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Natural Resource Stewardship and Science

Vegetation Mapping at Kennesaw Mountain National Battlefield Park

Natural Resource Report NPS/SECN/NRR—2015/1088

ON THE COVER
Piedmont Dry-Mesic Acidic Oak-Hickory Forest
Photograph courtesy of Jennifer Asper, NPS

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Rachel H. McManamay

National Park Service
Southeast Coast Inventory & Monitoring Network
135 Phoenix Road
Athens, GA 30605

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Executive Summary

The Southeast Coast Network (SECN), with the support of the National Park Service (NPS) Vegetation Mapping Inventory Program (VMI), described and mapped vegetation at Kennesaw Mountain National Battlefield Park (KEMO). This mapping effort was accomplished through collaboration with the Southeast regional office of NatureServe (Raleigh/Durham, N.C.).

The mapping area was 2,543 hectares (ha), encompassing the entire boundary of the park plus an additional buffered area of adjacent land. NatureServe ecologists identified plant associations for the park and a remote sensing specialist from the Southeast Coast Network conducted the vegetation mapping using 1:12,000-scale, color-infrared aerial photography and digital orthophotography. NatureServe collected vegetation and environmental data from 35 vegetation classification plots, and the remote sensing specialist assessed 91 observation points. The Atkins consulting firm was contracted by the Southeast Coast Network to conduct an accuracy assessment (AA), which entailed sampling 243 additional points. Fieldwork and mapping were completed between 2005 and 2015.

A total of 24 map classes were developed to map the vegetation and general land cover of Kennesaw Mountain National Battlefield Park and surroundings, including the following: 16 map classes representing natural/semi-natural vegetation at the association level in the National Vegetation Classification System (NVCS), 3 map classes representing cultural vegetation (e.g. developed) in the NVCS, and 5 map classes representing non-vegetated units (e.g. open water bodies, buildings, roads). Features were interpreted using 1:12,000 scale digital color-infrared aerial photography (flown 31 May 2009) through heads-up-digitizing in ArcGIS (Version 10.0, © 2010 Environmental Systems Research Institute, Redlands, California). Polygons were mapped to a 0.5-hectare minimum mapping unit (MMU).

A geodatabase containing various feature class layers and tables was constructed to show the locations of vegetation types and general land cover (vegetation map), vegetation plot samples, AA sites, project boundary extent, and aerial photographic centers. The feature class layer for the KEMO vegetation map provides 296 polygons of detailed attribute data covering 1419.2 hectares, with an average polygon size of 9.4 hectares. Of the area mapped, 195 polygons (65.9% of all polygons) represent natural/semi-natural vegetation types in the NVCS, encompassing 1,129.1.6 hectares (79.6%) of the total map extent.

Summary reports generated from the vegetation map layer indicate that the Early- to Mid-Successional Loblolly Pine Forest dominates the vegetated landscape (73 polygons covering 465.9 ha). The combined map class Tuliptree Forest Alliance / Piedmont Dry- Mesic Acidic Oak Hickory Forest / Interior Southern Red Oak – White Oak Forest (61 polygons, 392.9 ha) also covers a considerable portion of the park. Both of these map classes occur along the lower elevations in Kennesaw Mountain National Battlefield Park.

A thematic accuracy assessment study was conducted on the 16 classes in the boundary of the park that represent floristic types within the NVCS. Results present an overall accuracy of 80.0% (Kappa statistic = 68.2%) based on data from 243 AA sites.

Products resulting from the KEMO vegetation mapping project include:

Available in this report:

- Project summary of methods and results
- Illustrated photo-interpretation guide
- Detailed descriptions of vegetation associations
- Samples of field forms

Available elsewhere[1]:

- Geodatabase containing map polygon attributes, aerial photography flight lines, plot data, and park and project boundaries
- Ground photography of vegetation plots, observation points, and accuracy assessment points in hard copy and digital formats
- All field data (plot, observation point, and accuracy assessment point) stored in the Microsoft Access PLOTS database
- Hard copy vegetation maps
- Hard copy orthophotographs in DOQQ format and stereo aerial photograph prints
- Metadata for all digital products

Geospatial products are in the Universal Transverse Mercator (UTM) projection, Zone 17, using the North American Datum of 1983.

[1] Products and additional information can be found at the Integrated Resource Management Applications portal (NPS 2015a)..

Acknowledgments

Funding for this project was provided by the National Park Service Vegetation Mapping Inventory Program. The Southeast regional office of NatureServe (Raleigh/Durham, N.C.) completed the field survey and other tasks associated with the vegetation classification portion of the project. The Southeast Coast Network completed the vegetation mapping. The Atkins consulting firm performed the accuracy assessment. Jennifer Asper, University of Georgia, created the study site map. Special thanks to the staff of Kennesaw Mountain National Battlefield Park for their cooperation with this project.

Introduction

Kennesaw Mountain National Battlefield Park Vegetation Mapping Project

The Kennesaw Mountain National Battlefield Park (KEMO) Vegetation Mapping project was organized and coordinated by the National Park Service (NPS) Southeast Coast Network (SECN) between 2005 and 2015, with assistance from the Southeast regional office of NatureServe for the vegetation classification portion of the project. The purpose of this project was to inventory and map existing plant associations on approximately 1,392 hectares (ha) of Kennesaw Mountain, including a buffered area surrounding the park. The mapping information is provided in written, tabular, digital, and spatial formats that are useful to resource managers, the Southeast Coast Network, and others. The mapping product will serve as a useful baseline of vegetation information that will assist park natural and cultural resource stewardship. The identification and description of plant communities also provides habitat information important to understanding associated organisms (reptiles, amphibians, mammals, etc.) and providing inference to the location and abundance of species that are characteristic of each community.

Vegetation Mapping Inventory Program

The Vegetation Mapping Inventory Program (VMI) is an effort by the National Park Service to classify, describe, inventory, and map vegetation communities in more than 280 national park units across the United States. The primary objective of the Vegetation Mapping Inventory Program is to produce high-quality, standardized maps and associated data sets of vegetation and other land-cover occurring within parks. Since vegetation species and communities are unique from park to park, the inventory of these resources assists park managers on a wide array of management issues. For more information about the Vegetation Mapping Inventory Program, visit the program website (see NPS 2015b).

Vegetation Mapping Inventory Program Standards

The National Park Service and the Vegetation Mapping Inventory Program established guidance and standards for all vegetation mapping projects in a series of documents, including both protocols and standards:

Protocols:

- National Vegetation Classification System (TNC and ESRI 1994a, NatureServe 2003)
- Field methods and mapping procedures (TNC and ESRI 1994b)
- Statistically rigorous and consistent accuracy assessment procedures (ESRI and TNC 1994, Lea and Curtis 2010)
- Guidelines for using existing vegetation data (TNC 1994)

Standards:

- The National Vegetation Classification Standard (FGDC 1997, FGDC 2008, NatureServe 2015)
- Spatial Data Transfer Standard (FGDC 1998b)
- Content Standard for Digital Geospatial Metadata (FGDC 1998a)
- United States National Map Accuracy Standards (USGS 1999)
- Integrated Taxonomic Information System (U.S. Department of Agriculture)
- Program-defined standards for map attribute accuracy and minimum mapping unit

National Vegetation Classification Standard

The National Vegetation Classification Standard (NVCS) is the mapping standard used in SECN vegetation mapping projects. The NVCS, adopted by the Federal Geographic Data Committee (FGDC), evolved from work conducted by The Nature Conservancy, NatureServe, and the Natural Heritage Program network over more than two decades (FGDC 1997). The NVCS standard supports the development and use of a consistent national vegetation classification throughout the National Park Service and other organizations. Such a standard facilitates the production of uniform statistics about vegetation resources across the nation and makes cooperation on vegetation management issues across jurisdictional boundaries possible (Grossman et al. 1998). The Vegetation Subcommittee of the Federal Geographic Data Committee works to keep the standard relevant and current. Revisions made to the upper levels of the NVCS hierarchy adopted by the Vegetation Subcommittee as Version 2 (FGDC 2008) were not used in this project since the crosswalks for vegetation associations were unavailable when this project began.

Vegetation classification systems attempt to recognize and describe repeating assemblages of plants in similar habitats. The NVCS is a hierarchical system that incorporates physiognomic characters and floristic data to define seven levels of terrestrial vegetation classification. The five upper levels (class, subclass, group, subgroup, and formation) are based on physiognomic features. The two lower levels (alliance and association) are distinguished by differences in floristic composition. The physiognomic units have a broad geographic perspective and the floristic units have utility in local and site-specific applications (Grossman et al. 1998). The physiognomic levels of the NVCS are based on physical, structural, and environmental characteristics identifiable from satellite imagery, aerial photography, or ground observations (Table 1). Specific criteria defining these physiognomic units are based on ecologic characteristics that vary among major vegetation groups (FGDC 1997).

The alliance and association levels form the base of the NVCS hierarchy and are determined by the most abundant or diagnostic species comprising the various layers of a homogenous vegetation community. An association is here defined as a plant community type with a consistent species composition, uniform physiognomy, and similar habitat conditions (Flahault and Schroter 1910). Species composition differentiates associations (TNC and ESRI 1994a). An alliance is "a physiognomically uniform group of plant associations sharing one or more dominant or diagnostic species which, as a rule, are found in the uppermost strata of the vegetation." (Reid and Comer 1998). NatureServe coordinates plant association data for the SECN vegetation mapping projects. Associations are added to the NVCS and older concepts are refined as new data become available.

For more information about the NVCS, see the USGS-NPS Vegetation Mapping Program standards (see Lea 2011) or Grossman et al. 1998.

Table 1. Example of National Vegetation Classification hierarchy for terrestrial vegetation (FGDC 1997).

Level	Criteria Delineating Level	Example
Class	Structure (height, cover) of dominant vegetation strata	Forest
Subclass	Growth form characteristics including leaf type (evergreen, deciduous) for woody plants and persistent (perennial, annual) herbaceous species	Evergreen forest
Group	Leaf morphology (broad leaf, microphyllous, xeromorphic), leaf phenology, and climatic conditions	Temperate or subpolar needle-leaved evergreen forest
Subgroup	Relative degree of human disturbance	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest
Formation	Additional physiognomic characteristics, general environmental conditions, relative landscape position, and hydrologic regimes	Rounded-crowned temperate or subpolar needle-leaved evergreen forest
Alliance	Dominant or diagnostic species of uppermost or dominant stratum	*Pinus taeda* Forest Alliance
Association	Other dominant or diagnostic species from any stratum	*Pinus taeda/Liquidambar styraciflua-Acer rubrum* var. *rubrum/Vaccinium stamineum* Forest

Federal Geographic Data Committee Standards

In addition to vegetation classification, the Federal Geographic Data Committee sets standards for map spatial accuracy and for metadata employed in NPS vegetation mapping projects. Standards for map products stipulate a map scale of 1:24,000 or finer and a minimum polygon size of 0.5 hectares (1.24 acres [ac]). Positional accuracy for vegetation maps must meet National Map Accuracy Standards, which specify horizontal errors of less than 10.2 meters (m; 33.5 feet [ft]) on the ground for 1:12,000-scale maps.

All digital vegetation products resulting from this project are accompanied by FGDC-compliant metadata. Metadata are “data about the data,” and describe the content, quality, condition, and other characteristics of the spatial dataset. Metadata are critical elements that expedite the interpretation and exchange of information among users.

Methods

Study Area

Location

Kennesaw Mountain National Battlefield Park is an urban park located in Cobb County, Georgia roughly 20 miles (32 kilometers) northwest of Atlanta and immediately west of Marietta (Figure 1). The park is an important greenspace in the Atlanta area, and due to its close proximity to this city, it is actually the second most visited national battlefield in the United States, with nearly 1.5 million visitors a year (Strack and Miller 2008).

History

Kennesaw Mountain National Battlefield Park encompasses approximately 2,923 acres of mostly hardwood forest that preserves a Civil War battleground of the Atlanta Campaign. Between June 19 and July 2, 1864, a series of battles occurred here between Gen. Joseph E. Johnston's Confederate force of 65,000 troops and Gen. William T. Sherman's Union army of 100,000 men. Eventually, Sherman's army outflanked the Confederate force and forced them to abandon their lines. The loss of Kennesaw Mountain removed one of the last major geographic obstacles protecting Atlanta, which eventually fell to the Union army in September 1864. The fall of Atlanta bolstered the Union army's resolve to continue the conflict and eventually led to the re-election of Abraham Lincoln as president in 1864.

The purpose of Kennesaw Mountain National Battlefield Park is to preserve, protect, and interpret, for the benefit and inspiration of the people, the historical and natural features of this major battle site in the American Civil War's 1864 Atlanta Campaign (taken from NPS 2014).

Vegetation

The most expansive vegetation community types found at Kennesaw Mountain National Battlefield Park include the Early- to Mid- Successional Loblolly Pine Forest (Figure 2) and a mix of hardwood forest types including the Piedmont Dry-Mesic Acidic Oak-Hickory Forest, Interior Southern Red Oak – White Oak Forest, and Successional Tuliptree Forests. These communities are found throughout the park and are interspersed with forested wetland communities such as Upper Southeast Tuliptree Small Stream Sweetgum – Tuliptree Forest and Piedmont Low-Elevation Headwater Seepage Swamp (Figure 3). Other wetland communities, occurring in small patches, include Common Rush Marsh and Southern Woolgrass Bulrush Marsh (Figure 4). The Granitic Flatrock Complex, Perennial Zone and the Appalachian Low-Elevation Granitic Dome (Figure 5) communities can be found on the open, rock-faced summits of Little Kennesaw and Kennesaw Mountain.

Climate and Weather

Summer months at Kennesaw Mountain National Battlefield Park are hot and humid. The mean monthly maximum temperature in July ranges 30.1–31.0º C (86.1–87.8º F; 1961–1990). Winter

months at the park are relatively mild with intermittent cold spells. The mean monthly minimum temperature in January ranges -3.9--2 º C (24.9–28.4 ºF; 1961–1990). Precipitation is primarily in the form of rain from storm fronts in winter and spring months, and from thunderstorms, tropical storms, and hurricanes in the summer and fall months. The park receives an average precipitation amount of 1201–1400 millimeters per year (47.3–55.1 inches/year; 1961–1990) (Davey et al. 2007).

Geology and Soils

Kennesaw Mountain National Battlefield Park is located within the Piedmont of Georgia within the Central Uplands physiographic province. Kennesaw Mountain is made up of three summits: Big Kennesaw, Little Kennesaw, and Pigeon Hill. At the time of its formation, Kennesaw Mountain was part of a massive mountain chain whose surface has since eroded away, leaving behind tiny monadnocks. There are four main rock formations present in the park: Amphibolite/Mica Schist/Biotic Gneiss, Biotic Gneiss, Garnet Mica Schist, and Hornblende Gneiss/Amphibolite (Figure 6).

According to Soil Survey Geographic (SSURGO; NRCS 2015b), the park contains several soil types, including sandy loams, sandy clay loams, clay loams, gravelly soils, and stony soils (Figure 7).

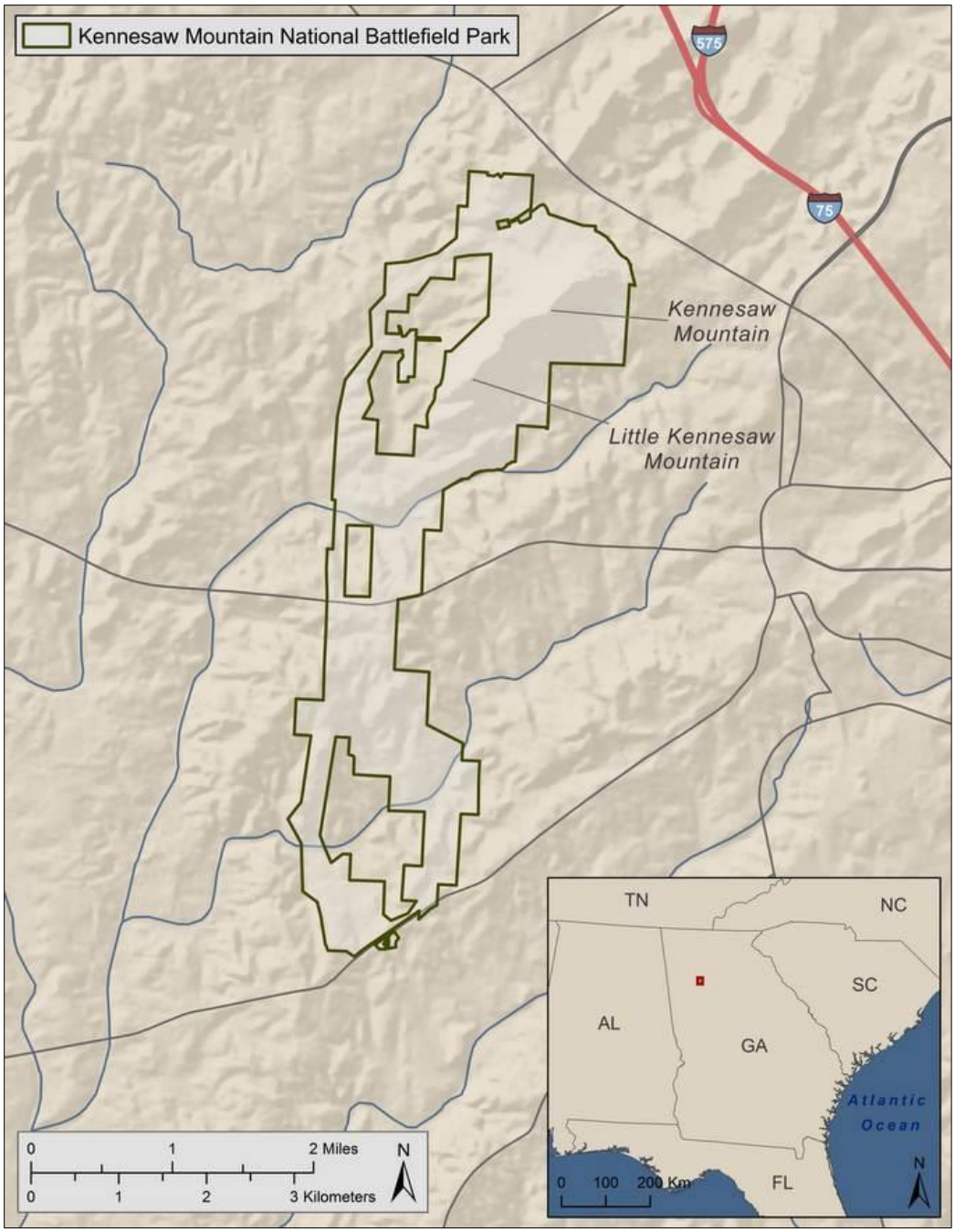

Figure 1. Location of Kennesaw Mountain National Battlefield Park.

Figure 2. Early- to Mid- Successional Loblolly Pine Forest covers the most area (465.9 ha) within Kennesaw Mountain National Battlefield Park.

Figure 3. An example of a Piedmont Low-Elevation Headwater Seepage Swamp, one of the wetland forested communities found in Kennesaw Mountain National Battlefield Park.

Figure 4. A Southern Woolgrass Bulrush Marsh in Kennesaw Mountain National Battlefield Park.

Figure 5. An example of an Appalachian Low-Elevation Granitic Dome in Kennesaw Mountain National Battlefield Park.

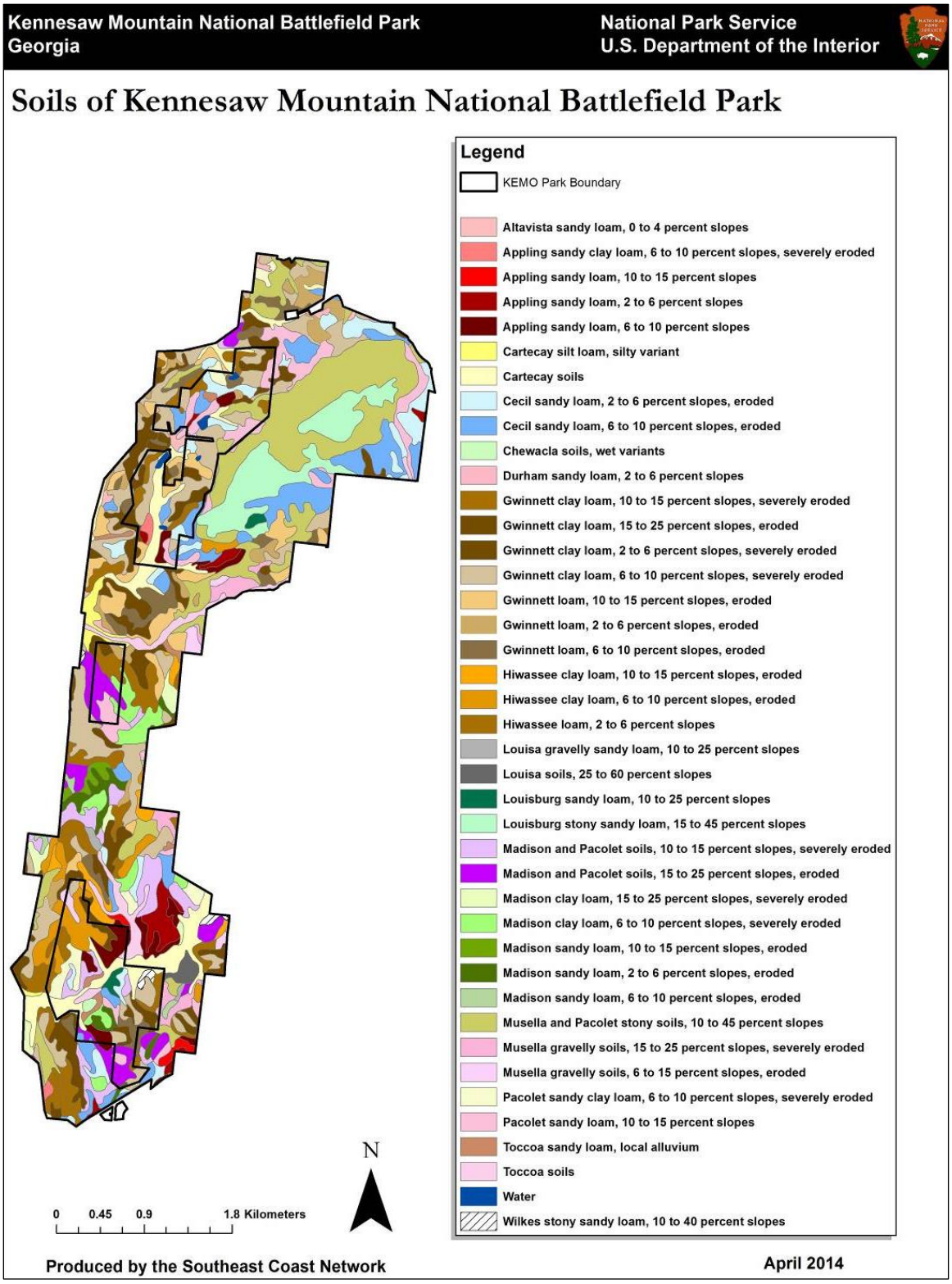

Figure 6. Soils of Kennesaw Mountain National Battlefield Park (Spatial data obtained for Cobb County, Ga. from NRCS 2015b).

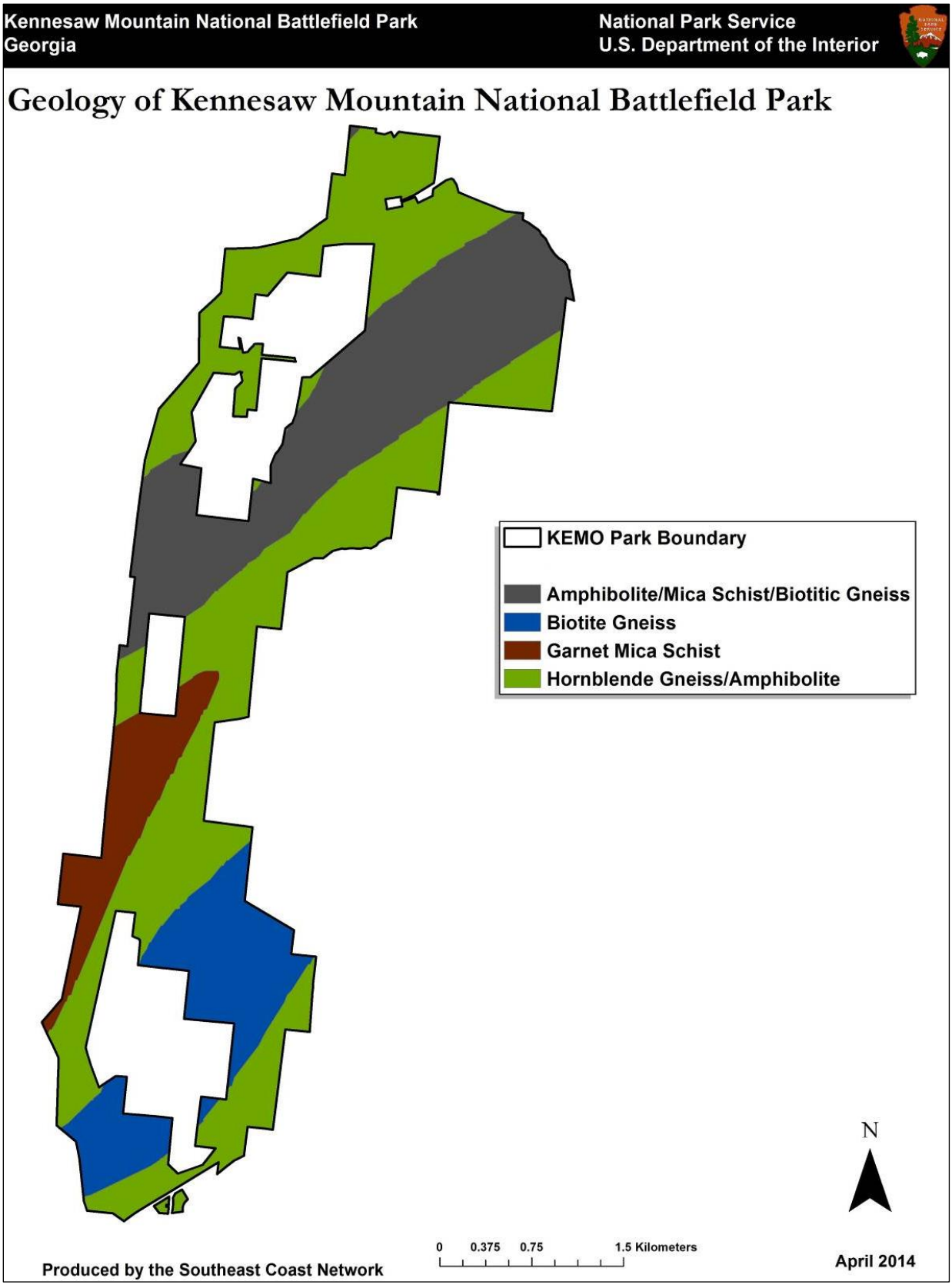

Figure 7. Geology of Kennesaw Mountain National Battlefield Park.

Project Scoping and Planning

In 2005, the Southeast Coast Network proposed to develop vegetation classification and maps for 16 parks: Cape Hatteras National Seashore, Cape Lookout National Seashore, Moores Creek National Battlefield, Fort Sumter National Monument, Fort Pulaski National Monument, Fort Frederica National Monument, Cumberland Island National Seashore, Fort Matanzas National Monument, Timucuan Ecological and Historic Preserve, Fort Caroline National Memorial, Castillo de San Marcos National Monument, Canaveral National Seashore, Ocmulgee National Monument, Horseshoe Bend National Military Park, Kennesaw Mountain National Battlefield Park, and Chattahoochee River National Recreation Area. The Southeast Coast Network teamed with the Southeast regional office of NatureServe to complete this project. NatureServe's role was to collect field data and develop the local association descriptions and the field key to map vegetation classes for each of the parks. The Southeast Coast Network agreed to complete the photographic interpretation/image analysis, digital map and database development, accuracy assessment, metadata, and final reports in-house.

Project Boundary Extent

The Southeast Coast Network determined that the KEMO vegetation mapping boundary extent should include the entire area within the park plus an additional buffer of 50 meters surrounding the park boundary. Therefore, the total map extent is 1,419.2 hectares, with 1376.4 hectares occurring within park boundaries and the remaining 42.8 ha occurring outside of park boundaries.

Field Survey

Prior to field work, NatureServe compiled a list of preliminary vegetation associations and alliances likely to occur in Kennesaw Mountain National Battlefield Park. Published floristic information, the plant-species list of the park, and expert local knowledge (including NPS staff at KEMO) were used to refine the list. The preliminary list of associations was used for planning, estimating the amount of field work necessary, and assigning provisional names to vegetation plots and observation points.

Plots were deliberately placed non-randomly in such a manner as to maximize capturing the diversity of vegetation communities at the park given the minimum number of plots for the project (C. Nordman, pers. comm., 21 Feb. 2011). Plot size was variable (e.g. 10 x 10 m, 10 x 30 m, 20 x 20 m, 20 x40 m, 20 x 50 m) and decided at the time of sampling based on which dimension would most adequately characterize the vegetation sampled in each plot. Thirty-five vegetation plots were sampled in the park between August 2007 and May 2008 (Figure 8).

In each plot, field staff estimated and recorded an array of vegetation and environmental data with the field form (Appendix A). The following four categories of data were collected for vegetation plots:

Location and Plot Identifiers

The locations of the vegetation plots were not permanently marked. The bounds of each plot were marked temporarily using measuring tapes. The Universal Transverse Mercator (UTM) coordinates

at the center of each plot were recorded (Zone 17, NAD83) on Garmin® hand-held Global Positioning System (GPS) receivers.

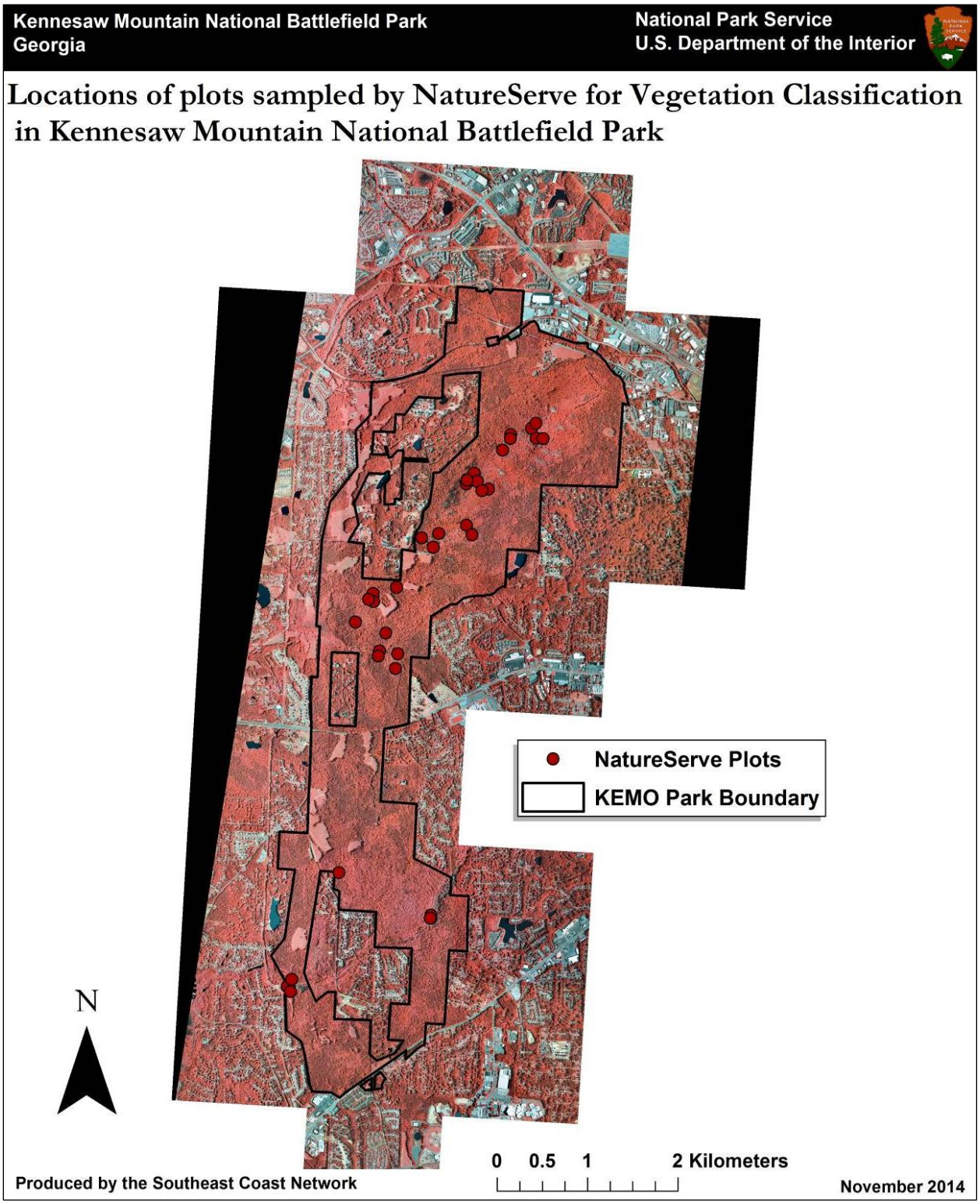

Figure 8. Locations of plots sampled by NatureServe for vegetation classification in Kennesaw Mountain National Battlefield Park.

Environmental Description

The physical characteristics of each plot were documented in both categorical and narrative fields. These characteristics included physical site features (elevation, slope, aspect, topography), hydrology, geology, and soils. Description of the ground surface included an estimate of the cover of rocks, sand, litter, bare soil, biological soil crust, moss, and lichen. A narrative field was provided for a general description of the plot setting and the influence of disturbance and hydrology on the vegetation.

Vegetation Description

Every vascular plant was assigned to one of eight physiognomic strata. Within each stratum, the investigator recorded the height class for the most abundant species (Table 2). The percent abundance for each species present in the plot was recorded, based on the cover class percentage for the species (Table 2). Field crews also recorded percent canopy cover for each species.

Table 2. Vegetation height and cover classes used in the Kennesaw Mountain National Battlefield Park Vegetation Mapping Project.

Code	Height scale (meters)	Code	Cover Class %
1	< 0.5	1	Trace
2	0.5–1.0	2	0.1–1
3	1.0–2.0	3	1.0–2.0
4	2.0–5.0	4	2.0–5.0
5	5.0–10.0	5	5.0–10.0
6	10.0–15.0	6	10.0–25.0
7	15.0–20.0	7	25.0–50.0
8	20.0–35.0	8	50.0–75.0
9	35.0–50.0	9	75.0–95.0
10	> 50.0	10	> 95

Other Ancillary Information Useful to Classification

Field crews optionally recorded how well the plot represented the vegetation of the surrounding area, the site disturbance history, and the overall character of the vegetation features of each plot.

Vegetation Classification

Plot data was manually entered into the NPSPLOTS Database Version 3.2, a Microsoft Access database designed for the NPS Vegetation Mapping Inventory Program (NPS 2011). The PLOTS database was designed specifically for the NPS vegetation and mapping program so that the electronic data entry fields mirror the standard field form. Data entry was facilitated by assigning each plant taxon a unique, standardized code and name based on the PLANTS database developed by the Natural Resources Conservation Service in cooperation with the Biota of North America Program (NRCS 2015a). Data was thoroughly proofed after entry to minimize errors.

Due to a relatively small sample size, cluster analysis techniques that have been traditionally used in other vegetation mapping projects to generate vegetation classifications were not used for Kennesaw Mountain National Battlefield Park. Instead, plots were assigned to an existing vegetation association based on a cursory overview of their best fit according to species composition (R.White, pers. comm., 25 March 2011). The vegetation associations and descriptions can be found on the NatureServe Explorer (see NatureServe 2015).

Final Map Classifications

Once the associations were finalized, a dichotomous key pertaining to Kennesaw Mountain National Battlefield Park, originally developed by NatureServe and later revised by the Southeast Coast Network (Appendix C), was updated. The full NVCS hierarchical classification and global descriptions are available in Appendix B. Vegetation descriptions specific to Kennesaw Mountain (i.e., local) were written based on KEMO plot data from this effort. In addition, the final vegetation associations were linked to map classes for use in the photo-interpretation and mapping portions of the project.

Vegetation that did not fall into the natural/semi-natural category (e.g. maintained lawn) was assigned to the Cultural Vegetation of the NVCS at the Type Level (NVCS Version 2, FGDC 2008).

For non-vegetated features (e.g. open water bodies, structures), we derived map classes from Level II of the Land Use and Land Cover Classification System (Anderson et al. 1976).

We further classified vegetated wetlands (natural/semi-natural vegetation) to the System Level of the U.S. Fish and Wildlife Service Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979). The wetlands within Kennesaw Mountain National Battlefield Park are considered Palustrine systems (Table 3).

Table 3. Map classification codes for wetlands derived from the U.S. Fish and Wildlife Service (USFWS) Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979).

Map Class Code from USFWS Wetland Classification	General Explanation of Wetland Systems
Upland	Non-Wetlands
Marine	Open ocean overlying the continental shelf and its associated high energy coastline
Estuarine	Deepwater tidal habitats and adjacent tidal wetlands in which ocean water is at least occasionally diluted by freshwater runoff from the land
Riverine	Wetlands and deepwater habitats contained within channels, except where wetlands are dominated by vegetation or where salinity exceeds 0.5%
Lacustrine	Wetlands and deep water habitats situated in a topographic depression or dammed river channel, lacking vegetation with greater than 30% aerial coverage, total area exceeds 8 hectares
Palustrine	All non-tidal wetlands dominated by vegetation and all such wetlands that occur in tidal areas where salinity is below 0.5%

Digital Imagery and Interpretation

Aerial Photography Acquisition and Processing

The Southeast Coast Network contracted with Aero-Metric, Inc., through the USGS Rolla, Missouri office to provide color-infrared (CIR) aerial photographs. Color-infrared imagery was chosen because healthy green vegetation is a very strong reflector of infrared radiation and appears bright red in color-infrared imagery, which helps tremendously in vegetation mapping efforts. This set of photography covered the full project boundary extent plus a 500 meter buffer surrounding the park boundary. The flight path and centers of the aerial photo mission were planned with 60% forward overlap and 30% side overlap to assure stereo viewing (Figure 9). Airborne GPS data and CIR images were provided by Richard Crouse & Associates, Inc. These images were scanned by HAS Images, Inc. Ground check point data was provided by Aero-Metric, Inc. The project was referenced horizontally to the North American Datum of 1983 (NAD83), Universal Transverse Mercator Zone 16, and vertically to the North American Vertical Datum of 1988 (NAVD88).

The scanned images (14 micron), Airborne Global Positioning System (ABGPS) data, ground check point data, and camera calibration data were used as inputs to the Zeiss/Intergraph ImageStation Automatic Triangulation (ISAT) softcopy program.

ISAT correlated image points are aerotriangulated in blocks of images to create the exposure station exterior orientations. The 31 ground control points provided by Aero-Metric, Inc. were manually measured on the imagery. These ground control points were included in the aerotriangulation adjustment as unconstrained points for absolute ground location verification. After the location of the ABGPS data was verified by the ground control points, the ground control points were constrained to 0.1 meter in the final adjustment.

Statistics associated with the aerotriangulation bundle adjustment are as follows:

- 24 photographs
- 1,703 image points
- 5 horizontal and vertical ground control points
- 4.7 microns image sigma
- 1,717 degrees of freedom
- Root mean square error of residuals for 5 ground control points:
    - 0.090 meters for horizontal-control eastings
    - 0.188 meters for horizontal-control northings
    - 0.081 meters for vertical control
- Root mean square error of residuals for 24 ABPGS exposure station control points:
    - 0.190 meters for horizontal-control eastings
    - 0.4131 meters for horizontal-control northings
    - 0.426 meters for vertical control

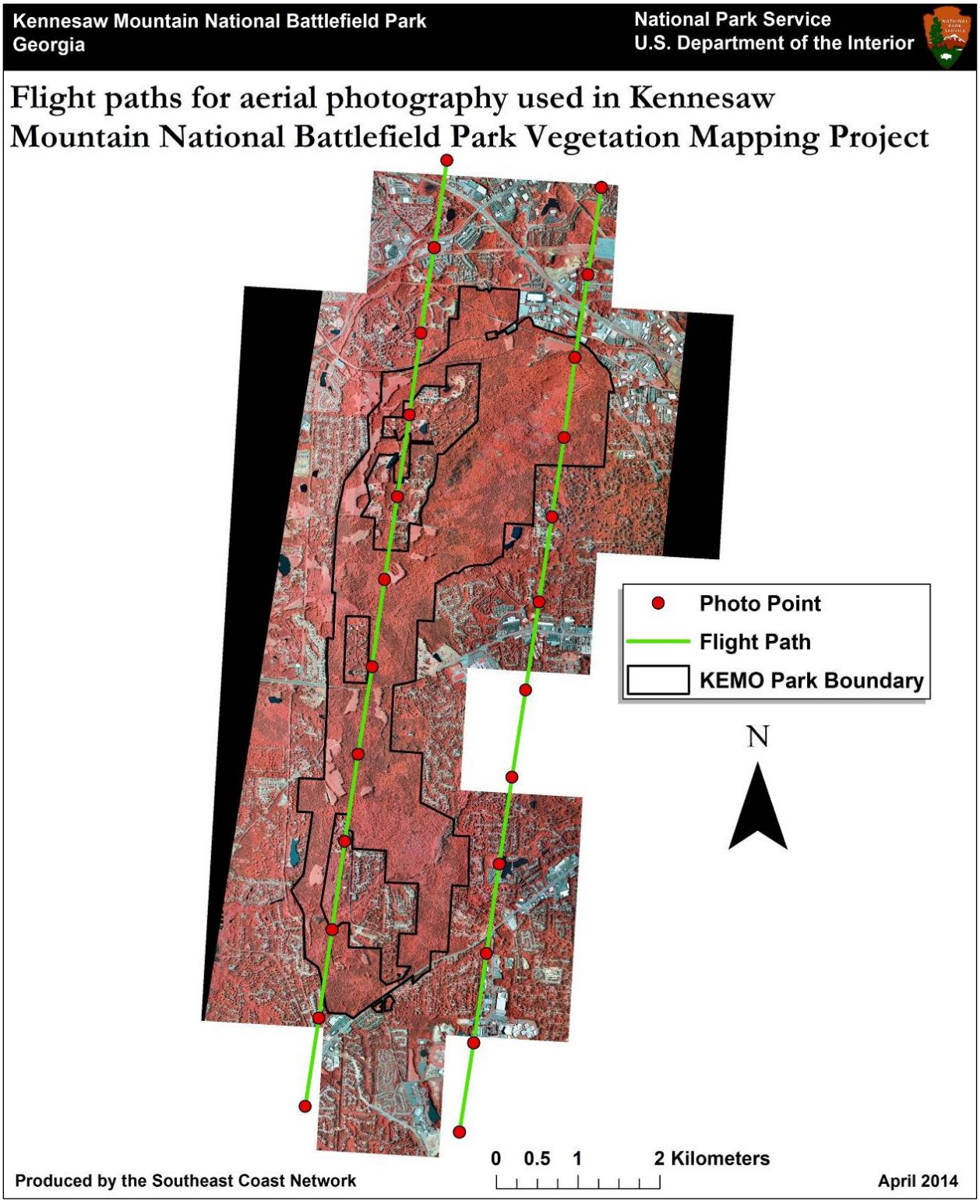

Figure 9. Flight paths for the 2011 color-infrared aerial photography coverage of Kennesaw Mountain National Battlefield Park.

Preliminary Photo-Interpretation

Prior to field reconnaissance, the individual interpreting the imagery became familiar with the project imagery as well as the vegetation types to be mapped. This early-mapping step allowed the vegetation mapper to identify particular areas of interest to visit during the field reconnaissance step. For this preliminary mapping, the SECN remote sensing specialist delineated vegetation polygons on the digital orthophoto mosaics to at least the Formation Level of the NVCS. Other features were mapped in addition to vegetation, such as non-vegetated surfaces that were classified according to the Anderson Land Use Level II mapping regime (Anderson et al. 1976). Polygons were digitized on-screen using Arc GIS (Version 10, © 2010 Environmental Systems Research Institute, Redlands, California).

Field Reconnaissance

The purpose of this step was to train the photo-interpreter on the correlation of photo-signatures with vegetation associations. A photo-signature is a set of diagnostic characteristics present on the imagery, such as color, tone, shape, and size, that represents a particular vegetation association. Field reconnaissance included exploration of a variety of locations representing various images, since color-infrared imagery is typically not consistent between photo sets. Even slight differences in sun angle, light intensity, shadow, and the particular film batch and printing process can affect vegetation's appearance on imagery (Hershey and Befort 1995). The ability of the photo-interpreter to identify diagnostic characteristics on the imagery that can be tied directly to a vegetation association is a key component to successful, consistent, and accurate mapping. For some vegetation types, a set of diagnostic characteristics may not be visible on the imagery (i.e. the obscured understory species may be the ones that are diagnostic). In such cases, the photo-interpreter may be able to rely on an informed understanding of the ecological and environmental settings of the particular vegetation types (e.g. the environmental setting where an association is likely to occur) to make a mapping decision. If a photo-signature cannot clearly be identified for each association, it is allowable to pool associations and map at a higher level of the hierarchy, or with less accuracy (ESRI 1994).

A field reconnaissance trip was taken to Kennesaw Mountain National Battlefield Park in June 2012. During this trip, the SECN remote sensing specialist investigated ground conditions with copies of the aerial photographs in hand. The specialist made notes about observations directly on the copies of the aerial imagery. The remote sensing specialist used a Garmin® Rino GPS unit to navigate to a set of predetermined points of interest within the vegetation polygons mapped during the preliminary mapping step. These points of interest were chosen specifically to aid in the identification of vegetation photo-signatures. Vegetation at each point was keyed to its association (as possible) using the key developed by NatureServe and revised by the Southeast Coast Network. Difficulties in determining association, if any, were documented on the field sheet (Appendix E). Dominant species found in each vegetation strata were documented. Ground photographs of each point were taken.

Photo-Interpretation and Polygon Attribution

Based on the information gathered from the field reconnaissance trip, the SECN remote sensing specialist developed a photo-interpretation guide that aided the delineation of vegetation classes (see Appendix D). Standard photo-signature characteristics were applied during the photo-interpretation process, including texture, color, pattern, and position in the landscape (Philipson 1997). In addition to photo-signature characteristics, understanding the environmental distribution of the vegetation types helped the remote sensing specialist not only identify types, but also properly place polygon boundaries. Polygons were interpreted and digitized on-screen using Arc GIS (Version 10.0, © 2010 Environmental Systems Research Institute, Redlands, California). Features were mapped to a minimum mapping unit (MMU) of 0.5 hectares, which is the NPS Vegetation Mapping Inventory Program standard. Exceptions for mapping below the MMU were allowed for map-class units with vegetation unique to the immediate surroundings. For each polygon, the appropriate map-class code along with its NVCS code, alliance, association, and association common name were entered into the fields of the associated attribute table (Table 4).

Table 4. Fields used in the attribute table of the vegetation polygon layer of the Kennesaw Mountain National Battlefield Park Vegetation Mapping Project.

Field in Attribute Table	Description	Polygon Types Field Applies to:
Cultural Type	NVCS cultural vegetation type	Cultural vegetation
Alliance	NVCS Alliance scientific name	Natural/semi-natural vegetation
Association	NVCS Association scientific name	Natural/semi-natural vegetation
Common_Name	NVCS Association common name	Natural/semi-natural vegetation
LUC_II	Land Cover and Land Use Level II Codes (Anderson et al. 1976)	Natural/semi-natural vegetation, cultural vegetation, and non-vegetated areas
ELCODE	NVCS element code	Natural/semi-natural vegetation
Map Code	Abbreviated code used by photo-interpreter	Natural/semi-natural vegetation, cultural vegetation, and non-vegetated areas
Wetland	Type of wetland	Natural/semi-natural vegetation
Hectares	Size of polygon in hectares	Natural/semi-natural vegetation, cultural vegetation, and non-vegetated areas

Field Verification

A second trip was taken to Kennesaw Mountain National Battlefield Park in August 2012 for field verification. Field verification allows the vegetation mapper to gauge how accurately the photo-signatures developed during the field reconnaissance step are with respect to consistently mapping vegetation associations on the ground. Specific issues with problem classes can be resolved during this step, prior to submitting the map for Accuracy Assessment in the next step.

Methodology for the field verification is nearly identical to the field reconnaissance step. The SECN remote sensing specialist navigated via GPS to a predetermined set of points. Vegetation at each point was keyed to its association by using the vegetation key developed by NatureServe (NatureServe 2008) and revised by Southeast Coast Network. Difficulties in determining association, if any, were documented on the field sheet.

Accuracy Assessment

The main goal of the accuracy assessment (AA) was to measure the probability that a particular location on the map created from the interpreted imagery was assigned to its correct vegetation class on the ground. A vegetation map is an abstract model of the distribution of vegetation on the ground, which entails the use of some generalizations. These generalizations contribute to errors in the map product. These map errors must be quantified so that the map user and the map producer understand the limitations of the map. A formalized accuracy assessment is a way to quantify these errors. In the AA, "producer's accuracy" is the probability that an AA point has been mapped correctly (also known as error of omission) and "user's accuracy" is the probability that the map actually represents what was found on the ground (also known as error of commission). Producer's accuracy and user's accuracy can be obtained from the same set of data using different analyses. Overall accuracy of the map is obtained by determining the fraction of accuracy assessment observations within all map classes that were mapped correctly. The Kappa Index is another measure of overall accuracy, which takes into account the probability that mapped polygons will be correct due to random chance.

Numerous factors contribute to error on a vegetation map, some of which are listed below. The field investigator should be aware of these situations and act to minimize error when possible.

- Locational error (when it is not possible to acquire reliable UTM coordinates, the AA point data collected may look like it is in another polygon, or if the polygons are small, narrow, and the GPS receiver is not working well, it may be difficult to know which polygon should be sampled).
- Field key is difficult to use, leading the investigator to assign the point to the wrong association.
- Field key does not include all the plant associations in the park, also leading to confusion regarding which association to assign a point.
- Field data error—either by misidentifying diagnostic species, or by not reading the key carefully, resulting in a bad field call when the map attribute is accurate.
- AA point falls within an ecotone, which is impossible to classify but still has to be mapped to something.
- Relationship between plant associations and map units (modeling) are flawed.
- Polygon is heterogeneous, including patches of varying vegetation that are too small to map individually. The AA point may fall in a part of the polygon with a different community than observed by the photo interpreter in the bigger picture.

The formal accuracy assessment consists of several parts. First, a sampling design must be developed that follows scientifically sound, and ideally practical and cost-effective, methodology. The sampling design should cover all vegetation types mapped across the park. Sample sites must be visited to determine the vegetation type actually present at that particular ground location. The results of sampling are used to create a contingency table (confusion matrix) that is used to calculate the per-class and overall accuracy of the map.

Sampling Design

We used a stratified random sampling approach to select accuracy assessment sites in Kennesaw Mountain National Battlefield Park. We included all map classes representing natural/semi-natural vegetation types, as defined in the NVCS in sampling selection (FGDC 1997). Cultural vegetation (e.g. warm season lawn) and non-vegetated (e.g. Commercial and Services) polygons were excluded from the assessment. The accuracy assessment was restricted to points within park boundaries. Based on these guidelines, thirteen map classes were eligible for sampling.

We determined the necessary sample size for each map class following guidelines outlined in Thematic Accuracy Assessment Procedures (Lea and Curtis 2010) (Table 5). Based on these criteria, we calculated that a total of 252 accuracy assessment points should be sampled (Figure 10).

Table 5. Standard sample size allocations for accuracy assessment, based on map class area (Lea and Curtis, 2010).

Map Class Total Area (hectares)	Number of observations per map class
> 50	30
8.33 to 50	0.6 (per hectare)
< 8.33	5

To account for positional error due to site location (GPS error), vegetation polygons were buffered internally by 10 meters prior to generation of the AA points, wherever possible. The AA points were generated randomly in ArcGIS using the Create Random Points tool in ArcToolbox (Version 10, © 2010 Environmental Systems Research Institute, Redlands, California).

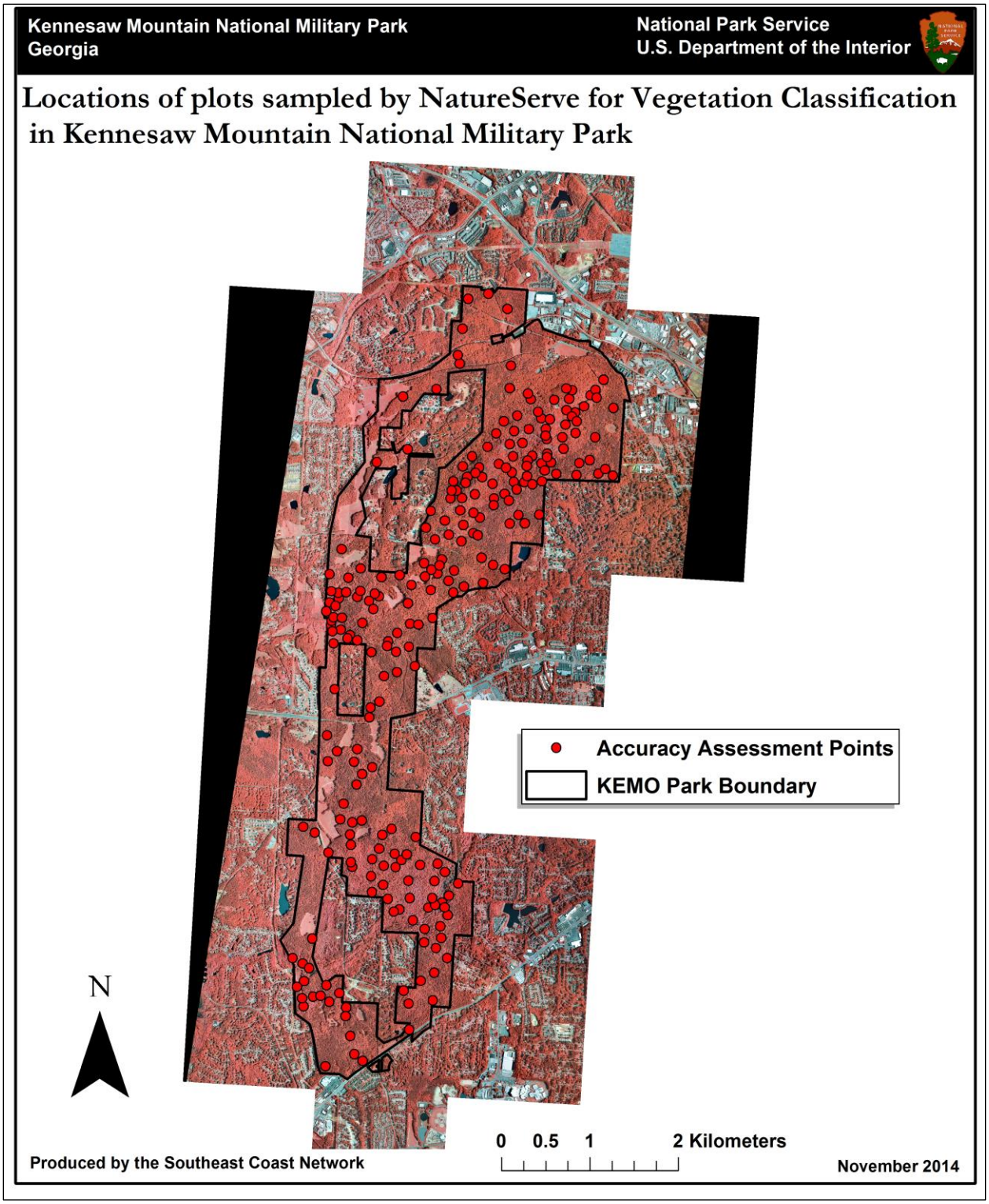

Figure 10. Locations of accuracy assessment points sampled in Kennesaw Mountain National Battlefield Park.

Field Data Collection

Accuracy assessment point data were collected at Kennesaw Mountain National Battlefield Park in October 2014. The Southeast Coast Network contracted ecologists from the Atkins consulting firm to complete the accuracy assessment. To navigate to points in the field, Atkins loaded AA points into a GPS receiver and used copies of the orthophotographs overlaid with the AA points (not including any of the lines from the mapped vegetation polygons). At each AA point, Atkins assessed the site within an area equal in size to the minimum radius (ha) of the observation area, following methodology outlined by Lea and Curtis (2010). At each AA point, Atkins collected applicable environmental data, including hydrology and topography data. Vegetation data collected included leaf phenology, leaf type of the dominant stratum, physiognomic class, and vegetation composition in each stratum (see Appendix F for example AA form). A space was provided for general comments about the classification of each plot, including notes of any problems that were encountered. Photographs were taken of the canopy and in each cardinal direction to provide visual documentation of each AA site.

Data Analysis

The AA point data were manually entered into the NPS PLOTS database version 3.2 (NPS 2011). PLOTS version 3.2 is a relational database in Microsoft Access designed to store vegetation inventory field data for taxonomy and accuracy assessment. The data were subjected to a thorough quality assessment/quality check prior to analysis. The analysis of the map accuracy included the following steps:

- Initial comparative analysis of the field and map data
- Review of all disagreements and correction for false errors as necessary
- Final comparative analysis of the field and map data
- Individual map class analysis
- Final output of results into a contingency matrix
- Final output of the analyses and results into a spatial database for use in GIS

Initial Comparative Analysis

We used the ArcGIS Intersect Tool in Arc Toolbox to combine the AA point layer and the map vegetation polygon layer (ArcGIS Version 10.0, © 2010 Environmental Systems Research Institute, Redlands, California). The resulting layer allowed us to compare each AA field-site call (vegetation type) to the corresponding map-polygon call (map class representing vegetation type). We used Microsoft Excel 2007 (Microsoft Corporation) to compare and tabulate the field-site call to the map-polygon call. We discovered that there were 9 accuracy assessment points that were not visited either because they were inaccessible (difficult terrain) or because they were located on private property. These omissions left 243 points for analysis.

Review of Disagreements

All mismatches (disagreements) were subsequently reviewed for false errors. A false error is a mismatch between the accuracy assessment field-site call and the map-polygon call, if the error is caused by an accuracy error in the GPS field coordinates, a missing or misapplied field call, or a field

site assessment of an area smaller than the minimum mapping unit. This review process involves looking at the AA sites and their corresponding polygons in ArcGIS to locate and view them on the aerial photographs. We also reviewed the field data sheets to contextualize the ground conditions. From this process, we determined if an initial disagreement was either a true error or indeed a match. We determined there were five points that were initially considered mismatches, but upon review were determined to be false errors because they occurred in areas below the minimum mapping unit. In each of these cases, the points were updated as matches because their matching vegetation associations occurred outside the inclusions upon which they occurred.

Final Output

We generated two outputs for the AA results: a sample contingency table and a population contingency table. The sample contingency table provides an initial summary of the AA data by displaying counts of observations, with sample data values (vegetation map classes) as rows and reference data values (vegetation types as identified on the ground) as columns. The values in the shaded cells along the diagonal represent counts for correctly classified observations, where the reference data (column) matches the mapped vegetation type (row). User's accuracy was calculated by dividing the number of samples that agreed with their corresponding map class by the total number of samples in that class. Producer's accuracy was calculated by dividing the number of samples that agreed with their corresponding map class by the total number of samples whose field call belonged to that category.

Previous NPS Vegetation Mapping Inventory Program guidance (ESRI et al. 1994) suggested calculating user's, producer's, and overall accuracies from the sample contingency table of observation counts. However, this practice did not account for the unequal probability sampling imposed by the stratification by map classes. The practice is appropriate for user's accuracies but will give inaccurate results for producer's accuracies and overall accuracy. Therefore, measures of accuracy for the AA are defined by the population contingency table. Similar to the sample contingency table, rows in the population contingency table are defined by the sample data values, and columns are defined by the reference data values. Unlike the sample contingency table, the values in each cell are the proportion of the target area in the corresponding true and mapped vegetation classes, rather than the raw counts of observations. The population and sample contingency tables are reported together as a summary of between-class error relationships and class accuracy statistics (from Lea and Curtis 2010) (see Appendix G).

We examined the overall accuracy and the accuracy for each map class individually to determine if accuracy requirements of the NPS Vegetation Mapping Inventory Program were met. Based on these results, we determined if it would be necessary to merge certain map classes to gain higher accuracy. The overall accuracy generated in the population contingency table was initially below the NPS Vegetation Mapping Inventory Program accuracy standard of 80%; therefore it was necessary to merge some of the vegetation classes to improve accuracy.

AA Spatial Database

For use in GIS, we produced a feature-class layer of the AA site locations, along with supporting attribute tables, and incorporated them into the KEMO vegetation mapping project geodatabase.

Results

Vegetation Classification

The final classifications for Kennesaw Mountain National Battlefield Park resulted in 20 vegetation associations in the NVCS. Some of these associations were later merged to improve accuracy (see Appendix B for full association descriptions).

Digital Imagery and Interpretation

Final reviews were made after the Accuracy Assessment, and 16 map units were developed and directly matched to the corresponding final vegetation associations in the NVCS for Kennesaw Mountain National Battlefield Park (Table 6). Five map classes were identified representing non-vegetated units (e.g. open water bodies, buildings, roads) (Table 7).

Ancillary data sources such as a digital raster graphic (DRG) and historical aerial photographs provided additional insight into ground conditions. Historical and current land management practices in the park provided details pertinent to classification issues.

Table 6. Final vegetation associations of the NVCS used for vegetation mapping (with their assigned Map Codes) in Kennesaw Mountain National Battlefield Park.

Vegetation Type	Association Common Name	NVCS Code(s)
Forest	Early - Successional Shortleaf Pine Forest	CEGL006327
	Early - to Mid- Successional Loblolly Pine Forest	CEGL006011
	Virginia Pine / Granitic Flatrock Border Woodland	CEGL003993
	Piedmont Acidic Mesic Mixed Hardwood Forest	CEGL008465
	Tuliptree Forest Alliance / Piedmont Dry - Mesic Acidic Oak Hickory Forest / Interior Southern Red Oak - White Oak Forest*	A.236/CEGL008475/ CEGL007244
	Successional Water Oak Forest	CEGL004638
	Xeric Ridgetop Chestnut Oak Forest / Mafic Xeric Piedmont Oak Forest*	CEGL008431/ CEGL004416
	Upper Southeast Small Stream Sweetgum - Tuliptree Forest	CEGL004418
	American Sycamore - Sugarberry - Green Ash Floodplain Forest	CEGL007730
	Piedmont Low-Elevation Headwater Seepage Swamp	CEGL004426
Shrubland	Southern Piedmont Mafic Shrubland	CEGL004243
	Blackberry - Greenbrier Successional Shrubland Thicket	CEGL004732
	Black Willow Riverbank Shrubland	CEGL003901
Herbaceous	Common Rush Marsh	CEGL004112
	Southern Woolgrass Bulrush Marsh	CEGL003866
	Granite Flatrock Complex, Perennial Zone / Appalachian Low-Elevation Granitic Dome*	CEGL004298/ CEGL007690

* Indicates map classes were combined to improve accuracy.

Table 7. Map classification codes for non-vegetated areas in Kennesaw Mountain National Battlefield Park, following Land Use and Land Cover Level II (Anderson et al. 1976).

Map Class Code	Anderson Land Use and Land Cover Level II (1976)
11	Residential
12	Commercial and Services
14	Transportation, Communications, and Utilities
17	Other Urban or Built Up Land
50	Water

Vegetation Map

Table 8 provides a summary report of the spatial-data layer (map) of Kennesaw Mountain National Battlefield Park and summarizes frequency, mean area (in ha), and sum of areas (in ha) for each map class.

Collectively, the KEMO spatial database layer is composed of 296 polygons covering 1,419.2 hectares (including a buffered area outside of park boundaries), with an average polygon size of 9.4 hectares. Map classes representing natural types in the NVCS apply to195 polygons (65.9% of all polygons) covering 1,129.1 hectares (79.6% of entire area) with an average polygon size of 4.5 hectares. Of these natural types, the Early- to Mid – Successional Loblolly Pine Forest covers the most area (465.9 ha). The combined class Tuliptree Forest Alliance / Piedmont Dry – Mesic Acidic Oak Hickory Forest / Interior Southern Red Oak – White Oak Forest also covers a considerable portion of the park (392.9 ha).

Within the category of cultural types in the NVCS, Cultural Meadow consists of 28 polygons (9.5% of all polygons) and covers 80.5 hectares (5.7% of the entire area). This particular type accounts for the maintained meadows within the park. Within cultural types, we created two provisional categories called “disturbed wetland” and “disturbed herbaceous wetland.” This area of vegetation (2.1 ha in size divided into two polygons) does not readily fit into any of the natural types in the NVCS and appears to have undergone some sort of disturbance.

Non-vegetated areas (including developed areas) consist of 98 polygons (33.1% of all polygons) and cover 283.3 hectares (20.0% of the entire area). Developed areas in the park include the NPS visitor center and maintenance buildings and roads within the project boundary.

Wetlands consist of 27 polygons (9.1% of all polygons) and cover 104.4 hectares (7.4% of entire area). Vegetation associations in the NVCS that are considered vegetated wetlands according to the U.S. Fish and Wildlife Service include the following: Successional Water Oak Forest, Upper Southeast Small Stream Sweetgum – Tuliptree Forest, Piedmont Low-Elevation Seepage Swamp, American Sycamore – Sugarberry – Green Ash Floodplain Forest, Black Willow Riverbank Shrubland, Common Rush Marsh, and Southern Woolgrass Bulrush Marsh.

A considerable number of additional analyses and deductions can be attained from even these simple summary reports. For example, a query could determine the average distance a certain vegetation association occurs from a road or another developed area. Additionally, more complex reports could

be derived by introducing additional spatial-data layers (e.g. amphibian distributions, invasive species). Such analyses would provide greater insight into vegetation and its ecology.

Map Layer Presentation

Figure 11 presents the map layer produced for the KEMO vegetation mapping project. The map is shown at its finest level; therefore, vegetation classes are shown at the association level, except for those classes that were merged to improve overall accuracy.

Accuracy Assessment

Overall accuracy was 80.0% (90% confidence interval [CI]: 74.2–85.8%) for primary map classes representing natural/semi-natural vegetation floristic types in the NVCS. A Kappa adjustment for chance agreements resulted in a final overall accuracy of 68.2% (90% CI: 62.5–73.9%). The sample and population contingency matrices for AA results are provided in Appendix G: Accuracy Assessment Contingency Tables. The population contingency matrix shows the accuracy of each map class (along with 90% CIs), with the user's accuracy reflecting errors of inclusion (commission errors) and the producer's accuracy reflecting errors of exclusion (omission errors) present in the mapping. The width of each CI is affected by the sample size used to derive the point estimate.

