

Subnations: GA, NC, SC, TN

TNC Ecoregions: 51:C, 52:C

USFS Ecoregions: M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, Anderson et al. 1990, Dellinger unpubl. data 1992, Farrar 1998, Nelson 1986, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Stotler and Crandall-Stotler 1977, Weakley 1993, Weakley and Schafale 1994, Wharton 1978, Zartman and Pittillo 1998

SOUTHERN INTERIOR CALCAREOUS CLIFF

WALL-RUE - PURPLE CLIFFBRAKE SPARSE VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Asplenium ruta-muraria - Pellaea atropurpurea* Sparse Vegetation

Database Code: CEGL004476

Formation: Cliffs with sparse vascular vegetation (VII.A.1.N.a)

Alliance: *Asplenium ruta-muraria - Pellaea atropurpurea* Sparsely Vegetated Alliance (A.1832)

ELEMENT CONCEPT

Summary: This community includes calcareous cliffs associated with limestone or dolomite geology in Alabama, Kentucky, Maryland, North Carolina, Pennsylvania, South Carolina, Tennessee, Virginia, and West Virginia, and may possibly range into South Carolina. It has little vegetative cover, often with 90% of the rock surface unvegetated. Mosses and lichens can have moderate coverage, and vascular plants occur on ledges and rooted in cracks. Calciphilic herbs, such as *Asplenium ruta-muraria, Pellaea atropurpurea, Pellaea glabella ssp. glabella, Asplenium resiliens, Aquilegia canadensis*, are characteristic. Moister microhabitats of

the crevice may have mosses such as *Anomodon rostratus* and *Anomodon attenuatus*. This community includes dry to rather moist limestone and dolomite outcrops, usually shaded by trees rooted in adjacent forested communities.

Environment: This community includes dry to rather moist limestone and dolomite outcrops, usually shaded by trees rooted in adjacent forested communities. It has little vegetative cover, often with 90% of the rock surface unvegetated. Mosses and lichens can have moderate coverage, and vascular plants occur on ledges and rooted in cracks.

Vegetation: Stands of this association have little vegetative cover, often with 90% of the rock surface unvegetated. Mosses and lichens can have moderate coverage, and vascular plants occur on ledges and rooted in cracks. Calciphilic herbs, such as *Asplenium ruta-muraria, Pellaea atropurpurea, Pellaea glabella ssp. glabella, Asplenium resiliens, Aquilegia canadensis*, are characteristic. Moister microhabitats of the crevice may have mosses such as *Anomodon rostratus* and *Anomodon attenuatus*.

Dynamics: No information

Similar Associations:

Related Concepts:

- IE1a. Southern Appalachian Calcareous Cliff (Allard 1990) ?
- Montane Cliff (Calcareous Subtype) (Schafale 1998b) ?
- Spleenwort-cliffbrake calcareous cliff (CAP pers. comm. 1998) ?

Classification Comments: This community is extremely uncommon in the Southern Blue Ridge.

CONSERVATION RANKING & RARE SPECIES

GRank: G3G4 (1997-8-11): No information

High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community occurs in areas of limestone or dolomite geology from Pennsylvania south to Alabama. It is found primarily in the Ridge and Valley and Cumberland Plateau, but ranges into scattered areas in the Blue Ridge.

Subnations: AL, GA?, KY, MD, NC, PA, SC, TN, VA, WV

TNC Ecoregions: 50:C, 51:C, 59:C, 60:P

USFS Ecoregions: 221Hb:CCC, 221Hc:CCC, 221Ja:CCC, 222Eo:CCC, M221Aa:CCC, M221Ac:CCC, M221Bb:CCP, M221Be:CCC, M221Dc:CCC

Federal Lands: NPS (Great Smoky Mountains); USFS (Pisgah)

ELEMENT SOURCES

References: Allard 1990, CAP pers. comm. 1998, Fike 1999, Fleming et al. 2001, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

WETLANDS, VEGETATED

CENTRAL INTERIOR HIGHLANDS AND APPALACHIAN SINKHOLE AND DEPRESSION POND

AMERICAN BUR-REED - NARROWLEAF WILLOW-HERB HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Sparganium americanum - Epilobium leptophyllum* Herbaceous Vegetation

Database Code: CEGL004510

Formation: Seasonally flooded temperate or subpolar grassland (V.A.5.N.k)

Alliance: *Sparganium americanum* Seasonally Flooded Herbaceous Alliance (A.1388)

ELEMENT CONCEPT

Summary: Wet, bog-like areas, with seasonal flooding, especially areas formerly flooded by beavers. *Sparganium americanum* strongly dominates the dense herb layer. Other species may include *Epilobium leptophyllum, Epilobium coloratum, Polygonum punctatum, Potamogeton* sp., *Ludwigia palustris*, and others.

Environment: In the Pisgah National Forest of North Carolina, this vegetation occupies wet, bog-like habitats with seasonal flooding, especially in areas formerly flooded by beavers. In the Allegheny Mountains, it occurs in abandoned beaver ponds and along small, beaver-impeded streams within northern hardwood or red spruce forest zones. In Virginia, the type is restricted to gentle, upper-slope stream-head valleys above 1060 m (3500 feet) elevation, where it occurs in patch-mosaics with wet spruce forests, sphagnous seepage bogs, and open to scrubby meadows. These sites were heavily altered by logging in the late 1920s. Soils are predominantly well-decomposed peat and organic muck with extremely low pH (ca. 3.9) and base status.

Vegetation: Vegetation of this community type is almost entirely herbaceous. In North Carolina stands, *Sparganium americanum* strongly dominates the dense herb layer. Associated species include *Epilobium leptophyllum, Epilobium coloratum, Polygonum punctatum, Potamogeton* sp., *Ludwigia palustris*, and others. In the Allegheny Mountains, *Sparganium americanum* and *Scirpus expansus* dominate in variable proportions. Common associates include *Carex scoparia, Carex gynandra, Carex stipata, Epilobium*

leptophyllum, Glyceria melicaria, Glyceria striata, Hydrocotyle americana, Impatiens capensis, Poa palustris, Polygonum hydropiperoides, Polygonum sagittatum, Scirpus hattorianus, Scutellaria lateriflora, Solidago rugosa, Sphenopholis pensylvanica, and *Symphyotrichum prenanthoides (= Aster prenanthoides)*. More locally, *Glyceria grandis* is an abundant grass.
Dynamics: No information
Similar Associations:
Related Concepts:
- *Picea rubens / Vaccinium angustifolium - Epilobium leptophyllum* Association: *Carex stipata - Sparganium americanum* Subassociation (Fleming and Moorhead 1996) ?
- *Sparganium americanum - Epilobium leptophyllum* Herbaceous Vegetation (Fleming and Coulling 2001) ?
- IID6a. Natural Impoundment Pond (Allard 1990) B Piedmont/Mountain Semipermanent Impoundment (Montane Boggy Subtype) (Schafale 1998b) ?

Classification Comments: Similar vegetation may occur in the Ridge and Valley of Virginia in abandoned beaver ponds. [See VAHP's Laurel Fork report, *Carex stipata - Sparganium americanum* subassociation (Fleming and Morehead 1996).]. Although not formally documented from West Virginia, large stands of this vegetation have been observed by Virginia DCR-DNH ecologists on the West Virginia slope of Allegheny Mountain in Pocahontas County, and many of its constituent species were reported by Allard and Leonard (1952) from wetlands in Canaan Valley (Tucker County). Additional occurrences are likely throughout the higher Allegheny region of West Virginia.

CONSERVATION RANKING & RARE SPECIES

GRank: G2G3 (2001-3-1): This association is known from only a few sites, each very small. It is dependent on periodic re-establishment by beaver flooding.
High-ranked species: *Aeshna mutata* (G3G4)

ELEMENT DISTRIBUTION

Range: This community is known from a few high-elevation sites in the Southern Blue Ridge of North Carolina and the Allegheny Mountains of Virginia and West Virginia.
Subnations: NC, TN, VA, WV
TNC Ecoregions: 50:P, 51:C, 59:C
USFS Ecoregions: M221Ba:CCC, M221Dc:CCC
Federal Lands: USFS (George Washington, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Allard and Leonard 1952, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

WOOLGRASS BULRUSH - THREEWAY SEDGE / PEATMOSS SPECIES HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Scirpus cyperinus - Dulichium arundinaceum / Sphagnum* spp. Herbaceous Vegetation
Database Code: CEGL004134
Formation: Seasonally flooded temperate or subpolar grassland (V.A.5.N.k)
Alliance: *Scirpus cyperinus* Seasonally Flooded Herbaceous Alliance (A.1386)

ELEMENT CONCEPT

Summary: This community includes emergent zones in upland depression ponds of the mountains of North Carolina and adjacent states, where water is ponded by an impermeable substrate. It includes a variety of shrub- and herb-dominated upland wetlands with very different substrates. Herbaceous vegetation occurs in monospecific clumps, with *Sphagnum* mats, and scattered shrubs and trees around the margins. Typical dominants are *Scirpus cyperinus, Dulichium arundinaceum, Juncus effusus var. solutus,* and *Juncus canadensis*. Other species include *Bartonia virginica, Osmunda regalis var. spectabilis, Sphagnum lescurii, Sphagnum pylaesii, Sphagnum cuspidatum, Sphagnum palustre*, and *Sphagnum recurvum*. Sparsely distributed trees may include *Nyssa sylvatica, Quercus phellos, Acer rubrum*, and *Liquidambar styraciflua*. Shrubs include *Cephalanthus occidentalis, Vaccinium* spp., and *Leucothoe racemosa*. This community has a pronounced seasonal fluctuation in water level, filling in the winter and often drying completely in the summer. It is extremely rare, known only from very few scattered sites in Burke and Buncombe counties, North Carolina.
Environment: Soils have a mucky surface layer and have a shallow clay hardpan or rock layer that prevents drainage. They are seasonally to semipermanently flooded, with rainfall apparently the main source of water (Weakley and Schafale 1994). This community has a pronounced seasonal fluctuation in water level, filling in the winter and often drying completely in the summer. Linville Mountain Pond is approximately 15 x 20 meters in size, occurs at 907 meters elevation over lower quartzite geology.
Vegetation: This community is dominated by various wetland shrubs and herbs. Herbaceous vegetation occurs in monospecific clumps, with *Sphagnum* mats, and scattered shrubs and trees around the margins. Other species include *Bartonia virginica, Juncus effusus var. solutus, Osmunda regalis var. spectabilis, Juncus canadensis, Sphagnum lescurii, Sphagnum pylaesii, Sphagnum*

cuspidatum, Sphagnum palustre, and *Sphagnum recurvum*. Sparsely distributed trees may include *Nyssa sylvatica, Quercus phellos, Acer rubrum*, and *Liquidambar styraciflua*. Shrubs include *Cephalanthus occidentalis, Vaccinium* spp., and *Leucothoe racemosa*. This community is surrounded by forests dominated by *Quercus prinus* and *Quercus coccinea*.

Dynamics: This upland pool community seems to be stable over long periods, but will slowly fill with sediment or organic matter. An ephemeral drawdown community may occur when water level drops. Extended droughts may be necessary for establishment of some species (Weakley and Schafale 1994). With time, occurrences of this community may gradually fill with sediment or organic matter and be succeeded by swamp forests or non-wetland forests.

Similar Associations:

Related Concepts:

- *Scirpus cyperinus-Dulichium* Pond (Newell and Peet 1995) ?
- IIE1g. Interior Vernal Pool Complex (Allard 1990) B
- Upland Pool (Weakley and Schafale 1994) ?
- Upland Pool (Mountain Subtype) (Schafale 1998b) ?

Classification Comments: This community provides important breeding habitat for amphibians. It is distinguished from all other wetlands in the Southern Blue Ridge by having standing water for significant parts of the year and by the lack of peaty mats and bog species found in other non-alluvial mountain wetlands. This classification was based on data from Linville Mountain Pond (Newell and Peet 1995) and may be modified as more regional information is collected. This association may be related to Virginia's Mountain Pools in the Shenandoahs. Resolve the classification with floristically similar types in the Coastal Plain and Piedmont of Virginia.

CONSERVATION RANKING & RARE SPECIES

GRank: G1Q (1995-7-15): This community is extremely rare, known only from very few scattered sites, totaling less than 100 acres, in Burke and Buncombe counties, North Carolina. Naturally occurring montane, upland depression pools are uncommon because the topographic and hydrologic situation necessary for the development of this community is almost non-existent in the highly weathered landscape of the southern Appalachians. These habitats provide important breeding habitat for amphibians. This association, or one similar to it, may occur in the Ridge and Valley of Virginia.

High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge of North Carolina and Georgia, and may extend north into the Ridge and Valley of Virginia. Its possible occurrence in South Carolina and Tennessee is speculative.

Subnations: GA, NC, SC?, TN, VA?

TNC Ecoregions: 51:C, 59:C

USFS Ecoregions: M221Dc:CCC

Federal Lands: USFS (Chattahoochee?, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Anderson 1990, Newell and Peet 1995, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Weakley 1993, Weakley and Schafale 1994

SOUTH-CENTRAL INTERIOR LARGE FLOODPLAIN

(EASTERN PERSIMMON, SYCAMORE) / LATE THOROUGHWORT - VIRGINIA BUTTONWEED HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *(Diospyros virginiana, Platanus occidentalis) / Eupatorium serotinum - Diodia virginiana* Herbaceous Vegetation

Database Code: CEGL003910

Formation: Temporarily flooded temperate perennial forb vegetation (V.B.2.N.d)

Alliance: *Eupatorium serotinum - Diodia virginiana* Temporarily Flooded Herbaceous Alliance (A.2017)

ELEMENT CONCEPT

Summary: This association consists of drawdown zones around artificial impoundments in the Southern Appalachians and likely adjacent provinces. Physiognomy and composition are highly variable. A scattering to sometimes well-developed stratum of woody trees and saplings is sometime present, and often includes species such as *Diospyros virginiana, Betula nigra*, and *Platanus occidentalis*. Characteristic herbs are weedy colonizers, such as *Eupatorium serotinum, Diodia virginiana, Juncus effusus, Ambrosia artemisiifolia, Juncus tenuis, Scirpus cyperinus, Lobelia inflata, Lobelia cardinalis, Apocynum cannabinum, Polygonum hydropiperoides, Acalypha virginica, Andropogon virginicus, Panicum* spp., *Hypericum mutilum, Hypericum punctatum, Plantago* spp., *Pseudognaphalium* spp., and others.

Environment: This community occurs along shores of artificial impoundments.

Vegetation: Physiognomy and composition are highly variable. A scattering to sometimes well-developed stratum of woody trees and saplings is sometime present, and often includes species such as *Diospyros virginiana, Betula nigra,* and *Platanus occidentalis*. Characteristic herbs are weedy colonizers, such as *Eupatorium serotinum, Diodia virginiana, Juncus effusus, Ambrosia artemisiifolia, Juncus tenuis, Scirpus cyperinus, Lobelia inflata, Lobelia cardinalis, Apocynum cannabinum, Polygonum hydropiperoides, Acalypha virginica, Andropogon virginicus, Panicum* spp., *Hypericum mutilum, Hypericum punctatum, Plantago* spp., *Pseudognaphalium* spp., and others.
Dynamics: This community is highly variable in space and time, due to differences in substrate, flooding regime, length of time since flooding, etc.
Similar Associations:
Related Concepts: No information
Classification Comments: This type will need substantial additional documentation, likely leading to classification and nomenclatural changes.

CONSERVATION RANKING & RARE SPECIES

GRank: GNA (invasive) (2002-11-1): No information
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community is found at low elevations of the southern Blue Ridge Mountains of western North Carolina, eastern Tennessee, northern Georgia, and probably northwestern South Carolina.
Subnations: GA, NC, SC?, TN, VA?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Nantahala)

ELEMENT SOURCES

References: NatureServe Ecology - Southeastern U.S. unpubl. data, Southeastern Ecology Working Group n.d.

CAROLINA RED MAPLE - GREEN ASH / FRINGED SEDGE - GREEN ARROW-ARUM FOREST

ELEMENT IDENTIFIERS

NVC association: *Acer rubrum* var. *trilobum - Fraxinus pennsylvanica / Carex crinita - Peltandra virginica* Forest
Database Code: CEGL004420
Formation: Seasonally flooded cold-deciduous forest (I.B.2.N.e)
Alliance: *Acer rubrum - Fraxinus pennsylvanica* Seasonally Flooded Forest Alliance (A.316)

ELEMENT CONCEPT

Summary: This community occurs in floodplain depressions in the Blue Ridge of North Carolina and possibly Tennessee. Some characteristic and often dominant canopy and subcanopy species include *Acer rubrum var. trilobum* and *Fraxinus pennsylvanica*. *Peltandra virginica* is prominent in the herbaceous layer. Other herbaceous species include *Carex crinita var. brevicrinis, Sparganium americanum, Leersia oryzoides, Cornus amomum (= ssp. amomum), Carex lupulina, Juncus effusus, Onoclea sensibilis*, and the aliens *Murdannia keisak* and *Microstegium vimineum*.
Environment: This community occurs in floodplain depressions in the Blue Ridge of North Carolina and possibly Tennessee.
Vegetation: Some characteristic and often dominant canopy and subcanopy species in stands of this association include *Acer rubrum var. trilobum* and *Fraxinus pennsylvanica*. *Peltandra virginica* is prominent in the herbaceous layer. Other herbaceous species include *Carex crinita var. brevicrinis, Sparganium americanum, Leersia oryzoides, Cornus amomum (= ssp. amomum), Carex lupulina, Juncus effusus, Onoclea sensibilis*, and the aliens *Murdannia keisak* and *Microstegium vimineum*.
Dynamics: No information
Similar Associations:
Related Concepts:
- IIA6e. Southern Appalachian Alluvial Forest (Allard 1990) B
- Montane Floodplain Slough Forest (Schafale 1998a) ?

Classification Comments: Known from alluvial depressions along the Little Tennessee River, probably more widespread (though certainly not common). Data are available from the North Carolina Vegetation Survey.

CONSERVATION RANKING & RARE SPECIES

GRank: G1 (2001-1-31): This floodplain depression forest occurs at very few sites in the floodplains of rivers in the Blue Ridge physiographic province. It is naturally very limited in extent. Many examples have been destroyed by alteration of floodplains, and all remaining examples have been altered by timber harvest, hydrologic alteration, and exotic species.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community occurs in the Blue Ridge of North Carolina and possibly Tennessee.
Subnations: NC, TN?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Pisgah)

ELEMENT SOURCES

References: Allard 1990, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Schafale 1998a, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

SWEETGUM - TULIPTREE - (SYCAMORE) / IRONWOOD - MOUNTAIN SILVERBELL / HOG-PEANUT FOREST

ELEMENT IDENTIFIERS

NVC association: *Liquidambar styraciflua - Liriodendron tulipifera - (Platanus occidentalis) / Carpinus caroliniana - Halesia tetraptera / Amphicarpaea bracteata* Forest
Database Code: CEGL007880
Formation: Temporarily flooded cold-deciduous forest (I.B.2.N.d)
Alliance: *Platanus occidentalis - (Liquidambar styraciflua, Liriodendron tulipifera)* Temporarily Flooded Forest Alliance (A.289)

ELEMENT CONCEPT

Summary: This is a low-elevation montane or submontane alluvial forest which is found on large alluvial flats and high terraces along large rivers (e.g., Little Pigeon River) or on small, disturbed flats along medium-sized perennial streams. It is found at lower elevations in the southern fringes of the Southern Blue Ridge Province, or in the adjacent Piedmont and Southern Ridge and Valley. It often occurs on sites that were formerly cleared for farming or settlement. Soils are typically deep, loamy silts but can have large rocks and cobbles. In the Great Smoky Mountains, the mean elevation of samples is 1680 feet, ranging from 1480-1900 feet. It would be possibly expected at lower elevations as well, especially in the adjacent ecoregions. This forest has an open to closed canopy dominated by *Liquidambar styraciflua* and *Liriodendron tulipifera*, often with *Platanus occidentalis*. It is distinguished from other kinds of Montane Alluvial Forests by the dominance or relatively higher importance of *Liquidambar styraciflua* in its stands, and by its habitat on larger, lower-elevation, riverine situations. *Platanus* is characteristic, but not necessarily dominant in stands of this association. Other minor species that are variably present in the canopy include *Acer rubrum, Aesculus flava, Fraxinus americana, Juglans cinerea, Juglans nigra, Pinus virginiana, Prunus serotina, Robinia pseudoacacia, Tilia americana var. heterophylla*, and *Ulmus americana*. In habitats with a more calcareous influence in the substrate, *Juglans nigra* may have a higher relative importance or even be codominant. The subcanopy is absent to well-developed. Typical dominants are *Carpinus caroliniana, Cornus florida*, and *Acer rubrum*. Other species that can be present in the subcanopy include *Betula alleghaniensis, Betula lenta, Aesculus flava, Tsuga canadensis, Juglans cinerea, Halesia tetraptera (var. monticola, var. tetraptera), Acer pensylvanicum, Acer saccharum, Amelanchier laevis, Oxydendrum arboreum*, and *Prunus serotina*. The shrub stratum is absent to moderately dense. *Rhododendron maximum* and *Tsuga canadensis* are the most common shrubs, although other species can be present, including *Alnus serrulata, Hamamelis virginiana*, and *Lindera benzoin*. Vines can include *Campsis radicans, Menispermum canadense, Parthenocissus quinquefolia, Smilax bona-nox*, and *Toxicodendron radicans*. Herbaceous cover is often absent or sparse, with ground cover dominated by litter and duff. On smaller streams, near open fields or where animal grazing is evident, herbaceous cover can approach 100% cover. Species often present with high coverage include *Amphicarpaea bracteata, Ageratina altissima var. altissima, Dichanthelium boscii, Thelypteris noveboracensis*, and *Toxicodendron radicans ssp. radicans*. Stands found on small, disturbed flats along medium-sized perennial streams may contain patches of *Xanthorhiza simplicissima*. Other common species include *Arisaema triphyllum, Asplenium platyneuron, Eurybia divaricata (= Aster divaricatus), Rudbeckia laciniata, Carex* spp. (e.g., *Carex digitalis, Carex intumescens, Carex laxiflora var. laxiflora, Carex plantaginea, Carex platyphylla, Carex retroflexa, Carex swanii, Carex torta), Dichanthelium* spp. (e.g., *Dichanthelium commutatum, Dichanthelium dichotomum, Dichanthelium sphaerocarpon), Collinsonia canadensis, Elymus virginicus, Houstonia serpyllifolia, Laportea canadensis, Lobelia cardinalis, Mertensia virginica, Mitchella repens, Polystichum acrostichoides, Prenanthes* spp., *Rudbeckia laciniata, Sanicula canadensis, Smallanthus uvedalius, Viola cucullata, Viola sororia*, and *Verbesina alternifolia*. The exotic grass *Microstegium vimineum* may have high cover in some stands.
Environment: This forest was defined from Great Smoky Mountains National Park, Tennessee, where it is found on large alluvial flats and high terraces along large rivers (e.g., Little Pigeon River) or on small, disturbed flats along medium-sized perennial streams. It often occurs on sites that were formerly cleared for farming or settlement. Soils are typically deep, loamy silts but can have large rocks and cobbles. The mean elevation of samples is 1680 feet, ranging from 1480-1900 feet.
Vegetation: This forest has an open to closed canopy dominated by *Liquidambar styraciflua* and *Liriodendron tulipifera*, often with *Platanus occidentalis*. Other minor species that are variably present in the canopy include *Acer rubrum, Fraxinus americana, Juglans nigra, Pinus virginiana, Prunus serotina, Robinia pseudoacacia, Tilia americana var. heterophylla*, and *Ulmus americana*. In habitats with a more calcareous influence in the substrate, *Juglans nigra* may have a higher relative importance or even be codominant. The subcanopy is absent to well-developed. Typical dominants are *Carpinus caroliniana, Cornus florida*, and *Acer rubrum*. Other species that can be present in the subcanopy include *Betula alleghaniensis, Betula lenta, Tsuga canadensis, Juglans*

cinerea, Halesia tetraptera var. monticola, Acer pensylvanicum, Acer saccharum, Amelanchier laevis, Oxydendrum arboreum, and *Prunus serotina*. The shrub stratum is absent to moderately dense. *Rhododendron maximum* and *Tsuga canadensis* are the most common shrubs, although other species can be present. Herbaceous cover is often absent or sparse, with ground cover dominated by litter and duff. On smaller streams, near open fields or where animal grazing is evident, herbaceous cover can approach 100% cover. Species often present with high coverage include *Amphicarpaea bracteata, Dichanthelium boscii, Microstegium vimineum, Thelypteris noveboracensis,* and *Toxicodendron radicans ssp. radicans*. Other common species include *Arisaema triphyllum, Asplenium platyneuron, Eurybia divaricata (= Aster divaricatus), Carex* spp. (e.g., *Carex digitalis, Carex intumescens, Carex laxiflora var. laxiflora, Carex plantaginea, Carex platyphylla, Carex retroflexa, Carex swanii, Carex torta), Dichanthelium* spp. (e.g., *Dichanthelium commutatum, Dichanthelium dichotomum, Dichanthelium sphaerocarpon), Houstonia serpyllifolia, Laportea canadensis, Mitchella repens, Parthenocissus quinquefolia, Polystichum acrostichoides, Prenanthes* spp., *Sanicula canadensis,* and *Verbesina alternifolia*.