Table 8. Summary statistics for the map classes in Kennesaw Mountain National Battlefield Park boundary and buffer. (ha—hectares)

Category	Map Class	Frequency (# Polygons)	Mean (ha)	Sum (ha)
Natural Vegetation	Early - Successional Shortleaf Pine Forest	3	18.0	54.1
	Early - to Mid- Successional Loblolly Pine Forest	73	6.4	465.9
	Virginia Pine / Granitic Flatrock Border Woodland	2	1.8	3.6
	Piedmont Acidic Mesic Mixed Hardwood Forest	9	3.3	29.5
	Tuliptree Forest Alliance / Piedmont Dry - Mesic Acidic Oak Hickory Forest / Interior Southern Red Oak - White Oak Forest	61	6.4	392.9
	Successional Water Oak Forest	1	4.6	4.6
	Xeric Ridgetop Chestnut Oak Forest / Mafic Xeric Piedmont Oak Forest	4	13.8	55.0
	Upper Southeast Small Stream Sweetgum - Tuliptree Forest	14	6.2	99.6
	American Sycamore - Sugarberry - Green Ash Floodplain Forest	2	3.0	6.0
	Piedmont Low-Elevation Headwater Seepage Swamp	2	1.7	3.4
	Southern Piedmont Mafic Shrubland	3	0.71	2.13
	Blackberry - Greenbrier Successional Shrubland Thicket	1	1.92	1.92
	Black Willow Riverbank Shrubland	1	2.66	2.66
	Common Rush Marsh	1	0.68	0.68
	Southern Woolgrass Bulrush Marsh	2	0.37	0.74
	Granite Flatrock Complex, Perennial Zone / Appalachian Low-Elevation Granitic Dome	16	0.40	6.34
	Natural Vegetation subtotal:	**195**	**4.5**	**1,129.1**
Cultural Vegetation	Cultural Meadow	28	2.9	80.5
	Disturbed Wetland	1	4.08	4.08
	Disturbed Herbaceous Wetland	1	1.38	1.38
	***Cultural Vegetation subtotal*:**	**30**	**2.8**	**86.0**
Non-Vegetated Areas	Commercial and Services	9	2.20	19.7
	Other Built Up Land	1	2.48	2.5
	Residential	43	3.41	146.7
	Transportation, Communications, and Utilities	14	2.4	33.9
	Water	4	0.3	1.4
	***Non-Vegetated Areas subtotal*:**	**71**	**2.2**	**204.2**
	Grand Total:	**296**	**9.4**	**1,419.2**

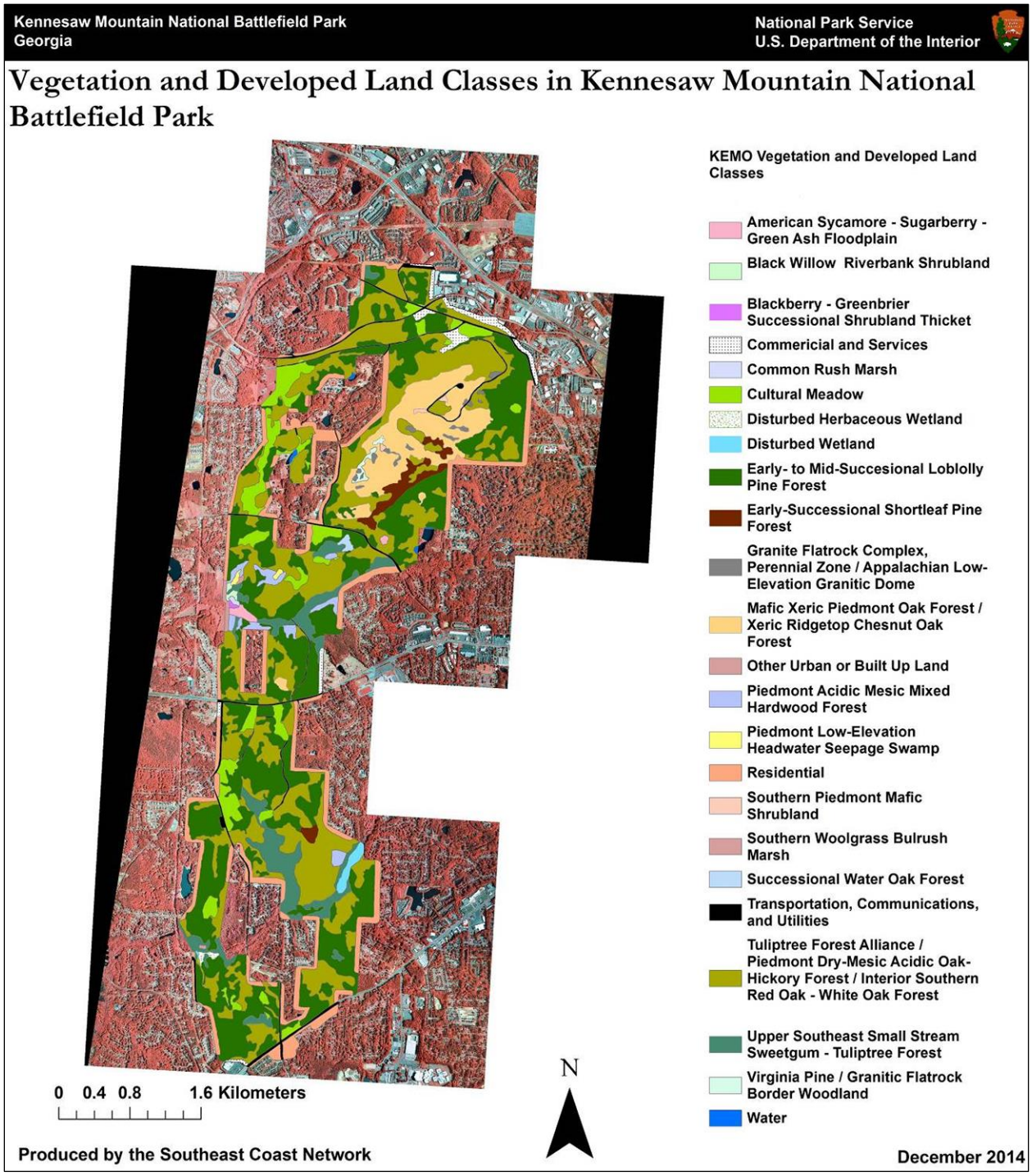

Figure 11. Vegetation and Developed map classes for Kennesaw Mountain National Battlefield Park (from NVCS 1997 and Anderson et al. 1976, respectively).

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Appendix A: Plot Sampling Form

04

NPS SE COAST PROJECT: Plot Sampling Form **Page 1**

County: ________ **Park: (circle one)** CHAT / (KEMO) / OCMU **Plot Code:** 04 **State:** GA **Location org:** NPS

Provisional community name ________

Classified community name ________

Classifier ________ *Date* ________ *NVC ELCODE* 4243

Survey date: 9/29/07 **time** 11 : 15 **Surveyors initials:** MP SLE GDB

Directions to plot (including any notes on best access route, and mile marker): From Kenn. Visitors Centre, take Mtn. Rd (2 km) to top parking lot, take trail that [illegible], [illegible] stone steps, <0.25 miles from parking lot @ montana forest to right of trail (KEMO 03) after [illegible] (<100m) plot lies when canopy opens into shrubland

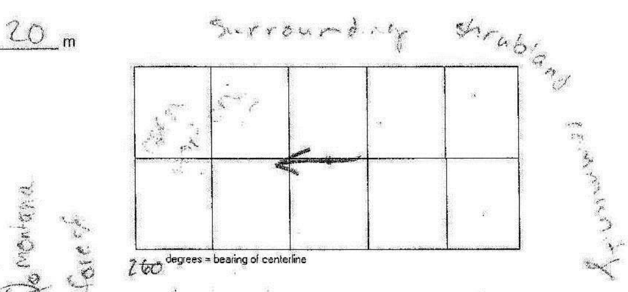
Time taken to walk to plot: 20 min

PLOT CONFIGURATION (Depict the plot layout on right with respect to the surrounding area and attempt to draw in points where GPS positions were collected, witness tree, bearing of centerline, locations of pictures taken, and communities near the plot.)

Plot representativeness -Is the surrounding area all the same? ___YES X NO - If not, depict below)

PLOT LOCATION (Below show general plot location)

Plot dimensions: 40 m X 20 m



Est. Extent of occurrence of community:

<1HA (1-10 HA) 10-100HA >100HA

PIC # 733 - 236 **Description of pictures (N,E,S & W from GPS point at middle of plot) :** NESW

Select one: UTM / (Lat/long) (If lat/long, then values are 33.97656 N 80.57975 W

GPS Techniques/Equipment: Garmin V **Datum(pick one)** (WGS84) / NAD83 / NAD27 UTM Zone: ____

GPS Unit ID ____ **GPS file name** KEMO04 (standard = First letter(s) of park + # of plot (e.g. CH04, CL04, MO04)

Field UTM X ________ **m E Y** ________ **m N Elevation** 1734 **m / (ft)**

Averaging performed (at least 120 observations)? Yes **Coordinate accuracy** 15 **m / (ft) DOP** ____ **# sats** 8

Community Survey
Page 1

NPS SE COAST PROJECT: Plot Sampling Form Page 2

County: _____ Park: (circle one) CHAT / KEMO / OCMU Plot Code: _____ State: GA Location org: NPS

ENVIRONMENTAL / SITE INFORMATION

Measured Slope 35 ° 70 %

__ Flat	0 °	0 %
__ Gentle	0-5 °	1-9%
__ Moderate	6-14 °	10-25%
__ Somewhat steep	15-25 °	26-49%
X Steep	27-45 °	50-100%
__ Very steep	45-69 °	101-275%
__ Abrupt	70-100 °	276-300
__ ovrhng/shltrd	>100 °	>300%

Measured Aspect 30 ° (N=0 °)

__ Flat		__ SE	113-157 °
__ Variable		__ S	158-202 °
__ N	338-22 °	__ SW	203-247 °
__ NE	23-67 °	__ W	248-292 °
__ E	68-112 °	X NW	293-337 °

Topographic Position

- __ Interfluve (Ridge/summit/crest)
- X High Slope (upper/convex slope)
- __ Midslope
- __ Lowslope (lower/footslope)
- __ Toeslope
- __ Low level (terrace)
- __ Channel bed

Cowardin System

- X Upland
- __ Palustrine
- __ Estuarine
- __ Lacustrine
- __ Riverine

Landform (check most applicable)

__ Alluvial flat	__ Bottomlands	__ Interdune Flat	__ Spit
__ Alluvial terrace	__ Carolina Bay	__ Lagoon	__ Streambed
__ Backslope Terrace	__ Channel	__ Lowland	__ Streamhead
__ Bank	__ Depression	__ Mound	__ Swale
__ Bar	__ Draw	__ Mudflat	__ Tidal Flat
__ Barrier Island	__ Dune	__ Ravine	__ Toe slope
__ Beach	__ Estuary	__ Ridge	__ Washover Fan
__ Beach Ridge	__ Floodplain	__ Seep	__ _____
__ Bench	__ Gap	X Slope	__ _____
	__ Gravel Bar	__ Slough	__ _____

Rock types present: granite

Hydrologic Regime:

X Not a wetland (Upland: XERIC : DRY : MESIC : MESIC)

__ Intermittently flooded __ Permanently flooded __ Semipermanently flooded __ Temporarily Flooded (e.g. floodplains) __ Tidally Flooded

__ Seasonally Flooded (e.g. seasonal ponds) __ Saturated (e.g. bogs, perennial seeps) __ Unknown __ Irregularly flooded __ Irrglrly exposed

QUALITATIVE ASSESSMENT:

A) HYDROLOGY:

B) LANDSCAPE AND LANDUSE HISTORY (including disturbance history and possible threats to sustainability):

Soil Texture:

__ Sand	__ Peat	__ Silt loam	__ Muck	
X Sandy loam	__ Loam	__ Clay loam	__ Clay	

Drainage:

X Rapidly drained	__ Moderately well drained	__ Somewhat poorly drained	
__ Well drained	__ Poorly drained	__ Very poorly drained	

Ground cover [Exclusive of living plants; adds to 100%]

75 % Bedrock	10 % Litter, duff	____ % Other _____
5 % Large rocks (cobbles, boulders >10cm)	5 % Wood (> 1 cm)	
3 % Small rocks (gravel, 0.2-10 cm)	____ % Water	
1 % Loose sand (0.1-2 mm)	1 % Bare soil	

Leaf type:

- X Broad-leaved
- __ Needle-leaved
- __ Microphyllous
- __ Graminoid
- __ Broad-leaved herbaceous
- __ Pteridophyte
- __ Extremely xeromorphic
- __ Succulent
- __ Mixed

Leaf phenology (dominant stratum)

- __ Evergreen
- X Cold-deciduous
- __ Drought-deciduous
- __ Mixed evergreen-cold-deciduous
- __ Mixed evergreen drought deciduous
- __ Herb - Annual
- __ Herb - Perennial

Physiognomic Class

- __ Forest (closed tree canopy)
- __ Woodland (open tree canopy)
- X Shrubland
- __ Dwarf Shrubland
- __ Herbaceous (less than 25% woody layers)
- __ Nonvascular
- __ Sparse Vegetation

Natural and Anthropogenic Disturbance

_ logging	_ fire	_ hydrologic
_ erosion	_ trails/roads	_ agriculture
_ grazing/browsing	_ wind/ice damage	_ herbicide spraying
_ pine bark beetle	X exotic plants	_ fire suppression
_ dogwood anthr	_ ORV	_ hog rooting

Disturbance and animal use comments:

Community Survey
Page 2

NPS SE COAST PROJECT: Plot Sampling Form Page 3

County: _____ Park: (circle one) CHAT / KEMO / OCMU Plot Code: 04 State: GA Location org: NPS

QUANTITATIVE VEGETATION SAMPLE "DEFAULT" TAXONOMIC REFERENCE: _____

STRATA	STRATA HEIGHT (1 only)	COVER CLASS	DOMINANT/DIAGNOSTIC SPECIES	Height scale (use tallest one for strata)	% cover for strata = top of cover class
Emergent – T1				< .5m 1	0-5% 1
Tree Canopy T2	5	3	Ulmus alata	.5-1m 2	5-10% 2
Subcanopy T3				1-2m 3	10-20% 3
Tall shrub S1	4	5	[illegible]	2-5m 4	20-30% 4
Short shrub S2	3	5	Philadelphus	5-10m 5	30-40% 5
Herbaceous	1	3	[illegible]	10-15m 6	40-50% 6
Non-vascular				15-20m 7	50-60% 7
Vine/liana				20-35m 8	60-70% 8
Other notable species (indicators of distinctive conditions, e.g. high pH soil, elevation, geographic region, other particularly abundant species):				35-50m 9	70-80% 9
				>50m 10	80-90% 10
					90-100% 11

T1: Emergent \ T2: Tree Canopy \ T3 Subcanopy \ S1 Tall Shrub \ S2 Short Shrub \ H Herbaceous \ N Nonvascular \ V Vines (lianas) \ E Epiphytes

SPECIES COMPOSITION AND COVER/ABUNDANCE CLASS BY STRATUM (enter cover values for each stratum AND for Total cover)

T 1	T 2	T 3	S 1	S 2	H	N	V	E	Total Cover	Name (7 letter code or full name)	Collected? Spec #?	Discarded ?
					3				3	Opuntia humifusa		
			5	5					6	Ptelea trifoliata var. mollis		
									2	Rhus copallina		
					2				2	Pantlenia spicata		
	4		4						5	Celtis occidentalis		
					3				3	Rubus [illegible] var. curvipes		
					2				2	Hypericum gentianoides		
					2				2	Mitchella repens		
→					2				2	Euonymus sessilifolium		
				2					2	Vitis cordifolia		
			3						3	Prunus persica		
			3						3	Crataegus - long spined		
			3						3	Crataegus - big hard smooth spine		
				8					8	Philadelphus sp.		
	5		3	3					6	Vitis alata		
					2				2	Hexastylis arifolia		
										~~Symplocos tinctoria~~		

Cover cls
1 trace
2 0.1-1%
3 1-2%
4 2-5%
5 5-10%
6 10-25%
7 25-50%
8 50-75%
9 75-95%
10 >95%

Community Survey
Page 3

NPS SE COAST PROJECT: Plot Sampling Form

County: __________ Park: (circle one) CHAT / KEMO / OCMU Plot Code: ____________ State: GA Location org: NPS

SPECIES COMPOSITION AND COVER/ABUNDANCE CLASS BY STRATUM

T 1	T 2	T 3	S 1	S 2	H	N	V	E	Total cover	Name (7 letter acronym or full name)	Collected? Spec #?	Discarded?
					4				4	Schizachyrium scoparium		
			6	4					6	Chionanthus virginicus		
				5					5	Ligustrum sinense		
			4						4	Lonicera japonica		
					2				2	Arabis laevigata		
					2				2	Packera anonyma		
					4				4	Carex sp. - veg.		
										~~Prunus persica~~		
					2				2	Tradescantia subaspera		
			4						4	Vaccinium arboreum		
			2						2	Bignonia capreolata		
			2						2	Smilax rotundifolia		
			4						4	Prunus umbellata		
						~~✓~~				~~Climacium~~		
					2				2	Dichanthelium sphaerocarpon		
					2				2	Juncus secundus		
					3				3	Andropogon gerardii		
					2				2	Asclepias tuberosa		
					2				2	Aquilegium [illegible]		
					2				2	Rubus argutus		
	3								3	Quercus rubra		
					2				2	Antennaria plantaginifolia		
					2				2	Lespedeza virginica		
					2				2	Talinum teretifolium		
					2				2	Cheilanthes lanosa		
	3								3	Carya pallida		
										~~Andropogon gerardii~~		
					2				2	Dichanthelium depauperatum		
										~~Packera anonyma~~		
						4			4	Thuidium del.		
					1				1	Cyperus retrorsus		

Cover classes
1. trace
2. 0.1-1%
3. 1-2%
4. 2-5%
5. 5-10%
6. 10-25%
7. 25-50%
8. 50-75%
9. 75-95%
10. >95%

T1: Emergent
T2: Tree Can
T3 Subcanopy
S1 Tall Shrub
S2 Short Shrub
H Herbaceous
N Nonvascular
V Vines (lianas)
E Epiphytes

Use bottom of this sheet or additional pages for other species in plot

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Appendix B: Descriptions of Vegetation Types

This subset of the International Ecological Classification Standard covers associations and alliances attributed to Kennesaw Mountain National Miliatary Park. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC <mary_russo@natureserve.org> and Milo Pyne Senior Regional Ecologist, Durham, NC <milo_pyne@natureserve.org>. Some classifications were altered by SECN staff and are detailed in the descriptions below. In those instances, comments should be directed to the authors of this report.

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These vegetation data, descriptions and classifications should be cited as:

NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 30 March 2009.

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Forest (I.)

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

Pinus echinata Forest Alliance (A.119)

Alliance Concept

Summary: This alliance includes forests dominated by *Pinus echinata* (shortleaf pine), 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, 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* (loblolly pine), *Pinus virginiana* (Virginia pine), *Pinus pungens* (Table Mountain pine), and *Pinus rigida* (pitch pine). Typical hardwood associates include *Quercus alba* (white oak), *Quercus falcata* (southern red oak), *Quercus velutina* (black oak), *Quercus coccinea* (scarlet oak), *Quercus marilandica* (blackjack oak), *Nyssa sylvatica* (blackgum), *Liquidambar styraciflua* (sweetgum), *Carya alba* (mockernut hickory), and *Carya glabra* (pignut hickory). Understory species vary across the range of the alliance, but some common components are *Vaccinium arboreum* (farkleberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Symplocos tinctoria* (common sweetleaf), *Ulmus alata* (winged elm), *Diospyros virginiana* (common persimmon), *Acer rubrum* (red maple), *Cornus florida* (flowering dogwood), and *Oxydendrum arboreum* (sourwood). One association in the West Gulf Coastal Plain of Arkansas has *Vaccinium elliottii* (Elliott's blueberry), *Aesculus pavia var. pavia* (red buckeye), and *Chasmanthium laxum* (slender woodoats). Common herbaceous species in this Coastal Plain association include *Smilax glauca* (cat greenbrier), *Silphium compositum* (kidneyleaf rosinweed), *Pteridium aquilinum var. latiusculum* (western brackenfern), *Scleria oligantha* (littlehead nutrush), *Piptochaetium avenaceum* (blackseed speargrass), and *Tephrosia virginiana* (Virginia tephrosia). 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 represent "climax" vegetation 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.

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

Similar Alliances:
• *Pinus echinata* Woodland Alliance (A.515)

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) ?

Alliance Description

Environment: In the more interior provinces, the 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 and Piedmont, this alliance is particularly typical of clay soils, on hillsides, ridges, flats, and low hills. These associations typically occur on south-facing slopes and saddles in the Ouachita Mountains and southern Arkansas Ozarks but may also occur on lower, north-facing slopes. In the northern Arkansas Ozarks, *Pinus echinata* forests occur naturally on steep slopes, over cherty residuum of the Boone Formation. Stands have suffered some damage from the southern pine beetle (*Dendroctonus frontalis*).

Vegetation: Forests are dominated by *Pinus echinata* (shortleaf pine), which on very dry sites may be virtually the only tree species present. Other pine species may be present in small amounts and include *Pinus taeda* (loblolly pine), *Pinus virginiana* (Virginia pine), *Pinus pungens* (Table Mountain pine), and *Pinus rigida* (pitch pine). Typical hardwood associates include *Quercus alba* (white oak), *Quercus falcata* (southern red oak), *Quercus velutina* (black oak), *Quercus coccinea* (scarlet oak), *Quercus marilandica* (blackjack oak), *Nyssa sylvatica* (blackgum), *Liquidambar styraciflua* (sweetgum), *Carya alba* (mockernut hickory), and *Carya glabra* (pignut hickory). *Vaccinium arboreum* (farkleberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Symplocos tinctoria* (common sweetleaf), *Ulmus alata* (winged elm), *Diospyros virginiana* (common persimmon), *Acer rubrum* (red maple), *Cornus florida* (flowering dogwood), and *Oxydendrum arboreum* (sourwood) are common in the understory. One association in the West Gulf Coastal Plain of Arkansas has *Vaccinium elliottii* (Elliott's blueberry), *Aesculus pavia var. pavia* (red buckeye), and *Chasmanthium laxum* (slender woodoats). Common herbaceous species include *Smilax glauca* (cat greenbrier), *Silphium compositum* (kidneyleaf rosinweed), *Pteridium aquilinum var. latiusculum* (western brackenfern), *Scleria oligantha* (littlehead nutrush), *Piptochaetium avenaceum* (blackseed speargrass), and *Tephrosia virginiana* (Virginia tephrosia).

Dynamics: Some associations can result from natural or anthropogenic disturbances such as fire, windstorms, plowing, or clearcuts, while others occur naturally on the landscape, are maintained by edaphic situations, and may even represent "climax" vegetation on these sites. Stands may have suffered 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, 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, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and possibly in West Virginia.

Nations: US

Subnations: AL, AR, DE, GA, KY, LA, MD, MO, MS, NC, NJ, 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:C, 53:C, 58:C, 59:C

USFS Ecoregions: 221Db:CCC, 221Ha:CCP, 221Hc:CCC, 221He:CCC, 221Jb:CCC, 221Jc:CCP, 222Ag:CCC, 222Dg:CCC, 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:CCP, 231Bc:CCP, 231Bd:CCC, 231Be:CCP, 231Bg:CC?, 231Bk:CC?, 231Ca:CC?, 231Cc:CCC, 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: BIA (Eastern Band of Cherokee); DOD (Camp Robinson); NPS (Buffalo River, Cowpens, Fort Donelson, Great Smoky Mountains, Kennesaw Mountain, Kings Mountain, Little River Canyon, Mammoth Cave, Natchez Trace?, Ozark Riverways, Shiloh); TVA (Tellico); USFS (Angelina, Bienville, Chattahoochee, Cherokee?, Daniel Boone, Davy Crockett, Holly Springs, Mark Twain, Nantahala, Oconee?, Ouachita, Ozark, Sabine, Sam Houston, St. Francis, Sumter, Talladega?, Tombigbee, Tuskegee?)

(CEGL006327) Early-Successional Shortleaf Pine Forest

***Pinus echinata* Early-Successional Forest**
Shortleaf Pine Early-Successional Forest

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
Formation	Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b.)
Alliance	*Pinus echinata* Forest Alliance (A.119)
Alliance (English name)	*Pinus echinata* Early-Successional Forest
Association	Shortleaf Pine Early-Successional Forest Association (English name)
Association (Common name)	Early-Successional Shortleaf Pine Forest
Ecological System(s):	East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest (CES203.506) Southern Appalachian Low-Elevation Pine Forest (CES202.332)

Element Concept

Global Summary: This association represents early-successional *Pinus echinata* (shortleaf pine)-dominated vegetation. This broadly defined type has a wide distribution throughout the native range of *Pinus echinata* (shortleaf pine) where it may develop under a variety of

circumstances associated with severe natural and/or anthropogenic disturbance. It is most frequently associated with abandoned agricultural land, unmanaged clearcuts, and burned or heavily eroded areas, where adjacent *Pinus echinata* (shortleaf pine) are able to seed into the newly disturbed area and colonize before other species such as *Pinus taeda* (loblolly pine). These are considered semi-natural forests as they typically result from anthropogenic disturbances that fundamentally alter the vegetation structure, floristic composition, and often the physical and chemical structure of the soil. Vegetation tends to be dense with a moderately to extremely barren understory. While *Pinus echinata* (shortleaf pine) is clearly the single most dominant tree, other "old-field" *Pinus* (pine) species (e.g., *Pinus taeda* (loblolly pine), *Pinus virginiana* (Virginia pine)) and/or other early-successional deciduous trees (e.g., *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree)) may also be present. Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species. As these forests age, mid-successional species such as *Quercus* (oak) spp. and *Carya* (hickory) spp. may begin to replace senescent *Pinus echinata* (shortleaf pine) individuals.

Environmental Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This early-successional shortleaf pine forest was sampled twice at Kennesaw Mountain. Within this park, this type ranges from gentle to moderate, northwest- and south-facing midslopes at 386-394 m (1267-1293 feet) elevation. Sites are dry with moderately well-drained loam and clay loam soils. The unvegetated surface is dominated by leaf litter (88-94% cover) with some wood (6-10%) and bare soil (0-2%). Mafic influence prevalent in vegetation types at higher elevations on both Little Kennesaw and Kennesaw Mountains appears subdued or absent along portions of the lower slopes of Little Kennesaw Mountain where this shortleaf pine forest was sampled.

Global Environment: This broadly defined type may develop under a variety of circumstances associated with severe natural and/or anthropogenic disturbance. It is most frequently associated with abandoned agricultural land, unmanaged clearcuts, and burned or eroded areas. These are considered semi-natural forests as they typically result from anthropogenic disturbances which fundamentally alter the vegetation structure, floristic composition, and often the physical and chemical structure of the soil.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderately dense (70% cover) tree canopy, 20-50 m tall, is dominated by *Pinus echinata* (shortleaf pine); additional canopy species may include *Acer rubrum* (red maple), *Carya ovalis* (red hickory), *Nyssa sylvatica* (blackgum), *Quercus alba* (white oak), *Quercus prinus* (chestnut oak), and *Quercus velutina* (black oak). *Pinus taeda* (loblolly pine) may also be an occasional sparse canopy associate (<5%). The very sparse (5-10%) subcanopy (15-20 m) is made up of canopy oaks and *Liquidambar styraciflua* (sweetgum). The sparse to moderate (20-60%) tall-shrub layer (2-10 m) and sparse (20-40%) short-shrub layer (1-2 m) include saplings of canopy species as well as *Asimina parviflora* (smallflower pawpaw), *Carya pallida* (sand hickory), *Cornus florida* (flowering dogwood), *Diospyros virginiana* (common persimmon), *Liquidambar styraciflua* (sweetgum), *Sassafras albidum* (sassafras), and *Vaccinium stamineum* (deerberry). The sparse (10-20%) herbaceous layer may include tree and shrub seedlings and *Chimaphila maculata* (striped prince's pine), *Dichanthelium*

boscii (Bosc's panicgrass), and *Euphorbia corollata* (flowering spurge). Vines of *Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Vitis aestivalis* (summer grape), and *Vitis rotundifolia* (muscadine) trail on the ground and/or climb into the shrub layers.

Global Vegetation: *Pinus echinata* (shortleaf pine) is clearly the single most dominant tree. In addition, other "old-field" Pinus (pine) species (e.g., *Pinus taeda* (loblolly pine), *Pinus virginiana* (Virginia pine) and/or other early-successional deciduous trees (e.g., *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree) may also be present. Forests of 50+ years may begin to become codominated by mid-successional species such as *Quercus* (oak) spp. and *Carya* (hickory) spp. in some instances. Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species.

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Quercus prinus (chestnut oak)*
Tree canopy	Broad-leaved deciduous tree	*Celtis laevigata (sugarberry)*
Tree canopy	Broad-leaved evergreen tree	*Ilex vomitoria (yaupon)*
Tree subcanopy	Broad-leaved evergreen tree	*Prunus caroliniana (Carolina laurelcherry)*
Shrub/sapling (tall & short)	Broad-leaved evergreen shrub	*Ilex vomitoria (yaupon)*
Herb (field)	Graminoid	*Oplismenus hirtellus ssp. setarius (bristle basketgrass)*

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Asimina parviflora* (smallflower pawpaw), *Carya pallida* (sand hickory), *Cornus florida* (flowering dogwood), *Diospyros virginiana* (common persimmon), *Liquidambar styraciflua* (sweetgum), *Pinus echinata* (shortleaf pine), *Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Quercus velutina* (black oak), *Sassafras albidum* (sassafras), *Vaccinium stamineum* (deerberry), *Vitis rotundifolia* (muscadine)

Global: *Pinus echinata* (shortleaf pine)

Other Noteworthy Species

Conservation Status Rank

Global Rank & Reasons: GNA (ruderal) (3-Apr-2000). This forest represents a ruderal community resulting from succession following anthropogenic disturbance of an area. It is not of conservation concern and does not receive a conservation status rank. Stands have suffered some damage from the southern pine beetle (*Dendroctonus frontalis*).

Classification

Status: Standard

Classification Confidence: 2 - Moderate Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Comments: There was discussion whether or not the Kennesaw Mountain examples of CEGL006327 represent successional forest or fire-suppressed woodland, but the easy accessibility of these stands, combined with the common occurrence of other, obviously early-successional pine forest types in close proximity suggests the former rather than the latter.

Global Comments: In Kentucky, this vegetation is known only from the eastern part of the state. A stand at Mammoth Cave National Park which is referred here may have originated with the planting of *Pinus echinata*. In Louisiana, this successional vegetation occurs in the Florida parishes and may have a dense shrub understory. In Arkansas, old fields succeed to *Pinus echinata*. Stands have suffered some damage from southern pine beetle (*Dendroctonus frontalis*).

Global Similar Associations:

• *Pinus taeda - Liquidambar styraciflua* Semi-natural Forest (CEGL008462)--is commonly found in the same area as CEGL006327 in the Piedmont. CEGL008462 contains at least 50% *Pinus taeda* in the canopy, whereas CEGL006327 is mostly *Pinus echinata*.
• *Pinus taeda / Liquidambar styraciflua - Acer rubrum var. rubrum / Vaccinium stamineum* Forest (CEGL006011)--occurs in similar environments with similar disturbance histories but is dominated by (>50% of canopy) *Pinus taeda* instead of *Pinus echinata*.
• *Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum* Forest (CEGL007119)--can have a very similar canopy in the Piedmont and Blue Ridge ecoregions, but CEGL007119 is generally created and maintained by fire and/or logging but not heavy plowing and/or erosion. CEGL006327 generally has signs of heavy agricultural use such as sparse herbaceous or shrub layers, large percentage of invasive exotics such as *Lonicera japonica* in the herbaceous layer, old plowlines, human debris, and extremely even-aged canopy, whereas CEGL007119 generally has a more intact herbaceous/shrub layer (especially *Vaccinium pallidum*) and less signs of severe human disturbance.
• *Pinus virginiana* Successional Forest (CEGL002591)--occurs in similar environments but is dominated (>50% of canopy) by *Pinus virginiana* instead of *Pinus echinata*.

Global Related Concepts:

• IA7a. Xeric Shortleaf Pine - Oak Forest (Allard 1990) B
• T1A9bI1a. *Pinus echinata* (Foti et al. 1994) ?

Other Comments

Other Comments: This association will probably eventually resemble other oak-hickory forest types found within the Kennesaw Mountain park area, as stand composition shifts over time with a gradual loss of *Pinus echinata* in the canopy to favor late-successional hardwood species.

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: This association is represented from two plots sampled along the midslopes of Little Kennesaw Mountain north of Burnt Hickory Road within the Pigeon Hill area. There is a moderate to high potential of additional occurrences in the park along dry to

xeric slopes where vegetation has been influenced by anthropogenic disturbance regimes. Substantial coverage of this type mixed with *Pinus taeda*-dominated forest may occur to the east of the two plots taken.
Global Range: This community is found throughout the southeastern United States.

Nations: US

States/Provinces: AL, AR, GA, KY, LA, MO, MS, NC, OK, SC, TN, TX, WV?

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

USFS Ecoregions: 221J:CC, 222Ag:CCC, 222Dg:CCC, 231A:CC, 231Bd:CCC, 231Cc:CCC, 231E:CP, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Bm:CCC, M221A:C?, M221B:C?, M221Dd:CCC, M222A:CC

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Buffalo River, Cowpens, Fort Donelson, Kennesaw Mountain, Kings Mountain, Little River Canyon, Mammoth Cave, Natchez Trace?, Shiloh); TVA (Tellico); USFS (Bienville?, Chattahoochee, Chattahoochee (Piedmont)?, Chattahoochee (Southern Blue Ridge), Daniel Boone, Holly Springs?, Mark Twain, Oconee?, Ouachita, Ouachita (Coastal Plain), Ouachita (Mountains), Ozark, St. Francis, Sumter (Piedmont)?, Sumter?, Talladega?, Tombigbee?, Tuskegee?)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: KEMO.09, KEMO.35.

Local Description Authors: M.J. Russo and L. Echols

Global Description Authors: A.S. Weakley and K.D. Patterson, mod. R.E. Evans

References: Allard 1990, Burns and Honkala 1990a, Foti 1994b, Foti et al. 1994, NatureServe Ecology - Southeastern U.S. unpubl. data, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. Data

Pinus taeda Forest Alliance (A.119)

Alliance Concept

Summary: This alliance includes both successional forests of *Pinus taeda* (loblolly pine), which develop following cropping or site conversion, as well as natural forests in the Piedmont, Cumberlands and Ridge and Valley, and Coastal Plain of the southeastern United States. Other canopy and subcanopy species that may be present in successional stands are *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), *Pinus virginiana* (Virginia pine), *Juniperus virginiana var. virginiana* (eastern red-cedar), *Quercus stellata* (post oak), *Quercus velutina* (black oak), *Ulmus rubra* (slippery elm), *Quercus alba* (white oak), *Nyssa sylvatica* (blackgum), *Ulmus alata* (winged elm), *Cornus florida* (flowering dogwood), *Prunus serotina var. serotina* (black cherry), and *Carya* (hickory) spp. *Vaccinium* (blueberry) spp., especially *Vaccinium stamineum* (deerberry), are common in these forests. One association in this alliance occurs on barrier islands in the Mid-Atlantic Coastal Plain. Along with the dominant *Pinus taeda* (loblolly pine), canopy associates often include *Quercus falcata* (southern red oak), *Acer rubrum* (red maple), *Prunus serotina var. serotina* (black cherry), and

Sassafras albidum (sassafras). The tall-shrub layer is comprised of *Morella cerifera* (wax-myrtle) and *Vaccinium formosum* (southern blueberry). Vines and lianas are always present in abundance; *Vitis rotundifolia* (muscadine) is most commonly present, but *Toxicodendron radicans* (eastern poison-ivy), *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), and *Parthenocissus quinquefolia* (Virginia creeper) are usually present in abundance as well. The herbaceous layer may be sparse, particularly if shrubs and vines are dense, but *Chasmanthium laxum* (slender woodoats) may be fairly abundant in this community. Other herbs include *Panicum amarum var. amarulum* (bitter panicgrass), *Eupatorium hyssopifolium* (hyssopleaf thoroughwort), and *Elephantopus nudatus* (smooth elephantsfoot). In southern Virginia and North Carolina, *Quercus virginiana* (live oak) and *Gelsemium sempervirens* (evening trumpetflower) may also be present, but *Quercus virginiana* (live oak) is never abundant and when present is usually restricted to the understory. *Pinus taeda* (loblolly pine) may occur rarely in the Ouachita Mountains and Ozarks of Arkansas where the species is becoming naturalized, expanding from its native range in the Coastal Plain, where it naturally occurs in low, moist areas (e.g., deep, well-drained soils of floodplains). However, a natural *Pinus taeda* (loblolly pine) forest association is not recognized for the Ozark or Ouachita region.

Classification Comments: On the Bankhead National Forest in the Cumberland Plateau of northern Alabama, this alliance includes streamside terraces that are presumed to have been previously farmed. Associations occurring as plantations are classed in *Pinus taeda* Planted Forest Alliance (A.99).

Similar Alliances:
• *Pinus echinata - Quercus (alba, falcata, stellata, velutina)* Forest Alliance (A.394)
• *Pinus taeda - Quercus (phellos, nigra, laurifolia)* Temporarily Flooded Forest Alliance (A.437)--mixed, temporarily flooded.
• *Pinus taeda - Quercus nigra* Forest Alliance (A.406)
• *Pinus taeda* Planted Forest Alliance (A.99)--includes monospecific, dense, plantation stands only.
• *Pinus taeda* Woodland Alliance (A.526)

Related Concepts:
• Loblolly Pine: 81 (Eyre 1980) I
• Lowland Pine - Oak Forest (Foti 1994b) ?
• T1A9bII2a. *Pinus taeda* (Foti et al. 1994) ?
• Upland Mixed Forest (FNAI 1992a) ?
• Upland Mixed Forest, Gumbo Loblolly Forest subtype (FNAI 1992b) ?

Alliance Description

Environment: This alliance includes both successional forests, following cropping or site conversion, and natural forests in the Piedmont, Cumberlands and Ridge and Valley, and Coastal Plain of the southeastern United States.

Vegetation: Canopy and subcanopy species that may be present in successional stands are *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), *Pinus virginiana* (Virginia pine), *Juniperus virginiana var. virginiana* (eastern red-cedar), *Quercus stellata* (post oak), *Quercus velutina* (black oak), *Ulmus rubra* (slippery elm), *Quercus alba* (white oak), *Nyssa sylvatica* (blackgum), *Ulmus alata* (winged elm), *Cornus florida* (flowering dogwood), *Prunus serotina var. serotina* (black cherry), and *Carya* (hickory)

spp. *Vaccinium* (blueberry) spp., especially *Vaccinium stamineum* (deerberry), are common in these forests. One association in this alliance occurs on barrier islands in the Mid-Atlantic Coastal Plain. Along with the dominant *Pinus taeda* (loblolly pine), canopy associates often include *Quercus falcata* (southern red oak), *Acer rubrum* (red maple), *Prunus serotina var. serotina* (black cherry), and *Sassafras albidum* (sassafras). The tall-shrub layer is comprised of *Morella cerifera* (wax-myrtle) and *Vaccinium formosum* (southern blueberry). Vines and lianas are always present in abundance; *Vitis rotundifolia* (muscadine) is most commonly present, but *Toxicodendron radicans* (eastern poison-ivy), *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), and *Parthenocissus quinquefolia* (Virginia creeper) are usually present in abundance as well. The herbaceous layer may be sparse, particularly if shrubs and vines are dense, but *Chasmanthium laxum* (slender woodoats) may be fairly abundant in this community. Other herbs include *Panicum amarum var. amarulum* (bitter panicgrass), *Eupatorium hyssopifolium* (hyssopleaf thoroughwort), and *Elephantopus nudatus* (smooth elephantsfoot). In southern Virginia and North Carolina, *Quercus virginiana* (live oak) and *Gelsemium sempervirens* (evening trumpetflower) may also be present, but *Quercus virginiana* (live oak) is never abundant and when present is usually restricted to the understory. *Pinus taeda* (loblolly pine) forests may occur rarely in the Ouachita Mountains and Ozarks of Arkansas where the species is becoming naturalized, expanding from its native range in the Coastal Plain, where it naturally occurs in low, moist areas (e.g., deep, well-drained soils of floodplains).
Dynamics: The understory of the heavily disturbed examples of this alliance is often dominated by exotic species, to the exclusion of natives. Common invasives are *Lonicera japonica* and *Microstegium vimineum*. Due to the dominance of these species, stand dynamics often shift so that there are less seedlings and saplings in the understory.

Alliance Distribution

Range: This alliance is found in the Cumberland Plateau, Piedmont, Interior Low Plateau, and Coastal Plains of the southeastern United States, from Delaware and Maryland south and west to Texas, and in the interior to Tennessee and possibly West Virginia.

Nations: US

Subnations: AL, AR, DE, FL, GA, LA, MD, MS, NC, NJ, OK, SC, TN, TX, VA

TNC Ecoregions: 31:P, 39:C, 40:C, 41:C, 42:P, 43:C, 44:C, 50:C, 52:C, 53:C, 55:?, 56:C, 57:C, 58:C, 59:C, 62:C

USFS Ecoregions: 221D:CC, 221Jb:CCC, 222Cb:CCC, 222Dc:CCC, 222Dd:CCC, 222Eb:CCC, 222Ec:CCC, 222Ef:CCC, 222Eg:CCC, 231Aa:CCC, 231Ab:CCC, 231Ac:CCC, 231Ad:CCC, 231Ae:CCC, 231Af:CCC, 231Ag:CCC, 231Ah:CCC, 231Ai:CCC, 231Aj:CCC, 231Ak:CCC, 231Al:CCC, 231Am:CCC, 231An:CCC, 231Ao:CCP, 231Ba:CCC, 231Bb:CCC, 231Bc:CCP, 231Bd:CCC, 231Be:CCC, 231Bf:CCP, 231Bg:CCC, 231Bh:CCC, 231Bi:CCC, 231Bj:CCC, 231Bk:CCC, 231Bl:CCC, 231Ca:CCP, 231Cb:CCP, 231Cc:CCC, 231Cd:CCC, 231Ce:CCC, 231Cf:CCC, 231Cg:CCP, 231Da:CCP, 231Dc:CCC, 231De:CC?, 231Ea:CCC, 231Eb:CC?, 231Ec:CC?, 231Ed:CC?, 231Ef:CC?, 231Eg:CCP, 231Eh:CCC, 231Ei:CC?, 231Ej:CC?, 231Ek:CCP, 231En:CC?, 231Fa:CPP, 231Fb:CP?, 232Ab:CCC, 232Ac:CCC, 232Ad:CCC, 232Ba:CCC, 232Bb:CCC, 232Bc:CC?, 232Bd:CC?, 232Be:CC?, 232Bg:CCC, 232Bh:CC?, 232Bi:CC?, 232Bj:CCC, 232Bk:CC?, 232Bl:CC?, 232Bm:CCC, 232Bn:CC?, 232Bo:CC?, 232Bp:CC?, 232Bq:CCC, 232Br:CCC, 232Bt:CC?, 232Bu:CC?, 232Bv:CC?, 232Bx:CCC, 232Bz:CCC, 232Ca:CCC, 232Cb:CCC, 232Cc:CC?, 232Ce:CCC, 232Cf:CC?,

232Cg:CC?, 232Ci:CC?, 232Da:CC?, 232Dc:CCC, 232Fa:CC?, 232Fb:CC?, 232Fe:CCC, 255Da:PPP, M221D:??

Federal Lands: DOD (Arnold, Fort Benning, Fort Gordon); NPS (Assateague Island, Cape Hatteras, Chattahoochee River, Chickamauga-Chattanooga, Colonial, Cowpens, Cumberland Island, Fort Donelson, Fort Frederica?, George Washington Birthplace, Guilford Courthouse, Horseshoe Bend, Kennesaw Mountain, Kings Mountain, Little River Canyon, Moores Creek, Natchez Trace, Ninety Six, Petersburg, Richmond, Shiloh); TVA (Tellico); USFS (Angelina, Apalachicola, Bankhead, Bienville, Chattahoochee, Conecuh?, Croatan, Davy Crockett, Kisatchie, Land Between the Lakes?, Oconee, Ouachita, Sabine, Sam Houston, Sumter, Talladega, Tuskegee, Uwharrie); USFWS (Back Bay?, Blackwater, Cape May, Chesapeake Marshlands, Chincoteague, Prime Hook)

(CEGL006011) Early- to Mid-Successional Loblolly Pine Forest

***Pinus taeda / Liquidambar styraciflua - Acer rubrum var. rubrum / Vaccinium stamineum* Forest**
Loblolly Pine / Sweetgum - Red Maple / Deerberry Forest

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
Formation	Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b.)
Alliance	*Pinus taeda* Forest Alliance (A.130)
Alliance (English name)	Loblolly Pine Forest Alliance
Association	*Pinus taeda / Liquidambar styraciflua - Acer rubrum var. rubrum / Vaccinium stamineum* Forest
Association (English name)	Loblolly Pine / Sweetgum - Red Maple / Deerberry Forest
Association (Common name)	Early- to Mid-Successional Loblolly Pine Forest
Ecological System(s):	Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074)

Element Concept

Global Summary: This wide-ranging association is most common from the Piedmont of Virginia, through North Carolina, South Carolina, Georgia and Alabama, likely extending throughout the adjacent Coastal Plain. A large amount of variability exists in species composition and density due to geographic and disturbance factors. It represents stands in which *Pinus taeda* (loblolly pine) is the monospecific dominant tree in the overstory. Stands typically have more-or-less closed canopies, understories dominated by fire-intolerant hardwoods, and shrub-dominated lower strata. These are generally early- to mid-successional forests where the pines have reached tree size (as opposed to saplings) and have been established for a long enough period to have developed a closed canopy. Below the canopy of *Pinus taeda* (loblolly pine), a well-developed subcanopy of hardwoods is present. *Acer rubrum var. rubrum* (red maple) and *Liquidambar styraciflua* (sweetgum) are often the dominant species in the subcanopy. If significant numbers of these species enter the canopy, the stand would instead be classified as *Pinus taeda - Liquidambar styraciflua* Semi-natural Forest (CEGL008462). Although this forest may result from a planted stand [see *Pinus taeda* (loblolly pine) Planted Forest (CEGL007179)], it is distinguished from young pine plantations by tree height and the

formation of distinct stratal layers, especially a well-developed subcanopy. This type may also develop following site preparation, with or without site conversion, and following agriculture.

Environmental Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This early- to mid-successional loblolly pine forest was sampled twice at Chattahoochee River and twice at Kennesaw Mountain. The sites range from flat to gentle and moderate mid and upper north-, south- and southeast-facing slopes at 220-450 m (720-1480 feet) elevation. Soils are dry to dry-mesic, moderately well-drained to somewhat poorly drained sandy loam and clay. The unvegetated surface is dominated by leaf litter (84-95% cover) with some wood (5-16%). Evidence of disturbance includes the presence of exotic plants.

Global Environment: This forest follows agricultural cropping or silvicultural site preparation on a variety of sites, and presumably is more likely on moderately dissected topography where fire is a rare occurrence. This community usually is not present on steep slopes and does not occur on wet soils. It occurs on well- to moderately well-drained soils, usually Ultisols, on sites that formerly were under hardwood cover or subjected to agriculture.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderately dense (60-70% cover) tree canopy, 20-50 m tall, is dominated almost exclusively by *Pinus taeda* (loblolly pine). The sparse to moderate (10-50%) subcanopy (10-20 m) is dominated by *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Oxydendrum arboreum* (sourwood), and/or *Ulmus rubra* (slippery elm) and may include lesser amounts of *Acer negundo* (box-elder), *Cornus florida* (flowering dogwood), *Fraxinus americana* (white ash), *Prunus serotina* (black cherry), and *Quercus alba* (white oak). The sparse to dense (10-80%) tall-shrub layer (2-10 m) is made up of canopy and subcanopy species as well as *Cercis canadensis* (eastern redbud), *Fagus grandifolia* (American beech), *Ilex opaca* (American holly), and *Lindera benzoin* (northern spicebush). The sparse to moderate (20-40%) short-shrub layer (1-2 m) is dominated by saplings of species from the upper layers and may also include *Euonymus americanus* (strawberry bush), *Phytolacca americana* (American pokeweed), and *Vaccinium stamineum* (deerberry). The herbaceous layer is sparse (5-30%) but may include *Aristolochia serpentaria* (Virginia snakeroot), *Chasmanthium sessiliflorum* (longleaf woodoats), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium boscii* (Bosc's panicgrass), *Lespedeza procumbens* (trailing lespedeza), *Mitchella repens* (partridgeberry), *Passiflora lutea* (yellow passionflower), *Polystichum acrostichoides* (Christmas fern), and *Toxicodendron radicans* (eastern poison-ivy). Vines trailing on the ground and climbing into the shrub layers include *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), and *Vitis rotundifolia* (muscadine).

Global Vegetation: The tree canopy of *Pinus taeda* (loblolly pine) is at least 60% but may be considerably more dense, up to and including closed canopies. Tree subcanopy density varies with stand disturbance history but generally is <50%. Shrub and herb layer coverages do not exceed 25% and decrease with increasing age of the stand. Other species of pine, especially *Pinus echinata* (shortleaf pine) and *Pinus virginiana* (Virginia pine) may be sparingly present in the canopy. Other species that may be present in the subcanopy in addition to *Liquidambar styraciflua* (sweetgum) and *Acer rubrum var. rubrum* (red maple) include *Quercus coccinea*

(scarlet oak), *Quercus velutina* (black oak), *Quercus alba* (white oak), *Quercus falcata* (southern red oak), *Nyssa sylvatica* (blackgum), *Carya glabra* (pignut hickory), *Carya alba* (mockernut hickory), *Diospyros virginiana* (common persimmon), *Prunus serotina* (black cherry), *Cornus florida* (flowering dogwood), *Liriodendron tulipifera* (tuliptree), and *Sassafras albidum* (sassafras) (NatureServe Ecology unpubl. data). Other species in addition to *Vaccinium stamineum* (deerberry) that may be present in the shrub stratum include *Juniperus virginiana* (eastern red-cedar), *Vaccinium arboreum* (farkleberry), *Rhus copallinum* (flameleaf sumac), *Gaylussacia baccata* (black huckleberry), *Callicarpa americana* (American beautyberry), and probably others. The herbaceous layer usually forms <5% cover and contains such species as *Gelsemium sempervirens* (evening trumpetflower), *Chimaphila maculata* (striped prince's pine), *Polystichum acrostichoides* (Christmas fern), and *Potentilla canadensis* (dwarf cinquefoil). An example from Oconee National Forest has a thinned canopy and grassy herbaceous layer.

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus taeda (loblolly pine)*
Tree subcanopy	Broad-leaved deciduous tree	*Liquidambar styraciflua (sweetgum), Liriodendron tulipifera (tuliptree), Oxydendrum arboreum (sourwood), Ulmus rubra (slippery elm)*
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Liquidambar styraciflua (sweetgum)*
Tall shrub/sapling	Broad-leaved deciduous shrub	*Cercis canadensis (eastern redbud), Cornus florida (flowering dogwood), Lindera benzoin (northern spicebush), Ulmus rubra (slippery elm)*
Herb (field)	Vine/Liana	*Vitis rotundifolia (muscadine)*

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Dichanthelium boscii* (Bosc's panicgrass), *Fagus grandifolia* (American beech), *Lindera benzoin* (northern spicebush), *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Oxydendrum arboreum* (sourwood), *Pinus taeda* (loblolly pine), *Ulmus rubra* (slippery elm), *Vitis rotundifolia* (muscadine)

Other Noteworth Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Ligustrum sinense (Chinese privet)	High/Medium	invasive/exotic
Lonicera japonica (Japanese honeysuckle)	High/Medium	invasive/exotic
Nandina domestica (sacred bamboo)	High/Low	invasive/exotic

Conservation Status Rank

Global Rank & Reasons: GNA (modified/managed) (8-Aug-2002). This is a successional forest composed of species native to the southeastern United States; it is not of conservation concern and does not receive a conservation status rank.

Classification

Status: Standard

Classification Confidence: 3 - Weak

Global Comments: The similarity of this association with *Pinus taeda - Liquidambar styraciflua* Semi-natural Forest (CEGL008462) suggests that a merge with that type should be considered.

Global Similar Associations:
• *Pinus echinata* Early-Successional Forest (CEGL006327)--occurs in the same region but is dominated by *Pinus echinata* instead of *Pinus taeda*.
• *Pinus taeda - Liquidambar styraciflua* Semi-natural Forest (CEGL008462)--is a related late-successional type with hardwoods in the canopy.
• *Pinus taeda - Liriodendron tulipifera / Acer saccharum* Successional Forest (CEGL007105)--of the Ridge and Valley.
• *Pinus taeda - Quercus (alba, falcata, stellata)* Successional Coastal Plain Forest [Provisional] (CEGL004766)
• *Pinus taeda - Quercus (falcata, hemisphaerica, nigra) - Liquidambar styraciflua / Rhus copallinum - Vaccinium stamineum* Forest (CEGL008450)
• *Pinus taeda / Rhus copallinum* Managed Forest (CEGL007108)
• *Pinus taeda* Planted Forest (CEGL007179)--applies to young dense monospecific stands with plantation structure.
• *Pinus virginiana* Successional Forest (CEGL002591)
• *Pinus taeda / Liquidambar styraciflua - Acer rubrum var. rubrum / Vaccinium stamineum* Forest (Bartgis 1986) ?
• IF3b. Plantation (Hardwood or Conifer) (Allard 1990) B
• Loblolly Pine (21) (USFS 1988) ?
• Loblolly Pine - Hardwood: 82 (Eyre 1980) B
• Loblolly Pine: 81 (Eyre 1980) B

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: Within Chattahoochee River NRA, one plot was sampled from the southern terminus of Palisades Whitewater Creek and one plot from the southern portion of Island Ford adjacent to Island Ford Road. This type was also potentially observed at McGinnis Ferry. This association could be expected at a number of other park units. Two plots attributable to this type were sampled from Kennesaw Mountain NBP less than one mile south of the Pigeon Hill Parking Area within the central portion of the park. This association is found frequently at Kennesaw Mountain south of Burnt Hickory Road in the central and southern portions of the park.

Global Range: This forest ranges from the Piedmont of Virginia, through North Carolina, South Carolina, Georgia and Alabama, extending into the adjacent Coastal Plains, including the eastern end of the Upper East Gulf Coastal Plain (e.g., Talladega National Forest).

Nations: US

States/Provinces: AL, DE, GA, LA, MD, MS, NC, NJ, SC, TN, TX, VA

TNC Ecoregions: 40:C, 41:C, 43:C, 44:C, 52:C, 53:C, 56:P, 57:C, 58:C, 62:C

USFS Ecoregions: 221D:CC, 222Ef:CCC, 222Eg:CCC, 231Aa:CCC, 231Ab:CCC, 231Ba:CCC, 231Bb:CCC, 231Bd:CCC, 231Be:CCC, 231Bg:CCC, 231Bh:CCC, 231Bi:CCC, 231Bj:CCC, 231Bk:CCC, 231Bl:CCC, 232Ab:CCC, 232Ac:CCC, 232Bb:CCC, 232Cb:CCC, M221D:??

Federal Lands: NPS (Chattahoochee River, Cowpens, George Washington Birthplace, Horseshoe Bend, Kennesaw Mountain, Little River Canyon?, Moores Creek, Natchez Trace, Petersburg, Shiloh); USFS (Land Between the Lakes?, Oconee, Sumter, Sumter (Piedmont), Talladega, Talladega (Oakmulgee), Talladega (Talladega), Uwharrie?); USFWS (Cape May, Chesapeake Marshlands)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: CHAT.59, CHAT.72, KEMO.07, KEMO.08.

Local Description Authors: M.J. Russo and L. Echols

Global Description Authors: S. Landaal, mod. L.A. Sneddon

References: Allard 1990, Bartgis 1986, Coxe 2008, Eyre 1980, Felix et al. 1983, Harrison 2004, McCrain and Church 1985, NatureServe Ecology - Southeastern U.S. unpubl. data, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, USFS 1988

Pinus virginiana Forest Alliance (A.131)

Alliance Concept

Summary: This alliance includes forests dominated by *Pinus virginiana* (Virginia pine) occurring in the Piedmont from Pennsylvania south to Alabama, and ranging west into the Appalachians, Ridge and Valley, the Cumberland Plateau, and at scattered locales in the Interior Low Plateau. Forests in this alliance may have admixtures of *Pinus taeda* (loblolly pine), *Pinus echinata* (shortleaf pine), *Pinus pungens* (Table Mountain pine), and/or *Pinus rigida* (pitch pine). 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 disturbances and natural forests in edaphically extreme situations. Typically, *Pinus virginiana* (Virginia pine) communities are short-lived as a forest and are more common as woodland communities [see *Pinus (rigida, pungens, virginiana) - Quercus prinus* Woodland Alliance (A.677)]. Associated species vary with the geographic distribution of the alliance.

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).

Similar Alliances:
• *Pinus (rigida, pungens, virginiana)* - *Quercus prinus* Woodland Alliance (A.677)
• *Pinus virginiana* Planted Forest Alliance (A.100)

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

Alliance Description

Environment: This alliance includes both early-successional forests resulting from natural or anthropogenic disturbances and natural forests in edaphically extreme situations.

Vegetation: This alliance includes evergreen forests dominated by *Pinus virginiana* (Virginia pine). These forests are usually dense and can contain admixtures of *Pinus taeda* (loblolly pine), *Pinus echinata* (shortleaf pine), *Pinus pungens* (Table Mountain pine), and/or *Pinus rigida* (pitch pine), and, particularly in fire-suppressed examples, small stems of deciduous species. Associated species vary with the geographic distribution of the alliance. In many associations, a dense ericaceous shrub stratum is typical. Types resulting from anthropogenic disturbance may have a greater admixture of deciduous species. In the Piedmont common associates include *Liquidambar styraciflua* (sweetgum), *Pinus taeda* (loblolly pine), *Pinus echinata* (shortleaf pine), and *Quercus* (oak) spp., while on extreme sites in the southern Appalachians, *Pinus pungens* (Table Mountain pine) and *Pinus rigida* (pitch pine) are more typical. In areas with calcareous geology, *Juniperus virginiana* (eastern red-cedar) is a typical associate. In many associations, a dense ericaceous shrub stratum is typical and can include species such as *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Vaccinium arboreum* (farkleberry), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry), *Gaylussacia baccata* (black huckleberry), *Gaylussacia ursina* (bear huckleberry), *Kalmia latifolia* (mountain laurel), *Rhododendron catawbiense* (Catawba rosebay), and *Rhododendron maximum* (great laurel). Dry-mesic successional examples may contain other *Pinus* (pine) species (e.g., *Pinus taeda* (loblolly pine), *Pinus echinata* (shortleaf pine)) or other early successional deciduous trees (e.g., *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree)). The subcanopy may contain *Acer saccharum* (sugar maple) and *Cornus florida* (flowering dogwood); other associated species may include *Cercis canadensis* (eastern redbud), *Parthenocissus quinquefolia* (Virginia creeper), *Lycopodium digitatum* (fan clubmoss), as well as the exotics *Lonicera japonica* (Japanese honeysuckle) and *Microstegium vimineum* (Nepalese browntop) (Andreu and Tukman 1995).

Dynamics: 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 *Pinus (rigida, pungens, virginiana)* - *Quercus prinus* Woodland Alliance (A.677)].

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 at scattered locales in the Interior Low Plateau.

Nations: US

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

TNC Ecoregions: 43:C, 44:C, 49:C, 50:C, 51:C, 52:C, 58:C, 59:C, 61:C, 62:C, 63:C

USFS Ecoregions: 221Da:CCC, 221Db:CCC, 221Ea:CC?, 221Eb:CCC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCC, 221Eg:CCC, 221Ha:CCC, 221Hc:CCC, 221He:CCC, 221Ja:CCC, 221Jb:CCC, 221Jc:CCC, 222Cg: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:CCC, 231Al:CCP, 231Am:CCP, 231An:CCC, 231Ao:CCP, 231Ap:CCP, 231Bc:CCC, 231Be:CCC, 231Ca:CCP, 231Cb:CCP, 231Cc:CCC, 231Cd:CCC, 231Ce:CCP, 231Cf:CCP, 231Cg:CCP, 231Da:CCC, 231Dc:CCC, 232Ab:CCC, 232Br:CCC, 232Bt:CCC, 232Bx:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ba:CC?, M221Bb:CCC, M221Bd:CCP, M221Be:CCC, M221Ca:CCP, M221Cb:CCC, M221Cc:CCC, M221Cd:CCC, M221Ce:CCC, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Abe Lincoln Birthplace, Appomattox Court House, Big South Fork, Blue Ridge Parkway, Bluestone, Booker T. Washington, C&O Canal?, Chickamauga-Chattanooga, Cumberland Gap, Fredericksburg-Spotsylvania, George Washington Parkway, Gettysburg, Great Smoky Mountains, Kennesaw Mountain, Kings Mountain, Little River Canyon, Mammoth Cave, Manassas?, Natchez Trace, National Capital-East?, New River Gorge, Obed, Prince William?, Shenandoah, Shiloh, Thomas Stone, Wolf Trap); TVA (Land Between the Lakes?, Tellico); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Monongahela, Nantahala, Pisgah, Sumter, Talladega, Uwharrie?, Wayne); USFWS (Chesapeake Marshlands)

(CEGL003993) Virginia Pine / Granitic Flatrock Border Woodland

***Pinus virginiana / Juniperus virginiana* - *Chionanthus virginicus* Granitic Flatrock Border Forest Virginia Pine / Eastern Red-cedar - White Fringetree Granitic Flatrock Border Forest**

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
Formation	Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b.)
Alliance	*Pinus virginiana* Forest Alliance (A.131)
Alliance (English name)	Virginia Pine Forest Alliance

Association	*Pinus virginiana / Juniperus virginiana - Chionanthus virginicus* Granitic Flatrock Border Forest
Association (English name)	Virginia Pine / Eastern Red-cedar - White Fringetree Granitic Flatrock Border Forest
Association (Common name)	Virginia Pine / Granitic Flatrock Border Woodland
Ecological System(s):	Southern Piedmont Granite Flatrock and Outcrop (CES202.329)

Element Concept

Global Summary: This granitic flatrock border woodland occurs on shallow soils over exfoliated granitic bedrock, on the margins of Piedmont Fall-line granite outcrops (some of which are actually found east of the fall-line in the Coastal Plain). Stands are generally associated with open granitic flatrock communities. Stands of this association are somewhat open forests or woodlands. The closure of stands may be variable, and many would fall below the 60% forest/woodland threshold, but this association is placed in a "forest" alliance. The canopy is typically dominated by *Pinus virginiana* (Virginia pine). Other canopy species, which also may form an open understory, include *Juniperus virginiana* (eastern red-cedar), *Ulmus alata* (winged elm), *Carya glabra* (pignut hickory), *Chionanthus virginicus* (white fringetree), and *Quercus stellata* (post oak). Shrubs include *Vaccinium stamineum* (deerberry) and *Rhus aromatica* (fragrant sumac). Woody vines, especially *Vitis rotundifolia* (muscadine), *Toxicodendron radicans* (eastern poison-ivy), *Smilax bona-nox* (saw greenbrier), and *Smilax rotundifolia* (roundleaf greenbrier), are often abundant. Herb cover is generally low to moderate and usually includes only small amounts of the species of the open rock. Grasses, including *Schizachyrium scoparium* (little bluestem), *Piptochaetium avenaceum* (blackseed speargrass), or *Danthonia spicata* (poverty oatgrass), may be common.

Environmental Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This granitic flatrock border woodland was sampled once at Kennesaw Mountain. The site is a somewhat steep, northwest-facing upper slope at 480 m (1580 feet) elevation. The soil is dry-mesic, well-drained loam. The unvegetated surface is made up of exposed bedrock (60% cover) with some leaf litter (23%), large rocks (10%), wood (5%) and bare soil (2%). Evidence of disturbance includes the presence of exotic plants.

Global Environment: Examples of this association are found on the margins of granitic flatrock communities, along the fall-line of the Piedmont of the southeastern United States, from Alabama north to Virginia.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The tree canopy, 10-15 m tall, is sparse (20% cover), giving the stand a woodland appearance, and is codominated by *Juniperus virginiana* (eastern red-cedar) and *Ulmus alata* (winged elm). No subcanopy is present. The moderately sparse (40%) tall-shrub layer (2-5 m) and sparse (20%) short-shrub layer (1-2 m) are dominated by *Chionanthus virginicus* (white fringetree); additional short shrubs include *Ptelea trifoliata* (common hoptree), *Rhus copallinum* (flameleaf sumac), and *Yucca filamentosa* (Adam's needle). The sparse (20%) herbaceous layer is a mix of ferns, forbs and grasses, including *Asplenium platyneuron* (ebony spleenwort), *Cheilanthes lanosa* (hairy lipfern), *Commelina erecta* (whitemouth dayflower), *Danthonia spicata* (poverty oatgrass), *Opuntia humifusa* (devil's-tongue), *Piptochaetium avenaceum* (blackseed speargrass), *Saxifraga michauxii* (Michaux's saxifrage), *Schizachyrium*

scoparium (little bluestem), and others. Lichens growing on the bedrock surface include *Cladina rangiferina* (greygreen reindeer lichen). Luxuriant epiphytic growth was noted on woody vegetation, including the vascular epiphyte *Pleopeltis polypodioides* (resurrection fern) and a number of crustose and foliose lichens. The invasive *Ligustrum sinense* (Chinese privet) was observed at low cover values (<1%) within the short-shrub layer.

Global Vegetation: Stands of this association are somewhat open forests or woodlands. The canopy is typically dominated by *Pinus virginiana* (Virginia pine). Other canopy species, which also may form an open understory, include *Juniperus virginiana* (eastern red-cedar), *Ulmus alata* (winged elm), *Carya glabra* (pignut hickory), *Chionanthus virginicus* (white fringetree), and *Quercus stellata* (post oak). Shrubs include *Vaccinium stamineum* (deerberry) and *Rhus aromatica* (fragrant sumac). Woody vines, especially *Vitis rotundifolia* (muscadine), *Toxicodendron radicans* (eastern poison-ivy), *Smilax bona-nox* (saw greenbrier), and *Smilax rotundifolia* (roundleaf greenbrier), are often abundant. Herb cover is generally low to moderate and usually includes only small amounts of the species of the open rock. Grasses, including *Schizachyrium scoparium* (little bluestem), *Piptochaetium avenaceum* (blackseed speargrass), or *Danthonia spicata* (poverty oatgrass), may be common. The understories of stands of this type may become invaded by the exotic shrub *Ligustrum sinense* (Chinese privet).

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Juniperus virginiana (eastern red-cedar)*
Tree canopy	Broad-leaved deciduous tree	*Ulmus alata (winged elm)*
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Chionanthus virginicus (white fringetree)*
Herb (field)	Graminoid	*Piptochaetium avenaceum (blackseed speargrass)*

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Chionanthus virginicus* (white fringetree), *Juniperus virginiana* (eastern red-cedar), *Piptochaetium avenaceum* (blackseed speargrass), *Schizachyrium scoparium* (little bluestem), *Ulmus alata* (winged elm)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Ligustrum sinense (Chinese privet)	High/Medium	invasive/exotic

Conservation Status Rank

Global Rank & Reasons: G3? (29-Sep-2004). This community is restricted to granitic outcrops in the southern Piedmont. Total acreage of occurrences is small. It is a fairly stable community but may be threatened by heavy recreational use. The understories of stands of this type may become invaded by the exotic shrub *Ligustrum sinense*. Stands are threatened by timber removal, exotic species invasion, heavy recreational use (e.g., ORV traffic) and adjacent agricultural practices (herbicide use, etc.). Some stands are limited to a narrow band between the granite flatrock and adjacent agricultural fields.

Classification

Status: Standard

Classification Confidence: 3 - Weak

Global Similar Associations:
• *Pinus virginiana - Juniperus virginiana var. virginiana - Ulmus alata* Forest (CEGL007121)--successional in the Ridge and Valley of Tennessee, on calcareous substrates with similar canopy and subcanopy composition.

Other Comments

Other Comments: The Kennesaw Mountain example is associated with a mosaic of other granitic outcrop communities and mafic forest/woodland communities underlain by amphibolite, rather than being found on the margin of a well-developed granitic flatrock community.

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: This association is potentially restricted to a small area along the higher elevations of Little Kennesaw Mountain west of the trail that follows the ridgeline, less than a half mile from the small parking area on Kennesaw Mountain Drive. It occurs less than 100 m from the ridgeline just below an area of exposed granite.
Global Range: This association is restricted to the Piedmont of the southeastern United States, from Alabama north to Virginia.

Nations: US

States/Provinces: AL?, GA, NC, SC, VA?

TNC Ecoregions: 52:C

USFS Ecoregions: 231Aa:CCC

Federal Lands: NPS (Kennesaw Mountain)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: KEMO.24.

Local Description Authors: M.J. Russo and L. Echols

Global Description Authors: M.P. Schafale and M. Pyne

References: Schafale and Weakley 1990, Schotz pers. comm., Southeastern Ecology Working Group n.d.

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

Fagus grandifolia – Quercus rubra – Quercus alba Forest Alliance (A.229)

Alliance Concept

Summary: Forests in this alliance occur in non-montane or low-elevation montane mesic situations. These forests often occur on concave and sheltered landforms, such as north-facing slopes, low slopes, high terraces along streams, and possibly other situations. The core concept of the range of this alliance includes areas inland from the Coastal Plain, as *Quercus rubra* (northern red oak) is absent from large areas of the Coastal Plain (as in North Carolina). Forests in this alliance occur in the Cumberlands and Southern Ridge and Valley, Piedmont and Interior Low Plateau, and on protected slopes and ravines in the Ozarks, central Ouachita Mountains, and Arkansas Valley. They are dominated by *Fagus grandifolia* (American beech) typically with some combination of *Quercus rubra* (northern red oak) and/or *Quercus alba* (white oak). Associated canopy and subcanopy species can include *Liriodendron tulipifera* (tuliptree), *Acer saccharum* (sugar maple), *Magnolia tripetala* (umbrella-tree), *Magnolia acuminata* (cucumber-tree) (Ozarks), *Tilia americana var. americana* (American basswood) (Ozarks), *Tilia americana var. heterophylla* (American basswood), *Quercus muehlenbergii* (chinkapin oak), *Acer rubrum* (red maple), *Cornus florida* (flowering dogwood), *Ostrya virginiana* (hophornbeam), *Aesculus sylvatica* (painted buckeye), and *Ilex opaca* (American holly). Some of these forests, particularly in the Piedmont of South Carolina, the southern Ridge and Valley of Alabama, or in Arkansas, may contain *Acer barbatum* (southern sugar maple) instead of *Acer saccharum* (sugar maple). Shrubs in this alliance include *Vaccinium stamineum* (deerberry), *Viburnum rafinesquianum* (downy arrow-wood), *Euonymus americanus* (strawberry bush), and, in some occurrences, *Kalmia latifolia* (mountain laurel). The herb layer can be relatively lush with such species as *Polystichum acrostichoides* (Christmas fern), *Galium circaezans* (licorice bedstraw), *Hexastylis arifolia* (littlebrownjug), *Hexastylis minor* (little heartleaf), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Erythronium umbilicatum ssp. umbilicatum* (dimpled troutlily), *Hepatica nobilis var. obtusa* (roundlobe hepatica), *Epifagus virginiana* (beechdrops), *Tiarella cordifolia var. collina* (heartleaf foamflower), *Trillium* (trillium) spp., *Heuchera americana* (American alumroot), *Stellaria pubera* (star chickweed), *Podophyllum peltatum* (mayapple), *Botrychium virginianum* (rattlesnake fern), and others present.

Classification Comments: The relationship between this alliance and the *Fagus grandifolia - Quercus alba* Forest Alliance (A.228) needs to be clarified. There may be some problems with assignment of associations where *Quercus rubra* does, in fact, enter the Coastal Plain, as in parts of Virginia, Alabama, and western Georgia. Vegetation from this alliance is known from Ozark and Ouachita national forests RNAs (Roaring Branch and Dismal Hollow) and occurs on the Shoal Creek District of the Talladega National Forest. One association, the "Piedmont American Beech Heath Bluff" (CEGL004539) ranges peripherally into the Coastal Plain (ECO57).

Similar Alliances:

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

• *Fagus grandifolia - Acer saccharum - (Liriodendron tulipifera)* Forest Alliance (A.227)
• *Fagus grandifolia - Quercus alba* Forest Alliance (A.228)--is an equivalent alliance found in the Coastal Plain and generally outside of the range of *Quercus rubra*.
• *Fagus grandifolia* Temporarily Flooded Forest Alliance (A.284)

Related Concepts:
• Appalachian mesophytic forest (Evans 1991) I
• Beech - Sugar Maple: 60 (Eyre 1980) I
• Beech RV (Pyne 1994) ?
• Coastal Forest/Woodland (Swain and Kearsley 2001) ?
• IA5g. Typic Mesic Piedmont Forest (Allard 1990) I
• Maritime Oak - Holly Forest / Woodland (Swain and Kearsley 2001) ?
• Mesic Mixed Hardwood Forest, Piedmont Subtype (Schafale and Weakley 1990) ?
• Mixed Mesophytic Forest (Foti 1994b) I
• Northern Red Oak: 55 (Eyre 1980) I
• Piedmont Mesic Broad-leaved Deciduous Forest (Ambrose 1990a) ?
• T1B4aI1a. *Fagus grandifolia - Magnolia tripetala* (Foti et al. 1994) ?
• T1B4aI1b. *Fagus grandifolia - Acer saccharum - Quercus* spp. (*alba, muehlenbergii, rubra*) (Foti et al. 1994) ?

Alliance Description

Environment: These forests often occur on concave and sheltered landforms such as north-facing slopes, low slopes, high terraces along streams, and possibly other situations.

Vegetation: Forests in this alliance occur in non-montane or low-elevation montane mesic situations and are dominated by *Fagus grandifolia* (American beech) typically with some combination of *Quercus rubra* (northern red oak) and/or *Quercus alba* (white oak). Associated canopy and subcanopy species can include *Liriodendron tulipifera* (tuliptree), *Acer saccharum* (sugar maple), *Magnolia tripetala* (umbrella-tree), *Magnolia acuminata* (cucumber-tree) (Ozarks), *Tilia americana var. americana* (American basswood) (Ozarks), *Tilia americana var. heterophylla* (American basswood), *Quercus muehlenbergii* (chinkapin oak), *Acer rubrum* (red maple), *Cornus florida* (flowering dogwood), *Ostrya virginiana* (hophornbeam), *Aesculus sylvatica* (painted buckeye), and *Ilex opaca* (American holly). Some of these forests, especially in the Piedmont of South Carolina, the southern Ridge and Valley of Alabama, or in Arkansas, may contain *Acer barbatum* (southern sugar maple) instead of *Acer saccharum* (sugar maple). Shrubs in this alliance include *Vaccinium stamineum* (deerberry), *Viburnum rafinesquianum* (downy arrow-wood), *Euonymus americanus* (strawberry bush), and, in some occurrences, *Kalmia latifolia* (mountain laurel). The herb layer can be relatively lush with such species as *Polystichum acrostichoides* (Christmas fern), *Galium circaezans* (licorice bedstraw), *Hexastylis arifolia* (littlebrownjug), *Hexastylis minor* (little heartleaf), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Erythronium umbilicatum ssp. umbilicatum* (dimpled troutlily), *Hepatica nobilis var. obtusa* (roundlobe hepatica), *Epifagus virginiana* (beechdrops), *Tiarella cordifolia var. collina* (heartleaf foamflower), *Trillium* (trillium) spp., *Heuchera americana* (American alumroot), *Stellaria pubera* (star chickweed), *Podophyllum peltatum* (mayapple), *Botrychium virginianum* (rattlesnake fern), and others present.
On Crowley's Ridge, Arkansas (Cross County south through Phillips County), canopies are dominated by *Fagus grandifolia* (American beech), *Quercus alba* (white oak), and *Liriodendron*

tulipifera (tuliptree), with associates including *Fraxinus americana* (white ash), *Sassafras albidum* (sassafras), *Ulmus rubra* (slippery elm), *Quercus michauxii* (swamp chestnut oak), *Acer saccharum* (sugar maple), *Magnolia acuminata* (cucumber-tree), *Carya illinoinensis* (pecan); and *Liquidambar styraciflua* (sweetgum), *Juglans cinerea* (butternut), *Ilex opaca* (American holly), *Tilia americana* (American basswood), *Gymnocladus dioicus* (Kentucky coffeetree), *Quercus pagoda* (cherrybark oak), and *Carya cordiformis* (bitternut hickory) in the deep moist gullies. Understory species include *Asimina triloba* (pawpaw), *Ostrya virginiana* (hophornbeam), *Hydrangea arborescens* (wild hydrangea), *Lindera benzoin* (northern spicebush), *Cornus florida* (flowering dogwood), *Carpinus caroliniana* (American hornbeam), *Cercis canadensis* (eastern redbud), *Ilex decidua* (possum-haw), and *Aralia spinosa* (devil's walkingstick); smaller shrubs include *Vaccinium arboreum* (farkleberry), *Vaccinium stamineum* (deerberry), and *Vaccinium pallidum* (Blue Ridge blueberry). *Schisandra glabra* (bay starvine) often forms a lush sprawling groundcover, sometimes reaching the canopy. Other herbaceous species include *Phegopteris hexagonoptera* (broad beechfern), *Polystichum acrostichoides* (Christmas fern), *Diplazium pycnocarpon* (glade fern), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), *Asarum canadense* (Canadian wildginger), *Podophyllum peltatum* (mayapple), *Arisaema dracontium* (green dragon), *Arisaema triphyllum* (Jack in the pulpit), *Actaea pachypoda* (white baneberry), *Uvularia* (bellwort) spp., *Maianthemum racemosum* (feathery false lily of the valley), *Polygonatum* (solomon's seal) spp., *Trillium* (trillium) spp., and *Smilax* (greenbrier) spp. These stands were formerly assigned to an association in the related (but more southerly) *Fagus grandifolia - Quercus alba* Forest Alliance (A.228).

Alliance Distribution

Range: The core concept of the range of this alliance includes areas inland from the Coastal Plain, as *Quercus rubra* is absent from large areas of this region. Forests in this alliance occur in the Cumberlands and Southern Ridge and Valley, Piedmont, and Interior Low Plateau, and on protected slopes and ravines in the Ozarks, central Ouachita Mountains, and Arkansas Valley. This alliance is known from the states of Alabama, Arkansas, Delaware, Georgia, Kentucky, Massachusetts, Maryland, North Carolina, New Jersey, New York, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Tennessee, Virginia, and West Virginia. It may possibly occur in southern Indiana and Connecticut.

Nations: US

Subnations: AL, AR, DC, DE, GA, IN?, KY, MA, MD, MS, NC, NJ, NY, OK, PA, RI, SC, TN, VA, WV

TNC Ecoregions: 38:C, 39:C, 42:C, 43:C, 44:C, 49:C, 50:C, 51:C, 52:C, 57:C, 58:C, 59:C, 60:C, 61:C, 62:C

USFS Ecoregions: 212Fc:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ae:CCP, 221Am:CCC, 221Da:CCC, 221Db:CCC, 221Dc:CCC, 221Ea:CCC, 221Ef:CCP, 221Eg:CCP, 221Ha:CCC, 221Hc:CCC, 221Hd:CCP, 221He:CCC, 221Ja:CCP, 221Jb:CC?, 221Jc:CCP, 222Ab:CCC, 222Ag:CCC, 222An:CCC, 222Cb:CCC, 222Cc:CCC, 222Cd:CC?, 222Ce:CC?, 222Cf:CC?, 222Cg:CCC, 222Da:CCP, 222Db:CCP, 222Dc:CCP, 222Dd:CCP, 222De:CCP, 222Dg:CCC, 222Di:CC?, 222Dj:CCC, 222Ea:CCC, 222Eb:CCC, 222Ec:CC?, 222Ee:CCP, 222Ef:CCP, 222Eg:CCC, 222Eh:CCP, 222Ei:CCP, 222Ej:CCP, 222Ek:CCP, 222Em:CCP, 222En:CCP, 222Eo:CCP, 222F:CC, 231Aa:CCC, 231Ab:CCC, 231Ac:CCC, 231Ad:CCC,

231Ae:CCC, 231Af:CCC, 231Ag:CCC, 231Ah:CCC, 231Ai:CCC, 231Aj:CCC, 231Ak:CCC, 231Al:CCC, 231Am:CCP, 231An:CCC, 231Ao:CCC, 231Ap:CCC, 231Ba:CC?, 231Bb:CC?, 231Bc:CCC, 231Be:CC?, 231Bg:CCC, 231Bh:CCC, 231Bi:CC?, 231Bk:CC?, 231Ca:CCP, 231Cb:CCP, 231Cc:CCC, 231Cd:CCC, 231Ce:CCP, 231Cf:CCP, 231Cg:CCP, 231Da:CCC, 231Db:CCC, 231Dc:CCC, 231Dd:CCC, 231Gb:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CCC, 232Br:CCC, 232Bt:CCC, 232Bx:CCP, 232Bz:CCC, 232Ch:CCC, 232Cj:CCC, 234Ab:CCC, M221Cc:CCC, M221Da:CCC, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC

Federal Lands: COE (Falls Lake, Jordan Lake, Kerr Reservoir); DOD (Fort A.P. Hill, Fort Belvoir, Fort Benning, Fort Dix, Fort Pickett, Yorktown); NPS (Appomattox Court House, Big South Fork, Buffalo River, C&O Canal, Cape Cod, Chattahoochee River, Chickamauga-Chattanooga, Colonial, Cumberland Gap, Fort Donelson, Fredericksburg-Spotsylvania, George Washington Parkway, Guilford Courthouse, Horseshoe Bend, Kennesaw Mountain, Little River Canyon, Mammoth Cave, Morristown, Natchez Trace, National Capital-East, Ninety Six, Petersburg, Prince William, Richmond, Rock Creek, Sagamore Hill, Shenandoah, Shiloh, Thomas Stone, Upper Delaware, Wolf Trap); TVA (Land Between the Lakes, Tellico); USFS (Bankhead, Chattahoochee, Cherokee?, Daniel Boone, Holly Springs, Jefferson?, Oconee?, Ouachita, Ozark, St. Francis, Sumter, Talladega, Uwharrie); USFWS (Great Swamp, James River, Lake Isom, Prime Hook)

(CEGL008465) Piedmont Acidic Mesic Mixed Hardwood Forest

***Fagus grandifolia - Quercus rubra / Cornus florida / Polystichum acrostichoides - Hexastylis virginica* Forest**
American Beech - Northern Red Oak / Flowering Dogwood / Christmas Fern - Virginia Heartleaf Forest

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Fagus grandifolia - Quercus rubra - Quercus alba* Forest Alliance (A.229)
Alliance (English name)	American Beech - Northern Red Oak - White Oak Forest Alliance
Association	*Fagus grandifolia - Quercus rubra / Cornus florida / Polystichum acrostichoides - Hexastylis virginica* Forest Association (English name) American Beech - Northern Red Oak / Flowering Dogwood / Christmas Fern - Virginia Heartleaf Forest
Association (Common name)	Piedmont Acidic Mesic Mixed Hardwood Forest
Ecological System(s):	Southern Piedmont Mesic Forest (CES202.342) Southern Atlantic Coastal Plain Mesic Hardwood Forest (CES203.242)

Element Concept

Global Summary: This association represents the more typical mesic mixed hardwood forest of the Piedmont from North Carolina to Georgia. The canopy of stands of this association is dominated by mesophytic trees such as *Fagus grandifolia* (American beech), *Quercus rubra* (northern red oak), *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), and in the western Piedmont, *Tsuga canadensis* (eastern hemlock). Typical understory trees include *Cornus florida* (flowering dogwood), *Oxydendrum arboreum* (sourwood), *Acer rubrum* (red maple), and *Ilex opaca* (American holly). Shrub species may include *Vaccinium stamineum* (deerberry), *Viburnum rafinesquianum* (downy arrow-wood), *Euonymus americanus* (strawberry bush), and sometimes *Kalmia latifolia* (mountain laurel). The herb layer is often moderately dense and

diverse, though it may be sparse under heavy shade. Herb species may include *Polystichum acrostichoides* (Christmas fern), *Viola* (violet) spp., *Dichanthelium* (rosette grass) spp., *Galium circaezans* (licorice bedstraw), *Hexastylis arifolia* (littlebrownjug), *Hexastylis minor* (little heartleaf), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Erythronium umbilicatum ssp. umbilicatum* (dimpled troutlily), *Chamaelirium luteum* (fairywand), *Epifagus virginiana* (beechdrops), *Tiarella cordifolia var. collina* (heartleaf foamflower), *Heuchera americana* (American alumroot), *Stellaria pubera* (star chickweed), *Podophyllum peltatum* (mayapple), *Prenanthes serpentaria* (cankerweed), *Thalictrum thalictroides* (rue-anemone), *Chrysogonum virginianum var. virginianum* (green and gold), *Hepatica nobilis var. obtusa* (roundlobe hepatica), *Thelypteris noveboracensis* (New York fern), and *Botrychium virginianum* (rattlesnake fern). Exact composition varies locally with position on slope and nature of soil. Western Piedmont sites often have increasing importance of *Tsuga canadensis* (eastern hemlock), *Rhododendron* (rhododendron) spp., and other species that are more typical of the Southern Blue Ridge.

Environmental Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This mesic mixed hardwood forest was sampled at three locations at Chattahoochee River and twice at Kennesaw Mountain. The sites range from very steep to gentle lower slopes of mostly northerly aspects. Elevations range from 270-355 m (890-1165 feet). Most of the sites have perennial streams running through them. Soils are moderately well- to well-drained loams and clay loams. The unvegetated surface is dominated by leaf litter (63-90% cover) with some exposed bedrock (0-7%), large rocks (0-7%), small rocks (0-3%), wood (6-16%), bare soil (1-5%), and standing water (0-6%). Evidence of disturbance includes the presence of trails, mortality due to dogwood anthracnose, and heavy infestation by exotic plants.

Global Environment: Examples of this association predominantly occur on steep but sheltered slopes adjacent to creeks or rivers in the Piedmont. They can occur further upslope, but occurrences are much more likely as one gets closer to streams.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderate to dense (50-80% cover) tree canopy, 20-50 m tall, is codominated by *Fagus grandifolia* (American beech), *Liriodendron tulipifera* (tuliptree), and *Quercus alba* (white oak). *Fagus grandifolia* (American beech) and *Oxydendrum arboreum* (sourwood) often dominate the sparse (10-40%) subcanopy (10-20 m). Common and/or dominant species in the very sparse to moderate (5-60%) tall-shrub layer (2-10 m) include *Acer leucoderme* (chalk maple), *Carpinus caroliniana* (American hornbeam), *Fagus grandifolia* (American beech), *Liriodendron tulipifera* (tuliptree), *Nyssa sylvatica* (blackgum), *Oxydendrum arboreum* (sourwood), and *Rhododendron canescens* (mountain azalea). The very sparse to sparse (5-40%) short-shrub layer (1-2 m) is made up of tall-shrub species as well as *Aesculus sylvatica* (painted buckeye), *Amelanchier arborea* (common serviceberry), *Asimina parviflora* (smallflower pawpaw), *Calycanthus floridus* (eastern sweetshrub), *Cornus florida* (flowering dogwood), *Lindera benzoin* (northern spicebush), *Toxicodendron radicans* (eastern poison-ivy), *Vaccinium stamineum* (deerberry), *Viburnum acerifolium* (mapleleaf viburnum), and others. The herbaceous layer may have sparse to moderate cover (20-60%); common and/or dominant

species include *Actaea racemosa* (black bugbane), *Chimaphila maculata* (striped prince's pine), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium commutatum* (variable panicgrass), *Dioscorea quaternata* (fourleaf yam), *Eurybia divaricata* (white wood aster), *Hexastylis arifolia* (littlebrownjug), *Parthenocissus quinquefolia* (Virginia creeper), *Polygonatum biflorum* (smooth Solomon's seal), *Polystichum acrostichoides* (Christmas fern), *Tipularia discolor* (crippled cranefly), *Xanthorhiza simplicissima* (yellowroot), and many others. Vines (5-10%) include *Decumaria barbara* (woodvamp), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis rotundifolia* (muscadine) and may be found trailing along the ground and/or climbing into upper layers. Several exotic species have invaded this community. However, it also supports state-vulnerable species, including *Agrimonia microcarpa* (smallfruit agrimony), *Castanea dentata* (American chestnut), *Collinsonia tuberosa* (deepwoods horsebalm), and *Dirca palustris* (eastern leatherwood).

Global Vegetation: The canopy of stands of this association is dominated by mesophytic trees such as *Fagus grandifolia* (American beech), *Quercus rubra* (northern red oak), *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), and in the western Piedmont, *Tsuga canadensis* (eastern hemlock). Typical understory trees include *Cornus florida* (flowering dogwood), *Oxydendrum arboreum* (sourwood), *Acer rubrum* (red maple), and *Ilex opaca* (American holly). Shrub species may include *Vaccinium stamineum* (deerberry), *Viburnum rafinesquianum* (downy arrow-wood), *Euonymus americanus* (strawberry bush), and sometimes *Kalmia latifolia* (mountain laurel). The herb layer is often moderately dense and diverse, though it may be sparse under heavy shade. Herb species may include *Polystichum acrostichoides* (Christmas fern), *Viola* (violet) spp., *Dichanthelium* (rosette grass) spp., *Galium circaezans* (licorice bedstraw), *Hexastylis arifolia* (littlebrownjug), *Hexastylis minor* (little heartleaf), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Erythronium umbilicatum ssp. umbilicatum* (dimpled troutlily), *Chamaelirium luteum* (fairywand), *Epifagus virginiana* (beechdrops), *Tiarella cordifolia var. collina* (heartleaf foamflower), *Heuchera americana* (American alumroot), *Stellaria pubera* (star chickweed), *Podophyllum peltatum* (mayapple), *Prenanthes serpentaria* (cankerweed), *Thalictrum thalictroides* (rue-anemone), *Chrysogonum virginianum var. virginianum* (green and gold), *Hepatica nobilis var. obtusa* (roundlobe hepatica), *Thelypteris noveboracensis* (New York fern), and *Botrychium virginianum* (rattlesnake fern) (Schafale and Weakley 1990). Exact composition varies locally with position on slope and nature of soil. Western Piedmont sites often have increasing importance of *Tsuga canadensis* (eastern hemlock), *Rhododendron* (rhododendron) spp., and other species that are more typical of the Southern Blue Ridge.

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Fagus grandifolia (American beech)*
Tree canopy	Broad-leaved deciduous tree	*Liriodendron tulipifera (tuliptree), Quercus alba (white oak)*
Tree subcanopy	Broad-leaved deciduous tree	*Oxydendrum arboreum (sourwood)*

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Rhododendron canescens (mountain azalea)*
Tall shrub/sapling	Broad-leaved deciduous shrub	*Carpinus caroliniana (American hornbeam), Fagus grandifolia (American beech)*
Short shrub/sapling	Broad-leaved deciduous shrub	*Calycanthus floridus (eastern sweetshrub), Lindera benzoin (northern spicebush)*
Herb (field)	Vine/Liana	*Toxicodendron radicans (eastern poison-ivy), Vitis rotundifolia (muscadine) Herb (field) Forb Xanthorhiza simplicissima (yellowroot) Herb (field) Fern or fern ally Polystichum acrostichoides (Christmas fern), Thelypteris noveboracensis (New York fern)*

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Actaea racemosa* (black bugbane), *Aesculus sylvatica* (painted buckeye), *Calycanthus floridus* (eastern sweetshrub), *Carpinus caroliniana* (American hornbeam), *Fagus grandifolia* (American beech), *Lindera benzoin* (northern spicebush), *Liriodendron tulipifera* (tuliptree), *Oxydendrum arboreum* (sourwood), *Parthenocissus quinquefolia* (Virginia creeper), *Polystichum acrostichoides* (Christmas fern), *Quercus alba* (white oak), *Rhododendron canescens* (mountain azalea), *Thelypteris noveboracensis* (New York fern), *Toxicodendron radicans* (eastern poison-ivy), *Vitis rotundifolia* (muscadine), *Xanthorhiza simplicissima* (yellowroot)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Elaeagnus pungens (thorny olive)	Low/Insignificant	invasive/exotic
Ligustrum sinense (Chinese privet)	High/Medium	invasive/exotic
Lonicera japonica (Japanese honeysuckle)	High/Medium	invasive/exotic
Microstegium vimineum (Nepalese browntop)	High/Medium	invasive/exotic
Stellaria media (common chickweed)	Low	invasive/exotic

Other Plant Species	GRank	Note
Agrimonia microcarpa (smallfruit agrimony)	G5	GA state-vulnerable
Castanea dentata (American chestnut)	G4	GA state-vulnerable
Collinsonia tuberosa (deepwoods horsebalm)	G3G4	GA state-vulnerable
Dirca palustris (eastern leatherwood)	G4	GA state-vulnerable

Conservation Status Rank

Global Rank & Reasons: G3G4 (18-Jan-2001). While not as extensive as the oak-hickory forests, Mesic Mixed Hardwood Forest communities are fairly common. Their occurrence on

steep sites has allowed many of them to escape, until recently, with less disturbance than most upland communities (Schafale and Weakley 1990). Some examples with old forest can be found. Selective timbering may have decreased the importance value of more desirable hardwoods (e.g., *Quercus rubra*). Some examples are protected in the Birkhead Mountain Wilderness Area and other parts of the Uwharrie National Forest.

Classification

Status: Standard Classification Confidence: Global Similar Associations:
• *Fagus grandifolia - Quercus (alba, rubra) - Liriodendron tulipifera / (Ilex opaca var. opaca) / Polystichum acrostichoides* Forest (CEGL006075)
• *Fagus grandifolia - Quercus rubra / Acer barbatum - Aesculus sylvatica / Actaea racemosa - Adiantum pedatum* Forest (CEGL008466)--the basic Piedmont equivalent.

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: Within Chattahoochee River NRA, two plots were sampled in the northern Sope Creek portion of Cochran Shoals (north end); this community was also observed in the Gunby Creek portion of Cochran Shoals (south end) where relatively undisturbed mesic forest is abundant in a localized area. Gold Branch, where this type was sampled once, contains multiple steep, sheltered ravines where this community dominates along the lower slopes. Bowmans Island contains typical examples casually observed along steep lower slopes in the northern portion of the park unit. This community was also casually observed adjacent to streams in the northern portion of Island Ford. There is a high potential for additional occurrences in other Chattahoochee park units in sheltered ravines and lower slopes along waterways where soils are productive. The Palisades, Vickery Creek, and Johnson Ferry North park units all contain suitable environments. At Kennesaw Mountain, the appropriate combination of environmental factors that favor this community occur less frequently. Two plots were sampled at Kennesaw Mountain: one approximately 0.5 mile south of the Pigeon Hill parking area and <0.25 mile west of the main park trail heading south, and one along steep slopes directly adjacent to Noses Creek west of the creek crossing (wooden bridge). Both plots were sampled in the central portion of the park. A few other examples may exist along sheltered, undisturbed slopes adjacent to streams.

Global Range: This association is found in the Piedmont of the southeastern United States, from North Carolina to Georgia.

Nations: US

States/Provinces: GA, NC, SC

TNC Ecoregions: 52:C

USFS Ecoregions: 231Aa:CCC, 231Ae:CCC

Federal Lands: DOD (Falls Lake, Jordan Lake, Kerr Reservoir); NPS (Chattahoochee River, Guilford Courthouse, Kennesaw Mountain, Ninety Six); USFS (Oconee?, Sumter (Piedmont)?, Sumter?, Uwharrie)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: CHAT.15, CHAT.16, CHAT.19, KEMO.06, KEMO.12.
Local Description Authors: M.J. Russo and L. Echols

M.P. Schafale References: LeGrand and Dalton 1987, Nehmeth 1968, Oosting 1942, Peet and Christensen 1980, Peet et al. unpubl. data 2002, Schafale and Weakley 1990, Skeen et al. 1980, Southeastern Ecology Working Group n.d.

Liriodendron tulipifera Forest Alliance (A.229)

Alliance Concept

Summary: This alliance includes deciduous forests dominated by *Liriodendron tulipifera* (tuliptree), 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* (tuliptree) as well as forests with *Liriodendron tulipifera* (tuliptree) associated with other species favored by canopy openings. Associated species vary with geographic location. Throughout most of the range of this alliance, *Acer rubrum* (red maple), *Robinia pseudoacacia* (black locust), *Betula lenta* (sweet birch), *Acer saccharum* (sugar maple), and *Acer negundo* (box-elder) are common components. In the Piedmont and Coastal Plain, *Liquidambar styraciflua* (sweetgum) is a common associate. In the Appalachians, *Halesia tetraptera* (mountain silverbell), *Tsuga canadensis* (eastern hemlock), *Tilia americana var. heterophylla* (American basswood), *Prunus serotina var. serotina* (black cherry), and *Magnolia fraseri* (mountain magnolia) can be additional components. In the Ridge and Valley and Cumberland Plateau, additional species include *Quercus rubra* (northern red oak), *Magnolia acuminata* (cucumber-tree), *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Pinus virginiana* (Virginia pine), *Sassafras albidum* (sassafras), *Pinus strobus* (eastern white pine), *Carpinus caroliniana* (American hornbeam), *Asimina triloba* (pawpaw), and *Staphylea trifolia* (American bladdernut). 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* (grape) spp., *Smilax* (greenbrier) spp., *Aristolochia macrophylla* (pipevine), and *Parthenocissus quinquefolia* (Virginia creeper). 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.

Similar Alliances:
• *Liquidambar styraciflua - (Liriodendron tulipifera, Acer rubrum)* Temporarily Flooded Forest Alliance (A.287)--temporarily flooded forests dominated or codominated by *Liriodendron tulipifera*.
• *Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235)

• *Pinus taeda - Liriodendron tulipifera* Temporarily Flooded Forest Alliance (A.434)--temporarily flooded forests dominated or codominated by *Liriodendron tulipifera*.

Related Concepts:
• Yellow-Poplar: 57 (Eyre 1980) I

Alliance Description

Environment: Forests in this alliance are primarily found in areas which were once clearcut, old fields, or cleared by fire or other natural disturbances. These forests are also found along streams in flat bottoms 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. They also occur in the Coastal Plain, Piedmont, Ridge and Valley, and Cumberland Plateau.

Vegetation: This alliance includes pure, often even-aged stands of *Liriodendron tulipifera* (tuliptree) as well as forests with *Liriodendron tulipifera* (tuliptree) associated with other species favored by canopy openings. Associated species vary with geographic location. Throughout most of the range of this alliance, *Acer rubrum* (red maple), *Robinia pseudoacacia* (black locust), *Betula lenta* (sweet birch), *Acer saccharum* (sugar maple), and *Acer negundo* (box-elder) are common components. In the Piedmont and Coastal Plain, *Liquidambar styraciflua* (sweetgum) is a common associate. In the Appalachians, *Halesia tetraptera* (mountain silverbell), *Tsuga canadensis* (eastern hemlock), *Tilia americana var. heterophylla* (American basswood), *Prunus serotina var. serotina* (black cherry), and *Magnolia fraseri* (mountain magnolia) can be additional components. In the Ridge and Valley and Cumberland Plateau, additional species include *Quercus rubra* (northern red oak), *Magnolia acuminata* (cucumber-tree), *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Pinus virginiana* (Virginia pine), *Sassafras albidum* (sassafras), *Pinus strobus* (eastern white pine), *Carpinus caroliniana* (American hornbeam), *Asimina triloba* (pawpaw), and *Staphylea trifolia* (American bladdernut). 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* (grape) spp., *Smilax* (greenbrier) spp., *Aristolochia macrophylla* (pipevine), and *Parthenocissus quinquefolia* (Virginia creeper).

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.

Nations: US

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

TNC Ecoregions: 43:C, 44:C, 50:C, 51:C, 52:C, 53:P, 58:C, 59:C, 61:C

USFS Ecoregions: 221Da:CCC, 221Ha:CCC, 221Hc:CCC, 221He:CCC, 221Jb:CCC, 222Cg:CCC, 222Dg:CCC, 222Dj:CCC, 222Eb:CCC, 222Ed:CCP, 222Eg:CCC, 222En:CCC, 222Eo:CCC, 231Aa:CCC, 231Ab:CCC, 231Ae:CCC, 231Ai:CCC, 231Ak:CCC, 231Al:CCC,

231An:CCC, 231Ap:CCC, 231Bc:CCC, 231Bh:CCC, 231Cd:CCC, 231Dc:CCC, 232Ad:CCC, 232Br:CCC, 232D:CP, 234Ab:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Bb:CCC, M221Be:CCC, M221Cb:CCC, M221Cd:CCC, M221Da:CCC, M221Db:CCP, M221Dc:CCC, M221Dd:CCC

Federal Lands: BIA (Eastern Band of Cherokee); DOD (Arnold, Fort Benning); NPS (Abe Lincoln Birthplace, Antietam, Appomattox Court House, Big South Fork, Blue Ridge Parkway, Bluestone, Booker T. Washington, C&O Canal, Catoctin Mountain, Chattahoochee River, Chickamauga-Chattanooga, Colonial, Cowpens, Cumberland Gap, Fort Donelson, Fort Necessity, Fredericksburg-Spotsylvania, George Washington Parkway, Gettysburg, Great Smoky Mountains, Guilford Courthouse, Harpers Ferry, Horseshoe Bend, Kennesaw Mountain, Kings Mountain, Mammoth Cave, Manassas, Monocacy?, Morristown, Natchez Trace, National Capital-East, New River Gorge, Ninety Six, Obed, Petersburg, Prince William, Richmond, Rock Creek, Shenandoah, Shiloh, Thomas Stone, Valley Forge, Vicksburg, Wolf Trap); TVA (Tellico); USFS (Apalachicola?, Bankhead, Bienville?, Chattahoochee, Cherokee, Conecuh?, Daniel Boone, De Soto?, George Washington, Jefferson, Monongahela, Nantahala, Oconee?, Pisgah, Sumter, Talladega, Tombigbee?, Tuskegee?)

(CEGL007521) Successional Tuliptree - Loblolly Pine Upland Forest

Liriodendron tulipifera - Pinus taeda Forest
Tuliptree - Loblolly Pine Forest

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Liriodendron tulipifera* Forest Alliance (A.236)
Alliance (English name)	Tuliptree Forest Alliance Association *Liriodendron tulipifera - Pinus taeda* Forest Association (English name) Tuliptree - Loblolly Pine Forest Association (Common name) Successional Tuliptree - Loblolly Pine Upland Forest

Element Concept

Global Summary: The initial USNVC description of this semi-natural tuliptree - loblolly pine forest was based on sites in the Piedmont of South Carolina, but it has since been documented in Virginia, Georgia and Alabama, and is almost certainly present in other parts of the Piedmont. The vegetation develops on slopes following cropping. This forest is strongly dominated by *Liriodendron tulipifera* (tuliptree) and *Pinus taeda* (loblolly pine) which together contribute more than 75% canopy cover. Other canopy species include *Liquidambar styraciflua* (sweetgum) and *Acer rubrum* (red maple). *Cornus florida* (flowering dogwood) sometimes occurs in the subcanopy, and vines such as *Lonicera japonica* (Japanese honeysuckle) (exotic), *Smilax rotundifolia* (roundleaf greenbrier) and *Toxicodendron radicans* (eastern poison-ivy) may be abundant. The understory and ground layers are very sparse with much open ground present. The invasive exotic *Microstegium vimineum* (Nepalese browntop) may be present in the herbaceous layer.

Environmental Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This successional tuliptree - loblolly pine upland forest was sampled once at Chattahoochee River on a moderate, northeast-facing upper slope at 325 m (1060 feet) elevation. The soil is dry, well-drained sandy loam. The unvegetated surface is dominated by leaf litter (76% cover) with some large rocks (2%), small rocks (1%), wood (20%), and bare soil (1%). This stand is apparently in transition from loss of canopy pines due to pine bark beetle infestations. Large jackpots of downed *Pinus taeda* logs are evident throughout the sampled area.

Global Environment: This successional forest community develops on slopes following cropping. The specific documented occurrences on the Sumter National Forest, South Carolina, have developed on former cotton fields of lower to midslopes, where soils usually have 60-70% sand.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The sparse (30% cover) tree canopy, 20-35 m tall, is dominated by *Liriodendron tulipifera* (tuliptree) and includes lesser amounts of *Acer rubrum* (red maple) and *Quercus nigra* (water oak). The moderate (40%) subcanopy (10-15 m) is codominated by *Cornus florida* (flowering dogwood) and *Oxydendrum arboreum* (sourwood) and includes canopy species as well as *Fagus grandifolia* (American beech), *Liquidambar styraciflua* (sweetgum), and *Pinus virginiana* (Virginia pine). The moderate (50%) tall-shrub layer (2-5 m) and sparse (20%) short-shrub layer (1-2 m) are diverse mixes of canopy species, *Carya* (hickory) spp., *Quercus* (oak) spp., *Cornus florida* (flowering dogwood), *Nyssa sylvatica* (blackgum), *Oxydendrum arboreum* (sourwood), *Prunus serotina* (black cherry), and *Vaccinium* (blueberry) spp. The very sparse (10%) herbaceous layer is made up of *Andropogon gerardii* (big bluestem), *Antennaria plantaginifolia* (woman's tobacco), *Chimaphila maculata* (striped prince's pine), *Dichanthelium commutatum* (variable panicgrass), *Dichanthelium laxiflorum* (openflower rosette grass), *Hypericum hypericoides* (St. Andrew's cross), and *Polystichum acrostichoides* (Christmas fern). Vines (5%) include *Vitis rotundifolia* (muscadine).

Global Vegetation: Stands of this forest community are strongly dominated by *Liriodendron tulipifera* (tuliptree) and *Pinus taeda* (loblolly pine) which together contribute more than 75% canopy cover. Other canopy species include *Liquidambar styraciflua* (sweetgum) and *Acer rubrum* (red maple). The understory and ground layers are very sparse with much open ground present.

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer rubrum (red maple)*
Tree canopy	Broad-leaved deciduous tree	*Liriodendron tulipifera (tuliptree)*

Stratum	Lifeform	Species
Tree subcanopy	Broad-leaved deciduous tree	*Cornus florida (flowering dogwood), Oxydendrum arboreum (sourwood)*

Global Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus taeda (loblolly pine)*
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum (red maple), Liquidambar styraciflua (sweetgum), Liriodendron tulipifera (tuliptree)*
Tree subcanopy	Broad-leaved deciduous tree	*Cornus florida (flowering dogwood)*
Shrub/sapling (tall & short)	Vine/Liana	*Smilax rotundifolia (roundleaf greenbrier)*
Herb (field)	Fern or fern ally	*Polystichum acrostichoides (Christmas fern)*

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Acer rubrum* (red maple), *Cornus florida* (flowering dogwood), *Liriodendron tulipifera* (tuliptree), *Oxydendrum arboreum* (sourwood), *Quercus velutina* (black oak), *Vaccinium arboreum* (farkleberry)

Global: *Carya alba* (mockernut hickory), *Cercis canadensis* (eastern redbud), *Quercus falcata* (southern red oak)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Lonicera japonica (Japanese honeysuckle)	High/Medium	invasive/exotic

Conservation Status Rank

Global Rank & Reasons: GNA (ruderal) (11-May-2001). A successional type, not of conservation value, but dominated by species native to North America (Grank changed from GW).

Classification

Status: Standard Classification Confidence: 3 - Weak
Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Comments: Chattahoochee River NRA Plot 36 was assigned to this association because it most closely resembles forest conditions before pine bark beetle infestations strongly altered the canopy composition. The forest sampled is currently in a state of transition and resembles a woodland as a result of the loss of *Pinus taeda* in the canopy. Global Similar Associations:
• *Liriodendron tulipifera - Acer negundo* Forest (CEGL007184)--has a shrub stratum of *Robinia pseudoacacia*.
• *Liriodendron tulipifera / (Cercis canadensis) / (Lindera benzoin)* Forest (CEGL007220)
• *Pinus taeda - Liquidambar styraciflua* Semi-natural Forest (CEGL008462)

Global Related Concepts:
• IF3a. Recently Harvested Timber Land (Allard 1990) B
• Loblolly Pine - Hardwood: 82 (Eyre 1980) B
• Yellow poplar (50) (USFS 1988) ?
• Yellow-Poplar: 57 (Eyre 1980) B

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: This community was observed in the northern portion of the Bowmans Island within Chattahoochee River National Recreation Area. As interpreted here, there is a moderate to high potential for its occurrence within other Chattahoochee River NRA park units. Vickery Creek may contain pine stands in transition from pine bark beetle damage that are attributable to this association.

Global Range: This association is known from the Piedmont of South Carolina, but is likely to be found in the North Carolina and Georgia Piedmont, as well the coastal plains. It also occurs in Virginia and Alabama and is likely in Tennessee.

Nations: US

States/Provinces: AL, FL?, GA, MS?, NC?, SC, TN?, VA

TNC Ecoregions: 43:C, 44:P, 52:C, 53:?

USFS Ecoregions: 222:C, 231:C

Federal Lands: NPS (Chattahoochee River, Colonial); USFS (Apalachicola?, Bankhead, Bienville?, Conecuh?, De Soto?, Oconee?, Sumter, Sumter (Piedmont), Tombigbee?, Tuskegee?)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: CHAT.36.
Local Description Authors: M.J. Russo and L. Echols Global Description Authors: S. Landaal, mod. M. Pyne and L.A. Sneddon

References: Allard 1990, Eyre 1980, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, USFS 1988

Quercus alba - (Quercus rubra, Carya spp.) Forest Alliance (A.239)

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* (white oak) and/or *Quercus rubra* (northern red oak), with or without *Carya* (hickory) species. Stands are found on gentle to moderately steep lower to upper 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 (sugar maple), *Tilia americana* (American basswood), *Acer rubrum* (red maple), and other mesic tree associates. This succession may be delayed by fire and grazing. In the eastern and southeastern United States, *Liriodendron tulipifera* (tuliptree), *Liquidambar styraciflua* (sweetgum), *Fraxinus americana* (white ash), *Acer rubrum* (red maple), and other mesic associates often increase after disturbances, such as clearcutting or windstorms, especially in the absence of fire and in areas adjacent to creeks and rivers. Stands are 15-25 m tall, with a closed, deciduous canopy. The shrub and herbaceous strata are typically well-developed. *Quercus alba* (white oak) usually dominates, either alone or in combination with *Quercus rubra* (northern red oak) (especially on moister sites) and sometimes *Quercus velutina* (black oak) and *Quercus falcata* (southern red oak) (especially on drier sites). Some associations in this alliance are dominated by *Quercus rubra* (northern red oak), although *Quercus alba* (white oak) is usually also a canopy component. *Carya* (hickory) species (particularly *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory) or *Carya ovata* (shagbark hickory)) 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* (pignut hickory), *Carya ovata* (shagbark hickory), *Carya alba* (mockernut hickory), *Fraxinus americana* (white ash), *Acer rubrum* (red maple), *Acer leucoderme* (chalk maple), *Cornus florida* (flowering dogwood), *Nyssa sylvatica* (blackgum), *Ostrya virginiana* (hophornbeam), *Calycanthus floridus* (eastern sweetshrub), *Pyrularia pubera* (buffalo nut), *Tilia americana var. caroliniana* (Carolina basswood), *Oxydendrum arboreum* (sourwood), *Kalmia latifolia* (mountain laurel), and others. This alliance is found throughout the midwestern United States on moderately rich, upland sites. Typical associates include *Fraxinus americana* (white ash), *Ulmus americana* (American elm), *Tilia americana* (American basswood), *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), and more locally, *Quercus macrocarpa* (bur oak) and *Quercus ellipsoidalis* (northern pin oak).

Similar Alliances:
Carya (glabra, ovata) - Fraxinus americana - Quercus (alba, rubra) Forest Alliance (A.258)
• *Quercus alba - (Quercus nigra)* Forest Alliance (A.238)
• *Quercus alba - Quercus (falcata, stellata)* Forest Alliance (A.241)
• *Quercus alba* Montane Forest Alliance (A.271)--forests dominated by *Quercus alba* in extreme montane landscapes.
• *Quercus rubra - (Acer saccharum)* Forest Alliance (A.251)--mesic forests dominated by *Quercus rubra*.
• *Quercus rubra* Montane Forest Alliance (A.272)--forests dominated by *Quercus rubra* in extreme montane landscapes.
• *Quercus velutina - Quercus alba - (Quercus coccinea)* Forest Alliance (A.1911)--includes floristically and structurally similar stands, typically drier that A.239.

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

Alliance Description

Environment: 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 Midwest, 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 East and Southeast, *Liriodendron tulipifera, Fraxinus americana, Liquidambar styraciflua*, and other mesic associates often increase after disturbances, such as clearcutting or windstorms, especially in the absence of fire (Eyre 1980) and in areas adjacent to creeks and rivers.

Vegetation: 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* (white oak) and *Quercus rubra* (northern red oak), with or without *Carya* (hickory) species. Stands are 15-25 m tall, with a closed deciduous canopy. The shrub and herbaceous strata are typically well-developed. *Quercus alba* (white oak) usually dominates stands, either alone or in combination with *Quercus rubra* (northern red oak) (especially on moister sites) and sometimes *Quercus velutina* (black oak) (especially on drier sites). Some associations in this alliance are dominated by *Quercus rubra* (northern red oak), although *Quercus alba* (white oak) is usually also a canopy component. *Carya* (hickory) species (particularly *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory) or *Carya ovata* (shagbark hickory)) 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 Interior Low Plateau, and mesic oak-hickory forests of Blue Ridge and interior highlands of the Ozarks and Ouachita Mountains. Associated species in the southeastern United States include *Carya glabra* (pignut hickory), *Carya ovata* (shagbark hickory), *Carya alba* (mockernut hickory), *Fraxinus americana* (white ash), *Acer rubrum* (red maple), *Acer leucoderme* (chalk maple), *Cornus florida* (flowering dogwood), *Nyssa sylvatica* (blackgum), *Ostrya virginiana* (hophornbeam), *Calycanthus floridus* (eastern sweetshrub), *Pyrularia pubera* (buffalo nut), *Kalmia latifolia* (mountain laurel), *Tilia americana var. caroliniana* (Carolina basswood), *Oxydendrum arboreum* (sourwood), and others. In the midwestern United States, this alliance is found throughout the region on moderately rich, upland sites. Typical associates include *Fraxinus americana* (white ash), *Ulmus americana* (American elm), *Tilia americana* (American basswood), *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), and more locally, *Quercus macrocarpa* (bur oak) and *Quercus ellipsoidalis* (northern pin oak).

Dynamics: 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.

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.

Nations: CA, US

Subnations: AL, AR, CT, DC, 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, 42:C, 43:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C, 51:C, 52:C, 53:?, 57:C, 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?, 221Aa:CCP, 221Ab:CCC, 221Ad:CCP, 221Ae:CCC, 221Af:CCC, 221Ag:CCC, 221Ah:CCC, 221Ai:CCC, 221Ak:CCC, 221Al:CCC, 221Am:CCC, 221Ba:CCC, 221Bb:CCC, 221Bc: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, 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:CCC, 222Dh:CCC, 222Di:CCC, 222Dj:CCC, 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:CCC, 231Be:CCC, 231Bg:CCC, 231Bh:CCP, 231Bk:CCC, 231Ca:CCC, 231Cb:CCC, 231Cc:CCC, 231Cd:CCC, 231Cf:CCC, 231Cg:CCC, 231Da:CCC, 231Dc:CCC, 231Dd:CCC, 231De:CCC, 231E:CC, 231Gb:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCP, 232Ad:CCC, 232Bq:CCC, 232Br:CCC, 232Bt:CCC, 232Bv:CCC, 232Bx:CCC, 232Ca:CCC, 232Cb:CCC, 232Ch:CCC, 232Cj: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, M221Ac:CCC, M221Bd:C??, M221Cc:CCC, M221Cd:CCC, M221Ce:CCC, M221Da:CCC, M221Dc:CCC, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: BIA (Eastern Band of Cherokee); COE (Dale Hollow?, Kerr Reservoir); DOD (Arnold, Fort Benning, Fort Pickett); DOE (Oak Ridge); NPS (Abe Lincoln Birthplace, Appomattox Court House, Big South Fork, Blue Ridge Parkway, Booker T. Washington, Boston Harbor Islands, Buffalo River, C&O Canal, Cape Cod, Carl Sandburg Home, Chattahoochee River, Chickamauga-Chattanooga, Colonial, Cowpens, Cumberland Gap, Delaware Water Gap, Effigy Mounds, Fort Donelson, Fort Necessity, Fredericksburg-Spotsylvania, George Washington Parkway, Gettysburg, Great Smoky Mountains, Guilford Courthouse, Indiana Dunes, Kennesaw Mountain, Kings Mountain, Little River Canyon, Mammoth Cave, Manassas, Minute Man, Morristown, Natchez Trace, Ninety Six, Obed, Ozark Riverways, Petersburg, Prince William, Richmond, Rock Creek, Russell Cave, Sagamore Hill, Saint Croix, Saratoga, Shenandoah, Shiloh, Upper Delaware, Weir Farm); TVA (Tellico); USFS (Bankhead, Chattahoochee, Cherokee, Chippewa, Daniel Boone, Finger Lakes, George Washington, Hoosier, Huron-Manistee, Jefferson, Land Between the Lakes, Manistee, Mark Twain, Nantahala, Oconee, Ouachita?, Ozark, Pisgah, Shawnee, St. Francis, Sumter, Uwharrie, Wayne); USFWS (Assabet River, Cape May, Great Meadows)

(CEGL008475) Piedmont Dry-Mesic Acidic Oak - Hickory Forest

***Quercus alba - Quercus rubra - Carya alba / Cornus florida / Vaccinium stamineum / Desmodium nudiflorum* Piedmont Forest White Oak - Northern Red Oak - Mockernut Hickory / Flowering Dogwood / Deerberry / Naked-stem Tick-trefoil Piedmont Forest**

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Quercus alba - (Quercus rubra, Carya* spp.) Forest Alliance (A.239)
Alliance (English name)	White Oak - (Northern Red Oak, Hickory species) Forest Alliance
Association	*Quercus alba - Quercus rubra - Carya alba / Cornus florida / Vaccinium stamineum / Desmodium nudiflorum* Piedmont Forest
Association (English name)	White Oak - Northern Red Oak - Mockernut Hickory / Flowering Dogwood / Deerberry / Naked-stem Tick-trefoil Piedmont Forest
Association (Common name)	Piedmont Dry-Mesic Acidic Oak - Hickory Forest
Ecological System(s):	Northern Atlantic Coastal Plain Hardwood Forest (CES203.475) Northeastern Interior Dry-Mesic Oak Forest (CES202.592) Southern Piedmont Dry Oak-(Pine) Forest (CES202.339) Piedmont Hardpan Woodland and Forest (CES202.268)

Element Concept

Global Summary: This forest is found on submesic to subxeric upland sites throughout the Piedmont of Georgia, the Carolinas, Virginia, and south-central Maryland. It favors mid- to upper-slope positions with northerly or easterly aspects, or mid- to lower slopes with more southerly aspects. In drier landscapes, this type occupies habitats considered relatively mesic (e.g., concave slopes, lower slopes, shallow ravines). These sites are described as dry to intermediate in soil moisture. The soils are moderately to strongly acidic and nutrient-poor, being weathered primarily from felsic metamorphic, metasedimentary, and sedimentary rocks, or

composed of unconsolidated sediments. At some sites, soils are weathered from interbedded metasedimentary and mafic rocks, resulting in soil chemistry that is intermediate or slightly basic. Stands of this forest are closed to somewhat open and are dominated by mixtures of oaks and hickories, with *Quercus alba* (white oak) being most prevalent, along with *Quercus rubra* (northern red oak), *Quercus coccinea* (scarlet oak), *Quercus velutina* (black oak), *Quercus falcata* (southern red oak), *Carya alba* (mockernut hickory), *Carya ovalis* (red hickory), and *Carya glabra* (pignut hickory). *Carya* (hickory) spp. are common in this type but often most abundant in the understory. In forests with a history of disturbance, such as selective logging or windstorms, early-successional species such as *Liriodendron tulipifera* (tuliptree) or *Pinus* (pine) sp. may codominate. In Virginia examples, *Quercus prinus* (chestnut oak) is inconstant but sometimes important. In addition, *Pinus* (pine) spp., *Liriodendron tulipifera* (tuliptree), *Liquidambar styraciflua* (sweetgum), and *Acer rubrum* (red maple) may be common. Understory species include *Acer rubrum* (red maple), *Cornus florida* (flowering dogwood), *Oxydendrum arboreum* (sourwood), *Ilex opaca* (American holly), and *Nyssa sylvatica* (blackgum). Shrubs include *Vaccinium stamineum* (deerberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum rafinesquianum* (downy arrow-wood), and *Euonymus americanus* (strawberry bush). The woody vines *Vitis rotundifolia* (muscadine) and *Toxicodendron radicans* (eastern poison-ivy) often are present. Herbs vary from sparse to moderately dense, with dry-mesophytic, acid-tolerant species such as *Hexastylis* (heartleaf) spp., *Goodyera pubescens* (downy rattlesnake plantain),
Chimaphila maculata (striped prince's pine), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Maianthemum racemosum* (feathery false lily of the valley), *Polygonatum biflorum* (smooth Solomon's seal), *Viola hastata* (halberdleaf yellow violet), *Tipularia discolor* (crippled cranefly), and *Hieracium venosum* (rattlesnakeweed) prevalent. This association occupies less nutrient-rich habitats than *Quercus rubra - Quercus alba - Carya glabra / Geranium maculatum* Forest (CEGL007237).

Environmental Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This dry-mesic oak-hickory forest was sampled twice at Kennesaw Mountain. One site is a gently sloping, north-facing ridge at 340 m (1115 feet) elevation, and the other is a somewhat steep, southwest-facing midslope at 345 m (1135 feet). Soils are dry-mesic moderately well-drained loam and dry well-drained loam, respectively. The unvegetated surface is dominated by leaf litter (87-91% cover) with some wood (8-12%) and bare soil (1%). Evidence of disturbance includes past logging, wind damage, and the presence of exotic plants.

Global Environment: The sites on which this vegetation is found are described as "intermediate" in soil moisture (Jones 1988a, 1988b). Soils are less nutrient-rich than *Quercus alba - Quercus rubra - Carya (ovata, carolinae-septentrionalis) / Cercis canadensis* Forest (CEGL007232). Virginia stands occur on submesic to subxeric uplands with acidic, moderately nutrient-poor soils weathered from felsic metamorphic, metasedimentary, and sedimentary rocks (especially Triassic siltstones), and unconsolidated sediments. However, Virginia soils supporting this type are demonstrably more fertile than those supporting very species-poor mixed oak forests with dense ericaceous shrub layers. At some sites, soils are weathered from interbedded metasedimentary and mafic rocks, resulting in soil chemistry that is intermediate or slightly basic. This type frequently occupies somewhat mesic habitats (e.g., concave slopes,

lower slopes, shallow ravines) in dry landscapes where mixed oak/heath types are prevalent. It is a large-patch or matrix type in some parts of Virginia but is not as abundant in the Piedmont as mixed oak/heath forests (G. Fleming pers. comm. 2001). In North Carolina, this is a matrix type, probably the most common forest type remaining in the Piedmont.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderately dense (70-80% cover) tree canopy, 20-50 m tall, is dominated by *Carya ovalis* (red hickory); codominants may include *Liriodendron tulipifera* (tuliptree), *Quercus alba* (white oak), *Quercus stellata* (post oak), and/or *Quercus velutina* (black oak). *Carya pallida* (sand hickory) and *Pinus echinata* (shortleaf pine) are occasional canopy components. The sparse to moderate (10-50%) subcanopy (10-20 m) has basically the same makeup as the canopy. The sparse (20-40%) tall-shrub layer (2-10 m) and sparse (20%) short-shrub layer (1-2 m) are dominated by *Cornus florida* (flowering dogwood) and *Prunus serotina* (black cherry) along with sapling canopy species. The sparse (5-30%) herbaceous layer may include *Carex cherokeensis* (Cherokee sedge), *Dichanthelium boscii* (Bosc's panicgrass), *Dioscorea quaternata* (fourleaf yam), *Mitchella repens* (partridgeberry), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy), *Uvularia sessilifolia* (sessileleaf bellwort), and *Viola* (violet) spp. *Vitis rotundifolia* (muscadine) vines can be abundant.

Global Vegetation: Stands of this forest are closed to somewhat open, and are dominated by mixtures of oaks and hickories, with *Quercus alba* (white oak) being most prevalent, along with *Quercus rubra* (northern red oak), *Quercus coccinea* (scarlet oak), *Quercus velutina* (black oak), *Carya alba* (mockernut hickory), *Carya ovalis* (red hickory), and *Carya glabra* (pignut hickory). *Carya* (hickory) spp. are common in this type but often most abundant in the understory. In Virginia examples, *Quercus prinus* (chestnut oak) and *Quercus falcata* (southern red oak) are inconstant but sometimes important. In addition, *Pinus* (pine) spp., *Liriodendron tulipifera* (tuliptree), *Liquidambar styraciflua* (sweetgum), and *Acer rubrum* (red maple) may be common, especially in disturbed stands. Understory species include *Acer rubrum* (red maple), *Cornus florida* (flowering dogwood), *Oxydendrum arboreum* (sourwood), *Ilex opaca* (American holly), and *Nyssa sylvatica* (blackgum). Shrubs include *Vaccinium stamineum* (deerberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum rafinesquianum* (downy arrow-wood), and *Euonymus americanus* (strawberry bush). In Virginia, *Vaccinium pallidum* (Blue Ridge blueberry) and *Vaccinium stamineum* (deerberry) are the principal ericads of patchy low-shrub layers (G. Fleming pers. comm. 2004). The woody vines *Vitis rotundifolia* (muscadine) and *Toxicodendron radicans* (eastern poison-ivy) often are present. Herbs vary from sparse to moderately dense, with dry-mesophytic species such as *Hexastylis* (heartleaf) spp., *Goodyera pubescens* (downy rattlesnake plantain), *Chimaphila maculata* (striped prince's pine), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Maianthemum racemosum* (feathery false lily of the valley), *Polygonatum biflorum* (smooth Solomon's seal), *Viola hastata* (halberdleaf yellow violet), *Tipularia discolor* (crippled cranefly), *Carex albicans* (whitetinge sedge), and *Hieracium venosum* (rattlesnakeweed) prevalent (Schafale and Weakley 1990). Although not lush, these forests can be impressively species-rich, with high woody diversity and many low-cover herbaceous species occurring. Species richness of 116 Virginia plots averages 53 taxa per 400 square meters, varying from a low of 17 to a high of 114. Low species richness in this type is most often the result of long-term overgrazing by

large deer populations. At least some of the stands with high species richness are located on sites where deer populations are effectively controlled.

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Carya ovalis (red hickory)*
Tree canopy	Broad-leaved deciduous tree	*Liriodendron tulipifera (tuliptree), Quercus alba (white oak), Quercus stellata (post oak), Quercus velutina (black oak)*
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Cornus florida (flowering dogwood)*
Short shrub/sapling	Broad-leaved deciduous shrub	*Quercus velutina (black oak)*
Herb (field)	Vine/Liana	*Vitis rotundifolia (muscadine)*

Global Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Carya alba (mockernut hickory), Carya glabra (pignut hickory), Carya ovalis (red hickory), Quercus alba (white oak), Quercus coccinea (scarlet oak), Quercus rubra (northern red oak), Quercus velutina (black oak)*
Tree subcanopy	Broad-leaved deciduous tree	*Cornus florida (flowering dogwood), Nyssa sylvatica (blackgum), Oxydendrum arboreum (sourwood)*
Tree subcanopy	Broad-leaved evergreen tree	*Ilex opaca (American holly)*

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Carya ovalis* (red hickory), *Cornus florida* (flowering dogwood), *Liriodendron tulipifera* (tuliptree), *Quercus alba* (white oak), *Quercus stellata* (post oak), *Quercus velutina* (black oak), *Vitis rotundifolia* (muscadine)

Global: *Acer rubrum* (red maple), *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Carya ovalis* (red hickory), *Chimaphila maculata* (striped prince's pine), *Cornus florida* (flowering dogwood), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Euonymus americanus* (strawberry bush), *Goodyera pubescens* (downy rattlesnake plantain), *Hieracium venosum* (rattlesnakeweed), *Ilex opaca* (American holly), *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Maianthemum racemosum* (feathery false lily of the valley), *Nyssa sylvatica* (blackgum), *Oxydendrum arboreum* (sourwood), *Polygonatum biflorum* (smooth Solomon's seal), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Tipularia discolor* (crippled cranefly), *Toxicodendron radicans* (eastern poison-ivy), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum rafinesquianum* (downy arrow-wood), *Viola hastata* (halberdleaf yellow violet), *Vitis rotundifolia* (muscadine)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Nandina domestica (sacred bamboo)	High/Low	invasive/exotic
Paulownia tomentosa (princesstree)	Medium/Low	invasive/exotic

Conservation Status and Rank

Global Rank & Reasons: G4G5 (15-Feb-2007). This is not a rare community type, although stands older than about 80 years old are probably rare. Most of the rolling upland landscape of the Piedmont and other regions where this occurs have been logged more than once since European settlement. This is a large-patch or matrix type in some regions of Virginia (G. Fleming pers. comm. 2001). In North Carolina, this is a matrix type, probably the most common forest type remaining in the Piedmont.

Classification

Status: Standard

Classification Confidence: 1 - Strong

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Comments: The occurrence of this type at Kennesaw Mountain NBP may constitute a range expansion to include the Georgia Piedmont.

Global Comments: At the northern end of the range, the classification is supported by analysis of a 1250-plot regional dataset assembled for the NCR and Mid-Atlantic national parks vegetation mapping project. In that analysis, this association was represented by 116 Virginia plots and several from Montgomery County, Maryland.

Global Similar Associations:
• *Quercus (alba, rubra, velutina) / Cornus florida / Viburnum acerifolium* Forest (CEGL006336)--northern analogue from Maryland to New England.
• *Quercus alba - Carya alba / Euonymus americanus / Hexastylis arifolia* Forest (CEGL006227)--similar with a more southerly range.
• *Quercus alba - Carya alba / Vaccinium elliottii* Forest [Provisional] (CEGL007224)--of the Coastal Plain.
• *Quercus alba - Carya glabra* / Mixed Herbs Coastal Plain Forest (CEGL007226)--of the Coastal Plain.
• *Quercus alba - Quercus nigra - Quercus falcata / Ilex opaca / Clethra alnifolia - Arundinaria gigantea ssp. tecta* Forest (CEGL007862)--of the Coastal Plain.
• *Quercus alba - Quercus prinus - Carya glabra / Cornus florida / Vaccinium pallidum / Carex pensylvanica* Forest (CEGL008515)
• *Quercus alba - Quercus rubra - Carya (ovata, carolinae-septentrionalis) / Cercis canadensis* Forest (CEGL007232)--occurs in the same region but on basic soils weathered from mafic rocks.

• *Quercus falcata - Quercus alba - Carya alba / Oxydendrum arboreum / Vaccinium stamineum* Forest (CEGL007244)--is a drier community of similar substrates, with more *Quercus falcata* or *Quercus stellata* than *Quercus rubra* codominating with *Quercus alba*.
• *Quercus rubra - Quercus alba - Carya glabra / Geranium maculatum* Forest (CEGL007237)
• *Quercus rubra / Magnolia tripetala - Cercis canadensis / Actaea racemosa - Tiarella cordifolia* Forest (CEGL003949)

Global Related Concepts:
• *Quercus alba - Quercus rubra - Carya (alba, glabra) / Cornus florida / Vaccinium stamineum* Forest (VDNH 2003) =
• *Quercus alba - Quercus rubra - Carya (alba, glabra) / Cornus florida / Vaccinium stamineum* Forest (Fleming pers. comm.) ?
• IA6i. Interior Upland Dry-Mesic Oak - Hickory Forest (Allard 1990) B
• Oak - Chestnut - Hickory Forest (Ambrose 1990a) B
• Piedmont Acidic Oak-Hickory Forest (Fleming et al. 2004) ?
• White oak - northern red oak - false Solomon's seal (*Quercus alba - Quercus rubra - Smilacina racemosa*) community type (Jones 1988a) ?
• White oak - northern red oak - false Solomon's seal (*Quercus alba - Quercus rubra - Smilacina racemosa*) community type (Jones 1988b) ?

Other Comments

Other Comments: The two Kennesaw Mountain NBP plots express a strong hickory (*Carya ovalis*) dominance or codominance with oaks in the canopy stratum. Kennesaw Mountain examples are clearly recovering from past anthropogenic disturbances, and species diversity is rather depauperate when compared to higher quality examples.

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: Within Kennesaw Mountain NBP, two plots were sampled from the central portion of the park north and south of Burnt Hickory Road. This type is fairly widespread in the central and southern portions of the park. Potential for additional occurrences is high along dry to dry-mesic slopes and ridges.

Global Range: This association occurs throughout the Piedmont of the Carolinas, Virginia, and south-central Maryland. Two plots attributable to this type were sampled from the Piedmont of Georgia. In northern Virginia and Maryland, it also occurs occasionally in the Coastal Plain.

Nations: US

States/Provinces: DC, GA, MD, NC, SC, VA

TNC Ecoregions: 52:C, 57:C, 58:C, 59:C, 61:C

USFS Ecoregions: 221Db:CCC, 231Aa:CCC, 231Ae:CCC, 231Af:CCC, 231Ak:CCC, 231Al:CCC, 231An:CCC, 231Ap:CCC, 232Ad:CCC, 232Br:CCC, 232Bt:CC?, 232Bx:CCC, 232Ch:CCC, 232Cj:CCC, M221Da:CCC

Federal Lands: DOD (Fort Pickett, Kerr Reservoir); NPS (Appomattox Court House, Booker T. Washington, C&O Canal, Colonial, Fredericksburg-Spotsylvania, George Washington Parkway,

Guilford Courthouse, Kennesaw Mountain, Kings Mountain, Manassas, Ninety Six, Petersburg, Prince William, Richmond, Rock Creek); USFS (Oconee?, Uwharrie)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: KEMO.11, KEMO.30.

Local Description Authors: M.J. Russo and L. Echols Global Description Authors: M.P. Schafale and G.P. Fleming

References: Allard 1990, Ambrose 1990a, Fleming 2007, Fleming et al. 2001, Fleming et al. 2004, Fleming pers. comm., Harrison 2004, Jones 1988a, Jones 1988b, NRCS 2006, Nelson 1986, Patterson pers. comm., Schafale and Weakley 1990, Skeen et al. 1980, Southeastern Ecology Working Group n.d., VDNH 2003

(CEGL007244) Interior Southern Red Oak - White Oak Forest

Quercus falcata - Quercus alba - Carya alba / Oxydendrum arboreum / Vaccinium stamineum Forest
Southern Red Oak - White Oak - Mockernut Hickory / Sourwood / Deerberry Forest

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Quercus alba - Quercus (falcata, stellata)* Forest Alliance (A.241)
Alliance (English name)	White Oak - (Southern Red Oak, Post Oak) Forest Alliance
Association	*Quercus falcata - Quercus alba - Carya alba / Oxydendrum arboreum / Vaccinium stamineum* Forest
Association (English name)	Southern Red Oak - White Oak - Mockernut Hickory / Sourwood / Deerberry Forest
Association (Common name)	Interior Southern Red Oak - White Oak Forest
Ecological System(s):	Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359) East Gulf Coastal Plain Northern Loess Plain Oak-Hickory Upland (CES203.482) Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898) Southern Piedmont Dry Oak-(Pine) Forest (CES202.339) East Gulf Coastal Plain Northern Dry Upland Hardwood Forest (CES203.483)

Element Concept

Global Summary: This southern red oak - white oak dry forest is found in the Piedmont of Georgia, South Carolina, North Carolina, and Virginia, and in the interior uplands and Cumberland Plateau of Kentucky and Tennessee. It has also been reported from the Upper East Gulf Coastal Plain of Mississippi, Tennessee and Georgia. It generally is a second-growth forest on low-fertility Ultisols. The vegetation is dominated by *Quercus* (oak) spp. and lesser amounts of *Carya* (hickory) spp. The canopy is continuous, and several species of *Quercus* (oak) may be present or codominant (e.g., *Quercus falcata* (southern red oak), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Quercus coccinea* (scarlet oak), and *Quercus stellata* (post oak)). The subcanopy closure is variable, ranging from less than 25% to more than 40% cover, and the shrub and herb layers generally are sparse. Subcanopy species include canopy species and *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Oxydendrum arboreum* (sourwood), *Liquidambar styraciflua* (sweetgum), *Ulmus alata* (winged elm), *Cornus florida* (flowering dogwood), *Nyssa sylvatica* (blackgum), *Juniperus virginiana var. virginiana* (eastern red-cedar),

and *Vaccinium arboreum* (farkleberry). The tall-shrub stratum may contain *Rhododendron canescens* (mountain azalea) and *Vaccinium arboreum* (farkleberry). The low-shrub stratum can be sparse to moderate and may be dominated by various ericaceous shrubs such as *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Vaccinium fuscatum* (black highbush blueberry), and *Gaylussacia baccata* (black huckleberry). *Smilax glauca* (cat greenbrier) and *Vitis rotundifolia* (muscadine) are common vines. Herbaceous species that may be present include *Aristolochia serpentaria* (Virginia snakeroot), *Symphyotrichum dumosum* (rice button aster), *Clitoria mariana* (Atlantic pigeonwings), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Euphorbia corollata* (flowering spurge), *Galium circaezans* (licorice bedstraw), *Chimaphila maculata* (striped prince's pine), *Polystichum acrostichoides* (Christmas fern), *Asplenium platyneuron* (ebony spleenwort), *Hexastylis arifolia* (littlebrownjug), *Coreopsis major* (greater tickseed), *Solidago odora* (anisescented goldenrod), *Tephrosia virginiana* (Virginia tephrosia), *Potentilla simplex* (common cinquefoil), *Porteranthus stipulatus* (Indian physic), *Pteridium aquilinum* (western brackenfern), *Lespedeza* (lespedeza) spp., *Dichanthelium* (rosette grass) spp., and *Hieracium venosum* (rattlesnakeweed).

Environmental Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This southern red oak dry forest was sampled at five locations at Chattahoochee River and once at Kennesaw Mountain. Sites are moderate to somewhat steep, south- and west-facing upper slopes and ridges at 300-325 m (980-1075 feet) elevation. Soils are dry to dry-mesic, moderately well- to well-drained loam, sandy loam and silt loam. The unvegetated surface is dominated by leaf litter (82-95% cover) with some large rocks (0-3%), small rocks (0-1%), wood (4-15%), and bare soil (0-3%). Evidence of disturbance includes foot trails, wind damage (canopy gaps), and the presence of exotic plants.

Global Environment: Stands are typically found on low fertility Ultisols in the Piedmont, the interior uplands, and the Cumberland Plateau. This community occurs on soils of relatively low fertility; suborders on which this community occurs include Hapludults and Paleudults. Stands are uneven-aged and tree replacement occurs in gaps; severe fires most likely destroy community occurrences although light fires probably are tolerated. In western Tennessee (Shiloh National Military Park) it occurs on silt loam and loam soils on moderate to gentle slopes and ridgetops.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderate to dense (60-80% cover) mature tree canopy, 20-50 m tall, is dominated by *Quercus falcata* (southern red oak); possible codominants include *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Liriodendron tulipifera* (tuliptree), *Pinus echinata* (shortleaf pine), *Pinus taeda* (loblolly pine), and more commonly *Quercus alba* (white oak), *Quercus stellata* (post oak), and *Quercus velutina* (black oak). The sparse to moderate (30-60%) subcanopy (10-35 m) is made up of canopy species as well as *Cornus florida* (flowering dogwood) and *Oxydendrum arboreum* (sourwood). The sparse (10-30%) tall-shrub layer (2-15 m) and sparse (10-30%) short-shrub layer (1-2 m) are made up mostly of saplings of the canopy species but may also include *Acer leucoderme* (chalk maple), *Acer rubrum* (red maple), *Amelanchier arborea* (common serviceberry), *Aralia spinosa* (devil's walkingstick), *Asimina parviflora* (smallflower pawpaw), *Diospyros virginiana* (common persimmon), *Nyssa sylvatica* (blackgum), *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), and

Vaccinium arboreum (farkleberry), several of which may dominate. The sparse to moderate (10-40%) herbaceous layer is comprised mainly of tree and shrub seedlings but may also include small amounts of *Asplenium platyneuron* (ebony spleenwort), *Botrychium virginianum* (rattlesnake fern), *Chimaphila maculata* (striped prince's pine), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium commutatum* (variable panicgrass), *Piptochaetium avenaceum* (blackseed speargrass), and *Polystichum acrostichoides* (Christmas fern). Common vines found trailing on the ground and climbing into the upper layers include *Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison-ivy), *Vitis aestivalis* (summer grape), and *Vitis rotundifolia* (muscadine). This community also supports state-vulnerable *Castanea dentata* (American chestnut).

Global Vegetation: The vegetation is dominated by *Quercus* (oak) spp. and lesser amounts of *Carya* (hickory) spp. The canopy is continuous, and several species of *Quercus* (oak) may be present (e.g., *Quercus falcata* (southern red oak), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Quercus coccinea* (scarlet oak), and *Quercus stellata* (post oak)). The subcanopy closure is variable, ranging from less than 25% to more than 40% cover, and the shrub and herb layers generally are sparse. Subcanopy species include canopy species and *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Oxydendrum arboreum* (sourwood), *Liquidambar styraciflua* (sweetgum), *Ulmus alata* (winged elm), *Cornus florida* (flowering dogwood), *Nyssa sylvatica* (blackgum), *Juniperus virginiana var. virginiana* (eastern red-cedar), and *Vaccinium arboreum* (farkleberry). The tall-shrub stratum may contain *Rhododendron canescens* (mountain azalea) and *Vaccinium arboreum* (farkleberry). The low-shrub stratum is dominated by various ericaceous shrubs such as *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Vaccinium fuscatum* (black highbush blueberry), and *Gaylussacia baccata* (black huckleberry). *Smilax glauca* (cat greenbrier) and *Vitis rotundifolia* (muscadine) are common vines. Herbaceous species that may be present include *Aristolochia serpentaria* (Virginia snakeroot), *Symphyotrichum dumosum* (rice button aster), *Clitoria mariana* (Atlantic pigeonwings), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Euphorbia corollata* (flowering spurge), *Galium circaezans* (licorice bedstraw), *Chimaphila maculata* (striped prince's pine), *Polystichum acrostichoides* (Christmas fern), *Asplenium platyneuron* (ebony spleenwort), *Hexastylis arifolia* (littlebrownjug), *Coreopsis major* (greater tickseed), *Solidago odora* (anisescented goldenrod), *Tephrosia virginiana* (Virginia tephrosia), *Potentilla simplex* (common cinquefoil), *Porteranthus stipulatus* (Indian physic), *Pteridium aquilinum* (western brackenfern), *Lespedeza* (lespedeza) spp., *Dichanthelium* (rosette grass) spp., and *Hieracium venosum* (rattlesnakeweed).