Dynamics: No information

Similar Associations:

- *Platanus occidentalis - Liriodendron tulipifera - Betula (alleghaniensis, lenta) / Alnus serrulata - Leucothoe fontanesiana* Forest (CEGL004691)

Related Concepts:

- *Platanus/Asimina/Microstegium* Alluvial Forest (Newell and Peet 1995) ?
- IIA6e. Southern Appalachian Alluvial Forest (Allard 1990) B

Classification Comments: This type is distinguished from other kinds of Montane Alluvial Forests by the dominance or relatively higher importance of *Liquidambar styraciflua* in its stands, and by its habitat on larger, lower elevation, riverine situations. Natural forests strongly dominated by *Liquidambar styraciflua* are uncommon in Southern Blue Ridge landscapes, thus this forest may represent a community that is more common at lower elevations in the southern fringes of the Southern Blue Ridge Province, or in the adjacent Piedmont and Southern Ridge and Valley. Information from a larger geographic range is needed to fully distinguish this association from related types. A similar alliance is the I.B.2.N.d *Liquidambar styraciflua - (Liriodendron tulipifera, Acer rubrum)* Temporarily Flooded Forest Alliance (A.287), but it is currently not defined for the Southern Blue Ridge. In Great Smoky Mountains National Park, Tennessee, this vegetation is found on the Little Pigeon River. A stand in Linville Gorge, now placed here (Newell and Peet 1997) is referred to as a "large high alluvial flat" in which *Liquidambar styraciflua* shares dominance. This association was initially defined from disturbed floodplains in Great Smoky Mountains National Park and is related to the more broadly defined *Platanus occidentalis - Liriodendron tulipifera - Betula (alleghaniensis, lenta) / Alnus serrulata - Leucothoe fontanesiana* Forest (CEGL004691), Montane Alluvial Forest.

CONSERVATION RANKING & RARE SPECIES

GRank: GNR (1999-3-22): The conservation status of this community has not yet been assessed.

High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community was defined from the western fringe of the Southern Blue Ridge, but is also found at lower elevations in the southern fringes of the Southern Blue Ridge Province, and probably in the adjacent Piedmont and Southern Ridge and Valley.

Subnations: GA, NC, TN

TNC Ecoregions: 51:C

USFS Ecoregions: M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Pisgah)

ELEMENT SOURCES

References: Allard 1990, NatureServe Ecology - Southeastern U.S. unpubl. data, NatureServe Ecology - Southeastern U.S. unpubl. data, Newell and Peet 1995, Patterson et al. 1999, Peet et al. unpubl. data 2002, Southeastern Ecology Working Group n.d.

SYCAMORE - TULIPTREE - (YELLOW BIRCH, SWEET BIRCH) / SMOOTH ALDER - MOUNTAIN DOGHOBBLE FOREST

ELEMENT IDENTIFIERS

NVC association: *Platanus occidentalis - Liriodendron tulipifera - Betula (alleghaniensis, lenta) / Alnus serrulata - Leucothoe fontanesiana* Forest

Database Code: CEGL004691

Formation: Temporarily flooded cold-deciduous forest (I.B.2.N.d)

Alliance: *Platanus occidentalis - (Liquidambar styraciflua, Liriodendron tulipifera)* Temporarily Flooded Forest Alliance (A.289)

ELEMENT CONCEPT

Summary: This association covers alluvial forests of Southern Blue Ridge and nearby portions of the inner Piedmont. This type is associated with narrow, rocky floodplains and islands in medium-sized rivers, typically at elevations below 3000 feet. It is more frequent below 2000 feet. Canopy composition of stands is variable but typical dominants are *Platanus occidentalis, Liriodendron tulipifera, Fraxinus americana, Betula alleghaniensis,* and *Betula lenta*. *Platanus* is characteristic, but not necessarily dominant in

stands of this association. Other canopy/subcanopy trees can include *Carpinus caroliniana, Betula nigra, Acer rubrum, Pinus virginiana, Pinus strobus*, and *Tsuga canadensis*. In contrast to montane alluvial forests on the margins of the Southern Blue Ridge or on larger rivers, *Liquidambar styraciflua* is rare to absent in this type. The shrub stratum can be dense, often with local dominance by *Leucothoe fontanesiana* or *Rhododendron maximum*. Other characteristic shrubs include *Alnus serrulata, Xanthorhiza simplicissima, Corylus americana, Cornus amomum, Hamamelis virginiana, Euonymus americana*, and *Hydrangea arborescens*. Vines can be prominent including *Aristolochia macrophylla, Parthenocissus quinquefolia, Smilax glauca, Smilax rotundifolia*, and *Vitis aestivalis*. Herbaceous species composition varies from site to site, and herbaceous strata can be quite patchy on the rocky substrate. Characteristic species known from these forests include *Amphicarpaea bracteata, Actaea racemosa (= Cimicifuga racemosa), Polystichum acrostichoides, Eurybia divaricata (= Aster divaricatus), Anemone quinquefolia, Athyrium filix-femina, Claytonia virginica, Erythronium americanum, Medeola virginiana, Packera aurea, Stellaria pubera, Tiarella cordifolia*, and *Viola blanda*. *Carex* species may be common (e.g., *Carex appalachica, Carex austrocaroliniana, Carex blanda, Carex digitalis, Carex plantaginea, Carex swanii, Carex torta*). Examples are known from the Nantahala Gorge, Slickrock Creek, the South Toe River, and the Black and Craggy Mountains.

Environment: This association covers alluvial forests of Southern Blue Ridge and nearby portions of the inner Piedmont. This type is associated with narrow, rocky floodplains and islands in medium-sized rivers, typically at elevations below 3000 feet. It is more frequent below 2000 feet. Examples are known from the Nantahala Gorge, Slickrock Creek (Newell et al. 1997), Great Smoky Mountains, the South Toe River, the Black and Craggy Mountains (McLeod and Ulrey unpubl. data), and the Chattahoochee National Forest of Georgia.

Vegetation: Canopy composition of stands is variable but typical dominants are *Platanus occidentalis, Liriodendron tulipifera, Fraxinus americana, Betula alleghaniensis*, and *Betula lenta*. *Platanus* is characteristic, but not necessarily dominant in stands of this association. Other canopy/subcanopy trees can include *Carpinus caroliniana, Betula nigra, Acer rubrum, Pinus virginiana, Pinus strobus*, and *Tsuga canadensis*. In contrast to montane alluvial forests on the margins of the Southern Blue Ridge or on larger rivers, *Liquidambar styraciflua* is rare to absent in this type. The shrub stratum can be dense, often with local dominance by *Leucothoe fontanesiana* or *Rhododendron maximum*. Other characteristic shrubs include *Alnus serrulata, Xanthorhiza simplicissima, Corylus americana, Cornus amomum, Hamamelis virginiana, Euonymus americana*, and *Hydrangea arborescens*. Vines can be prominent including *Aristolochia macrophylla, Parthenocissus quinquefolia, Smilax glauca, Smilax rotundifolia*, and *Vitis aestivalis*. Herbaceous species composition varies from site to site, and herbaceous strata can be quite patchy on the rocky substrate. Characteristic species known from these forests include *Amphicarpaea bracteata, Actaea racemosa (= Cimicifuga racemosa), Polystichum acrostichoides, Eurybia divaricata (= Aster divaricatus), Anemone quinquefolia, Athyrium filix-femina, Claytonia virginica, Erythronium americanum, Medeola virginiana, Packera aurea, Stellaria pubera, Tiarella cordifolia*, and *Viola blanda*. In addition, *Carex* species may be common (e.g., *Carex appalachica, Carex austrocaroliniana, Carex blanda, Carex digitalis, Carex plantaginea, Carex swanii, Carex torta*).

Dynamics: No information

Similar Associations:

- *Liquidambar styraciflua - Liriodendron tulipifera - (Platanus occidentalis) / Carpinus caroliniana - Halesia tetraptera / Amphicarpaea bracteata* Forest (CEGL007880) -- with at least partial dominance by *Liquidambar styraciflua*.

Related Concepts:

- *Liriodendron - Platanus / Amphicarpaea* Alluvial Forest (Newell et al. 1997) ?
- *Platanus - Betula alleghaniensis* Alluvial Forest (Newell et al. 1997) ?
- Alluvial Forest (McLeod 1988) ?
- Floodplain Woodlands (Pittillo and Smathers 1979) ?
- IIA6e. Southern Appalachian Alluvial Forest (Allard 1990) B
- Montane Alluvial Forest (Large River Subtype) (Schafale 1998a) ?

Classification Comments: This alluvial forest type is less common in the Southern Blue Ridge than alluvial forests dominated by *Tsuga canadensis*, which are found in areas with better-developed soils and less frequent flooding than the I.A.8.N.e *Tsuga canadensis - (Pinus strobus)* Temporarily Flooded Forest Alliance (A.171).

CONSERVATION RANKING & RARE SPECIES

GRank: G2? (1999-2-23): This community is naturally uncommon in the Southern Blue Ridge. Well-developed examples are rare due to clearing for agriculture and development. This community is threatened by road building and other disturbances causing hydrologic alteration.

High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community is found in the Southern Blue Ridge of western North Carolina, northern South Carolina, and eastern Tennessee. It likely extends into Georgia.

Subnations: GA?, NC, SC, TN

TNC Ecoregions: 51:C, 52:C

USFS Ecoregions: M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee?, Cherokee?, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, McLeod 1988, NatureServe Ecology - Southeastern U.S. unpubl. data, Newell and Peet 1995, Newell et al. 1997, Peet et al. unpubl. data 2002, Pittillo and Smathers 1979, Schafale 1998a, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

TWISTED SEDGE HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Carex torta* Herbaceous Vegetation
Database Code: CEGL004103
Formation: Temporarily flooded temperate or subpolar grassland (V.A.5.N.j)
Alliance: *Carex torta* Temporarily Flooded Herbaceous Alliance (A.1340)

ELEMENT CONCEPT

Summary: This association accommodates *Carex torta*-dominated alluvial wetlands on sand, gravel, and rock bars along riverbanks in valleys and gorges in the southern Appalachians, ranging west into the Cumberland Plateau and the Interior Low Plateau, and north into the Central Appalachians. This association is characterized by light-requiring, tough-rooted herbaceous perennials tolerant of frequent inundation and flood-scouring. *Carex torta* often forms dense, extensive colonies. Associated species vary with geography but can include *Verbena hastata, Doellingeria umbellata (= Aster umbellatus), Dichanthelium clandestinum, Solidago rugosa ssp. aspera, Juncus effusus, Scirpus expansus, Scirpus cyperinus, Equisetum arvense, Onoclea sensibilis, Vernonia noveboracensis, Lycopus virginicus, Scutellaria lateriflora, Lobelia cardinalis, Symphyotrichum dumosum (= Aster dumosus), Lycopus virginicus, Osmunda regalis, Hypericum mutilum, Eupatorium fistulosum, Solidago patula,* and *Salix sericea*.

Environment: This association occupies boulder and gravel bars on the frequently flooded, active channel shelves of high-gradient rivers and large streams. Along Laurel Fork, flooding duration is probably similar to that documented along Passage Creek in Shenandoah County, Virginia, by Hupp (1982). In that drainage, the channel shelf was inundated approximately 15% of the time. Periodic large or severe floods transport and deposit large numbers of cobbles, stones, and even boulders in characteristic bars both within the channel (islands) and along its edges (streambanks). These bars provide a matrix for deposition of finer alluvium and habitats for the establishment of tough, adaptable herbaceous plants, which in turn stabilize the bars with massive networks of perennial rootstocks. Regular flood-scouring batters or removes woody plants which take root in these habitats, maintaining open-canopy conditions. These habitats are highly dynamic, with conditions more or less constantly shifting in response to an irregular but powerful disturbance regime. While some of the bar habitats may be damaged or removed by severe floods, others may accrete or be newly deposited during the same events.

Vegetation: Vegetation is characterized by light-demanding, tough-rooted herbaceous perennials tolerant of frequent inundation and flood-scouring. *Carex torta* is the dominant species and typically forms dense, extensive colonies. Associated species vary with geography but can include *Verbena hastata, Doellingeria umbellata (= Aster umbellatus), Dichanthelium clandestinum, Solidago rugosa ssp. aspera, Juncus effusus var. solutus, Scirpus expansus, Scirpus cyperinus, Equisetum arvense, Onoclea sensibilis, Vernonia noveboracensis, Lycopus virginicus, Scutellaria lateriflora, Lobelia cardinalis, Symphyotrichum dumosum (= Aster dumosus), Osmunda regalis var. spectabilis, Eupatorium fistulosum, Solidago patula,* and *Hypericum mutilum*. Small specimens of *Salix sericea* and other woody plants are also frequent.

Dynamics: Periodic large or severe floods transport and deposit large numbers of cobbles, stones, and even boulders in characteristic bars both within the channel (islands) and along its edges (streambanks). These bars provide a matrix for deposition of finer alluvium and habitats for the establishment of tough, adaptable herbaceous plants, which in turn stabilize the bars with massive networks of perennial rootstocks. Regular flood-scouring batters or removes woody plants which take root in these habitats, maintaining open-canopy conditions. These habitats are highly dynamic, with conditions more or less constantly shifting in response to an irregular but powerful disturbance regime. While some of the bar habitats may be damaged or removed by severe floods, others may accrete or be newly deposited during the same events (Hupp 1982). Successionally, this unit can be considered a pioneering type on new, coarse alluvial land, but it is also more or less permanently maintained by natural disturbances.

Similar Associations:

- *Carex torta - Apocynum cannabinum* Herbaceous Vegetation (CEGL006536)

Related Concepts:

- *Carex torta* Association (Fleming and Moorhead 1996) ?
- *Carex torta* Herbaceous Vegetation (Fleming and Coulling 2001) ?
- IIE3a. Riverside Shoal and Stream Bar Complex (Allard 1990) B
- Riverine Upper and Lower Perennial Beach/Bar, Cobble/Gravel, Seasonally Flooded (R2and3BB1C) (Cowardin et al. 1979) ?
- Riverine Upper and Lower Perennial Beach/Bar, Sand, Seasonally Flooded (R2and3BB2C) (Cowardin et al. 1979) ?
- Rocky Bar and Shore (Twisted Sedge Subtype) (Schafale 1998b) ?
- Torturous sedge gravel rivershore (CAP pers. comm. 1998) ?

Classification Comments:

CONSERVATION RANKING & RARE SPECIES

GRank: G3G4 (2000-1-21): This community is found as linear occurrences along waterways in the Southern Appalachians, west into the Cumberland Plateau and the Interior Low Plateau, and north into the Central Appalachians and Allegheny Mountains. Although this community has a moderately large geographic range, it is uncommon within its range and occurrences are small. This community is more common than the number of documented occurrences would suggest, since it is often overlooked in inventories.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community is found as linear occurrences along waterways in the Southern Appalachians, west into the Cumberland Plateau and the Interior Low Plateau, and north into the Central Appalachians, and Allegheny Mountains.
Subnations: AL, DE, GA, KY, NC, SC, TN, VA, WV
TNC Ecoregions: 44:C, 50:C, 51:C, 58:C, 59:C
USFS Ecoregions: 221Ba:CCC, 221Ha:CC?, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 222Eg:CCC, 222En:CCC, 222Eo:CCC, 231Cd:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCP, M221Ba:CCC, M221Bb:CCC, M221Bd:CCC, M221Be:CCC, M221Cd:CCP, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, CAP pers. comm. 1998, Cowardin et al. 1979, Eyre 1980, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Hupp 1982, NatureServe Ecology - Southeastern U.S. unpubl. data, Palmer-Ball et al. 1988, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Southeastern Ecology Working Group n.d.

SOUTH-CENTRAL INTERIOR SMALL STREAM AND RIPARIAN

COMMON WATER-WILLOW HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Justicia americana* Herbaceous Vegetation
Database Code: CEGL004286
Formation: Temporarily flooded temperate perennial forb vegetation (V.B.2.N.d)
Alliance: *Justicia americana* Temporarily Flooded Herbaceous Alliance (A.1657)

ELEMENT CONCEPT

Summary: This association is found primarily in the Piedmont, Cumberland Plateau, Interior Low Plateau, Ozarks, Ouachita Mountains, and adjacent provinces. Stands occur on the shoals or bars of rocky streams and riverbeds. It provides habitat in some portions of its range for globally rare dragonflies and herbs. *Justicia americana* is the characteristic dominant. Other herbaceous species that may be present include *Diodia teres, Gratiola brevifolia, Leersia* sp., *Lemna minor, Orontium aquaticum, Podostemum ceratophyllum, Scirpus* sp., *Saururus cernuus,* and *Xyris difformis var. difformis*. A sparse canopy layer, which can include *Carpinus caroliniana ssp. caroliniana, Salix interior, Fagus grandifolia,* and *Fraxinus pennsylvanica* among other species, may be present.
Environment: This association occurs on the shoals or bars of rocky streams and riverbeds, or gravelly sands.
Vegetation: *Justicia americana* is the characteristic dominant. Other herbaceous species that may be present include *Diodia teres, Gratiola brevifolia, Leersia* sp., *Lemna minor, Orontium aquaticum, Podostemum ceratophyllum, Saururus cernuus,* and *Xyris difformis var. difformis*. In Ohio, *Justicia* usually grows in nearly pure patches, so that few other species are associated with it. *Bidens* spp., *Cuscuta gronovii, Mimulus ringens, Polygonum* spp., *Rumex* spp., and *Salix interior* can occur (Anderson 1982). A sparse canopy layer may be present, which can include *Carpinus caroliniana, Fagus grandifolia,* and *Fraxinus pennsylvanica*, among others. In the Cumberland Plateau of Alabama, *Justicia americana* is present in dense patches with some interspersion of other species including *Pilea pumila, Boehmeria cylindrica, Eclipta prostrata (= Eclipta alba), Juncus coriaceus, Mikania scandens, Ludwigia palustris, Leersia* sp. and *Bidens* sp. Schmalzer and DeSelm (1982) discuss *Orontium aquaticum* growing along streambanks or in shallow riffles "along or with" *Justicia americana* in the Obed River in the Cumberland Plateau of Tennessee.
Dynamics: Stands in some situations may be obliterated by ongoing river channeling. Anderson (1982) describes some of the life-history characteristics of *Justicia americana* that allow it to persist in river channels.
Similar Associations:
Related Concepts:

- Aquatic Types (Schmalzer and DeSelm 1982) B
- IIE3a. Riverside Shoal and Stream Bar Complex (Allard 1990) B
- Rocky Bar and Shore (Water Willow Subtype) (Schafale 1998b) ?

Classification Comments: This type, in Ohio, often forms pure patches, but consistent identification may require a simple cutoff rule, such as at least 50% cover of *Justicia* (Anderson 1982). However, Anderson (1996) no longer recognizes this type.

CONSERVATION RANKING & RARE SPECIES

GRank: G4G5 (1997-9-12): No information
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This type is found primarily in the Piedmont, Interior Low Plateau, Cumberland Plateau, Ozarks, Ouachita Mountains, and adjacent provinces. It ranges from Alabama, Georgia and the Carolinas west to Arkansas and Oklahoma and north to Ohio, Pennsylvania, and Delaware.
Subnations: AL, AR, GA, KY, MD?, NC, OH, OK, PA, SC?, TN, VA?, WV
TNC Ecoregions: 38:C, 39:C, 43:C, 44:C, 45:C, 48:C, 49:C, 50:C, 51:C, 52:C, 59:C, 60:C, 61:C
USFS Ecoregions: 212Fa:CCP, 212Fb:CCC, 212Ga:CCP, 212Gb:CCP, 221Am:CCP, 221Ba:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCP, 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 222Eb:CCC, 222Ej:CCP, 222En:CCC, 222Eo:CCC, 222Ha:CCC, 231Af:CCC, 231B:CC, 231Cd:CCC, 231D:CC, M221Aa:CCC, M221Ac:CCC, M221Ad:CCC, M221Bb:CCC, M221Bd:CCC, M221Be:CCC, M221Bf:CCC, M221Cd:CCC, M221Da:CCC, M221Dc:CCC, M222A:CC, M231A:CC
Federal Lands: NPS (Little River Canyon?, Natchez Trace, Stones River); USFS (Bankhead, Cherokee, Daniel Boone, Oconee?, Ouachita, Ozark, Pisgah, Sumter?, Uwharrie)

ELEMENT SOURCES

References: Allard 1990, Anderson 1982, Anderson 1996, Fike 1999, Fleming et al. 2001, Hoagland 1997, Hoagland 2000, Major et al. 1999, McCoy 1958, Nelson 1986, Palmer-Ball et al. 1988, Peet et al. unpubl. data 2002, Penfound 1953, Schafale 1998b, Schafale and Weakley 1990, Schmalzer and DeSelm 1982, Southeastern Ecology Working Group n.d.

EASTERN HEMLOCK - (EASTERN WHITE PINE) TEMPORARILY FLOODED FOREST

ELEMENT IDENTIFIERS

NVC association: *Tsuga canadensis - (Pinus strobus)* Temporarily Flooded Forest
Database Code: CEGL007143
Formation: Temporarily flooded temperate or subpolar needle-leaved evergreen forest (I.A.8.N.e)
Alliance: *Tsuga canadensis - (Pinus strobus)* Temporarily Flooded Forest Alliance (A.171)

ELEMENT CONCEPT

Summary: This association covers forested alluvial wetlands dominated by *Tsuga canadensis* and/or *Pinus strobus* which occur on temporarily flooded alluvial flats and ravines in the Southern Blue Ridge, the Cumberlands, and possibly in adjacent ecoregions. These dense forests usually occur over silty, acidic soils. The shrub and herbaceous strata may be dense to open, but have components indicative of the temporarily flooded hydrology, thus separating this type from similar, non-wetland communities. *Rhododendron maximum* is a typical shrub and can form a dense subcanopy.
Environment: These dense forested alluvial wetlands occur on temporarily flooded alluvial flats and ravines. These forests usually occur over silty, acidic soils. Forests may be eroded or disturbed by catastrophic floods, sometimes frequently enough to maintain some stands in an early- to mid-successional stage. The flood-carried sediments provide some nutrient inputs into the system. Beavers may create impoundments that may later form early successional stands (Schafale and Weakley 1990).
Vegetation: Stands of this forested alluvial wetland association are dominated by *Tsuga canadensis* and/or *Pinus strobus*. The shrub and herbaceous strata may be dense to open, but have components indicative of the temporarily flooded hydrology. *Rhododendron maximum* is a typical shrub and can form a dense subcanopy. In eastern Kentucky (Campbell 2001), stands may contain *Acer rubrum* and *Liriodendron tulipifera*. Other trees include *Fagus grandifolia, Ilex opaca, Liquidambar styraciflua, Nyssa sylvatica*, and *Oxydendrum arboreum*. Shrub cover may be low but contains patches of *Rhododendron maximum*, with scattered *Alnus serrulata, Carpinus caroliniana, Clethra acuminata, Hamamelis virginiana, Leucothoe fontanesiana*, and *Kalmia latifolia*. Ground cover may be sparse, with scattered patches of Carices (*Carex gracilescens, Carex laxiculmis, Carex lucorum*), *Hexastylis arifolia, Medeola virginiana, Thelypteris noveboracensis*, and others. Nearer to the stream channel, species such as *Carex torta, Carex gynandra, Carex baileyi, Viola cucullata*, and *Xanthorhiza simplicissima* may be more common. More disturbed parts of the stand may contain *Betula* spp., *Magnolia* spp., and local patches of *Pinus strobus* (Campbell 2001). In North Carolina, the herbaceous layer may include *Arisaema triphyllum, Chamaelirium luteum, Cicuta maculata, Claytonia virginica, Glyceria melicaria, Polygonum punctatum*, and *Packera aurea (= Senecio aureus)* (Schafale and Weakley 1990). More information is needed to adequately describe the rangewide features of this community and distinguish it from similar vegetation. In the field, this association may be difficult to separate from similar non-wetland vegetation.
Dynamics: No information
Similar Associations:

- *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543)
- *Pinus strobus - Tsuga canadensis / Acer pensylvanicum / Polystichum acrostichoides* Forest (CEGL006019)
- *Pinus strobus - Tsuga canadensis / Rhododendron maximum - (Leucothoe fontanesiana)* Forest (CEGL007102)

- *Tsuga canadensis - Acer rubrum - (Liriodendron tulipifera, Nyssa sylvatica) / Rhododendron maximum / Sphagnum* spp. Forest (CEGL007565)
- *Tsuga canadensis / Rhododendron maximum - (Clethra acuminata, Leucothoe fontanesiana)* Forest (CEGL007136)
- *Tsuga canadensis / Rhododendron maximum / Sphagnum* spp. Forest (CEGL006279)

Related Concepts:
- IIA6e. Southern Appalachian Alluvial Forest (Allard 1990) B
- Montane Alluvial Forest (Small River Subtype) (Schafale 1998a) ?