At Shiloh (western Tennessee) this association is documented from 3 plots; the canopy is dominated by *Quercus alba* (white oak), *Quercus falcata* (southern red oak), *Quercus stellata* (post oak), *Ulmus alata* (winged elm), and *Carya alba* (mockernut hickory). *Quercus muehlenbergii* (chinkapin oak) is also present as a canopy species in one of the plots. Subcanopy dominants are *Liquidambar styraciflua* (sweetgum), *Ulmus alata* (winged elm), *Nyssa sylvatica* (blackgum), *Fraxinus americana* (white ash), and *Carya glabra* (pignut hickory). Other subcanopy trees are *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Carya alba* (mockernut hickory), *Juniperus virginiana var. virginiana* (eastern red-cedar), *Carya ovalis* (red hickory), *Diospyros virginiana* (common persimmon), and *Fagus grandifolia* (American beech). The most abundant tall shrubs are *Carya alba* (mockernut hickory), *Quercus falcata* (southern

red oak), *Ulmus alata* (winged elm), and *Liquidambar styraciflua* (sweetgum). Other tall shrubs are *Carya ovalis* (red hickory), *Sassafras albidum* (sassafras), *Quercus alba* (white oak), *Nyssa sylvatica* (blackgum), *Vaccinium arboreum* (farkleberry), *Vaccinium stamineum* (deerberry), and less abundant *Quercus velutina* (black oak), *Quercus rubra* (northern red oak), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Acer rubrum* (red maple), *Smilax rotundifolia* (roundleaf greenbrier), and *Ilex opaca* (American holly). Short shrubs are diverse; *Quercus falcata* (southern red oak), *Vitis rotundifolia* (muscadine), *Vaccinium stamineum* (deerberry), and *Carya alba* (mockernut hickory) are the most abundant. Other short shrubs are *Quercus velutina* (black oak), *Ulmus alata* (winged elm), *Quercus alba* (white oak), *Nyssa sylvatica* (blackgum), *Parthenocissus quinquefolia* (Virginia creeper), *Prunus serotina* (black cherry), and *Sassafras albidum* (sassafras). Short shrubs which are sparse include *Amelanchier arborea* (common serviceberry), *Vaccinium arboreum* (farkleberry), *Juniperus virginiana var. virginiana* (eastern red-cedar), *Diospyros virginiana* (common persimmon), *Hypericum hypericoides* (St. Andrew's cross), *Fraxinus americana* (white ash), *Smilax rotundifolia* (roundleaf greenbrier), *Ilex opaca* (American holly), *Acer rubrum* (red maple), *Quercus phellos* (willow oak), *Celtis occidentalis* (common hackberry), *Rubus argutus* (sawtooth blackberry), *Morus rubra* (red mulberry), *Smilax bona-nox* (saw greenbrier), *Ilex decidua* (possum-haw), *Toxicodendron radicans* (eastern poison-ivy), and *Carya ovalis* (red hickory). In one of the plots *Chasmanthium sessiliflorum* (longleaf woodoats) is the dominant herb, in the other plots there is no single dominant and herbs are all sparse. Other herbs include *Dichanthelium boscii* (Bosc's panicgrass), *Carex complanata* (hirsute sedge), *Dichanthelium laxiflorum* (openflower rosette grass), *Danthonia spicata* (poverty oatgrass), *Lespedeza repens* (creeping lespedeza), *Lespedeza procumbens* (trailing lespedeza), *Carex leavenworthii* (Leavenworth's sedge), *Schizachyrium scoparium* (little bluestem) and present a in trace amounts *Carex swanii* (Swan's sedge), *Dichanthelium dichotomum var. dichotomum* (cypress panicgrass), *Sericocarpus linifolius* (narrowleaf whitetop aster), *Galium circaezans* (licorice bedstraw), *Panicum anceps* (beaked panicgrass), *Tridens flavus* (purpletop tridens), *Aristolochia serpentaria* (Virginia snakeroot), *Dichanthelium acuminatum var. acuminatum* (tapered rosette grass), *Galium pilosum* (hairy bedstraw), *Solidago rugosa* (wrinkleleaf goldenrod), *Erechtites hieraciifolia* (American burnweed), *Sanicula canadensis* (Canadian blacksnakeroot), *Asplenium platyneuron* (ebony spleenwort), *Acalypha rhomboidea* (Virginia threeseed mercury), *Mimosa microphylla* (littleleaf sensitive-briar), *Conyza canadensis* (Canadian horseweed), and *Penstemon calycosus* (longsepal beardtongue).

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Quercus alba (white oak), Quercus falcata (southern red oak), Quercus stellata (post oak), Quercus velutina (black oak)*
Tree subcanopy	Broad-leaved deciduous tree	*Oxydendrum arboreum (sourwood)*
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Carya alba (mockernut hickory), Cornus florida (flowering dogwood)*
Shrub/sapling (tall & short)	Broad-leaved evergreen shrub	*Vaccinium arboreum (farkleberry)*

Global Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Carya alba (mockernut hickory), Quercus alba (white oak), Quercus coccinea (scarlet oak), Quercus falcata (southern red oak), Quercus velutina (black oak)*
Tree subcanopy	Broad-leaved deciduous tree	*Cornus florida (flowering dogwood), Oxydendrum arboreum (sourwood)*
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium pallidum (Blue Ridge blueberry), Vaccinium stamineum (deerberry)*

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Amelanchier arborea* (common serviceberry), *Carya alba* (mockernut hickory), *Chimaphila maculata* (striped prince's pine), *Cornus florida* (flowering dogwood), *Oxydendrum arboreum* (sourwood), *Quercus alba* (white oak), *Quercus falcata* (southern red oak), *Quercus stellata* (post oak), *Quercus velutina* (black oak), *Toxicodendron radicans* (eastern poison-ivy), *Vaccinium arboreum* (farkleberry), *Vitis rotundifolia* (muscadine)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Albizia julibrissin (silktree)	High/Low	invasive/exotic
Ligustrum sinense (Chinese privet)	High/Medium	invasive/exotic

Other Plant Species	GRank	Note
Castanea dentata (American chestnut)	G4	GA state-vulnerable

Global

Exotic and Invasive Species	I-Rank	Note
Lonicera japonica (Japanese honeysuckle)	High/Medium	invasive exotic

Other Plant Species	GRank	Note
Amorpha schwerinii (Schwerin's false indigo)	G3G4	
Brickellia cordifolia (Flyr's nemesis)	G2G3	
Corallorhiza wisteriana (spring coralroot)	G5	
Hexastylis lewisii (Lewis' heartleaf)	G3	
Monotropsis odorata (pygmypipes)	G3	

Other Plant Species	GRank	Note
Nestronia umbellula (leechbrush)	G4	
Onosmodium virginianum (wild Job's tears)	G4	
Porteranthus stipulatus (Indian physic)	G5	
Prunus umbellata (hog plum)	G4G5	
Rhus michauxii (false poison sumac)	G2G3	Federally listed endangered
Thermopsis mollis (Allegheny Mountain goldenbanner)	G3G4	
Yucca filamentosa (Adam's needle)	G5	

Conservation Status Rank

Global Rank & Reasons: G4G5 (13-Feb-2009). This is not a rare forest type, although most examples have been impacted by removal of the more valuable timber species (e.g., *Quercus alba*), and remaining ones on private land are highly vulnerable to canopy removal and conversion to other forest types or other land uses. This is one of the most common dry to dry-mesic oak forest communities found at Chattahoochee River National Recreation Area (L. Echols pers. comm. 2009).

Classification

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: The limits of the range of this type needs to be clarified in Kentucky.

Global Similar Associations:
• *Pinus echinata - Quercus alba / Vaccinium pallidum / Hexastylis arifolia - Chimaphila maculata* Forest (CEGL008427)--a related mixed type.
• *Quercus alba - Carya alba / Euonymus americanus / Hexastylis arifolia* Forest (CEGL006227)--a more mesic type with range overlap in the southern Piedmont.
• *Quercus alba - Quercus falcata / Vaccinium (arboreum, hirsutum, pallidum)* Forest (CEGL008567)--more eastern and montane in distribution.
• *Quercus alba - Quercus rubra - Carya alba / Cornus florida / Vaccinium stamineum / Desmodium nudiflorum* Piedmont Forest (CEGL008475)--has a higher proportion of *Quercus alba* to other oak species.
• *Quercus falcata - Quercus alba - Quercus stellata - Quercus velutina* Forest (CEGL005018)
• *Quercus stellata - Quercus marilandica - Carya (glabra, texana) / Vaccinium arboreum* Forest (CEGL002075)

Global Related Concepts:
• Black Oak: 110 (Eyre 1980) B
• IA6i. Interior Upland Dry-Mesic Oak - Hickory Forest (Allard 1990) B
• Mesotrophic Forest (Rawinski 1992) ?
• Southern Red Oak, HR (Pyne 1994) B
• Submesic Broadleaf Deciduous Forest (Ambrose 1990a) B
• White Oak - Black Oak - Northern Red Oak: 52 (Eyre 1980) B

• White Oak - Mixed Hardwoods, HR (Pyne 1994) B
• White Oak - Mixed Oak - Hickory, HR (Pyne 1994) B
• White Oak: 53 (Eyre 1980) B

Other Comments

Other Comments: This is one of the most common dry to dry-mesic oak forest communities found at Chattahoochee River NRA.

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: This association was sampled from five plots in four different park units within Chattahoochee River NRA. One plot was sampled from the northeast portion of Palisades, where the type can be expected along upper slopes and ridgetops. One plot was sampled from the southern end of Gold Branch. In Vickery Creek, one plot was sampled at the southern end where this type is commonly found along upper slopes and ridgetops. Two plots were taken from Bowmans Island: one from the southern portion east of the Chattahoochee River and the DNR Trout Hatchery, and one in the northern portion north of River Run Court. This association is widespread at Chattahoochee River NRA, having a high potential for occurrence in any park unit with significant relief. One plot was also taken from Kennesaw Mountain NBP less than 0.5 mile south of the Pigeon Hill parking area. This community is much less widespread at Kennesaw Mountain, although there is a moderate potential for other occurrences in the central and southern portions of the park along upper slopes and ridgetops.

Global Range: This southern red oak - white oak dry forest is found in the Piedmont of Georgia, South Carolina, North Carolina, and Virginia, and in the interior uplands and Cumberland Plateau of Kentucky and Tennessee. It has also been reported from the Upper East Gulf Coastal Plain of Mississippi, Tennessee and Georgia.

Nations: US

States/Provinces: AL, GA, KY, MS, NC, SC, TN

TNC Ecoregions: 43:C, 44:C, 50:C, 52:C, 53:?

USFS Ecoregions: 221Hc:CCC, 222Cg:CCC, 222Eb:CCC, 222Ef:CCC, 222Eg:CCC, 231Aa:CCC, 231Ab:CCC, 231Ae:CCC, 231Bb:CCC, 231Bg:CCC, 231Bh:CCC, 231Bj:CCC, 231Bk:CCC, 231Cc:CCC

Federal Lands: DOD (Arnold, Fort Benning, Fort Gordon?); DOE (Oak Ridge); NPS (Chattahoochee River, Cowpens, Guilford Courthouse, Horseshoe Bend, Kennesaw Mountain, Kings Mountain, Little River Canyon, Natchez Trace, Ninety Six, Shiloh); USFS (Daniel Boone, Holly Springs?, Oconee, Sumter, Sumter (Piedmont), Talladega, Talladega (Oakmulgee), Talladega (Talladega), Tombigbee?, Tuskegee?, Uwharrie); USFWS (Eufaula)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: CHAT.03, CHAT.23, CHAT.31, CHAT.37, CHAT.54, KEMO.10.
Local Description Authors: M.J. Russo and L. Echols

Global Description Authors: S. Landaal, mod. R.E. Evans

References: ALNHP 2002, Allard 1990, Ambrose 1990a, Echols pers. comm., Evans 1991, Eyre 1980, Golden 1979, NatureServe Ecology - Southeastern U.S. unpubl. data, Oberholster 1993, Oosting 1942, Peet and Christensen 1980, Peet et al. unpubl. data 2002, Pyne 1994, Rawinski 1992, Schafale and Weakley 1990, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data

Quercus prinus - (Quercus coccinea, Quercus velutina) Forest Alliance (A.248)

Alliance Concept

Summary: This alliance includes xeric oak forests strongly dominated by *Quercus prinus* (chestnut oak) or *Quercus prinus* (chestnut oak) with admixtures of *Quercus coccinea* (scarlet oak) and/or *Quercus velutina* (black oak), occurring in the southern and central Appalachians, Ridge and Valley, Cumberland Plateau, Piedmont, Interior Low Plateau, and possibly in the northern Appalachians. These forests occur on convex, upper slopes and ridgetops, south-facing slopes, over thin, rocky, infertile soils in the Appalachians, typically below 1066 m (3500 feet) 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. In the Piedmont and Ridge and Valley, and in areas transitional to these provinces, *Quercus stellata* (post oak) and *Quercus marilandica* (blackjack oak) may be canopy associates. Other canopy/subcanopy associates include *Acer rubrum* (red maple), *Amelanchier arborea* (common serviceberry), *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Cornus florida* (flowering dogwood), *Hamamelis virginiana* (American witch-hazel), *Magnolia fraseri* (mountain magnolia), *Nyssa sylvatica* (blackgum), *Oxydendrum arboreum* (sourwood), *Pinus rigida* (pitch pine), *Pinus strobus* (eastern white pine), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Robinia pseudoacacia* (black locust), and *Sassafras albidum* (sassafras). In the Appalachians, a dense ericaceous shrub layer is characteristic, with species such as *Gaylussacia baccata* (black huckleberry), *Gaylussacia ursina* (bear huckleberry), *Kalmia latifolia* (mountain laurel), *Leucothoe recurva* (redtwig doghobble), *Rhododendron maximum* (great laurel), *Vaccinium pallidum* (Blue Ridge blueberry), and *Vaccinium stamineum* (deerberry). In the upper Piedmont *Kalmia latifolia* (mountain laurel), *Vaccinium arboreum* (farkleberry), and *Vaccinium pallidum* (Blue Ridge blueberry) are common. In the montane distribution of this alliance, forests of this alliance have replaced forests formerly dominated or codominated by *Castanea dentata* (American chestnut), and chestnut sprouts are common in the understory. Other shrub species found in forests of this alliance include *Chionanthus virginicus* (white fringetree), *Diospyros virginiana* (common persimmon), *Robinia hispida* (bristly locust), *Sassafras albidum* (sassafras), *Styrax grandifolius* (bigleaf snowbell), *Symplocos tinctoria* (common sweetleaf), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum prunifolium* (blackhaw), and *Viburnum rufidulum* (rusty blackhaw). Herbaceous cover is typically sparse in these dry, rocky forests and species vary with geographic location.

Similar Alliances:

- *Acer rubrum - Nyssa sylvatica - Magnolia fraseri* Forest Alliance (A.2009)
- *Pinus strobus - Quercus (alba, rubra, velutina)* Forest Alliance (A.401)
- *Pinus strobus - Quercus (coccinea, prinus)* Forest Alliance (A.402)

• *Quercus prinus - Quercus (alba, falcata, rubra, velutina)* Forest Alliance (A.249)

• *Quercus prinus - Quercus rubra* Forest Alliance (A.250)--occurs on more mesic sites, have a more diverse canopy, and have an overall more diverse species composition than forests in this alliance.

Similar Alliance Comments: Forests in this alliance (A.248) differ from forests in *Quercus prinus - Quercus rubra* Forest Alliance (A.250) by lacking dominance by *Quercus rubra* and occurring on more extreme sites.

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) ?

Alliance Description

Environment: These forests occur on convex, upper slopes and ridgetops, south-facing slopes, over thin, rocky, infertile soils in the Appalachians, typically below 1066 m (3500 feet), 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.

Vegetation: This alliance consists of xeric oak forests in the Appalachians, Interior Plateau, and Piedmont, dominated by pure *Quercus prinus* (chestnut oak) or *Quercus prinus* (chestnut oak) with admixtures of *Quercus coccinea* (scarlet oak) and/or *Quercus velutina* (black oak). In the Piedmont and Ridge and Valley, and in areas transitional to these provinces, *Quercus stellata* (post oak) and *Quercus marilandica* (blackjack oak) may be canopy associates. Other canopy/subcanopy associates include *Acer rubrum* (red maple), *Amelanchier arborea* (common serviceberry), *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Cornus florida* (flowering dogwood), *Hamamelis virginiana* (American witch-hazel), *Magnolia fraseri* (mountain magnolia), *Nyssa sylvatica* (blackgum), *Oxydendrum arboreum* (sourwood), *Pinus rigida* (pitch pine), *Pinus strobus* (eastern white pine), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Robinia pseudoacacia* (black locust), and *Sassafras albidum* (sassafras). In the Appalachians, a dense ericaceous shrub layer is characteristic, with species such as *Gaylussacia baccata* (black huckleberry), *Gaylussacia ursina* (bear huckleberry), *Kalmia latifolia* (mountain laurel), *Leucothoe recurva* (redtwig doghobble), *Rhododendron maximum* (great laurel), *Vaccinium pallidum* (Blue Ridge blueberry), and *Vaccinium stamineum* (deerberry). In the upper Piedmont *Kalmia latifolia* (mountain laurel), *Vaccinium arboreum*

(farkleberry), and *Vaccinium pallidum* (Blue Ridge blueberry) are common. In the montane distribution of this alliance, forests of this alliance have replaced forests formerly dominated or codominated by *Castanea dentata* (American chestnut), and chestnut sprouts are common in the understory. Other shrub species found in forests of this alliance include *Chionanthus virginicus* (white fringetree), *Diospyros virginiana* (common persimmon), *Robinia hispida* (bristly locust), *Sassafras albidum* (sassafras), *Styrax grandifolius* (bigleaf snowbell), *Symplocos tinctoria* (common sweetleaf), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum prunifolium* (blackhaw), and *Viburnum rufidulum* (rusty blackhaw). Herbaceous cover is typically sparse in these dry, rocky forests and species vary with geographic location. Some typical herbaceous species include *Antennaria plantaginifolia* (woman's tobacco), *Aureolaria laevigata* (entireleaf yellow false foxglove), *Chamaelirium luteum* (fairywand), *Chimaphila maculata* (striped prince's pine), *Danthonia spicata* (poverty oatgrass), *Dichanthelium commutatum* (variable panicgrass), *Dichanthelium dichotomum* (cypress panicgrass), *Dioscorea quaternata* (fourleaf yam), *Epigaea repens* (trailing arbutus), *Galax urceolata* (beetleweed), *Galium latifolium* (purple bedstraw), *Gaultheria procumbens* (eastern teaberry), *Goodyera pubescens* (downy rattlesnake plantain), *Hieracium venosum* (rattlesnakeweed), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Medeola virginiana* (Indian cucumber), *Monotropa uniflora* (Indianpipe), *Potentilla canadensis* (dwarf cinquefoil), *Pteridium aquilinum* (western brackenfern), *Stenanthium gramineum* (eastern featherbells), *Uvularia puberula* (mountain bellwort), and *Uvularia sessilifolia* (sessileleaf bellwort).

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 ranges from Illinois east to Maine, south to Virginia and possibly Florida, and west to Kentucky. It also occurs in Ontario, Canada.

Nations: CA, US

Subnations: AL, CT, DC, DE, GA, IL, IN, KY, MA, MD, ME, NC, NH, NJ, NY, OH, ON, 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, 58:C, 59:C, 60:C, 61:C, 63:C, 64:C

USFS Ecoregions: 212A:CC, 212D:CC, 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:CCC, 221Ak:CCP, 221Al:CCC, 221Am:CCC, 221Ba:CCC, 221Bb:CCC, 221Bc: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, 221Hc:CCC, 221He:CCC, 221Ja:CCP, 221Jb:CCC, 221Jc:CCP, 222Aq:CCC, 222Cf:CCP, 222Cg:CCP, 222Da:CCP, 222Db:CCC, 222Dc:CCP, 222De:CCC, 222Dg:CCC, 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, 231Cc:CCC, 231Cd:CCC, 231Dc:CCC, 232Aa:CCP, 232Ac:CCP, 232Ad:CCC, 232Ba:CP?, 232Bc:CP?, 232Bd:CPP, 232Br:CPP, 232Ch:CPP, M212Ba:CCP, M212Bb:CCP, 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:CCP, M221Cb:CCC, M221Cc:CCP, M221Cd:CCP, M221Ce:CCP, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: BIA (Eastern Band of Cherokee); DOD (Fort Knox); NPS (Big South Fork, Blue Ridge Parkway, C&O Canal, Carl Sandburg Home, Catoctin Mountain, Chattahoochee River, Chickamauga-Chattanooga, Cumberland Gap, Delaware Water Gap, George Washington Parkway, Gettysburg, Great Smoky Mountains, Harpers Ferry, Kennesaw Mountain, Kings Mountain, Little River Canyon, Mammoth Cave, National Capital-East, New River Gorge, Obed, Rock Creek, Russell Cave, Shenandoah, Upper Delaware, Valley Forge, Weir Farm, Wolf Trap); TVA (Land Between the Lakes, Tellico); USFS (Allegheny, Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Hoosier, Jefferson, Monongahela, Nantahala, Oconee?, Pisgah, Shawnee, Sumter, Talladega?, Uwharrie, Wayne)

(CEGL008431) Xeric Ridgetop Chestnut Oak Forest

Quercus prinus - (Quercus coccinea) / Carya pallida / Vaccinium arboreum - Vaccinium pallidum Forest
Chestnut Oak - (Scarlet Oak) / Sand Hickory / Farkleberry - Hillside Blueberry Forest

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Quercus prinus - (Quercus coccinea, Quercus velutina)* Forest Alliance (A.248)
Alliance (English name)	Chestnut Oak - (Scarlet Oak, Black Oak) Forest Alliance
Association	*Quercus prinus - (Quercus coccinea) / Carya pallida / Vaccinium arboreum - Vaccinium pallidum* Forest
Association (English name)	Chestnut Oak - (Scarlet Oak) / Sand Hickory / Farkleberry - Hillside Blueberry Forest Association (Common name) Xeric Ridgetop Chestnut Oak Forest
Ecological System(s):	Southern Appalachian Oak Forest (CES202.886) Southern Piedmont Dry Oak-(Pine) Forest (CES202.339) Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359)

Element Concept

Global Summary: This association includes xeric rock chestnut oak forests on high slopes and ridges in the southern Cumberland Plateau, southern Ridge and Valley, Southern Blue Ridge, and occasionally in the Piedmont of North Carolina, South Carolina, and Georgia. This forest occurs over rocky, shallow soils derived from various geologies. These include sandstone, quartzite (in the Piedmont), schist, or weakly metamorphosed, metasedimentary rocks (in the western edge of the Southern Blue Ridge). This is a closed-canopy, deciduous forest with open to sparse shrub layers and a sparse to absent herb layer. The canopy is dominated by *Quercus prinus* (chestnut oak), sometimes sharing dominance with *Quercus coccinea* (scarlet oak). Other oaks in the canopy can include *Quercus velutina* (black oak), *Quercus stellata* (post oak), and *Quercus alba* (white oak), although these oaks are not dominant. Hickories (e.g., *Carya glabra* (pignut hickory), *Carya pallida* (sand hickory)) may be present in the canopy and/or subcanopy. Some examples may have coverage of pine in the canopy, most commonly *Pinus virginiana* (Virginia pine) and *Pinus echinata* (shortleaf pine). The most common subcanopy trees are *Acer rubrum* (red maple), *Carya pallida* (sand hickory), *Cornus florida* (flowering dogwood), *Nyssa sylvatica* (blackgum), and *Oxydendrum arboreum* (sourwood). The most constant shrub species

are *Chimaphila maculata* (striped prince's pine), *Vaccinium arboreum* (farkleberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Diospyros virginiana* (common persimmon), and *Sassafras albidum* (sassafras). Herb coverage is sparse, with little constancy among examples. Some of the more typical herb species are *Euphorbia corollata* (flowering spurge), *Hieracium venosum* (rattlesnakeweed), *Carex nigromarginata* (black edge sedge), and *Solidago odora* (anisescented goldenrod), but many other species may occur.

Environmental Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This chestnut oak forest was sampled three times at Chattahoochee River and once at Kennesaw Mountain. The sites range from moderate to steep, north, east- and southwest-facing upper and lower slopes at 270-320 m (890-1045 feet) elevation. Soils are dry well-drained loam. The unvegetated surface is usually dominated by leaf litter (46-96% cover) with exposed bedrock (0-50%), large rocks (0-4%), wood (2-11%), and bare soil (1-4%). Evidence of disturbance includes the presence of invasive exotic plants.

Global Environment: This forest is found on north- and west-facing high slopes and ridgetops over soils derived from sandstone, in the Cumberland Plateau and Ridge and Valley, or weakly metamorphosed, metasedimentary rocks in the western edge of the Southern Blue Ridge. Examples range from 225 to 732 m (740-2400 feet) elevation, with most examples occurring over 274 m (900 feet) elevation. Examples in the Piedmont are usually over metamorphic rock such as schist or quartzite. In the Blue Ridge, this type does not generally reach elevations above 732 m (2400 feet).

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderately dense (70-80% cover) tree canopy is variable in height, ranging from 15-50 m tall. It is dominated by *Quercus prinus* (chestnut oak); additional species may include *Carya alba* (mockernut hickory), *Carya pallida* (sand hickory), *Pinus echinata* (shortleaf pine), *Pinus taeda* (loblolly pine), *Quercus falcata* (southern red oak), and *Quercus stellata* (post oak). The sparse to moderate (20-50%) subcanopy (10-20 m) is also dominated by *Quercus prinus* (chestnut oak). The sparse (20-30%) tall-shrub layer (5-10 m) and sparse (20-30%) short-shrub layer (1-2 m) are made up of saplings of tree species as well as *Acer rubrum* (red maple), *Amelanchier arborea* (common serviceberry), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Nyssa sylvatica* (blackgum), *Rhododendron minus* (piedmont rhododendron), *Toxicodendron radicans* (eastern poison-ivy), *Vaccinium* (blueberry) spp., *Viburnum acerifolium* (mapleleaf viburnum), and others. The sparse (5-40%) herbaceous layer is dominated by tree and shrub seedlings along with small amounts of *Chimaphila maculata* (striped prince's pine), *Coreopsis major*, *Dichanthelium acuminatum*, *Dryopteris intermedia* (intermediate woodfern), *Polystichum acrostichoides* (Christmas fern), and *Solidago arguta* (Atlantic goldenrod). Vines, particularly *Vitis rotundifolia* (muscadine), may cover much of the ground surface and climb into the upper layers.

Global Vegetation: This is a closed-canopy, deciduous forest with open to sparse shrub layers and a sparse to absent herb layer. The canopy is dominated by *Quercus prinus* (chestnut oak) sometimes sharing dominance with *Quercus coccinea* (scarlet oak) (and in some Piedmont examples, with *Quercus coccinea* (scarlet oak) as the dominant canopy tree). Other oaks in the canopy can include *Quercus velutina* (black oak), *Quercus stellata* (post oak), and *Quercus alba*

(white oak), although these oaks are not dominant. Hickories (e.g., *Carya glabra* (pignut hickory), *Carya pallida* (sand hickory)) may be present in the canopy and/or subcanopy. Some examples may have coverage of pine in the canopy, most commonly *Pinus virginiana* (Virginia pine) and *Pinus echinata* (shortleaf pine). The most common subcanopy trees are *Acer rubrum* (red maple), *Carya pallida* (sand hickory), *Cornus florida* (flowering dogwood), *Nyssa sylvatica* (blackgum), and *Oxydendrum arboreum* (sourwood). Other minor species in the canopy and subcanopy can include *Carya glabra* (pignut hickory), *Castanea dentata* (American chestnut), and *Magnolia macrophylla* (bigleaf magnolia). The most constant shrub species are *Chimaphila maculata* (striped prince's pine), *Vaccinium arboreum* (farkleberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Diospyros virginiana* (common persimmon), and *Sassafras albidum* (sassafras). Other shrubs that can occur in examples of this community are *Lyonia ligustrina* (maleberry), *Castanea pumila* (chinkapin), *Viburnum acerifolium* (mapleleaf viburnum), *Rhododendron alabamense* (Alabama azalea), and *Rhododendron canescens* (mountain azalea). Herb coverage is sparse, with little constancy among examples. Some of the more typical herb species are *Euphorbia corollata* (flowering spurge), *Hieracium venosum* (rattlesnakeweed), *Carex nigromarginata* (black edge sedge), and *Solidago odora* (anisescented goldenrod), but many other species may occur. In the lower Piedmont of Georgia, some additional herbs may include *Schizachyrium scoparium* (little bluestem), *Dichanthelium boscii* (Bosc's panicgrass), *Piptochaetium avenaceum* (blackseed speargrass), *Tephrosia virginiana* (Virginia tephrosia), *Verbesina virginica* (white crownbeard), *Hypoxis hirsuta* (common goldstar), *Tragia urticifolia* (nettleleaf noseburn), *Brickellia eupatorioides* (false boneset), *Scutellaria elliptica* (hairy skullcap), *Arnoglossum atriplicifolium* (pale Indian plaintain), *Pityopsis aspera* (pineland silkgrass), and *Coreopsis major* (greater tickseed).

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Quercus prinus (chestnut oak)*
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Amelanchier arborea (common serviceberry)*
Herb (field)	Vine/Liana	*Vitis rotundifolia (muscadine)*

Global Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus coccinea (scarlet oak), Quercus prinus (chestnut oak)*
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum (red maple)*

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Amelanchier arborea* (common serviceberry), *Chimaphila maculata* (striped prince's pine), *Quercus prinus* (chestnut oak), *Vitis rotundifolia* (muscadine)

Global: *Acer rubrum* (red maple), *Oxydendrum arboreum* (sourwood), *Quercus coccinea* (scarlet oak), *Quercus prinus* (chestnut oak)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Elaeagnus pungens (thorny olive)	Low/Insignificant	invasive/exotic
Ligustrum sinense (Chinese privet)	High/Medium	invasive/exotic

Conservation Status Rank

Global Rank & Reasons: G4G5 (31-Jan-2003). This is a wide-ranging type, found on a variety of substrates in several ecoregions; its threats are limited.

Classification

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This association was defined from examples found in the southern Ridge and Valley of northwestern Georgia, the Cumberland Plateau of northern Alabama, and the western edge of the Southern Blue Ridge in northern Georgia and southeastern Tennessee, where it represents the driest oak forests of this region. This type may be present in the McCreary and Somerset ranger districts of the Daniel Boone National Forest (Kentucky). Stands of *Quercus prinus* along ecoregional transitions may be difficult to classify [see similar associations].

Global Similar Associations:

• *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271)--is defined for the Southern Blue Ridge. Has dense, less diverse, ericaceous shrub layer and more acid-loving, Blue Ridge species.

• *Quercus prinus - Carya* spp. *- Quercus velutina / Vaccinium arboreum / Iris verna var. smalliana* Forest (CEGL007261)--is defined for the lower Piedmont of Alabama and has Coastal Plain affinities.

• *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023)

• *Quercus prinus - Quercus alba / Oxydendrum arboreum / Vitis rotundifolia* Forest (CEGL006281)--is defined for the Piedmont and occurs on granite monadnocks.

• *Quercus prinus - Quercus marilandica* Piedmont Woodland (CEGL003708)--can often be found in adjacent ridgetop areas of the Piedmont but has a more open canopy and contains *Quercus marilandica*.

• *Quercus prinus - Quercus* spp. / *Vaccinium arboreum - (Kalmia latifolia, Styrax grandifolius)* Forest (CEGL007700)--is a broadly defined type for the Appalachian Plateau and Interior Low Plateau.

Global Related Concepts:

• Chestnut Oak Forest (Lipps and DeSelm 1969) ?

• Chestnut Oak Forest (Lipps 1966) ?
• Chestnut Oak Type (Chapman 1957) ?

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: Within Chattahoochee River NRA, three plots were sampled from two different park units. One plot was sampled from a localized area in the central portion of Vickery Creek. Two plots were sampled from the northern end of Palisades west of the Chattahoochee River on high slopes accessible from Akers Mill parking area. Other small occurrences may exist along upper slopes within Palisades. This type is not frequently found at Chattahoochee River, and the probability for additional occurrences in other park units is low. Within Kennesaw Mountain NBP, one plot was sampled from the middle slopes of Little Kennesaw Mountain less than 0.5 mile from the Pigeon Hill parking area. There is a moderate potential for other occurrences on Kennesaw Mountain where mafic influence is not pronounced.

Global Range: This association occurs in the southern Cumberland Plateau and southern Ridge and Valley of Georgia, Tennessee and Alabama, and ranges into the Southern Blue Ridge and Piedmont regions as well. This or related vegetation is reported from the Daniel Boone National Forest of Kentucky; this needs investigation.

Nations: US

States/Provinces: AL, GA, KY?, SC, TN

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

USFS Ecoregions: 221Hc:CCC, 221He:CCC, 231Aj:CCC, 231Cc:CCC, 231Cd:CCC, 231Dc:CCC, M221Dd:CCC

Federal Lands: NPS (Big South Fork, Chattahoochee River, Chickamauga-Chattanooga, Kings Mountain, Little River Canyon, Obed, Russell Cave); USFS (Bankhead, Chattahoochee, Chattahoochee (Piedmont), Chattahoochee (Southern Blue Ridge), Cherokee, Daniel Boone?)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: CHAT.27, CHAT.62, CHAT.63, KEMO 33.

Local Description Authors: M.J. Russo and L. Echols

Global Description Authors: mod. R. White

References: Chapman 1957, Govus 2002, Lipps 1966, Lipps and DeSelm 1969, NatureServe Ecology - Southeastern U.S. unpubl. data, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data

(CEGL004416) Mafic Xeric Piedmont Oak Forest

Quercus prinus - Quercus stellata - Carya glabra / Vaccinium arboreum - Viburnum rufidulum Forest
Chestnut Oak - Post Oak - Pignut Hickory / Farkleberry - Rusty Blackhaw Forest

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)

Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Quercus prinus - (Quercus coccinea, Quercus velutina)* Forest Alliance (A.248)
Alliance (English name)	Chestnut Oak - (Scarlet Oak, Black Oak) Forest Alliance
Association	*Quercus prinus - Quercus stellata - Carya glabra / Vaccinium arboreum - Viburnum rufidulum* Forest
Association (English name)	Chestnut Oak - Post Oak - Pignut Hickory / Farkleberry - Rusty Blackhaw Forest Association (Common name) Mafic Xeric Piedmont Oak Forest
Ecological System(s):	Southern Piedmont Dry Oak-(Pine) Forest (CES202.339)

Element Concept

Global Summary: This is an oak-hickory forest of the Piedmont which is found on various mafic volcanic substrates, including amphibolite. These forests may occur as a matrix surrounding herbaceous glades. The canopy of stands typically contains *Quercus prinus* (chestnut oak), Carya pallida (sand hickory), Quercus stellata (post oak), Quercus marilandica (blackjack oak), Carya glabra (pignut hickory), and Pinus echinata (shortleaf pine). The subcanopy may contain Carya pallida (sand hickory), Quercus marilandica (blackjack oak), Cercis canadensis (eastern redbud), and Cornus florida (flowering dogwood). Shrubs include Rhus copallinum (flameleaf sumac), Ptelea trifoliata (common hoptree), Viburnum rufidulum (rusty blackhaw), Asimina parviflora (smallflower pawpaw), Styrax grandifolius (bigleaf snowbell), Vaccinium arboreum (farkleberry), and Vaccinium pallidum (Blue Ridge blueberry). The rare shrub Amorpha schwerinii (Schwerin's false indigo) may be present within its limited range. Some woody vines which may be present include Cocculus carolinus (Carolina coralbead) and Vitis rotundifolia (muscadine). Some typical herbs (all of which may have low cover values) may include Schizachyrium scoparium (little bluestem), Tragia urticifolia (nettleleaf noseburn), Dichanthelium (rosette grass) sp., Piptochaetium avenaceum (blackseed speargrass), Coreopsis major (greater tickseed), Tephrosia virginiana (Virginia tephrosia), Pityopsis graminifolia (narrowleaf silkgrass), and Solidago odora var. odora (anisescented goldenrod). More information is to be found in data (NC Vegetation Survey) from Uwharrie National Forest (North Carolina) and data (NatureServe Ecology - Southeast U.S. unpubl. data) from the Chattahoochee National Forest.

Environmental Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This chestnut oak - sand hickory forest was sampled at five locations at Kennesaw Mountain. The sites range from somewhat steep to steep, mostly south- and west-facing mid and upper slopes at 360-500 m (1190-1630 feet). Soils are dry, rapidly to well-drained loam and sandy loam. The unvegetated surface is dominated by leaf litter (44-90% cover) and/or exposed bedrock (2-42%) with some large rocks (1-6%), small rocks (0-1%), wood (2-7%), and bare soil (0-6%). Evidence of disturbance includes the presence of invasive exotic plants.

Global Environment: This Piedmont oak-hickory forest is found on various mafic volcanic substrates, including amphibolite. These forests may occur as a matrix surrounding herbaceous glades.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderate to dense (50-80% cover) tree canopy, 15-35 m tall, is codominated almost exclusively by *Carya pallida* (sand hickory) and *Quercus prinus* (chestnut oak), as is the very sparse to moderate (5-50%) subcanopy (10-20 m). Additional tree species may include *Carya ovalis* (red hickory), *Pinus echinata* (shortleaf pine), *Quercus rubra* (northern red oak), and *Quercus stellata* (post oak). The very sparse to moderate (5-50%) tall-shrub layer (2-10 m) and sparse (20-40%) short-shrub layer (1-2 m) are dominated by the canopy species; additional shrubs may include *Asimina parviflora* (smallflower pawpaw), *Celtis occidentalis* (common hackberry), *Chionanthus virginicus* (white fringetree), *Diospyros virginiana* (common persimmon), *Philadelphus hirsutus* (streambank mock orange), *Ptelea trifoliata* (common hoptree), *Sassafras albidum* (sassafras), and *Vaccinium arboreum* (farkleberry). The sparse to moderate (10-50%) herbaceous layer may include *Arabis laevigata* (smooth rockcress), *Asplenium platyneuron* (ebony spleenwort), *Chimaphila maculata* (striped prince's pine), *Cocculus carolinus* (Carolina coralbead), *Dichanthelium boscii* (Bosc's panicgrass), *Dichanthelium commutatum* (variable panicgrass), *Houstonia longifolia* (longleaf summer bluet), *Passiflora lutea* (yellow passionflower), *Piptochaetium avenaceum* (blackseed speargrass) (often dominant), *Rubus argutus* (sawtooth blackberry), *Schizachyrium scoparium* (little bluestem), and many others. *Parthenocissus quinquefolia* (Virginia creeper), *Smilax bona-nox* (saw greenbrier), and *Vitis rotundifolia* (muscadine) are common and abundant vines. This community supports several state-rare species, including state-critically imperiled *Muhlenbergia sobolifera* (rock muhly), state-imperiled *Pycnanthemum curvipes* (stone mountainmint), and state-vulnerable *Eupatorium sessilifolium* (upland boneset).

Global Vegetation: The canopy of stands typically contains *Quercus prinus* (chestnut oak), *Carya pallida* (sand hickory), *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), *Carya glabra* (pignut hickory), and *Pinus echinata* (shortleaf pine). The subcanopy may contain *Carya pallida* (sand hickory), *Quercus marilandica* (blackjack oak), *Cercis canadensis* (eastern redbud), and *Cornus florida* (flowering dogwood). Shrubs include *Rhus copallinum* (flameleaf sumac), *Ptelea trifoliata* (common hoptree), *Viburnum rufidulum* (rusty blackhaw), *Asimina parviflora* (smallflower pawpaw), *Styrax grandifolius* (bigleaf snowbell), *Vaccinium arboreum* (farkleberry), and *Vaccinium pallidum* (Blue Ridge blueberry). The rare shrub *Amorpha schwerinii* (Schwerin's false indigo) may be present within its limited range. Some woody vines which may be present include *Cocculus carolinus* (Carolina coralbead) and *Vitis rotundifolia* (muscadine). Some typical herbs (all of which may have low cover values) may include *Schizachyrium scoparium* (little bluestem), *Tragia urticifolia* (nettleleaf noseburn), *Dichanthelium* (rosette grass) sp., *Piptochaetium avenaceum* (blackseed speargrass), *Coreopsis major* (greater tickseed), *Tephrosia virginiana* (Virginia tephrosia), *Pityopsis graminifolia* (narrowleaf silkgrass), and *Solidago odora var. odora* (anisescented goldenrod).

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Carya pallida (sand hickory), Quercus prinus (chestnut oak)*

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Ptelea trifoliata (common hoptree)*
Herb (field)	Graminoid	*Piptochaetium avenaceum (blackseed speargrass)*

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Carya pallida* (sand hickory), *Dichanthelium boscii* (Bosc's panicgrass), *Parthenocissus quinquefolia* (Virginia creeper), *Piptochaetium avenaceum* (blackseed speargrass), *Ptelea trifoliata* (common hoptree), *Quercus prinus* (chestnut oak), *Vaccinium arboreum* (farkleberry), *Vitis rotundifolia* (muscadine)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Alliaria petiolata (garlic mustard)	High/Medium	Invasive/exotic
Ligustrum sinense (Chinese privet)	High/Medium	Invasive/exotic
Lonicera japonica (Japanese honeysuckle)	High/Medium	Invasive/exotic

Plant Species	GRank	Note
Eupatorium sessilifolium (upland boneset)	G5	GA state-vulnerable
Muhlenbergia sobolifera (rock muhly)	G5	GA state-critically imperiled
Pycnanthemum curvipes (stone mountainmint)	G3	Globally vulnerable; GA state-imperiled

Global Other Plant Species	GRank	Note
Amorpha schwerinii (Schwerin's false indigo)	G3G4	

Conservation Status Rank

Global Rank & Reasons: G2G3 (13-Feb-2009). This deciduous forest association is naturally very restricted in range and environmental setting, being restricted to mafic substrates in the Piedmont. Stands are impacted by grazing, timber removal, and conversion to other land uses. Some examples are at least partly and informally protected in USDA Forest Service lands, and some examples are protected on the slopes of Kennesaw and Little Kennesaw mountains in Kennesaw Mountain National Battlefield Park.

Classification

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: More information is to be found in data (NC Vegetation Survey) from Uwharrie National Forest (North Carolina) and data (NatureServe Ecology - Southeast U.S. unpubl. data) from the Chattahoochee National Forest.

Global Related Concepts:
• Mafic Xeric Oak Forest (Schafale pers. comm.)?

Other Comments

Other Comments: This globally rare community is locally quite common on both Kennesaw and Little Kennesaw mountains, due to the apparent abundance of mafic substrate. There is a high potential for other rare species where occurrences of this community are found.

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: Plots representing this association were sampled from five locations within Kennesaw Mountain NBP: two plots were taken from the slopes of Kennesaw Mountain, and three plots were taken from the slopes of Little Kennesaw Mountain. This community is apparently quite common along middle and upper slopes of Kennesaw and Little Kennesaw mountains in the northern end of the park. Numerous other occurrences should be expected on both mountains. Global Range: This community occurs in the Piedmont of Georgia, North Carolina and possibly South Carolina. Nations: US States/Provinces: GA, NC, SC? TNC Ecoregions: 52:C USFS Ecoregions: 231Ad:CCC, 231Af:CCC Federal Lands: NPS (Kennesaw Mountain); USFS (Chattahoochee, Chattahoochee (Piedmont), Uwharrie)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: KEMO.03, KEMO.21, KEMO.25, KEMO.27, KEMO.34. Local Description Authors: M.J. Russo and L. Echols Global Description Authors: A.S. Weakley and M. Pyne References: NC Vegetation Survey - Southeast U.S. unpubl. data unpubl. data, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Schafale and Weakley 1990, Schafale pers. comm., Southeastern Ecology Working Group n.d.

Temporarily flooded cold-deciduous forest (I.B.2.N.d)

Liquidambar styraciflua - (Liriodendron tulipifera, Acer rubrum) Temporarily Flooded Forest Alliance (A.287)

Alliance Concept

Summary: This southeastern alliance includes a variety of bottomland communities of moderately wet floodplains of the lower Piedmont, Interior Low Plateau, and Coastal Plain, extending north and west into the Cumberland Plateau and Ridge and Valley, as well as the Ouachita Mountains and Ozarks. This alliance is fairly common in the lower Piedmont of Georgia, as well as on small stream floodplains and bottoms in all of the Interior Low Plateau of Kentucky (except the Bluegrass region) where it is somewhat successional. Soils are relatively

acidic. *Liriodendron tulipifera* (tuliptree) is dominant in disturbed areas of Kentucky and is common on well-drained floodplains of Kentucky without *Liquidambar styraciflua* (sweetgum). Conversely, *Liriodendron tulipifera* (tuliptree) is absent in Ouachita - Ozark examples. Stands are dominated by *Liquidambar styraciflua* (sweetgum) with or without some combination of *Liriodendron tulipifera* (tuliptree) and *Acer rubrum* (red maple) as codominants. Canopy and subcanopy associates vary with geography and substrate, but may include *Acer barbatum* (southern sugar maple), *Ilex opaca var. opaca* (American holly), *Aesculus sylvatica* (painted buckeye), *Quercus nigra* (water oak), *Carya cordiformis* (bitternut hickory), *Platanus occidentalis* (American sycamore), *Betula nigra* (river birch), *Carpinus caroliniana ssp. caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), *Fagus grandifolia* (American beech), *Juglans nigra* (black walnut), *Morus rubra var. rubra* (red mulberry), *Ostrya virginiana var. virginiana* (hophornbeam), *Oxydendrum arboreum* (sourwood), *Pinus echinata* (shortleaf pine), *Prunus serotina var. serotina* (black cherry), *Quercus alba* (white oak), *Quercus rubra var. rubra* (northern red oak), *Ulmus rubra* (slippery elm), *Ulmus americana* (American elm), *Ulmus alata* (winged elm), *Juniperus virginiana var. virginiana* (eastern red-cedar), *Nyssa sylvatica* (blackgum), *Fraxinus americana* (white ash), and *Fraxinus pennsylvanica* (green ash). The shrub layer often is well-developed and includes *Euonymus americanus* (strawberry bush), *Lindera benzoin var. benzoin* (northern spicebush), *Corylus americana* (American hazelnut), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum nudum var. nudum* (possumhaw), *Viburnum prunifolium* (blackhaw), *Viburnum rufidulum* (rusty blackhaw), *Hamamelis virginiana* (American witch-hazel), *Asimina triloba* (pawpaw), and *Ilex decidua* (possum-haw) among others. Vines are prominent and species include *Vitis rotundifolia* (muscadine), *Apios americana* (groundnut), *Campsis radicans* (trumpet creeper), *Aristolochia serpentaria* (Virginia snakeroot), *Bignonia capreolata* (crossvine), *Dioscorea quaternata* (fourleaf yam), *Gelsemium sempervirens* (evening trumpetflower), *Parthenocissus quinquefolia* (Virginia creeper), *Campsis radicans* (trumpet creeper), *Passiflora lutea* (yellow passionflower), *Smilax bona-nox* (saw greenbrier), *Smilax glauca* (cat greenbrier), *Smilax hugeri* (Huger's carrionflower), *Smilax rotundifolia* (roundleaf greenbrier), and *Toxicodendron radicans ssp. radicans* (eastern poison-ivy). The herbaceous layer can be species-rich and often has good sedge development. Common species in this layer include *Thalictrum thalictroides* (rue-anemone), *Trillium cuneatum* (little sweet Betsy), *Arisaema triphyllum ssp. triphyllum* (Jack in the pulpit), *Asplenium platyneuron var. platyneuron* (ebony spleenwort), *Botrychium virginianum* (rattlesnake fern), *Carex* (sedge) spp., *Carex impressinervia* (ravine sedge), *Carex striatula* (lined sedge), *Galium circaezans* (licorice bedstraw), *Geum canadense* (white avens), *Polystichum acrostichoides* (Christmas fern), and *Scutellaria integrifolia* (helmet flower) among many others. The exotics *Microstegium vimineum* (Nepalese browntop), *Ligustrum sinense* (Chinese privet), and *Lonicera japonica* (Japanese honeysuckle) may be common in examples of this alliance.

Classification Comments: Need association that is one version of a small stream swamp forest with the nominals (J. Ambrose pers. comm.).

Similar Alliances:
- *Liquidambar styraciflua - (Acer rubrum)* Seasonally Flooded Forest Alliance (A.321)
- *Liquidambar styraciflua* Forest Alliance (A.234)
- *Liriodendron tulipifera* Forest Alliance (A.236)
- *Pinus taeda - Liquidambar styraciflua - Nyssa biflora* Temporarily Flooded Forest Alliance (A.433)

• *Pinus taeda - Liriodendron tulipifera* Temporarily Flooded Forest Alliance (A.434)--includes related associations with longer hydroperiods.

Related Concepts:
• Lowland Oak - Sweetgum Forest (Foti 1994b) I
• Piedmont/Low Mountain Alluvial Forest (Schafale and Weakley 1990) I

Alliance Description

Environment: This alliance includes a variety of bottomland communities of moderately wet floodplains. It is fairly common in the lower Piedmont of Georgia (J. Ambrose pers. comm.), as well as on small stream floodplains and bottoms in all of the Interior Low Plateau of Kentucky (except the Bluegrass region) where it is somewhat successional (L. McKinney pers. comm.). Soils are relatively acidic.

Vegetation: This alliance includes a variety of bottomland communities dominated by *Liquidambar styraciflua* (sweetgum) with or without some combination of *Liriodendron tulipifera* (tuliptree) and *Acer rubrum* (red maple) as codominants. Canopy and subcanopy associates vary with geography and substrate, but may include *Acer barbatum* (southern sugar maple), *Ilex opaca var. opaca* (American holly), *Aesculus sylvatica* (painted buckeye), *Quercus nigra* (water oak), *Carya cordiformis* (bitternut hickory), *Platanus occidentalis* (American sycamore), *Betula nigra* (river birch), *Carpinus caroliniana ssp. caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), *Fagus grandifolia* (American beech), *Juglans nigra* (black walnut), *Morus rubra var. rubra* (red mulberry), *Ostrya virginiana var. virginiana* (hophornbeam), *Oxydendrum arboreum* (sourwood), *Pinus echinata* (shortleaf pine), *Prunus serotina var. serotina* (black cherry), *Quercus alba* (white oak), *Quercus rubra var. rubra* (northern red oak), *Ulmus rubra* (slippery elm), *Ulmus americana* (American elm), *Ulmus alata* (winged elm), *Juniperus virginiana var. virginiana* (eastern red-cedar), *Nyssa sylvatica* (blackgum), *Fraxinus americana* (white ash), and *Fraxinus pennsylvanica* (green ash). *Liriodendron tulipifera* (tuliptree) is dominant in disturbed areas of Kentucky and is common on well-drained floodplains of Kentucky without *Liquidambar styraciflua* (sweetgum). Conversely, *Liriodendron tulipifera* (tuliptree) is absent in Ouachita - Ozark examples. Some stands may exhibit dominance by *Acer rubrum* (red maple). The shrub layer often is well-developed and species include *Euonymus americanus* (strawberry bush), *Lindera benzoin var. benzoin* (northern spicebush), *Corylus americana* (American hazelnut), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum nudum var. nudum* (possumhaw), *Viburnum prunifolium* (blackhaw), *Viburnum rufidulum* (rusty blackhaw), *Hamamelis virginiana* (American witch-hazel), *Asimina triloba* (pawpaw), and *Ilex decidua* (possum-haw) among others. Vines are prominent and species include *Vitis rotundifolia* (muscadine), *Apios americana* (groundnut), *Campsis radicans* (trumpet creeper), *Aristolochia serpentaria* (Virginia snakeroot), *Bignonia capreolata* (crossvine), *Dioscorea quaternata* (fourleaf yam), *Gelsemium sempervirens* (evening trumpetflower), *Parthenocissus quinquefolia* (Virginia creeper), *Campsis radicans* (trumpet creeper), *Passiflora lutea* (yellow passionflower), *Smilax bona-nox* (saw greenbrier), *Smilax glauca* (cat greenbrier), *Smilax hugeri* (Huger's carrionflower), *Smilax rotundifolia* (roundleaf greenbrier), and *Toxicodendron radicans ssp. radicans* (eastern poison-ivy). The herbaceous layer can be species-rich and often has good sedge development. Common species in this layer include *Thalictrum thalictroides* (rue-anemone), *Trillium cuneatum* (little sweet Betsy), *Arisaema triphyllum ssp. triphyllum* (Jack in the pulpit), *Asplenium platyneuron var. platyneuron* (ebony spleenwort), *Botrychium virginianum* (rattlesnake fern), *Carex* (sedge) spp., *Carex*

impressinervia (ravine sedge), *Carex striatula* (lined sedge), *Galium circaezans* (licorice bedstraw), *Geum canadense* (white avens), *Polystichum acrostichoides* (Christmas fern), and *Scutellaria integrifolia* (helmet flower) among many others. Soils are relatively acidic. The exotics *Microstegium vimineum* (Nepalese browntop), *Ligustrum sinense* (Chinese privet), and *Lonicera japonica* (Japanese honeysuckle) may be common in examples of this alliance.

Alliance Distribution

Range: This alliance is fairly common in the lower Piedmont of Georgia (J. Ambrose pers. comm.), as well as on small stream floodplains and bottoms in all of the Interior Low Plateau of Kentucky (except the Bluegrass Region) where it is somewhat successional (L. McKinney pers. comm.). Its range extends north and west into the Cumberland Plateau and Ridge and Valley, as well as the Ouachita Mountains and Ozarks.

Nations: US

Subnations: AL, AR, DC, FL?, GA, KY, MD, MS, NC, NJ, OK, SC, TN, VA

TNC Ecoregions: 38:C, 39:C, 43:C, 44:C, 50:C, 52:C, 53:?, 56:C, 57:C, 58:C

USFS Ecoregions: 221Hc:CCC, 222Ab:CCC, 222Ag:CCC, 222An:CCC, 222Cb:CCP, 222Cc:CCP, 222Cd:CCP, 222Ce:CCP, 222Cf:CCP, 222Cg:CCC, 222Da:CCP, 222Db:CCP, 222Dc:CCP, 222Dd:CCP, 222De:CCP, 222Dg:CCC, 222Di:CCP, 222Ea:CC?, 222Eb:CCC, 222Ec:CC?, 222Ed:CC?, 222Ee:CC?, 222Ef:CC?, 222Eg:CCC, 222Eh:CC?, 222Ei:CC?, 222Ej:CC?, 222Ek:CC?, 222En:CC?, 222Eo:CC?, 231Aa:CCC, 231Ab:CCC, 231Ac:CCC, 231Ad:CCC, 231Ae:CCC, 231Af:CCC, 231Ag:CC?, 231Ah:CC?, 231Ai:CC?, 231Aj:CC?, 231Ak:CCC, 231Al:CC?, 231Am:CC?, 231An:CCC, 231Ao:CC?, 231Ap:CC?, 231Ba:CCC, 231Bb:CC?, 231Bc:CC?, 231Bd:CCC, 231Be:CCC, 231Bf:CC?, 231Bg:CCC, 231Bh:CC?, 231Bi:CCC, 231Bj:CC?, 231Bk:CCC, 231Bl:CC?, 231Ca:CC?, 231Cb:CC?, 231Cc:CCC, 231Cd:CCC, 231Ce:CC?, 231Cf:CC?, 231Cg:CCC, 231Da:CC?, 231Db:CC?, 231Dc:CC?, 231Dd:CC?, 231De:CC?, 231Ga:CCP, 231Gb:CCP, 231Gc:CCC, 232Ad:CCC, 232Ba:CCP, 232Bb:CCP, 232Bc:CCP, 232Bd:CCC, 232Be:CCP, 232Bf:CCP, 232Bg:CCP, 232Bh:CCP, 232Bi:CCP, 232Bj:CCP, 232Bk:CCP, 232Bl:CCP, 232Bm:CCP, 232Bn:CCP, 232Bo:CCP, 232Bp:CCP, 232Bq:CCC, 232Br:CCC, 232Bs:CCC, 232Bt:CCP, 232Bu:CCP, 232Bv:CCP, 232Bx:CCP, 232Bz:CCP, 232Cg:CCC, 234Ab:PP?, 234An:PPP, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: DOD (Arnold, Fort Belvoir, Fort Benning, Fort Gordon); DOE (Oak Ridge?, Savannah River Site); NPS (Big South Fork, Buffalo River, Carl Sandburg Home, Chickamauga-Chattanooga, Colonial, Cowpens, Fort Donelson, Fredericksburg-Spotsylvania, Guilford Courthouse, Horseshoe Bend, Kennesaw Mountain, Kings Mountain, Little River Canyon, Mammoth Cave, Natchez Trace, National Capital-East, Ninety Six, Ocmulgee, Petersburg, Prince William, Richmond, Shiloh, Thomas Stone); USFS (Bankhead?, Bienville?, Daniel Boone, De Soto?, Delta?, Francis Marion?, Holly Springs?, Homochitto?, Oconee, Ouachita, Ozark, Sumter?, Talladega?, Tombigbee?, Tuskegee?, Uwharrie)

(CEGL004418) Upper Southeast Small Stream Sweetgum - Tuliptree Forest

Liquidambar styraciflua - Liriodendron tulipifera / Lindera benzoin / Arisaema triphyllum Forest Sweetgum - Tuliptree / Northern Spicebush / Jack-in-the-Pulpit Forest

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Temporarily flooded cold-deciduous forest (I.B.2.N.d.)
Alliance	*Liquidambar styraciflua - (Liriodendron tulipifera, Acer rubrum)* Temporarily Flooded Forest Alliance (A.287)
Alliance (English name)	Sweetgum - (Tuliptree, Red Maple) Temporarily Flooded Forest Alliance
Association	*Liquidambar styraciflua - Liriodendron tulipifera / Lindera benzoin / Arisaema triphyllum* Forest Association (English name) Sweetgum - Tuliptree / Northern Spicebush / Jack-in-the-Pulpit Forest Association (Common name) Upper Southeast Small Stream Sweetgum - Tuliptree Forest **Ecological System(s):** Northern Atlantic Coastal Plain Stream and River (CES203.070) Southern Piedmont Small Floodplain and Riparian Forest (CES202.323)

Element Concept

Global Summary: These low-elevation forests develop along relatively acidic soils on small streams in the Coastal Plain of Maryland and Virginia, extending west across the Virginia and North Carolina Piedmont to the Cumberland Plateau and Ridge and Valley. The topographic features of floodplains can heavily influence the individual makeup of examples of this association. The canopy, subcanopy, shrub, and herbaceous layers often are well-developed. Dominant canopy species always include *Liquidambar styraciflua* (sweetgum) and *Liriodendron tulipifera* (tuliptree), while *Acer barbatum* (southern sugar maple) and *Acer rubrum var. rubrum* (red maple) may also make up significant amounts of the canopy. This community type exists as a continuum between two subtypes, i.e., the tuliptree subtype and the sweetgum subtype. In some examples, only one or the other dominates the canopy. However, in many examples, both are equally dominant. Common species in the canopy and understory include *Ilex opaca var. opaca* (American holly), *Aesculus sylvatica* (painted buckeye), *Carpinus caroliniana ssp. caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), *Fagus grandifolia* (American beech), *Juglans nigra* (black walnut), *Morus rubra var. rubra* (red mulberry), *Ostrya virginiana var. virginiana* (hophornbeam), *Oxydendrum arboreum* (sourwood), *Pinus echinata* (shortleaf pine), *Prunus serotina var. serotina* (black cherry), *Quercus alba* (white oak), *Quercus rubra var. rubra* (northern red oak), *Ulmus rubra* (slippery elm), *Ulmus americana* (American elm), *Ulmus alata* (winged elm), *Juniperus virginiana var. virginiana* (eastern red-cedar), *Nyssa sylvatica* (blackgum), *Fraxinus americana* (white ash), *Halesia tetraptera var. tetraptera* (mountain silverbell), *Arundinaria gigantea ssp. gigantea* (giant cane), *Cornus florida* (flowering dogwood), *Platanus occidentalis* (American sycamore), *Betula nigra* (river birch), and *Fraxinus pennsylvanica* (green ash). *Euonymus americanus* (strawberry bush), *Lindera benzoin var. benzoin* (northern spicebush), and *Corylus americana* (American hazelnut) are common and dominant in the shrub layer. The herbaceous layer is species-rich and often has good sedge development. The exotics *Microstegium vimineum* (Nepalese browntop), *Ligustrum sinense* (Chinese privet), and *Lonicera japonica* (Japanese honeysuckle) are common in this community.

Environmental Description

USFWS Wetland System: Palustrine

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This sweetgum - tuliptree forest was sampled at four locations at Kennesaw Mountain. Sites are on gently sloping lowlands and alluvial terraces at 310-325 m (1010-1060 feet) elevation. Soils are mesic, moderately well-drained clay loam, silt loam and loam; one site is temporarily flooded. The unvegetated surface is dominated by leaf litter (92-95% cover) with some large rocks (0-1%), wood (5-6%), and bare soil (0-2%). Evidence of disturbance includes the presence of invasive exotic plants.

Global Environment: These forests develop along small streams. Soils are relatively acidic and relatively well-drained. Topographic differences from one floodplain to another, such as gradient and height above the creek, as well as floodplain microtopography (i.e., depositional landforms such as natural levees and sloughs) may influence the variation of vegetation within this association. However, in most floodplains supporting this type, the distinct alluvial landforms are poorly developed or occur at very small scales.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderate to dense (60-80% cover) tree canopy, 20-50 m tall, is codominated by *Liquidambar styraciflua* (sweetgum) and *Liriodendron tulipifera* (tuliptree); additional species may include *Fraxinus pennsylvanica* (green ash), *Pinus taeda* (loblolly pine), *Platanus occidentalis* (American sycamore), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Quercus falcata* (southern red oak), and *Quercus rubra* (northern red oak). The moderately sparse (30-40%) subcanopy (10-20 m) is dominated by *Liquidambar styraciflua* (sweetgum) and includes other canopy species, as well as *Fagus grandifolia* (American beech). *Carpinus caroliniana* (American hornbeam) and *Lindera benzoin* (northern spicebush) dominate the sparse to moderate (20-50%) tall-shrub layer (2-10 m) and sparse to moderately dense (10-70%) short-shrub layer (1-2 m); additional shrubs may include *Acer rubrum* (red maple), *Aesculus sylvatica* (painted buckeye), *Carya* (hickory) spp., *Cornus florida* (flowering dogwood), *Corylus americana* (American hazelnut), *Fagus grandifolia* (American beech), *Morus rubra* (red mulberry), *Oxydendrum arboreum* (sourwood), *Prunus serotina* (black cherry), and *Toxicodendron radicans* (eastern poison-ivy). The sparse (10-40%) herbaceous layer is dominated by vines (up to 20%), particularly *Decumaria barbara* (woodvamp), but may include *Bignonia capreolata* (crossvine), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (cat greenbrier), and *Vitis rotundifolia* (muscadine). Herbs include *Actaea racemosa* (black bugbane), *Asplenium platyneuron* (ebony spleenwort), *Botrychium virginianum* (rattlesnake fern), *Dioscorea quaternata* (fourleaf yam), *Goodyera pubescens* (downy rattlesnake plantain), *Rubus argutus* (sawtooth blackberry), *Sanicula canadensis* (Canadian blacksnakeroot), *Viola sororia* (common blue violet), and *Viola walteri* (prostrate blue violet). In addition, this community supports state-vulnerable *Collinsonia tuberosa* (deepwoods horsebalm).

Global Vegetation: The canopy, subcanopy, shrub, and herbaceous layers of stands of this association are often well-developed. Dominant canopy species always include *Liquidambar styraciflua* (sweetgum) and *Liriodendron tulipifera* (tuliptree), while *Acer barbatum* (southern sugar maple) (in the southern part of the range) and *Acer rubrum var. rubrum* (red maple) may also make up significant amounts of the canopy. This community type exists as a continuum between two subtypes, i.e., the tuliptree subtype and the sweetgum subtype. In some examples, only one or the other dominates the canopy. However, in many examples, both are equally dominant. Other common

species in the canopy and understory include *Ilex opaca var. opaca* (American holly), *Aesculus sylvatica* (painted buckeye), *Carpinus caroliniana ssp. caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), *Fagus grandifolia* (American beech), *Juglans nigra* (black walnut), *Morus rubra var. rubra* (red mulberry), *Ostrya virginiana var. virginiana* (hophornbeam), *Oxydendrum arboreum* (sourwood), *Pinus echinata* (shortleaf pine), *Prunus serotina var. serotina* (black cherry), *Quercus alba* (white oak), *Quercus rubra var. rubra* (northern red oak), *Ulmus rubra* (slippery elm), *Ulmus americana* (American elm), *Ulmus alata* (winged elm), *Juniperus virginiana var. virginiana* (eastern red-cedar), *Nyssa sylvatica* (blackgum), *Fraxinus americana* (white ash), *Halesia tetraptera var. tetraptera* (mountain silverbell), *Arundinaria gigantea ssp. gigantea* (giant cane), and *Fraxinus pennsylvanica* (green ash). Scattered individuals of *Platanus occidentalis* (American sycamore) and *Betula nigra* (river birch) may also occur in some stands. *Euonymus americanus* (strawberry bush), *Lindera benzoin var. benzoin* (northern spicebush), and *Corylus americana* (American hazelnut) are common and dominant in the shrub layer. Other shrub species that may be present include *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum nudum var. nudum* (possumhaw), *Viburnum prunifolium* (blackhaw), *Viburnum rufidulum* (rusty blackhaw), *Hamamelis virginiana* (American witch-hazel), *Asimina triloba* (pawpaw), and *Ilex decidua* (possum-haw), among others. On the most acidic sites of the Maryland Coastal Plain, *Clethra alnifolia* (coastal sweet-pepperbush), *Vaccinium corymbosum* (highbush blueberry), and *Magnolia virginiana* (sweetbay) may be present. Vines are prominent and include *Vitis rotundifolia* (muscadine), *Apios americana* (groundnut), *Campsis radicans* (trumpet creeper), *Aristolochia* macrophylla (pipevine), Bignonia capreolata (crossvine), Dioscorea quaternata (fourleaf yam), Gelsemium sempervirens (evening trumpetflower), Parthenocissus quinquefolia (Virginia creeper), Campsis radicans (trumpet creeper), Passiflora lutea (yellow passionflower), Smilax bona-nox (saw greenbrier), Smilax glauca (cat greenbrier), Smilax hugeri (Huger's carrionflower), Smilax rotundifolia (roundleaf greenbrier), and Toxicodendron radicans ssp. radicans (eastern poison-ivy). The herbaceous layer is species-rich and often has good sedge development. Common species in this layer include Thalictrum thalictroides (rue-anemone), Trillium cuneatum (little sweet Betsy), Arisaema triphyllum (Jack in the pulpit), Asplenium platyneuron var. platyneuron (ebony spleenwort), Botrychium virginianum (rattlesnake fern), Carex (sedge) spp., Carex impressinervia (ravine sedge), Carex striatula (lined sedge), Cinna arundinacea (sweet woodreed), Elymus virginicus (Virginia wildrye), Galium circaezans (licorice bedstraw), Geum (avens) canadense, Medeola virginiana (Indian cucumber), Polystichum acrostichoides (Christmas fern), and Scutellaria integrifolia (helmet flower), among many others. Thelypteris noveboracensis (New York fern) is a common patch-dominant in the northern part of the range and the Uwharrie Mountains of North Carolina. The exotics Microstegium vimineum (Nepalese browntop), Ligustrum sinense (Chinese privet), and Lonicera japonica (Japanese honeysuckle) are common in this community. Other exotics that colonize quickly in disturbed and fragmented versions of this association include Wisteria sinensis (Chinese wisteria), Rosa multiflora (multiflora rose), Clematis terniflora (sweet autumn virginsbower), Hedera helix (English ivy), and Elaeagnus (elaeagnus) sp.

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Liquidambar styraciflua (sweetgum), Quercus alba (white oak)*
Tree canopy	Broad-leaved deciduous tree	*Liriodendron tulipifera (tuliptree)*
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Carpinus caroliniana (American hornbeam), Lindera benzoin (northern spicebush)*
Herb (field)	Vine/Liana	*Decumaria barbara (woodvamp), Vitis rotundifolia (muscadine)*

Global Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Liquidambar styraciflua (sweetgum), Liriodendron tulipifera (tuliptree)*

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Carpinus caroliniana* (American hornbeam), *Decumaria barbara* (woodvamp), *Lindera benzoin* (northern spicebush), *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Quercus alba* (white oak), *Vitis rotundifolia* (muscadine)

Global: *Arisaema triphyllum* (Jack in the pulpit), *Asplenium platyneuron* (ebony spleenwort), *Botrychium virginianum* (rattlesnake fern), *Campsis radicans* (trumpet creeper), *Carex striatula* (lined sedge), *Cinna arundinacea* (sweet woodreed), *Corylus americana* (American hazelnut), *Elymus virginicus* (Virginia wildrye), *Euonymus americanus* (strawberry bush), *Galium circaezans* (licorice bedstraw), *Geum canadense* (white avens), *Lindera benzoin* (northern spicebush), *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Medeola virginiana* (Indian cucumber), *Polystichum acrostichoides* (Christmas fern), *Scutellaria integrifolia* (helmet flower), *Smilax rotundifolia* (roundleaf greenbrier), *Thalictrum thalictroides* (rue-anemone), *Toxicodendron radicans* (eastern poison-ivy), *Trillium cuneatum* (little sweet Betsy)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Clematis terniflora (sweet autumn virginsbower)	-	invasive/exotic
Elaeagnus pungens (thorny olive)	Low/Insignificant	invasive/exotic
Ligustrum sinense (Chinese privet)	High/Medium	invasive/exotic
Lonicera fragrantissima (sweet breath of spring)	-	invasive/exotic
Lonicera japonica (Japanese honeysuckle)	High/Medium	invasive/exotic

Other Plant Species	GRank	Note
Collinsonia tuberosa (deepwoods horsebalm)	G3G4	GA state-vulnerable

Global

Exotic and Invasive Species	I-Rank	Note
Clematis terniflora (sweet autumn virginsbower)	-	invasive exotic
Hedera helix (English ivy)	High/Medium	Invasive exotic
Ligustrum sinense (Chinese privet)	High/Medium	invasive exotic
Lonicera japonica (Japanese honeysuckle)	High/Medium	invasive exotic
Microstegium vimineum (Nepalese browntop)	High/Medium	invasive exotic
Rosa multiflora (multiflora rose)	Medium/Low	invasive exotic
Wisteria sinensis (Chinese wisteria)	Medium invasive e	exotic

Other Plant Species	GRank	Note
Carex impressinervia (ravine sedge)	G2	globally imperiled

Conservation Status

Global Rank & Reasons: G4 (15-Feb-2007). This community is widespread from the Coastal Plain of Maryland and Virginia through the Piedmont of Virginia and North Carolina to the Cumberland Plateau. Very few streams supporting this type have impoundments or diversions, and most are protected by wetland regulations. However, few, if any, pristine examples remain, and all are highly threatened by invasive exotic species that have colonized most of the remaining examples of this association.

Classification

Status: Standard

Classification Confidence: 3 - Weak

Global Comments: At Chickamauga-Chattanooga National Military Park, this association was observed on Lookout Creek, but no plot data were taken. Low-quality occurrences of this type may look very similar to some occurrences of *Liquidambar styraciflua - (Liriodendron tulipifera)* Temporarily Flooded Forest (CEGL007330). The presence of higher quality patches of native herbs and stands of native shrubs such as *Lindera benzoin* is the best way to distinguish these two types. In addition, stands of CEGL007330 will generally be more even-aged and single species-dominated than this association (CEGL004418).

Global Similar Associations:

• *Betula nigra - Acer rubrum - (Liquidambar styraciflua, Platanus occidentalis)* Successional Forest (CEGL006976)

• *Liquidambar styraciflua - (Liriodendron tulipifera)* Temporarily Flooded Forest (CEGL007330)--occurs in the same habitat but is a highly impacted version of this forest that occurs on old farm fields and other second-growth areas.
• *Liquidambar styraciflua* Forest (CEGL007216)
• *Liriodendron tulipifera - Acer (rubrum, negundo) - (Platanus occidentalis) / Carpinus caroliniana / Polygonum virginianum* Forest (CEGL006492)

Global Related Concepts:
• *Liquidambar styraciflua - Quercus palustris / Carpinus caroliniana / Carex intumescens* Forest (Meininger and McCarthy 1998) ?
• Maple-Gum Association of the Western Shore District (Shreve et al. 1910) B

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: Four plots representing this association were taken from Kennesaw Mountain NBP. Two plots were taken in the central portion of the park adjacent to Noses Creek. One plot was sampled from a bottomland off the primary loop trail beginning less than 0.5 mile from the Pigeon Hill parking area. One plot was sampled from the Cheatham Hill area less than 0.25 mile from the Cheatham Hill parking area headed north along the trail. There is a moderate probability for other occurrences within this park south of Burnt Hickory Road along streams in areas where vegetation has remained relatively undisturbed for several decades.

Global Range: This association is found in the Chesapeake Bay Lowlands, the Piedmont, and other low-elevation interior ecoregions (e.g., parts of the Cumberland Plateau and Ridge and Valley). It is defined as being absent from the Mid-Atlantic Coastal Plain of southeastern Virginia, the Carolinas, and Georgia. Its status in the Upper East Gulf Coastal Plain is unknown.

Nations: US

States/Provinces: DC, GA, MD, NC, SC?, TN, VA

TNC Ecoregions: 50:C, 52:C, 58:C

USFS Ecoregions: 231Ad:CCC, 231Ae:CCC, 231Af:CCC, 231Ak:CCC, 231An:CCC, 231Cc:CCC, 232Ad:CCC, 232Br:CCC

Federal Lands: DOD (Fort Belvoir); NPS (Chickamauga-Chattanooga, Colonial, Cowpens, Fredericksburg-Spotsylvania, Guilford Courthouse, Kennesaw Mountain, Kings Mountain, National Capital-East, Petersburg, Prince William, Richmond, Thomas Stone); USFS (Uwharrie)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: KEMO.05, KEMO.19, KEMO.20, KEMO.29.

Local Description Authors: M.J. Russo and L. Echols

Global Description Authors: R.K. Peet, mod. R. White, M. Pyne, G.P. Fleming

References: Fleming et al. 2001, Meininger and McCarthy 1998, Naczi et al. 2002, Peet et al. unpubl. data 2002, Schafale and Weakley 1990, Shreve et al. 1910, Southeastern Ecology Working Group n.d.

Platanus occidentalis - (Fraxinus pennsylvanica, Celtis laevigata, Acer saccharinum) Temporarily Flooded Forest Alliance (A.288)

Alliance Concept

Summary: Forests in this alliance occur on the fronts, terraces, and levees of small, medium and large rivers of the Atlantic Coastal Plain, Southern Ridge and Valley, Interior Low Plateau, Ozark Highlands, Ouachita Mountains, Arkansas Valley, East and West Gulf coastal plains, Mississippi River Alluvial Plain, Cumberland Plateau, Southern Blue Ridge, and lower Piedmont. These forests are dominated by Platanus occidentalis (American sycamore) or a mixture of it with Fraxinus pennsylvanica (green ash), Celtis laevigata (sugarberry), and Acer saccharinum (silver maple), as well as Acer negundo (box-elder), Ulmus americana (American elm), Liquidambar styraciflua (sweetgum), Ulmus alata (winged elm), Planera aquatica (planertree), Juglans nigra (black walnut), Celtis occidentalis (common hackberry), Carya illinoinensis (pecan), Quercus nigra (water oak), Salix nigra (black willow), Carya cordiformis (bitternut hickory), Quercus pagoda (cherrybark oak), and Carya aquatica (water hickory). The understory may be dense and typically contains Asimina triloba (pawpaw), Crataegus viridis (green hawthorn), Crataegus spathulata (littlehip hawthorn), and Lindera benzoin (northern spicebush). Herbaceous species that may be present include Elymus virginicus (Virginia wildrye), Carex grayi (Gray's sedge), Carex lupulina (hop sedge), Carex abscondita (thicket sedge), Chasmanthium latifolium (Indian woodoats), Boehmeria cylindrica (small-spike false nettle), Polygonum virginianum (jumpseed), Elymus virginicus (Virginia wildrye), Pilea pumila (Canadian clearweed), Leersia lenticularis (catchfly grass), and others. Vines may be abundant and species include Bignonia capreolata (crossvine), Toxicodendron radicans (eastern poison-ivy), and Smilax tamnoides (bristly greenbrier). This alliance does not include typical alluvial forests of the upper Piedmont and Blue Ridge, but forests in this alliance may occur in these areas in restricted calcareous situations. In Arkansas, these forests occur during point bar succession as intermediates between forests dominated by Salix (willow) and Populus (cottonwood), and those dominated by Carya illinoinensis (pecan). In Kentucky and Arkansas, Fraxinus americana (white ash), Fraxinus pennsylvanica (green ash), Ulmus rubra (slippery elm), and Ulmus americana (American elm) are common in these forests. According to K. Ribbeck (pers. comm.) "Sycamore - River Birch - Silver Maple" forests of the Pearl River in Louisiana are included here.

Classification Comments: The relationship between this alliance and the *Fraxinus pennsylvanica - Ulmus americana - Celtis (occidentalis, laevigata)* Temporarily Flooded Forest Alliance (A.286) needs to be defined more clearly. It appears that this alliance (A.288) may be more northern in distribution and more often located closer to the river and in areas of more active deposition, but further research is needed. In Texas, where *Acer saccharinum* is absent, these forests occur on the Sabine and Neches rivers. In Arkansas, forests in this alliance that are dominated by *Celtis laevigata, Platanus occidentalis*, and *Carya illinoinensis* occur in areas with flowing water, active deposition, and lots of meandering; still water and lesser deposition are needed for succession to oaks (T. Foti pers. comm.).

Similar Alliances:

• *Acer saccharinum* Temporarily Flooded Forest Alliance (A.279)--with stronger dominance by *Acer saccharinum*.

• *Fraxinus pennsylvanica - Ulmus americana - Celtis (occidentalis, laevigata)* Temporarily Flooded Forest Alliance (A.286)
• *Platanus occidentalis - (Liquidambar styraciflua, Liriodendron tulipifera)* Temporarily Flooded Forest Alliance (A.289)

Similar Alliance Comments: Is this alliance (A.288) in a more base-rich and/or lower gradient environment than A.289?

Related Concepts:
• Alluvial forest (Evans 1991) I
• IIA7g. Sycamore - Sweetgum - American Elm Riverfront Forest (Allard 1990) I
• Riparian forest (Evans 1991) I
• Sycamore - Sweetgum - American Elm: 94 (Eyre 1980) I
• Sycamore-Willow Series (Diamond 1993) I

Alliance Description

Environment: Forests in this alliance occur on fronts, terraces, and levees of small, medium and large rivers, particularly where there are base-rich inputs to the sediments. In Arkansas, these forests occur during point bar succession as intermediates between forests dominated by *Salix* and *Populus*, and those dominated by *Carya illinoinensis* (T. Foti pers. comm.).

Vegetation: These forests are dominated by *Platanus occidentalis* (American sycamore) or a mixture of it with *Fraxinus pennsylvanica* (green ash), *Celtis laevigata* (sugarberry), and *Acer saccharinum* (silver maple), as well as *Acer negundo* (box-elder), *Ulmus americana* (American elm), *Liquidambar styraciflua* (sweetgum), *Ulmus alata* (winged elm), *Planera aquatica* (planertree), *Juglans nigra* (black walnut), *Celtis occidentalis* (common hackberry), *Carya illinoinensis* (pecan), *Quercus nigra* (water oak), *Salix nigra* (black willow), *Carya cordiformis* (bitternut hickory), *Quercus pagoda* (cherrybark oak), and *Carya aquatica* (water hickory). *Asimina triloba* (pawpaw), *Crataegus viridis* (green hawthorn), *Crataegus spathulata* (littlehip hawthorn), and *Lindera benzoin* (northern spicebush) may be fairly dense in the understory. Herbaceous species that may be present include *Elymus virginicus* (Virginia wildrye), *Carex grayi* (Gray's sedge), *Carex lupulina* (hop sedge), *Carex abscondita* (thicket sedge), *Chasmanthium latifolium* (Indian woodoats), *Boehmeria cylindrica* (small-spike false nettle), *Polygonum virginianum* (jumpseed), *Elymus virginicus* (Virginia wildrye), *Pilea pumila* (Canadian clearweed), *Leersia lenticularis* (catchfly grass), and others. Vines may be abundant and species include *Bignonia capreolata* (crossvine), *Toxicodendron radicans* (eastern poison-ivy), and *Smilax tamnoides* (bristly greenbrier). In Kentucky and Arkansas, *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), *Ulmus rubra* (slippery elm), and *Ulmus americana* (American elm) are common in these forests. In the Cumberland Plateau of Alabama, *Platanus occidentalis* (American sycamore) is codominant with *Celtis laevigata* (sugarberry) and *Liriodendron tulipifera* (tuliptree).

Alliance Distribution

Range: Forests in this alliance occur on the fronts, terraces, and levees of small, medium and large rivers of the Atlantic Coastal Plain, Southern Ridge and Valley, Cumberland Plateau, Interior Low Plateau, Ozark Highlands, Ouachita Mountains, Arkansas Valley, East and West Gulf coastal plains, Mississippi River Alluvial Plain, and lower Piedmont. It also ranges into the southern midwestern United States. This alliance does not include typical alluvial forests of the

upper Piedmont and Blue Ridge, but forests in this alliance may occur in these areas in restricted calcareous situations.

Subnations: AL, AR, CT, DC, DE, GA, IN, KY, LA, MA, MD, MO, MS, NC, NH, NJ, NY, OH, PA, RI, SC, TN, TX, VA, VT, WV **TNC Ecoregions:** 24:C, 29:C, 31:C, 32:?, 37:C, 38:C, 39:P, 40:C, 41:C, 42:C, 43:C, 44:C, 45:C, 49:C, 50:C, 51:C, 52:C, 53:C, 56:C, 57:C, 58:C, 59:C, 60:C, 61:C, 63:C **USFS Ecoregions:** 212E:C?, 212Fb:CCP, 212Fc:CCC, 221Af:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Ea:CCC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCP, 221Eg:CCC, 221Fa:CCC, 221Ha:CCC, 221Hc:CCC, 221He:CCC, 222Ab:CCC, 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Ah:CCC, 222Aj:CCC, 222Ak:CCC, 222Am:CCC, 222An:CCC, 222Cb:CCP, 222Cd:CCP, 222Ce:CCP, 222Cg:CCC, 222De:CCP, 222Dg:CCC, 222Dj:CCC, 222Eb:CCC, 222Ec:CCC, 222Ed:CCP, 222Eg:CCC, 222Eh:CCP, 222Em:CCP, 222En:CCC, 222Eo:CCC, 222Fa:CCC, 222Fb:CCC, 222Fc:CCC, 222Fd:CCC, 222Hb:CCC, 222Hf:CCC, 222I:C?, 222O:C?, 231Aa:CCC, 231Ae:CCC, 231Af:CCC, 231Ak:CCP, 231Al:CCC, 231Ap:CCC, 231Ba:CCP, 231Bc:CCP, 231Bd:CCP, 231Be:CCC, 231Bg:CCP, 231Bh:CCC, 231Bj:CCP, 231Bk:CCP, 231Bl:CCP, 231Cd:CCC, 231Da:CCC, 231Dc:CCC, 231Ef:CCC, 231Eg:CCP, 231Eh:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Ad:CCC, 232Bb:CCC, 232Bj:CCC, 232Bk:CCP, 232Bl:CCP, 232Bq:CCC, 232Br:CCP, 232Bs:CCC, 232Bu:CCP, 232Bv:CCP, 232Ca:CPP, 232Fa:CCP, 232Fb:CCP, 232Fc:CCP, 232Fd:CCP, 234Aa:CCP, 234Ab:CC?, 234Ac:CCC, 234Ae:CCP, 234Ag:CCC, 234Ah:CC?, 234Ai:CCP, 234Am:CCC, 234An:CCC, 251Cd:CPP, 251Eb:CCC, 255Da:CCP, 255Db:CCC, 315:C, M212Bd:CCC, M221Aa:CCC, M221Ab:CCC, M221Cd:CCC, M221Da:CCC, M221Db:CCP, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231:P **Federal Lands:** BIA (Eastern Band of Cherokee); DOD (Arnold, Fort Benning); NPS (Abe Lincoln Birthplace, Antietam, Blue Ridge Parkway, Buffalo River, C&O Canal, Chattahoochee River, Chickamauga-Chattanooga, Congaree Swamp, Delaware Water Gap, Eisenhower, Fort Donelson, Friendship Hill, George Washington Parkway, Gettysburg, Great Smoky Mountains, Harpers Ferry, Kennesaw Mountain, Mammoth Cave, Manassas, Monocacy, Natchez Trace, National Capital-East, Ninety Six, Ocmulgee, Ozark Riverways, Rock Creek, Russell Cave, Shiloh, Upper Delaware, Valley Forge, Vicksburg); USFS (Angelina, Bankhead, Bienville, Chattahoochee, Daniel Boone, Davy Crockett, De Soto, Delta?, George Washington, Holly Springs, Homochitto, Hoosier, Jefferson, Kisatchie, Mark Twain, Oconee, Ozark, Pisgah?, Sabine, Sam Houston, St. Francis?, Tombigbee?, Tuskegee, Wayne?); USFWS (Erie, San Bernard?)

(CEGL007730) American Sycamore - Sugarberry - Green Ash Floodplain Forest

Platanus occidentalis - Celtis laevigata - Fraxinus pennsylvanica / Lindera benzoin - Ilex decidua / Carex retroflexa Forest

American Sycamore - Sugarberry - Green Ash / Northern Spicebush - Possum-haw / Reflexed Sedge Forest

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Temporarily flooded cold-deciduous forest (I.B.2.N.d.)
Alliance	*Platanus occidentalis - (Fraxinus pennsylvanica, Celtis laevigata, Acer saccharinum)* Temporarily Flooded Forest Alliance (A.288)

Alliance (English name)	American Sycamore - (Green Ash, Sugarberry, Silver Maple) Temporarily Flooded Forest Alliance
Association	*Platanus occidentalis - Celtis laevigata - Fraxinus pennsylvanica / Lindera benzoin - Ilex decidua / Carex retroflexa* Forest
Association (English name)	American Sycamore - Sugarberry - Green Ash / Northern Spicebush - Possum-haw / Reflexed Sedge Forest Association (Common name) American Sycamore - Sugarberry - Green Ash Floodplain Forest
Ecological System(s):	Atlantic Coastal Plain Small Brownwater River Floodplain Forest (CES203.250) Southern Piedmont Small Floodplain and Riparian Forest (CES202.323) Southern Atlantic Coastal Plain Large River Floodplain Forest (CES203.066)

Element Concept

Global Summary: This forest association occurs on terraces of associated rivers and large creeks in the Mid-Atlantic Coastal Plain, lower Piedmont, and possibly in adjacent regions. These are relatively more well-drained than the adjacent flats. The mostly closed canopy of this community is dominated by *Platanus occidentalis* (American sycamore), *Celtis laevigata* (sugarberry), and *Fraxinus pennsylvanica* (green ash). These species, along with *Acer negundo* (box-elder), are important in the well-developed subcanopy also. Other tree species are possible in these strata; these include *Crataegus viridis* (green hawthorn), *Juglans nigra* (black walnut), *Acer saccharinum* (silver maple), *Morus rubra* (red mulberry), *Ilex decidua* (possum-haw), *Ulmus americana* (American elm), *Planera aquatica* (planertree), *Quercus laurifolia* (laurel oak), *Quercus nigra* (water oak), *Liquidambar styraciflua* (sweetgum), *Populus deltoides* (eastern cottonwood), *Carya aquatica* (water hickory), and others. The shrub layer generally is sparse and is dominated by *Lindera benzoin* (northern spicebush), *Ilex decidua* (possum-haw), *Asimina triloba* (pawpaw), and likely other species as well. Some examples of this community also have patches of *Arundinaria gigantea* (giant cane) in spots. The herbaceous layer is typically sparse to moderate and constant species are *Boehmeria cylindrica* (small-spike false nettle), *Carex grayi* (Gray's sedge), *Carex retroflexa* (reflexed sedge), and *Viola* (violet) spp. Other typical species include *Botrychium dissectum* (cutleaf grapefern), *Carex frankii* (Frank's sedge), *Carex lupulina* (hop sedge), *Chasmanthium latifolium* (Indian woodoats), *Onoclea sensibilis* (sensitive fern), *Pilea pumila* (Canadian clearweed), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum virginianum* (jumpseed), and others. The vine stratum is moderate and many species are possible. Among these are *Bignonia capreolata* (crossvine), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax tamnoides* (bristly greenbrier), *Vitis rotundifolia* (muscadine), *Ampelopsis arborea* (peppervine), *Berchemia scandens* (Alabama supplejack), *Gelsemium sempervirens* (evening trumpetflower), and *Toxicodendron radicans* (eastern poison-ivy). Exotic species such as *Ligustrum sinense* (Chinese privet), *Lonicera japonica* (Japanese honeysuckle), and *Microstegium vimineum* (Nepalese browntop) may invade stands of this association, and increase following disturbance. This forest type is documented in the Mid-Atlantic Coastal Plain (and lower Piedmont) but is possible in adjacent regions; global distribution needs assessment.

Environmental Description

USFWS Wetland System: Palustrine

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This sycamore - sugarberry - green ash forest was sampled three times at Chattahoochee River. The sites are flat to gently sloping, temporarily flooded bottomlands and alluvial terraces at 260-275 m (845-900 feet) elevation. Soils are mesic,

moderately well-drained to somewhat poorly drained loam, sandy loam and clay, respectively. The unvegetated surface is dominated by leaf litter (88-92% cover) with some wood (2-10%) and bare soil (1-6%). Evidence of disturbance includes the presence of invasive exotic plants.
Global Environment: This forest occurs on terraces of associated rivers and on well-drained bottoms of creeks in the Mid-Atlantic Coastal Plain, lower Piedmont, and possibly in adjacent regions. These terraces are relatively more well-drained than the adjacent flats.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderately dense (70% cover) tree canopy, 20-35 m tall, is dominated by various combinations of *Celtis laevigata* (sugarberry), *Fraxinus pennsylvanica* (green ash), *Juglans nigra* (black walnut), *Liriodendron tulipifera* (tuliptree), and *Platanus occidentalis* (American sycamore); additional canopy species may include *Betula nigra* (river birch), *Carya cordiformis* (bitternut hickory), *Liquidambar styraciflua* (sweetgum), *Pinus taeda* (loblolly pine), *Quercus nigra* (water oak), and *Quercus rubra* (northern red oak). The sparse (30-40%) subcanopy (10-20 m) may include canopy species as well as *Acer barbatum* (southern sugar maple), *Carpinus caroliniana* (American hornbeam), *Fagus grandifolia* (American beech), *Halesia tetraptera* (mountain silverbell), *Morus rubra* (red mulberry), *Ostrya virginiana* (hophornbeam), and *Ulmus rubra* (slippery elm). Dominants in the moderate (40-60%) tall-shrub layer (5-10 m) include *Acer barbatum* (southern sugar maple), *Carpinus caroliniana* (American hornbeam), *Lindera benzoin* (northern spicebush), *Morus rubra* (red mulberry), and the exotic *Ligustrum sinense* (Chinese privet). The sparse to dense (40-80%) short-shrub layer (1-2 m) may include tall-shrub species along with *Asimina triloba* (pawpaw), *Staphylea trifolia* (American bladdernut), and *Toxicodendron radicans* (eastern poison-ivy). Herbs in the sparse (20-30%) herbaceous layer include *Ageratina altissima* (white snakeroot), *Bignonia capreolata* (crossvine), *Botrychium biternatum* (sparselobe grapefern), *Chasmanthium latifolium* (Indian woodoats), *Chasmanthium laxum* (slender woodoats), *Elephantopus carolinianus* (Carolina elephantsfoot), *Geum canadense* (white avens), *Laportea canadensis* (Canadian woodnettle), *Onoclea sensibilis* (sensitive fern), *Passiflora lutea* (yellow passionflower), *Polystichum acrostichoides* (Christmas fern), and *Verbesina occidentalis* (yellow crownbeard). Vines include *Decumaria barbara* (woodvamp), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis rotundifolia* (muscadine).

Global Vegetation: The mostly closed canopy of this community is dominated by *Platanus occidentalis* (American sycamore), *Celtis laevigata* (sugarberry), and *Fraxinus pennsylvanica* (green ash). These species, along with *Acer negundo* (box-elder), are important in the well-developed subcanopy also. Other tree species are possible in these strata and include *Crataegus viridis* (green hawthorn), *Juglans nigra* (black walnut), *Acer saccharinum* (silver maple), *Morus rubra* (red mulberry), *Ilex decidua* (possum-haw), *Ulmus americana* (American elm), *Planera aquatica* (planertree), *Quercus laurifolia* (laurel oak), *Liquidambar styraciflua* (sweetgum), *Carya aquatica* (water hickory), and others. The shrub layer generally is sparse and is dominated by *Lindera benzoin* (northern spicebush), *Ilex decidua* (possum-haw), *Asimina triloba* (pawpaw), and likely other species as well. *Acer barbatum* (southern sugar maple) may be an important shrub-layer component at the southern end of this community's range. Some examples of this community also have patches of *Arundinaria gigantea* (giant cane) in spots. The herbaceous layer is typically sparse; constant species are *Boehmeria cylindrica* (small-spike false nettle), *Carex grayi* (Gray's sedge), *Carex retroflexa* (reflexed sedge), and *Viola* (violet) spp. Other

typical species include *Botrychium dissectum* (cutleaf grapefern), *Carex lupulina* (hop sedge), *Chasmanthium latifolium* (Indian woodoats), *Onoclea sensibilis* (sensitive fern), *Pilea pumila* (Canadian clearweed), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum virginianum* (jumpseed), and others. The vine stratum is moderate and many species are possible. Among these are *Bignonia capreolata* (crossvine), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax tamnoides* (bristly greenbrier), *Vitis rotundifolia* (muscadine), and *Toxicodendron radicans* (eastern poison-ivy). Exotic species such as *Ligustrum sinense* (Chinese privet), *Lonicera japonica* (Japanese honeysuckle), and *Microstegium vimineum* (Nepalese browntop) may invade stands of this association and increase following disturbance.

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Celtis laevigata (sugarberry), Fraxinus pennsylvanica (green ash), Juglans nigra (black walnut), Liriodendron tulipifera (tuliptree)*
Tree subcanopy	Broad-leaved deciduous tree	*Carpinus caroliniana (American hornbeam), Morus rubra (red mulberry), Ulmus rubra (slippery elm)*
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Acer barbatum (southern sugar maple), Carpinus caroliniana (American hornbeam), Halesia tetraptera (mountain silverbell)*
Tall shrub/sapling	Broad-leaved deciduous shrub	*Morus rubra (red mulberry)*
Short shrub/sapling	Broad-leaved deciduous shrub	*Lindera benzoin (northern spicebush), Staphylea trifolia (American bladdernut)*

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Acer barbatum* (southern sugar maple), *Carpinus caroliniana* (American hornbeam), *Celtis laevigata* (sugarberry), *Fraxinus pennsylvanica* (green ash), *Halesia tetraptera* (mountain silverbell), *Juglans nigra* (black walnut), *Lindera benzoin* (northern spicebush), *Liriodendron tulipifera* (tuliptree), *Morus rubra* (red mulberry), *Staphylea trifolia* (American bladdernut), *Toxicodendron radicans* (eastern poison-ivy), *Ulmus rubra* (slippery elm)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Elaeagnus pungens (thorny olive)	Low/Insignificant	invasive/exotic
Hedera helix (English ivy)	High/Medium	invasive/exotic
Ligustrum sinense (Chinese privet)	High/Medium	invasive/exotic
Lonicera japonica (Japanese honeysuckle)	High/Medium	invasive/exotic
Rosa multiflora (multiflora rose)	Medium/Low	invasive/exotic

Global Exotic and Invasive Species	I-Rank	Note
Ligustrum sinense (Chinese privet)	High/Medium	invasive/exotic
Lonicera japonica (Japanese honeysuckle)	High/Medium	invasive/exotic
Microstegium vimineum (Nepalese browntop)	High/Medium	invasive/exotic

Conservation Status Rank

Global Rank & Reasons: G4? (9-Oct-2001). This community type is globally relatively secure (TNC 1998b). This community, and other types of floodplain forests, are threatened by alteration of the hydroperiod by artificial impoundments or river diversion projects, or the disruption of the floodplain communities by forestry or agriculture. Exotic species such as *Ligustrum sinense, Lonicera japonica,* and *Microstegium vimineum* may invade stands of this association, and increase following disturbance.

Classification

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This association was described based on 1998 data from the Congaree Swamp National Monument. The exotics *Ligustrum sinense* and *Microstegium vimineum* may be dominant in occurrences of this community.

Global Similar Associations:
• *Celtis laevigata - Fraxinus pennsylvanica - Acer negundo - (Juglans nigra) / Asimina triloba / Carex grayi* Forest (CEGL004740)--is without dominance by *Platanus*.
• *Platanus occidentalis - Liquidambar styraciflua / Carpinus caroliniana - Asimina triloba* Forest (CEGL007340)--is somewhat overlapping in range, in different alliance (A.289) and does not generally contain *Acer negundo* or *Fraxinus pennsylvanica*.

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: Three plots representing this association were sampled from two park units within Chattahoochee River NRA. One plot was collected within a bottomland adjacent to a creek less than 0.5 mile from the Suwanee Creek entrance to the right of the trail, along the eastern edge of the park unit. Two plots were sampled from Medlock Bridge along river terraces at the eastern edge of the park unit adjacent to the Chattahoochee River. There is a moderate potential for additional occurrences of this type, given the abundance of alluvial terrace habitat within the park. However, it does not appear to be as common as other alluvial forest types sampled.

Global Range: This forest type is documented in the Mid-Atlantic Coastal Plain and lower Piedmont, but is possible in adjacent regions; global distribution needs assessment.

Nations: US

States/Provinces: GA, MS?, NC?, SC, VA?

TNC Ecoregions: 52:C, 53:P, 56:C, 57:C

USFS Ecoregions: 231Aa:CCC, 232Bq:CCC, 232Bs:CCC

Federal Lands: NPS (Chattahoochee River, Congaree Swamp, Ninety Six, Ocmulgee); USFS (De Soto?, Homochitto?, Oconee)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: CHAT.49, CHAT.65, CHAT.66.

Local Description Authors: M.J. Russo and L. Echols Global Description Authors: S. Landaal

References: NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Southeastern Ecology Working Group n.d., TNC 1998b

Saturated cold-deciduous forest (I.B.2.N.g.)

Acer rubrum - Nyssa sylvatica Saturated Forest Alliance (A.348)

Alliance Concept

Summary: This alliance covers deciduous forested acidic seeps, saturated swamp forests, and "basin swamps" of the eastern and southeastern United States. These wetland forests occur where surface water is seldom present, but the substrate is saturated to the surface for extended periods during the growing season. They include forested acidic seeps on hillsides or streamheads, on edges of floodplains, and other poorly drained depressions. Individual occurrences of these forests tend to be small in extent and can provide habitat for rare plant species. Forests in this alliance have variable canopy composition, but *Acer rubrum* (red maple) and *Nyssa sylvatica* (blackgum) are common components. Canopy composition differs from the surrounding upland and varies with geography. Typical canopy species across the range of this alliance include *Acer rubrum var. trilobum* (red maple), *Nyssa sylvatica* (blackgum), and *Liquidambar styraciflua* (sweetgum). Understory and shrub species include *Alnus serrulata* (hazel alder), *Ilex opaca var. opaca* (American holly), *Photinia pyrifolia* (red chokeberry), and *Ilex verticillata* (common winterberry). Characteristic herbaceous species are *Osmunda cinnamomea* (cinnamon fern) and *Osmunda regalis* (royal fern). *Sphagnum* (sphagnum) spp. are typical.

Classification Comments: This alliance may only cover a portion of the variation in wooded seeps in Arkansas, where a calcareous shale and a sandstone seep type need to be defined (D. Zollner pers. comm.).

Similar Alliances:
• *Acer rubrum - Fraxinus pennsylvanica* Saturated Forest Alliance (A.3035)
• *Acer rubrum* Saturated Woodland Alliance (A.657)
• *Magnolia virginiana - Nyssa biflora - (Quercus laurifolia)* Saturated Forest Alliance (A.378)
• *Nyssa biflora - Acer rubrum - (Liriodendron tulipifera)* Saturated Forest Alliance (A.351)--includes similar forests, but with *Nyssa biflora*, typically found in the Coastal Plain to the east and south of this (A.348) alliance's range.
• *Pinus rigida - Acer rubrum* Saturated Forest Alliance (A.3005)
• *Quercus laurifolia - Nyssa biflora* Saturated Forest Alliance (A.352)

Related Concepts:
• Acidic Broadleaf Swamp (Smith 1991) ?
• Appalachian acid seep (Evans 1991) I
• Black Gum Swamp (Swain and Kearsley 2001) ?
• Boggy Streamside Seep (Schafale pers. comm.) ?
• Circumneutral Broadleaf Swamp (Smith 1991) I
• Coastal Plain / Piedmont Acidic Seepage Swamp (Schafale pers. comm.) ?
• Cretaceous Hills forested acid seep (Evans 1991) ?
• IIA9a. Forested Mountain Seep (Allard 1990) I
• Low Elevation Seep (Schafale and Weakley 1990) ?
• Red Maple Swamp (Swain and Kearsley 2001) ?

• Red maple - black gum palustrine forest (Fike 1999) ?
• Wooded Seep (Foti 1994b) I

Alliance Description

Environment: These wetland forests occur where surface water is seldom present, but the substrate is saturated to the surface for extended periods during the growing season, and include forested acidic seeps on hillsides or streamheads, on edges of floodplains, and other poorly drained depressions. Individual occurrences of these forests tend to be small in extent, and can provide habitat for rare plant species.

Vegetation: Forests in this alliance have variable canopy composition, but *Acer rubrum* (red maple) and *Nyssa sylvatica* (blackgum) are common components. Canopy composition differs from the surrounding upland and varies with geography. Typical canopy species across the range of this alliance include *Acer rubrum var. trilobum* (red maple), *Nyssa sylvatica* (blackgum), and *Liquidambar styraciflua* (sweetgum). Associations placed in this alliance generally contain *Nyssa sylvatica* (blackgum) instead of *Nyssa biflora* (swamp tupelo) (which is normally found in the Coastal Plain to the east and south of this alliance's range, but some stands of these associations may vary from this general assumption, which is further confounded by identification problems between these two taxa. Understory and shrub species include *Alnus serrulata* (hazel alder), *Ilex opaca var. opaca* (American holly), *Photinia pyrifolia* (red chokeberry), and *Ilex verticillata* (common winterberry). Characteristic herbaceous species are *Osmunda cinnamomea* (cinnamon fern) and *Osmunda regalis* (royal fern). *Sphagnum* (sphagnum) spp. are typical.

Alliance Distribution

Range: This alliance is known from the Cumberland Plateau of Alabama, Kentucky and Tennessee; the Allegheny Plateau of Kentucky; the Upper East Gulf Coastal Plain of Kentucky and Tennessee; the Piedmont of North Carolina, South Carolina, and Virginia; the Arkansas River Valley; and the Coastal Plain of North Carolina, New Jersey, Pennsylvania, Delaware, Maryland, and Virginia. It is also found in Georgia, Oklahoma, Connecticut, Massachusetts, Maine, New Hampshire, New York, Rhode Island, Vermont, West Virginia, and possibly Illinois and Louisiana.

Nations: US

Subnations: AL, AR, CT, DC, DE, GA, IL?, KY, LA?, MA, MD, ME, NC, NH, NJ, NY, OK, PA, RI, SC, TN, VA, VT, WV

TNC Ecoregions: 32:P, 38:P, 39:C, 40:C, 41:C, 43:C, 44: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: 212Aa:CCP, 212Ab:CCP, 212Ba:CCP, 212Bb:CCP, 212Ca:CCP, 212Cb:CCP, 212Da:CCP, 212Db:CCP, 212Dc:CCP, 212Ec:CPP, 212Ed:CP?, 212Fa:CCC, 212Fb:CCC, 212Fc:CCC, 212Fd:CCC, 212Ga:CCC, 212Gb:CCC, 221Aa:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ae:CCC, 221Af:CCC, 221Ag:CCC, 221Ah:CCC, 221Ai:CCC, 221Ak:CCP, 221Al:CCC, 221Am:CCC, 221Ba:CCP, 221Bb:CCC, 221Bc:CCP, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Dc:CCC, 221Ea:CCP, 221Eb:CCP, 221Fa:CPP, 221Fb:CPP, 221Hc:CCC, 221He:CCC, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Ca:CC?, 222Cb:CCC, 222Ce:CCC, 222Cg:CCC, 222Dc:CCP, 222Dg:CCC, 222Eg:CC?, 222Eo:CCC,

222G:CC, 222Ia:CPP, 231Aa:CCC, 231Ad:CCC, 231Ae:CCC, 231Af:CCC, 231Ak:CCC, 231Al:CCC, 231An:CCC, 231Ao:CCP, 231Bc:CCC, 231Be:CCC, 231Ca:CCC, 231Cc:CCC, 231Cd:CCC, 231Db:CCC, 231Dc:CCC, 231De:CCC, 231Ec:CCC, 231F:CC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Aa:CCP, 232Ab:CCC, 232Ac:CCP, 232Ad:CCC, 232Ae:CCC, 232Ba:CCP, 232Bb:CCP, 232Bc:CCP, 232Bq:CCC, 232Br:CCC, 232Bt:CCC, 232Bz:CCC, 232Ch:CP?, M212Aa:CC?, M212Ab:CC?, M212Ac:CCP, M212Ad:CCP, M212Bb:CCC, M212Bc:CCP, M212Bd:CCC, M212Cb:CCC, M212Cc:CCP, M212Eb:CCP, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CCC, M221Bb:CCP, M221Bc:CCC, M221Bd:CCP, M221Be:CCC, M221Bf:CCP, M221Ca:CC?, M221Cb:CCC, M221Cc:CC?, M221Ce:CC?, M221Da:CCC, M221Db:CC?, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: BIA (Eastern Band of Cherokee); DOD (Fort A.P. Hill, Fort Belvoir, Fort Jackson, Pine Bluff Arsenal); NPS (Assateague Island, Big South Fork, Blue Ridge Parkway, Boston Harbor Islands, C&O Canal?, Cape Cod, Catoctin Mountain, Delaware Water Gap, Fire Island, Fredericksburg-Spotsylvania, Gateway, George Washington Birthplace, George Washington Parkway?, Kings Mountain, Little River Canyon, Mammoth Cave, Minute Man, Natchez Trace, National Capital-East, New River Gorge, Petersburg, Prince William, Richmond, Shenandoah, Shiloh, Thomas Stone, Weir Farm); USFS (Allegheny, Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Green Mountain, Monongahela, Ouachita, Ozark, Talladega?, Uwharrie, White Mountain); USFWS (Assabet River, Cape May, Felsenthal?, Great Meadows, Great Swamp, Mountain Longleaf, Overflow?, Oxbow, Parker River, Pond Creek?)

(CEGL004426) Piedmont Low-Elevation Headwater Seepage Swamp

Acer rubrum var. trilobum / Viburnum nudum var. nudum / Osmunda cinnamomea - Saururus cernuus - Impatiens capensis Forest Carolina Red Maple / Possumhaw / Cinnamon Fern - Lizard's-tail - Orange Jewelweed Forest

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Saturated cold-deciduous forest (I.B.2.N.g.)
Alliance	*Acer rubrum - Nyssa sylvatica* Saturated Forest Alliance (A.348)
Alliance (English name)	Red Maple - Blackgum Saturated Forest Alliance
Association	*Acer rubrum var. trilobum / Viburnum nudum var. nudum / Osmunda cinnamomea - Saururus cernuus - Impatiens capensis* Forest
Association (English name)	Carolina Red Maple / Possumhaw / Cinnamon Fern - Lizard's-tail - Orange Jewelweed Forest
Association (Common name)	Piedmont Low-Elevation Headwater Seepage Swamp
Ecological System(s):	Piedmont Seepage Wetland (CES202.298)

Element Concept

Global Summary: This saturated vegetation is found in seepage areas, often on edges of floodplains or in headwaters of small streams, in the upper Coastal Plain and Piedmont of North Carolina, South Carolina, Georgia, Virginia, and likely other states. The canopy includes *Acer rubrum* (red maple), *Quercus phellos* (willow oak), and possibly other wetland trees. Some examples may contain, or even be codominated by, *Nyssa sylvatica* (blackgum) or less likely *Nyssa biflora* (swamp tupelo). Some herbs found in this association include *Saururus cernuus*

(lizard's-tail), *Impatiens capensis* (jewelweed), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis var. spectabilis* (royal fern), *Boehmeria cylindrica* (small-spike false nettle), *Rudbeckia laciniata* (cutleaf coneflower), *Ranunculus recurvatus* (blisterwort), and *Juncus* (rush) spp. Some more western examples may contain *Chelone glabra* (white turtlehead) and *Saxifraga micranthidifolia* (lettuceleaf saxifrage). Occurrences in South Carolina's Savannah River drainage are dominated by *Carex atlantica ssp. capillacea* (prickly bog sedge), *Carex debilis var. pubera* (white edge sedge), *Carex debilis var. debilis* (white edge sedge), and *Carex leptalea* (bristlystalked sedge).

Environmental Description

USFWS Wetland System: Palustrine

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment:
This saturated seepage swamp forest was sampled once at Kennesaw Mountain on a flat lowland at 300 m (1000 feet) elevation. The soil is saturated, somewhat poorly drained loam. There are seepy areas within the sampled stand and places where the soil was still mucky even at the height of last year's drought. The unvegetated surface is dominated by leaf litter (88% cover) with some wood (8%) and bare soil (4%). Evidence of disturbance includes the presence of invasive exotic plants.

Global Environment: This saturated vegetation is found in seepage areas, often on edges of floodplains or in headwaters of small streams in the upper Coastal Plain and Piedmont of North Carolina, South Carolina, Virginia, and likely other states.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderately dense (70% cover) tree canopy, 35-50 m tall, and sparse (30%) subcanopy (15-20 m) are codominated by *Nyssa sylvatica* (blackgum) and *Liriodendron tulipifera* (tuliptree); additional species include *Fraxinus pennsylvanica* (green ash), *Pinus taeda* (loblolly pine), and *Ulmus americana* (American elm). The sparse (30%) tall-shrub layer (5-10 m) and sparse (20%) short-shrub layer (1-2 m) include *Acer rubrum* (red maple), *Carpinus caroliniana* (American hornbeam), *Fagus grandifolia* (American beech), *Lindera benzoin* (northern spicebush), *Liquidambar styraciflua* (sweetgum), *Viburnum nudum* (possumhaw), and others. The moderate (40%) herbaceous layer is dominated by ferns *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), *Polystichum acrostichoides* (Christmas fern), *Thelypteris noveboracensis* (New York fern), and *Woodwardia virginica* (Virginia chainfern). Vines trailing on the ground and climbing into the upper layers include *Decumaria barbara* (woodvamp), *Smilax rotundifolia* (roundleaf greenbrier), and *Vitis rotundifolia* (muscadine).

Global Vegetation: The canopy includes *Acer rubrum* (red maple), *Quercus phellos* (willow oak), and possibly other wetland trees. Some examples may contain, or even be codominated by, *Nyssa sylvatica* (blackgum) or less likely *Nyssa biflora* (swamp tupelo). Some herbs found in this association include *Saururus cernuus* (lizard's-tail), *Impatiens capensis* (jewelweed), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis var. spectabilis* (royal fern), *Boehmeria cylindrica* (small-spike false nettle), *Chelone glabra* (white turtlehead), *Rudbeckia laciniata* (cutleaf coneflower), *Ranunculus recurvatus* (blisterwort), and *Juncus* (rush) spp. Some

more montane-influenced examples (e.g., Stokes County, North Carolina) may contain *Saxifraga micranthidifolia* (lettuceleaf saxifrage) (Schafale and Weakley 1990). Occurrences in South Carolina's Savannah River drainage are dominated by *Carex atlantica ssp. capillacea* (prickly bog sedge), *Carex debilis var. pubera* (white edge sedge), *Carex debilis var. debilis* (white edge sedge), and *Carex leptalea* (bristlystalked sedge) (P. Hyatt pers. comm.). An apparent example at Hanging Rock State Park (Stokes County, northwestern Piedmont of North Carolina) contains *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis var. spectabilis* (royal fern), *Woodwardia areolata* (netted chainfern), *Carex intumescens* (greater bladder sedge), *Chasmanthium laxum* (slender woodoats), *Calamagrostis coarctata* (arctic reedgrass), *Doellingeria umbellata var. umbellata* (parasol whitetop), *Viola X primulifolia* (primroseleaf violet), and *Chelone cuthbertii* (Cuthbert's turtlehead).

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Liriodendron tulipifera (tuliptree), Nyssa sylvatica (blackgum)*
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Carpinus caroliniana (American hornbeam), Lindera benzoin (northern spicebush)*
Herb (field)	Vine/Liana	*Decumaria barbara (woodvamp)*

Global Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum (red maple)*
Herb (field)	Fern or fern ally	*Osmunda cinnamomea (cinnamon fern)*

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Carpinus caroliniana* (American hornbeam), *Decumaria barbara* (woodvamp), *Lindera benzoin* (northern spicebush), *Liriodendron tulipifera* (tuliptree), *Nyssa sylvatica* (blackgum), *Osmunda cinnamomea* (cinnamon fern), *Polystichum acrostichoides* (Christmas fern), *Thelypteris noveboracensis* (New York fern)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Ligustrum sinense (Chinese privet)	High/Medium	invasive/exotic
Lonicera japonica (Japanese honeysuckle)	High/Medium	invasive/exotic

Global Other Plant Species	GRank	Note
Chelone cuthbertii (Cuthbert's turtlehead)	G3	

Conservation Status Rank

Global Rank & Reasons: G3? (31-Jan-2001). This seepage forest community occurs in small areas over a fairly wide distribution. Few, if any, examples are unaltered, and nearly all examples have been altered by both timber harvest and siltation.

Classification

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: Vegetation which may fit this concept at Hanging Rock State Park (Stokes County, northwestern Piedmont of North Carolina) has a canopy dominated by *Acer rubrum var. trilobum* and *Liriodendron tulipifera*, and a subcanopy containing *Ilex opaca var. opaca* and *Acer rubrum*. Shrubs include *Viburnum nudum var. nudum, Ilex montana, Photinia pyrifolia (= Aronia arbutifolia)*, and *Gaylussacia frondosa*?. The herbaceous layer contains *Osmunda cinnamomea, Osmunda regalis var. spectabilis, Woodwardia areolata, Carex intumescens, Chasmanthium laxum, Calamagrostis coarctata, Doellingeria umbellata var. umbellata (= Aster umbellatus var. umbellatus), Viola X primulifolia*, and *Chelone cuthbertii* (M. Pyne pers. comm. 1997).

Global

Similar Associations:
• *Acer rubrum var. trilobum - Liriodendron tulipifera / Ilex opaca var. opaca / Osmunda cinnamomea* Forest (CEGL004551)

Global Related Concepts:
• Diabase Bog (Hall and Boyer 1992) ?

Other Comments

Other Comments: The Kennesaw Mountain NBP plot constitutes a decent-quality example of this community, with a noticeably tall canopy and good stratification of forest layers and little evidence of recent anthropogenic disturbance. *Ligustrum sinense* and *Lonicera japonica* are both problematic, however. This community would be a good target for invasive removal efforts within the park.

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: This association is represented from one plot within Kennesaw Mountain NBP. It was sampled less than 0.5 mile south of Burnt Hickory Road within a bottomland area along the loop trail, less than 0.25 mile west of the main trail heading south. This type appears to be rare within Kennesaw Mountain, and there is low probability for other occurrences.

Global Range: This vegetation is found in the upper Coastal Plain and Piedmont of North Carolina, South Carolina, Virginia, and likely other states. Examples are known from Orange, Stokes, and Yadkin counties in the Piedmont of North Carolina (Schafale and Weakley 1990), and Cherokee County, South Carolina (NatureServe Ecology unpubl. data 2004).

Nations: US

States/Provinces: GA, NC, SC, VA?

TNC Ecoregions: 52:C, 56:P, 57:C, 58:?

USFS Ecoregions: 231Aa:CCP, 231Ae:CCP, 231Af:CCP, 231An:CCP, 231Ao:CCP, 232Bq:CCP, 232Br:CCP

Federal Lands: NPS (Kings Mountain)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: KEMO.31.

Local Description Authors: M.J. Russo and L. Echols

Global Description Authors: M. Pyne

References: Hall and Boyer 1992, Hyatt pers. comm., NatureServe Ecology - Southeastern U.S. unpubl. data, Pyne pers. comm., Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

Woodland (II.)

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

Pinus echinata - Quercus stellata - Quercus marilandica Woodland Alliance (A.680)

Alliance Concept

Summary: This alliance includes shortleaf pine-oak woodlands of the interior southeastern United States, ranging from the Piedmont along the southern edge of the Southern Blue Ridge and into the Southern Ridge and Valley, possibly into the Cumberland Plateau, and west into the Ozark and Ouachita mountains. These woodlands have mixed evergreen and deciduous canopies where *Pinus echinata* (shortleaf pine), *Quercus stellata* (post oak), and *Quercus marilandica* (blackjack oak) occur in varying ratios. This vegetation tends to occur on edaphically and/or topographically extreme sites such as on steep and rocky south- and west-facing slopes and ridges with thin soils, although some may be on upland flats with extreme soil conditions. Canopy associates include *Pinus virginiana* (Virginia pine), *Quercus prinus* (chestnut oak), *Quercus falcata* (southern red oak), *Nyssa sylvatica* (blackgum), *Quercus alba* (white oak), *Quercus coccinea var. coccinea* (scarlet oak), *Quercus velutina* (black oak), and other species. The trees are often stunted. Subcanopy and shrub species include *Oxydendrum arboreum* (sourwood), *Acer rubrum var. rubrum* (red maple), *Kalmia latifolia* (mountain laurel), *Symplocos tinctoria* (common sweetleaf), *Vaccinium arboreum* (farkleberry), *Vaccinium formosum* (southern blueberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Gaylussacia dumosa* (dwarf huckleberry), and *Lyonia mariana* (piedmont staggerbush). The herbaceous layer varies from sparse to dense and may contain *Schizachyrium scoparium* (little bluestem), *Andropogon glomeratus var. pumilus* (bushy bluestem), *Danthonia spicata* (poverty oatgrass), *Danthonia sericea* (downy danthonia), *Iris verna var. verna* (dwarf violet iris), *Pteridium aquilinum var. pseudocaudatum* (western brackenfern), *Smilax glauca* (cat greenbrier), and *Tephrosia virginiana* (Virginia tephrosia). Occurrences in the mountains likely will have *Baptisia tinctoria* (horseflyweed), *Chamaecrista fasciculata* (sleepingplant), *Chamaecrista nictitans* (partridge pea), *Ceanothus americanus* (New Jersey tea), *Chrysopsis mariana* (Maryland goldenaster), *Clitoria mariana* (Atlantic pigeonwings), *Coreopsis tripteris* (tall tickseed), *Crotalaria sagittalis* (arrowhead rattlebox), *Desmodium rotundifolium* (prostrate ticktrefoil), *Saccharum giganteum* (sugarcane plumegrass), *Euphorbia corollata* (flowering spurge), *Helianthus atrorubens* (purpledisk sunflower), *Helianthus microcephalus* (small woodland sunflower), and *Pityopsis aspera* (pineland silkgrass) in the herbaceous layer. Species that are common on occurrences on mafic rock include *Carya carolinae-septentrionalis* (southern shagbark hickory), *Fraxinus americana* (white ash), *Vaccinium arboreum* (farkleberry), *Viburnum rufidulum* (rusty blackhaw), and *Cercis canadensis var. canadensis* (eastern redbud).

Classification Comments: Develop historic type for Louisiana and elsewhere. In Louisiana, this vegetation only occurs as *Pinus echinata* stands with *Quercus* spp. coming in because of lack of fire. In South Carolina, this vegetation is known from the Blue Ridge/Piedmont transition but is all but extirpated. According to Tom Foti, this alliance occurred in the Coastal Plain of Arkansas, at least historically.

Similar Alliances:
• *Pinus (echinata, taeda) - Quercus (stellata, marilandica, falcata)* Woodland Alliance (A.2011)--occurs on less edaphically or topographically extreme sites, in the Coastal Plain west of the Mississippi River.
• *Pinus echinata* Woodland Alliance (A.515)

Related Concepts:
• Dry Oak--Hickory Forest, Dry Pine Variant (Schafale and Weakley 1990) ?
• IA6a. Dry Shortleaf Pine - Oak - Hickory Forest (Allard 1990) I
• Shortleaf Pine - Oak: 76 (Eyre 1980) I
• Shortleaf Pine: 75 (Eyre 1980) I
• T2B3aI1a. *Pinus echinata - Quercus stellata - Quercus marilandica* (Foti et al. 1994) ?
• Xeric Shortleaf Pine - Oak Woodland (Foti 1994b) ?

Alliance Description

Environment: The naturally occurring associations in this alliance often are on steep and rocky south- and west-facing slopes and ridges with thin soils, although some may be on upland flats with extreme soil conditions. The underlying geology may vary, with resultant variation in detailed floristics.

Vegetation: This alliance, found throughout the interior southeastern United States, is composed of woodlands with mixed evergreen and deciduous canopies where *Pinus echinata* (shortleaf pine), *Quercus stellata* (post oak), and *Quercus marilandica* (blackjack oak) occur in varying ratios. Canopy associates include *Pinus virginiana* (Virginia pine), *Quercus prinus* (chestnut oak), *Quercus falcata* (southern red oak), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Quercus velutina* (black oak), *Nyssa sylvatica* (blackgum), and other species. The trees often are stunted. Subcanopy and shrub species include *Oxydendrum arboreum* (sourwood), *Acer rubrum* (red maple), *Kalmia latifolia* (mountain laurel), *Symplocos tinctoria* (common sweetleaf), *Vaccinium arboreum* (farkleberry), *Vaccinium formosum* (southern blueberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Gaylussacia dumosa* (dwarf huckleberry), and *Lyonia mariana* (piedmont staggerbush). The herbaceous layer is often sparse and may contain *Schizachyrium scoparium* (little bluestem), *Andropogon glomeratus var. pumilus* (bushy bluestem), *Danthonia spicata* (poverty oatgrass), *Danthonia sericea* (downy danthonia), *Iris verna* (dwarf violet iris), *Pteridium aquilinum* (western brackenfern), *Smilax glauca* (cat greenbrier), and *Tephrosia virginiana* (Virginia tephrosia). Occurrences in the mountains likely will have *Baptisia tinctoria* (horseflyweed), *Chamaecrista fasciculata* (sleepingplant), *Chamaecrista nictitans* (partridge pea), *Ceanothus americanus* (New Jersey tea), *Chrysopsis mariana* (Maryland goldenaster), *Clitoria mariana* (Atlantic pigeonwings), *Coreopsis tripteris* (tall tickseed), *Crotalaria sagittalis* (arrowhead rattlebox), *Desmodium rotundifolium* (prostrate ticktrefoil), *Saccharum giganteum* (sugarcane plumegrass), *Euphorbia corollata* (flowering spurge), *Helianthus atrorubens* (purpledisk sunflower), *Helianthus microcephalus* (small woodland sunflower), and *Pityopsis aspera* (pineland silkgrass) in the herbaceous layer. Species that are common on occurrences on mafic rock include *Carya carolinae-septentrionalis* (southern shagbark hickory), *Fraxinus americana* (white ash), *Vaccinium arboreum* (farkleberry), *Viburnum rufidulum* (rusty blackhaw), and *Cercis canadensis* (eastern redbud).

Alliance Distribution

Range: Vegetation in this alliance occurs in the Piedmont, Southern Blue Ridge, Southern Ridge and Valley, Ozarks, and Ouachita Mountains. It may possibly range into the Cumberland Plateau. It is found in southern Missouri, Arkansas, Alabama, Georgia, North Carolina, South Carolina, Oklahoma, Tennessee, Virginia, and possibly Kentucky and West Virginia.

Nations: US

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

TNC Ecoregions: 38:C, 39:C, 50:C, 51:C, 52:C, 59:C

USFS Ecoregions: 221Jb:???, 222Ab:CCC, 222Ag:CCC, 222Am:CC?, 222An:CCC, 231Ad:CCC, 231Ag:CCP, 231D:CC, 231Ea:CC?, 231Eh:CCC, 231Ej:CCP, 231Gb:CCC, 232Ad:CCC, 232Fb:CCC, 234Ab:PPP, M221Ce:CCC, M221Dc:CCP, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCP, M231Ab:CCC, M231Ac:CCP

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Blue Ridge Parkway?, Buffalo River, Kennesaw Mountain, Kings Mountain, Little River Canyon?, Ozark Riverways); USFS (Chattahoochee, Daniel Boone?, Jefferson, Ouachita, Ozark, Sumter, Uwharrie)

(CEGL008492) Upper Piedmont Mafic Shortleaf Pine - Oak Woodland

Pinus echinata - (Quercus stellata, Quercus marilandica) / Schizachyrium scoparium - Salvia urticifolia Woodland Shortleaf Pine - (Post Oak, Blackjack Oak) / Little Bluestem - Nettleleaf Sage Woodland

NVC Classification

Physiognomic Class	Woodland (II)
Physiognomic Subclass	Mixed evergreen - deciduous woodland (II.C.)
Physiognomic Group	Mixed needle-leaved evergreen - cold-deciduous woodland (II.C.3.)
Physiognomic Subgroup	Natural/Semi-natural mixed needle-leaved evergreen - cold-deciduous woodland (II.C.3.N.)
Formation	Mixed needle-leaved evergreen - cold-deciduous woodland (II.C.3.N.a.)
Alliance	*Pinus echinata - Quercus stellata - Quercus marilandica* Woodland Alliance (A.680)
Alliance (English name)	Shortleaf Pine - Post Oak - Blackjack Oak Woodland Alliance
Association	*Pinus echinata - (Quercus stellata, Quercus marilandica) / Schizachyrium scoparium - Salvia urticifolia* Woodland
Association (English name)	Shortleaf Pine - (Post Oak, Blackjack Oak) / Little Bluestem - Nettleleaf Sage Woodland
Association (Common name)	Upper Piedmont Mafic Shortleaf Pine - Oak Woodland
Ecological System(s):	Southern Piedmont Dry Oak-(Pine) Forest (CES202.339) Piedmont Hardpan Woodland and Forest (CES202.268)

Element Concept

Global Summary: This Upper Piedmont association occurs on moderate to steep slopes over soils derived from mafic rock. Bedrock is often visible at the surface. The canopy is typically open but can be closed in some occurrences. The canopy is dominated by *Pinus echinata* (shortleaf pine). Other canopy species may include *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), *Quercus velutina* (black oak), *Quercus alba* (white oak), *Carya glabra* (pignut hickory), *Carya pallida* (sand hickory), and *Pinus virginiana* (Virginia pine). Members of the characteristically open shrub layer include *Vaccinium arboreum* (farkleberry), *Chionanthus virginicus* (white fringetree), *Diospyros virginiana* (common persimmon), *Prunus serotina* (black cherry), *Gaylussacia dumosa* (dwarf huckleberry), *Vaccinium pallidum* (Blue

Ridge blueberry), and *Hypericum hypericoides ssp. hypericoides* (St. Andrew's cross). The diverse and typically dense herbaceous stratum may include mafic rock indicators such as *Cirsium carolinianum* (soft thistle), *Oligoneuron album* (prairie goldenrod), *Salvia urticifolia* (nettleleaf sage), *Tragia urticifolia* (nettleleaf noseburn), *Silphium compositum* (kidneyleaf rosinweed), and *Liatris squarrosa* (scaly blazing star), along with *Schizachyrium scoparium* (little bluestem), *Pteridium aquilinum* (western brackenfern), *Tephrosia virginiana* (Virginia tephrosia), *Euphorbia corollata* (flowering spurge), *Eryngium yuccifolium var. yuccifolium* (button eryngo), *Scleria oligantha* (littlehead nutrush), *Coreopsis major* (greater tickseed), *Pityopsis graminifolia* (narrowleaf silkgrass), *Symphyotrichum patens* (late purple aster), *Danthonia sericea* (downy danthonia), *Dichanthelium dichotomum* (cypress panicgrass), *Eupatorium album* (white thoroughwort), *Iris verna* (dwarf violet iris), *Liatris pilosa var. pilosa* (shaggy blazing star), *Linum striatum* (ridged yellow flax), *Monarda fistulosa* (wild bergamot), *Parthenium integrifolium var. integrifolium* (wild quinine), and *Viola pedata* (birdfoot violet).

Environmental Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This shortleaf pine - blackjack oak woodland was sampled once at Kennesaw Mountain on a somewhat steep, south-facing upper slope at 450 m (1490 feet) elevation. The soil is dry, well-drained sandy loam. The unvegetated surface is dominated by leaf litter (62% cover) with some exposed bedrock (20%), large rocks (6%), wood (4%), and bare soil (8%). Evidence of disturbance includes the presence of invasive exotic plants.
Global Environment: This Upper Piedmont mixed woodland occurs on moderate to steep slopes over soils derived from mafic rock. Bedrock is often visible at the surface.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderately sparse (40% cover) somewhat stunted tree canopy, 5-10 m tall, is dominated by *Quercus marilandica* (blackjack oak) and includes *Carya pallida* (sand hickory), *Pinus echinata* (shortleaf pine), *Prunus umbellata* (hog plum), and *Ulmus alata* (winged elm); there is no subcanopy. The moderately dense (70%) tall-shrub layer (2-5 m) and moderate (60%) short-shrub layer (1-2 m) are codominated by *Chionanthus virginicus* (white fringetree), *Ptelea trifoliata* (common hoptree), *Rhus copallinum* (flameleaf sumac), and *Vaccinium arboreum* (farkleberry); additional shrubs include *Prunus umbellata* (hog plum), *Toxicodendron pubescens* (Atlantic poison-oak), and *Yucca filamentosa* (Adam's needle). The herbaceous layer is moderately dense (70%) due to the open canopy and is strongly dominated by *Piptochaetium avenaceum* (blackseed speargrass); additional herbs include small amounts of *Asplenium platyneuron* (ebony spleenwort), *Commelina erecta* (whitemouth dayflower), *Euphorbia corollata* (flowering spurge), *Galactia* (milkpea) sp., *Polygonum* (knotweed) sp., *Schizachyrium scoparium* (little bluestem), and the state-imperiled *Pycnanthemum curvipes* (stone mountainmint). Nonvascular species (lichens), including *Cladina rangiferina* (greygreen reindeer lichen) and *Thuidium* (thuidium moss) sp., cover 5% of bedrock surface.

Global Vegetation: The canopy is typically open but can be closed in some occurrences. The canopy is dominated by *Pinus echinata* (shortleaf pine). Other canopy species may include *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), *Quercus velutina* (black oak), *Quercus alba* (white oak), *Carya glabra* (pignut hickory), *Carya pallida* (sand hickory), and *Pinus virginiana* (Virginia pine) (NatureServe Ecology unpubl. data). Members of the

characteristically open shrub layer include *Vaccinium arboreum* (farkleberry), *Chionanthus virginicus* (white fringetree), *Diospyros virginiana* (common persimmon), *Prunus serotina* (black cherry), *Prunus umbellata* (hog plum), *Gaylussacia dumosa* (dwarf huckleberry), *Ptelea trifoliata* (common hoptree), *Vaccinium pallidum* (Blue Ridge blueberry), and *Hypericum hypericoides ssp. hypericoides* (St. Andrew's cross). The diverse and typically dense herbaceous stratum may include mafic rock indicators such as *Cirsium carolinianum* (soft thistle), *Oligoneuron album* (prairie goldenrod), *Salvia urticifolia* (nettleleaf sage), *Tragia urticifolia* (nettleleaf noseburn), *Silphium compositum* (kidneyleaf rosinweed), and *Liatris squarrosa* (scaly blazing star), along with *Schizachyrium scoparium* (little bluestem), *Pteridium aquilinum* (western brackenfern), *Tephrosia virginiana* (Virginia tephrosia), *Euphorbia corollata* (flowering spurge), *Eryngium yuccifolium var. yuccifolium* (button eryngo), *Scleria oligantha* (littlehead nutrush), *Coreopsis major* (greater tickseed), *Pityopsis graminifolia* (narrowleaf silkgrass), *Symphyotrichum patens* (late purple aster), *Danthonia sericea* (downy danthonia), *Dichanthelium dichotomum* (cypress panicgrass), *Eupatorium album* (white thoroughwort), *Iris verna* (dwarf violet iris), *Liatris pilosa var. pilosa* (shaggy blazing star), *Linum striatum* (ridged yellow flax), *Monarda fistulosa* (wild bergamot), *Parthenium integrifolium var. integrifolium* (wild quinine), and *Viola pedata* (birdfoot violet).

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus echinata (shortleaf pine)*
Tree canopy	Broad-leaved deciduous tree	*Carya pallida (sand hickory), Quercus marilandica (blackjack oak)*
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Chionanthus virginicus (white fringetree), Ptelea trifoliata (common hoptree), Rhus copallinum (flameleaf sumac)*
Shrub/sapling (tall & short)	Broad-leaved evergreen shrub	*Vaccinium arboreum (farkleberry) Herb (field) Graminoid Piptochaetium avenaceum (blackseed speargrass)*

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Ligustrum sinense (Chinese privet)	High/Medium	invasive/exotic
Lonicera japonica (Japanese honeysuckle)	High/Medium	invasive/exotic

Other Plant Species	GRank	Note
Pycnanthemum curvipes (stone mountainmint)	G3	globally vulnerable; GA state-imperiled

Global

Other Plant Species	GRank	Note
Aletris farinosa (white colicroot)	G5	
Clematis ochroleuca (curlyheads)	G4	GA state-imperiled
Echinacea laevigata (smooth purple coneflower)	G2G3	Federally listed endangered
Gymnopogon brevifolius (shortleaf skeletongrass)	G5	GA state-imperiled
Manfreda virginica (false aloe)	G5	
Oligoneuron album (prairie goldenrod)	G5	GA state-vulnerable
Symphyotrichum georgianum (Georgia aster)	G2G3	Federal candidate for listing

Conservation Status Rank

Global Rank & Reasons: G2? (22-Oct-2002). This association is naturally restricted in range and environmental setting to mafic rock outcrops in northern Georgia. The degree of uncertainty in the rank reflects the need for further inventory to assess the remaining number of occurrences of this type. Shortleaf pine (*Pinus echinata*) populations seem to have undergone rangewide declines in the vigor and extent. This phenomenon is primarily due to changes in fire regime and to depredations of the Southern Pine Beetle (*Dendroctonus frontalis*). The mafic, rocky habitat of this association may never have been common. Stands of this association are threatened by removal of commercially valuable tree species (e.g., *Quercus alba, Quercus stellata, Pinus echinata*) and by the effects of continued fire suppression, which would inhibit the reproduction of *Pinus echinata* and cause the grass- and forb-dominated herbaceous layer to deteriorate. Following the removal of the commercially valuable species, and in the absence of fire, stands could become populated with successional hardwoods (e.g., *Liriodendron tulipifera, Liquidambar styraciflua*) as well as less-fire-adapted pines (*Pinus virginiana*).

Classification

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This association is described from mafic rock outcrops in the Piedmont portions of the Chattahoochee National Forest in Stephens County, Georgia.

Global Similar Associations:
• *Pinus echinata - Quercus stellata - Quercus marilandica / Andropogon gyrans - Chrysopsis mariana* Woodland (CEGL004447)

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: One plot was documented from Little Kennesaw Mountain within Kennesaw Mountain NBP. This plot was located less than 0.5 mile from Kennesaw Mountain Drive parking lot heading southwest on the Little Kennesaw Mountain ridgeline trail. There may be additional isolated occurrences of this type on Little Kennesaw and/or Kennesaw mountains, but it appears to be very restricted within the park.

Global Range: This association is known only from the Upper Piedmont of Georgia.

Nations: US

States/Provinces: GA

TNC Ecoregions: 52:C

USFS Ecoregions: 231Ad:CCC

Federal Lands: NPS (Kennesaw Mountain); USFS (Chattahoochee, Chattahoochee (Piedmont))

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: KEMO.23.

Local Description Authors: M.J. Russo and L. Echols

Global Description Authors: J. Teague References: NatureServe Ecology - Southeastern U.S. unpubl. data, Southeastern Ecology Working Group n.d.

Shrubland (III.)

Temperate cold-deciduous shrubland (II.B.2.N.a.)

(Hydrangea spp., Philadelphus spp.) / Heuchera spp. Shrubland Alliance (A.680)

Alliance Concept

Summary: Stands of this alliance are physiognomically variable, edaphically controlled areas without a tree canopy. They are open zones in a primarily forested environment. Some examples are dry and others are moist with evident, at least seasonal, seepage. Stands occur in rocky places, typically either on solid vertical and near-vertical exposures, or cobble/channery debris fields of varying sizes. At a given location, the substrate may be composed of limestone, siltstone, mudstone, calcareous sandstones, as well as mafic metamorphic and igneous rocks. This alliance is potentially widespread in the Southern Blue Ridge, Cumberlands and Southern Ridge and Valley, Interior Low Plateau, and Interior Highlands. The vegetation composition is variable and often has 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* (hydrangea) spp. (*Hydrangea arborescens* (wild hydrangea), *Hydrangea cinerea* (ashy hydrangea), *Hydrangea radiata* (silverleaf hydrangea)), *Philadelphus* (mock orange) spp. (*Philadelphus hirsutus* (streambank mock orange), *Philadelphus inodorus* (scentless mock orange), *Philadelphus pubescens* (hoary mock orange)), *Toxicodendron radicans* (eastern poison-ivy), *Physocarpus opulifolius* (common ninebark), and *Ribes* (currant) spp. (*Ribes cynosbati* (eastern prickly gooseberry)). Characteristic herbs are *Heuchera* (alumroot) spp. (*Heuchera americana var. americana* (American alumroot), *Heuchera americana var. hirsuticaulis* (American alumroot), *Heuchera americana var. hispida* (American alumroot), *Heuchera caroliniana* (Carolina alumroot), *Heuchera villosa var. arkansana* (Arkansas alumroot), *Heuchera villosa var. villosa* (hairy alumroot)). Other species which are typical include various ferns (e.g., *Woodsia obtusa* (bluntlobe cliff fern), *Dryopteris* (woodfern) spp., *Cystopteris* (bladderfern) spp.) and/or grasses (e.g., *Dichanthelium* (rosette grass) spp., *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), and others). Some characteristic mosses include *Anomodon attenuatus* (anomodon moss) and *Anomodon rostratus* (anomodon moss).

Classification Comments: The range of this alliance is extended to include Virginia and Maryland with the addition of the provisional association *Hydrangea arborescens / Sedum ternatum - Polypodium virginianum* Shrubland (CEGL006479) that occupies cliff-faces weathered from siltstone, shale, calcareous sandstone, and metabasalt located above rivers and large streams.