Classification Comments: More detailed information is needed to adequately describe this community and distinguish it from similar vegetation. In the field, this association may be difficult to separate from similar non-wetland vegetation (e.g., *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543), *Pinus strobus - Tsuga canadensis / Rhododendron maximum - (Leucothoe fontanesiana)* Forest (CEGL007102), and *Tsuga canadensis / Rhododendron maximum - (Clethra acuminata, Leucothoe fontanesiana)* Forest (CEGL007136)) and similar vegetation with longer hydroperiods (e.g., *Tsuga canadensis - Acer rubrum - (Liriodendron tulipifera, Nyssa sylvatica) / Rhododendron maximum / Sphagnum* spp. Forest (CEGL007565) and *Tsuga canadensis / Rhododendron maximum / Sphagnum* spp. Forest (CEGL006279)).

CONSERVATION RANKING & RARE SPECIES

GRank: G3 (2002-9-3): No information
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community is known from the Southern Blue Ridge from southwestern Virginia, south to northern Georgia, ranging into the Cumberland Mountains of Kentucky, and possibly into the Ridge and Valley of Virginia.
Subnations: GA, KY, NC, SC, TN, VA?
TNC Ecoregions: 50:C, 51:C, 59:P
USFS Ecoregions: 221Hc:CCC, M221Ce:CP?, M221Dc:CCC, M221Dd:CCC
Federal Lands: USFS (Chattahoochee?, Cherokee?, Daniel Boone, Nantahala?, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Campbell 2001, Peet et al. unpubl. data 2002, Schafale 1998a, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

SMOOTH ALDER - YELLOWROOT SHRUBLAND

ELEMENT IDENTIFIERS

NVC association: *Alnus serrulata - Xanthorhiza simplicissima* Shrubland
Database Code: CEGL003895
Formation: Temporarily flooded cold-deciduous shrubland (III.B.2.N.d)
Alliance: *Alnus serrulata* Temporarily Flooded Shrubland Alliance (A.943)

ELEMENT CONCEPT

Summary: This association includes shrublands on rocky or gravelly substrates along narrow river margins in the southeastern Blue Ridge Escarpment gorges, ranging into the Cumberland Plateau. Vegetation composition, density, and height vary with frequency of flooding, substrate, and soil depth. The nominal shrubs are common and characteristic but not always dominant. Other shrubs may include *Arundinaria gigantea, Diervilla sessilifolia, Salix nigra, Salix sericea, Rhododendron arborescens, Rhododendron viscosum, Rhododendron maximum, Rhododendron periclymenoides, Kalmia latifolia, Leucothoe fontanesiana, Cornus foemina, Cornus amomum, Itea virginica*, and *Viburnum nudum var. cassinoides*. Arborescent species that occur as tall shrubs (or as occasional trees, less than 10% cover) include *Acer rubrum, Carpinus caroliniana, Diospyros virginiana, Liquidambar styraciflua, Liriodendron tulipifera, Platanus occidentalis*, and *Tsuga canadensis*. Open areas dominated by grasses and forbs include species such as *Agrostis perennans, Boykinia aconitifolia, Carex torta, Holcus lanatus* (exotic), *Lycopus virginicus, Trautvetteria caroliniensis, Houstonia serpyllifolia, Impatiens capensis, Hypericum mutilum, Viola X primulifolia*, and *Eupatorium fistulosum*. Adjacent alluvial forests in the Blue Ridge are dominated by *Tsuga canadensis, Liriodendron tulipifera, Betula lenta*, and, at lower elevations, below 600 m (2000 feet), *Platanus occidentalis* and *Liquidambar styraciflua*.
Environment: This association includes shrublands on rocky or gravelly substrates along narrow river margins in the southeastern Blue Ridge Escarpment gorges, ranging into the Cumberland Plateau. Vegetation composition, density, and height vary with frequency of flooding, substrate, and soil depth. The occurrences can be in very narrow bands of 1-2 meters or wider bars of up to 10-20 meters wide adjacent to large creeks and small rivers.
Vegetation: The nominal shrubs are common and characteristic but not always dominant. Other shrubs may include *Arundinaria gigantea, Diervilla sessilifolia, Salix nigra, Salix sericea, Rhododendron arborescens, Rhododendron viscosum, Rhododendron maximum, Rhododendron periclymenoides, Kalmia latifolia, Leucothoe fontanesiana, Cornus foemina, Cornus amomum, Itea virginica*, and *Viburnum nudum var. cassinoides*. Arborescent species that occur as tall shrubs (or as occasional trees, less than 10% cover) include *Acer rubrum, Carpinus caroliniana, Diospyros virginiana, Liquidambar styraciflua, Liriodendron tulipifera, Platanus*

occidentalis, and *Tsuga canadensis*. Open areas dominated by grasses and forbs include species such as *Agrostis perennans, Boykinia aconitifolia, Carex torta, Holcus lanatus* (exotic), *Lycopus virginicus, Trautvetteria caroliniensis, Houstonia serpyllifolia, Impatiens capensis, Hypericum mutilum, Viola X primulifolia*, and *Eupatorium fistulosum*. Adjacent alluvial forests in the Blue Ridge are dominated by *Tsuga canadensis, Liriodendron tulipifera, Betula lenta*, and, at lower elevations, below 600 m (2000 feet), *Platanus occidentalis* and *Liquidambar styraciflua*.

Dynamics: No information

Similar Associations:

Related Concepts:

- *Alnus/Xanthorhiza* rocky stream margin (Newell and Peet 1995) ?
- IIE3a. Riverside Shoal and Stream Bar Complex (Allard 1990) B
- Rocky Bar And Shore (Alder-Yellowwood Subtype) (Schafale 1998b) ?

Classification Comments: This association is known from the Bankhead National Forest, but further inventory is needed to fully describe the variation of this type on the Bankhead and elsewhere in the Cumberland Plateau.

CONSERVATION RANKING & RARE SPECIES

GRank: G3G4 (1999-12-17): This community is naturally restricted in terms of geography and habitat, thus could be vulnerable to elimination. However, this community is often overlooked in inventories or not separately distinguished, and is likely much more common than the number of documented occurrences suggests. Threats to this community include alteration of the natural flooding regime due to damming of rivers and invasion by exotic species carried on river courses.

High-ranked species: *Diervilla rivularis* (G3), *Spiraea virginiana* (G2)

ELEMENT DISTRIBUTION

Range: This association is found along montane rivers in the southeastern Blue Ridge Escarpment gorges and in the Cumberland Plateau of Kentucky south to Alabama.

Subnations: AL, GA, KY, NC, SC, TN

TNC Ecoregions: 50:C, 51:C, 52:P

USFS Ecoregions: 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 231Cd:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains, Little River Canyon?); USFS (Bankhead, Chattahoochee, Daniel Boone, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Newell and Peet 1995, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

SYCAMORE - TULIPTREE - (YELLOW BIRCH, SWEET BIRCH) / SMOOTH ALDER - MOUNTAIN DOGHOBBLE FOREST

ELEMENT IDENTIFIERS

NVC association: *Platanus occidentalis - Liriodendron tulipifera - Betula (alleghaniensis, lenta) / Alnus serrulata - Leucothoe fontanesiana* Forest

Database Code: CEGL004691

Formation: Temporarily flooded cold-deciduous forest (I.B.2.N.d)

Alliance: *Platanus occidentalis - (Liquidambar styraciflua, Liriodendron tulipifera)* Temporarily Flooded Forest Alliance (A.289)

ELEMENT CONCEPT

Summary: This association covers alluvial forests of Southern Blue Ridge and nearby portions of the inner Piedmont. This type is associated with narrow, rocky floodplains and islands in medium-sized rivers, typically at elevations below 3000 feet. It is more frequent below 2000 feet. Canopy composition of stands is variable but typical dominants are *Platanus occidentalis, Liriodendron tulipifera, Fraxinus americana, Betula alleghaniensis*, and *Betula lenta*. *Platanus* is characteristic, but not necessarily dominant in stands of this association. Other canopy/subcanopy trees can include *Carpinus caroliniana, Betula nigra, Acer rubrum, Pinus virginiana, Pinus strobus*, and *Tsuga canadensis*. In contrast to montane alluvial forests on the margins of the Southern Blue Ridge or on larger rivers, *Liquidambar styraciflua* is rare to absent in this type. The shrub stratum can be dense, often with local dominance by *Leucothoe fontanesiana* or *Rhododendron maximum*. Other characteristic shrubs include *Alnus serrulata, Xanthorhiza simplicissima, Corylus americana, Cornus amomum, Hamamelis virginiana, Euonymus americana*, and *Hydrangea arborescens*. Vines can be prominent including *Aristolochia macrophylla, Parthenocissus quinquefolia, Smilax glauca, Smilax rotundifolia*, and *Vitis aestivalis*. Herbaceous species composition varies from site to site, and herbaceous strata can be quite patchy on the rocky substrate. Characteristic species known from these forests include *Amphicarpaea bracteata, Actaea racemosa (= Cimicifuga racemosa), Polystichum acrostichoides, Eurybia divaricata (= Aster divaricatus), Anemone quinquefolia, Athyrium filix-femina, Claytonia virginica, Erythronium americanum, Medeola virginiana, Packera aurea, Stellaria pubera, Tiarella cordifolia*, and *Viola blanda*. *Carex* species may be common (e.g., *Carex appalachica, Carex austrocaroliniana, Carex blanda, Carex digitalis, Carex plantaginea, Carex swanii, Carex torta*). Examples are known from the Nantahala Gorge, Slickrock Creek, the South Toe River, and the Black and Craggy Mountains.

Environment: This association covers alluvial forests of Southern Blue Ridge and nearby portions of the inner Piedmont. This type is associated with narrow, rocky floodplains and islands in medium-sized rivers, typically at elevations below 3000 feet. It is more frequent below 2000 feet. Examples are known from the Nantahala Gorge, Slickrock Creek (Newell et al. 1997), Great Smoky Mountains, the South Toe River, the Black and Craggy Mountains (McLeod and Ulrey unpubl. data), and the Chattahoochee National Forest of Georgia.

Vegetation: Canopy composition of stands is variable but typical dominants are *Platanus occidentalis, Liriodendron tulipifera, Fraxinus americana, Betula alleghaniensis,* and *Betula lenta*. *Platanus* is characteristic, but not necessarily dominant in stands of this association. Other canopy/subcanopy trees can include *Carpinus caroliniana, Betula nigra, Acer rubrum, Pinus virginiana, Pinus strobus,* and *Tsuga canadensis*. In contrast to montane alluvial forests on the margins of the Southern Blue Ridge or on larger rivers, *Liquidambar styraciflua* is rare to absent in this type. The shrub stratum can be dense, often with local dominance by *Leucothoe fontanesiana* or *Rhododendron maximum*. Other characteristic shrubs include *Alnus serrulata, Xanthorhiza simplicissima, Corylus americana, Cornus amomum, Hamamelis virginiana, Euonymus americana,* and *Hydrangea arborescens*. Vines can be prominent including *Aristolochia macrophylla, Parthenocissus quinquefolia, Smilax glauca, Smilax rotundifolia,* and *Vitis aestivalis*. Herbaceous species composition varies from site to site, and herbaceous strata can be quite patchy on the rocky substrate. Characteristic species known from these forests include *Amphicarpaea bracteata, Actaea racemosa (= Cimicifuga racemosa), Polystichum acrostichoides, Eurybia divaricata (= Aster divaricatus), Anemone quinquefolia, Athyrium filix-femina, Claytonia virginica, Erythronium americanum, Medeola virginiana, Packera aurea, Stellaria pubera, Tiarella cordifolia,* and *Viola blanda*. In addition, *Carex* species may be common (e.g., *Carex appalachica, Carex austrocaroliniana, Carex blanda, Carex digitalis, Carex plantaginea, Carex swanii, Carex torta*).

Dynamics: No information

Similar Associations:

- *Liquidambar styraciflua - Liriodendron tulipifera - (Platanus occidentalis) / Carpinus caroliniana - Halesia tetraptera / Amphicarpaea bracteata* Forest (CEGL007880) -- with at least partial dominance by *Liquidambar styraciflua*.

Related Concepts:

- *Liriodendron - Platanus / Amphicarpaea* Alluvial Forest (Newell et al. 1997) ?
- *Platanus - Betula alleghaniensis* Alluvial Forest (Newell et al. 1997) ?
- Alluvial Forest (McLeod 1988) ?
- Floodplain Woodlands (Pittillo and Smathers 1979) ?
- IIA6e. Southern Appalachian Alluvial Forest (Allard 1990) B
- Montane Alluvial Forest (Large River Subtype) (Schafale 1998a) ?

Classification Comments: This alluvial forest type is less common in the Southern Blue Ridge than alluvial forests dominated by *Tsuga canadensis*, which are found in areas with better-developed soils and less frequent flooding than the I.A.8.N.e *Tsuga canadensis - (Pinus strobus)* Temporarily Flooded Forest Alliance (A.171).

CONSERVATION RANKING & RARE SPECIES

GRank: G2? (1999-2-23): This community is naturally uncommon in the Southern Blue Ridge. Well-developed examples are rare due to clearing for agriculture and development. This community is threatened by road building and other disturbances causing hydrologic alteration.

High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community is found in the Southern Blue Ridge of western North Carolina, northern South Carolina, and eastern Tennessee. It likely extends into Georgia.

Subnations: GA?, NC, SC, TN

TNC Ecoregions: 51:C, 52:C

USFS Ecoregions: M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee?, Cherokee?, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, McLeod 1988, NatureServe Ecology - Southeastern U.S. unpubl. data, Newell and Peet 1995, Newell et al. 1997, Peet et al. unpubl. data 2002, Pittillo and Smathers 1979, Schafale 1998a, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

TWISTED SEDGE HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Carex torta* Herbaceous Vegetation

Database Code: CEGL004103

Formation: Temporarily flooded temperate or subpolar grassland (V.A.5.N.j)

Alliance: *Carex torta* Temporarily Flooded Herbaceous Alliance (A.1340)

ELEMENT CONCEPT

Summary: This association accommodates *Carex torta*-dominated alluvial wetlands on sand, gravel, and rock bars along riverbanks in valleys and gorges in the southern Appalachians, ranging west into the Cumberland Plateau and the Interior Low Plateau, and north into the Central Appalachians. This association is characterized by light-requiring, tough-rooted herbaceous perennials tolerant of frequent inundation and flood-scouring. *Carex torta* often forms dense, extensive colonies. Associated species vary with geography but can include *Verbena hastata, Doellingeria umbellata (= Aster umbellatus), Dichanthelium clandestinum, Solidago rugosa ssp. aspera, Juncus effusus, Scirpus expansus, Scirpus cyperinus, Equisetum arvense, Onoclea sensibilis, Vernonia noveboracensis, Lycopus virginicus, Scutellaria lateriflora, Lobelia cardinalis, Symphyotrichum dumosum (= Aster dumosus), Lycopus virginicus, Osmunda regalis, Hypericum mutilum, Eupatorium fistulosum, Solidago patula,* and *Salix sericea*.

Environment: This association occupies boulder and gravel bars on the frequently flooded, active channel shelves of high-gradient rivers and large streams. Along Laurel Fork, flooding duration is probably similar to that documented along Passage Creek in Shenandoah County, Virginia, by Hupp (1982). In that drainage, the channel shelf was inundated approximately 15% of the time. Periodic large or severe floods transport and deposit large numbers of cobbles, stones, and even boulders in characteristic bars both within the channel (islands) and along its edges (streambanks). These bars provide a matrix for deposition of finer alluvium and habitats for the establishment of tough, adaptable herbaceous plants, which in turn stabilize the bars with massive networks of perennial rootstocks. Regular flood-scouring batters or removes woody plants which take root in these habitats, maintaining open-canopy conditions. These habitats are highly dynamic, with conditions more or less constantly shifting in response to an irregular but powerful disturbance regime. While some of the bar habitats may be damaged or removed by severe floods, others may accrete or be newly deposited during the same events.

Vegetation: Vegetation is characterized by light-demanding, tough-rooted herbaceous perennials tolerant of frequent inundation and flood-scouring. *Carex torta* is the dominant species and typically forms dense, extensive colonies. Associated species vary with geography but can include *Verbena hastata, Doellingeria umbellata (= Aster umbellatus), Dichanthelium clandestinum, Solidago rugosa ssp. aspera, Juncus effusus var. solutus, Scirpus expansus, Scirpus cyperinus, Equisetum arvense, Onoclea sensibilis, Vernonia noveboracensis, Lycopus virginicus, Scutellaria lateriflora, Lobelia cardinalis, Symphyotrichum dumosum (= Aster dumosus), Osmunda regalis var. spectabilis, Eupatorium fistulosum, Solidago patula*, and *Hypericum mutilum*. Small specimens of *Salix sericea* and other woody plants are also frequent.

Dynamics: Periodic large or severe floods transport and deposit large numbers of cobbles, stones, and even boulders in characteristic bars both within the channel (islands) and along its edges (streambanks). These bars provide a matrix for deposition of finer alluvium and habitats for the establishment of tough, adaptable herbaceous plants, which in turn stabilize the bars with massive networks of perennial rootstocks. Regular flood-scouring batters or removes woody plants which take root in these habitats, maintaining open-canopy conditions. These habitats are highly dynamic, with conditions more or less constantly shifting in response to an irregular but powerful disturbance regime. While some of the bar habitats may be damaged or removed by severe floods, others may accrete or be newly deposited during the same events (Hupp 1982). Successionally, this unit can be considered a pioneering type on new, coarse alluvial land, but it is also more or less permanently maintained by natural disturbances.

Similar Associations:

- *Carex torta - Apocynum cannabinum* Herbaceous Vegetation (CEGL006536)

Related Concepts:

- *Carex torta* Association (Fleming and Moorhead 1996) ?
- *Carex torta* Herbaceous Vegetation (Fleming and Coulling 2001) ?
- IIE3a. Riverside Shoal and Stream Bar Complex (Allard 1990) B
- Riverine Upper and Lower Perennial Beach/Bar, Cobble/Gravel, Seasonally Flooded (R2and3BB1C) (Cowardin et al. 1979) ?
- Riverine Upper and Lower Perennial Beach/Bar, Sand, Seasonally Flooded (R2and3BB2C) (Cowardin et al. 1979) ?
- Rocky Bar and Shore (Twisted Sedge Subtype) (Schafale 1998b) ?
- Torturous sedge gravel rivershore (CAP pers. comm. 1998) ?

Classification Comments:

CONSERVATION RANKING & RARE SPECIES

GRank: G3G4 (2000-1-21): This community is found as linear occurrences along waterways in the Southern Appalachians, west into the Cumberland Plateau and the Interior Low Plateau, and north into the Central Appalachians and Allegheny Mountains. Although this community has a moderately large geographic range, it is uncommon within its range and occurrences are small. This community is more common than the number of documented occurrences would suggest, since it is often overlooked in inventories.

High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community is found as linear occurrences along waterways in the Southern Appalachians, west into the Cumberland Plateau and the Interior Low Plateau, and north into the Central Appalachians, and Allegheny Mountains.

Subnations: AL, DE, GA, KY, NC, SC, TN, VA, WV

TNC Ecoregions: 44:C, 50:C, 51:C, 58:C, 59:C

USFS Ecoregions: 221Ba:CCC, 221Ha:CC?, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 222Eg:CCC, 222En:CCC, 222Eo:CCC, 231Cd:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCP, M221Ba:CCC, M221Bb:CCC, M221Bd:CCC, M221Be:CCC, M221Cd:CCP, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

References: Allard 1990, CAP pers. comm. 1998, Cowardin et al. 1979, Eyre 1980, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Hupp 1982, NatureServe Ecology - Southeastern U.S. unpubl. data, Palmer-Ball et al. 1988, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Southeastern Ecology Working Group n.d.

SOUTHERN APPALACHIAN SEEPAGE WETLAND

(ORANGE JEWELWEED, YELLOW JEWELWEED) - BEEBALM - APPALACHIAN BLACK-EYED-SUSAN HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata* var. *humilis* Herbaceous Vegetation

Database Code: CEGL004293

Formation: Saturated temperate perennial forb vegetation (V.B.2.N.f)

Alliance: *Impatiens (capensis, pallida) - Monarda didyma* Saturated Herbaceous Alliance (A.1690)

ELEMENT CONCEPT

Summary: This association covers forb-dominated palustrine vegetation occurring as small wetlands at high elevations (greater than 1200 m or 4000 feet), on upper slopes and ridgetops in the Southern Blue Ridge ecoregion. These areas lack extensive *Sphagnum* and are typically open, without shading from a forest canopy. Typical dominant species include *Impatiens capensis, Impatiens pallida, Monarda didyma*, and *Rudbeckia laciniata var. humilis*. Other characteristic species include *Aconitum reclinatum, Cardamine clematitis, Carex leptonervia, Carex debilis var. rudgei (= Carex flexuosa), Carex ruthii, Chelone lyonii, Cicuta maculata, Claytonia caroliniana, Conioselinum chinense, Euonymus obovata, Geum geniculatum, Helenium autumnale, Houstonia serpyllifolia, Lilium superbum, Lilium grayi, Packera aurea (= Senecio aureus), Solidago patula, Thalictrum clavatum, Trautvetteria caroliniensis, Veratrum viride, Viola cucullata*, and *Viola macloskeyi ssp. pallens*. This vegetation is often associated with boulderfield forests or other northern hardwood forests [see *Betula alleghaniensis - Fagus grandifolia - Aesculus flava* Forest Alliance (A.266)].

Environment: Stands of this association are forb-dominated palustrine vegetation occurring as small wetlands at high elevations (greater than 1200 m or 4000 feet), on upper slopes and ridgetops in the Southern Blue Ridge ecoregion. These areas lack extensive *Sphagnum* and are typically open, without shading from a forest canopy. This vegetation is often associated with boulderfield forests or other northern hardwood forests.

Vegetation: Typical dominant species include *Impatiens capensis, Impatiens pallida, Monarda didyma*, and *Rudbeckia laciniata var. humilis*. Other characteristic species include *Aconitum reclinatum, Cardamine clematitis, Carex leptonervia, Carex debilis var. rudgei (= Carex flexuosa), Carex ruthii, Chelone lyonii, Cicuta maculata, Claytonia caroliniana, Conioselinum chinense, Euonymus obovata, Geum geniculatum, Helenium autumnale, Houstonia serpyllifolia, Lilium superbum, Lilium grayi, Packera aurea (= Senecio aureus), Solidago patula, Thalictrum clavatum, Trautvetteria caroliniensis, Veratrum viride, Viola cucullata*, and *Viola macloskeyi ssp. pallens*. These stands lack extensive cover by *Sphagnum* spp., and are typically open, without shading from a forest canopy.

Dynamics: No information

Similar Associations:

- *Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis* Herbaceous Vegetation (CEGL004296) -- typically occurs at lower elevations and is associated with cove forests.

Related Concepts:

- IID3a. Herbaceous High Elevation Seepage Slope (Allard 1990) B
- Jewelweed-beebalm-coneflower seep (CAP pers. comm. 1998) ?
- Rich Montane Seep (High Elevation Subtype) (Schafale 1998b) ?

Classification Comments: Another high-elevation herbaceous seep association known from the southern Appalachians, *Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis* Herbaceous Vegetation (CEGL004296), typically occurs at lower elevations and is associated with cove forests.

CONSERVATION RANKING & RARE SPECIES

GRank: G3 (1998-12-14): This community occurs at moderate to high elevations of the southern Blue Ridge Mountains of western North Carolina, eastern Tennessee, southwestern Virginia, northern Georgia, and probably northwestern South Carolina. It occurs as a small patch community, embedded in a variety of regional forest types. While restricted in range and of small size, the community is relatively frequent within its range, many examples are protected, and threats are relatively few and minor.