Similar Alliances:

• *Impatiens pallida - Cystopteris bulbifera - Adoxa moschatellina* Herbaceous Alliance (A.1598)--appears to be related midwestern alliance in terms of its environment to some members of this alliance (A.1905).

Alliance Description

Environment: 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.

Vegetation: Characteristic shrubs are *Hydrangea* (hydrangea) spp. (*Hydrangea arborescens* (wild hydrangea), *Hydrangea cinerea* (ashy hydrangea), *Hydrangea radiata* (silverleaf hydrangea)), *Philadelphus* (mock orange) spp. (*Philadelphus hirsutus* (streambank mock orange), *Philadelphus inodorus* (scentless mock orange), *Philadelphus pubescens* (hoary mock orange)), *Toxicodendron radicans* (eastern poison-ivy), *Physocarpus opulifolius* (common ninebark), and *Ribes* (currant) spp. (*Ribes cynosbati* (eastern prickly gooseberry)). Characteristic herbs are *Heuchera* (alumroot) spp. (*Heuchera americana var. americana* (American alumroot), *Heuchera americana var. hirsuticaulis* (American alumroot), *Heuchera americana var. hispida* (American alumroot), *Heuchera caroliniana* (Carolina alumroot), *Heuchera villosa var. arkansana* (Arkansas alumroot), *Heuchera villosa var. villosa* (hairy alumroot)). Other species which are typical include *Dichanthelium* (rosette grass) spp., *Woodsia obtusa* (bluntlobe cliff fern), *Dryopteris* (woodfern) spp., *Cystopteris* (bladderfern) spp., *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), and others. Characteristic mosses include *Anomodon attenuatus* (anomodon moss) and *Anomodon rostratus* (anomodon moss).

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, Virginia and Maryland, and possibly Georgia, Mississippi, and Oklahoma.

Nations: US

Subnations: AL, AR, GA, KY, MD, 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: 221Hc:CCC, 222Dg:CCC, 222Ea:CCC, 222Eb:CCC, 222Ee:CC?, 222Ef:CC?, 222Eg:CCC, 222Eh:CCC, 222Eo:CCC, 231A:CC, 231Be:CPP, 231Gb:CCC, M221Dc:CCC, M221Dd:CCC, M222Ab:CCC

Federal Lands: NPS (Abe Lincoln Birthplace, Blue Ridge Parkway?, C&O Canal, Harpers Ferry, Kennesaw Mountain, Mammoth Cave, Manassas, Natchez Trace, Russell Cave); USFS (Chattahoochee?, Cherokee, Jefferson, Ouachita?, Ozark, Pisgah)

(CEGL004243) Southern Piedmont Mafic Shrubland

Philadelphus hirsutus - Ptelea trifoliata var. mollis / Schizachyrium scoparium - Pycnanthemum curvipes / Thuidium delicatulum Shrubland Streambank Mock Orange - Hoptree / Little Bluestem - Stone Mountainmint / Delicate Fern Moss Shrubland

NVC Classification

Physiognomic Class	Shrubland (III)
Physiognomic Subclass	Deciduous shrubland (III.B.)
Physiognomic Group	Cold-deciduous shrubland (III.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
Formation	Temperate cold-deciduous shrubland (III.B.2.N.a.)

Alliance	*(Hydrangea* spp., *Philadelphus* spp.) / *Heuchera* spp. Shrubland Alliance (A.1905)
Alliance (English name)	(Hydrangea species, Mock Orange species) / Alumroot species Shrubland Alliance
Association	*Philadelphus hirsutus - Ptelea trifoliata var. mollis / Schizachyrium scoparium - Pycnanthemum curvipes / Thuidium delicatulum* Shrubland
Association (English name)	Streambank Mock Orange - Hoptree / Little Bluestem - Stone Mountainmint / Delicate Fern Moss Shrubland
Association (Common name)	Southern Piedmont Mafic Shrubland
Ecological System(s):	Southern Piedmont Glade and Barrens (CES202.328)

Element Concept

Global Summary: This association represents edaphically controlled shrublands that occur on slopes of mafic amphibolite rock on dry, west- to southwest-facing areas at upper elevations (generally from 450-500 m [1470-1650 feet]) of Kennesaw Mountain, Georgia. It exhibits generally dense shrub thickets interspersed with grass/herb patches and some areas of bare rock and moss cover. Vascular plants root in crevices between rocks and boulders. The most abundant shrubs are *Philadelphus hirsutus* (streambank mock orange), *Ptelea trifoliata var. mollis* (common hoptree), *Chionanthus virginicus* (white fringetree), *Crataegus pruinosa* (waxyfruit hawthorn), and *Crataegus uniflora* (dwarf hawthorn). Other vascular species present include *Yucca filamentosa* (Adam's needle), *Schizachyrium scoparium* (little bluestem), *Andropogon gerardii* (big bluestem), *Danthonia spicata* (poverty oatgrass), *Bulbostylis capillaris* (densetuft hairsedge), *Juncus secundus* (lopsided rush), *Dichanthelium sphaerocarpon* (roundseed panicgrass), *Pycnanthemum curvipes* (stone mountainmint), *Apocynum cannabinum* (Indianhemp), *Arabis laevigata* (smooth rockcress), *Monarda fistulosa* (wild bergamot), *Tradescantia subaspera* (zigzag spiderwort), *Eupatorium sessilifolium* (upland boneset), *Solidago petiolaris* (downy ragged goldenrod), *Asplenium platyneuron* (ebony spleenwort), *Talinum teretifolium* (quill fameflower), *Hypericum gentianoides* (orangegrass), *Euphorbia corollata* (flowering spurge), and *Silene virginica* (fire pink). In addition, *Thuidium delicatulum* (delicate thuidium moss) is a common and conspicuous nonvascular plant. Trees are very limited, at coverages of less than 10%, and may include *Carya glabra* (pignut hickory), *Celtis occidentalis* (common hackberry), *Ulmus alata* (winged elm), and *Quercus marilandica* (blackjack oak).

Environmental Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This mock orange - sugarberry - hoptree shrubland was sampled twice at Kennesaw Mountain. The sites are steep, west- and northwest-facing mid and upper slopes at 470-530 m (1540-1735 feet) elevation. Soils are dry, rapidly to well-drained sandy loam and loam. The unvegetated surface is dominated by exposed bedrock (45-53% cover) with some large rocks (5-9%), small rocks (3-5%), leaf litter (30%), wood (4%), and bare soil (4-6%). Evidence of disturbance includes the presence of invasive exotic plants.

Global Environment: This community is known from west- to southwest-facing, dry rocky openings over mafic metamorphic (amphibolite) rocks of intermediate composition, generally from 450-500 m (1470-1650 feet) elevation, in the upper Piedmont physiographic province. The amphibolite is composed of bedded rocks, probably metamorphosed limestones.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: This community is defined by its moderately dense (40% cover) tall-shrub (2-5 m tall) and short-shrub layers (1-2 m) of *Celtis occidentalis* (common hackberry), *Chionanthus virginicus* (white fringetree), *Philadelphus hirsutus* (streambank mock orange), *Ptelea trifoliata* (common hoptree), and *Vaccinium arboreum* (farkleberry). However, there is also a sparse (20%) emergent tree canopy (5-10 m) that may include *Carya glabra* (pignut hickory), *Carya pallida* (sand hickory), *Juniperus virginiana* (eastern red-cedar), *Quercus rubra* (northern red oak), and/or *Ulmus alata* (winged elm). Additional shrubs include these canopy species as well as *Crataegus* (hawthorn) spp., *Prunus umbellata* (hog plum), and *Rhus copallinum* (flameleaf sumac). The herbaceous layer is sparse (20-40%) but fairly diverse, including *Schizachyrium scoparium* (little bluestem) (dominant), *Andropogon gerardii* (big bluestem), *Arabis laevigata* (smooth rockcress), *Cheilanthes lanosa* (hairy lipfern), *Danthonia spicata* (poverty oatgrass), *Dichanthelium depauperatum* (starved panicgrass), *Dichanthelium sphaerocarpon* (roundseed panicgrass), *Heuchera americana* (American alumroot), *Hypericum gentianoides* (orangegrass), *Lespedeza virginica* (slender lespedeza), *Opuntia humifusa* (devil's-tongue), *Rubus argutus* (sawtooth blackberry), *Talinum teretifolium* (quill fameflower), and others; over 45 species were recorded from the two sampled plots. *Smilax rotundifolia* (roundleaf greenbrier) is the dominant vine. In addition, this community supports state-imperiled *Pycnanthemum curvipes* (stone mountainmint) and state-vulnerable *Cyperus retrofractus* (rough flatsedge) and *Eupatorium sessilifolium* (upland boneset).

Global Vegetation: This community has dense cover of shrubs and patchy cover of herbaceous vascular plants and also has substantial cover of nonvascular plants. Vascular plants root in the crevices and gaps between rock and boulders. The most abundant shrubs are *Philadelphus hirsutus* (streambank mock orange), *Ptelea trifoliata var. mollis* (common hoptree), *Chionanthus virginicus* (white fringetree), and *Crataegus* (hawthorn) spp. Some examples may contain or be codominated by *Vaccinium arboreum* (farkleberry). Other vascular species present include *Yucca filamentosa* (Adam's needle), *Schizachyrium scoparium* (little bluestem), *Andropogon gerardii* (big bluestem), *Danthonia spicata* (poverty oatgrass), *Pycnanthemum curvipes* (stone mountainmint), *Apocynum cannabinum* (Indianhemp), *Arabis laevigata* (smooth rockcress), *Monarda fistulosa* (wild bergamot), *Tradescantia subaspera* (zigzag spiderwort), *Eupatorium sessilifolium* (upland boneset), *Asplenium platyneuron* (ebony spleenwort), *Euphorbia corollata* (flowering spurge), and *Silene virginica* (fire pink). In addition, *Thuidium delicatulum* (delicate thuidium moss) is a common and conspicuous nonvascular plant. Trees are very limited, at coverages of less than 10%, and may include *Carya glabra* (pignut hickory), *Carya texana* (black hickory), *Celtis occidentalis* (common hackberry), *Ulmus alata* (winged elm), and *Quercus marilandica* (blackjack oak).

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Carya glabra (pignut hickory), Ulmus alata (winged elm)*

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Celtis occidentalis (common hackberry), Philadelphus hirsutus (streambank mock orange), Ptelea trifoliata (common hoptree)*
Shrub/sapling (tall & short)	Broad-leaved evergreen shrub	*Vaccinium arboreum (farkleberry)*
Tall shrub/sapling	Broad-leaved deciduous shrub	*Chionanthus virginicus (white fringetree)*
Herb (field)	Vine/Liana	*Smilax rotundifolia (roundleaf greenbrier)*
Herb (field)	Graminoid	*Schizachyrium scoparium (little bluestem)*

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Agalinis tenuifolia* (slenderleaf false foxglove), *Carya glabra* (pignut hickory), *Celtis occidentalis* (common hackberry), *Chionanthus virginicus* (white fringetree), *Philadelphus hirsutus* (streambank mock orange), *Ptelea trifoliata* (common hoptree), *Schizachyrium scoparium* (little bluestem), *Smilax rotundifolia* (roundleaf greenbrier), *Ulmus alata* (winged elm), *Vaccinium arboreum* (farkleberry)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Ligustrum sinense (Chinese privet)	High/Medium	invasive/exotic
Lonicera japonica (Japanese honeysuckle)	High/Medium	invasive/exotic
Prunus persica (peach)	Insignificant	invasive/exotic
Rosa multiflora (multiflora rose)	Medium/Low	invasive/exotic

Other Plant Species	GRank	Note
Cyperus retrofractus (rough flatsedge)	G5	GA state-vulnerable
Eupatorium sessilifolium (upland boneset)	G5	GA state-vulnerable
Pycnanthemum curvipes (stone mountainmint)	G3	globally vulnerable; GA state-imperiled

Global

Other Plant Species	GRank	Note
Pycnanthemum curvipes (stone mountainmint)	G3	

Conservation Status Rank

Global Rank & Reasons: G2 (1-Oct-2007). This type appears to be naturally rare and limited in its range. It has few threats, and most examples are apparently protected at Kennesaw Mountain

National Battlefield Park, where there are from 10-12 examples, some up to 10 acres in size. It is not know if it occurs elsewhere.

Classification

Status: Standard

Classification Confidence: 1 – Strong

Other Comments

Other Comments: There is a high potential for additional rare species within occurrences of this community due to its inherent uniqueness and association with mafic substrates.

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: Two plots were sampled from Kennesaw Mountain NBP. One plots was sampled less than 0.1 mile west of Kennesaw Mountain Drive adjacent to the ridgeline trail that traverses Little Kennesaw Mountain. One plot was sampled close to the summit of Kennesaw Mountain proper approximately 0.15 mile southwest of the main upper parking lot. Other occurrences of this community should be expected where substantial mafic rock outcroppings occur along Little Kennesaw and Kennesaw mountains.

Global Range: This type is known from a small area of the upper Piedmont in Georgia. Its additional potential occurrence is unknown.

Nations: US

States/Provinces: GA

TNC Ecoregions: 52:C

USFS Ecoregions: 231A:CC

Federal Lands: NPS (Kennesaw Mountain)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: KEMO.01, KEMO.04.

Local Description Authors: M.J. Russo and L. Echols

Global Description Authors: M. Pyne and L. Echols

References: NatureServe Ecology - Southeastern U.S. unpubl. data, Southeastern Ecology Working Group n.d.

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

Salix nigra Temporarily Flooded Shrubland Alliance (A.948)

Alliance Concept

Summary: Young, or frequently disturbed, thickets of *Salix nigra* (black willow) along rivers or the shores of artificial lakes, often with few to no other species present. Placement of this vegetation in shrublands is related to disturbance frequency, both natural and anthropogenic. This alliance is present in the following regions: Piedmont, Cumberland Plateau, Coastal Plain, Ozark Highlands, Boston Mountains, Ouachita Mountains, Osage Hills, and Arkansas Valley.

Classification Comments: Now (2000-05-17) includes the former *Salix nigra* Woodland (CEGL003731). Later successional and/or more speciose communities with *Salix nigra* as a dominant will be found in *Salix nigra* Temporarily Flooded Forest Alliance (A.297). **Similar**

Alliances:
• *Platanus occidentalis - (Betula nigra, Salix* spp.) Temporarily Flooded Woodland Alliance (A.633)
• *Salix nigra* Seasonally Flooded Forest Alliance (A.334)
• *Salix nigra* Temporarily Flooded Forest Alliance (A.297)

Related Concepts:
• Black Willow: 95 (Eyre 1980) I
• Black willow scrub/shrub wetland (Fike 1999) ?
• Brownwater stream-edge shrub/scrub vegetation (Ambrose 1990a) ?
• River Gravel Community (Smith 1991) ?
• Rocky Bar and Shore (Schafale and Weakley 1990) I
• Sand and Mud Bar (Schafale and Weakley 1990) I

Alliance Description

Environment: These thickets of *Salix nigra* are found along rivers or the shores of artificial lakes.

Vegetation: These young, or frequently disturbed, thickets of *Salix nigra* (black willow) often have few to no other species present.

Dynamics: These young, or frequently disturbed, thickets, often have few to no other species present. The presence of this vegetation is related to disturbance frequency, both natural and anthropogenic.

Alliance Distribution

Range: This alliance is present in the following regions: Piedmont, Cumberland Plateau, Coastal Plain, Ozark Highlands, Boston Mountains, Ouachita Mountains, Arkansas Valley, Mississippi River Alluvial Plain, and Florida Peninsula. It is found throughout the eastern United States from Maine to Florida, west to Oklahoma and Texas. It may also occur in Ontario, Canada.

Nations: CA, US

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

TNC Ecoregions: 32:P, 37:C, 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:P, 50:C, 51:C, 52:C, 53:C, 55:P, 56:C, 57:C, 59:C, 60:C, 61:C, 64:P

USFS Ecoregions: 212Fa:CCP, 212Fb:CCP, 212Fc:CCC, 212Fd:CCP, 212Ga:CCP, 212Gb:CCP, 221Ae:CCC, 221Af:CCC, 221Ag:CCP, 221Bd:CCC, 221Db:CCC, 221Ec:C??, 221Ed:C??, 221Ef:C??, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 231Ca:CCC, 231Cd:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232:C, 234Aa:CC?, 234Ai:CC?, 234Ak:CC?, 234Al:CC?, 234An:CCC, M212Bb:CCC, M212Bd:CCC, M212Cc:CCC, M212Eb:CCP, M221Aa:CCP, M221Ab:CCP, M221Ac:CCC, M221Ad:CCC, M221Bb:CCC, M221Bf:CCC, M221Da:CCC, M221Dc:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: DOD (Fort Benning); NPS (Chattahoochee River, Chickamauga-Chattanooga?, Delaware Water Gap, Upper Delaware); USFS (Allegheny, Bankhead, Cherokee, Daniel Boone, Monongahela, Oconee?, Ouachita?, Ozark?); USFWS (Eufaula, Great Meadows)

CEGL003901) Black Willow Riverbank Shrubland

***Salix nigra* Temporarily Flooded Shrubland**
Black Willow Temporarily Flooded Shrubland

NVC Classification

Physiognomic Class	Shrubland (III)
Physiognomic Subclass	Deciduous shrubland (III.B.)
Physiognomic Group	Cold-deciduous shrubland (III.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
Formation	Temporarily flooded cold-deciduous shrubland (III.B.2.N.d.)
Alliance	*Salix nigra* Temporarily Flooded Shrubland Alliance (A.948)
Alliance (English name)	Black Willow Temporarily Flooded Shrubland Alliance
Association	*Salix nigra* Temporarily Flooded Shrubland
Association (English name)	Black Willow Temporarily Flooded Shrubland
Association (Common name)	Black Willow Riverbank Shrubland
Ecological System(s):	Central Appalachian Stream and Riparian (CES202.609) Southern Piedmont Small Floodplain and Riparian Forest (CES202.323) Southern Atlantic Coastal Plain Large River Floodplain Forest (CES203.066) Ozark-Ouachita Riparian (CES202.703)

Element Concept

Global Summary: This broadly defined type represents vegetation dominated by scrubby forms of *Salix nigra* (black willow) across the southeastern and northeastern United States, and possibly into Canada. Stature and closure may vary depending on disturbance. Additional types may be developed as more information becomes available.

Environmental Description

USFWS Wetland System: Palustrine

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This black willow riverbank shrubland was sampled once at Chattahoochee River on a flat temporarily flooded floodplain at 275 m (905 feet) elevation. The soil is somewhat poorly drained loam. The unvegetated surface is made up almost entirely of leaf

litter (95% cover) with some wood (5%). Evidence of disturbance includes the presence of exotic plants.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderate (40% cover) tall-shrub layer (2-5 m tall) is dominated by *Salix nigra* (black willow) with lesser amounts of *Acer rubrum* (red maple) and *Liquidambar styraciflua* (sweetgum). The sparse (20%) short-shrub layer (2-5 m) includes *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), and *Rubus argutus* (sawtooth blackberry). The dense (80%) herbaceous layer is codominated by *Erechtites hieraciifolia* (American burnweed) and *Juncus effusus* (common rush) and includes lesser amounts of *Panicum rigidulum* (redtop panicgrass), *Polygonum setaceum* (bog smartweed), and exotic *Polygonum hydropiper* (marshpepper knotweed).

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Salix nigra (black willow)*
Herb (field)	Graminoid	*Erechtites hieraciifolia (American burnweed), Juncus effusus (common rush)*

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Erechtites hieraciifolia* (American burnweed), *Juncus effusus* (common rush), *Salix nigra* (black willow)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-rank	Note
Polygonum hydropiper (marshpepper knotweed)	-	**Invasive/exotic**

Conservation Status Rank

Global Rank & Reasons: G4? (19-Sep-2001).

Classification

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This type conceptually includes communities formerly treated as woodlands [see the archived *Salix nigra* Woodland (CEGL003731)].

Global Similar Associations:

• *Populus deltoides - Salix nigra* Forest (CEGL002018)

Global Related Concepts:
• Alluvial Shrub Swamp/Woodland (Thompson 1996) B

Other Comments

Other Comments: *Hibiscus moscheutos* individuals within this community are very well-developed. This species strongly dominates the vegetative character of the plot.

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: One plot was sampled from the northeast portion of Suwanee Creek within a temporarily flooded floodplain. There is a moderate to high probability for additional examples of this type, especially within the Johnson Ferry, Suwannee Creek, and Cochran Shoals park units.

Global Range: This is a potentially wide-ranging association found throughout the southeastern and eastern United States, and possibly into Canada. This broadly defined association is found from the Ozarks and Interior Low Plateau, south to the West and East Gulf coastal plains and Florida Peninsula, east to the Atlantic Coastal Plain (excluding the Southern Blue Ridge) and north into the Central Appalachians and Northern Piedmont.

Nations: CA?, US

States/Provinces: AL, AR, FL, GA, IL?, KY, LA, MD, MS, NC, OH, OK, ON?, SC, TN, TX, VA?, WV

TNC Ecoregions: 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:P, 50:C, 51:C, 52:C, 53:C, 55:P, 56:C, 57:C, 59:C

USFS Ecoregions: 221Ec:C??, 221Ed:C??, 221Ef:C??, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 231Ca:CCC, 231Cd:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232:C, M221Aa:CCP, M221Ab:CCP, M221Ac:CCC, M221Ad:CCC, M221Bb:CCC, M221Bf:CCC, M221Da:CCC, M221Dc:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: DOD (Fort Benning); NPS (Chattahoochee River, Chickamauga-Chattanooga?); USFS (Bankhead, Cherokee?, Oconee?, Ouachita (Coastal Plain)?, Ouachita (Mountains)?, Ouachita?, Ozark?); USFWS (Eufaula)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: CHAT.47.

Local Description Authors: M.J. Russo and L. Echols

Global Description Authors: Southeastern Ecology Group

References: ALNHP 2002, Allard 1990, Baalman 1965, Blair 1938, Blair and Hubbell 1938, Cowardin et al. 1979, Fleming et al. 2001, Harrison 2004, Hefley 1937, Hoagland 2000, Johnson 1984, Kelting and Penfound 1950, McCoy 1958, Penfound 1953, Penfound 1961, Penfound

1965, Petranka and Holland 1980, Schafale and Weakley 1990, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Thompson 1996

Semipermanently flooded cold-deciduous shrubland (III.B.2.N.f.)

Cephalanthus occidentalis Semipermanently Flooded Shrubland Alliance (A.1011)

Alliance Concept

Summary: This alliance, which occurs throughout the eastern half of the United States and southern Ontario, Canada, contains semipermanently flooded stands dominated by *Cephalanthus occidentalis* (common buttonbush). Stands vary from dense, tall-shrub thickets to open shrublands. Tree canopy cover may reach 25% in some stands, with tree associates including *Acer saccharinum* (silver maple) and *Quercus palustris* (pin oak) in the North to *Taxodium distichum* (bald-cypress) in the South. Standing water may cover the ground layer. *Cephalanthus occidentalis* (common buttonbush) is often the sole dominant in stands of this alliance, particularly in deeper (>0.5 m depth) zones of groundwater basins or lake borders on deep organic soils. Occasional shrub associates in the northern parts of its range include any number of *Salix* (willow) spp. or *Cornus* (dogwood) spp., *Viburnum dentatum* (southern arrow-wood), *Rosa palustris* (swamp rose), *Ilex verticillata* (common winterberry), and *Vaccinium corymbosum* (highbush blueberry). Floating aquatics, such as *Lemna* (duckweed) spp., can be common in deepwater habitats, whereas a variety of forbs and graminoids are associates under less flooded conditions. These include *Boehmeria cylindrica* (small-spike false nettle), *Scutellaria lateriflora* (blue skullcap), *Sium suave* (hemlock waterparsnip), and *Bidens tripartita* (threelobe beggarticks), *Glyceria* (mannagrass) spp., *Leersia oryzoides* (rice cutgrass), *Polygonum* (knotweed) spp., and a wide variety of *Carex* (sedge) spp. This shrubland vegetation occupies shallow water depressions, oxbow ponds, sinkhole ponds, and backwater sloughs of stream and river floodplains throughout swampy forested areas in the eastern United States. Inundation is usually continuous throughout the year, but these sites can become dry in mid or late summer or during periods of prolonged drought. *Cephalanthus* (buttonbush) appears to be very tolerant of extended periods of inundation which, by slowing canopy closure of trees and maintaining higher light levels, may favor this shrub. Soils can vary in texture from clays to sands, with organic horizons overlying these soils.

Classification Comments: Examples from Arkansas include Pond Creek Bottoms in the West Gulf Coastal Plain and the Saline River in the Ouachita Mountains (J. Campbell pers. comm., D. Zollner pers. comm.). Found throughout Kentucky. Occurs in sagponds in the Cumberland Plateau in Alabama (Jackson County). This alliance needs to be compared with the *Cephalanthus occidentalis* Seasonally Flooded Shrubland Alliance (A.988), which has a more restricted range. Stands dominated by *Cephalanthus* can also arise in artificially impounded systems. Work needs to be done to determine precisely the extent of occurrence of both of these alliances.

Similar Alliances:
• *Cephalanthus occidentalis* Seasonally Flooded Shrubland Alliance (A.988)--has a more restricted range.

Related Concepts:

• *Cephalanthus occidentalis* shrubland alliance (Hoagland 1998a) ?
• Basin Marsh (FNAI 1992a) I
• Buttonbush Series (Diamond 1993) ?
• Buttonbush wetland (Fike 1999) ?
• Circumneutral Shrub Swamp (Smith 1991) I
• IIE1c. Sagpond Complex (Allard 1990) I
• L4B3cI1a. *Cephalanthus occidentalis* (Foti et al. 1994) ?
• Natural impoundment pond shrub/scrub vegetation (Ambrose 1990a) ?
• P4B3cII4a. *Cephalanthus occidentalis* (Foti et al. 1994) ?
• Sagpond shrub/scrub vegetation (Ambrose 1990a) ?
• Shrub Swamp (Foti 1994b) I
• Shrub swamp (Evans 1991) I

Alliance Description

Environment: This shrubland occupies shallow water depressions, oxbow ponds, sinkhole ponds, and backwater sloughs of stream and river floodplains throughout swampy forested areas in the eastern United States. Inundation is usually continuous throughout the year, but these sites can become dry in mid or late summer or during periods of prolonged drought (Faber-Langendoen and Maycock 1989). *Cephalanthus* appears to be very tolerant of extended periods of inundation which, by slowing canopy closure of trees and maintaining higher light levels, may favor this shrub (Conner et al. 1981). Soils can vary in texture from clays to sands, with organic horizons overlying these soils.

Vegetation: This alliance, which occurs throughout the eastern half of the United States and southern Ontario, Canada, contains semipermanently flooded stands dominated by *Cephalanthus occidentalis* (common buttonbush). Stands vary from dense tall-shrub thickets to open shrublands. Tree canopy may reach 25% in some stands, with tree associates varying from *Acer saccharinum* (silver maple) and *Quercus palustris* (pin oak) in the north to *Taxodium distichum* (bald-cypress) in the south. Standing water may dominate the ground layer. *Cephalanthus occidentalis* (common buttonbush) is often the sole dominant in stands of this alliance, particularly in deeper (>0.5 m depth) zones of groundwater basins or lake borders on deep organic soils. Occasional shrub associates in the northern parts of its range include any number of *Salix* (willow) spp. or *Cornus* (dogwood) spp., *Viburnum dentatum* (southern arrow-wood), *Rosa palustris* (swamp rose), *Ilex verticillata* (common winterberry), and *Vaccinium corymbosum* (highbush blueberry). Floating aquatics, such as *Lemna* (duckweed) spp., can be common in deepwater habitats, whereas a variety of forbs and graminoids are associates under less flooded conditions. These include *Boehmeria cylindrica* (small-spike false nettle), *Scutellaria lateriflora* (blue skullcap), *Sium suave* (hemlock waterparsnip), and *Bidens tripartita* (threelobe beggarticks), *Glyceria* (mannagrass) spp., *Leersia oryzoides* (rice cutgrass), *Polygonum* (knotweed) spp., and a wide variety of Carices (Anderson 1982, Tyrrell 1987, Faber-Langendoen and Maycock 1989).

Alliance Distribution

Range: This alliance is found in throughout the eastern U.S. and Canada, from Maine to Florida and west to from Texas to Michigan, as well as in southern Ontario, Canada.

Nations: CA, US

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

TNC Ecoregions: 31:C, 32:C, 36:C, 37:C, 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:C, 45:C, 46:C, 48:C, 49:C, 50:C, 52:C, 53:P, 55:C, 56:C, 57:?, 58:C, 59:C, 60:C, 61:C, 62:C, 63:C, 64:P

USFS Ecoregions: 212Dc:CCC, 212Fa:CCC, 212Fb:CCC, 212Fc:CCC, 212Fd:CCC, 212Ga:CCC, 212Gb:CCC, 212Hv:CCC, 221Aa:CCP, 221Ab:CCC, 221Ae:CCC, 221Af:CCC, 221Ag:CCC, 221Ah:CCC, 221Ai:CCC, 221Al:CCC, 221Ba:CCC, 221Bb:CCC, 221Bc:CCC, 221Bd:CCC, 221Da:CCC, 221Ec:CCP, 221Ed:CCP, 221Ef:CCP, 221Fa:CCC, 221Fc:CCC, 221Ha:CCC, 221Hc:CCC, 221He:CCC, 222Ab:CCC, 222Ad:CCC, 222Ag:CCC, 222Ah:CCC, 222Am:CCC, 222An:CCC, 222Aq:CCC, 222Cg:CCC, 222Da:CCC, 222Eb:CCC, 222Ec:CCC, 222Ee:CC?, 222Ef:CCP, 222Eg:CCC, 222Ej:CCP, 222En:CCC, 222Eo:CCC, 222F:CP, 222Ga:CCC, 222Gb:CCC, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Hf:CCP, 222Ib:CCC, 222Jb:CCC, 222Jc:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 231A:CC, 231Bc:CCC, 231Bd:CCC, 231Bg:CCC, 231Cc:CCC, 231Cd:CCP, 231Ce:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Ac:CCC, 232Br:CCC, 232Bs:CCC, 232Bt:CCC, 232Cg:CCC, 232Ch:CC?, 232Fa:CPP, 232Gb:CCC, 234Aa:CCC, 234Ac:CCC, 234Ae:CCC, 234Af:CCP, 234Ag:CCC, 234Ah:CCP, 234Ai:CCP, 234Ak:CCP, 234Al:CCP, 234Am:CCC, 234An:CCC, 251Cc:CCC, 251Cf:CCC, 251Cj:CCC, 251Ck:CCC, 251Dd:CCP, 251De:CCP, 251Dg:CCC, 251Dh:CCP, 255Db:CCC, M212A:CP, M212Bb:CCC, M212Bd:CCC, M212Cb:CCC, M212Cc:CCC, M212De:CCC, M212Ea:CCC, M212Eb:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Bb:CCC, M221Bd:CCC, M221Be:CCC, M221Bf:CCP, M221Cd:CCC, M221Da:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: DOD (Arnold, Fort Benning); NPS (Boston Harbor Islands, Buffalo River, C&O Canal?, Canaveral, Cape Cod, Delaware Water Gap, Effigy Mounds, Indiana Dunes, Minute Man, Natchez Trace, National Capital-East?, Saratoga, Shiloh, Weir Farm); TVA (Land Between the Lakes); USFS (Allegheny, Angelina, Bankhead?, Daniel Boone, Davy Crockett, George Washington, Jefferson, Kisatchie, Mark Twain, Monongahela, Ouachita, Ozark, Sabine, Sam Houston, Shawnee, Talladega, Tuskegee, Wayne, White Mountain?); USFWS (Assabet River, Chesapeake Marshlands, Great Meadows, Great Swamp, Holla Bend, Iroquois, Little River, Oxbow, Reelfoot, San Bernard)

(CEGL002191) Southern Buttonbush Pond

***Cephalanthus occidentalis / Carex* spp. - *Lemna* spp. Southern Shrubland Common Buttonbush / Sedge species - Duckweed species Southern Shrubland**

NVC Classification

Physiognomic Class	Shrubland (III)
Physiognomic Subclass	Deciduous shrubland (III.B.)
Physiognomic Group	Cold-deciduous shrubland (III.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
Formation	Semipermanently flooded cold-deciduous shrubland (III.B.2.N.f.)
Alliance	*Cephalanthus occidentalis* Semipermanently Flooded Shrubland Alliance (A.1011)
Alliance (English name)	Common Buttonbush Semipermanently Flooded Shrubland Alliance
Association	*Cephalanthus occidentalis / Carex* spp. - *Lemna* spp. Southern Shrubland
Association (English name)	Common Buttonbush / Sedge species - Duckweed species Southern Shrubland
Association (Common name)	Southern Buttonbush Pond

Ecological System(s): East Gulf Coastal Plain Large River Floodplain Forest (CES203.489) Central Appalachian River Floodplain (CES202.608) North-Central Interior Floodplain (CES202.694) South-Central Interior Large Floodplain (CES202.705) Southern Atlantic Coastal Plain Large River Floodplain Forest (CES203.066) East Gulf Coastal Plain Small Stream and River Floodplain Forest (CES203.559) Mississippi River Bottomland Depression (CES203.490)

Element Concept

Global Summary: This buttonbush shrubland occurs widely throughout the southeastern United States. Stands occupy shallow water depressions, oxbow ponds, beaver ponds, and backwater sloughs of stream and river floodplains. It also occurs in upland pond depressions. Inundation is usually continuous throughout the year, but these sites can become dry in mid or late summer or during periods of prolonged drought. In floodplain situations, soils are deep (1 m or more) consisting of peat or muck over alluvial parent material. *Cephalanthus occidentalis* (common buttonbush) comprises nearly 90% of the shrub layer in waters 1-2 m deep. Other shrubs commonly encountered may include *Cornus* (dogwood) sp. (*Cornus foemina* (stiff dogwood) or *Cornus amomum* (silky dogwood) to the south and *Cornus sericea* (red-osier dogwood) to the north) and *Salix* (willow) spp. Sedges, including *Carex stipata* (owlfruit sedge), *Carex stricta* (upright sedge), *Carex lurida* (shallow sedge), and *Carex intumescens* (greater bladder sedge), are the dominant herbaceous species present, although *Hibiscus* (rosemallow) spp. can also form dense stands in shallower water. *Lemna* (duckweed) spp. and *Leersia oryzoides* (rice cutgrass) are also common plants in this natural community. *Populus heterophylla* (swamp cottonwood) and *Nyssa biflora* (swamp tupelo) or *Nyssa aquatica* (water tupelo) may also occur within their range. Floristic characteristics that distinguish this type from more northern types are needed. This may occur as a long-persistent successional stage. This community can result from natural or artificial disturbance of hydrology.

Environmental Description

USFWS Wetland System: Palustrine

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This black willow riverbank shrubland was sampled once at Chattahoochee River on a semipermanently flooded floodplain at 245 m (800 feet) elevation that slopes gently to the southeast. The soil is poorly drained loam. The unvegetated surface is made up almost entirely of leaf litter (98% cover) with some wood (1%) and bare soil (1%). Evidence of disturbance includes the presence of exotic plants.

Global Environment: Stands occupy shallow water depressions, oxbow ponds, upland pond depressions, beaver ponds, and backwater sloughs of stream and river floodplains. Inundation is usually continuous throughout the year, but these sites can become dry in mid or late summer or during periods of prolonged drought. In floodplain situations, soils are deep (one meter or more) consisting of peat or muck over alluvial parent material (Nelson 1985, Lauver et al. 1999). Key environmental factors which favor the establishment and maintenance of this community include nearly continuous inundation from 1-2 m in depth (Voigt and Mohlenbrock 1964).

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The general appearance of this community is that of a short shrubland. However, there is also a sparse (20% cover) tree canopy (5-10 m tall) of *Salix nigra*

(black willow) and *Fraxinus pennsylvanica* (green ash) and a very sparse (10%) tall-shrub layer (2-5 m) of *Acer rubrum* (red maple) and *Fraxinus pennsylvanica* (green ash). The defining stratum (100%) is the short-shrub layer (1-2 m) that is dominated by *Alnus serrulata* (hazel alder), *Cephalanthus occidentalis* (common buttonbush), *Hibiscus moscheutos ssp. moscheutos* (crimsoneyed rosemallow), and *Salix nigra* (black willow). The moderate (40%) herbaceous layer is dominated by *Ludwigia palustris* (marsh seedbox) and *Polygonum lapathifolium* (curlytop knotweed); additional herbs include *Fimbristylis puberula* (hairy fimbry), *Galium tinctorium* (stiff marsh bedstraw), *Hypericum mutilum* (dwarf St. Johnswort), *Juncus effusus* (common rush), *Saururus cernuus* (lizard's-tail), and *Triadenum walteri* (greater marsh St. Johnswort).

Global Vegetation: *Cephalanthus occidentalis* (common buttonbush) comprises nearly 90% of the shrub layer in waters 1-2 m deep (Voigt and Mohlenbrock 1964). Other shrubs commonly encountered include *Cornus amomum* (silky dogwood) to the south and *Cornus sericea* (red-osier dogwood) to the north) and *Salix* (willow) spp. Sedges are the dominant herbaceous species present, including *Carex stipata* (owlfruit sedge), *Carex stricta* (upright sedge), *Carex lurida* (shallow sedge), and *Carex intumescens* (greater bladder sedge), although *Hibiscus* (rosemallow) spp. can also form dense stands in shallower water. *Lemna* (duckweed) spp. and *Leersia oryzoides* (rice cutgrass) are also common plants in this natural community. *Populus heterophylla* (swamp cottonwood) and *Nyssa biflora* (swamp tupelo) may also occur within their range (TNC 1995a). In the Columbia Bottomlands of Texas, common associates include *Salix nigra* (black willow), *Forestiera acuminata* (eastern swamp-privet), *Echinodorus berteroi* (upright burrhead), *Sagittaria* (arrowhead) sp., and floating aquatics, such as *Pistia stratiotes* (water lettuce), *Limnobium spongia* (American spongeplant), *Azolla caroliniana* (Carolina mosquitofern), and *Spirodela polyrrhiza* (common duckmeat). In the Upper East Gulf Coastal Plain, some associated herbs (e.g., at Shiloh National Military Park) include *Leersia oryzoides* (rice cutgrass), *Polygonum* (knotweed) spp., and *Saururus cernuus* (lizard's-tail).

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Salix nigra (black willow)*
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer rubrum (red maple)*
Short shrub/sapling	Broad-leaved deciduous shrub	*Alnus serrulata (hazel alder), Cephalanthus occidentalis (common buttonbush), Hibiscus moscheutos ssp. moscheutos (crimsoneyed rosemallow), Salix nigra (black willow)*
Herb (field)	Forb	*Ludwigia palustris (marsh seedbox), Polygonum lapathifolium (curlytop knotweed)*

Global

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous	*Nyssa aquatica* (water tupelo), *Populus heterophylla*

Stratum	Lifeform	Species
	tree	(swamp cottonwood)
Tall shrub/sapling	Broad-leaved deciduous tree	*Cephalanthus occidentalis* (common buttonbush)

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Acer rubrum* (red maple), *Alnus serrulata* (hazel alder), *Cephalanthus occidentalis* (common buttonbush), *Fraxinus pennsylvanica* (green ash), *Hibiscus moscheutos* ssp. *moscheutos* (crimsoneyed rosemallow), *Ludwigia palustris* (marsh seedbox), *Polygonum lapathifolium* (curlytop knotweed), *Salix nigra* (black willow)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Polygonum hydropiper (marshpepper knotweed)	-	**Invasive/exotic**

Global

Other Plant Species	GRank	Note
Leitneria floridana (corkwood)	G3	

Animal Species	Grank	Note
Agkistrodon piscivorus (cottonmouth)	G5	
Aix sponsa (wood duck)	G5	
Anas rubripes (american black duck)	G5	
Ardea herodias (great blue heron)	G5	
Castor canadensis (american beaver)	G5	
Coccyzus americanus (yellow-billed cuckoo)	G5	
Dendroica petechia (yellow warbler)	G5	
Dumetella carolinensis (gray catbird)	G5	
Geothlypis trichas (common yellowthroat)	G5	
Hybognathus hayi (cypress minnow)	G5	
Lontra canadensis (north american river otter)	G5	
Lophodytes cucullatus (hooded merganser)	G5	
Neovison vison (american mink)	G5	
Ondatra zibethicus (common muskrat)	G5	
Orconectes lancifer (shrimp crayfish)	G5	
Procyon lotor (raccoon)	G5	

Pseudacris crucifer (spring peeper)	G5
Pseudacris streckeri (strecker's chorus frog)	G5
Rana palustris (pickerel frog)	G5
Rana pipiens (northern leopard frog)	G5
Seiurus motacilla (louisiana waterthrush)	G5
Seiurus noveboracensis (northern waterthrush)	G5

Conservation Status Rank

Global Rank & Reasons: G4 (3-Oct-1996). This type is widespread with many occurrences suspected across its range. However, many sites have also been drained for conversion to cropland. A number of remaining examples of this community are protected, but even these can be threatened by accelerated siltation resulting from excessive soil erosion and channelization in adjacent areas.

Classification

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This community can be highly dynamic from one season to the next, and species composition and density are wholly dependent on water regime (Niering 1985). Primary identifying characteristics include the near absence of trees and dominance of buttonbush (at least 25% coverage). Floristic characteristics that distinguish this type from more northern types are needed. Stands of buttonbush with widely scattered *Taxodium* (<10%?, <20% cover?) should be placed in this type.

Global Similar Associations:
• *Cephalanthus occidentalis - (Leucothoe racemosa) / Carex joorii* Shrubland (CEGL004075)
• *Cephalanthus occidentalis - Decodon verticillatus* Shrubland (CEGL006069)
• *Cephalanthus occidentalis / Carex* spp. Northern Shrubland (CEGL002190)
• *Cephalanthus occidentalis / Hibiscus moscheutos ssp. moscheutos* Depression Pond Shrubland (CEGL004742)
• *Taxodium distichum - (Nyssa aquatica) / Forestiera acuminata - Planera aquatica* Forest (CEGL002421)

Global Related Concepts:
• Buttonbush Series (Diamond 1993) =
• Eastern Broadleaf and Needleleaf Forests: 113: Southern Floodplain Forest (*Quercus-Nyssa-Taxodium*) (Kuchler 1964) B
• Palustrine: Palustrine Scrub Shrub Wetland (Cowardin et al. 1979) F
• Palustrine: Scrub-Shrub Wetland: Riparian (TNC 1985) B
• UNESCO FORMATION CODE: III.B.3c (UNESCO 1973) B

Other Comments

Other Comments: *Hibiscus moscheutos* individuals within this community are very well-developed. This species strongly dominates the vegetative character of the plot.

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: This association was sampled once from a well-developed floodplain in the central portion of Cochran Shoals within Chattahoochee River NRA. This community was only observed at Cochran Shoals, with a low probability for other occurrences within the park.

Global Range: This buttonbush shrubland type occurs widely throughout the southeastern United States, ranging from southern Ohio west to Kansas, south to Texas and east to North Carolina. This community also occurs in Delaware and possibly in New Jersey and Pennsylvania.

Nations: US

States/Provinces: AL, AR, DE?, GA, IL, IN, KS, KY, LA, MO, MS, NC, NJ, OH, OK, PA?, SC, TN, TX:S4

TNC Ecoregions: 31:C, 32:C, 37:C, 38:C, 39:C, 40:P, 41:C, 42:C, 43:C, 44:C, 49:C, 50:C, 52:P, 53:P, 56:C, 57:?, 62:C

USFS Ecoregions: 221E:CC, 221Ha:CCC, 221Hc:CCC, 221He:CCC, 222Ab:CCC, 222Ad:CCC, 222Ag:CCC, 222Ah:CCC, 222Am:CCC, 222An:CCC, 222Aq:CCC, 222Cg:CCC, 222D:CC, 222Eb:CCC, 222Ej:CCP, 222En:CCC, 222Eo:CCC, 222F:CP, 222G:CC, 231A:CP, 231Bg:CCC, 231Cd:CCP, 231Ce:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Ac:CCC, 234A:CC, 255Db:CCC, M221Cd:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: DOD (Fort Benning); NPS (Chattahoochee River, Natchez Trace, Shiloh); USFS (Angelina, Bankhead?, Daniel Boone, Davy Crockett, Kisatchie?, Land Between the Lakes?, Ouachita, Ouachita (Coastal Plain)?, Ouachita (Mountains), Ozark, Sabine, Sam Houston?, Shawnee, Talladega?, Tuskegee?, Wayne); USFWS (Reelfoot, San Bernard)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: CHAT.08.

Local Description Authors: M.J. Russo and L. Echols

Global Description Authors: M. Guetersloh, mod. D. Faber-Langendoen and E. Largay

References: Benyus 1989, Blair 1938, Cowardin et al. 1979, Dennis 1988, Diamond 1993, Duck and Fletcher 1945, Duncan and Duncan 1988, Evans 1991, Ewel and Odum 1984b, Faircloth 1971, Fehrenbacher et al. 1982, Hoagland 2000, Illinois Nature Preserve Commission 1973, Kuchler 1964, Lauver et al. 1999, McCoy 1958, Mitsch and Gosselink 1993, Mohlenbrock 1959, Nelson 1985, Niering 1985, Roe 1998, Schafale and Weakley 1990, Schotz pers. comm., Smith 1996a, Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC 1985, TNC 1995a, UNESCO 1973, Voigt and Mohlenbrock 1964, Wharton 1989, White and Anderson 1970, White and Madany 1978

Herbaceous Vegetation (V.)

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

Andropogon virginicus Herbaceous Alliance (A.1208)

Alliance Concept

Summary: This alliance includes vegetation dominated by *Andropogon virginicus var. virginicus* (broomsedge bluestem) that occurs on old fields, pastures, and rocky sites. Associated species vary with geography and habitat and include typical pioneer species. This is a very wide-ranging alliance. There is no known natural vegetation in this alliance.

Related Concepts:
• *Andropogon virginicus* herbaceous alliance (Hoagland 1998a) ?

Alliance Description

Environment: Stands of this alliance occur on old fields, pastures, and rocky sites.

Vegetation: Stands of this alliance are dominated by *Andropogon virginicus var. virginicus* (broomsedge bluestem). Associated species vary with geography and habitat and include typical pioneer species.

Alliance Distribution

Range: This alliance is found in Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, New York, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and Missouri, and possibly Illinois, Indiana, and elsewhere.

Nations: US

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

TNC Ecoregions: 31:C, 32:C, 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:C, 48:C, 50:C, 51:P, 52:C, 53:C, 56:C, 57:C, 58:C, 59:C, 60:C, 61:C, 62:C

USFS Ecoregions: 212Fc:CCC, 221Ab:CCC, 221Bc:CCC, 221Bd:CCC, 221C:CP, 221Db:CCC, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Cg:CCC, 222Eg:CCC, 222Ib:CCC, 231Aa:CCC, 231Ae:CCC, 231Ba:CCC, 231Be:CCC, 231Cc:CCC, 231Fa:CCP, 231Fb:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Aa:CCC, 232Ac:CCC, 232Bt:CCC, 232Ce:CCC, 232F:CC, 255Da:CCC, 255Dc:CCC, M221Aa:CCC, M221Ab:CCC, M221Ba:CC?, M221Bb:CCC, M221Bd:CC?, M221Ca:CPP, M221Cb:CPP, M221Cc:CPP, M221Ce:CPP, M221Da:CCC, M221Db:CCC, M221Dc:CCP, M221Dd:CCP, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: DOD (Arnold, Fort Benning, Fort Gordon); NPS (Abe Lincoln Birthplace, Big South Fork, Boston Harbor Islands, Cape Cod, Chattahoochee River, Chickamauga-Chattanooga?, Cowpens, Delaware Water Gap, Fire Island, Fort Donelson, Gateway, Kings Mountain, Little River Canyon, Mammoth Cave?, Natchez Trace, Ninety Six, Saratoga, Shiloh,

Stones River, Upper Delaware, Weir Farm); USFS (Cherokee, George Washington, Jefferson, Oconee?, Ouachita?, Ozark?, Talladega?, Tuskegee?); USFWS (Anahuac, Big Boggy?, Brazoria, Great Swamp, Iroquois)

(CEGL004044) Successional Broomsedge Vegetation

Andropogon virginicus var. virginicus Herbaceous Vegetation
Broomsedge Bluestem Herbaceous Vegetation

NVC Classification

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Medium-tall sod temperate or subpolar grassland (V.A.5.N.c.)
Alliance	*Andropogon virginicus* Herbaceous Alliance (A.1208)
Alliance (English name)	Broomsedge Bluestem Herbaceous Alliance
Association	*Andropogon virginicus var. virginicus* Herbaceous Vegetation
Association (English name)	Broomsedge Bluestem Herbaceous Vegetation Association (Common name) Successional Broomsedge Vegetation

Element Concept

Global Summary: This association includes herbaceous-dominated vegetation that has been anthropogenically altered and/or maintained, especially on old fields and pastures. Examples support predominately native species or a mixture of native and exotic species, one of the most dominant or characteristic species being *Andropogon virginicus var. virginicus* (broomsedge bluestem). *Lolium pratense* (meadow ryegrass) can dominate fields early in the season. This is a very common and wide-ranging association that can be quite variable in terms of species composition. Additional components are other perennial grasses and herbaceous species, most with pioneer or weedy tendencies, the exact composition of which will vary with geography, management history, and habitat.

Environmental Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This successional broomsedge vegetation was sampled once at Chattahoochee River on a lowland flat at 285 m (930 feet) elevation. The soil is moderately well-drained loam. The unvegetated surface is made up entirely of leaf litter (100% cover).

Global Environment: This vegetation typically occurs on old fields, pastures, and rocky sites. It will persist indefinitely under a regular mowing regime, e.g., in powerline corridors.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The completely closed (100% cover) herbaceous layer (1-2 m tall) is dominated by grasses *Andropogon virginicus* (broomsedge bluestem), *Dichanthelium scoparium* (velvet panicum), and *Tridens flavus* (purpletop tridens) and the forb *Eupatorium capillifolium* (dogfennel). Additional herbs include *Acalypha gracilens* (slender threeseed mercury), *Dichanthelium laxiflorum* (openflower rosette grass), *Eragrostis* (lovegrass) sp., *Lespedeza repens* (creeping lespedeza), *Potentilla canadensis* (dwarf cinquefoil), *Pseudognaphalium obtusifolium*, and exotic *Setaria pumila* (yellow bristlegrass).

Global Vegetation: Stands of this community are dominated by *Andropogon virginicus var. virginicus* (broomsedge bluestem), sometimes codominant with *Lolium pratense* (meadow ryegrass). Associated species vary with geography and habitat and include typical pioneer species. Species with high cover values in plot samples attributed to this type include *Tridens flavus* (purpletop tridens), *Setaria parviflora* (marsh bristlegrass), *Eragrostis spectabilis* (purple lovegrass), and *Panicum anceps* (beaked panicgrass) (NatureServe Ecology unpubl. data). On the eastern Highland Rim of Tennessee (Arnold Air Force Base), associated species include *Diodia teres* (poorjoe), *Aristida dichotoma* (churchmouse threeawn), *Aristida oligantha* (prairie threeawn), *Packera anonyma* (Small's ragwort), *Paspalum laeve* (field paspalum), *Lespedeza virginica* (slender lespedeza), and *Plantago virginica* (Virginia plantain). *Rubus argutus* (sawtooth blackberry) and *Smilax* (greenbrier) spp. may be locally abundant but are not dominant. In clearcuts, *Schizachyrium scoparium* (little bluestem), *Danthonia spicata* (poverty oatgrass), and *Dichanthelium* (rosette grass) spp. are also common, as are occasional *Quercus* (oak) spp. and *Rubus argutus* (sawtooth blackberry). The plot at Shiloh National Military Park (western Tennessee) was a mowed field of mostly native species, dominated by *Andropogon virginicus var. virginicus* (broomsedge bluestem). *Paspalum setaceum* (thin paspalum) and *Tridens flavus* (purpletop tridens) were codominant (with less cover). Other herbaceous plants with high cover values were *Setaria parviflora* (marsh bristlegrass), *Diodia teres* (poorjoe), *Schizachyrium scoparium* (little bluestem), and less common were *Packera anonyma* (Small's ragwort), *Sorghum halepense* (Johnsongrass), and *Cyperus retrorsus* (pine barren flatsedge). At less than 1% cover were *Polypremum procumbens* (juniper leaf), *Oxalis stricta* (common yellow oxalis), *Eragrostis spectabilis* (purple lovegrass), *Salvia lyrata* (lyreleaf sage), *Solanum carolinense* (Carolina horsenettle), *Digitaria sanguinalis* (hairy crabgrass), *Panicum anceps* (beaked panicgrass), *Croton willdenowii* (Willdenow's croton), *Trifolium pratense* (red clover), *Kummerowia striata* (Japanese clover), *Coreopsis pubescens* (star tickseed), *Plantago lanceolata* (narrowleaf plantain), and *Mecardonia acuminata* (axilflower). At only a trace amount of cover were *Conyza canadensis* (Canadian horseweed), *Acalypha virginica* (Virginia threeseed mercury), *Solidago* (goldenrod) sp., *Erigeron annuus* (eastern daisy fleabane), *Sida spinosa* (prickly fanpetals), *Hypericum drummondii* (nits and lice), *Polygala verticillata* (whorled milkwort), *Eupatorium capillifolium* (dogfennel), *Passiflora incarnata* (purple passionflower), and *Asclepias amplexicaulis* (clasping milkweed). In West Virginia, common associates include *Sorghastrum nutans* (Indiangrass), *Dichanthelium clandestinum* (deertongue), *Anthoxanthum odoratum* (sweet vernalgrass), *Phleum pratense* (timothy), *Dactylis glomerata* (orchardgrass), *Daucus carota* (Queen Anne's lace), *Lotus corniculatus* (birdfoot deervetch), *Trifolium pratense* (red clover), *Leucanthemum vulgare* (oxeye daisy), *Solidago canadensis* (Canada goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), and *Solidago nemoralis* (gray goldenrod).

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Herb (field)	Forb	*Eupatorium capillifolium* (dogfennel)
Herb (field)	Graminoid	*Andropogon virginicus (broomsedge bluestem), Dichanthelium scoparium (velvet panicum), Tridens flavus (purpletop tridens)*

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Andropogon virginicus* var. *virginicus* (broomsedge bluestem)

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Andropogon virginicus* (broomsedge bluestem), *Dichanthelium scoparium* (velvet panicum), *Eupatorium capillifolium* (dogfennel), *Tridens flavus* (purpletop tridens)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Setaria pumila (yellow bristlegrass)	**Low/Insignificant**	**invasive/exotic**

Conservation Status Rank

Global Rank & Reasons: GNA (ruderal) (8-Aug-2000). This is a ruderal community and represents vegetation resulting from succession following anthropogenic disturbance of an area. It is not a conservation priority for its own sake and does not receive a conservation rank.

Classification

Status: Standard

Classification Confidence: 1 - Strong

Global Comments: Phenology can affect apparent composition: in West Virginia, fields visited early in the season had high cover of *Lolium pratense*, while those sampled later in the season were dominated by *Andropogon virginicus*.

Global Related Concepts:
• Old fields (Vanderhorst 2001a) ?

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: Within Chattahoochee River NRA, one plot attributable to this association was taken from Bowmans Island west of the Chattahoochee River 0.5 mile northeast of the DNR Trout Hatchery. While this type does not appear to be widespread within this park, and other occurrences are quite possible in maintained old field-type habitats around parking areas. Occurrences should be expected from the numerous maintained meadow areas throughout the central and southern portions of Kennesaw Mountain NBP, although this type was never sampled from that park.

Global Range: This community ranges throughout most or all of the southeastern United States, extending north to Virginia and West Virginia.

Nations: US

States/Provinces: AL, AR, GA, IL, IN, KY, LA, MO?, MS, NC, OK, SC, TN, TX, VA, WV
TNC Ecoregions: 31:C, 32:C, 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:C, 50:C, 51:P, 52:C, 53:C, 56:C, 57:C, 59:C

USFS Ecoregions: 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Cg:CCC, 222Eg:CCC, 231Aa:CCC, 231Ba:CCC, 231Be:CCC, 231Cc:CCC, 231Fa:CCP, 231Fb:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232B:CC, 232Ce:CCC, 232F:CC, 255Da:CCC, 255Dc:CCC, M221Aa:CCC, M221Ab:CCC, M221Ba:CC?, M221Bb:CCC, M221Bd:CC?, M221Ca:CPP, M221Cb:CPP, M221Cc:CPP, M221Ce:CPP, M221Da:CCC, M221Db:CCC, M221Dc:CCP, M221Dd:CCP, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: DOD (Arnold, Fort Benning, Fort Gordon); NPS (Abe Lincoln Birthplace, Big South Fork, Chattahoochee River, Chickamauga-Chattanooga?, Cowpens, Fort Donelson, Kings Mountain, Little River Canyon, Mammoth Cave?, Natchez Trace, Ninety Six, Shiloh, Stones River); USFS (Cherokee, George Washington, Jefferson, Oconee?, Ouachita (Coastal Plain)?, Ouachita (Mountains)?, Ouachita?, Ozark?, Talladega (Oakmulgee)?, Talladega (Talladega)?, Talladega?, Tuskegee?); USFWS (Anahuac, Big Boggy?, Brazoria)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: CHAT.43.

Local Description Authors: M.J. Russo and L. Echols

Global Description Authors: A.S. Weakley, mod. C.W. Nordman and S.C. Gawler

References: Fleming and Coulling 2001, Hoagland 2000, NatureServe Ecology - Southeastern U.S. unpubl. data, Penfound 1953, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC 1998a, Tarr et al. 1980, Vanderhorst 2001a, Vanderhorst and Streets 2006, White and Madany 1978

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

Juncus effusus Seasonally Flooded Herbaceous Alliance (A.1375)

Alliance Concept

Summary: This alliance includes wetland herbaceous vegetation dominated or codominated by *Juncus effusus* (common rush). These communities are most characteristically seasonally flooded, but in some cases, examples may have temporarily or semipermanently flooded hydrologies. Still, all these are conceptually placed in this alliance, at least until more detailed information is available. These marshy communities vary greatly in size, situation, geographical location, species composition, and naturalness. Some are beaver-made or human-made impoundments. It should be noted that this species has a very wide ecological amplitude, and additional alliances with different hydrologies may need to be defined.

Classification Comments: There are several varieties. The nominate variety (*Juncus effusus var. effusus*) is more northern in its distribution, ranging south only to Idaho and Michigan.

Juncus effusus var. brunneus and *Juncus effusus var. gracilis* are restricted to the Pacific coast. The southeastern plants are probably *Juncus effusus var. solutus* (Kartesz 1999). There are additional varieties in the southwestern and northeastern states. In Cades Cove (Great Smoky Mountains), *Juncus effusus* codominates with *Andropogon glomeratus*. On Arnold Air Force Base, Tennessee, vegetation dominated by *Juncus effusus* is maintained by mowing. *Juncus effusus*-dominated vegetation is also found along the border of Woods Reservoir at Arnold Air Force Base, where it is often encountered as the first zone of vegetation along the water's edge. This zone stays inundated with water for the majority of the year. *Juncus effusus* and *Scirpus cyperinus* usually dominate and can form thick stands. Other species include *Cyperus* spp., *Typha latifolia*, and *Galium aparine*.

Related Concepts:
• *Juncus effusus* herbaceous alliance (Hoagland 1998a) ?
• Depression Meadow (Nelson 1986) I
Piedmont/Mountain Semipermanent Impoundment (Schafale and Weakley 1990) I
• Rush-Sedge Series (Diamond 1993) I

Alliance Description

Environment: These marshy communities vary greatly in size, situation, geographical location, species composition, and naturalness. Some are beaver-made or human-made impoundments.

Vegetation: This alliance is currently broadly and literally defined, based on dominance by *Juncus effusus* (common rush). In various parts of its broad range, associated species may include *Andropogon glomeratus* (bushy bluestem), *Cyperus* (flatsedge) spp., *Typha latifolia* (broadleaf cattail), *Scirpus cyperinus* (woolgrass), *Triadenum walteri* (greater marsh St. Johnswort), *Apios americana* (groundnut), and *Galium aparine* (stickywilly).

Dynamics: It should be noted that *Juncus effusus* has a very wide ecological amplitude, and additional alliances with different hydrologies may need to be defined.

Alliance Distribution

Range: This alliance is found in the Southeast states of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and elsewhere. The full range in North America is incomplete, but it also includes the Pacific Northwest from British Columbia south to California. The species is widespread in the United States and Canada, including most states and provinces, including Alaska.

Nations: CA, US

Subnations: AL, AR, CA, FL, GA, KY, LA, MS, NC, OK, OR, SC, TN, TX, VA, WA

TNC Ecoregions: 2:C, 14:P, 15:C, 43:C, 44:C, 50:C, 51:C, 52:C, 53:P, 56:P, 57:P, 58:C, 59:C

USFS Ecoregions: 222C:CC, 222D:CC, 222Eb:CCC, 222F:CC, 222H:CC, 231Bi:CCC, 231Ca:CCP, 231Cd:CCP, 231Db:CCC, 232Ce:PPP, 242A:CC, 263A:CC, M221Ab:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: BIA (Eastern Band of Cherokee); DOD (Arnold, Fort Benning); NPS (Blue Ridge Parkway, Carl Sandburg Home, Chattahoochee River, Chickamauga-Chattanooga?, Cumberland Gap, Cumberland Island?, Great Smoky Mountains, Natchez Trace, Point Reyes, Santa Monica Mountains); USFS (Bankhead, Chattahoochee, Cherokee?, Oconee?, Talladega)

(CEGL004112) Common Rush Marsh

***Juncus effusus* Seasonally Flooded Herbaceous Vegetation**
Common Rush Seasonally Flooded Herbaceous Vegetation

NVC Classification

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Seasonally flooded temperate or subpolar grassland (V.A.5.N.k.)
Alliance	*Juncus effusus* Seasonally Flooded Herbaceous Alliance (A.1375)
Alliance (English name)	Soft Rush Seasonally Flooded Herbaceous Alliance
Association	*Juncus effusus* Seasonally Flooded Herbaceous Vegetation
Association (English name)	Common Rush Seasonally Flooded Herbaceous Vegetation
Association (Common name)	Common Rush Marsh
Ecological System(s):	East Gulf Coastal Plain Depression Pondshore (CES203.558) East Gulf Coastal Plain Small Stream and River Floodplain Forest (CES203.559) South-Central Interior Small Stream and Riparian (CES202.706) Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582)
Ecological System(s):	Southern and Central Appalachian Bog and Fen (CES202.300)

Element Concept

Global Summary: This broadly defined type represents freshwater marsh vegetation dominated by *Juncus effusus* (common rush). Additional types may be developed as more information becomes available. This vegetation may occur in natural or artificial ponds, including beaver-enhanced ones. In various parts of its broad range as currently defined, associated species may include *Andropogon glomeratus* (bushy bluestem), *Cyperus* (flatsedge) spp., *Typha latifolia* (broadleaf cattail), *Scirpus cyperinus* (woolgrass), *Triadenum walteri* (greater marsh St. Johnswort), *Apios americana* (groundnut), and *Galium aparine* (stickywilly). This type includes seasonally to temporarily flooded vegetation dominated or codominated by *Juncus effusus* (common rush) in the central and southern Appalachians.

Environmental Description

USFWS Wetland System: Palustrine

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This common rush marsh was sampled at three locations at Chattahoochee River. Sites are flat saturated to temporarily flooded floodplains at 240-275 m (795-905 feet) elevation. Soils are poorly to very poorly drained loam silt loam and muck with evidence of iron oxidation. The unvegetated surface is dominated by either leaf litter (0-97% cover) or standing water (0-100%) with wood (0-3%) and bare soil (0-10%). Evidence of disturbance includes the presence of invasive exotic plants. Global Environment: This is a seasonally (to temporarily) flooded marsh vegetation type; it may occur in natural or artificial ponds, including beaver-enhanced ponds, artificial waterways (wet ditches), and disturbed wet fields.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The general appearance of this community is that of a herbaceous wetland. However, there may also be a moderate (60% cover) emergent tall-shrub layer (5-10 m tall) and a very sparse (10%) short-shrub layer (2-5 m) that may include *Salix nigra (*black willow), *Fraxinus pennsylvanica* (green ash), *Acer negundo* (box-elder), *Acer rubrum* (red maple), and *Liquidambar styraciflua* (sweetgum). The defining stratum (100%) is the herb layer (1-2 m) that is dominated by *Juncus effusus* (common rush); additional herbs include *Erechtites hieraciifolia* (American burnweed), *Hydrolea quadrivalvis* (waterpod), *Impatiens capensis* (jewelweed), *Ludwigia palustris* (marsh seedbox), *Panicum rigidulum* (redtop panicgrass), and *Scirpus cyperinus* (woolgrass). This community also supports state-vulnerable *Polygonum densiflorum* (denseflower knotweed).

Global Vegetation: This type is currently broadly and literally defined, based on dominance by *Juncus effusus* (common rush). In various parts of its broad range as currently defined, associated species may include *Andropogon glomeratus* (bushy bluestem), *Carex* (sedge) spp., *Cyperus* (flatsedge) spp., other *Juncus* (rush) spp., *Typha latifolia* (broadleaf cattail), *Scirpus cyperinus* (woolgrass), *Triadenum walteri* (greater marsh St. Johnswort), *Apios americana* (groundnut), and *Galium aparine* (stickywilly). In Georgia, Wharton (1978) cites *Carex rostrata* (beaked sedge), *Carex stipata* (owlfruit sedge), *Schoenoplectus pungens* (common threesquare), and *Sagittaria latifolia* (broadleaf arrowhead) as associates of beaver pond vegetation containing *Juncus effusus* (common rush).

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Salix nigra (black willow)*
Tall shrub/sapling	Broad-leaved deciduous shrub	*Fraxinus pennsylvanica (green ash)*
Herb (field)	Forb	*Erechtites hieraciifolia (American burnweed)*
Herb (field)	Graminoid	*Juncus effusus (common rush), Panicum rigidulum (redtop panicgrass), Scirpus cyperinus (woolgrass)*

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Juncus effusus* (common rush)

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Juncus effusus* (common rush), *Scirpus cyperinus* (woolgrass)

Global: *Juncus effusus* (common rush)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Lonicera japonica (Japanese honeysuckle)	**High/Medium**	**invasive/exotic**

Other Plant Species	GRank	Note
Polygonum densiflorum (denseflower knotweed)	G5	state-vulnerable

Conservation Status Rank

Global Rank & Reasons: G5 (28-Mar-2001). This is a broadly defined, widely distributed, and reasonably secure vegetation type.

Classification

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: Though this association was not seen at the Bankhead National Forest, it is expected to occur there.

Global Related Concepts:
• Beaver Dam Type (Wharton 1978) ?
• IID6a. Natural Impoundment Pond (Allard 1990) B

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: Three plots representing this type were taken from two park units within Chattahoochee River NRA. Two plots were sampled from the central portion of Johnson Ferry South within a seasonally flooded and/or saturated floodplain environment. One plot was sampled from the northeast portion of Suwanee Creek within a temporarily flooded floodplain. There is a moderate to high probability for additional examples of this type, especially within the Johnson Ferry, Suwannee Creek, and Cochran Shoals park units.

Global Range: The range of this broadly defined association has not been fully described. It is confirmed as occurring in the Central Appalachians and is thought to occur in the Interior Low Plateau, Cumberland Plateau, Southern Ridge and Valley, Southern Blue Ridge, Piedmont, Chesapeake Bay Lowlands, and the Coastal Plain from the Mid-Atlantic to the Upper East Gulf Coastal Plain.

Nations: US

States/Provinces: AL, AR, FL, GA, KY, LA, MS, NC, OK, SC, TN, TX, VA

TNC Ecoregions: 43:C, 44:C, 50:P, 51:C, 52:C, 53:P, 56:P, 57:P, 58:P, 59:C

USFS Ecoregions: 222Eb:CCC, 231Bi:CCC, 231Ca:CPP, 231Cd:CPP, 231Db:CCC, 232Ce:PPP, M221Ab:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: BIA (Eastern Band of Cherokee); DOD (Arnold, Fort Benning); NPS (Blue Ridge Parkway?, Carl Sandburg Home, Chattahoochee River, Chickamauga-Chattanooga?, Cumberland Island?, Great Smoky Mountains, Natchez Trace); USFS (Bankhead, Cherokee?, Oconee?, Talladega, Talladega (Oakmulgee), Talladega (Talladega)?)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: CHAT.10, CHAT.13, CHAT.46.

Local Description Authors: M.J. Russo and M. Pyne

Global Description Authors: Southeastern Ecology Group

References: Allard 1990, Fleming et al. 2001, Hoagland 1998c, Hoagland 2000, Peet et al. unpubl. data 2002, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC 1998a, Wharton 1978

Scirpus cyperinus Seasonally Flooded Herbaceous Alliance (A.1386)

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* (woolgrass), 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* (woolgrass); other species present may include *Carex* (sedge) spp., *Dichanthelium* (rosette grass) spp., *Dulichium arundinaceum* (threeway sedge), *Glyceria* (mannagrass) spp., *Juncus* (rush) spp., *Leersia* (cutgrass) spp., *Panicum rigidulum* (redtop panicgrass), *Rhynchospora* (beaksedge) spp., and *Thelypteris palustris* (eastern marsh fern), as well as other species of *Scirpus* (bulrush) including *Scirpus microcarpus* (panicled bulrush) and *Scirpus atrovirens* (green bulrush). The vegetation may consist of monospecific clumps of the component species, either scattered in the marsh or around the pond margin. Mats of *Sphagnum* (sphagnum) mosses may be prominent in some examples (e.g., *Sphagnum lescurii* (Lescur's sphagnum), *Sphagnum pylaesii* (Pylaes' sphagnum), *Sphagnum cuspidatum* (toothed sphagnum), *Sphagnum palustre* (prairie sphagnum), and *Sphagnum recurvum* (recurved sphagnum). Some examples may have scattered woody plants, including shrubs and small trees such as *Acer rubrum* (red maple), *Alnus serrulata* (hazel alder), *Cephalanthus occidentalis* (common buttonbush), *Rosa palustris* (swamp rose), and *Nyssa sylvatica* (blackgum). To the north, *Vaccinium corymbosum* (highbush blueberry) is a typical associate, while *Hibiscus moscheutos* (crimsoneyed rosemallow), *Itea virginica* (Virginia sweetspire), *Liquidambar styraciflua* (sweetgum), *Pinus taeda* (loblolly pine), and *Quercus phellos* (willow oak) occur more frequently in the southern portion of the range. Sparsely distributed shrubs in montane examples may include *Vaccinium* (blueberry) spp. and *Leucothoe racemosa* (swamp doghobble). 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.