High-ranked species: *Aconitum reclinatum* (G3), *Cardamine clematitis* (G2G3), *Carex ruthii* (G3), *Geum geniculatum* (G2), *Lilium grayi* (G3)

ELEMENT DISTRIBUTION

Range: This community occurs at moderate to high elevations in the southern Blue Ridge Mountains of western North Carolina, eastern Tennessee, southwestern Virginia, northern Georgia, and northwestern South Carolina.
Subnations: GA, NC, SC, TN, VA, WV?
TNC Ecoregions: 51:C, 59:P
USFS Ecoregions: M221Ba:CCC, M221Bb:CCP, M221Bc:CCC, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee, Jefferson, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, CAP pers. comm. 1998, Fleming et al. 2001, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

FOWL MANNAGRASS - MOUNTAIN FRINGED SEDGE - WHITE TURTLEHEAD - PURPLE-STEM ASTER / PEATMOSS SPECIES HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Glyceria striata - Carex gynandra - Chelone glabra - Symphyotrichum puniceum / Sphagnum* spp. Herbaceous Vegetation
Database Code: CEGL008438
Formation: Saturated temperate or subpolar grassland (V.A.5.N.m)
Alliance: *Symphyotrichum puniceum - Vernonia noveboracensis - Solidago (patula, rugosa)* Saturated Herbaceous Alliance (A.2016)

ELEMENT CONCEPT

Summary: This acidic seep occurs in small-scale patch communities along streams in the Southern Appalachians. Occurrences are nearly always less than 0.4 hectare (1 acre) in size. Hydrology is seepage-fed, and these sites may also receive short-term flooding from adjacent streams. Characteristic species include *Glyceria striata, Glyceria melicaria, Osmunda cinnamomea, Carex gynandra, Symphyotrichum puniceum (= Aster puniceus), Solidago patula var. patula, Chelone glabra,* and *Sphagnum recurvum*. Most occurrences are herbaceous-dominated, though scattered shrubs and trees may occur, and trees rooted outside the community sometimes provide substantial shade.
Environment: This acidic seep occurs in small-scale patch communities along streams in the Southern Appalachians. Occurrences are nearly always less than 0.4 hectare (1 acre) in size. Hydrology is seepage-fed, and these sites may also receive short-term flooding from adjacent streams.
Vegetation: The physiognomic structure of this community type is variable. Most occurrences are herbaceous-dominated, though scattered shrubs and trees may occur, and trees rooted outside the community sometimes provide substantial shade. The most characteristic species include *Glyceria striata, Glyceria melicaria, Osmunda cinnamomea, Carex gynandra, Symphyotrichum puniceum (= Aster puniceus), Solidago patula var. patula, Chelone glabra,* and *Sphagnum recurvum*. Other species reported from some occurrences include *Betula lenta, Liriodendron tulipifera, Pinus strobus, Acer rubrum, Kalmia latifolia, Lyonia ligustrina var. ligustrina, Vaccinium fuscatum, Oxypolis rigidior, Athyrium filix-femina ssp. asplenioides, Salix nigra, Salix sericea,* and *Laportea canadensis*.
Dynamics: These communities appear to be relatively stable. They can be affected by beaver activity.
Similar Associations:
- *Carex gynandra - Scirpus cyperinus - Eriophorum virginicum - Osmunda cinnamomea* Herbaceous Vegetation (CEGL007771) -- is associated with smaller streams in the Cumberland Plateau from Virginia south possibly to Tennessee.

Related Concepts: No information
Classification Comments: These communities are sometimes regarded as "poorly-developed bogs." This type needs additional study and reconciliation against communities in North Carolina currently treated as forests ("Swamp Forest - Bog Complexes").

CONSERVATION RANKING & RARE SPECIES

GRank: G2G3 (2001-6-26): This community is rather widespread but always occurs in very small patches.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community was defined from the western fringe of the Southern Blue Ridge in northern Georgia, eastern Tennessee, and western North Carolina, but likely extends into adjacent areas of Alabama, Kentucky, and South Carolina.
Subnations: AL?, GA, NC, SC?, TN
TNC Ecoregions: 50:P, 51:C
USFS Ecoregions: 231Dc:CCC, 231De:CCP, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala?)

ELEMENT SOURCES

References: NatureServe Ecology - Southeastern U.S. unpubl. data, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

MOUNTAIN FRINGED SEDGE - SMALL GREEN WOOD ORCHID - ROUNDLEAF SUNDEW - RUTH'S SEDGE - PRICKLY BOG SEDGE / PEATMOSS SPECIES HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Carex gynandra - Platanthera clavellata - Drosera rotundifolia - Carex ruthii - Carex atlantica / Sphagnum* spp. Herbaceous Vegetation
Database Code: CEGL007697
Formation: Saturated temperate or subpolar grassland (V.A.5.N.m)
Alliance: *Carex ruthii - Carex gynandra* Saturated Herbaceous Alliance (A.1898)

ELEMENT CONCEPT

Summary: This association accommodates sedge-dominated, seepage slopes scattered throughout the high elevations (>5000 feet) of the Southern Blue Ridge. This non-alluvial wetland is generally graminoid-dominated but may have significant coverage by trees or shrubs, especially around the edges. Particularly small examples may be completely shaded by trees in the community and in the adjacent forests. Typically this community has well-developed *Sphagnum* mats. Characteristic species include *Carex gynandra, Carex ruthii, Carex atlantica, Carex debilis var. rudgei (= Carex flexuosa), Glyceria striata, Glyceria melicaria, Hypericum graveolens, Hypericum mitchellianum, Hypericum mutilum, Chelone lyonii, Platanthera clavellata,* and *Drosera rotundifolia*. Occurrences of this community are surrounded by or were formerly surrounded by forests dominated by *Abies fraseri* and *Picea rubens* or by the highest northern hardwood forests (forests dominated by *Fagus grandifolia, Betula alleghaniensis*, and *Aesculus flava*). They are influenced by the high rainfall and low evaporation rates in these high mountain landscapes.
Environment: These seepage slopes are scattered throughout the high elevations (>5000 feet) of the Southern Blue Ridge. They are influenced by the high rainfall and low evaporation rates in these high mountain landscapes. This non-alluvial wetland is generally graminoid-dominated but may have significant coverage by trees or shrubs, especially around the edges. Particularly small examples may be completely shaded by trees in the community and in the adjacent forests.
Vegetation: Characteristic species in stands of this type include *Carex gynandra, Carex ruthii, Carex atlantica, Carex debilis var. rudgei (= Carex flexuosa), Glyceria striata, Glyceria melicaria, Hypericum graveolens, Hypericum mitchellianum, Hypericum mutilum, Chelone lyonii, Platanthera clavellata,* and *Drosera rotundifolia*. Typically this community has well-developed *Sphagnum* mats.
Dynamics: No information
Similar Associations:
- *Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis* Herbaceous Vegetation (CEGL004296)
- *Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata var. humilis* Herbaceous Vegetation (CEGL004293)

Related Concepts:
- *Carex gynandra* Wetland (Newell and Peet 1996a) ?
- *Carex ruthii* Wetland (Newell and Peet 1996a) ?
- High Elevation Boggy Seep (Schafale 1998b) ?

Classification Comments: This community is distinguished from other high-elevation seeps in the Blue Ridge, such as *Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata var. humilis* Herbaceous Vegetation (CEGL004293) and *Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis* Herbaceous Vegetation (CEGL004296), by being graminoid-dominated and having *Sphagnum* present. Examples of this association generally lack *Rudbeckia laciniata, Laportea canadensis, Monarda didyma,* and *Diphylleia cymosa*. It is distinguished from Southern Blue Ridge bog communities by floristic differences and by occurring on a pronounced slope at high elevations.

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (1998-12-14): This community occurs in a limited portion of high-elevation areas of the Southern Blue Ridge. Occurrences are small and embedded in forests or sometimes high-elevation grassy balds or heath balds. Many examples are in protected areas. Those which are not are vulnerable to logging and alteration of hydrology.
High-ranked species: *Carex ruthii* (G3)

ELEMENT DISTRIBUTION

Range: This community occurs in a limited portion of high-elevation areas of the Southern Blue Ridge (Tennessee, North Carolina, Virginia?).
Subnations: NC, TN, VA?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Pisgah)

ELEMENT SOURCES

References: Newell and Peet 1996a, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

UMBRELLA-LEAF - BRANCH-LETTUCE - WOOD NETTLE HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis* Herbaceous Vegetation
Database Code: CEGL004296
Formation: Saturated temperate perennial forb vegetation (V.B.2.N.f)
Alliance: *Diphylleia cymosa - Saxifraga micranthidifolia* Saturated Herbaceous Alliance (A.1688)

ELEMENT CONCEPT

Summary: A characteristic association of shaded seeps of the southern Appalachian Mountains, usually with overhanging canopies though trees not rooted in the seep itself. Often not large enough to be readily mappable, but a distinctive habitat for many plants, invertebrate and vertebrate animals. Stands typically contain *Diphylleia cymosa, Saxifraga micranthidifolia,* and *Laportea canadensis*. Other characteristic species include *Cardamine clematitis, Chelone lyonii, Chelone glabra, Chrysosplenium americanum, Boykinia aconitifolia, Cicuta maculata, Houstonia serpyllifolia, Viola cucullata, Viola macloskeyi ssp. pallens, Lilium grayi, Oxypolis rigidior, Parnassia asarifolia, Tiarella cordifolia, Thalictrum clavatum, Trautvetteria caroliniensis, Stellaria corei,* and *Geum geniculatum*. Occurrences associated with more acidic soil conditions often contain *Juncus gymnocarpus*. This association often occurs in cove forests.
Environment: This association often occurs in cove forests. It is a characteristic association of shaded seeps of the southern Appalachian Mountains, usually with overhanging canopies though trees not rooted in the seep itself. Often not large enough to be readily mappable, but a distinctive habitat for many plants, invertebrate and vertebrate animals.
Vegetation: Stands typically contain *Diphylleia cymosa, Saxifraga micranthidifolia,* and *Laportea canadensis*. Other characteristic species include *Cardamine clematitis, Chelone lyonii, Chelone glabra, Chrysosplenium americanum, Boykinia aconitifolia, Cicuta maculata, Houstonia serpyllifolia, Viola cucullata, Viola macloskeyi ssp. pallens, Lilium grayi, Oxypolis rigidior, Parnassia asarifolia, Tiarella cordifolia, Thalictrum clavatum, Trautvetteria caroliniensis, Stellaria corei,* and *Geum geniculatum*. Occurrences associated with more acidic soil conditions often contain *Juncus gymnocarpus* (G. Kauffman pers. comm.).
Dynamics: No information
Similar Associations:
- *Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata var. humilis* Herbaceous Vegetation (CEGL004293)

Related Concepts:
- IID3a. Herbaceous High Elevation Seepage Slope (Allard 1990) B
- Rich Montane Seep (Cove Subtype) (Schafale 1998b) ?

Classification Comments: The nominal species *Diphylleia cymosa*, is a conspicuous component of this association, but may also be found in seeps of varying canopy closure at middle and high elevations. The associated nominal species, *Saxifraga micranthidifolia* and *Laportea canadensis*, are indicative of shaded seeps (G. Kauffman pers. comm.). Another high-elevation herbaceous seep association known from the southern Appalachians, *Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata var. humilis* Herbaceous Vegetation (CEGL004293), often occurs on boulder fields or in northern hardwood forests, at higher elevations than the association defined here.

CONSERVATION RANKING & RARE SPECIES

GRank: G3 (1998-12-14): This community occurs at moderate to high elevations of the southern Blue Ridge Mountains of western North Carolina, eastern Tennessee, southwestern Virginia, northern Georgia, and probably northwestern South Carolina. It occurs as a small patch community, embedded in a variety of regional forest types. While restricted in range and of small size, the community is relatively frequent within its range, many examples are protected, and threats are relatively few and minor.
High-ranked species: *Aconitum reclinatum* (G3), *Cardamine clematitis* (G2G3), *Geum geniculatum* (G2), *Lilium grayi* (G3)

ELEMENT DISTRIBUTION

Range: This community is found at moderate to high elevations of the southern Blue Ridge Mountains of western North Carolina, eastern Tennessee, southwestern Virginia, northern Georgia, and probably northwestern South Carolina.
Subnations: GA, NC, SC?, TN, VA
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Jefferson, Nantahala, Pisgah, Sumter?)

ELEMENT SOURCES

References: Allard 1990, Fleming et al. 2001, Kauffman pers. comm., Nelson 1986, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

WOOLGRASS BULRUSH - THREEWAY SEDGE / PEATMOSS SPECIES HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Scirpus cyperinus - Dulichium arundinaceum / Sphagnum* spp. Herbaceous Vegetation
Database Code: CEGL004134
Formation: Seasonally flooded temperate or subpolar grassland (V.A.5.N.k)
Alliance: *Scirpus cyperinus* Seasonally Flooded Herbaceous Alliance (A.1386)

ELEMENT CONCEPT

Summary: This community includes emergent zones in upland depression ponds of the mountains of North Carolina and adjacent states, where water is ponded by an impermeable substrate. It includes a variety of shrub- and herb-dominated upland wetlands with very different substrates. Herbaceous vegetation occurs in monospecific clumps, with *Sphagnum* mats, and scattered shrubs and trees around the margins. Typical dominants are *Scirpus cyperinus, Dulichium arundinaceum, Juncus effusus var. solutus,* and *Juncus canadensis*. Other species include *Bartonia virginica, Osmunda regalis var. spectabilis, Sphagnum lescurii, Sphagnum pylaesii, Sphagnum cuspidatum, Sphagnum palustre*, and *Sphagnum recurvum*. Sparsely distributed trees may include *Nyssa sylvatica, Quercus phellos, Acer rubrum*, and *Liquidambar styraciflua*. Shrubs include *Cephalanthus occidentalis, Vaccinium* spp., and *Leucothoe racemosa*. This community has a pronounced seasonal fluctuation in water level, filling in the winter and often drying completely in the summer. It is extremely rare, known only from very few scattered sites in Burke and Buncombe counties, North Carolina.
Environment: Soils have a mucky surface layer and have a shallow clay hardpan or rock layer that prevents drainage. They are seasonally to semipermanently flooded, with rainfall apparently the main source of water (Weakley and Schafale 1994). This community has a pronounced seasonal fluctuation in water level, filling in the winter and often drying completely in the summer. Linville Mountain Pond is approximately 15 x 20 meters in size, occurs at 907 meters elevation over lower quartzite geology.
Vegetation: This community is dominated by various wetland shrubs and herbs. Herbaceous vegetation occurs in monospecific clumps, with *Sphagnum* mats, and scattered shrubs and trees around the margins. Other species include *Bartonia virginica, Juncus effusus var. solutus, Osmunda regalis var. spectabilis, Juncus canadensis, Sphagnum lescurii, Sphagnum pylaesii, Sphagnum cuspidatum, Sphagnum palustre*, and *Sphagnum recurvum*. Sparsely distributed trees may include *Nyssa sylvatica, Quercus phellos, Acer rubrum*, and *Liquidambar styraciflua*. Shrubs include *Cephalanthus occidentalis, Vaccinium* spp., and *Leucothoe racemosa*. This community is surrounded by forests dominated by *Quercus prinus* and *Quercus coccinea*.
Dynamics: This upland pool community seems to be stable over long periods, but will slowly fill with sediment or organic matter. An ephemeral drawdown community may occur when water level drops. Extended droughts may be necessary for establishment of some species (Weakley and Schafale 1994). With time, occurrences of this community may gradually fill with sediment or organic matter and be succeeded by swamp forests or non-wetland forests.
Similar Associations:
Related Concepts:

- *Scirpus cyperinus-Dulichium* Pond (Newell and Peet 1995) ?
- IIE1g. Interior Vernal Pool Complex (Allard 1990) B
- Upland Pool (Weakley and Schafale 1994) ?
- Upland Pool (Mountain Subtype) (Schafale 1998b) ?

Classification Comments: This community provides important breeding habitat for amphibians. It is distinguished from all other wetlands in the Southern Blue Ridge by having standing water for significant parts of the year and by the lack of peaty mats and bog species found in other non-alluvial mountain wetlands. This classification was based on data from Linville Mountain Pond (Newell and Peet 1995) and may be modified as more regional information is collected. This association may be related to Virginia's Mountain Pools in the Shenandoahs. Resolve the classification with floristically similar types in the Coastal Plain and Piedmont of Virginia.

CONSERVATION RANKING & RARE SPECIES

GRank: G1Q (1995-7-15): This community is extremely rare, known only from very few scattered sites, totaling less than 100 acres, in Burke and Buncombe counties, North Carolina. Naturally occurring montane, upland depression pools are uncommon because the topographic and hydrologic situation necessary for the development of this community is almost non-existent in the highly weathered landscape of the southern Appalachians. These habitats provide important breeding habitat for amphibians. This association, or one similar to it, may occur in the Ridge and Valley of Virginia.
High-ranked species: No information

ELEMENT DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge of North Carolina and Georgia, and may extend north into the Ridge and Valley of Virginia. Its possible occurrence in South Carolina and Tennessee is speculative.
Subnations: GA, NC, SC?, TN, VA?
TNC Ecoregions: 51:C, 59:C

USFS Ecoregions: M221Dc:CCC
Federal Lands: USFS (Chattahoochee?, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Anderson 1990, Newell and Peet 1995, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Weakley 1993, Weakley and Schafale 1994

SOUTHERN AND CENTRAL APPALACHIAN BOG AND FEN

EASTERN HEMLOCK - RED MAPLE - (TULIPTREE, BLACKGUM) / GREAT RHODODENDRON / PEATMOSS SPECIES FOREST

ELEMENT IDENTIFIERS

NVC association: *Tsuga canadensis - Acer rubrum - (Liriodendron tulipifera, Nyssa sylvatica) / Rhododendron maximum / Sphagnum* spp. Forest
Database Code: CEGL007565
Formation: Saturated mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.d)
Alliance: *Tsuga canadensis - Acer rubrum* Saturated Forest Alliance (A.447)

ELEMENT CONCEPT

Summary: This palustrine forest has a closed or open canopy and an open to dense shrub layer, interspersed with small *Sphagnum*-herb dominated depressions. These forests are found throughout the Southern Blue Ridge, and in the Cumberland Mountains and Cumberland Plateau, at elevations below 1200 m (4000 feet), in poorly drained bottomlands, generally with visible microtopography of ridges and sloughs or depressions. It often occurs near streams and is undoubtedly occasionally flooded. The canopy is composed of various mixtures of evergreen and deciduous species, often dominated by *Tsuga canadensis* and *Acer rubrum*, and less often by *Liriodendron tulipifera, Nyssa sylvatica, Pinus strobus*, or *Pinus rigida*. The dominant shrubs are usually *Rhododendron maximum, Kalmia latifolia*, and *Leucothoe fontanesiana*, but other shrubs include *Salix nigra, Alnus serrulata, Ilex montana, Cornus amomum, Viburnum nudum var. cassinoides*, and *Toxicodendron vernix*. Herbs in *Sphagnum*-herb dominated openings include *Solidago patula var. patula, Symphyotrichum puniceum (= Aster puniceus), Dalibarda repens, Osmunda cinnamomea, Carex folliculata, Carex gynandra, Carex scabrata, Carex leptalea, Carex stricta, Sarracenia purpurea, Sagittaria latifolia (= var. pubescens)*, and *Leersia virginica*. Herbs in the forested areas include *Glyceria melicaria, Lycopodium obscurum, Onoclea sensibilis, Maianthemum canadense, Thelypteris noveboracensis*, and *Osmunda regalis var. spectabilis*.
Environment: The type occurs mostly at elevations below 1200 m (4000 feet), in poorly drained bottomlands, generally with visible microtopography of ridges and sloughs or depressions. It often occurs near streams and is undoubtedly occasionally flooded. In Virginia, habitats range from 790-1340 m (2600-4400 feet) elevation and are typically located along small, braided headwaters streams draining visible groundwater discharge. Soils are very strongly acidic (mean pH in plots = 4.8) with low base status.
Vegetation: This palustrine forest has a closed or open canopy and an open to dense shrub layer, interspersed with small *Sphagnum*- and herb-dominated depressions. The canopy is composed of various mixtures of evergreen and deciduous species, including *Tsuga canadensis, Acer rubrum, Liriodendron tulipifera, Nyssa sylvatica, Pinus strobus*, and *Pinus rigida*. Canopy dominants vary with elevation. Occurrences at lower elevations tend to be dominated by *Acer rubrum, Liriodendron tulipifera*, and/or *Nyssa sylvatica*, while examples at higher elevations are usually dominated by *Tsuga canadensis* and/or *Betula alleghaniensis*. *Picea rubens* is a minor canopy component at the highest elevations. The dominant shrubs are usually *Rhododendron maximum, Kalmia latifolia*, and *Leucothoe fontanesiana*, but other shrubs may include *Salix nigra, Alnus serrulata, Ilex montana, Cornus amomum, Viburnum nudum var. cassinoides*, and *Toxicodendron vernix*. Herbaceous species of sphagnous openings include *Solidago patula, Symphyotrichum puniceum (= Aster puniceus), Dalibarda repens, Osmunda cinnamomea, Carex folliculata, Carex gynandra, Carex scabrata, Carex leptalea, Carex stricta, Sarracenia purpurea, Sagittaria latifolia (= var. pubescens)*, and *Leersia virginica*. Herbs in more densely shaded areas include *Glyceria melicaria, Lycopodium obscurum, Onoclea sensibilis, Maianthemum canadense, Thelypteris noveboracensis*, and *Osmunda regalis var. spectabilis*.

Overstory composition of the very few documented examples in Virginia is somewhat heterogeneous and may represent an elevational gradient. The lowest-elevation stand (at 790 m or 2600 feet) in Carroll County (Southern Blue Ridge) is codominated by *Acer rubrum* and *Pinus strobus* with minor associates of *Betula alleghaniensis*, and *Tsuga canadensis*. A Giles County (Ridge and Valley) stand at 1160 m (3800 feet) has a mixed canopy of *Acer rubrum, Nyssa sylvatica, Picea rubens*, and *Pinus rigida*. The third stand, located at 1335 m (4380 feet) in Grayson County (Southern Blue Ridge) is overwhelmingly dominated by *Betula alleghaniensis*, with minor associates of *Acer rubrum* and *Picea rubens*. *Rhododendron maximum* is the dominant shrub, and *Osmunda cinnamomea* the dominant herb, at all three sites. Other species prominent in at least two of the three stands include *Kalmia latifolia, Hamamelis virginiana, Rhododendron viscosum, Rubus hispidus, Viola macloskeyi ssp. pallens, Carex trisperma, Glyceria melicaria, Lycopodium obscurum*, and *Carex intumescens*. *Dalibarda repens* is an abundant herb at the Carroll County (lowest-

elevation) site, while *Solidago rugosa*, *Carex ruthii*, and *Carex baileyi* are common at the Grayson County (highest-elevation) site. Mean species richness ranges from 30 to 46 taxa per 400 m2 (mean = 40).

Dynamics: The factors responsible for creating and maintaining this community are not well known, although beaver activity may play a role. The frequency and role of flooding is not known. This community may represent late successional stage of primary succession from once extensive, open bog areas and will remain in a forest condition unless the canopy is removed by tree blowdown, logging, or fire.

Similar Associations:

Related Concepts:

- *Acer rubrum - Betula alleghaniensis / Rhododendron maximum / Osmunda cinnamomea - Carex trisperma* Forest (Fleming and Coulling 2001) ?
- Eastern Hemlock: 23 (Eyre 1980) B
- Eastern hemlock-red maple-great laurel swamp (CAP pers. comm. 1998) ?
- Hemlock-Hardwood (08) (USFS 1988) ?
- IIE1a. Southern Appalachian Bog Complex (Allard 1990) B Swamp Forest-Bog Complex (Typic Subtype) (Schafale 1998a) ?

Classification Comments: Canopy dominants vary with elevation. Occurrences at lower elevations tend to be dominated by *Acer rubrum*, *Liriodendron tulipifera*, and/or *Nyssa sylvatica*, while examples at higher elevations are usually dominated by *Tsuga canadensis*. This community is naturally rare, due to the scarcity of flat, wet sites in the Blue Ridge Mountains and Cumberland Mountains. Its rarity is also due to anthropogenic factors, being located in accessible, low-elevation sites which are prone to logging and agricultural activities. Most historic occurrences of this community have been destroyed or strongly altered by draining, impoundment, or conversion to pasture. This community extends to a few sites in the Appalachian Plateau of Kentucky, where similar seeps are known, but these lack *Leucothoe fontanesiana* and *Sarracenia purpurea*. Higher elevation bogs exist in the Smokies and other portions of the Blue Ridge [see CEGL007877 and CEGL007697, for example], but they occur in much higher elevations, have a higher proportion of *Carex* spp., and occur within a matrix of spruce-fir or northern hardwood forests.

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (1998-12-14): This community is somewhat more common and secure than herbaceous and shrub-dominated nonalluvial wetlands of the Southern Blue Ridge, most of which are ranked G1. However, this community has been severely impacted by development, conversion to pasture and agriculture, and hydrologic alterations--changes which are concentrated in flat areas along streams in the steep landscapes of the Southern Blue Ridge. Most occurrences are small (less than 5 acres), very few are unaltered, and almost all have experienced alterations of hydrology, which makes their long-term viability questionable.

High-ranked species: *Carex ruthii* (G3), *Chelone cuthbertii* (G3), *Helonias bullata* (G3)

ELEMENT DISTRIBUTION

Range: This community is found in the Southern Blue Ridge and Ridge and Valley from Pennsylvania south to Georgia, ranging west into the Cumberland Mountains and Cumberland Plateau of Kentucky.

Subnations: GA, KY, NC, PA, SC, TN, VA

TNC Ecoregions: 50:C, 51:C, 52:C, 59:C

USFS Ecoregions: M221Aa:CCC, M221Ac:CCC, M221Bb:CCP, M221Bf:CCC, M221Cc:CCC, M221Da:CCP, M221Db:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Cumberland Gap); USFS (Chattahoochee, Cherokee, Daniel Boone?, Jefferson, Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, CAP pers. comm. 1998, Evans 1991, Eyre 1980, Fike 1999, Fleming and Coulling 2001, Fleming et al. 2001, Peet et al. unpubl. data 2002, Schafale 1998a, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., USFS 1988, Weakley and Schafale 1994

MOUNTAIN FRINGED SEDGE - SMALL GREEN WOOD ORCHID - ROUNDLEAF SUNDEW - RUTH'S SEDGE - PRICKLY BOG SEDGE / PEATMOSS SPECIES HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Carex gynandra - Platanthera clavellata - Drosera rotundifolia - Carex ruthii - Carex atlantica / Sphagnum* spp. Herbaceous Vegetation

Database Code: CEGL007697

Formation: Saturated temperate or subpolar grassland (V.A.5.N.m)

Alliance: *Carex ruthii - Carex gynandra* Saturated Herbaceous Alliance (A.1898)

ELEMENT CONCEPT

Summary: This association accommodates sedge-dominated, seepage slopes scattered throughout the high elevations (>5000 feet) of the Southern Blue Ridge. This non-alluvial wetland is generally graminoid-dominated but may have significant coverage by trees or shrubs, especially around the edges. Particularly small examples may be completely shaded by trees in the community and in the adjacent forests. Typically this community has well-developed *Sphagnum* mats. Characteristic species include *Carex gynandra*, *Carex*

ruthii, Carex atlantica, Carex debilis var. rudgei (= Carex flexuosa), Glyceria striata, Glyceria melicaria, Hypericum graveolens, Hypericum mitchellianum, Hypericum mutilum, Chelone lyonii, Platanthera clavellata, and *Drosera rotundifolia*. Occurrences of this community are surrounded by or were formerly surrounded by forests dominated by *Abies fraseri* and *Picea rubens* or by the highest northern hardwood forests (forests dominated by *Fagus grandifolia, Betula alleghaniensis*, and *Aesculus flava*). They are influenced by the high rainfall and low evaporation rates in these high mountain landscapes.

Environment: These seepage slopes are scattered throughout the high elevations (>5000 feet) of the Southern Blue Ridge. They are influenced by the high rainfall and low evaporation rates in these high mountain landscapes. This non-alluvial wetland is generally graminoid-dominated but may have significant coverage by trees or shrubs, especially around the edges. Particularly small examples may be completely shaded by trees in the community and in the adjacent forests.

Vegetation: Characteristic species in stands of this type include *Carex gynandra, Carex ruthii, Carex atlantica, Carex debilis var. rudgei (= Carex flexuosa), Glyceria striata, Glyceria melicaria, Hypericum graveolens, Hypericum mitchellianum, Hypericum mutilum, Chelone lyonii, Platanthera clavellata,* and *Drosera rotundifolia*. Typically this community has well-developed *Sphagnum* mats.

Dynamics: No information

Similar Associations:

- *Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis* Herbaceous Vegetation (CEGL004296)
- *Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata var. humilis* Herbaceous Vegetation (CEGL004293)

Related Concepts:

- *Carex gynandra* Wetland (Newell and Peet 1996a) ?
- *Carex ruthii* Wetland (Newell and Peet 1996a) ?
- High Elevation Boggy Seep (Schafale 1998b) ?

Classification Comments: This community is distinguished from other high-elevation seeps in the Blue Ridge, such as *Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata var. humilis* Herbaceous Vegetation (CEGL004293) and *Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis* Herbaceous Vegetation (CEGL004296), by being graminoid-dominated and having *Sphagnum* present. Examples of this association generally lack *Rudbeckia laciniata, Laportea canadensis, Monarda didyma*, and *Diphylleia cymosa*. It is distinguished from Southern Blue Ridge bog communities by floristic differences and by occurring on a pronounced slope at high elevations.

CONSERVATION RANKING & RARE SPECIES

GRank: G2 (1998-12-14): This community occurs in a limited portion of high-elevation areas of the Southern Blue Ridge. Occurrences are small and embedded in forests or sometimes high-elevation grassy balds or heath balds. Many examples are in protected areas. Those which are not are vulnerable to logging and alteration of hydrology.

High-ranked species: *Carex ruthii* (G3)

ELEMENT DISTRIBUTION

Range: This community occurs in a limited portion of high-elevation areas of the Southern Blue Ridge (Tennessee, North Carolina, Virginia?).

Subnations: NC, TN, VA?

TNC Ecoregions: 51:C

USFS Ecoregions: M221Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains); USFS (Pisgah)

ELEMENT SOURCES

References: Newell and Peet 1996a, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

PRICKLY BOG SEDGE - ROUGHLEAF GOLDENROD - GRAY'S LILY / BARTLETT'S PEATMOSS HERBACEOUS VEGETATION

ELEMENT IDENTIFIERS

NVC association: *Carex atlantica - Solidago patula* var. *patula - Lilium grayi / Sphagnum bartlettianum* Herbaceous Vegetation

Database Code: CEGL004158

Formation: Saturated temperate or subpolar grassland (V.A.5.N.m)

Alliance: *Carex (atlantica, echinata) - Eriophorum virginicum - Rhynchospora capitellata - Solidago patula* Saturated Herbaceous Alliance (A.1450)

ELEMENT CONCEPT

Summary: This community is an open, graminoid-dominated wetland with significant cover of *Sphagnum* spp. It has a strong component of species of northern phytogeography occurring in combination with species endemic to the southern Appalachians, and in association with felsic gneisses or schists and acidic, nutrient-poor seepage. The dwarf-shrub (less than 0.5 m), *Vaccinium macrocarpon*, may be scattered throughout or be locally dominant. Typical dominants are *Carex echinata, Solidago patula var.*

patula, Carex leptalea, Carex atlantica, Rhynchospora capitellata, Scirpus atrovirens, Osmunda cinnamomea, Lysimachia terrestris, Vaccinium macrocarpon, Eriophorum virginicum, and *Polytrichum commune*. Other characteristic species are *Arethusa bulbosa, Aulacomnium palustre, Bazzania trilobata, Calopogon tuberosus, Carex folliculata, Carex gynandra, Carex trisperma, Chelone cuthbertii, Juncus effusus, Juncus subcaudatus, Lilium grayi, Melanthium virginicum, Orontium aquaticum, Osmunda regalis var. spectabilis, Oxypolis rigidior, Parnassia asarifolia, Platanthera grandiflora, Poa paludigena, Rhizomnium appalachianum, Sagittaria latifolia (= var. pubescens), Scirpus cyperinus, Scirpus expansus, Scirpus polyphyllus, Packera aurea (= Senecio aureus), Sphagnum bartlettianum, Sphagnum fallax, Sphagnum affine (= Sphagnum imbricatum), Sphagnum palustre, Sphagnum recurvum, Spiraea alba, Spiraea tomentosa, Stenanthium gramineum var. robustum, Thelypteris palustris var. pubescens, Thelypteris simulata* (rarely), and *Rhizomnium appalachianum*. This community can occur on flat areas, in portions of valley bottoms that are not subject to flooding, but maintained hydrologically by rainwater and a high water table, or in the upper portions of stream watersheds, on slight slopes, hydrologically maintained by very nutrient-poor to fairly nutrient-rich seepage.

Environment: This community occurs in a variety of sites. Some are on flat areas, in portions of valley bottoms that are not subject to flooding. These sites receive little seepage and are presumably largely maintained hydrologically by rainwater and high water table. This community also occurs in the upper portions of stream watersheds, on slight to moderate slopes, hydrologically maintained by very nutrient-poor to fairly nutrient-rich seepage. Soils are organic or organic-rich mineral soils, presumably very acidic to slightly acidic.

Vegetation: This community is an open, graminoid-dominated wetland with significant cover of *Sphagnum* spp. The dwarf-shrub (<0.5 m) *Vaccinium macrocarpon* may be scattered throughout or be locally dominant. Typical dominants are *Carex echinata, Solidago patula var. patula, Carex leptalea, Carex atlantica, Rhynchospora capitellata, Scirpus atrovirens, Osmunda cinnamomea, Lysimachia terrestris, Vaccinium macrocarpon, Eriophorum virginicum*, and *Polytrichum commune*. Other species may include *Carex folliculata, Carex gynandra, Scirpus expansus, Scirpus cyperinus, Scirpus polyphyllus, Osmunda regalis var. spectabilis, Packera aurea (= Senecio aureus), Thelypteris palustris var. pubescens, Juncus effusus, Juncus subcaudatus, Lilium grayi, Oxypolis rigidior, Parnassia asarifolia, Sagittaria latifolia (= var. pubescens),* and *Orontium aquaticum*. *Sphagnum* species include *Sphagnum palustre, Sphagnum affine, Sphagnum bartlettianum, Sphagnum recurvum*, and, rarely, northern disjuncts such as *Sphagnum fallax*. Other important bryophytes include *Rhizomnium appalachianum, Aulacomnium palustre*, and *Bazzania trilobata*.

Dynamics: Reduction of *Sphagnum* cover, due to siltation, trampling, or nutrient input, promotes succession by woody species. Little is known about the successional dynamics of mountain wetlands. One known occurrence of this community, dating from 10,000 years B.P., is showing signs of woody secession, suggesting that recent changes may be responsible for promoting vegetative succession to woody species (Weakley and Schafale 1994).

Similar Associations:

Related Concepts:

- IIE1b. Southern Appalachian Bog Complex (Allard 1990) B
- Southern Appalachian Bog (Typic Herb Subtype) (Schafale 1998b) ?
- Southern Appalachian Bog, Typic Variant (Weakley and Schafale 1994) B

Classification Comments: This community may dominate a site or occur as a complex with *Alnus serrulata - Kalmia carolina - Rhododendron catawbiense - Spiraea alba / Carex folliculata - Lilium grayi* Shrubland (CEGL003915). It is typically surrounded by forests dominated by *Picea rubens, Fagus grandifolia, Betula alleghaniensis, Quercus rubra, Tsuga canadensis*, and *Liriodendron tulipifera* with dense *Rhododendron maximum* understories. Few sites remain, probably less than 500 acres in total, and all are degraded from hydrological modification or are threatened by grazing, agricultural runoff, and construction activities. Similar open, herbaceous bogs are at Grayson Highlands, Virginia. The definition of this association may need to be modified to cover these Virginia occurrences.

CONSERVATION RANKING & RARE SPECIES

GRank: G1 (1995-6-15): Few sites remain, probably less than 200 acres in total, and nearly all of that hydrologically modified to one degree or another. Remaining occurrences of this community have been degraded or are threatened by grazing, agricultural runoff, and construction activities.

High-ranked species: *Chelone cuthbertii* (G3), *Glyptemys muhlenbergii* (G3), *Lilium grayi* (G3), *Parnassia grandifolia* (G3), *Poa paludigena* (G3)

ELEMENT DISTRIBUTION

Range: In western North Carolina, possibly in eastern Tennessee, and in southwestern Virginia, on felsic metamorphic rocks in the Southern Blue Ridge.

Subnations: NC, TN?, VA?

TNC Ecoregions: 51:C, 59:P

USFS Ecoregions: M221Db:CCC, M221Dc:CCC

Federal Lands: NPS (Blue Ridge Parkway?); USFS (Cherokee?, Nantahala?, Pisgah?)

ELEMENT SOURCES

References: Allard 1990, Anderson 1990, Burt and Grossenheider 1980, Conant and Collins 1991, Kartesz 1999, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Weakley 1993, Weakley and Schafale 1994

RED SPRUCE - (EASTERN HEMLOCK) / GREAT RHODODENDRON SATURATED FOREST

ELEMENT IDENTIFIERS

NVC association: *Picea rubens - (Tsuga canadensis) / Rhododendron maximum* Saturated Forest
Database Code: CEGL006277
Formation: Saturated temperate or subpolar needle-leaved evergreen forest (I.A.8.N.g)
Alliance: *Picea rubens* Saturated Forest Alliance (A.198)

ELEMENT CONCEPT

Summary: This spruce-hemlock wetland forest of the central and southern Appalachian Mountains occurs on relatively flat terrain in poorly drained bottomlands of small streams at high elevations (above 3500 feet elevation in the Southern Blue Ridge to above 2000 feet in the central Appalachians). It historically occurred in Tennessee. Soils are seasonally to semipermanently saturated due to a high water table or seepage from adjacent slopes. The tree canopy is dominated by *Picea rubens* or mixtures of *Picea rubens* and *Tsuga canadensis*. Other tree species that may occur in the canopy or subcanopy include *Tsuga canadensis, Betula alleghaniensis, Acer rubrum var. rubrum, Taxus canadensis,* and *Amelanchier arborea*. This forest often has a dense shrub layer dominated by *Rhododendron maximum* with other associates often including *Kalmia latifolia, Ilex verticillata, Ilex collina, Viburnum nudum var. cassinoides, Photinia melanocarpa (= Aronia melanocarpa),* and *Vaccinium* spp. The herbaceous layer is sparse, with the majority of herbaceous species restricted to openings, and includes *Carex trisperma, Carex folliculata, Glyceria melicaria, Osmunda cinnamomea, Osmunda regalis,* and *Maianthemum canadense*. *Listera smallii, Oclemena acuminata (= Aster acuminatus), Huperzia lucidula,* and *Dryopteris campyloptera* are characteristic herbs. The bryophyte layer is of variable cover but is dominated by *Sphagnum*. The absence of *Abies balsamea* and the importance of *Rhododendron maximum* differentiate this forest from *Picea rubens - Abies balsamea / Sphagnum magellanicum* Forest (CEGL006311).
Environment: This community occurs in poorly drained bottomlands of small streams at high elevations, 1300-1400 m (4200-4500 feet) in North Carolina, and 1070 m (3500 feet) in Virginia. Flooding is rare and soils are seasonally to semipermanently saturated due to a high water table or seepage from adjacent slopes.
Vegetation: This community generally occurs as an open canopy woodland dominated by *Picea rubens*, with an open to dense shrub layer, interspersed with small, open *Sphagnum*-herb-dominated depressions. Other tree species that may occur in the canopy or subcanopy include *Tsuga canadensis, Betula alleghaniensis, Acer rubrum var. rubrum*, and *Amelanchier arborea*. A dense shrub layer, dominated by *Kalmia latifolia* and *Rhododendron maximum* or *Rhododendron catawbiense*, is usually present. Other characteristic shrubs include *Ilex verticillata, Ilex collina, Taxus canadensis, Viburnum nudum var. cassinoides, Photinia melanocarpa (= Aronia melanocarpa),* and *Vaccinium* spp. The herbaceous layer is sparse and patchy and generally restricted to openings with plenty of light. Characteristic herbs include *Carex trisperma, Carex folliculata, Glyceria melicaria, Osmunda cinnamomea, Osmunda regalis var. spectabilis, Listera smallii, Maianthemum canadense,* and *Houstonia serpyllifolia*. *Sphagnum* patches may occur scattered beneath the canopy as well as in small depressions. Other nonvascular plants include *Bazzania trilobata* and *Leucobryum glaucum*.
Dynamics: The factors responsible for creating and maintaining this community are not well known, although beaver activity may play a role. The frequency and role of flooding is not known. This community may represent late successional stage of primary succession from once extensive, open bog areas and will remain in a forest condition unless the canopy is removed by tree blowdown or logging.
Similar Associations:
Related Concepts:

- IIE1a. Southern Appalachian Bog Complex (Allard 1990) B
- Oligotrophic Forest (Rawinski 1992) ?
- Red Spruce-Northern Hardwoods (17) (USFS 1988) ?
- Red Spruce: 32 (Eyre 1980) B
- Red spruce-hemlock/great laurel swamp (CAP pers. comm. 1998) ?
- Swamp Forest-Bog Complex (Spruce Subtype) (Schafale 1998a) ?

Classification Comments: This community is rare in the Southern Blue Ridge, and remaining examples are in poor condition throughout its range. It is known from the Blue Ridge of North Carolina (Alarka Laurel, Long Hope Valley), and was historic in Tennessee.

CONSERVATION RANKING & RARE SPECIES

GRank: G2? (1997-12-1): No information
High-ranked species: *Ilex collina* (G3)

ELEMENT DISTRIBUTION

Range:
Subnations: MD, NC, PA, TN?, VA?, WV
TNC Ecoregions: 51:C, 59:C, 60:C
USFS Ecoregions: 212Fb:CCC, 212Fd:CCC, 212G:CC, 221Bd:CCP, M212Ea:CCC, M221Aa:CCC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Dc:CCC
Federal Lands: USFS (Nantahala, Pisgah)

ELEMENT SOURCES

References: Allard 1990, Anderson 1990, Anderson et al. 1990, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Eyre 1980, Fike 1999, Peet et al. unpubl. data 2002, Rawinski 1992, Rawinski et al. 1994, Richardson and Gibbons 1993, Schafale 1998a, Schafale and Weakley 1990, Stotler and Crandall-Stotler 1977, USFS 1988, Weakley and Schafale 1994

SMOOTH ALDER - SOUTHERN SHEEPKILL - CATAWBA RHODODENDRON - WHITE MEADOWSWEET / NORTHERN LONG SEDGE - GRAY'S LILY SHRUBLAND

ELEMENT IDENTIFIERS

NVC association: *Alnus serrulata - Kalmia carolina - Rhododendron catawbiense - Spiraea alba / Carex folliculata - Lilium grayi* Shrubland
Database Code: CEGL003915
Formation: Saturated mixed evergreen - cold-deciduous shrubland (III.C.2.N.e)
Alliance: *Alnus serrulata - Salix sericea - Rhododendron (catawbiense, maximum)* Saturated Shrubland Alliance (A.1880)

ELEMENT CONCEPT

Summary: This wetland community is dominated by shrubs, occurring over graminoids, forbs, and *Sphagnum* spp. It has a strong component of species of northern phytogeography occurring in combination with species endemic to the southern Appalachians, and in association with felsic gneisses or schists and acidic, nutrient-poor seepage. Shrub cover ranges from 25-100%, and trees may be scattered throughout or dominate in patches or on the edges. *Ilex verticillata, Salix sericea, Spiraea alba,* and *Spiraea tomentosa* are often dominant, occurring with *Alnus serrulata, Rosa palustris, Photinia pyrifolia (= Aronia arbutifolia), Photinia melanocarpa (= Aronia melanocarpa), Rhododendron maximum, Rhododendron viscosum, Rhododendron catawbiense, Kalmia latifolia, Kalmia carolina, Hypericum densiflorum, Lyonia ligustrina var. ligustrina,* and *Menziesia pilosa*. Typical tree species are *Pinus strobus, Tsuga canadensis, Pinus rigida,* and *Picea rubens*. Herbaceous cover may be sparse to dense and typically includes *Carex atlantica, Carex intumescens, Carex folliculata, Schoenoplectus* spp. (= *Scirpus* spp.), and *Osmunda cinnamomea*. *Sphagnum* spp. include *Sphagnum palustre, Sphagnum affine (= Sphagnum imbricatum), Sphagnum bartlettianum, Sphagnum recurvum*, and, rarely, northern disjuncts such as *Sphagnum fallax*. Other characteristic species include *Poa paludigena, Lilium grayi, Platanthera grandiflora, Melanthium virginicum, Stenanthium gramineum var. robustum, Arethusa bulbosa, Calopogon tuberosus, Chelone cuthbertii, Thelypteris simulata, Carex trisperma, Rhizomnium appalachianum, Polytrichum commune, Aulacomnium palustre,* and *Bazzania trilobata*. This community can occur on flat areas in valley bottoms, on portions where wet conditions are maintained hydrologically by rainwater and a high water table rather than by flooding, or in the upper portions of stream watersheds, on slight slopes, hydrologically maintained by very nutrient-poor to fairly nutrient-rich seepage. This community occurs at elevations from 900-1250 m (3000-4200 feet) in the northern part of its range and, in the southern part of the range, at elevations from 1000-1800 m (3300-5800 feet).

Environment: This community can occur on flat areas in valley bottoms, on portions where wet conditions are maintained hydrologically by rainwater and a high water table rather than by flooding, or in the upper portions of stream watersheds, on slight slopes, hydrologically maintained by very nutrient-poor to fairly nutrient-rich seepage. This community occurs at elevations from 900-1250 m (3000-4200 feet) in the northern part of its range and, in the southern part of the range, at elevations from 1000-1800 m (3300-5800 feet). These occurrences are in association with felsic gneisses or schists and acidic, nutrient-poor seepage.

Vegetation: Shrub cover in stands of this association range from 25-100%, and trees may be scattered throughout or dominate in patches or on the edges. *Ilex verticillata, Salix sericea, Spiraea alba,* and *Spiraea tomentosa* are often dominant, occurring with *Alnus serrulata, Rosa palustris, Photinia pyrifolia (= Aronia arbutifolia), Photinia melanocarpa (= Aronia melanocarpa), Rhododendron maximum, Rhododendron viscosum, Rhododendron catawbiense, Kalmia latifolia, Kalmia carolina, Hypericum densiflorum, Lyonia ligustrina var. ligustrina,* and *Menziesia pilosa*. Typical tree species are *Pinus strobus, Tsuga canadensis, Pinus rigida,* and *Picea rubens*. Herbaceous cover may be sparse to dense and typically includes *Carex atlantica, Carex intumescens, Carex folliculata, Schoenoplectus* spp. (= *Scirpus* spp.), and *Osmunda cinnamomea*. *Sphagnum* spp. include *Sphagnum palustre, Sphagnum affine (= Sphagnum imbricatum), Sphagnum bartlettianum, Sphagnum recurvum*, and, rarely, northern disjuncts such as *Sphagnum fallax*. Other characteristic species include *Poa paludigena, Lilium grayi, Platanthera grandiflora, Melanthium virginicum, Stenanthium gramineum var. robustum, Arethusa bulbosa, Calopogon tuberosus, Chelone cuthbertii, Thelypteris simulata, Carex trisperma, Rhizomnium appalachianum, Polytrichum commune, Aulacomnium palustre,* and *Bazzania trilobata*.

Dynamics: Reduction of *Sphagnum* cover, due to siltation, trampling, or nutrient input, promotes succession by woody species. The successional relationship between this palustrine shrubland and *Carex atlantica - Solidago patula var. patula - Lilium grayi /*

Sphagnum bartlettianum Herbaceous Vegetation (CEGL004158) (Southern Appalachian Herb Bog, Typic Variant) is poorly understood. One known occurrence of this community, dating from 10,000 years B.P., is showing signs of woody succession, suggesting that recent changes may be responsible for promoting vegetative succession to woody species (Weakley and Schafale 1994).

Similar Associations:

Related Concepts:

- IIE1b. Southern Appalachian Bog Complex (Allard 1990) B
- Southern Appalachian Bog (Typic Shrub Subtype) (Schafale 1998b) ?
- Southern Appalachian Bog, Typic Variant (Weakley and Schafale 1994) B

Classification Comments: This community may dominate a site or occur as a complex with *Carex atlantica - Solidago patula var. patula - Lilium grayi / Sphagnum bartlettianum* Herbaceous Vegetation (CEGL004158). It is typically surrounded by forests dominated by *Picea rubens, Fagus grandifolia, Betula alleghaniensis, Quercus rubra, Tsuga canadensis*, and/or *Liriodendron tulipifera* with dense *Rhododendron maximum* understories.

Similar non-alluvial wetlands occur in the Blue Ridge, but are distinguished by having a strong component of species of southern phytogeography (*Sarracenia rubra ssp. jonesii, Sarracenia purpurea, Sarracenia oreophila, Smilax laurifolia, Viburnum nudum var. nudum, Rhododendron arborescens, Helonias bullata*) or are associated with mafic geology and nutrient-rich seepage.

CONSERVATION RANKING & RARE SPECIES

GRank: G1G2 (1998-4-30): This community is known from western North Carolina and southwestern Virginia on felsic metamorphic rocks, in the Southern Blue Ridge. Few sites remain, probably less than 500 acres in total, and nearly all of that hydrologically modified to one degree or another. Remaining occurrences of this community have been degraded or are threatened by grazing, agricultural runoff, and construction activities.

High-ranked species: *Chelone cuthbertii* (G3), *Glyptemys muhlenbergii* (G3), *Lilium grayi* (G3), *Poa paludigena* (G3)

ELEMENT DISTRIBUTION

Range: This community occurs in western North Carolina, possibly in eastern Tennessee, and in southwestern Virginia, on felsic metamorphic rocks in the Southern Blue Ridge.

Subnations: NC, TN?, VA?

TNC Ecoregions: 51:C, 59:C

USFS Ecoregions: M221Dc:CCC

Federal Lands: NPS (Blue Ridge Parkway?); USFS (Cherokee?, Nantahala?, Pisgah?)