Classification Comments: There is apparently an undescribed association in the Coastal Plain from Louisiana to Alabama (at least), found in beaver-enhanced, stream-related wetlands. Stands include *Scirpus cyperinus, Dulichium arundinaceum, Juncus triglomeratus, Rhynchospora corniculata, Utricularia* spp., Ludwigia spp., and *Eleocharis* spp. More information will be available from Patty Faulkner and Al Schotz (2008).

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

Alliance Description

Environment: This alliance inhabits seasonally flooded marshes or emergent zones of upland depression ponds. 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.

Vegetation: The vegetation is typically dominated by patches or zones of *Scirpus cyperinus* (woolgrass); other species present may include *Carex* (sedge) spp., *Dichanthelium* (rosette grass) spp., *Dulichium arundinaceum* (threeway sedge), *Glyceria* (mannagrass) spp., *Juncus* (rush) spp., *Leersia* (cutgrass) spp., *Panicum rigidulum* (redtop panicgrass), *Rhynchospora* (beaksedge) spp., and *Thelypteris palustris* (eastern marsh fern), as well as other species of *Scirpus* (bulrush) including *Scirpus microcarpus* (panicled bulrush) and *Scirpus atrovirens* (green bulrush). The vegetation may consist of monospecific clumps of the component species, either scattered in the marsh or around the pond margin. Mats of Sphagnum (sphagnum) mosses may be prominent in some examples (e.g., Sphagnum lescurii (Lescur's sphagnum), Sphagnum pylaesii (Pylaes' sphagnum), Sphagnum cuspidatum (toothed sphagnum), Sphagnum palustre (prairie sphagnum), and Sphagnum recurvum (recurved sphagnum). Some examples may have scattered woody plants, including shrubs and small trees such as Acer rubrum (red maple), Alnus serrulata (hazel alder), Cephalanthus occidentalis (common buttonbush), Rosa palustris (swamp rose), and Nyssa sylvatica (blackgum). To the north, Vaccinium corymbosum (highbush blueberry) is a typical associate, while Hibiscus moscheutos (crimsoneyed rosemallow), Itea virginica (Virginia sweetspire), Liquidambar styraciflua (sweetgum), Pinus taeda (loblolly pine), and Quercus phellos (willow oak) occur more frequently in the southern portion of the range. Sparsely distributed shrubs in montane examples may include Vaccinium (blueberry) spp. and Leucothoe racemosa (swamp doghobble). Dynamics: 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. 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.

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, the Chesapeake Bay Lowlands (Delmarva Peninsula of Virginia, Chincoteague National Wildlife Refuge), and from the

Central Appalachians (Allegheny Mountains region of West Virginia). It could occur in adjacent provinces (e.g., Piedmont, Ridge and Valley).

Nations: US

Subnations: AL, AR?, CT, DC?, 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, 49:C, 50:P, 51:C, 52:C, 53:C, 56:P, 57:C, 58:C, 59:C, 60:?, 61:C, 62:C, 64:C

USFS Ecoregions: 221Ab:CCC, 221Bc:CCC, 221Fa:CCC, 221H:CP, 221J:CP, 222Cf:CCP, 222Cg:CCP, 222Eb:CCC, 222Eg:CCP, 222Eh:CCP, 231Ab:CCC, 231Bc:CCC, 231Be:CCC, 232Ac:CCC, 232B:CC, 232C:CP, 232D:CP, 234A:PP, M221Ba:CCC, M221Bc:CCC, M221Dc:CCC

Federal Lands: DOD (Arnold, Fort Benning); NPS (Big South Fork, Blue Ridge Parkway?, C&O Canal?, Cape Cod, Chattahoochee River, Chickamauga-Chattanooga?, Gateway, Horseshoe Bend, Kennesaw Mountain, Natchez Trace, National Capital-East?, Saratoga, Thomas Stone); USFS (Chattahoochee?, Francis Marion, Monongahela, Oconee?, Pisgah, Talladega, Tuskegee?); USFWS (Assabet River, Canaan Valley, Chincoteague, Erie, Great Meadows, Rachel Carson?, Supawna Meadows)

(CEGL003866) Southern Woolgrass Bulrush Marsh

***Scirpus cyperinus* Seasonally Flooded Southern Herbaceous Vegetation**
Woolgrass Bulrush Seasonally Flooded Southern Herbaceous Vegetation

NVC Classification

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Seasonally flooded temperate or subpolar grassland (V.A.5.N.k.)
Alliance	Scirpus cyperinus Seasonally Flooded Herbaceous Alliance (A.1386)
Alliance (English name)	Woolgrass Bulrush Seasonally Flooded Herbaceous Alliance
Association	Scirpus cyperinus Seasonally Flooded Southern Herbaceous Vegetation
Association (English name)	Woolgrass Bulrush Seasonally Flooded Southern Herbaceous Vegetation
Association (Common name)	Southern Woolgrass Bulrush Marsh Ecological System(s): East Gulf Coastal Plain Small Stream and River Floodplain Forest (CES203.559)

Element Concept

Global Summary: This association is a semi-natural type, consisting of *Scirpus cyperinus* (woolgrass) as an essentially monospecific stand, especially in artificial wetlands, such as borrow pits or ponds. The water table is at or above the soil surface for at least part of the growing season. The dominant species, *Scirpus cyperinus* (woolgrass), often forms dense, almost monotypic stands. *Carex* (sedge) spp. and *Schoenoplectus* (bulrush) spp. are often found in this community. Other co-occurring species of this association are not fully known. It is a widespread type. At Fort Benning, Georgia, *Scirpus cyperinus* (woolgrass) occurs with *Saccharum giganteum* (sugarcane plumegrass), *Juncus* (rush) sp., and occasional *Alnus serrulata* (hazel alder) and *Nyssa biflora* (swamp tupelo) in beaver ponds and other hydrologically enhanced areas. In the Interior Low Plateau of Tennessee, *Scirpus cyperinus* (woolgrass) is commonly

found with *Typha latifolia* (broadleaf cattail) in roadside ditches and on the margins of ponds and reservoirs.

Environmental Description

USFWS Wetland System: Palustrine

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This woolgrass bulrush marsh was sampled once at Chattahoochee River and once at Kennesaw Mountain on flat floodplains at 245-300 m (800-985 feet) elevation, respectively. The Chattahoochee River site is permanently flooded with very poorly drained muck soil; the unvegetated surface is dominated by standing water (75% cover) with some wood (20%) and leaf litter (5%). The Kennesaw Mountain site is semipermanently flooded with poorly drained clay soil; the unvegetated surface is dominated by leaf litter (63% cover) with some wood (10%), standing water (2%), and bare soil (25%).

Global Environment: At Fort Benning, Georgia, this is found in beaver ponds and other hydrologically enhanced areas. In the Interior Low Plateau of Tennessee, *Scirpus cyperinus* is commonly found with *Typha latifolia* in roadside ditches and on the margins of ponds and reservoirs. In the Francis Marion National Forest (South Carolina), *Scirpus cyperinus* sometimes dominates open depressions within or adjacent to the Santee River floodplain and larger stream floodplains, and can also dominate deeper borrow pits (Glitzenstein and Streng 2004).

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: This community is defined by the dominance of *Scirpus cyperinus* (woolgrass) in the herbaceous layer which may be completely closed (90-100% cover). At Chattahoochee River, there is a very sparse (10%) emergent tree layer (5-10 m) of *Fraxinus pennsylvanica* (green ash) and sparse (30%) shrub layer (1-5 m) of *Alnus serrulata* (hazel alder), which is also found at the Kennesaw Mountain site along with a small amount *Salix nigra* (black willow). Additional herbs found in small amounts at one site or the other or both include *Boehmeria cylindrica* (small-spike false nettle), *Eleocharis obtusa* (blunt spikerush), *Juncus biflorus* (bog rush), *Juncus effusus* (common rush), *Lobelia cardinalis* (cardinalflower), *Ludwigia palustris* (marsh seedbox), *Mikania scandens* (climbing hempvine), *Polygonum hydropiper* (marshpepper knotweed) (exotic), *Polygonum punctatum* (dotted smartweed), *Proserpinaca pectinata* (combleaf mermaidweed), *Sparganium americanum* (American bur-reed), and *Triadenum walteri* (greater marsh St. Johnswort).

Global Vegetation: Stands of this association consist of *Scirpus cyperinus* (woolgrass) as an essentially monospecific stand. *Saccharum* (sugarcane) spp., *Carex* (sedge) spp., and *Schoenoplectus* (bulrush) spp. are often found in this community, especially on the margins. Other co-occurring species of this association are not fully understood. In the Interior Low Plateau of Tennessee, *Scirpus cyperinus* (woolgrass) is commonly found with *Typha latifolia* (broadleaf cattail). In addition, *Juncus effusus* (common rush) and an occasional *Alnus serrulata* (hazel alder) are also present.

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Herb(field)	Graminoid	*Scirpus cyperinus* (woolgrass)

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Scirpus cyperinus* (woolgrass)

Other Noteworthy Species

Exotic and Invasive Species	I-Rank	Note
Polygonum hydropiper (marshpepper knotweed)	-	invasive/exotic

Conservation Status Rank

Global Rank & Reasons: G4 (15-Oct-2002). This is a wide-ranging type that can be found in naturally occurring as well as artificial wetlands.

Classification

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This community may be at least a minor component of many Southeastern wetland systems, but little work has been done to determine its range and component species. The variability of this association across its range and its relation to related types in this alliance are not fully understood. At Arnold Air Force Base, Coffee and Franklin counties, Tennessee, this vegetation is related to that found scattered along the border of Woods Reservoir. This appears to be a component of a mosaic of communities which form bands from the edge of the reservoir to the surrounding forest. The band found at the reservoir's edge is dominated by *Scirpus cyperinus* and *Typha latifolia* [see CEGL004150 for the *Typha latifolia*-dominated phase]. *Juncus* sp., grasses, and an occasional *Alnus serrulata* are also present. The *Scirpus cyperinus* grows in dense clumps throughout the outer band. Similarly, at Fort Benning, Georgia, this community forms bands at the outer edge of hydrologically enhanced areas. On Fort Benning *Scirpus cyperinus* is found in conjunction with *Saccharum giganteum, Juncus* sp., and occasional *Alnus serrulata* and *Nyssa biflora*.

Global Similar Associations:
• *Typha latifolia* Southern Herbaceous Vegetation (CEGL004150)

Global Related Concepts:
• IID6a. Natural Impoundment Pond (Allard 1990) B

Other Comments

Other Comments: Plots representing this association at both parks fit the global description of a semi-natural wetland community. The areas sampled are clearly influenced by past anthropogenic disturbance.

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: Within Chattahoochee River NRA, this association was sampled once

in the southern portion of Cochran Shoals (Gunby Creek area) south of the restroom facilities. There is a high probability for additional occurrences of this type at Chattahoochee River NRA in park units containing extensive emergent wetland areas: namely Johnson Ferry North and South, other portions of Cochran Shoals, and Swannee Creek. Within Kennesaw Mountain NBP, this association was sampled once within the southwest portion of the park south of the Cheatham Hill parking area just before reaching the bridge over John Ward Creek. This type does not appear to be common within the park; potential for additional occurrences is low to moderate.

Global Range: This vegetation is possible throughout the southeastern United States.

Nations: US

States/Provinces: AL, AR?, FL?, GA, KY, LA?, MS?, NC?, SC, TN, VA?, WV?

TNC Ecoregions: 42:P, 43:C, 44:C, 50:P, 52:C, 53:C, 56:P, 57:C, 59:P

USFS Ecoregions: 221H:PP, 221J:PP, 222Cf:CCP, 222Cg:CCP, 222Eb:CCC, 222Eg:CCP, 222Eh:CCP, 231A:PP, 232B:CC, 232C:CP, 232D:CP, 234A:PP, M221:P

Federal Lands: DOD (Fort Benning); NPS (Big South Fork, Chattahoochee River, Chickamauga-Chattanooga?, Kennesaw Mountain); USFS (Francis Marion, Oconee?, Talladega (Oakmulgee)?, Talladega (Talladega)?, Talladega?, Tuskegee?)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: CHAT.14, KEMO.18.

Local Description Authors: M.J. Russo and L. Echols

Global Description Authors: M. Pyne References: Allard 1990, Glitzenstein and Streng 2004, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data

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)

Alliance Concept

Summary: This alliance includes *Schizachyrium scoparium* (little bluestem)-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* (eastern red-cedar). Graminoids dominate stands of this alliance with scattered trees and shrubs. Various combinations of *Quercus* (oak) spp. and *Juniperus virginiana* (eastern red-cedar) may be present, with *Quercus stellata* (post oak) and *Quercus marilandica* (blackjack oak) being the most common trees, although *Quercus velutina* (black oak) may often be present. Some montane associations may contain *Quercus prinus* (chestnut oak). *Andropogon virginicus* (broomsedge bluestem), *Schizachyrium scoparium* (little bluestem), *Danthonia spicata* (poverty oatgrass), and *Dichanthelium* (rosette grass) spp. are the most abundant herbs. Some other herbs which may be

found include *Castilleja coccinea* (scarlet Indian paintbrush), *Coreopsis tripteris* (tall tickseed), *Liatris* (blazing star) spp., *Rudbeckia* (coneflower) spp., *Silphium* (rosinweed) spp., *Carex* (sedge) spp., and *Asclepias amplexicaulis* (clasping milkweed). *Smilax glauca* (cat greenbrier), *Smilax bona-nox* (saw greenbrier), *Rhus aromatica* (fragrant sumac), *Toxicodendron radicans* (eastern poison-ivy), *Ulmus alata* (winged elm), and *Vaccinium arboreum* (farkleberry) make up the sparse to moderate shrub layer. Lichens (e.g., *Cladonia* (cup lichen) spp. and *Cladina* (reindeer lichen) 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.

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.

Similar Alliances:
• (Fraxinus americana, Juniperus virginiana) / Carex pensylvanica - Schizachyrium scoparium Wooded Herbaceous Alliance (A.3014)
• (Juniperus virginiana) / Schizachyrium scoparium - (Bouteloua curtipendula) Wooded Herbaceous Alliance (A.1919)
• Amphianthus pusillus - Isoetes spp. Seasonally Flooded Herbaceous Alliance (A.1817)
• Juniperus virginiana Woodland Alliance (A.545)--shares many abundant species.

Similar Alliance Comments: This alliance (A.1920) is similar to *(Juniperus virginiana) / Schizachyrium scoparium - (Bouteloua curtipendula)* Wooded Herbaceous Alliance (A.1919), but it occurs on more acidic, rather than base-rich, substrates. This formation/alliance should be compared with related woodlands or herbaceous vegetation.

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

Alliance Description

Environment: 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 (Nelson 1987). 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.

Vegetation: *Schizachyrium scoparium* (little bluestem)-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* (eastern red-cedar). Graminoids dominate stands of this alliance with scattered trees and shrubs. Various combinations of *Quercus* (oak) spp. and *Juniperus virginiana* (eastern red-cedar) may be present, with *Quercus stellata* (post oak) and *Quercus marilandica* (blackjack oak) being the most common trees, although *Quercus velutina* (black oak) may often be present. Some montane associations may contain *Quercus prinus* (chestnut oak). *Andropogon virginicus* (broomsedge bluestem), *Schizachyrium scoparium* (little bluestem), *Danthonia spicata* (poverty oatgrass), and *Dichanthelium* (rosette grass) spp. are the most abundant herbs. Some other herbs which may be found include *Castilleja coccinea* (scarlet Indian paintbrush), *Coreopsis tripteris* (tall tickseed), *Liatris* (blazing star) spp., *Rudbeckia* (coneflower) spp., *Silphium* (rosinweed) spp., *Carex* (sedge) spp., and *Asclepias amplexicaulis* (clasping milkweed). *Smilax glauca* (cat greenbrier), *Smilax bona-nox* (saw greenbrier), *Rhus aromatica* (fragrant sumac), *Toxicodendron radicans* (eastern poison-ivy), *Ulmus alata* (winged elm), and *Vaccinium arboreum* (farkleberry) make up the sparse to moderate shrub layer. Lichens (e.g., *Cladonia* (cup lichen) spp. and *Cladina* (reindeer lichen) spp.) and mosses are prominent on exposed rock.

Alliance Distribution

Range: This alliance is found in the eastern U.S. from Illinois to Virginia and south to Georgia, Oklahoma, and Louisiana.

Nations: US

Subnations: AL, AR, GA, IL, IN, KS, KY, LA, MO, NC, NY, 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:?, 61:C

USFS Ecoregions: 221Ae:CCC, 221Ed:CPP, 221Ef:CPP, 221Ha:CCP, 221Hc:CCC, 221He:CCC, 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, M221Dc:CCC, M221Dd:CC?, M222Aa:CCC, M231Ab:CCC, M231Ac:CCC

Federal Lands: DOD (Fort Chaffee); NPS (Big South Fork, Buffalo River, Kennesaw Mountain, Obed, Ozark Riverways); USFS (Bankhead, Chattahoochee, Daniel Boone, Hoosier, Mark Twain, Nantahala?, Ouachita, Ozark, Shawnee, Wayne)

(CEGL004298) Granite Flatrock Complex, Perennial Zone

***Packera tomentosa - Croton willdenowii - Schizachyrium scoparium - (Selaginella rupestris)* Herbaceous Vegetation**
Woolly Ragwort - Willdenow's Croton - Little Bluestem - (Rock Spike-moss) Herbaceous Vegetation

NVC Classification

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland with a sparse tree layer (V.A.6.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland with a sparse tree layer (V.A.6.N.)
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)
Alliance (English name)	(Post Oak, Blackjack Oak) / Little Bluestem Wooded Herbaceous Alliance
Association	*Packera tomentosa - Croton willdenowii - Schizachyrium scoparium - (Selaginella rupestris)* Herbaceous Vegetation
Association (English name)	Woolly Ragwort - Willdenow's Croton - Little Bluestem - (Rock Spike-moss) Herbaceous Vegetation
Association (Common name)	Granite Flatrock Complex, Perennial Zone
Ecological System(s):	Southern Piedmont Granite Flatrock and Outcrop (CES202.329)

Element Concept

Global Summary: This perennial-dominated herbaceous community is a zonal component of granitic flatrock communities of the Piedmont of Georgia, South Carolina, North Carolina, Alabama, and Virginia. The characteristic and typically dominant species are *Packera tomentosa* (woolly ragwort) and *Croton willdenowii* (Willdenow's croton). In some examples, *Schizachyrium scoparium* (little bluestem) and *Selaginella rupestris* (northern selaginella) may have high cover. Other characteristic species include *Diodia teres* (poorjoe).

Environmental Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This granite flatrock vegetation was sampled three times at Kennesaw Mountain. The sites are somewhat steep to steep, northwest- and southeast-facing mid and upper slopes at 440-480 m (1450-1570 feet) elevation. Soils are dry to xeric, rapidly to well-drained sandy loam and loam. The unvegetated surface is dominated either by exposed bedrock (10-78% cover) or leaf litter (18-71%) with some large rocks (1-6%), small rocks (1-4%), wood (1-3%), and bare soil (0-6%). Evidence of disturbance includes the presence of invasive exotic plants.

Global Environment: This perennial-dominated herbaceous community is a zonal component of granitic flatrock communities of the Piedmont.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The sparse (10-40% cover) tall-shrub layer (2-5 m tall) and sparse (20-30%) short-shrub layer (1-2 m) may include *Celtis occidentalis* (common hackberry), *Chionanthus virginicus* (white fringetree), *Fraxinus americana* (white ash), *Juniperus virginiana* (eastern red-cedar), *Ptelea trifoliata* (common hoptree), *Ulmus alata* (winged elm), and *Vaccinium arboreum* (farkleberry). There may also be a sparse (10-20%) emergent tree layer (5-10 m) of *Fraxinus americana* (white ash), *Juniperus virginiana* (eastern red-cedar), and *Ulmus alata* (winged elm). The sparse to dense (<5%) herbaceous layer, which defines this community, may be dominated by *Cheilanthes lanosa* (hairy lipfern), *Piptochaetium avenaceum* (blackseed speargrass), *Schizachyrium scoparium* (little bluestem), and/or *Tradescantia hirsuticaulis* (hairystem spiderwort); other common herbs include *Arabis laevigata* (smooth rockcress), *Croton willdenowii* (Willdenow's croton), *Hypericum gentianoides* (orangegrass), *Packera tomentosa* (woolly ragwort), *Selaginella rupestris* (northern selaginella), *Talinum teretifolium* (quill fameflower), and others. Nonvascular species (mosses and lichens) cover up to 20% of the bedrock surface and may include *Cladina rangiferina* (greygreen reindeer lichen) and *Thuidium* (thuidium moss) sp. In addition, this community supports state-imperiled *Pycnanthemum curvipes* (stone mountainmint).

Global Vegetation: The characteristic and typically dominant species in stands of this type are *Packera tomentosa* (woolly ragwort) and *Croton willdenowii* (Willdenow's croton). In some examples, *Schizachyrium scoparium* (little bluestem) and *Selaginella rupestris* (northern selaginella) may have high cover. Other characteristic species include *Diodia teres* (poorjoe) and *Dichanthelium* (rosette grass) sp. (*Dichanthelium acuminatum* (tapered rosette grass) complex?). In a stand on the Chattahoochee National Forest (Stephens County, Georgia), the following species were present in the herbaceous stratum: *Dichanthelium dichotomum var. dichotomum* (cypress panicgrass), *Schizachyrium scoparium* (little bluestem), *Liatris microcephala* (smallhead blazing star), *Danthonia sericea* (downy danthonia), *Hypericum gentianoides* (orangegrass), *Opuntia humifusa* (devil's-tongue), *Polygala curtissii* (Curtiss' milkwort), *Commelina erecta* (whitemouth dayflower), *Nuttallanthus canadensis* (Canada toadflax), *Parthenium integrifolium var. integrifolium* (wild quinine), and *Rhexia* (meadowbeauty) sp.

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Chionanthus virginicus (white fringetree)*
Short shrub/sapling	Broad-leaved deciduous shrub	*Ptelea trifoliata (common hoptree)*
Herb (field)	Forb	*Tradescantia hirsuticaulis (hairystem spiderwort)*
Herb (field)	Graminoid	*Piptochaetium avenaceum (blackseed speargrass), Schizachyrium scoparium (little bluestem)*

Stratum	Lifeform	Species
Herb (field)	Fern or fern ally	*Cheilanthes lanosa (hairy lipfern)*

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Cheilanthes lanosa* (hairy lipfern), *Chionanthus virginicus* (white fringetree), *Croton willdenowii* (Willdenow's croton), *Hypericum gentianoides* (orangegrass), *Packera tomentosa* (woolly ragwort), *Piptochaetium avenaceum* (blackseed speargrass), *Ptelea trifoliata* (common hoptree), *Schizachyrium scoparium* (little bluestem), *Tradescantia hirsuticaulis* (hairystem spiderwort), *Vaccinium arboreum* (farkleberry)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Ligustrum sinense (Chinese privet)	High/Medium	invasive/exotic
Lonicera japonica (Japanese honeysuckle)	High/Medium	invasive/exotic
Prunus persica (peach)	Insignificant	invasive/exotic

Other Plant Species	GRank	Note
Pycnanthemum curvipes (stone mountainmint	G3	Globally variable; GA state-imperiled

Conservation Status Rank

Global Rank & Reasons: G3 (18-Mar-2002). This community is restricted to granitic outcrops in the southern Piedmont. 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. Some occurrences are found on U.S. Forest Service lands in the Chattahoochee National Forest, Georgia.

Classification

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This association was formerly placed in a perennial forb formation in its own unique alliance. Coffey (1964) cites *Packera tomentosa* (as *Senecio tomentosus*) as occurring "in dense stands on damp grassy places." She does not name or identify either particular zones or specific associations in her work on flat granitic outcrops. There are extensive stands of this association at Arabia Mountain, DeKalb County, Georgia.

Global Similar Associations:

• *Amphianthus pusillus - Isoetes melanospora - Isoetes tegetiformans* Herbaceous Vegetation (CEGL004342)--a different zone of depressions on granitic flatrocks and domes.

• *Diamorpha smallii - Minuartia glabra - Minuartia uniflora - Cyperus granitophilus* Herbaceous Vegetation (CEGL004344)--a wet zone of granitic flatrocks dominated by annual and perennial forbs.
• *Selaginella rupestris - Schizachyrium scoparium - Hypericum gentianoides - Bulbostylis capillaris* Herbaceous Vegetation (CEGL007690)--of granitic domes rather than flatrocks, in ECO51 (and ECO52?).
• *Talinum teretifolium - Minuartia glabra - Diodia teres - Croton willdenowii* Herbaceous Vegetation (CEGL003857)

Global Related Concepts:
• Annual-perennial herb community (Quarterman et al. 1993) ?
• Annual-perennial herb community (Burbanck and Platt 1964)

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: Three plots representing this association were taken from Kennesaw Mountain NBP. Two were sampled close the ridgeline of Little Kennesaw Mountain approximately 0.5 mile southwest of the small parking area along Kennesaw Mountain Drive. One plot was sampled from the midslopes of Little Kennesaw Mountain approximately 0.6 mile northeast of the Pigeon Hill parking area. There is a moderate to high potential for additional occurrences on Little Kennesaw and Kennesaw mountains where well-developed granitic outcrops exist.

Global Range: This community is restricted to granitic outcrops in the southern Piedmont from Virginia to Alabama.

Nations: US

States/Provinces: AL, GA, NC, SC, VA?

TNC Ecoregions: 52:C

USFS Ecoregions: 231Aa:CCC, 231Ad:CCC, 231Ae:CCC, 231Af:CCC

Federal Lands: NPS (Kennesaw Mountain); USFS (Chattahoochee, Chattahoochee (Piedmont))

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: KEMO.26, KEMO.28, KEMO.32.

Local Description Authors: M.J. Russo and L. Echols

Global Description Authors: M. Pyne

References: Burbanck and Platt 1964, Coffey 1964, Fleming et al. 2001, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Quarterman et al. 1993, Schafale 2003a, Schafale and Weakley 1990, Schotz pers. comm., Southeastern Ecology Working Group n.d., Wharton 1978

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

Selaginella (tortipila, rupestris) Herbaceous Alliance (A.1985)

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 1525 m (5000 feet) in the Blue Ridge, but occur below 915 m (3000 feet) in the Piedmont. 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 in the Piedmont of North Carolina and Georgia are more xeric and differ floristically from montane associations. This alliance has sparse to dense (10-90%) coverage by *Selaginella tortipila* (twistedhair spikemoss) or *Selaginella rupestris* (northern selaginella) 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* (Buckley's St. Johnswort), *Packera millefolia* (piedmont ragwort), *Carex biltmoreana* (stiff sedge), *Carex umbellata* (parasol sedge), *Solidago simulans* (fall goldenrod), *Danthonia epilis* (Carolina oatgrass), *Trichophorum caespitosum* (tufted bulrush), *Rhododendron catawbiense* (Catawba rosebay), and *Leiophyllum buxifolium* (sandmyrtle). Lower elevation associations typically include *Grimmia laevigata* (grimmia dry rock moss), *Andropogon virginicus* (broomsedge bluestem), *Coreopsis major* (greater tickseed), *Danthonia spicata* (poverty oatgrass), *Schizachyrium scoparium* (little bluestem), and *Talinum teretifolium* (quill fameflower). Some unique associations with circumneutral influence include species indicative of high pH soils such as *Arabis laevigata* (smooth rockcress), *Cheilanthes lanosa* (hairy lipfern), *Dodecatheon meadia* (pride of Ohio), *Sedum glaucophyllum* (cliff stonecrop), and *Hylotelephium telephioides* (Allegheny stonecrop).

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).

Similar Alliances:

• *Carex biltmoreana* Herbaceous Alliance (A.1277)--Vegetation may be floristically similar, but those associations occur as small patches (less than 10 acres) within a forested matrix and are generally more vegetated than associations in this alliance (A.1985).

• *Selaginella bigelovii* Herbaceous Alliance (A.2665)

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

Alliance Description

Environment: 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 (Nelson 1987). 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.

Vegetation: *Schizachyrium scoparium* (little bluestem)-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* (eastern red-cedar). Graminoids dominate stands of this alliance with scattered trees and shrubs. Various combinations of *Quercus* (oak) spp. and *Juniperus virginiana* (eastern red-cedar) may be present, with *Quercus stellata* (post oak) and *Quercus marilandica* (blackjack oak) being the most common trees, although *Quercus velutina* (black oak) may often be present. Some montane associations may contain *Quercus prinus* (chestnut oak). *Andropogon virginicus* (broomsedge bluestem), *Schizachyrium scoparium* (little bluestem), *Danthonia spicata* (poverty oatgrass), and *Dichanthelium* (rosette grass) spp. are the most abundant herbs. Some other herbs which may be found include *Castilleja coccinea* (scarlet Indian paintbrush), *Coreopsis tripteris* (tall tickseed), *Liatris* (blazing star) spp., *Rudbeckia* (coneflower) spp., *Silphium* (rosinweed) spp., *Carex* (sedge) spp., and *Asclepias amplexicaulis* (clasping milkweed). *Smilax glauca* (cat greenbrier), *Smilax bona-nox* (saw greenbrier), *Rhus aromatica* (fragrant sumac), *Toxicodendron radicans* (eastern poison-ivy), *Ulmus alata* (winged elm), and *Vaccinium arboreum* (farkleberry) make up the sparse to moderate shrub layer. Lichens (e.g., *Cladonia* (cup lichen) spp. and *Cladina* (reindeer lichen) spp.) and mosses are prominent on exposed rock.

Alliance Distribution

Range: This alliance is found in the eastern U.S. from Illinois to Virginia and south to Georgia, Oklahoma, and Louisiana.

Nations: US

Subnations: AL, AR, GA, IL, IN, KS, KY, LA, MO, NC, NY, 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:?, 61:C

USFS Ecoregions: 221Ae:CCC, 221Ed:CPP, 221Ef:CPP, 221Ha:CCP, 221Hc:CCC, 221He:CCC, 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, M221Dc:CCC, M221Dd:CC?, M222Aa:CCC, M231Ab:CCC, M231Ac:CCC

Federal Lands: DOD (Fort Chaffee); NPS (Big South Fork, Buffalo River, Kennesaw Mountain, Obed, Ozark Riverways); USFS (Bankhead, Chattahoochee, Daniel Boone, Hoosier, Mark Twain, Nantahala?, Ouachita, Ozark, Shawnee, Wayne)

(CEGL007690) Appalachian Low-Elevation Granitic Dome

***Selaginella rupestris - Schizachyrium scoparium - Hypericum gentianoides - Bulbostylis capillaris* Herbaceous Vegetation Rock Spike-moss - Little Bluestem - Pineweed - Common Hairsedge Herbaceous Vegetation**

NVC Classification

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial forb vegetation (V.B.)
Physiognomic Group	Temperate or subpolar perennial forb vegetation (V.B.2.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar perennial forb vegetation (V.B.2.N.)
Formation	Low temperate or subpolar perennial forb vegetation (V.B.2.N.b.)
Alliance	*Selaginella (tortipila, rupestris)* Herbaceous Alliance (A.1985)
Alliance (English name)	(Twisted-hair Spike-moss, Rock Spike-moss) Herbaceous Alliance
Association	*Selaginella rupestris - Schizachyrium scoparium - Hypericum gentianoides - Bulbostylis capillaris* Herbaceous Vegetation
Association (English name)	Rock Spike-moss - Little Bluestem - Pineweed - Common Hairsedge Herbaceous Vegetation
Association (Common name)	Appalachian Low-Elevation Granitic Dome
Ecological System(s):	Southern Appalachian Granitic Dome (CES202.297)

Element Concept

Global 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 915 m (3000 feet) 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* (northern selaginella) 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* (northern selaginella) is almost always a major dominant of the vegetation

mats. However, distribution of *Selaginella rupestris* (northern selaginella) can be spotty, so there are examples of this association that do not contain this species. Other characteristic herbaceous species are *Baptisia tinctoria* (horseflyweed), *Cheilanthes lanosa* (hairy lipfern), *Coreopsis major* (greater tickseed), *Corydalis sempervirens* (rock harlequin), *Danthonia sericea* (downy danthonia), *Lindernia monticola* (piedmont false pimpernel), *Phlox nivalis* (trailing phlox), *Schizachyrium scoparium* (little bluestem), *Scleria triglomerata* (whip nutrush), and *Talinum teretifolium* (quill fameflower). Common woody species include *Carya pallida* (sand hickory), *Chionanthus virginicus* (white fringetree), *Fraxinus americana* (white ash), *Juniperus virginiana* (eastern red-cedar), *Kalmia latifolia* (mountain laurel), *Pinus echinata* (shortleaf pine), *Pinus rigida* (pitch pine), *Quercus prinus* (chestnut oak), *Rhododendron minus* (piedmont rhododendron), *Ulmus alata* (winged elm), and *Vaccinium stamineum* (deerberry).

Environmental Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This granitic dome vegetation was sampled once at Kennesaw Mountain on a steep, south-facing upper slope at 510 m 1665 feet) elevation. The soil is xeric, rapidly drained loam. The unvegetated surface is dominated by exposed bedrock (73% cover) with some large rocks (6%), small rocks (2%), leaf litter (10%, wood (1%), and bare soil (8%).

Global 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 915 m (3000 feet) but may be found at slightly higher ones.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: This community is defined by the dominance of *Selaginella rupestris* (northern selaginella) in the sparse (30% cover) herbaceous layer. In addition, there is a sparse (10%) emergent tall-shrub layer (2-5 m) and moderate (40%) short-shrub layer (1-2 m) of *Celtis occidentalis* (common hackberry), *Ptelea trifoliata* (common hoptree), *Rhus copallinum* (flameleaf sumac), *Rubus argutus* (sawtooth blackberry), Smilax rotundifolia (roundleaf greenbrier), and Vaccinium arboreum (farkleberry). Additional herb species include Danthonia spicata (poverty oatgrass), Hypericum gentianoides (orangegrass), Packera anonyma (Small's ragwort), Panicum virgatum (switchgrass), Schizachyrium scoparium (little bluestem), Talinum teretifolium (quill fameflower), and others. Nonvascular species (Thuidium (thuidium moss) lichens) cover 10% of the rock surface. In addition, this community supports state-imperiled Pycnanthemum curvipes (stone mountainmint).

Global Vegetation: In stands of this type, the vegetation consists primarily of lichens on bare rock, or of shallow mats generally dominated by *Selaginella rupestris* (northern selaginella) 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* (northern selaginella) is almost always a major dominant of the vegetation mats. However, distribution of *Selaginella rupestris* (northern selaginella) can be spotty, so there are examples of this association that do not contain this species. Other characteristic herbaceous species are *Baptisia tinctoria* (horseflyweed), *Cheilanthes lanosa* (hairy lipfern), *Coreopsis major* (greater tickseed),

Corydalis sempervirens (rock harlequin), *Danthonia sericea* (downy danthonia), *Lindernia monticola* (piedmont false pimpernel), *Phlox nivalis* (trailing phlox), *Schizachyrium scoparium* (little bluestem), *Scleria triglomerata* (whip nutrush), and *Talinum teretifolium* (quill fameflower). Common woody species include *Carya pallida* (sand hickory), *Chionanthus virginicus* (white fringetree), *Fraxinus americana* (white ash), *Juniperus virginiana* (eastern red-cedar), *Kalmia latifolia* (mountain laurel), *Pinus rigida* (pitch pine), *Quercus prinus* (chestnut oak), *Rhododendron minus* (piedmont rhododendron), *Ulmus alata* (winged elm), and *Vaccinium stamineum* (deerberry).

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* (northern selaginella) dominate the stand. Widely scattered trees include *Pinus virginiana* (Virginia pine) and *Quercus prinus* (chestnut oak). A prevalent shrub is *Rhus aromatica* (fragrant sumac). Other herbs include *Ageratina aromatica* (lesser snakeroot), *Agrostis perennans* (upland bentgrass), *Andropogon* (bluestem) sp. *Cheilanthes lanosa* (hairy lipfern), *Packera anonyma* (Small's ragwort), *Solanum ptychanthum* (West Indian nightshade)?, and the characteristic *Talinum teretifolium* (quill fameflower). Examples of this association on granite gneiss at Carl Sandburg Home National Historic Site also contained patches of *Amelanchier laevis* (Allegheny serviceberry) and *Pinus virginiana* (Virginia pine) scattered in pockets of deeper soil.

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Rhus copallinum (flameleaf sumac)*
Herb (field)	Vine/Liana	*Smilax rotundifolia (roundleaf greenbrier)*
Herb (field)	Graminoid	*Panicum virgatum (switchgrass)*
Herb (field)	Fern or fern ally	*Selaginella rupestris (northern selaginella)*

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Panicum virgatum* (switchgrass), *Ptelea trifoliata* (common hoptree), *Rhus copallinum* (flameleaf sumac), *Selaginella rupestris* (northern selaginella), *Smilax rotundifolia* (roundleaf greenbrier)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Other Plant Species	GRank	Note
Pycnanthemum curvipes (stone mountainmint)	G31	Globally vulnerable; GA state-imperiled

Conservation Status Rank

Global Rank & Reasons: G2 (30-Apr-1998). 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.

Classification

Status: Standard

Classification Confidence: 2 - Moderate

Global 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 915 m [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.

Global Similar Associations:
• *(Quercus prinus) / Vaccinium pallidum / Schizachyrium scoparium - Danthonia spicata / Cladonia* spp. Herbaceous Vegetation (CEGL004990)
• *Packera tomentosa - Croton willdenowii - Schizachyrium scoparium - (Selaginella rupestris)* Herbaceous Vegetation (CEGL004298)
• *Selaginella rupestris - Schizachyrium scoparium - Hylotelephium telephioides - Allium cernuum* Herbaceous Vegetation (CEGL004991)
• *Selaginella tortipila - Krigia montana - Houstonia longifolia* Herbaceous Vegetation (CEGL004283)

Global Related Concepts:
• Low Elevation Granitic Dome (Schafale 1998b) ?

Other Comments

Other Comments: *Selaginella rupestris* mats were probably more extensive on large granitic outcrops within Kennesaw Mountain NBP at one time. Heavy recreational use of the park has left many outcrop areas with a depauperate flora.

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: One plot representing this association was sampled from Kennesaw

Mountain NBP. It was taken approximately 0.1 mile east of the small parking area on Kennesaw Mountain Drive. A moderate to high potential exists for additional occurrences on Kennesaw and/or Little Kennesaw mountains where substantial, relatively undisturbed granitic outcrops exist.

Global 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.

Nations: US

States/Provinces: GA, NC, SC?

TNC Ecoregions: 51:C, 52:C

USFS Ecoregions: 231Ad:CCC, M221Dc:CCC

Federal Lands: NPS (Blue Ridge Parkway?, Carl Sandburg Home, Kennesaw Mountain); USFS (Chattahoochee, Chattahoochee (Piedmont), Chattahoochee (Southern Blue Ridge), Nantahala, Pisgah)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: KEMO.22. Local Description Authors: M.J. Russo and L. Echols Global Description Authors: Southeast Ecology Group 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

Seasonally flooded temperate perennial forb vegetation (V.B.2.N.h.)

Polygonum spp. (section Persicaria) Seasonally Flooded Herbaceous Alliance (A.1881)

Alliance Concept

Summary: This alliance covers various wet depressions, lakes, and ponds dominated by various *Polygonum* (knotweed) species (section Persicaria), singly or in combination, or with other obligate wetland plant species. Associations have been described that are dominated by, or contain, *Polygonum amphibium* (water knotweed), *Polygonum densiflorum* (denseflower knotweed), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum lapathifolium* (curlytop knotweed), *Polygonum pensylvanicum* (Pennsylvania smartweed), *Polygonum punctatum* (dotted smartweed), and/or related *Polygonum* (knotweed) spp. The many associated species vary with geography and habitat. In western Kentucky, this alliance occurs in marshes associated with the Ohio River in backflood areas around oxbows, beaver-flooded areas, levees, and depressional drainages. Associated species include *Nelumbo lutea* (American lotus), *Cephalanthus occidentalis* (common buttonbush), *Sagittaria brevirostra* (shortbeak arrowhead), *Peltandra virginica* (green arrow-arum), and *Juncus effusus* (common rush). Associates in

Oklahoma include *Ammannia coccinea* (valley redstem), *Helianthus annuus* (common sunflower), *Lemna minor* (common duckweed), *Stuckenia pectinata* (sago pondweed), *Spirodela polyrrhiza* (common duckmeat), *Utricularia gibba* (humped bladderwort), and *Xanthium strumarium* (rough cockleburr). In Mississippi, one example of this vegetation is dominated by the perennial *Polygonum densiflorum* (denseflower knotweed); associated species include *Lemna minor* (common duckweed), *Saccharum giganteum* (sugarcane plumegrass), *Hydrocotyle umbellata* (manyflower marshpennywort), *Saururus cernuus* (lizard's-tail), *Carex lupulina* (hop sedge), *Triadenum walteri* (greater marsh St. Johnswort), *Cephalanthus occidentalis* (common buttonbush), *Leersia* (cutgrass) sp., *Ludwigia peploides* (floating primrose-willow), *Boehmeria cylindrica* (small-spike false nettle), *Juncus effusus* (common rush), *Rhynchospora corniculata* (shortbristle horned beaksedge), *Ludwigia decurrens* (wingleaf primrose-willow), *Habenaria repens* (waterspider bog orchid), *Mikania scandens* (climbing hempvine), *Scirpus cyperinus* (woolgrass), and others. It occurs as a band ringing the shores of ponds in the East Gulf Coastal Plain and along the banks of ditches and sloughs in the Mississippi River Alluvial Plain. This alliance also occurs in a wide variety of human- and beaver-created wetlands. Composition is highly variable and re-evaluation may be required as additional data become available. In the western United States and adjacent Canada, this alliance is found primarily over a wide elevational range from near sea level to over 2700 m. Stands are found in permanently flooded depressions such as margins of lake shores and oxbow lakes in river floodplains. The vegetation is characterized by the dominance or codominance of *Polygonum amphibium* (water knotweed). Associates may include species of *Potamogeton* (pondweed) and other aquatic plants.

Similar Alliances:

• Non-tidal Mudflat Seasonally/Temporarily Flooded Sparsely Vegetated Alliance (A.1878)

• *Polygonum* spp. - *Echinochloa* spp. Temporarily Flooded Herbaceous Alliance (A.1348)--vegetation of temporarily flooded playa lakebeds in Kansas and adjacent states that contains *Polygonum* spp., occurs in playa lakebeds that have a thick claypan beneath the soil surface.

Similar Alliance Comments: Alliances dominated by *Polygonum* spp. should be re-evaluated as a group; eventual redivision may be possible once adequate data are available. Hydrology of associations should also be reviewed.

Related Concepts:
• *Persicaria amphibia* Association (Cooper and Severn 1992) ?
• *Polygonum amphibium* herbaceous series (Hoagland 1997) I
• *Polygonum pensylvanicum* herbaceous series (Hoagland 1997) I
• *Polygonum* spp. (section *Persicaria*) herbaceous alliance
• Freshwater Aquatic Beds (Chappell et al. 1997) ?

Alliance Description

Environment: In the southeastern United States, this alliance occurs in a wide variety of human- and beaver-created wetlands (wet depressions, lakes, and ponds), including a band ringing the shores of ponds in the East Gulf Coastal Plain and in ditches and sloughs in the Mississippi River Alluvial Plain. In the western United States, Great Plains, and one province in Canada, it occurs over a wide elevational range from near sea level to over 2700 m. Stands are found in permanently flooded depressions such as margins of lake shores and oxbow lakes in river floodplains. occurs in shallow water along the edges of ponds and lakes in the western United

States. Stands are found in oxbow lakes and backwater areas of the Columbia River floodplain, in glacial ponds, or prairie potholes, in northern Montana, and in shallow lakes in the mountains of Colorado. Stands are located in standing water that is permanent or present at least during the growing season. These ponds have low concentrations of ions and salts and bottoms composed of finer sediments, organic muck, clay, or silt. The elevation of the vegetation in the alliance varies depending on geographical location. Stands on the Columbia River are located just above sea level, in Montana between 640-1080 m, and in Colorado from 2050-2700 m. *Typha latifolia* and *Schoenoplectus acutus* may grow adjacent to the vegetation in this alliance in deeper water, and *Carex aquatilis* grows in shallower water along the shore.

Vegetation: Stands of this alliance are dominated by various *Polygonum* (knotweed) species (section Persicaria), singly or in combination, or with other obligate wetland plant species. Associations have been described that are dominated by, or contain, *Polygonum amphibium* (water knotweed), *Polygonum densiflorum* (denseflower knotweed), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum lapathifolium* (curlytop knotweed), *Polygonum pensylvanicum* (Pennsylvania smartweed), *Polygonum punctatum* (dotted smartweed), and/or related *Polygonum* (knotweed) spp. The many associated species vary with geography and habitat. In western Kentucky, associated species include *Nelumbo lutea* (American lotus), *Cephalanthus occidentalis* (common buttonbush), *Sagittaria brevirostra* (shortbeak arrowhead), *Peltandra virginica* (green arrow-arum), and *Juncus effusus* (common rush). Associates in Oklahoma include *Ammannia coccinea* (valley redstem), *Helianthus annuus* (common sunflower), *Lemna minor* (common duckweed), *Stuckenia pectinata* (sago pondweed), *Spirodela polyrrhiza* (common duckmeat), *Utricularia gibba* (humped bladderwort), and *Xanthium strumarium* (rough cockleburr). In Mississippi, one example of this vegetation is dominated by the perennial *Polygonum densiflorum* (denseflower knotweed); associated species include *Lemna minor* (common duckweed), *Saccharum giganteum* (sugarcane plumegrass), *Hydrocotyle umbellata* (manyflower marshpennywort), *Saururus cernuus* (lizard's-tail), *Carex lupulina* (hop sedge), *Triadenum walteri* (greater marsh St. Johnswort), *Cephalanthus occidentalis* (common buttonbush), *Leersia* (cutgrass) sp., *Ludwigia peploides* (floating primrose-willow), *Boehmeria cylindrica* (small-spike false nettle), *Juncus effusus* (common rush), *Rhynchospora corniculata* (shortbristle horned beaksedge), *Ludwigia decurrens* (wingleaf primrose-willow), *Habenaria repens* (waterspider bog orchid), *Mikania scandens* (climbing hempvine), *Scirpus cyperinus* (woolgrass), and others. In the western United States and adjacent Canada, stands are characterized by the dominance or codominance of *Polygonum amphibium* (water knotweed). Associates may include species of *Potamogeton* (pondweed) and other aquatic plants. Floating-leaved aquatic forbs cover at least 30% of the water's surface (Kunze 1994). In the western United States, *Polygonum amphibium* (water knotweed) often forms dense, nearly monotypic stands. *Lemna minor* (common duckweed), *Potamogeton natans* (floating pondweed), *Spirodela polyrrhiza* (common duckmeat), and *Wolffia* (watermeal) spp. are occasionally present. In addition, *Typha latifolia* (broadleaf cattail) and *Schoenoplectus acutus* (hardstem bulrush) may grow adjacent to the vegetation in this alliance in deeper water, and *Carex aquatilis* (water sedge) grows in shallower water along the shore.

Alliance Distribution

Range: This alliance is widespread but scattered throughout the eastern and midwestern United States. In the western United States, this alliance is found in California (?), Oregon, Washington, Montana, and Colorado. It also occurs in British Columbia, Canada.

Nations: CA, US

Subnations: AL, AR, BC, CA?, CO, FL?, GA, IA, ID, IL, IN, KY, LA?, MO, MS, MT, NC, NJ, OK, OR, PA, SC, SD, TN, TX?, UT, WA, WI

TNC Ecoregions: 1:C, 2:C, 3:C, 4:C, 6:C, 10:C, 19:C, 20:C, 26:C, 27:C, 28:P, 32:C, 33:C, 36:C, 37:C, 38:C, 39:C, 42:C, 43:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C, 51:P, 52:C, 53:C, 56:C, 57:C, 61:C, 62:C, 81:C

USFS Ecoregions: 212Ja:PPP, 212Jb:PPP, 212Jc:PPP, 212Je:PPP, 212Jf:PPP, 212Jj:PPP, 212Jl:PPP, 212Jm:PPP, 221Ea:CCC, 221Ha:CCC, 221Hc:CCC, 221Hd:CC?, 221He:CCC, 222Ab:CCC, 222Ag:CCC, 222Aj:CCC, 222Ak:CC?, 222Am:CCC, 222Ce:CCP, 222Cf:CCP, 222Cg:CCC, 222Db:CCC, 222Eb:CCC, 222Eg:CCP, 222Ej:CCC, 222En:CCC, 222Eo:CCC, 222Gc:CCC, 222Jb:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 231Aa:CCC, 231Ab:CCC, 231Ae:CCP, 231Af:CCP, 231Ao:CCC, 231Ba:CCC, 231Bc:CC?, 231Bd:CC?, 231Be:CC?, 231Bi:CCC, 231Bk:CC?, 231Cc:CCC, 231Cd:CCC, 231D:CP, 231E:CP, 231Ga:CCC, 231Gb:CCC, 232Ac:CCC, 232Bd:CCC, 232Bj:CCC, 232Bl:CCC, 232Bq:CCC, 232Bs:CCC, 232Cb:CCC, 232Ce:CCC, 232D:CP, 232E:CP, 232F:CP, 234An:CCC, 242A:CC, 251Cc:CCC, 251Cd:CC?, 251Cf:CCC, 251Cg:CCC, 251Ck:CCC, 251Eb:CCC, 251F:CC, 255A:CC, 311A:CC, 315B:PP, 315C:PP, 331B:CC, 331D:CC, 331F:CP, 331G:CC, 331I:C?, 332C:CP, 332E:CC, 341C:CC, 342B:CC, 342C:C?, M221Cd:CCC, M222A:??, M231A:??, M242A:CC, M242B:CC, M242C:CC

Federal Lands: COE (Claiborne Lake); DOD (Fort Benning); NPS (Chattahoochee River, Chickamauga-Chattanooga, Cumberland Island, Friendship Hill, Great Sand Dunes, Great Smoky Mountains, Horseshoe Bend, Kennesaw Mountain, Lake Meredith, Morristown, Natchez Trace, Ocmulgee, Shiloh); USFS (Bankhead, Bienville, Chequamegon, Chequamegon-Nicolet, Daniel Boone, Francis Marion, Nicolet, Oconee, Oregon Dunes, Siuslaw, Talladega?); USFWS (Lacreek, Ouray, Reelfoot, Supawna Meadows)

(CEGL004290) Smartweed - Cutgrass Beaver Pond

***Polygonum (hydropiperoides, punctatum)* - *Leersia* spp. Herbaceous Vegetation (Swamp Smartweed, Dotted Smartweed) - Cutgrass species Herbaceous Vegetation**

NVC Classification

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial forb vegetation (V.B.)
Physiognomic Group	Temperate or subpolar perennial forb vegetation (V.B.2.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar perennial forb vegetation (V.B.2.N.)
Formation	Seasonally flooded temperate perennial forb vegetation (V.B.2.N.h.)
Alliance	*Polygonum* spp. (section *Persicaria*) Seasonally Flooded Herbaceous Alliance (A.1881)
Alliance (English name)	Smartweed species Seasonally Flooded Herbaceous Alliance
Association	*Polygonum (hydropiperoides, punctatum)* - *Leersia* spp. Herbaceous Vegetation
Association (English name)	(Swamp Smartweed, Dotted Smartweed) - Cutgrass species Herbaceous Vegetation
Association (Common name)	Smartweed - Cutgrass Beaver Pond
Ecological System(s):	East Gulf Coastal Plain Small Stream and River Floodplain Forest (CES203.559) East Gulf Coastal Plain Depression Pondshore (CES203.558) South-Central Interior Small Stream and Riparian (CES202.706) Northern Atlantic Coastal Plain Pond (CES203.518)

Element Concept

Global Summary: This association incorporates vegetation of beaver ponds and other semipermanent impoundments in the Piedmont, South Atlantic Coastal Plain, Upper East Gulf Coastal Plain, scattered localities in the Blue Ridge, and possibly other adjacent provinces. Stands of this vegetation are dominated by some combination of *Polygonum punctatum* (dotted smartweed), *Polygonum hydropiperoides* (swamp smartweed), *Leersia lenticularis* (catchfly grass), *Leersia oryzoides* (rice cutgrass), and/or *Leersia virginica* (whitegrass). Other herbaceous species present include *Saururus cernuus* (lizard's-tail), *Proserpinaca* (mermaidweed) sp., *Bidens aristosa* (bearded beggarticks), and *Xanthium strumarium* (rough cockleburr). Scattered individuals of *Cephalanthus occidentalis* (common buttonbush) and *Acer saccharinum* (silver maple) may be present. A Piedmont North Carolina example contains *Impatiens capensis* (jewelweed), *Boehmeria cylindrica* (small-spike false nettle), and the exotic *Murdannia keisak* (wartremoving herb).

Environmental Description

USFWS Wetland System: Palustrine Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This smartweed - cutgrass vegetation was sampled twice at Kennesaw Mountain. The sites are intermittently flooded lowlands at 290-300 m (960-1000 feet) elevation. Soils are very poorly to poorly drained muck and clay. The unvegetated surface is made up entirely of leaf litter (100% cover). Evidence of disturbance includes the presence of exotic plants. One plot (KEMO.13) is located within a wetland area serving as a sewer overflow where several raised manholes are present. At least some portions of the wet meadow area where plot KEMO.16 was sampled are periodically mowed.

Global Environment: This association incorporates vegetation of beaver ponds and other semipermanent impoundments.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The closed (100% cover) herbaceous layer (1-2 m tall) is codominated by *Leersia oryzoides* (rice cutgrass) and *Polygonum sagittatum* (arrowleaf tearthumb). Additional species include *Bidens frondosa* (devil's beggartick), *Echinochloa crus-galli* (barnyardgrass) (exotic), *Mikania scandens* (climbing hempvine), *Scirpus cyperinus* (woolgrass), and *Commelina virginica* (Virginia dayflower). This constitutes the entire species list for the two sampled plots.

Global Vegetation: Stands of this vegetation are dominated by some combination of *Polygonum punctatum* (dotted smartweed), *Polygonum hydropiperoides* (swamp smartweed), *Leersia lenticularis* (catchfly grass), *Leersia oryzoides* (rice cutgrass), and/or *Leersia virginica* (whitegrass). Other herbaceous species which may be present include *Polygonum densiflorum* (denseflower knotweed), *Saururus cernuus* (lizard's-tail), *Proserpinaca* (mermaidweed) sp., *Sparganium americanum* (American bur-reed), *Typha latifolia* (broadleaf cattail), *Scirpus cyperinus* (woolgrass), *Lobelia cardinalis* (cardinalflower), *Onoclea sensibilis* (sensitive fern), *Penthorum sedoides* (ditch stonecrop), *Boehmeria cylindrica* (small-spike false nettle), *Sambucus canadensis* (common elderberry), *Bidens aristosa* (bearded beggarticks), and *Xanthium strumarium* (rough cockleburr). Scattered individuals of *Cephalanthus occidentalis*

(common buttonbush) and *Acer saccharinum* (silver maple) or other woody plants may be present. Examples which have become dried-out (through drought and/or beaver dam failure) may exhibit greater dominance by *Leersia* (cutgrass) rather than *Polygonum* (knotweed). The combination of *Polygonum punctatum - Leersia virginica* was first noted, but the combination of *Polygonum hydropiperoides* (swamp smartweed) and *Leersia lenticularis* (catchfly grass) has also been observed in the Oconee National Forest. At Ocmulgee National Monument near Macon, Georgia, *Leersia oryzoides* (rice cutgrass) was the sole dominant at the time of sampling.

Most Abundant Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Stratum	Lifeform	Species
Herb (field)	Forb	*Polygonum sagittatum (arrowleaf tearthumb)*
Herb (field)	Graminoid	*Leersia oryzoides (rice cutgrass)*

Global Stratum	Lifeform	Species
Herb (field)	Forb	*Polygonum hydropiperoides (swamp smartweed), Polygonum punctatum (dotted smartweed)*
Herb (field)	Graminoid	*Leersia lenticularis (catchfly grass), Leersia virginica (whitegrass)*

Characteristic Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park: *Leersia oryzoides* (rice cutgrass), *Polygonum sagittatum* (arrowleaf tearthumb)
Global: *Leersia lenticularis* (catchfly grass), *Leersia virginica* (whitegrass), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum punctatum* (dotted smartweed)

Other Noteworthy Species

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

Exotic and Invasive Species	I-Rank	Note
Echinochloa crus-galli (barnyardgrass)	**Medium/Insignificant**	**invasive/exotic**

Global Exotic and Invasive Species	I-Rank	Note
Murdannia keisak (wartremoving herb)	Medium/Low	exotic

Conservation Status Rank

Global Rank & Reasons: G4? (21-Dec-2000). This association is found in the Coastal Plain and Interior from Tennessee and Alabama to the Carolinas. The full extent of its distribution is not known. This is not a rare community type, but it is threatened by filling of wetlands.

Classification

Status: Standard

Classification Confidence: 2 - Moderate

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Comments: Classification of plot KEMO.16 as this association should be considered tentative. This plot consists of a near-monotypic dominance of the scrambling herb *Polygonum sagittatum*; this species is effectively excluding other wetland vegetation. Its dominance and suppression of other wetland plants may represent a response to recent anthropogenic disturbance. This plot may represent a new ruderal association if additional examples are documented.

Global Comments: This association is documented from a beaver pond in the floodplain of Owl Creek, Shiloh National Battlefield, Tennessee, on Collins silt loam; it is also documented on Bailey Island in the ACE Basin (C. Aulbach-Smith pers. comm.). It has also been seen in the Bankhead National Forest and Horseshoe Bend National Military Park, Alabama, and the Oconee National Forest, Georgia.

Element Distribution

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Range: Within Kennesaw Mountain NBP, two plots attributable to this association were sampled south of the Cheatham Hill activity area in low-lying wetlands adjacent to John Ward Creek. Herbaceous wetland areas are uncommon within the park; potential for additional occurrences of this type are low.

Global Range: This association is found in the Coastal Plain, Ridge and Valley, and other interior provinces from Tennessee and Alabama to the Carolinas. The full extent of its distribution is not known.

Nations: US

States/Provinces: AL, GA, KY?, MS, NC, NJ, PA, SC, TN

TNC Ecoregions: 42:?, 43:C, 44:P, 49:C, 50:C, 51:P, 52:C, 53:C, 56:C, 57:P, 62:C

USFS Ecoregions: 221Ea:CCC, 221Ha:CCC, 221Hc:CCC, 221Hd:CC?, 221He:CCC, 222Ce:CCP, 222Cf:CCP, 222Cg:CCC, 222Eb:CCC, 222Eg:CCP, 222Ej:CCC, 222En:CCC, 222Eo:CCC, 231Aa:CCC, 231Ab:CCC, 231Ae:CCP, 231Af:CCP, 231Ao:CCC, 231Bc:CC?, 231Bd:CC?, 231Be:CC?, 231Bi:CCC, 231Cc:CCC, 231Cd:CCC, 232Ac:CCC, 232Bl:CCC, 232Bq:CCC, M221Cd:CCC

Federal Lands: DOD (Fort Benning); NPS (Chickamauga-Chattanooga, Friendship Hill, Great Smoky Mountains, Horseshoe Bend, Kennesaw Mountain, Morristown, Natchez Trace, Ocmulgee, Shiloh); USFS (Bankhead, Daniel Boone?, Oconee, Talladega (Oakmulgee)?, Talladega (Talladega)?, Talladega?); USFWS (Supawna Meadows)

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: KEMO.13, KEMO.16.

Local Description Authors: M.J. Russo and L. Echols

Global Description Authors: M. Andreu and M. Tukman, mod. H. Summer References: Aulbach-Smith pers. comm., Ehrenfeld 1977, Gallyoun et al. 1996, NatureServe Ecology -

Southeastern U.S. unpubl. data, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data

No Alliance Placement

(CEGL004692) Disturbed Herbaceous Wetland

Disturbed Herbaceous Wetland

NVC Classification

Association	Disturbed Herbaceous Wetland
Association (English name)	Disturbed Herbaceous Wetland

Element Concept

Global Summary:

Environmental Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Environment: This ruderal, managed herbaceous wetland vegetation is found in a mowed sewerline easement at Kennesaw Mountain National Battlefield Park. The area is periodically mowed and temporarily flooded and serves as a sewer overflow during flooding events.

Vegetation Description

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: Some of the codominant plant species include *Panicum anceps* (beaked panicgrass), *Juncus effusus* (common rush), *Dichanthelium scoparium* (velvet panicum), *Solidago canadensis* (Canada goldenrod), *Symphyotrichum dumosum* (rice button aster), *Tripsacum dactyloides* (eastern gamagrass), and *Vernonia gigantea* (giant ironweed).

Most Abundant Species

Other Noteworthy Species

Conservation Status Rank

Global Rank & Reasons: GNA (ruderal) (10-Feb-2009).

Classification

Status: Nonstandard

Classification Confidence:

Element Sources

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Plots: KEMO.15, KEMO.17.

Local Description Authors: M. Pyne

Global Description Authors: References: Eastern Ecology Working Group n.d.

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Appendix C: Field Key to Vegetation Types

Draft Key to the National Vegetation Classification (NVC) Associations, which occur at Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park

April 2009

Associations which are documented from Chattahoochee River National Recreation Area (CHAT) and/or Kennesaw Mountain National Battlefield Park (KEMO) are in bold type. For each association, the common name is given, with the Element Code in parentheses (CEGL00####) and the Alliance Code in brackets [A.###]. The presence of each association within CHAT and/or KEMO is denoted in parentheses with their respective abbreviations.

CHATTAHOOCHEE RIVER NATIONAL RECREATION AREA
AND KENNESAW MOUNTAIN NATIONAL BATTLEFIELD PARK

KEY TO KEYS

1. Vegetation not dominated by trees; trees absent or sparse 2

1. Vegetation dominated by trees; forests or woodlands KEY A - FORESTS & WOODLANDS

2. Shrub dominated areas with few or no trees; shrubs usually range 1-5 m (feet) in height, occasionally reaching heights > 5 meters within mafic shrubland KEY - B SHRUBLANDS

2. Vegetation dominated by herbaceous plants, including sparse vegetation of herbaceous plants associated with granitic outcrops, and herbaceous vegetation intermixed with sparse shrub cover
KEY C - HERBACEOUS VEGETATION

KEY A-FORESTS & WOODLANDS

1**.** Pine (*Pinus* spp.) dominated canopy, broadleaf trees maybe present in the canopy but with low cover **2**

1. Broadleaf dominated canopy, frequently with pine component but not composing more than 50% of the canopy **6**

2. Pine forest associated with flat to gently sloping, low-lying areas; either only a few meters away from active stream channel or occupying well-defined floodplains or lowland areas **3**

2. Pine forest associated with higher topographic positions including ridges, middle and upper slopes; situated away from active stream channel and/or floodplain **4**

3. Planted pine forest; Pinus strobus-dominated canopy with trees in rows; depauperate understory diversity typical of plantation forest types .... **White Pine Plantation (CEGL007178) [A.98] (CHAT)**

3. Naturally generating forest; Pinus taeda-dominated canopy not in rows; subcanopy dominated by Liriodendron tulipifera along with nearly equal amounts of Acer rubrum, Fraxinus americana, Liquidambar styraciflua, Nyssa sylvatica, Quercus alba, Quercus nigra, and Sassafras albidum; Old growth Pinus taeda present; average pine canopy height > 45 m (148 ft); relatively diverse understory typical of late successional forest types

..... **Piedmont Loblolly Pine Mixed Oak Floodplain Forest (CEGL007551) [A.437] (CHAT)**

4. Canopy clearly dominated by Pinus echinata, with lesser amounts of Acer rubrum, Carya ovalis, Nyssa sylvatica, Quercus alba, Quercus prinus, and Quercus velutina in the canopy

..... **Early Successional Shortleaf Pine Forest (CEGL006327) [A.119] (KEMO)**

4. Canopy dominated by Pinus taeda with admixtures of oaks (Quercus spp.) and other hardwoods present in the canopy **5**

5. Seminatural *Pinus taeda*-dominated forest sufficiently aged to develop a more pronounced hardwood character; oaks (*Quercus alba, Quercus coccinea, Quercus falcata, Quercus nigra, Quercus prinus, Quercus velutina*) prevalent in subcanopy and lower strata (and occasionally the canopy)

.....**Piedmont Loblolly Pine-Oak Forest (CEGL004232) [A.404] (CHAT)**

5. Younger, seminatural *Pinus taeda*-dominated forest exhibiting early to mid-successional characteristics with less pronounced hardwood character; oaks (*Quercus* spp.) usually absent or sparse; *Liriodendron tulipifera, Liquidambar styraciflua* and *Oxydendrum arboreum* dominate the subcanopy

..... **Early- to Mid-Successional Loblolly Pine Forest (CEGL006011) [A.130] (CHAT, KEMO)**

6. Forests associated with lowland and/or mesic areas, including alluvial terraces, bottomlands, and lower slopes; Canopy usually dominated by species typical of mesic or wet sites (*Betula nigra, Celtis laevigata, Fagus grandifolia, Juglans nigra, Liriodendron tulipifera, Fraxinus pensylvanica,*); oaks often associated with mesic forests (*Quercus alba, Quercus nigra, Quercus rubra*) may constitute a significant canopy component **7**

6. Forests associated with upland areas (middle and upper slopes and ridges); Canopy usually dominated by oaks typical of dry-mesic, dry, or xeric sites (*Quercus alba, Quercus falcata, Quercus prinus, Quercus stellata*) with admixtures of hickories (*Carya alba, Carya glabra, Carya ovalis*) and other hardwoods; *Liriodendron tulipifera* dominates disturbed successional forests along middle and upper slopes in some examples..... **16**

7. Canopy dominated or codominated by a combination of species typical of bottomlands and well-developed floodplains, including *Betula nigra, Celtis laevigata, Fraxinus pensylvanica, Juglans nigra,* and *Platanus occidentalis*; examples always associated with alluvial terraces or bottomlands . **8**

7. Canopy may be dominated by a variety of species, but not the combination of floodplain/bottomland species listed above; forests associated with a variety of landscape positions . **9**

8. Canopy may include a number of species indicative of floodplain landforms, but *Betula nigra* dominates 50% or more of the canopy; additional canopy species include *Acer leucoderme, Celtis laevigata, Juglans nigra, Liriodendron tulipifera, Pinus taeda, Platanus occidentalis, Prunus serotina,* and *Quercus nigra,* associated with alluvial terraces

..... **River Birch Levee Forest (CEGL007312) [A.280] (CHAT)**

8. Canopy may include *Betula nigra* but always in lesser abundance; canopy dominated by some combination of *Celtis laevigata, Fraxinus pensylvanica, Juglans nigra, Liriodendron tulipifera,* and *Platanus occidentalis*; associated with alluvial terraces or bottomlands

American Sycamore-Sugarberry-Green Ash Floodplain Forest (CEGL007730) [A.288] (CHAT)

9. Seepage swamp forest associated with small stream bottoms; canopy dominated by *Nyssa sylvatica* with lesser amounts of *Liriodendron tulipifera* and *Pinus taeda*; numerous perennial seepage areas evident with mucky soil; wetland ferns, including *Osmunda cinnamomea and Osmunda regalis,* characteristic within seepage areas

..... **Piedmont Low-Elevation Headwater Seepage Swamp (CEGL004426) [A.348] (KEMO)**

9. Forests associated with a variety of landforms including small stream bottoms; *Nyssa sylvatica* absent or sparse in the canopy layer; canopy species, often associated with mesic sites, may include *Fagus grandifolia, Liriodendron tulipifera, Pinus taeda, Quercus alba, Q. nigra,* and *Q. rubra*; perennial seepage areas with mucky soil absent, although examples associated with stream bottoms may be subject to periodic flooding..... **10**

10. Mesic mafic forest underlain by amphibolite; canopy codominated by *Quercus alba* and *Tilia americana* with lesser amounts of *Carya alba*; shrub layers codominated by *Celtis occidentalis* and *Cercis canadensis* ..... **Piedmont Rocky Mesic Mafic Forest (CEGL004542) [A.239] (CHAT)**

10. Mesic forest typically not underlain by amphibolite; Canopy may contain *Quercus alba* as a codominant but *Tilia americana* is absent or sparse; shrub layers dominated by various species..... **11**

11. Mature and/or uneven-aged mesic forest codominated by characteristic mesic species which may include *Fagus grandifolia, Liriodendron tulipifera, Quercus rubra,* and *Quercus alba*..... **12**

11. Successional, more-or-less uneven-aged forest dominated by a combination of mesic canopy species other than above; *Liriodendron tulipifera* or *Quercus nigra* usually dominant..... **13**

12. Mature forest codominated by *Fagus grandifolia, Liriodendron tulipifera,* and *Quercus alba*; *Fagus grandifolia* always a significant canopy component; occurs on sheltered, north-facing slopes adjacent to streams

.....Piedmont Acidic Mesic Mixed Hardwood Forest (CEGL008465) [A.229] (CHAT, KEMO)

12. Successional, uneven-aged forest dominated by *Liriodendron tulipifera, Pinus taeda, Quercus alba,* and *Quercus rubra*; *Fagus grandifolia* absent; occurs on small, sheltered floodplains.