ELEMENT SOURCES

References: Allard 1990, Burt and Grossenheider 1980, Conant and Collins 1991, Kartesz 1999, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Weakley and Schafale 1994

SMOOTH ALDER - SOUTHERN WILD RAISIN - LEATHERLEAF / NETTED CHAINFERN - MOUNTAIN SWEET PITCHERPLANT SHRUBLAND

ELEMENT IDENTIFIERS

NVC association: *Alnus serrulata - Viburnum nudum* var. *nudum - Chamaedaphne calyculata / Woodwardia areolata - Sarracenia rubra* ssp. *jonesii* Shrubland

Database Code: CEGL003918

Formation: Saturated mixed evergreen - cold-deciduous shrubland (III.C.2.N.e)

Alliance: *Alnus serrulata - Salix sericea - Rhododendron (catawbiense, maximum)* Saturated Shrubland Alliance (A.1880)

ELEMENT CONCEPT

Summary: This community includes non-alluvial wetland vegetation with a unique species composition, including both low mountain and Coastal Plain species, and occurring in low elevation areas of the Southern Blue Ridge. The vegetation consists of a mosaic or zoned pattern of shrub thickets and herb-dominated areas, much of it underlain by *Sphagnum* mats. Trees may be scattered throughout or may dominate on the edges. Shrubs may include *Alnus serrulata, Rosa palustris, Salix sericea, Photinia pyrifolia (= Aronia arbutifolia), Myrica gale, Chamaedaphne calyculata, Gaylussacia dumosa (= var. bigeloviana), Rhododendron maximum, Rhododendron viscosum, Rhododendron arborescens, Viburnum nudum var. nudum, Viburnum nudum var. cassinoides, Kalmia latifolia, Kalmia carolina, Hypericum densiflorum, Lyonia ligustrina var. ligustrina, Ilex verticillata*, and *Menziesia pilosa*. The woody vine *Smilax laurifolia* is often present, climbing high into the shrubs and trees. The herb layer may include *Carex leptalea, Carex echinata, Carex folliculata, Carex gynandra, Carex collinsii, Scirpus cyperinus, Osmunda cinnamomea, Osmunda regalis var. spectabilis, Solidago patula var. patula, Packera aurea (= Senecio aureus), Thelypteris palustris var. pubescens, Isoetes valida (= Isoetes caroliniana), Hypericum denticulatum, Juncus effusus, Juncus caesariensis, Drosera rotundifolia, Woodwardia virginica, Woodwardia areolata, Dulichium arundinaceum, Sarracenia purpurea, Sarracenia oreophila, Sarracenia rubra ssp. jonesii, Eriophorum virginicum*, and *Parnassia asarifolia*. *Sphagnum* species include *Sphagnum palustre, Sphagnum affine (= Sphagnum*

imbricatum), Sphagnum bartlettianum, and *Sphagnum recurvum*. This type ranges from 500-700 m (1700-2400 feet) in elevation, on sites near streams that are generally flat to slightly sloping. These areas receive some seepage from adjacent slopes and are permanently saturated to intermittently dry. This community is found in the broad basin of the French Broad River in southern Buncombe, Henderson, and eastern Transylvania counties, North Carolina. It formerly occupied as much as 1000 acres, now reduced by drainage to a few altered remnants totaling less than 20 acres.

Environment: This type occurs in flat or gently sloping areas, generally in valley bottoms that are not subject to flooding. Soils have not been carefully studied but are likely to be acidic, organic-rich mineral soils developed over gravelly floodplain deposits. Most bog soils are mapped as Toxaway (Cumulic Humaquept), Wehadkee (Typic Fluvaquent), or Hatboro (Typic Fluvaquent) series. The hydrology is palustrine, permanently saturated to intermittently dry. Sites are generally in flat to slightly sloping areas near streams, and receive some seepage from adjacent slopes. The hydrology of this type appears to be less dominated by seepage than are other non-alluvial wetlands of the Southern Blue Ridge. This type ranges from 500-700 m (1700-2400 feet) in elevation.

Vegetation: The vegetation consists of a mosaic or zoned pattern of shrub thickets and herb-dominated areas, much of it underlain by *Sphagnum* mats. Trees such as *Acer rubrum var. rubrum, Pinus strobus, Nyssa sylvatica, Liriodendron tulipifera, Tsuga canadensis*, and *Pinus rigida* may be scattered throughout or may dominate on the edges. Shrubs may include *Alnus serrulata, Rosa palustris, Salix sericea, Photinia pyrifolia (= Aronia arbutifolia), Myrica gale, Chamaedaphne calyculata, Gaylussacia dumosa (= var. bigeloviana), Rhododendron maximum, Rhododendron viscosum, Rhododendron arborescens, Viburnum nudum var. nudum, Viburnum nudum var. cassinoides, Kalmia latifolia, Kalmia carolina, Hypericum densiflorum, Lyonia ligustrina var. ligustrina, Ilex verticillata*, and *Menziesia pilosa*. The woody vine *Smilax laurifolia* is often present, climbing high into the shrubs and trees. The herb layer may include *Carex leptalea, Carex echinata, Carex folliculata, Carex gynandra, Carex collinsii, Scirpus cyperinus, Osmunda cinnamomea, Osmunda regalis var. spectabilis, Solidago patula var. patula, Packera aurea (= Senecio aureus), Thelypteris palustris var. pubescens, Isoetes valida (= Isoetes caroliniana), Hypericum denticulatum (= var. denticulatum), Juncus effusus, Juncus caesariensis, Drosera rotundifolia, Woodwardia virginica, Woodwardia areolata, Dulichium arundinaceum, Sarracenia purpurea, Sarracenia oreophila, Sarracenia rubra ssp. jonesii, Eriophorum virginicum*, and *Parnassia asarifolia*. *Sphagnum* species include *Sphagnum palustre, Sphagnum affine, Sphagnum bartlettianum*, and *Sphagnum recurvum*.

Dynamics: Reduction of *Sphagnum* cover, due to siltation, trampling, or nutrient input, promotes succession by woody species. Little is known about the successional dynamics of these wetlands. All of the few remaining examples have been hydrologically altered.

Similar Associations:

Related Concepts:

- French Broad Valley Bog (Weakley and Schafale 1994) ?
- French Broad Valley Bog (Schafale 1998a) ?
- IIE1b. Southern Appalachian Bog Complex (Allard 1990) B

Classification Comments: This community includes non-alluvial wetland vegetation with a unique species composition, including both low mountain and Coastal Plain species, and occurring in low-elevation areas of the Southern Blue Ridge. It is a very distinctive community, restricted to the French Broad River Valley, and has numerous unique species components that distinguish it from other montane wetlands. The nominal species are constant and abundant in the known occurrences. *Sarracenia rubra ssp. jonesii* is limited to the montane regions of North Carolina and South Carolina, and *Viburnum nudum var. nudum* is more typical of the Coastal Plain.

Similar non-alluvial wetland communities occur in the Southern Blue Ridge. This community is distinguished by occurring in the basin of the French Broad River and containing a suite of species that are disjunct from the northern Coastal Plain. Species not found in this community but typical of other, generally higher elevation, southern Appalachian bogs include *Carex trisperma, Carex buxbaumii, Rhynchospora alba, Filipendula rubra, Dryopteris cristata, Thelypteris simulata, Spiraea alba, Schizachyrium scoparium, Lilium grayi, Pogonia ophioglossoides, Juncus subcaudatus, Ilex collina, Picea rubens, Vaccinium macrocarpon*, and *Saxifraga pensylvanica*.

CONSERVATION RANKING & RARE SPECIES

GRank: G1 (1995-6-15): This community is found at low elevations in the broad basin of the French Broad River in southern Buncombe, Henderson, and eastern Transylvania counties, North Carolina. A concentration formerly occurred in Henderson County, North Carolina, but nearly all of these bogs have been destroyed by drainage. This type formerly occupied as much as 1000 acres, now reduced by drainage to a few altered remnants totaling less than 20 acres. The flat terraces of the French Broad River and its tributaries once supported the largest concentration and acreage of non-alluvial wetlands in western North Carolina. Nearly all of these wetlands have been ditched, drained, and converted to agriculture, golf courses, industrial parks, and residential areas (Weakley and Schafale 1994).

High-ranked species: *Carex schweinitzii* (G3G4), *Chelone cuthbertii* (G3), *Coreopsis helianthoides* (G3G4Q), *Glyptemys muhlenbergii* (G3), *Helenium brevifolium* (G3G4), *Helonias bullata* (G3), *Juncus caesariensis* (G2), *Marshallia grandiflora* (G2), *Narthecium americanum* (G2), *Platanthera integrilabia* (G2G3), *Sagittaria fasciculata* (G1)

ELEMENT DISTRIBUTION

Range: This community is found at low elevations in the broad basin of the French Broad River in southern Buncombe, Henderson, and eastern Transylvania counties, North Carolina. A concentration formerly occurred in Henderson County, North Carolina, but nearly all of these bogs have been destroyed by drainage.

Subnations: NC, TN?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC
Federal Lands: USFS (Pisgah?)

ELEMENT SOURCES

References: Allard 1990, Anderson et al. 1990, Kartesz 1999, Peet et al. unpubl. data 2002, Schafale 1998a, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Weakley 1993, Weakley and Schafale 1994

SMOOTH ALDER - SWAMP AZALEA - GREAT RHODODENDRON / NAKED-FRUIT RUSH - CUTHBERT'S TURTLEHEAD SHRUBLAND

ELEMENT IDENTIFIERS

NVC association: *Alnus serrulata - Rhododendron viscosum - Rhododendron maximum / Juncus gymnocarpus - Chelone cuthbertii* Shrubland
Database Code: CEGL003916
Formation: Saturated mixed evergreen - cold-deciduous shrubland (III.C.2.N.e)
Alliance: *Alnus serrulata - Salix sericea - Rhododendron (catawbiense, maximum)* Saturated Shrubland Alliance (A.1880)

ELEMENT CONCEPT

Summary: This montane wetland occurs as a mosaic or zoned pattern of shrub thickets and herb-dominated areas, much of it underlain by *Sphagnum* mats. All or nearly all examples are flat and occur in the higher portions of the floodplains of creeks or small rivers, receive minimal seepage, and are rarely or never flooded. Trees such as *Acer rubrum, Liriodendron tulipifera, Pinus strobus, Tsuga canadensis*, and *Pinus rigida* may be scattered throughout or may dominate in patches or on the edges. Shrubs may include *Alnus serrulata, Rosa palustris, Salix sericea, Photinia pyrifolia (= Aronia arbutifolia), Photinia melanocarpa (= Aronia melanocarpa), Rhododendron maximum, Rhododendron viscosum, Kalmia latifolia, Kalmia carolina, Hypericum densiflorum, Lyonia ligustrina, Ilex verticillata, Spiraea tomentosa, Spiraea alba*, and *Menziesia pilosa*. The herb layer may include *Carex leptalea, Carex folliculata, Carex gynandra, Carex atlantica, Rhynchospora capitellata, Scirpus expansus, Scirpus cyperinus, Scirpus atrovirens, Osmunda cinnamomea, Osmunda regalis var. spectabilis, Solidago patula var. patula, Packera aurea (= Senecio aureus), Thelypteris palustris var. pubescens, Juncus effusus, Juncus subcaudatus, Lysimachia terrestris, Vaccinium macrocarpon, Eriophorum virginicum, Oxypolis rigidior, Sagittaria latifolia (= var. pubescens)*, and *Orontium aquaticum*. *Sphagnum* species include *Sphagnum palustre, Sphagnum affine (= Sphagnum imbricatum), Sphagnum bartlettianum*, and *Sphagnum recurvum*. Other important bryophytes include *Polytrichum commune, Rhizomnium appalachianum*, and *Aulacomnium palustre*. This community occurs at moderate elevations from about 750-950 m (2400-3200 feet), in the northern part of the Southern Blue Ridge, primarily in Allegheny and Ashe counties, North Carolina, and probably in adjacent Virginia. It also occurs south of the Asheville Basin in southwestern North Carolina and probably in adjacent South Carolina and Georgia at elevations of 900-1200 m (3000-4000 feet).
Environment: This community occurs at moderate elevations from about 750-950 m (2400-3200 feet), in the northern part of the Southern Blue Ridge, primarily in Allegheny and Ashe counties, North Carolina, and probably in adjacent Virginia. This community also occurs south of the Asheville Basin in southwestern North Carolina and probably adjacent South Carolina and Georgia at elevations of about 900-1200 m (3000-4000 feet). All or nearly all examples are nearly flat and occur in the higher (rarely or never flooded) portions of the floodplains of creeks or small rivers, and receive minimal seepage.
Vegetation: The vegetation generally consists of a mosaic or zoned pattern of shrub thickets and herb-dominated areas, much of it underlain by *Sphagnum* mats. Trees such as *Acer rubrum, Liriodendron tulipifera, Pinus strobus, Tsuga canadensis*, and *Pinus rigida* may be scattered throughout or may dominate in patches or on the edges. Shrubs may include *Alnus serrulata, Rosa palustris, Salix sericea, Photinia pyrifolia (= Aronia arbutifolia), Photinia melanocarpa (= Aronia melanocarpa), Rhododendron maximum, Rhododendron viscosum, Kalmia latifolia, Kalmia carolina, Hypericum densiflorum, Lyonia ligustrina, Ilex verticillata, Spiraea tomentosa, Spiraea alba*, and *Menziesia pilosa*. The herb layer may include *Carex leptalea, Carex folliculata, Carex gynandra, Carex atlantica, Rhynchospora capitellata, Scirpus expansus, Scirpus cyperinus, Scirpus atrovirens, Osmunda cinnamomea, Osmunda regalis var. spectabilis, Solidago patula var. patula, Packera aurea (= Senecio aureus), Thelypteris palustris var. pubescens, Juncus effusus, Juncus subcaudatus, Lysimachia terrestris, Vaccinium macrocarpon, Eriophorum virginicum, Oxypolis rigidior, Sagittaria latifolia (= var. pubescens)*, and *Orontium aquaticum*. *Sphagnum* species include *Sphagnum palustre, Sphagnum affine, Sphagnum bartlettianum*, and *Sphagnum recurvum*. Other important bryophytes include *Polytrichum commune, Rhizomnium appalachianum*, and *Aulacomnium palustre*.
Dynamics: Some occurrences of this community may have formed as the result of logging or catastrophic fire, followed by beaver activity. Reduction of *Sphagnum* cover, due to siltation, trampling, or nutrient input, promotes succession by woody species. Little is known about the successional dynamics of mountain wetlands. It is thought that beaver may have been responsible for maintaining a shifting mosaic of boggy habitats which included this community (Weakley and Schafale 1994). With the extirpation of beaver in the North Carolina mountains, vegetative succession proceeds in these habitats and will eventually result in a forested community.
Similar Associations:
Related Concepts:

- IIE1b. Southern Appalachian Bog Complex (Allard 1990) B
- Mountain Bog/Seep Herbaceous Vegetation (Ambrose 1990a) B
- Mountain Bog/Seep Shrub/Scrub Vegetation (Ambrose 1990a) B
- Southern Appalachian Bog (Low Elevation Shrub Subtype) (Schafale 1998b) ?
- Southern Appalachian Bog, Low Elevation Variant (Weakley and Schafale 1994) ?
- Southern Appalachian Bog, Southern Floodplain Variant (Weakley and Schafale 1994) ?

Classification Comments: The nominals are used to distinguish this type from high-elevation bogs; *Juncus gymnocarpus* is not in all occurrences and perhaps another nominal should be found. *Carex stricta*-dominated wetlands may occur adjacent to this community. Similar wetland communities occur in the southern and central Appalachian Mountains. This community typically occurs at lower elevations, is associated with floodplains, and lacks species characteristic of higher elevations, such as *Houstonia serpyllifolia, Picea rubens, Betula alleghaniensis,* and *Carex trisperma*.

CONSERVATION RANKING & RARE SPECIES

GRank: G1G2 (1998-4-30): This community occurs at moderate elevations (750-950 meters; 2400-3200 feet), in the northern part of the Southern Blue Ridge, primarily in Allegheny and Ashe counties, North Carolina, and probably in adjacent Virginia. It also occurs south of the Asheville Basin in southwestern North Carolina and probably adjacent South Carolina and Georgia. Few examples remain, and many of these are in degraded condition. Threats include grazing, agricultural inputs, aerial deposition of air pollutants, and watershed alteration, including road building and development, all which can alter the natural hydrologic regime.
High-ranked species: *Carex schweinitzii* (G3G4), *Chelone cuthbertii* (G3), *Helenium brevifolium* (G3G4), *Helonias bullata* (G3), *Lilium grayi* (G3), *Poa paludigena* (G3)

ELEMENT DISTRIBUTION

Range: This community is known from the northern part of the Southern Blue Ridge, primarily in Allegheny and Ashe counties, North Carolina, in Monroe County, Tennessee, and probably in adjacent Virginia. It also occurs south of the Asheville Basin in southwestern North Carolina and probably in adjacent South Carolina and Georgia.
Subnations: GA, NC, SC, TN, VA?
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah?, Sumter?)

ELEMENT SOURCES

References: Allard 1990, Ambrose 1990a, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Weakley 1993, Weakley and Schafale 1994

BIBLIOGRAPHY

Abrams, M. D. 1992. Fire and the development of oak forests. BioScience 42(5):346-353.

Adams, H. S., S. L. Stephenson, T. J. Blasing, and D. N. Duvick. 1985. Growth trend declines of spruce and fir in mid-Appalachian subalpine forest. Environmental and Experimental Botany 25:315-325.

Adams, H. S., and S. L. Stephenson. 1991. High elevation coniferous forests in Virginia. Virginia Journal of Science 42:391-399.

Allard, D. J. 1984. Natural community characterization abstracts. Unpublished manuscripts. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond.

Allard, D. J. 1990. Southeastern United States ecological community classification. Interim report, Version 1.2. The Nature Conservancy, Southeast Regional Office, Chapel Hill, NC. 96 pp.

Allard, D. J., K. M. Doyle, S. J. Landaal, and R. S. Martin. 1990. Community characterization abstracts for the southeastern United States. Unpublished manuscript. The Nature Conservancy, Southern Heritage Task Force, Chapel Hill, NC.

Allard, H. A., and E. C. Leonard. 1952. The Canaan and the Stony River valleys of West Virginia, their former magnificent spruce forsts, their vegetation and floristics today. Castanea 17:1-60.

Allred, B. W., and H. C. Mitchell. 1955. Major plant types of Arkansas, Louisiana, Oklahoma, and Texas and their relation to climate and soils. Texas Journal of Science 7:7-19.

Ambrose, J. 1990a. Georgia's natural communities--A preliminary list. Unpublished document. Georgia Natural Heritage Inventory. 5 pp.

Anderson, D. M. 1982. Plant communities of Ohio: A preliminary classification and description. Division of Natural Areas and Preserves, Ohio Department of Natural Resources, Columbus, OH. 182 pp.

Anderson, D. M. 1996. The vegetation of Ohio: Two centuries of change. Draft. Ohio Biological Survey.

Anderson, L. E. 1990. A checklist of *Sphagnum* in North America north of Mexico. The Bryologist 93:500-501.

Anderson, L. E., H. A. Crum, and W. R. Buck. 1990. List of mosses of North America north of Mexico. The Bryologist 93:448-499.

Andreu, M. G., and M. L. Tukman. 1995. Forest communities of the Tellico Lake Area, East Tennessee. M.F. project report, Duke University, School of the Environment. Durham, NC. 66 pp. plus appendices.

Arends, E. 1981. Vegetation patterns a half century following the chestnut blight in the Great Smoky Mountains National Park. M.S. thesis, University of Tennessee, Knoxville. 79 pp.

Aulbach-Smith, C. Personal communication. Botanical Services of SC.

Barden, L. S. 1977. Self-maintaining populations of *Pinus pungens* Lam. in the southern Appalachian Mountains. Castanea 42:316-323.

Barden, L. S., and F. W. Woods. 1976. Effects of fire on pine and pine-hardwood forests in the southern Appalachians. Forest Science 22:399-403.

Barnes, B. V. 1991. Deciduous forests of North America. Chapter 10 in: E. Rohrig and B. Ulrich, editors. Ecosystems of the World 7: Temperate deciduous forests. Elsevier Scientific Publishing Company, New York.

Belden, A., Jr., G. P. Fleming, and J. C. Ludwig. 1994. A natural heritage inventory of the Appalachian Trail in Virginia. Natural Heritage Technical Report 94-16. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond. Unpublished report submitted to the Appalachian Trail Conference and George Washington and Jefferson National Forests. 608 pp. plus appendices.

Billings, W. D., and A. F. Mark. 1957. Factors involved in the persistence of montane treeless balds. Ecology 38:140-142.

Boufford, D. E., and E. W. Wood. 1977. An unusual plant community in South Carolina. Castanea 42:116-119.

Bowen, B., M. Pyne, and D. Withers. 1995. An ecological survey of selected tracts in the Tennessee River Gorge: A report to the Tennessee River Gorge Trust. Tennessee Natural Heritage Program, Department of Environment and Conservation, Nashville. 100 pp.

Bratton, S. P. 1975. The effect of the European wild boar, *Sus scrofa*, on Gray beech forest in the Great Smoky Mountains. Ecology 56:1356-1366.

Braun, E. L. 1940. An ecological transect of Black Mountain, Kentucky. Ecological Monographs 10:194-241.

Braun, E. L. 1950. Deciduous forests of eastern North America. Hafner Press, New York. 596 pp.

Bromley, S. W. 1935. The original forest types of southern New England. Ecological Monographs 5:61-89.

Brown, D. M. 1941. Vegetation of Roan Mountain: A phytosociological and successional study. Ecological Monographs 11:61-97.

Brown, J. D., W. H. Elder, and K. E. Evans. 1982b. Winter foraging by cavity nesting birds in an oak-hickory forest. Wildlife Society Bulletin 10:271-275.

Bruck, R. I. 1988. Interactions of spruce-fir pathogens, insects, and ectomychorrhizae on the etiology and epidemiology of boreal montane forest decline in the southern Appalachian Mountains. Pages 133-143 in: Proceedings of the US/FRG research symposium: Effects of atmospheric pollutants on the spruce-fir forests of the eastern U.S. and the Federal Republic of Germany. USDA Forest Service. General Technical Report NE-120. Washington, DC.

Bruner, W. E. 1931. The vegetation of Oklahoma. Ecological Monographs 1:99-188.

Burns, R. M., and B. H. Honkala, technical coordinators. 1990a. Silvics of North America: Volume 1. Conifers. USDA Forest Service. Agriculture Handbook 654. Washington, DC. 675 pp.

Burns, R. M., and B. H. Honkala, technical coordinators. 1990b. Silvics of North America: Volume 2. Hardwoods. USDA Forest Service. Agriculture Handbook 654. Washington, DC. 877 pp.

Burt, W. H., and R. P. Grossenheider. 1980. A field guide to the mammals: Field marks of all North America species found north of Mexico. Third edition. The Peterson Field Guide Series No. 5. Houghton Mifflin Company, Boston. 289 pp. plus color plates.

Busing, R. T., E. E. C. Clebsch, C. C. Eagar, and E. F. Pauley. 1988. Two decades of change in a Great Smoky Mountains spruce-fir forest. Bulletin of the Torrey Botanical Club 115:25-31.

CAP [Central Appalachian Forest Working Group]. 1998. Central Appalachian Working group discussions. The Nature Conservancy, Boston, MA.

Cain, M. D., and M. G. Shelton. 1994. Indigenous vegetation in a southern Arkansas pine-hardwood forest after a half century without catastrophic disturbances. Natural Areas Journal 14:165-174.

Cain, S. A. 1930a. Certain floristic affinities of the trees and shrubs of the Great Smoky Mountains and vicinity. Butler University Botanical Studies 1:129-150.

Cain, S. A. 1930b. An ecological study of the heath balds of the Great Smoky Mountains. Butler University Botanical Studies 1:177-208.

Cain, S. A. 1931. Ecological studies of the vegetation of the Great Smoky Mountains of North Carolina and Tennessee. I. Soil reaction and plant distribution. Botanical Gazette 91:22-41.

Callaway, R. M., E. E. C. Clebsch, and P. S. White. 1987. A multivariate analysis of forest communities in the western Great Smoky Mountains National Park. The American Midland Naturalist 118:107-120.

Campbell, J. 2001. Native vegetation types of Appalachian Kentucky. Unpublished report. The Nature Conservancy, Lexington, KY. 210 pp.

Campbell, J. J. N. 1980. Present and presettlement forest conditions in the Inner Bluegrass region of Kentucky. Ph.D. dissertation, University of Kentucky, Lexington. 109 pp. [Excerpts only]

Caplenor, D. 1965. The vegetation of the gorges of the Fall Creek Falls State Park in Tennessee. Journal of the Tennessee Academy of Science 40:27-39.

Chafin, L. G., and S. B. Jones, Jr. 1989. Community structure of two southern Appalachian boulderfields. Castanea 54:230-237.

Chapman, J. A. 1957. The natural vegetation of English Mountain, Tennessee. Ph.D. dissertation, University of Tennessee, Knoxville. 102 pp.

Chester, E. W., and A. F. Scott. 1980. *Pinus strobus* in Middle Tennessee: Fifty-four years after discovery. Journal of the Tennessee Academy of Science 55:85-86.

Churchill, J. A., and D. W. Wolfe. 1993. A rare flora survey and an application of the TNC Regional Natural Community Classification Key on the Tellico Ranger District and Sampson Wilderness, Cherokee National Forest. The Nature Conservancy, Tennessee Field Office, Nashville. 25 pp. plus appendices.

Coffman, M. S., and G. L. Willis. 1977. The use of indicator species to classify climax sugar maple and eastern hemlock forests in upper Michigan. Forestry and Ecology Management 1:149-168.

Cogbill, C. V., and P. S. White. 1991. The latitude-elevation relationship for spruce-fir forest and treeline along the Appalachian mountain chain. Vegetatio 94:153-175.

Coker, W. C., and H. R. Totten. 1945. Trees of the southeastern United States. University of North Carolina Press, Chapel Hill.

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

Conant, R., and J. T. Collins. 1991. A field guide to reptiles and amphibians: Eastern and central North America. Third edition. The Peterson Field Guide Series No. 12. Houghton Mifflin Company, New York. 450 pp. plus color plates.

Cooper, A. W. 1963. A survey of the vegetation of the Toxaway River Gorge with some remarks about early botanical explorations and an annotated list of the vascular plants of the gorge area. Journal of the Elisha Mitchell Scientific Society 79:1-22.

Cooper, A. W., and J. W. Hardin. 1970. Floristics and vegetation of the gorges on the southern Blue Ridge escarpment. Pages 291-330 in: P. C. Holt, editor. The distributional history of the biota of the southern Appalachians, Part II: Flora. Virginia Polytechnical Institute and State University, Research Division Monograph No. 2.

Core, E. L. 1966. Vegetation of West Virginia. McClain Printing, Parsons, WV. 217 pp.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service, Biological Service Program. FWS/OBS-79/31. Washington, DC. 103 pp.

Crandall, D. L. 1958. Ground vegetation patterns of the spruce-fir area of the Great Smoky Mountains National Park. Ecological Monographs 28:337-360.

Crandall, D. L. 1960. Ground vegetation patterns of the spruce-fir area of the Great Smoky Mountains National Park. Virginia Journal of Science January 1960:9-18.

Crites, G. D., and E. E. C. Clebsch. 1986. Woody vegetation in the inner Nashville Basin: An example from the Cheek Bend area of the central Duck River valley. ASB Bulletin 33:167-177.

Curtis, J. T. 1959. The vegetation of Wisconsin: An ordination of plant communities. University of Wisconsin Press, Madison. 657 pp. [reprinted in 1987]

Davis, J. H., Jr. 1930. Vegetation of the Black Mountains of North Carolina: An ecological study. Journal of the Elisha Mitchell Scientific Society 45:291-318.

DeLapp, J. A. 1978. Gradient analysis and classification of the high elevation red oak community of the southern Appalachians. M.S. thesis, North Carolina State University, Raleigh. 483 pp.

DeSelm, H. R., and N. Murdock. 1993. Grass-dominated communities. Pages 87-141 in: W. H. Martin, S. G. Boyce, and A. C. Echternacht, editors. Biodiversity of the southeastern United States: Upland terrestrial communities. John Wiley and Sons, New York.

DeYoung, H. R. 1979. The white pine-hardwood vegetation types of the Great Smoky Mountains National Park. M.S. thesis, University of Tennessee, Knoxville.

Delcourt, H. R., and P. A. Delcourt. 1997. Pre-Columbian Native American use of fire on southern Appalachian landscapes. Conservation Biology 11(4):1010-1014.

Dellinger, B. 1992. Natural areas survey, Nantahala National Forest, Highlands Ranger District: Site survey reports. Unpublished data. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program, Raleigh.

Diamond, D. D. 1993. Classification of the plant communities of Texas (series level). Unpublished document. Texas Natural Heritage Program, Austin. 25 pp.

DuMond, D. M. 1970. Floristic and vegetational survey of the Chattooga River Gorge. Castanea 35:201-244.

Dull, C. W., J. D. Ward, H. D. Brown, G. W. Ryan, W. H. Clerke, and R. J. Uhler. 1988a. Evaluation of spruce and fir mortality in the southern Appalachian mountains. USDA Forest Service, Southern Region. Protection report R8-PR 13. 92 pp.

Dull, C. W., J. D. Ward, H. D. Brown, and G. W. Ryan. 1988b. Evaluation of tree mortality in the spruce-fir forest of the southeastern United States. Pages 107-110 in: Proceedings of the US/FRG research symposium: Effects of atmospheric pollutants on the spruce-fir forests of the eastern U.S. and the Federal Republic of Germany. USDA Forest Service. General Technical Report NE-120. Washington DC.

Eagar, C., and M. B. Adams, editors. 1992. Ecology and decline of red spruce in the eastern United States. Springer-Verlag, New York. 417 pp.

Eastern Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boston, MA.

Evans, M. 1991. Kentucky ecological communities. Draft report to the Kentucky Nature Preserves Commission. 19 pp.

Evans, Marc. Personal communication. Ecologist. Kentucky Natural Heritage Program, Kentucky State Nature Preserves Commission, Frankfort.

Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.

FNAI [Florida Natural Areas Inventory]. 1992a. Natural communities. Unpublished document. The Nature Conservancy, Florida Natural Areas Inventory, Tallahassee. 6 pp.

FNAI [Florida Natural Areas Inventory]. 1992b. Natural community classification. Unpublished document. The Nature Conservancy, Florida Natural Areas Inventory, Tallahassee. 16 pp.

Faber-Langendoen, D., and Midwest State Natural Heritage Program Ecologists. 1996. Terrestrial vegetation of the midwest United States. International classification of ecological communities: Terrestrial vegetation of the United States. The Nature Conservancy, Arlington, VA.

Fahey, T. J. 1976. The vegetation of a heath bald in Maine. Bulletin of the Torrey Botanical Club 103:23-29.

Farrar, D. R. 1998. The tropical flora of rockhouse cliff formations in the eastern United States. Journal of the Torrey Botanical Society 125(2):91-108.

Fehrenbacher, J. B., J. D. Alexander, I. J. Jansen, R. A. Pope, M. A. Flock, W. F. Andrews, L. J. Bushue, J. W. Scott, and E. E. Voss. 1982. General soil map of Illinois, 1:500,000 scale. University of Illinois, College of Agriculture, Agricultural Experiment Station, and USDA Soil Conservation Service, Champaign, IL.

Feldcamp, S. M. 1984. Revegetation of upper elevation debris slide scars on Mt. LeConte in the Great Smoky Mountains National Park. M.S. thesis, University of Tennessee, Knoxville. 106 pp.

Felix, A. C., III, T. L. Sharik, B. S. McGinnes, and W. C. Johnson. 1983. Succession in loblolly pine plantations converted from second growth forest in the central Piedmont of Virginia. The American Midland Naturalist 110:365-380.

Fernald, M. L. 1950. Gray's manual of botany. Eighth edition. A handbook of the flowering plants and ferns of the central and northeastern United States and Adjacent Canada. American Book Co., New York.

Fike, J. 1999. Terrestrial and palustrine plant communities of Pennsylvania. Pennsylvania Natural Diversity Inventory. Pennsylvania Department of Conservation and Recreation. Bureau of Forestry. Harrisburg, PA. 86 pp.

Fincher, J. M. 1991. The relationship of soil-site factors to forest plant communities in the Green Mountain and White Mountain national forests. M.S. thesis, University of New Hampshire, Concord. 163 pp.

Fleming, G. P. 1999. Plant communities of limestone, dolomite, and other calcareous substrates in the George Washington and Jefferson national forests, Virginia. Natural Heritage Technical Report 99-4. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond. Unpublished report submitted to the USDA Forest Service. 218 pp. plus appendices.

Fleming, G. P., P. P. Coulling, D. P. Walton, K. M. McCoy, and M. R. Parrish. 2001. The natural communities of Virginia: Classification of ecological community groups. First approximation. Natural Heritage Technical Report 01-1. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. Unpublished report. January 2001. 76 pp.

Fleming, G. P., and P. P. Coulling. 2001. Ecological communities of the George Washington and Jefferson national forests, Virginia. Preliminary classification and description of vegetation types. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. 317 pp.

Fleming, G. P., and W. H. Moorhead, III. 1996. Ecological land units of the Laurel Fork Area, Highland County, Virginia. Virginia Department of Conservation and Recreation, Division of Natural Heritage. Natural Heritage Technical Report 96-08. Richmond. 114 pp. plus appendices.

Fleming, G. P., and W. H. Moorhead, III. 2000. Plant communities and ecological land units of the Peter's Mountain area, James River Ranger District, George Washington and Jefferson national forests, Virginia. Natural Heritage Technical Report 00-07. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond. Unpublished report submitted to the USDA Forest Service. 195 pp. plus appendices.

Fleming, Gary P. Personal communication. Ecologist, Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA.

Flinchum, D. M. 1977. Lesser vegetation as indicators of varying moisture regimes in bottomland and swamp forests of northeastern North Carolina. Ph.D. dissertation, North Carolina State University, Raleigh. 105 pp.

Foti, T., M. Blaney, X. Li, and K. G. Smith. 1994. A classification system for the natural vegetation of Arkansas. Proceedings of the Arkansas Academy of Science 48:50-53.

Foti, T., compiler. 1994b. Natural vegetation classification system of Arkansas, draft five. Unpublished document. Arkansas Natural Heritage Commission, Little Rock. 8 pp.

Fountain, M. S., and J. M. Sweeney. 1985. Ecological assessment of the Roaring Branch Research Natural Area. USDA Forest Service, Southern Forest Experiment Station. Research Paper SO-213. New Orleans, LA. 15 pp.

Fountain, M. S., and J. M. Sweeney. 1987. Ecological assessment of the Lake Winona Research Natural Area. USDA Forest Service, Southern Forest Experiment Station. Research Paper SO-235. New Orleans. 14 pp.

Fowells, H. A, compiler. 1965. Silvics of the forest trees of the United States. Agriculture Handbook No. 271. USDA Forest Service, Washington, DC. 762 pp.

Fralish, J. S. 1988b. Predicting potential stand composition from site characteristics in the Shawnee Hills Forest of Illinois. The American Midland Naturalist 120(1):79-101.

Fralish, J. S., F. B. Crooks, J. L. Chambers, and F. M. Harty. 1991. Comparison of presettlement, second-growth and old-growth forest on six site types in the Illinois Shawnee Hills. The American Midland Naturalist 125:294-309.

Frelich, L. E., and C. G. Lorimer. 1991a. Natural disturbance regimes in hemlock-hardwood forests of the upper Great Lakes region. Ecological Monographs 61(2):145-164.

Frost, C. C. 1998. Presettlement fire frequency regimes of the United States: A first approximation. Pages 70-81 in: T. L. Pruden and L. A. Brennan, editors. Fire in ecosystem management: Shifting the paradigm from suppression to prescription. Tall Timbers Fire Ecology Conference Proceedings, No. 20. Tall Timbers Research Station, Tallahassee, FL.

Frothingham, E. H., J. S. Holmes, W. J. Damtoft, E. F. McCarthy, and C. F. Korstian. 1926. A forest type classification for the southern Appalachian Mountains and adjacent plateau and coastal region. Journal of Forestry 24:673-684.

Fuller, R. D. 1977. Why does spruce not invade the high elevation beech forests of the Great Smoky Mountains? M.S. thesis, University of Tennessee, Knoxville. 64 pp.

Gaddy, L. L. Chick. Personal communication. Private consultant. 125 South Edisto Avenue, Columbia, SC 29205. terrainc@innova.net

Gallyoun, M., G. Meyer, A. Andreu, and W. Slocumb. 1996. Mapping vegetation communities with The Nature Conservancy's vegetation classification system on five small national parks in the southeastern USA. Unpublished report. The Nature Conservancy, Southeast Regional Office, Conservation Science Department, Chapel Hill, NC.

Gant, R. E. 1978. The role of allelopathic interference in the maintenance of southern Appalachian heath balds. Ph.D. dissertation, University of Tennessee, Knoxville. 123 pp.

Gant, R. E. 1978. The role of allelopathic interference in the maintenance of southern Appalachian heath balds. Ph.D. dissertation. University of Tennessee, Knoxville. 123 pp.

Gattis, J. T. 1992. Landscape ecosystem classification on the Highlands Ranger District, Nantahala National Forest in North Carolina. M.S. thesis, Clemson University, Clemson, SC. 55 pp.

Gersmehl, P. 1973. Pseudo-timberline: The southern Appalachian grassy balds. Arctic and Alpine Research 9:A137-A138.

Gersmehl, P. J. 1969. A geographic evaluation of the ecotonal hypothesis of bald location in the Southern Appalachians. Proceedings of the American Society of Geographers 1:51-54.

Gersmehl, P. J. 1971. Factors involved in the persistence of southern Appalachian treeless balds: An experimental study. Proceedings of the Association of American Geographers 3:56-61.

Gettman, R. W. 1974. A floristic survey of Sumter National Forest--The Andrew Pickens Division. M.S. thesis, Clemson University, Clemson, SC. 131 pp.

Gibbon, E. L. 1966. The vegetation of three monadnocks in the eastern Piedmont of North Carolina. M.S. thesis, North Carolina State University, Raleigh. 98 pp.

Glenn, S. 1990. Community characterization abstract: Dwarf *Quercus alba* forest. Oklahoma Biological Survey, Natural Heritage Inventory, Norman. 1 p.

Glitzenstein, J. S., and D. R. Streng. 2004. Evaluating the NatureServe preliminary plant community classification for Francis Marion National Forest. Tall Timbers Research Station, Tallahassee, FL. Plus appendices and data.

Golden, M. S. 1974. Forest vegetation and site relationships in the central portion of the Great Smoky Mountains National Park. Ph.D. dissertation, University of Tennessee, Knoxville. 275 pp.

Golden, M. S. 1979. Forest vegetation of the lower Alabama Piedmont. Ecology 60:770-782.

Golden, M. S. 1981. An integrated multivariate analysis of forest communities of the central Great Smoky Mountains. The American Midland Naturalist 106:37-53.

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.

Gordon, R. B. 1937b. A botanical survey of the southwestern section of the Allegheny State Park. New York State Museum Handbook 17:199-247. State University of New York, Albany.

Govus, T. E. 1982. Vegetative profiles of the major forest types in the Pisgah and Nantahala national forests. USDA Forest Service. Contract No. 00-4550-1-1399. 71 pp.

Greenlee, K. W. 1974. A vegetation analysis of a pristine and a selectively cut cove forest of the Unicoi Mountains, western North Carolina. M.S. thesis, Western Carolina University, Cullowhee, NC. 36 pp.

Grossman, D. H., and K. L. Goodin. 1995. Rare terrestrial ecological communities of the United States. In: E. T. LaRoe, G. S. Farris, C. E. Puckett, P. D. Doran, and M. J. Mac, editors. Our living resources: A report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. USDI National Biological Service, Washington, DC.

Harrod, J. C., and R. D. White. 1999. Age structure and radial growth in xeric pine-oak forests in western Great Smoky Mountains National Park. Journal of the Torrey Botanical Society 126(2):139-146.

Hedlin, A. F., H. O. Yates, III, D. C. Tover, B. H. Ebel, T. W. Koerber, and E. P. Merkel. 1981. Cone and seed insects of North American conifers. USDA Forest Service. Cooperative Publication. Washington, DC.

Hines, Martina. Personal communication. Ecologist, Kentucky Natural Heritage Program, Kentucky State Nature Preserves Commission, Frankfort.

Hinkle, C. R. 1978. The segregation of forest communities and selected species to edaphic and topographic factors in the Cumberland Plateau of Tennessee. Ph.D. dissertation, University of Tennessee, Knoxville. 262 pp.

Hinkle, C. R. 1989. Forest communities of the Cumberland Plateau of Tennessee. Journal of the Tennessee Academy of Science 64:123-129.

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. 1997. Preliminary plant community classification for Oklahoma. Unpublished draft document, version 35629. University of Oklahoma, Oklahoma Natural Heritage Inventory, Norman. 47 pp.

Hoagland, B. W. 1998a. Classification of Oklahoma vegetation types. Working draft. University of Oklahoma, Oklahoma Natural Heritage Inventory, Norman. 43 pp.

Hoagland, Bruce W. Personal communication. Ecologist, Oklahoma Natural Heritage Inventory, University of Oklahoma, Norman.

Hodgdon, A. R., and R. Pike. 1961. An ecological interpretation of *Rhododendron* colonies in Maine and New Hampshire. Rhodora 63:61-70.

Homoya, Michael. Personal communication. Indiana Natural Heritage Data Center. Division of Nature Preserves, Department of Natural Resources, 402 West Washington Street, Room W267, Indianapolis, IN 46204. 317/232-4052. Personal communication with S. L. Neid, MRO, March/April, 1997.

Horn, J. C. 1976. Avian succession following clearcutting in the southern Appalachians. Unpublished report. Highlands Biological Station, NC.

Horn, J. C. 1980. Short-term changes in vegetation after clearcutting in the southern Appalachians. Castanea 45:88-96.

Humphrey, L. D. 1989. Life history traits of *Tsuga caroliniana* Engelm. (Carolina hemlock) and its role in community dynamics. Castanea 54:172-190.

Hupp, C. R. 1982. Stream-grade variation and riparian forest ecology along Passage Creek, Virginia. Bulletin of the Torrey Botanical Club 109:488-499.

Jones, S. M. 1988a. Old-growth forests within the Piedmont of South Carolina. Natural Areas Journal 8:31-37.

Jones, S. M. 1988b. Old-growth, steady state forests within the Piedmont of South Carolina. Ph.D. dissertation, Clemson University, Clemson, SC. 94 pp.

Kartesz, J. T. 1999. A synonymized checklist and atlas with biological attributes for the vascular flora of the United States, Canada, and Greenland. First edition. In: J. T. Kartesz and C. A. Meacham. Synthesis of the North American Flora, Version 1.0. North Carolina Botanical Garden, Chapel Hill, NC.

Kauffman, Gary. Personal communication. Botanist. USDA Forest Service, Nantahala National Forest, Highlands, NC.

Keever, C., H. J. Oosting, and L. E. Anderson. 1951. Plant succession on exposed granite of Rocky Face Mountain, Alexander County, North Carolina. Bulletin of the Torrey Botanical Club 78:401-421.

Keever, N. C. 1942. Plant succession on exposed granite of Rocky Face Mountain in Alexander County, North Carolina. M.S. thesis, Duke University, Durham, NC.

King, P. B., and A. Stupka. 1950. The Great Smoky Mountains - their geology and natural history. Scientific Monthly 71:31-43.

Korstian, C. F. 1937. Perpetuation of spruce on cut-over and burned lands in the higher southern Appalachian Mountains. Ecological Monographs 7:125-167.

Kuchler, A. W. 1964. Potential natural vegetation of the conterminous United States. American Geographic Society Special Publication 36. New York, NY. 116 pp.

Lindsay, M. 1976. History of the grassy balds of Great Smoky Mountains National Park. USDI National Park Service, Uplands Field Research Lab. Research/Resources Management Report No. 4. Gatlinburg, TN. 215 pp.

Lindsay, M. 1977. Management of grassy balds in Great Smoky Mountains National Park. USDI National Park Service, Southeast Region, Uplands Field Research Laboratory. Research/Resources Management Report No. 17. Gatlinburg, TN. 67 pp.

Lindsay, M. 1978. The vegetation of the grassy balds and other high elevation disturbed areas in the Great Smoky Mountains National Park. USDI National Park Service, Southeast Region. Uplands Field Research Laboratory. Research/Resources Management Report SER-26. Atlanta, GA. 150 pp.

Lindsay, M. M., and S. P. Bratton. 1979a. Grassy balds of the Great Smoky Mountains: Their history and flora in relation to potential management. Environmental Management 3:417-430.

Lindsay, M. M., and S. P. Bratton. 1979b. The vegetation of grassy balds and other high elevation disturbed areas in the Great Smoky Mountains National Park. Bulletin of the Torrey Botanical Club 106:264-275.

Lindsay, M. M., and S. P. Bratton. 1980. The rate of woody plant invasion on two grassy balds. Castanea 45:75-87.

Livingston, D., and C. Mitchell. 1976. Site classification and mapping in the Mt. LeConte growth district, Great Smoky Mountains National Park. Unpublished report. Great Smoky Mountains National Park Library.

Lohman, M. L., and A. J. Watson. 1943. Identity and host relations of *Nectria* species associated with disease of hardwoods in the eastern states. Lloydia 6:77-108.

Lorimer, C. G. 1980. Age structure and disturbance history of a southern Appalachian virgin forest. Ecology 61:1169-1184.

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.

Major, C. S., C. Bailey, J. Donaldson, R. McCoy, C. Nordman, M. Williams, and D. Withers. 1999. An ecological inventory of selected sites in the Cherokee National Forest. Tennessee Department of Environment and Conservation, Tennessee Division of Natural Heritage. Cost Share Agreement #99-CCS-0804-001. Nashville, TN.

Malter, J. L. 1977. The flora of Citico Creek Wilderness Study Area, Cherokee National Forest, Monroe County, Tennessee. M.S. thesis, University of Tennessee, Knoxville. 116 pp.

Mansberg, L., and T. R. Wentworth. 1984. Vegetation and soils of a serpentine barren in western North Carolina. Bulletin of the Torrey Botanical Club 111:273-286.

Mark, A. F. 1958. The ecology of the southern Appalachian grass balds. Ecological Monographs 28:293-336.

Mark, A. F. 1959. The flora of the grass balds and fields of the southern Appalachian Mountains. Castanea 24:1-21.

Martin, D. L., and L. M. Smith. 1991. A survey and description of the natural plant communities of the Kisatchie National Forest, Winn and Kisatchie districts. Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA. 372 pp.

Martin, D. L., and L. M. Smith. 1993. A survey and description of the natural plant communities of the Kisatchie National Forest, Evangeline and Catahoula districts. Louisiana Department of Wildlife and Fisheries, Baton Rouge. 274 pp.

Martin, N. D. 1959a. An analysis of forest succession in Algonquin Park, Ontario. Ecological Monographs 29(3):187-218.

Martin, W. H. 1989. Forest patterns in the Great Valley of Tennessee. Journal of the Tennessee Academy of Science 64:137-144.

McCormick, J. F., and R. B. Platt. 1980. Recovery of an Appalachian forest following the chestnut blight, or Catherine Keever--You were right! The American Midland Naturalist 104:264-273.

McCoy, D. A. 1958. Vascular plants of Pontotoc County, Oklahoma. American Midland Naturalist 59:371-396.

McDougal, K. M., and C. R. Parks. 1984. Elevational variation in foliar flavonoids of *Quercus rubra* L. (Fagaceae). American Journal of Botany 71:301-308.

McGee, C. E., and R. M. Hooper. 1970. Regeneration after clearcutting in the southern Appalachians. USDA Forest Service. Research Paper SE-70. 12 pp.

McGee, C. E., and R. Smith. 1967. Undisturbed *Rhododendron* thickets are not spreading. Journal of Forestry 65:334-335.

McLaughlin, S. B., D. J. Downing, T. J. Blasing, E. R. Cook, and H. S. Adams. 1987. An analysis of climate and competition as contributors to decline of red spruce in high elevation Appalachian forests of the eastern United States. Oecologia 72:487-501.

McLeod, D. E. 1981. Baseline data for hardwood forests in the Black Mountain Research Natural Area including vegetation patterns. Final report to USDA Forest Service, Southeast Experiment Station. Forest Service Project No. FS-SE-1102. 130 pp.

McLeod, D. E. 1988. Vegetation patterns, floristics, and environmental relationships in the Black and Craggy mountains of North Carolina. Ph.D. dissertation, University of North Carolina, Chapel Hill. 222 pp.

McLeod, D. E. 1988. Vegetation patterns, floristics, and environmental relationships in the Black and Craggy mountains of North Carolina. Ph.D. dissertation. University of North Carolina, Chapel Hill. 222 pp.

McLeod, D. E. Personal communication. Ecologist. Mars Hill College (retired), Celo, NC.

McNab, W. H., and S. A. Browning. 1993. Preliminary ecological classification of arborescent communities on the Wine Spring Creek watershed, Nantahala National Forest. Pages 213-221 in: J. C. Brissette, editor. Proceedings of the Seventh Biennial Southern Silvicultural Research Conference. USDA Forest Service, Southern Forest Experiment Station. General Technical Report SO-93. New Orleans, LA.

McVaugh, R. 1943. The vegetation of the granitic flat-rocks of the southeastern United States. Ecological Monographs 13:120-166.

Monk, C. D., D. T. McGinty, and F. P. Day, Jr. 1985. The ecological importance of *Kalmia latifolia* and *Rhododendron maximum* in the deciduous forest of the southern Appalachians. Bulletin of the Torrey Botanical Club 112:187-193.

Monk, C. D., D. W. Imm, and R. L. Potter. 1990. Oak forests of eastern North America. Castanea 55(2):77-96.

Morey, H. F. 1936. A comparison of two virgin forests in northwestern Pennsylvania. Ecology 17:43-55.

Mowbray, T. B. 1966. Vegetational gradients in the Bearwallow Gorge of the Blue Ridge escarpment. Journal of the Elisha Mitchell Scientific Society 82:138-149.

NCNHP [North Carolina Natural Heritage Program]. 1993. North Carolina Natural Heritage Program biennial protection plan. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program, Raleigh. 120 pp.

NatureServe Ecology - Southeastern United States. No date. Unpublished data. NatureServe, Durham, NC.

Nelson, J. B. 1986. The natural communities of South Carolina: Initial classification and description. South Carolina Wildlife and Marine Resources Department, Division of Wildlife and Freshwater Fisheries, Columbia, SC. 55 pp.

Nelson, P. W. 1985. The terrestrial natural communities of Missouri. Missouri Natural Areas Committee, Jefferson City. 197 pp. Revised edition, 1987.

Newell, C. L., R. K. Peet, and J. C. Harrod. 1997. Vegetation of Joyce Kilmer-Slickrock Wilderness, North Carolina. Unpublished report to USDA Forest Service. University of North Carolina, Curriculum in Ecology & Department of Biology, Chapel Hill, NC. 282 pp. plus maps.

Newell, C. L., and R. K. Peet. 1995. Vegetation of Linville Gorge Wilderness, North Carolina. Unpublished report. to USDA Forest Service. University of North Carolina, Department of Biology, Chapel Hill. 211 pp.

Newell, C. L., and R. K. Peet. 1996a. Vegetation of Shining Rock Wilderness, North Carolina. Unpublished report to USDA Forest Service. University of North Carolina, Department of Biological Science, Chapel Hill, NC. 253 pp. plus map.

Nicholas, N. S., S. M. Zedaker, C. Eagar, and F. T. Bonner. 1992. Seedling recruitment and stand regeneration in spruce-fir forests of the Great Smoky Mountains. Bulletin of the Torrey Botanical Club 119:289-299.

Nicholas, N. S., and S. M. Zedaker. 1989. Ice damage in spruce-fir forests of the Black Mountains, North Carolina. Canadian Journal of Forest Research 19:1487-1491.

Nowacki, G. J., and M. D. Abrams. 1992. Community, edaphic, and historical analysis of mixed oak forests of the Ridge and Valley Province in central Pennsylvania. Canadian Journal of Forest Research 22:790-800.

Nuttall, T. 1821. A journal of travels into the Arkansas territory during the year 1819. T. H. Palmer, Philadelphia. (Re-published 1980. University of Oklahoma Press, Norman.)

Oakley, S. C., H. E. LeGrand, Jr., and M. P. Schafale. 1995. An inventory of mafic natural areas in the North Carolina Piedmont. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program, Raleigh. 252 pp.

Ohmann, L. F., and P. R. Ream. 1971. Wilderness ecology: Virgin plant communities of the Boundary Waters Canoe Area. USDA Forest Service, North Central Forest Experiment Station. Research Paper NC-63. St. Paul, MN. 35 pp.

Oosting, H. J. 1942. An ecological analysis of the plant communities of Piedmont, North Carolina. The American Midland Naturalist 28:1-127.

Oosting, H. J., and P. F. Bourdeau. 1955. Virgin hemlock forest segregates in the Joyce Kilmer Memorial Forest of western North Carolina. Botanical Gazette 116:340-359.

Oosting, H. J., and W. D. Billings. 1951. A comparison of virgin spruce-fir forest in the northern and southern Appalachian system. Ecology 32:84-103.

Palmer, E. J. 1924. The ligneous flora of Rich Mountain, Arkansas and Oklahoma. Journal of the Arnold Arboretum 5:108-134.

Palmer-Ball, B., Jr., J. J. N. Campbell, M. E. Medley, D. T. Towles, J. R. MacGregor, and R. R. Cicerello. 1988. Cooperative inventory of endangered, threatened, sensitive and rare species, Daniel Boone National Forest, Somerset Ranger District. USDA Forest Service, Daniel Boone National Forest, Berea, KY. 244 pp.

Patterson, K. D. 1994. Classification of vegetation in Ellicott Rock Wilderness, Southeastern Blue Ridge Escarpment. M.S. thesis, North Carolina State University, Raleigh. 91 pp.

Patterson, K. D., C. J. Ulrey, and J. Drake. 1999. Vegetation classification of Great Smoky Mountains National Park: Cades Cove and Mount Le Conte quadrangles. Unpublished report submitted to BRD-NPS Vegetation Mapping Program. The Nature Conservancy, Chapel Hill, NC.

Patterson, K. D., D. J. Allard, and S. Landaal. 1994. Rare plant communities of the conterminous United States: Southeastern region. Pages 105-210 in: D. H. Grossman, K. Lemon Goodin, and C. L. Reuss, editors. Rare plant communities of the conterminous United States: An initial survey. The Nature Conservancy, Arlington, VA.

Peet, R. K., T. R. Wentworth, M. P. Schafale, and A.S. Weakley. 2002. Unpublished data of the North Carolina Vegetation Survey. University of North Carolina, Chapel Hill.

Peet, R. K., and N. L. Christensen. 1980. Hardwood forest vegetation of the North Carolina Piedmont. Veroeff. Geobot. Inst. Eidg. Tech. Hochsch., Stift. Ruebel Zuer. 69:14-39.

Pell, W. F., and J. H. Rettig, compiler. 1983. Arkansas natural community abstracts. Arkansas Natural Heritage Commission, Little Rock. 37 pp.

Penfound, W. T. 1953. Plant communities of Oklahoma lakes. Ecology 34:561-583.

Phillips, D. L., and D. J. Shure. 1990. Patch-size effects on early succession in southern Appalachian forests. Ecology 71:204-212.

Phillips, D. L., and W. Murdy. 1985. Effects of Rhododendron on regeneration of southern Appalachian hardwoods. Forest Science 31:226-233.

Pittillo, J. D., and G. A. Smathers. 1979. Phytogeography of the Balsam Mountains and Pisgah Ridge, southern Appalachian Mountains. Pages 206-245 in: H. Lieth and E. Landolt, editors. Proceedings of the 16th International phytogeographic excursion. Veroff. Geobot. Inst., Stiftung Rubel, Zurich.

Plocher, A. E., and K. L. Carvell. 1987. Population dynamics of rosebay rhododendron thickets in the southern Appalachians. Bulletin of the Torrey Botanical Club 114:121-126.

Pyne, M. 1994. Tennessee natural communities. Unpublished document. Tennessee Department of Conservation, Ecology Service Division, Nashville. 7 pp.

Quarterman, E., B. H. Turner, and T. E. Hemmerly. 1972. Analysis of virgin mixed mesophytic forests in Savage Gulf, Tennessee. Bulletin of the Torrey Botanical Club 99:228-232.

Quarterman, E., M. P. Burbanck, and D. J. Shure. 1993. Rock outcrop communities: Limestone, sandstone, and granite. Pages 35-86 in: W. H. Martin, S. G. Boyce, and A. C. Echternacht, editors. Biodiversity of the southeastern United States: Upland terrestrial communities. John Wiley and Sons, New York.

Racine, C. H. 1966. Pine communities and their site characteristics in the Blue Ridge escarpment. Journal of the Elisha Mitchell Scientific Society 82:172-181.

Racine, C. H., and J. W. Hardin. 1975. The vascular flora and vegetation in the Green River Gorge, North Carolina. Castanea 40:319-345.

Radford, A. E., and D. L. Martin. 1975. Potential ecological natural landmarks: Piedmont region, eastern United States. University of North Carolina, Department of Botany, Chapel Hill. 249 pp.

Ramseur, G. S. 1958. The vascular flora of high mountain communities of the southern Appalachians. Ph.D. dissertation, University of North Carolina, Chapel Hill. 106 pp.

Ramseur, G. S. 1960. The vascular flora of high mountain communities of the southern Appalachians. Journal of the Elisha Mitchell Scientific Society 76:82-112.

Rawinski, T. 1984. Natural community description abstract - southern New England calcareous seepage swamp. Unpublished report. The Nature Conservancy, Boston, MA. 6 pp.

Rawinski, T. J. 1992. A classification of Virginia's indigenous biotic communities: Vegetated terrestrial, palustrine, and estuarine community classes. Unpublished document. Virginia Department of Conservation and Recreation, Division of Natural Heritage. Natural Heritage Technical Report No. 92-21. Richmond, VA. 25 pp.

Rawinski, T. J., G. P. Fleming, and F. V Judge. 1994. Forest vegetation of the Ramsey's Draft and Little Laurel Run Research Natural Areas, Virginia: Baseline ecological monitoring and classification. Natural Heritage Technical Report 94-14. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond. 45 pp. plus appendices.

Rawinski, T. J., G. P. Fleming, and F. V. Judge. 1994. Forest vegetation of the Ramsey's Draft and Little Laurel Run Research Natural Areas, Virginia: Baseline ecological monitoring and classification. Natural Heritage Technical Report 94-14. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond. 45 pp. plus appendices.

Rawinski, T. J., K. N. Hickman, J. Waller-Eling, G. P. Fleming, C. S. Austin, S. D. Helmick, C. Huber, G. Kappesser, F. C. Huber, Jr., T. Bailey, and T. K. Collins. 1996. Plant communities and ecological land units of the Glenwood Ranger District, George Washington and Jefferson national forests, Virginia. Virginia Department of Conservation and Recreation, Division of Natural Heritage. Natural Heritage Technical Report 96-20. Richmond. 65 pp. plus appendices.

Rawinski, T. J., and T. F. Wieboldt. 1993. Classification and ecological interpretation of mafic glade vegetation on Buffalo Mountain, Floyd County, Virginia. Banisteria 2:3-10.

Rentch, J. S., H. S. Adams, R. B. Coxe, and S. L. Stephenson. 2000. An ecological study of a Carolina hemlock (*Tsuga caroliniana*) community in southwestern Virginia. Castanea 65(1):1-8.

Rheinhardt, R. D. 1981. The vegetation of the Balsam Mountains of Southwest Virginia: A phytosociological study. M.A. thesis. College of William and Mary, Williamsburg, VA. 146 pp.

Rheinhardt, R. D., and S. A. Ware. 1984. The vegetation of the Balsam Mountains of southwestern Virginia: A phytosociological study. Buletin of the Torrey Botanical Club 111:287-300.

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.

Risk, P. L. 1993. High elevation heath communities in the Blue Ridge of North Carolina. Ph.D. dissertation, University of North Carolina, Chapel Hill.

Risk, P. L. 1993. High elevation heath communities in the Blue Ridge of North Carolina. Ph.D. dissertation. University of North Carolina, Chapel Hill.

Robertson, P. A., M. D. MacKenzie, and L. F. Elliott. 1984. Gradient analysis and classification of the woody vegetation for four sites in southern Illinois and adjacent Missouri. Vegetatio 58:87-104.

Rodgers, C. L. 1965. The vegetation of Horsepasture Gorge. Journal of the Elisha Mitchell Scientific Society 81:103-122.

Rodgers, C. L., and R. E. Shake. 1965. Survey of vascular plants in Bearcamp Creek watershed. Castanea 30:149-166.

Rogers, R. S. 1980. Hemlock stands from Wisconsin to Nova Scotia: Transitions in understory composition along a floristic gradient. Ecology 61(1):178-193.

Rohrer, J. R. 1983. Vegetation pattern and rock type in the flora of the Hanging Rock Area, North Carolina. Castanea 48:189-205.

Russell, N. H. 1953. The beech gaps of the Great Smoky Mountains. Ecology 34:366-374.

Schafale, M. 1998a. Fourth approximation guide. Mountain wetlands. February 1998 draft. North Carolina Natural Heritage Program, Raleigh.

Schafale, M. 1998b. Fourth approximation guide. High mountain communities. March 1998 draft. North Carolina Natural Heritage Program, Raleigh.

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.

Schafale, Mike P. Personal communication. Ecologist, North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program, Raleigh.

Schmalzer, P. A. 1978. Classification and analysis of forest communities in several coves of the Cumberland Plateau in Tennessee. M.S. thesis, University of Tennessee, Knoxville. 24 pp.

Schmalzer, P. A., and H. R. DeSelm. 1982. Vegetation, endangered and threatened plants, critical plant habitats and vascular flora of the Obed Wild and Scenic River. Unpublished report. USDI National Park Service, Obed Wild and Scenic River. 2 volumes. 369 pp.

Schofield, W. B. 1960. The ecotone between spruce-fir and deciduous forest in the Great Smoky Mountains. Ph.D. dissertation, Duke University, Durham, NC. 176 pp.

Segars, C. B., L. C. Crawford, and A. M. Harvill. 1951. The occurrence and distribution of hemlock in Alabama. Ecology 32:149-151.

Seischab, F. K. 1990. Presettlement forests of the Phelps and Gorham Purchase in western New York. Bulletin of the Torrey Botanical Club 117:27-38.

Simon, Steve. Personal communication.

Sims, R. A., W. D. Towill, K. A. Baldwin, and G. M. Wickware. 1989. Field guide to the forest ecosystem classification for northwestern Ontario. Ontario Ministry of Natural Resources.

Singer, F. J., W. T. Swank, and E. E. C. Clebsch. 1984. Effects of wild pig rooting in a deciduous forest. Journal of Wildlife Management 48:464-473.

Small, C. J. 1996. Characterization of montane cedar-hardwood woodlands in the Southern Blue Ridge Province. M.S. thesis, North Carolina State University, Raleigh. 79 pp.

Smith, L. M., compiler. 1996a. Natural plant communities in Louisiana currently recognized by the Louisiana Natural Heritage Program. Unpublished document. Louisiana Department of Wildlife and Fisheries, Natural Heritage Program, Baton Rouge. 2 pp.

Smith, T. L. 1991. Natural ecological communities of Pennsylvania. First revision. Unpublished report. Pennsylvania Science Office of The Nature Conservancy, Middletown, PA. 111 pp.

Southeastern Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Durham, NC.

Stamper. 1976. Vegetation of Beech Mountain, North Carolina. M.S. thesis, University of Tennessee, Knoxville. 185 pp.

Stephenson, S. L., and H. S. Adams. 1984. The spruce-fir forest on the summit of Mount Rogers in southwestern Virginia. Bulletin of the Torrey Botanical Club 111:69-75.

Stephenson, S. L., and H. S. Adams. 1989. The high-elevation red oak (*Quercus rubra*) community type in western Virginia. Castanea 54:217-229.

Stephenson, S. L., and J. F. Clovis. 1983. Spruce forests of the Allegheny Mountains in central West Virginia. Castanea 48:1-12.

Stotler, R., and B. Crandall-Stotler. 1977. A checklist of liverworts and hornworts of North America. The Bryologist 80:405-428.

Stratton, D. A., and P. S. White. 1982. Grassy balds of Great Smoky Mountains National Park: Vascular plant floristics, rare plant distributions, and an assessment of the floristic data base. USDI National Park Service, Southeast Region. Uplands Field Research Laboratory. Research/Resources Management Report SER-58. Gatlinburg, TN.

Sutherland, E. K., H. Grissino-Mayer, C. A. Woodhouse, W. W. Covington, S. Horn, L. Huckaby, R. Kerr, J. Kush, M. Moore, and T. Plumb. 1993. Two centuries of fire in a southwestern Virginia *Pinus pungens* community. Paper presented at IUFRO conference on inventory and management in the context of catastrophic events. University Park, PA.

Swain, P. C., and J. B. Kearsley. 2001. Classification of natural communities of Massachusetts. September 2001 draft. Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife. Westborough, MA.

Taggart, J. B. 1973. Floristic survey and vegetational analysis of Stone Mountain State Park in North Carolina. M.S. thesis, North Carolina State University, Raleigh. 51 pp.

Thomas, R. D. 1966. The vegetation and flora of Chilhowee Mountain. Ph.D. dissertation, University of Tennessee, Knoxville. 355 pp.

Thomas, R. D. 1989. The vegetation of Chilhowee Mountain, Tennessee. Journal of the Tennessee Academy of Science 64:185-188.

Tiner, R. W., Jr. 1985a. Wetlands of Delaware. Cooperative publication of USDI Fish & Wildlife Service, National Wetlands Inventory, Newton Corner, MA, and Delaware Department of Natural Resources and Environmental Control, Dover, DE. 77 pp.

Tobe, J. D., J. E. Fairey, III, and L. L. Gaddy. 1992. Vascular flora of the Chauga River Gorge, Oconee County, South Carolina. Castanea 57:77-109.

Tucker, L. W. 1973. Vegetational analysis of Joyce Kilmer Memorial Forest. M.A. thesis, Western Carolina University, Cullowhee, NC. 79 pp.

Turrill, N. L., and E. R. Buckner. 1995. The loss of southern Appalachian *Pinus pungens* Lam. due to fire suppression. ASB Bulletin 42:109.

USFS [U.S. Forest Service]. 1988. Silvicultural examination and prescription field book. USDA Forest Service, Southern Region. Atlanta, GA. 35 pp.

Ulrey, C. J. 1999. Classification of the vegetation of the Southern Appalachians. Final report. USDA Forest Service, Southeastern Research Station, Bent Creek Experimental Forest, Asheville, NC. 90 pp.

Vankat, J. L. 1990. A classification of the forest types of North America. Vegetatio 88:53-66.

Walck, J. L., J. M. Baskin, and C. C. Baskin. 1996. Sandstone rockhouses of the eastern United States, with particular reference to the ecology and evolution of the endemic plant taxa. Botanical Review 62(4):311-362.

Walton, D., N. Putnam, and P. Trianosky. 1997. A classification of the terrestrial plant communities of West Virginia. Second draft. West Virginia Natural Heritage Program. Elkins, WV.

Ware, D. M. E., and S. Ware. 1992. An *Acer barbatum*-rich ravine forest community in the Virginia coastal plain. Castanea 57:110-122.

Weakley, A. S. 1980. Natural areas inventory and management recommendations for Big Yellow Mountain, Avery County, North Carolina. Unpublished document. The Nature Conservancy, North Carolina Field Office. Carrboro, NC. 100 pp.

Weakley, A. S. 1997. Flora of the Carolinas and Virginia. Unpublished May draft. The Nature Conservancy, Southeast Regional Office, Chapel Hill, NC.

Weakley, A. S., L. A. Mehrhoff, III, and L. Mansberg. 1979. Natural area inventory--Master plan for Bluff Mountain, Ashe County, North Carolina. Unpublished report. The Nature Conservancy, North Carolina Field Office, Carrboro. 225 pp.

Weakley, A. S., and M. P. Schafale. 1994. Non-alluvial wetlands of the Southern Blue Ridge: Diversity in a threatened ecosystem. Water, Air, and Soil Pollution 77:359-383.

Weakley, A. S., compiler. 1993. Natural Heritage Program list of the rare plant species of North Carolina. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program. Raleigh. 79 pp.

Weakley, Alan. Personal communication. Former Chief Ecologist, NatureServe, Southeast Region, 6114 Fayetteville Street, Suite 109, Durham, NC 27513.

Wells, E. F. 1974. A vascular flora of the Uwharrie Wildlife Management Area, Montgomery County, North Carolina. Castanea 39:39-57.

Wentworth, T. R., P. S. White, C. Pyle, and M. P. Schafale. 1988. Compilation and interpretation of the vegetation database and disturbance history of southern Appalachian spruce-fir. Pages 145-149 in: Proceedings of the US/FRG research symposium: Effects of atmospheric pollutants on the spruce-fir forests of the eastern U.S. and the Federal Republic of Germany. USDA Forest Service. General Technical Report NE-120. Washington, DC.

Wharton, C. H. 1978. The natural environments of Georgia. Georgia Department of Natural Resources, Atlanta. 227 pp.

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.

Wheat, R. M. 1986. Classification of forest plant communities and their relationships to landtypes on the highly dissected plateau of the western Highland Rim in middle Tennessee. M.S. thesis, University of Tennessee, Knoxville. 146 pp.

Whigham, D. F. 1969. Vegetation patterns on the north slopes of Bluff Mountain, Ashe County, North Carolina. Journal of the Elisha Mitchell Scientific Society 85:1-15.

White, J., and M. Madany. 1978. Classification of natural communities in Illinois. Pages 311-405 in: Natural Areas Inventory technical report: Volume I, survey methods and results. Illinois Natural Areas Inventory, Urbana, IL.

White, P. 1984a. Impacts of cultural and historic resources on natural diversity: Lessons from Great Smoky Mountains National Park, North Carolina and Tennessee. Pages 119-132 in: J. L. Cooley and J. H. Cooley, editors. 1984. Natural diversity in forest ecosystems. Proceedings of a workshop. University of Georgia, Institute of Ecology, Athens. 282 pp.

White, P. S., E. R. Buckner, J. D. Pittillo, and C. V. Cogbill. 1993. High-elevation forests: Spruce-fir forests, northern hardwoods forests, and associated communities. Pages 305-337 in: W. H. Martin, S. G. Boyce, and A. C. Echternacht, editors. Biodiversity of the southeastern United States: Upland terrestrial communities. John Wiley and Sons, New York.

White, P. S., and C. V. Cogbill. 1992. Spruce-fir forests in eastern North America. Page 3-39 in: C. Eagar and M. B. Adams, editors. Ecology and decline of red spruce in the eastern United States. Springer-Verlag, New York.

White, P. S., and S. T. A. Pickett. 1985. Natural disturbance and patch dynamics: An introduction. Pages 3-13 in: P. S. White and S. T. A. Pickett, editors. The ecology of natural disturbance and patch dynamics. Academic Press, Orlando, FL.

White, P. S., editor. 1984b. The southern Appalachian spruce-fir ecosystem: Its biology and threats. USDI National Park Service, Research/Resource Management Report SER-71. 268 pp.

White, Rickie. Personal communication. Regional Ecologist. NatureServe, Southern Resource Office, Durham, NC.

Whittaker, R. H. 1956. Vegetation of the Great Smoky Mountains. Ecological Monographs 26:1-80.

Whittaker, R. H. 1979. Appalachian balds and other North American heathlands. Pages 427-439 in: R. L. Specht, editor. Ecosystems of the world. Series Publication 9A. Heathlands and related shrublands: Descriptive studies. Elsevier Scientific Publishing Company, New York.

Wiegl, P. D., and T. W. Knowles. 1999. Antiquity of southern Appalachian grass balds: The role of keystone megaherbivores. Pages 215-223 in: R. P. Eckerlin, editor. Proceedings of the Appalachian Biogeography Symposium, Virginia Museum of Natural History Special Publication Number 7.

Wieland, R. G. 1994b. Mississippi Natural Heritage Program: Ecological communities. Unpublished document. Mississippi Department of Wildlife, Fisheries, and Parks, Museum of Natural Science, Natural Heritage Program, Jackson, MS. 7 pp.

Williams, C. E. 1991. Maintenance of the disturbance-dependent Appalachian endemic, *Pinus pungens*, under low disturbance regimes. Natural Areas Journal 11:169-170.

Williams, C. E., M. V. Lipscomb, W. C. Johnson, and E. T. Nilsen. 1990a. Influence of leaf litter and soil moisture on early establishment of *Pinus pungens*. The American Midland Naturalist 124:142-152.

Williams, C. E., and W. C. Johnson. 1990. Age structure and the maintenance of *Pinus pungens* in pine-oak forests of southwestern Virginia. The American Midland Naturalist 124:130-141.

Williams, C. E., and W. C. Johnson. 1992. Factors affecting recruitment of *Pinus pungens* in the southern Appalachian Mountains. Canadian Journal of Forest Research 22:878-887.

Winstead, J. E., and K. A. Nicely. 1976. A preliminary study of a virgin forest tract of the Cumberland Plateau in Laurel County, Kentucky. Transactions of the Kentucky Academy of Science 37:29-32.

Wiser, S. K. 1993. Vegetation of high-elevation rock outcrops of the southern Appalachians: Composition, environmental relationships, and biogeography of communities and rare species. Ph.D. dissertation, University of North Carolina, Chapel Hill. 271 pp.

Wiser, S. K., R. K. Peet, and P. S. White. 1996. High-elevation rock outcrop vegetation of the southern Appalachian Mountains. Journal of Vegetation Science 7:703-722.

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.

Wood, E. W. 1975. A comparison of mature, yellow birch-dominated forests in northern and southern Appalachian regions. Unpublished document. University of Georgia Herbarium Library, Athens. 67 pp.

Woods, A. J., J. M. Omernik, W. H. Martin, G. J. Pond, W. M. Andrews, S. M. Call, J. A. Comstock, and D. D. Taylor. 2002. Ecoregions of Kentucky (color poster with map, descriptive text, summary tables, and photographs). U.S. Geological Survey, Reston, VA. (map scale 1:1,000,000)

Zartman, C. E., and J. D. Pittillo. 1998. Spray cliff communities of the Chattooga Basin. Castanea 63(3):217-240.

Zedaker, S. M., N. S. Nicholas, C. Eagar, P. S. White, and T. Burk. 1988. Stand characteristics associated with potential decline of spruce-fir forests in the southern Appalachians. Pages 123-131 in: Proceedings of the US/FRG research symposium: Effects of atmospheric pollutants on the spruce-fir forests of the eastern U.S. and the Federal Republic of Germany. USDA Forest Service. General Technical Report NE-120. Washington, DC.

Zobel, D. B. 1969. Factors affecting the distribution of *Pinus pungens*, an Appalachian endemic. Ecological Monographs 39:303-333.