.....**Successional Tuliptree Forest (Acidic Type) (CEGL7221) (CHAT)**

13. Successional forest with canopy dominated by *Quercus nigra*; additional species may include *Liquidambar styraciflua, Liriodendron tulipifera, Pinus taeda, Platanus occidentalis, Quercus alba, Quercus coccinea, Quercus falcata, Quercus pagoda, Quercus rubra,* and *Quercus velutina*; associated with various landscape positions .....
Successional Water Oak Forest (CEGL004638) [A.247] (CHAT)

13. Successional forest dominated a combination of mesic canopy species other than *Quercus nigra*; *Liriodendron tulipifera* usually dominates or codominates the canopy; associated with stream bottoms and low slopes **14**

14. *Liriodendron tulipifera* and *Pinus taeda* codominate the canopy; early successional, highly disturbed forest with depauperate species diversity and strong understory invasive component

..... **Loblolly Pine-Tuliptree Successional Forest (CEGL007546) [A.434] (CHAT)**

14. Successional forest in which *Pinus taeda*, if present, occurs in lesser amounts within the canopy; *Liriodendron tulipifera*-dominated forest often with diverse understory, or understory strongly dominated by *Lindera benzoin*..... **15**

15. Circumneutral forest dominated by *Liriodendron tulipifera* with lesser amounts of *Carya alba, Liquidambar styraciflua*, *Pinus taeda,* and *Quercus* spp. in the canopy; shrub layers may be diverse or strongly dominated by *Lindera benzoin*; herb layer may be relatively diverse, often containing state-rare species
..... **Successional Tuliptree Forest (Circumneutral Type) (CEGL007220) [A.236) (CHAT)**

15. Relatively acidic forest codominated by *Liriodendron tulipifera* and *Liquidambar styraciflua* in the canopy; shrub layers dominated by *Carpinus caroliniana* and/or *Lindera benzoin*

..... **Upper Southeast Small Stream Sweetgum-Tuliptree Forest (CEGL004418) [A.287] (KEMO)**

16. Dry-mesic forest; sites often tend to be somewhat dry, but intermediate conditions may allow codominance of species usually associated with more mesic or lowland environments; dominants often include a variable mixture of oaks (*Quercus* spp.), hickories (*Carya* spp.) **17**

16. Dry to xeric forests or woodlands; sites often associated with drier conditions (upper exposed slopes, thin soils) that prohibit dominance of species associated with more mesic environments; dominants may include oak species such as *Quercus falcata*, *Quercus marilandica*, and *Quercus prinus* **19**

17. Sparse canopy (<30%) dominated by *Liriodendron tulipifera* with lesser amounts of *Acer rubrum* and *Quercus nigra*; community recovering from Pine Bark Beetle infestation; numerous jackpots of downed *Pinus taeda* are evident

..... **Successional Tuliptree-Loblolly Pine Upland Forest (CEGL007521) [A.236] (CHAT)**

17. Dense canopy (>50%) usually dominated by admixtures of Quercus spp. and Carya spp; community not suffering from Pine Bark Beetle infestation; Pinus taeda may be present as a lesser canopy component but never a codominant..... **18**

18**.** Dry-mesic forest associated with base-rich soils; canopy codominated by *Carya alba*, *Quercus alba* and *Quercus rubra*; other occasional oak species include *Quercus prinus* and *Quercus stellata*; shrub layers often exhibiting high cover of *Acer leucoderme*, a species indicative of basic and/or rich sites; herbaceous layer notably diverse within high quality examples

..... **Piedmont Dry-mesic Basic Oak Hickory Forest (CEGL007232) [A.239] (CHAT)**

18. Dry mesic forest associated with more acidic soils; canopy dominated by *Carya ovalis*; other codominants include *Liriodendron tulipifera*, *Quercus alba*, *Quercus stellata*, and *Quercus velutina*; shrub layer dominants include species not necessarily indicative of base-rich soil conditions such as *Cornus florida* and *Prunus serotina*; herbaceous layer typically sparse

..... **Piedmont Dry-mesic Acidic Oak Hickory Forest (CEGL008475) [A.239] (KEMO)**

19. Woodland with sparse to moderately sparse tree canopy 5-15 m tall; subcanopy absent; *Juniperus virginiana*, *Quercus marilandica* and/or *Ulmus alata* may dominate the canopy; species often indicative of mafic substrates, including *Chionanthus virginicus* and *Philadelphus hirsutus, Ptelea trifoliata*, dominate shrub layers **20**

19. Forest (may include those associated with mafic substrates) with moderately dense to dense tree canopy 10-35m tall; subcanopy usually always present; dominants may include various *Quercus* spp. and/or *Carya* spp.; various species (including those with mafic affinities) dominate shrub layers..... **21**

20. Mafic woodland with moderately sparse, somewhat stunted tree canopy 5-10 m tall dominated by *Quercus marilandica*; other codominates include *Carya pallida, Pinus echinata, Prunus umbellata,* and *Ulmus alata*; shrub layers are codominated by *Chionanthus virginicus, Ptelea trifoliata, Rhus copallinum,* and *Vaccinium arboreum* .....

..... **Upper Piedmont Mafic Shortleaf Pine-Oak Woodland (CEGL008492) [A.280] (KEMO)**

20. Granitic flatrock border woodland with sparse canopy 10-15 tall dominated by *Juniperus virginiana* and *Ulmus alata*; shrub layers are dominated by *Chionanthus virginicus,* with lesser amounts of *Ptelea trifoliata*, *Rhus copallinum*, and *Yucca filamentosa* .....

..... **Virginia Pine/Granitic Flatrock Border Forest (CEGL003993) [A.131] (KEMO)**

21. Canopy dominated by *Quercus falcata*; codominants may include *Carya alba, Carya glabra, Liriodendron tulipifera, Pinus echinata, Pinus taeda*, and more commonly *Quercus alba, Quercus stellata*, and *Quercus velutina*; usually associated with low fertility soils .....

..... **Interior Southern Red Oak-White Oak Forest (CEGL007244) [A.241] (CHAT, KEMO)**

21. Canopy dominated by *Quercus prinus*; important codominants may include a number of *Carya* spp., *Pinus* spp. and *Quercus* spp.; associated with a variety of soils, including those arising from mafic parent material **22**

22. *Quercus prinus*-dominated canopy; other codominants include *Liriodendron tulipifera, Pinus echinata, Pinus taeda, Quercus alba, Quercus coccinea, Quercus falcata, Quercus rubra*, and/or *Quercus velutina*; very dense shrub layers dominated by *Rhododendron minus* and/or *Kalmia latifolia;* at least some examples underlain by amphibolite; associated with steep to very steep slopes adjacent to stream channels **Piedmont Chestnut Oak/Heath Bluff (CEGL004415) [A.249] (CHAT)**

22. *Quercus prinus*-dominated canopy, sometimes with *Carya pallida* as a codominant; moderate to steep slopes, shrub layers variable but never dominated by dense layer of *Rhododendron minus* or *Kalmia latifolia;* sometimes associated with mafic substrates **23**

23. Mafic forest underlain by amphibolite with canopy/subcanopy almost exclusively dominated by *Quercus prinus* and *Carya pallida*; additional species include *Carya ovalis, Pinus echinata, Quercus rubra,* and *Quercus stellata*; numerous shrubs associated with mafic substrates present, including *Celtis occidentalis, Chionanthus virginicus, Philadelphus hirsutus,* and *Ptelea trifoliata* .....

..... Xeric Mafic Chestnut Oak Forest (CEGL004416) [A.248] (CHAT)

23. Forest lacking mafic influence with *Quercus prinus*-dominated canopy; other important species include *Carya alba, Carya pallida, Pinus echinata, Pinus taeda, Quercus falcata*, and *Quercus stellata*; shrub layer variable, including *Vaccinium arboreum* and *Vaccinium pallidum*, but lacking species associated with mafic substrates.....

..... **Xeric Ridgetop Chestnut Oak Forest (CEGL008431) [A.248] (CHAT, KEMO)**

KEY B - SHRUBLANDS

1. Shrublands associated with mafic dry upland habitats, found on steep slopes over thin, rapidly draining soils; dominants include *Celtis occidentalis, Chionanthus virginicus, Philadelphus hirsutus, Ptelea trifoliata,* and *Vaccinium arboreum*.....

.....**Southern Piedmont Mafic Shrubland (CEGL004243) [A.1905] (KEMO)**

1. Shrublands associated with lowland/wetland or disturbed early successional habitats, found on gently sloping to flat floodplains over temporarily to permanently flooded soils; dominants may include *Alnus serrulata, Cephalanthus occidentalis, Hibiscus moscheutos* ssp. *moscheutos, Rubus argutus,* and *Salix nigra*..... 2

2. Ruderal community associated with power line right-of-ways; community made up almost entirely of *Rubus argutus*.....

.....**Blackberry-Greenbrier Successional Shrubland Thicket (CEGL004732) [A.908] (CHAT)**

2. Wetland communities associated with temporarily to semipermanently flooded floodplain sites; *Rubus argutus* absent; dominants may include *Alnus serrulata, Cephalanthus occidentalis, Hibiscus moscheutos* ssp. *moscheutos,* and *Salix nigra*..... **3**

3. Temporarily flooded floodplain community dominated by *Salix nigra*; other lesser codominants variable and may include *Liquidambar styraciflua* and *Acer rubrum*

..... **Black Willow Riverbank Shrubland CEGL003901) [A.948] (CHAT)**

3. Seasonally to semipermanently flooded floodplain community; dominants may include *Alnus serrulata*, *Cephalanthus occidentalis,* and *Hibiscus moscheutos* ssp. *Moscheutos*..... **4**

4. Semipermanently flooded shrubland overwhelmingly dominated by very dense cover of *Hibiscus moscheutos* ssp. *moscheutos*; other shrub codominants include *Alnus serrulata, Cephalanthus occidentalis,* and *Salix nigra*; sparse tree canopy may contain *Salix nigra* and *Fraxinus pennsylvanica*

.....**Southern Buttonbush Pond (CEGL002191) [A.1011] (CHAT)**

4. Seasonally flooded shrubland dominated by moderately sparse cover of *Alnus serrulata* with lesser amounts of *Cephalanthus occidentalis*; very sparse emergent tree layer may contain *Nyssa biflora*

.....**Southeastern Alder Swamp (CEGL008474) [A.994] (CHAT)**

KEY C - HERBACEOUS VEGETATION

1. Herbaceous communities associated with dry upland granitic habitats, found on steep slopes over thin soils; dominants may include Cheilanthes lanosa, Piptochaetium avenaceum, Selaginella rupestris, Schizachyrium scoparium, and Tradescantia hirsuticaulis..... **2**

1. Herbaceous communities typically associated with maintained anthropogenic habitats and/or wetland habitats over deep soils; various dominants indicative of pastures and/or wetlands **3**

2. Vegetation associated with perennial zones of granitic flatrocks (although slopes may be quite steep); herbaceous cover dominated by a variety of ferns, grasses, and forbs, including *Cheilanthes lanosa, Piptochaetium avenaceum, Schizachyrium scoparium,* and *Tradescantia hirsuticaulis*; nonvascular species cover up to 20%.; bedrock cover up to 78%

..... **Granite Flatrock Complex, Perennial Zone (CEGL4298) [A.1920] (KEMO)**

2. Vegetation associated with granitic domes; herbaceous cover dominated by *Selaginella rupestris* mats; additional herbaceous species include *Danthonia spicata, Hypericum gentianoides, Packera tomentosa, Panicum virgatum, Schizachyrium scoparium, Talinum teretifolium*; nonvascular species cover up to 10%; bedrock rock cover >70% .....

..... **Appalachian Low Elevation Granitic Dome (CEGL007690) [A.1985] (KEMO)**

3. Anthropogenically maintained, well-drained old field vegetation dominated by grasses *Andropogon virginicus, Dichanthelium scoparium*, and *Tridens flavus* and the forb *Eupatorium capillifolium* .....

.....**Successional Broomsedge Vegetation (CEGL004044) [A.1208] (CHAT)**

3. Wetland vegetation with soils ranging from temporarily flooded to saturated; most examples resulting from previous or ongoing anthropogenic disturbance; dominants may include *Juncus effusus, Leersia* spp., *Polygonum* spp., *Scirpus cyperinus*..... **4**

4. Periodically mowed, temporarily flooded wet meadow vegetation of variable composition; dominants may include *Cephalanthus occidentalis, Dichanthelium scoparium, Juncus effusus,* and *Vernonia gigantea*.....**Cultural Wet Meadow (local description) (KEMO)**

4. Wetland vegetation ranging from intermittently flooded to saturated lowlands and floodplains; dominants usually clearly discernable and may include *Juncus effusus, Leersia oryzoides, Leersia* spp., *Polygonum* spp., and *Scirpus cyperinus*..... **5**

5. Vegetation clearly dominated by stands of either *Juncus effusus* or *Scirpus cyperinus*..... **6**

5. Vegetation clearly dominated by either *Leersia* spp. and/or or *Polygonum* spp **7**

6. *Juncus effusus* clearly dominates herbaceous vegetation, often forming dense, monotypic stands; other lesser herbaceous components may include *Hydrolea quadrivalvis, Scirpus cyperinus, Erechtites hieraciifolia*, and *Panicum rigidulum*; *Fraxinus pennsylvanica*, and *Salix nigra* may occasionally occur within sparse tall shrub layer..... **Rush Marsh (CEGL004112) [A.1375] (CHAT)**

6. *Scirpus cyperinus* clearly dominates herbaceous vegetation; other lesser herbaceous components may include *Boehmeria cylindrica, Eleocharis obtusa, Juncus effusus, Ludwigia palustris,* and *Mikania scandens*; *Alnus serrulata* may occasionally occur within sparse tall shrub layer.....

.....**Southern Woolgrass Bulrush Marsh (CEGL3866) [A.1386] (CHAT, KEMO)**

7. Wetland community associated with seasonally flooded to saturated floodplains; *Polygonum densiflorum* an overwhelming dominant, other sparse components include *Hydrolea quadrivalvis, Juncus effusus, Ludwigia palustris Sagittaria latifolia*, and *Scirpus cyperinus* .....

.....**Knotweed Pondshore and Ditchbank Vegetation (CEGL004966) [A.1881] (CHAT)**

7. Wetland community associated with intermittently flooded lowlands; community occurs within a sewer overflow area with anthropogenic nutrient inputs; dominants include either *Leersia oryzoides* or *Polygonum sagittatum*; other *Leersia* spp. and *Polygonum* spp. may be present; lesser components include *Bidens frondosa*, *Echinochloa crus galli*, and *Mikania scandens*.....

..... **Smartweed-Cutgrass Beaver Pond (CEGL004290) [A.1881] (KEMO)**

Appendix D: Photo-Interpretation Guide

Photo-Interpretation Guide to the Vegetated Map Classes of Kennesaw Mountain National Battlefield Park

I. Forest

Map Class 1: Early Successional Shortleaf Pine Forest
Map Class 2: Early- to Mid-Successional Loblolly Pine Forest
Map Class 3: American Sycamore – Sugarberry Green Ash Floodplain Forest
Map Class 4: Piedmont Low-Elevation Seepage Swamp
Map Class 5: Piedmont Acidic Mesic Mixed Hardwood Forest
Map Class 6: Tuliptree Forest Alliance / Piedmont Dry-Mesic Acidic Oak Hickory Forest / Interior Southern Red Oak- White Oak Forest
Map Class 7: Successional Water Oak Forest
Map Class 8: Upper Southeast Small Stream Sweetgum Tuliptree Forest
Map Class 9: Virginia Pine / Granitic Flatrock Border Forest
Map Class 10: Xeric Ridgetop Chestnut Oak Forest / Mafic Xeric Piedmont Oak Forest

III. Shrubland

Map Class 11: Southern Piedmont Mafic Shrubland
Map Class 12: Blackberry-Greenbrier Successional Shrubland Thicket
Map Class 13: Black Willow Riverbank Shrubland

V. Herbaceous

Map Class 14: Common Rush Marsh
Map Class 15: Southern Woolgrass Bulrush Marsh
Map Class 16: Granite Flatrock Complex, Perennial Zone / Appalachian Low-Elevation Granitic Dome

I. Forest

MAP CLASS 1

Early Successional Shortleaf Pine Forest (CEGL006327)

Figure D1. Photo of early successional shortleaf pine forest

Association

Pinus echinata Early-Successional Forest

Abundant species

- Pinus echinata
- Celtis laevigata
- Ilex vomitoria
- Quercus virginiana
- Morella cerifera

Map Class Statistics
Frequency: 3 polygons
Total area: 54.1 ha
Average polygon size: 18.0 ha
Producer's accuracy: 22.9%
User's accuracy: 37.5%

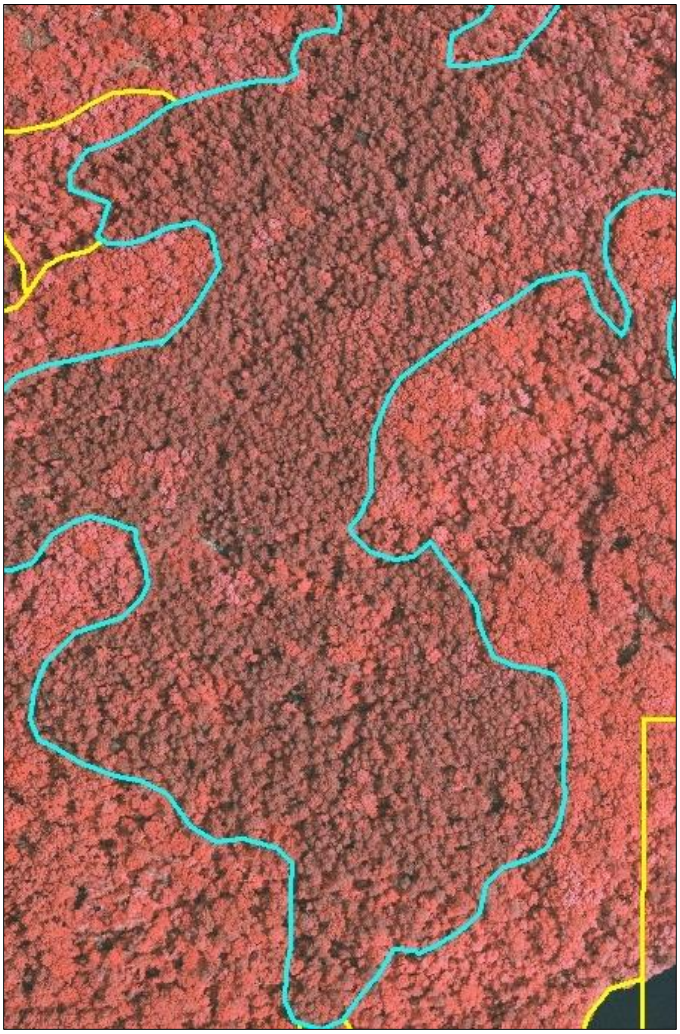

Figure D2. Example of photo signature for Early Successional Shortleaf Pine Forest (inside blue polygon)

Interpretation

The Early Successional Shortleaf Pine Forest is one of two conifer dominated classes at KEMO. The appearance on the imagery is a brown color with a symmetric, small crown size for the visible canopy species. The Early Successional Shortleaf Pine Forest can be difficult to differientiate from the other conifer dominated class, Early – to Mid- Successional Longleaf Pine Forest, but typically occurs at slightly higher elevations than Early- to Mid- Successional Longleaf Pine Forest along the slopes of Kennesaw and Little Kennesaw mountains.

MAP CLASS 2

Early- to Mid-Successional Loblolly Pine Forest (CEGL006011)

Figure D3. Photo of Early to Mid-successional Loblolly Pine Forest

Association

Pinus taeda / Liquidambar styraciflua – Acer rubrum var. rubrum / Vaccinium stamineum Forest

Abundant species

- *Pinus taeda*
- *Liquidambar styraciflua*
- *Cercis canadensis*
- *Cornus florida*
- *Fagus grandifolia*
- *Liriodendron tulipifera*
- *Oxydendrum arboreum*
- *Ulmus rubra*
- *Vitis rotundifolia*

Map Class Statistics
Frequency: 73 polygons
Total area: 465.9 ha
Average polygon size: 6.4 ha
Producer's accuracy: 98.5%
User's accuracy: %

Interpretation
The appearance of Early -to Mid- Successional Lobolly Pine Forest is similar in appearance to the Early Successional Shortleaf Pine Forest. The canopy is dominated by Loblolly Pine which appears brown in color and has a round, small crown. The main distinguishing feature between this class and Shortleaf Pine Forest is that it typically occurs at lower elevations than the Shortleaf Pine class. In addition, typically more patches of understory species are also visible, which appear light pink in color.

Figure D4. Example of photo signature for Early- to Mid- Successional Loblolly Pine Forest (inside blue polygon).

MAP CLASS 3

American Sycamore – Sugarberry Green Ash Floodplain Forest (CEGL007730)

Figure D5. Photo of American Sycamore – Sugarberry Green Ash Floodplain Forest (CEGL007730)

Association

Platanus occidentalis – Celtis laevigata – Fraxinus pennsylvanica / Lindera benzoin – Ilex decidua / Carex retroflexa Forest

Abundant Species

- Platanus occidentalis
- Fraxinus pennsylvanica
- Celtis laevigata
- Acer barbatum
- Carpinus caroliniana
- Liriodendron tulipifera
- Morus rubra
- Staphylea trifolia

- Toxicodendron radicans
- Halesia tetraptera

Map Class Statistics
Frequency: 2 polygons
Total area: 6.0 ha
Average polygon size: 3.0 ha
Producer's accuracy: 18.6%
User's accuracy: 100%

Interpretation
The American Sycamore – Sugarberry Green Ash Floodplain Forest occurs along small to medium-sized streams. The characteristic dominant species, American Sycamore, is visible on the imagery as light pink to almost white in color. Sweetgum is also typically visible as bright pink in color with a moderate crown size.

Figure D6. Example of photo signature for American Sycamore – Sugarberry Green Ash Floodplain Forest (inside blue polygon).

MAP CLASS 4

Piedmont Low-Elevation Headwater Seepage Swamp (CEGL004426)

Figure D7. Piedmont Low-Elevation Headwater Seepage Swamp

Abundant species

- Celtis laevigata
- Liriodendron tulipifera
- Nyssa sylvatica
- Carpinus caroliniana
- Lindera benzoin
- Decumaria Barbara

Map Class Statistics

Frequency: 2 polygons
Total area: 3.4 ha
Average polygon size: 1.7 ha
Producer's accuracy: 0%
User's accuracy: 0%

Interpretation

The Piedmont Low Elevation Seepage Swamp occurs on temporarily flooded bottomlands. The combination of Sugarberry and Tuliptree dominating the canopy has an appearance of light pink, small crown size (sugarberry) and bright pink, small to moderate crown size.

Figure D8. Example of photo signature for Piedmont Low-Elevation Headwater Seepage Swamp.

MAP CLASS 5

Piedmont Acid Mesic Mixed Hardwood Forest (CEGL008465)

Figure D9. Photo of Piedmont Acid Mesic Mixed Hardwood Forest

Association

Fagus grandifolia – Quercus rubra / Cornus florida / Polystichum acrostichoides – Hexastylis virginica Forest

Abundant species

- *Fagus grandifolia*
- *Liriodendron tulipifera*
- *Quercus alba*
- *Oxydendrum arboreum*
- *Rhododendron canescens*
- *Carpinus caroliniana*
- *Fagus grandifolia*
- *Calycanthus floridus*

- *Lindera benzoin*
- *Toxicodendron radicans*
- *Vitis rotundifolia*
- *Xanthorhiza simplicissima*
- *Polystichum acroistichoides*
- *Thelypteris noveboracensis*

Map Class Statistics

Frequency: 9 polygons

Total area: 29.5 ha

Average polygon size: 3.3 ha

Producer's accuracy: 41.6%

User's accuracy: 50%

Interpretation

The Piedmont Acidic-Mesic Mixed Hardwood Forest typically occurs on steep but sheltered slopes adjacent to creeks or rivers, mostly on northern aspects. Location is important for identifying this association. Appearance on the imagery is a mix of pink to red colors with a variety of crown sizes due to the variety of species that occur. Commonly Tuliptree is often visible, with a bright pink color and small to moderate crown size.

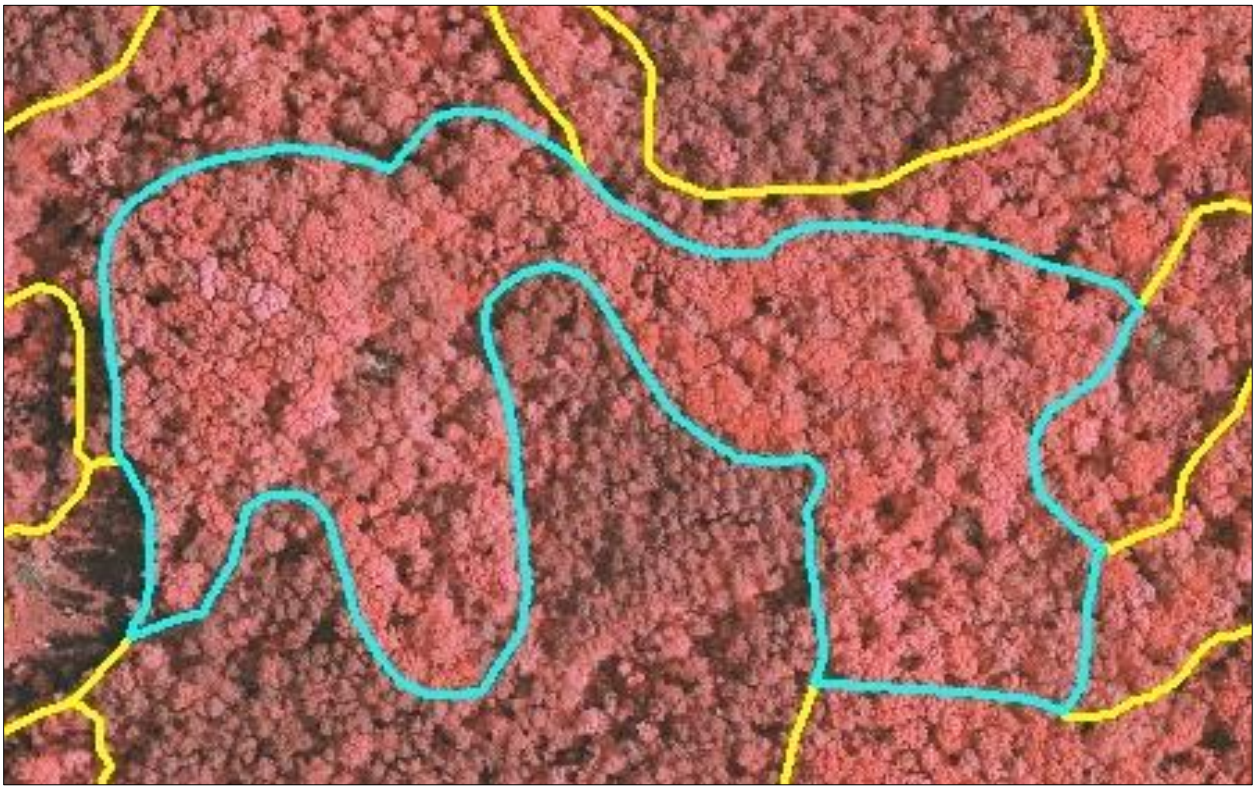

Figure D10. Example of photo signature for Piedmont Acidic Mesic Mixed Hardwood Forest (inside blue polygon)

MAP CLASS 6

Tuliptree Forest Alliance (A.236) / Piedmont Dry- Mesic Acidic Oak-Hickory Forest (CEGL) / Interior Southern Red Oak – White Oak Forest

Figure D11. Photo of Tuliptree Forest Alliance.

Figure D12. Photo of Piedmont Dry-Mesic Acidic Oak-Hickory Forest.

Figure D13. Photo of Interior Southern Red Oak – White Oak Forest.

Alliance/Association

Liriodendron tulipifera Forest Alliance / Piedmont Dry- Mesic Acidic Oak-Hickory Forest / Interior Southern Red Oak – White Oak Forest

Characteristic species of Liriodendron tulipifera Forest Alliance

- *Liriodendron tulipifera*
- *Acer rubrum*

Characteristic species of Piedmont Dry-Mesic Acidic Oak-Hickory Forest

- *Carya ovalis*
- *Liriodendron tulipifera*
- *Quercus alba*
- *Quercus stellata*
- *Quercus velutina*
- *Cornus florida*
- *Vitis rotundifolia*

Characteristic Species of Interior Southern Red Oak – White Oak Forest

- *Quercus alba*
- *Quercus falcata*
- *Quercus stellata*
- *Quercus velutina*

- *Oxydendrum arboreum*
- *Carya alba*
- *Cornus florida*
- *Vaccinium arboreum*

Map Class Statistics (for combined class)
Frequency: 61 polygons
Total area: 392.9 ha
Average polygon size: 6.4 ha
Producer's accuracy: 75.8%
User's accuracy: 83.5%

Interpretation
These three associations were combined due to a commonality of species and similarity in site characteristics where they occur. This class is very widespread within KEMO, often interspersed throughout stands of Early- to Mid- Successional Loblolly Forest. Appearance on the imagery is a mixture of pink to red colors and with moderate to large crown size. Oaks and hickories are often very visible, which are often red in color with a large crown size.

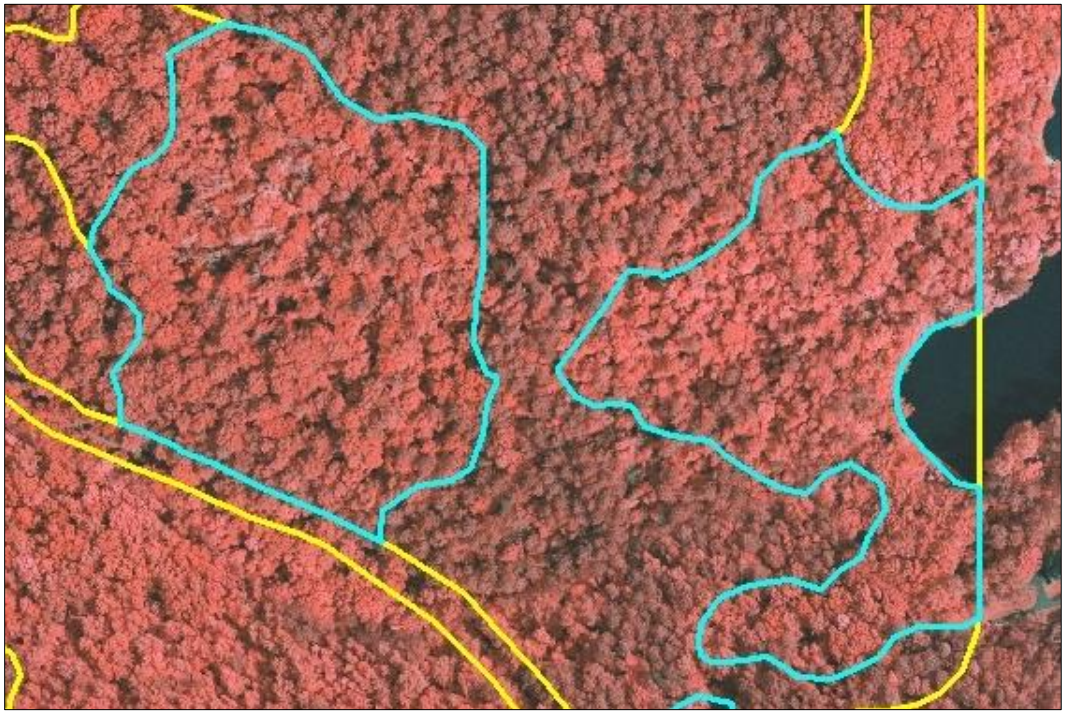

Figure D14. Example one of photo signature for *Liriodendron tulipifera* Forest Alliance / Piedmont Dry-Mesic Acidic Oak-Hickory Forest / Interior Southern Red Oak – White Oak Forest.

Figure D15. Example two of photo signature for *Liriodendron tulipifera* Forest Alliance / Piedmont Dry-Mesic Acidic Oak-Hickory Forest / Interior Southern Red Oak – White Oak Forest

MAP CLASS 7

Successional Water Oak Forest (CEGL004638)

Figure D16. Photo of Successional Water Oak Forest.

Association

Quercus nigra Forest

Characteristic species of Successional Water Oak Forest

- *Quercus nigra* (water oak)
- *Acer barbatum* (southern sugar maple)
- *Acer leucoderme* (chalk maple)
- *Carpinus caroliniana* (American hornbeam)
- *Cornus florida* (flowering dogwood)
- *Liquidambar styraciflua (sweetgum)*
- *Liriodendron tulipifera (tuliptree)*

Map Class Statistics (for combined class)
Frequency: 1 polygons
Total area: 4.6 ha
Average polygon size: 4.6 ha
Producer's accuracy: 75.8%
User's accuracy: 83.5%

MAP CLASS 8

Upper Southeast Small Stream Sweetgum – Tuliptree Forest (CEGL004418)

Figure D17. Photo of Upper Southeast Small Stream Sweetgum – Tuliptree Forest

Association

Liquidambar styraciflua – Liriodendron tulipifera / Lindera benzoin / Arisaema triphyllum Forest

Abundant species

- *Liquidambar styraciflua*
- *Quercus alba*
- *Liriodendron tulipifera*
- *Carpinus caroliniana*
- *Lindera benzoin*
- *Decumaria barbara*
- *Vitis rotundifolia*

Map Class Statistics
Frequency: 14 polygons
Total area: 6.2 ha
Average polygon size: 99.6 ha
Producer's accuracy: 81.3%
User's accuracy: 60.0%

Interpretation
The Upper Southeast Small Stream Sweetgum – Tuliptree Forest occurs along relatively acidic soils on small streams at lower elevations within KEMO. On the imagery these forests are often seen occurring along the length of small creeks or streams. Appearance on the imagery is often a mixture of light pink colors with moderate crown size (tuliptree) and red colors (oaks and sweetgum).

Figure D18. Example of the photo signature for the Upper Southeast Small Stream Sweetgum – Tuliptree Forest (inside blue polygon).

MAP CLASS 9

Virginia Pine / Granitic Flatrock Border Forest (CEGL003993)

Figure D19. Photo of Virginia Pine / Granitic Flatrock Border Forest.

Association

Pinus virginiana / Juniperus virginiana – Chionanthus virginicus Granitic Flatrock Border Forest

Abundant species

- *Juniperus virginiana*
- *Ulmus alata*
- *Chionanthus virginicus*
- *Piptochaetium avenaceum*

Map Class Statistics
Frequency: 2 polygons
Total area: 3.6 ha
Average polygon size: 1.8 ha
Producer's accuracy: 100%
User's accuracy: 50%

Interpretation
The Virginia Pine / Granitic Flatrock Border Forest is restricted to a small area along the higher elevations of Little Kennesaw Mountain west of the trail that follows the ridgeline. On the imagery, this association occurs near a few areas of open rock face and the canopy appears dark red to brown in color with small crown sizes.

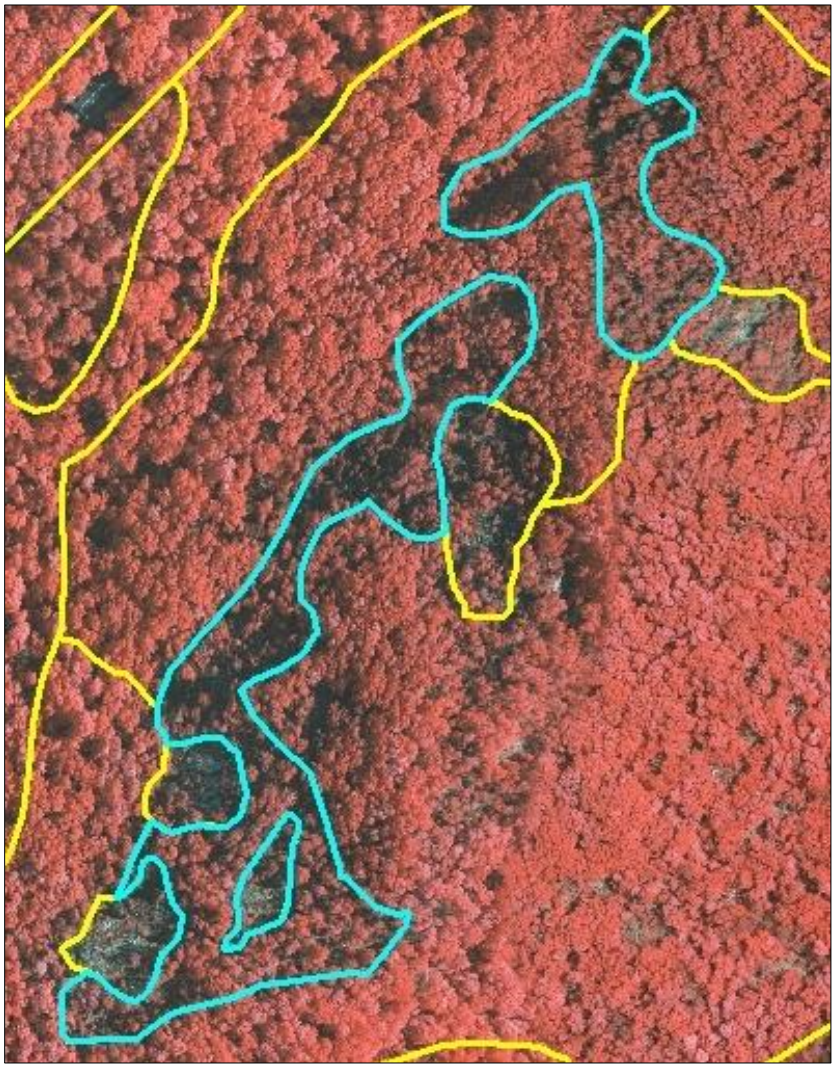

Figure D20. Example of photo signature of Virginia Pine / Granitic Flatrock Border Forest (inside blue polygons).

MAP CLASS 10

Xeric Ridgetop Chestnut Oak Forest (CEGL008431) / Mafic Xeric Piedmont Oak Forest (CEGL004416)

Figure D21. Photo of Xeric Ridgetop Chestnut Oak Forest (CEGL008431).

Figure D22. Photo of Mafic Xeric Piedmont Oak Forest (CEGL004416).

Association

Quercus prinus – (Quercus coccinea) / Carya pallida / Vaccinium arboreum – Vaccinium pallidum Forest

Abundant species for Xeric Ridgetop Chestnut Oak Forest

- *Quercus prinus*
- *Amelanchier arborea*
- *Vitis rotundifolia*
- *Quercus coccinea*
- *Acer rubrum*

Abundant species for Mafic Xeric Piedmont Oak Forest

- *Carya pallida*
- *Quercus prinus*
- *Ptelea trifoliata*
- *Piptochaetium avenaceum*

Map Class Statistics (for combined class):
Frequency: 4 polygons
Total area: 55.0 ha
Average polygon size: 13.8 ha
Producer's accuracy: 81.3%
User's accuracy: 76.3%

Interpretation
This combined map class is dominated by hickory sp. and chestnut oaks that appear dark red on the imagery with moderate to large crown sizes. The map class if found on shallow, rocky soils on slopes of Kennesaw and Little Kennesaw Mountains.

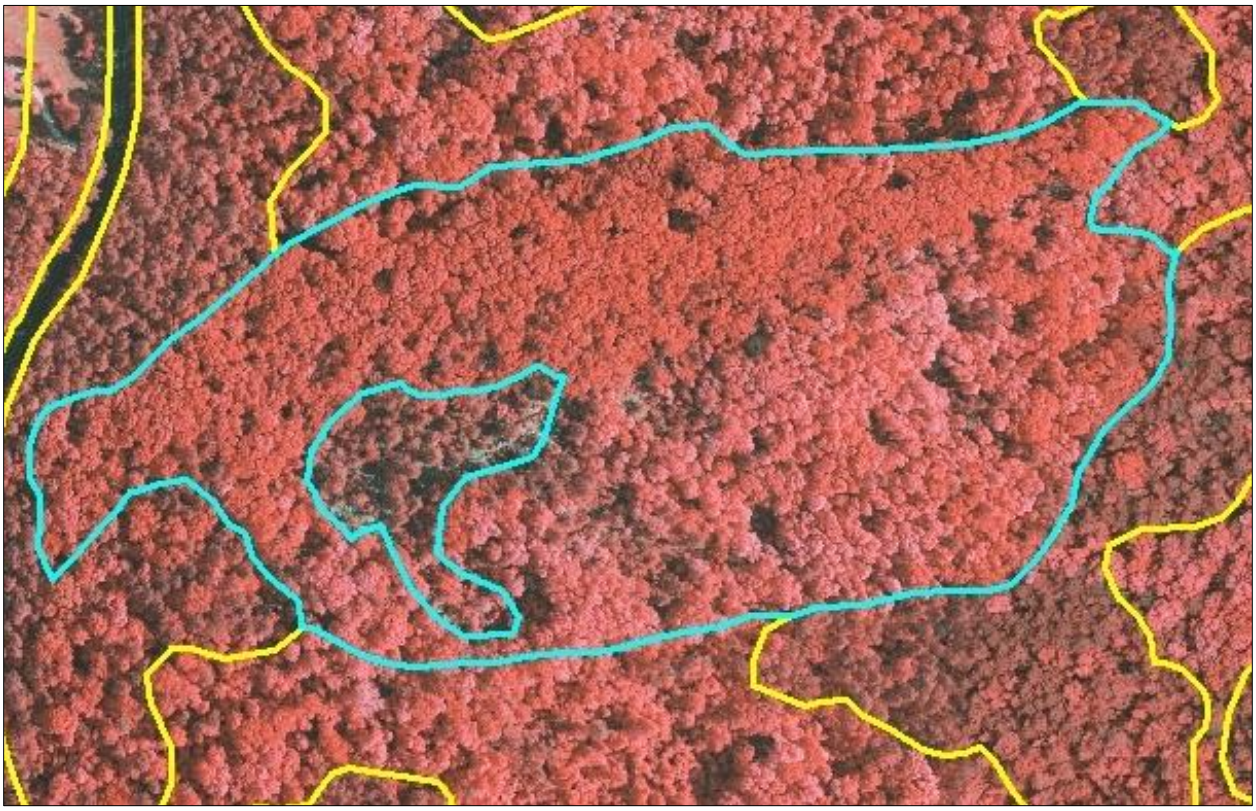

Figure D23. Example of photo signature of Xeric Ridgetop Chestnut Oak Forest (inside blue polygon).

II. Shrubland

MAP CLASS 11

Southern Piedmont Mafic Shrubland (CEGL00004243)

Figure D24. Photo of Southern Piedmont Mafic Shrubland.

Association

Philadelphus hirsutus – Ptelea trifoliata var. mollis / Schizachyrium scoparium – Pycanthemum curvipes / Thuidium delicatulum Shrubland

Abundant species

- *Carya glabra*
- *Ulmus alata*
- *Celtis occidentalis*
- *Philadelphus hirsutus*
- *Ptelea trifoliata*
- *Vaccinium arboreum*
- *Chionanthus virginicus*
- *Smilax rotundifolia*

- *Schizachyrium scoparium*

Map Class Statistics
Frequency: 3 polygons
Total area: 2.13 ha
Average polygon size: 0.71ha
Producer's accuracy: 49.5%
User's accuracy: 100%

Interpretation
This shrub community occurs on slopes of mafic amphibolite rock on dry, west- to southwest-facing areas at upper elevations (1470-1650 feet). Besides location, the appearance on the imagery is light pink, shorter in stature vegetation with small crown size, with some rock visible.

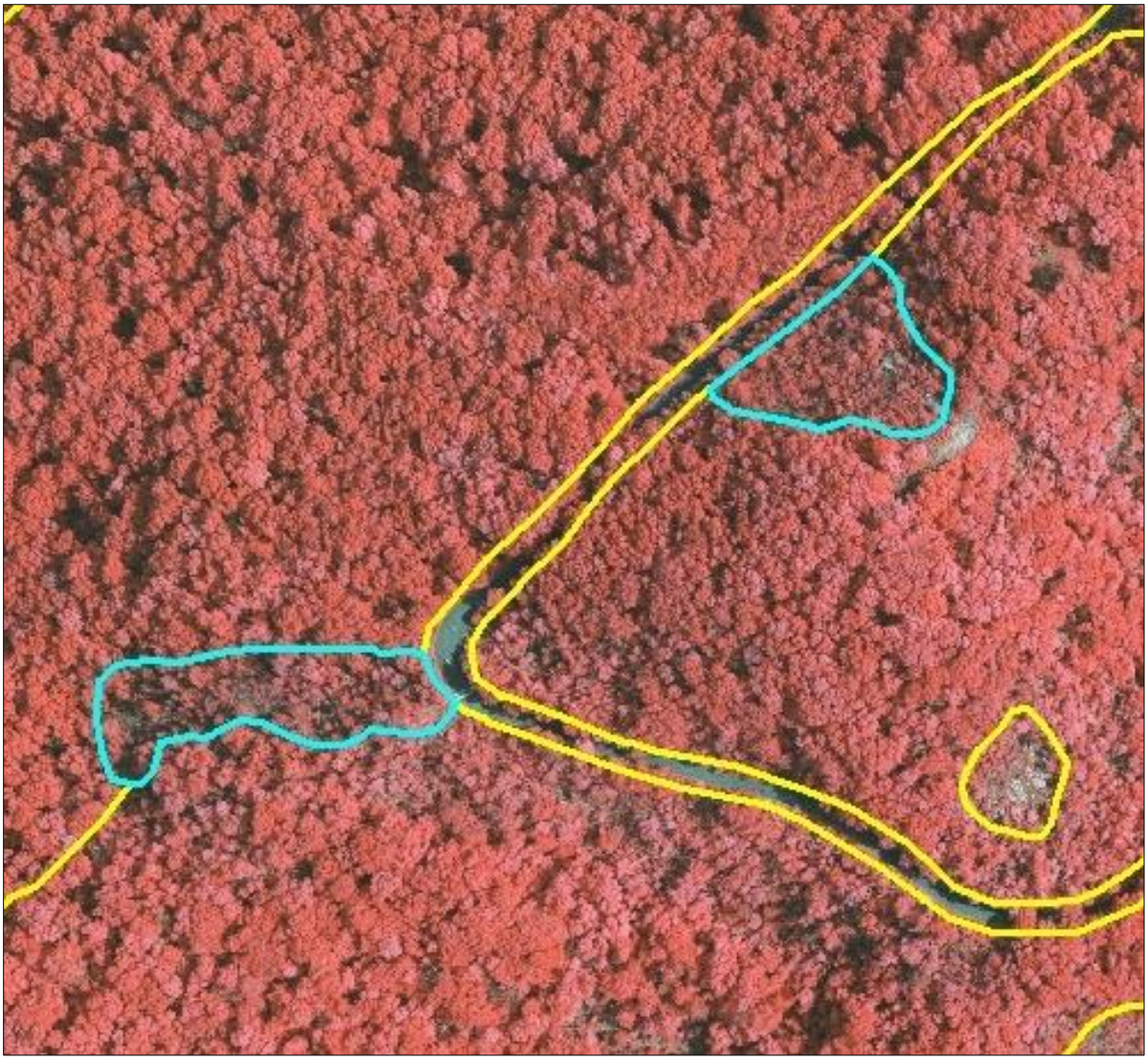

Figure D25. Example of photo signature of Southern Piedmont Mafic Shrubland (inside blue polygons)

MAP CLASS 12

Blackberry-Greenbrier Successional Shrubland Thicket (CEGL004732)

Figure D26. Photo of Blackberry-Greenbrier Successional Shrubland Thicket

Association

Rubus (argutus, trivialis) – Smilax (glauca, rotundifolia) Shrubland

Abundant species

- *Rubus argutus*

Map Class Statistics

Frequency: 1 polygons
Total area: 1.92 ha
Average polygon size: 1.92 ha
Producer's accuracy: 0%
User's accuracy: 0%

Interpretation

This shrubland occurs in areas that have a history of disturbance. On the imagery, the shrub layer is visible, which appears as vegetation that has a small to moderate crown size of shorter stature than canopy species. The herbaceous layer is also visible, which is a smooth pink to gray color, and is of shorter stature than the shrub layer.

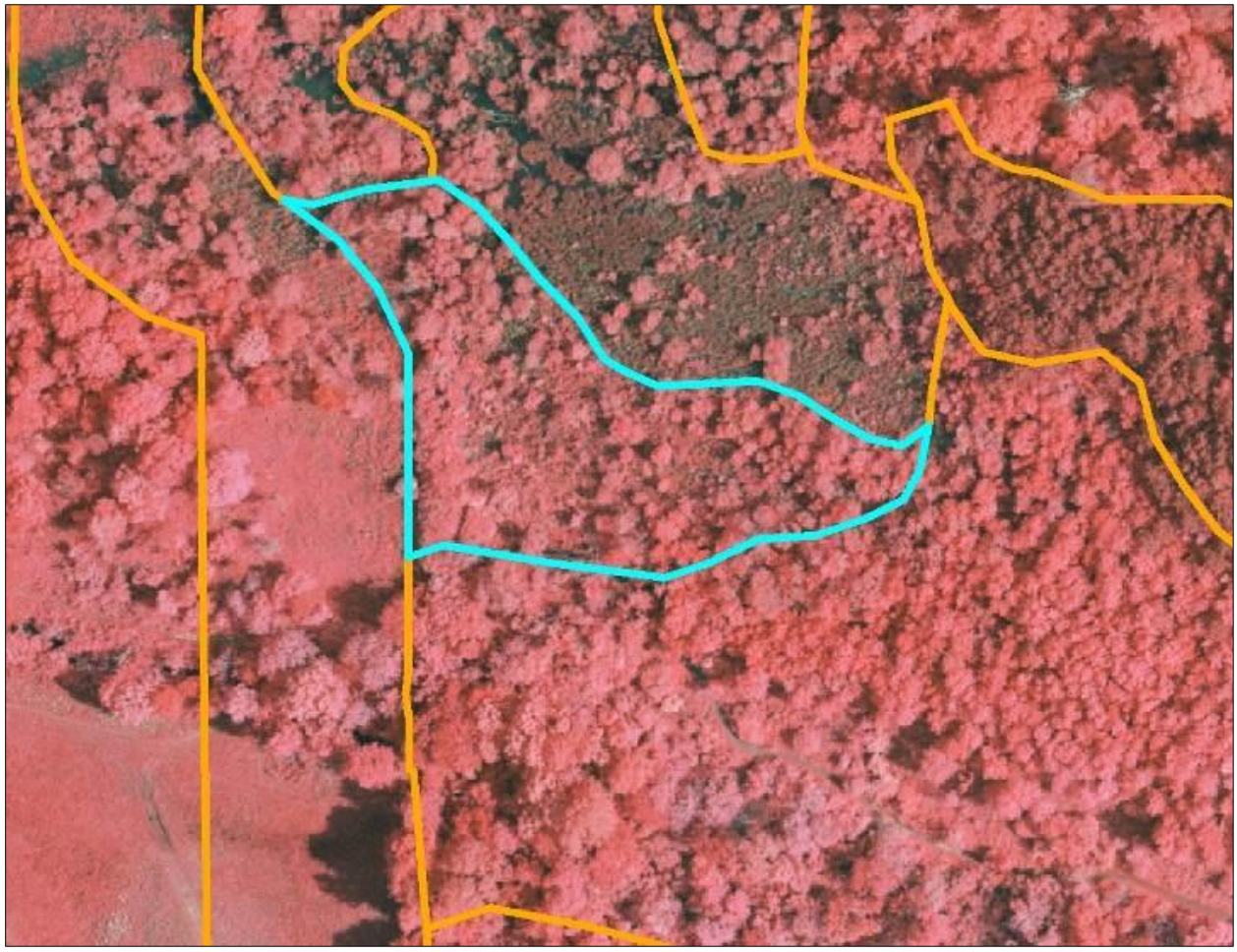

Figure D27. Example of photo signature of Blackberry –Greenbrier Successional Shrubland Thicket

MAP CLASS 13

Black Willow Riverbank Shrubland (CEGL002103)

Figure D28. Photo of Black Willow Riverbank Shrubland

Association

Salix nigra Temporarily Flooded Shrubland

Abundant species

- *Salix nigra*
- *Erechtites hieracifolia*
- *Juncus effusus*

Map Class Statistics

Frequency: 1 polygons
Total area: 2.66 ha
Average polygon size: 2.66 ha
Producer's accuracy: 100%
User's accuracy: 25%

Interpretation

This shrubland occurs in palustrine environments and is dominated by scrubby black willow. The appearance on the imagery are trees of shorter stature with small circular crowns that are light pink in color.

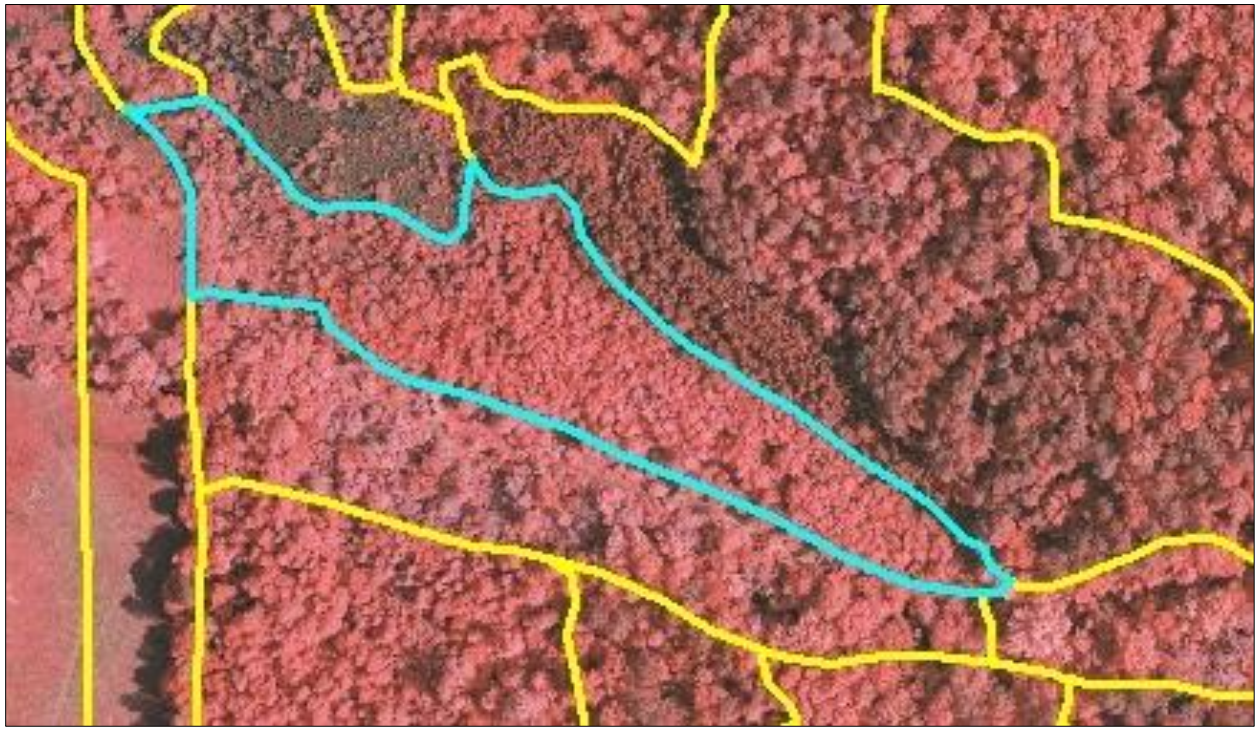

Figure D29. Example of photo signature of Black Willow Riverbank Shrubland (inside blue polygon).

V. Herbaceous

MAP CLASS 14

Common Rush Marsh (CEGL004112)

Figure D30. Photo of Common Rush Marsh.

Association

Juncus effusus Seasonally Flooded Herbaceous Vegetation

Abundant species

- *Salix nigra*
- *Fraxinus pennsylvanica*
- *Erechtites hieraciifolia*
- *Juncus effusus*
- *Panicum rigidulum*
- *Scirpus cyperinus*

Map Class Statistics
Frequency: 1 polygon
Total area: 0.68 ha
Average polygon size: 0.68 ha
Producer's accuracy: 0%
User's accuracy: 0%

Interpretation
This herbaceous association represents freshwater marsh vegetation that may occur in natural or artificial ponds. On the imagery, this association occurred in one polygon, and it had the appearance of a light to moderate pink color with a stipled texture.

Figure D31. Example of photo signature of Common Rush Marsh (inside blue polygon).

MAP CLASS 15

Southern Woolgrass Bulrush Marsh (CEGL03866)

Figure D32. Photo of Southern Woolgrass Bulrush Marsh.

Association

Scirpus cyperinus Seasonally Flooded Southern Herbaceous Vegetation

Abundant species

- *Scirpus cyperinus*

Map Class Statistics

Frequency: 2 polygons
Total area: 0.74 ha
Average polygon size: 0.37 ha
Producer's accuracy: 100%
User's accuracy: 66.7%

Interpretation

This association is found in flat floodplain areas where the water table is low. Appeareance on the imagery is a smooth gray to pink color that is interspersed with some shrubs that are visible mainly on the margins or edges of the community.

Figure D33. Example of photo signature of Southern Woolgrass Bulrush Marsh (inside blue polygons).

MAP CLASS 16

Granite Flatrock Complex, Perennial Zone (CEGL004298) / Appalachian Low-Elevation Granitic Dome (CEGL007690)

Figure D34. Photo of Granite Flatrock Complex, Perennial Zone (CEGL004298).

Figure D35. Photo of Appalachian Low-Elevation Granitic Dome (CEGL007690).

Association

Packera tomentosa – Croton willdenowii – Schizachyrium scoparium – (Selaginella rupestris) Herbaceous Vegetation

Abundant species for Granite Flatrock Complex, Perennial Zone

- *Packera tomentosa*
- *Croton willdenowii*
- *Chionanthus virginicus*
- *Selaginella rupestris*
- *Ptelea trifoliata*
- *Tradescantia hirsuticaulis*
- *Piptochaetium avenaceum*
- *Schizachyrium scoparium*
- *Cheilanthes lanosa*

Abundant species for Appalachian Low Elevation Granitic Dome

- *Rhus copallinum*
- *Smilax rotundifolia*
- *Panicum virgatum*
- *Selaginella rupestris*

Map Class Statistics (for combined class)
Frequency: 16 polygons
Total area: 0.40 ha
Average polygon size: 6.34 ha
Producer's accuracy: 56.4%
User's accuracy: 100%

Interpretation
This combined class occurs on granitic flatrocks on Kennesaw and Little Kennesaw Mountains. On the imagery the granitic flatrocks are visible as a smooth gray color. Scattered shrubs and grasses are visible on the flatrocks.

Figure D36. Example of photo signature of Granitic Flatrock Complex, Perennial Zone / Appalachian Low-Elevation Granitic Dome (inside blue polygons)

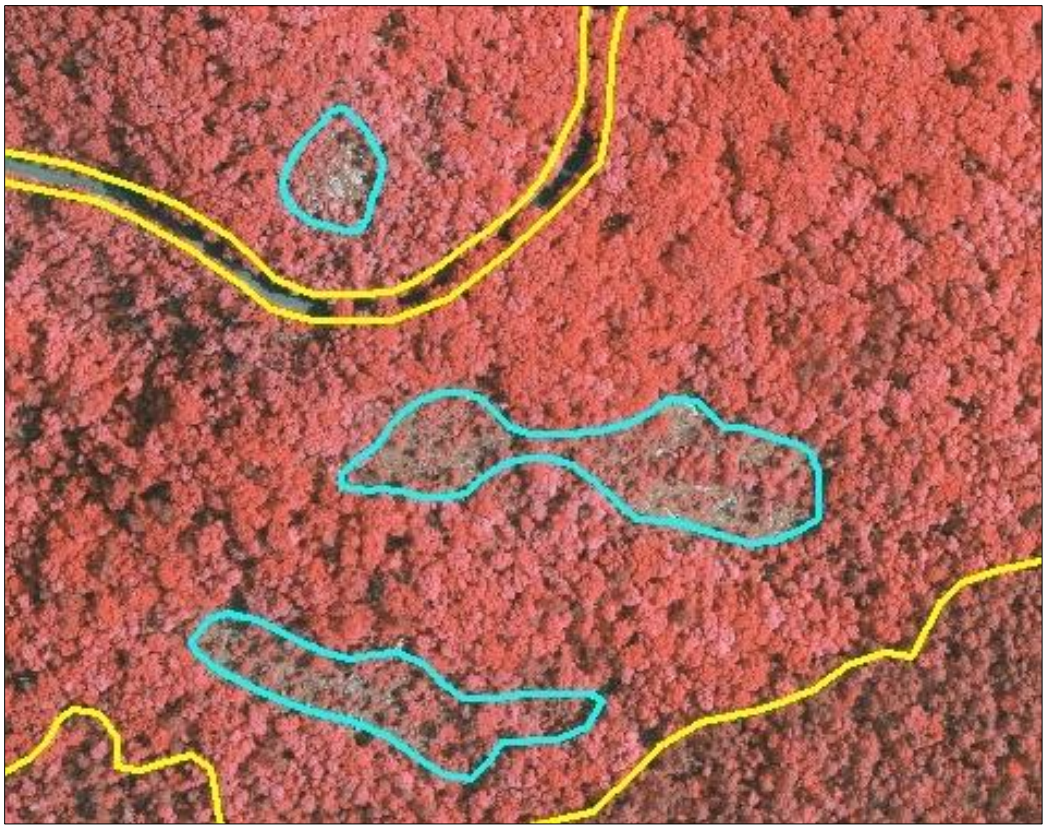

Figure D37. Example of photo signature of Granitic Flatrock Complex, Perennial Zone / Appalachian Low-Elevation Granitic Dome (inside blue polygons)

Appendix E: Field Reconnaissance Form

KENNESAW MOUNTAIN NATIONAL BATTLEFIELD PARK FIELD RECONNAISSANCE SHEET

I. LOCATION DATA

1. Point #: _____ 2. Date: _____ 3. Observers: _____

4. Photo (s) #: _____

5. Coordinates: X:_____ Y: _____

6. GPS Error: _____ (m) 7. Number of satellites: _____ 8. Elevation: _____

II. ENVIRONMENTAL/ SITE DESCRIPTION

1. Environmental Comments *(site specific information (if applicable) such as hydrology, topographic position, unvegetated surfaces, recent disturbances, etc.)*

III. VEGETATION DESCRIPTION

Leaf phenology (of dominant stratum)

Trees and Shrubs
___Evergreen
___Cold-deciduous
___Drought-deciduous
___Mixed evergreen – cold-deciduous
___Mixed evergreen – drought-deciduous

Herbs
___Annual
___Perennial

Leaf Type (of Dominant stratum)

___Broad-leaved
___Needle-leaved
___Mixed broad-leaved/Needle-leaved
___Microphyllous
___Graminoid
___Forb
___Pteridophyte

Physiognomic class

___Forest
___Woodland
___Shrubland
___Dwarf Shrubland
___Herbaceous
___Nonvascular
___Sparsely Vegetated

IV. VEGETATION COMPOSITION *(list **dominant species only** and indicate which stratum it occurs in by checking the appropriate stratum next to the species name)*

Species	Canopy layer	Sub-canopy layer	Shrub layer	Herb layer

V. VEGETATION ASSOCIATION

1. Primary and secondary (if there is a close call or multiple associations within the same polygon) vegetation classification(s) within radius of observation point, based on field key:

Appendix F: Accuracy Assessment Form

Accuracy Assessment Form for SECN Parks

I. LOCATION DATA:

1. AA Point Code: _____ 2. Date: _____

3. Observers: _____

4. Photo (s) #: _____

5. Coordinates: X: _____ Y: _____

6. Estimated Accuracy (m): _____ 7. Number of Satellites: _____

II. ENVIRONMENTAL/ SITE DESCRIPTION:

1. Environmental Comments *(site specific information such as hydrology, topographic position, unvegetated surfaces, recent disturbances, etc.*

III. VEGETATION DESCRIPTION:

Leaf phenology (of dominant stratum)	**Leaf Type (of dominant stratum)**	**Physiognomic class**
Trees and Shrubs: ___Evergreen ___Cold-deciduous ___Drought-deciduous ___Mixed evergreen - cold-deciduous ___Mixed evergreen - drought-deciduous Herbs: ___Annual ___Perennial	___Broad-leaved ___Needle-leaved ___Mixed broad-leaved/Needle leaved ___Microphyllous ___Graminoid ___Forb ___Pteridophyte	___Forest ___Woodland ___Shrubland ___Dwarf Shrubland ___Herbaceous ___Nonvascular ___Sparsely Vegetated

IV. VEGETATION COMPOSITION: *(list dominant species only and indicate which stratum it occurs in by checking the appropriate stratum next to the species name)*

Species	Canopy layer	Sub-canopy layer	Shrub layer	Herb layer

V. VEGETATION ASSOCIATION:

1. Primary and secondary (if there is a close call or multiple associations within the same polygon) vegetation classification(s) within radius of observation point, based on field key:

2. Are there other vegetation associations present within the radius observation area in addition to what was listed above?

3. Representativeness: Does the assigned association represent the vegetation well? If not, why? Please rank the fit as "Good" "Fair" or "Poor."

V. SOIL CHARACTERISTICS:

Soil Notes:

_____

_____

_____

VI. CLASSIFICATION COMMENTS *(use this space to provide additional comments about problems or ease in applying the vegetation key at this site, rationale for choice of association if there was doubt, etc.)*

Appendix G: Accuracy Assessment Contingency Table

Explanation of the Contingency Matrices

The accuracy assessment contingency matrix for the Kennesaw Mountain National Battlefield Park vegetation map layer is designed in a row and column format so as to compare the results of the vegetation types represented on the map layer to the vegetation types as verified on the ground. Map-class codes are used to identify vegetation types for ease of comparison during the analysis. (A crosswalk between map classes and vegetation types is provided.)

The sample contingency table provides an initial summary of the AA data by displaying counts of observations, with sample data values (vegetation map classes) as rows and reference data values (vegetation types as identified on the ground) as columns. The values in the shaded cells along the diagonal represent counts for correctly classified observations, where the reference data (column) matches the mapped vegetation type (row). User's accuracy was calculated by dividing the number of samples that agreed with their corresponding map class by the total number of samples in that class. Producer's accuracy was calculated by dividing the number of samples that agreed with their corresponding map class by the total number of samples whose field call belonged to that category.

Measures of accuracy for the AA are defined on the population contingency table. Similar to the sample contingency table, rows in the population contingency table are defined by the sample data values, and the columns are defined by the by the reference data values. Unlike the sample contingency table, the values in each cell are the proportion of the target area in the corresponding true and mapped vegetation classes, rather than the raw counts of observations. The population and sample contingency tables are reported together as a summary of between-class error relationships and class accuracy statistics (Lea and Curtis 2010).

Table G1. Sample Contingency Table.

Photointerpreter's Determination: Map Units	Field Determination: A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	Totals	User's Accuracy	90% Confidence Interval -	90% Confidence Interval +
A	0														2				1	3	0%	0%	17%
B		2			1															3	67%	5%	100%
C			1							1	1						1			4	25%	0%	65%
D				2		1		1												4	50%	0%	100%
E					0							1								1	0%	0%	0%
F						2														2	100%	75%	100%
G							2													2	100%	75%	100%
H								10												10	100%	95%	100%
I								1	29			1					7			38	76%	0%	86%
J										26		1			1	4				32	81%	68%	100%
K										1	0					1	1			3	0%	0%	17%
L												22	1				4			27	81%	67%	100%
M													3				5			8	38%	3%	66%
N										3				0						3	0%	0%	17%
O															2					2	100%	75%	100%
P										1						5	4			10	50%	19%	75%
Q									5	7					1	1	76	1		91	84%	77%	100%
R																		0		0	0%	0%	100%
S																			0	0	0%	0%	100%
Totals	0	2	1	2	1	3	2	12	34	39	1	25	4	0	6	11	98	1	1	**243**			
Producer's Accuracy	0%	100%	100%	100%	0%	67%	100%	83%	85%	67%	0%	88%	75%	0%	0%	0%	5%	0%	0%				
90% Confidence Interval -	23%	75%	0%	0%	0%	5%	75%	0%	74%	53%	0%	0%	27%	0%	0%	100%	1%	0%	0%				
90% Confidence Interval +	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	0%	8%	5%	9%	50%	50%				

Table Note: 182 Correct Points; 243 Total Points

Key to Map Class Codes

A = Black Willow Forest
B = Southern Woolgrass Bulrush Marsh
C = Black Willow Riverbank Shrubland
D = Virginia Pine / Granitic Flatrock Border Woodland
E = Common Rush Marsh
F =Southern Piedmont Mafic Shrubland
G = Smartweed Cutgrass Beaver Pond
H = Granitic Flatrock Complex, Perennial Zone/ Appalachian Low Elevation Granitic Dome
I = Mafic Xeric Piedmont Oak Forest / Xeric Ridgetop Chestnut Oak Forest
J = Upper Southeast Small Stream Sweetgum - Tuliptree Forest
K = Piedmont Low Elevtion Seepage Swamp
L = Early- to Mid-Successional Loblolly Pine Forest
M = Early-Successional Shortleaf Pine Forest
N = Successional Tuliptree - Loblolly Pine Forest
O = American Sycamore - Green Ash Floodplain Forest
P = Piedmont Acidic Mesic Mixed Hardwood Forest
Q = Piedmont Dry-Mesic Acidic Oak-Hickory Forest / Interior Southern Red Oak – White Oak Forest / Tuliptree Forest Alliance
R = Successional Water Oak Forest
S = Blackberry – Greenbrier Successional Shrubland Thicket

Table G2. Population Contingency Table.

(Observations Selected Within the Map Class)	Reference Data (Observations Classified as Vegetation Type on Ground)																			Row Total	Map Class Area (Ha)	Point Estimate (Users' Accuracy)	Lower Limit, 90% Conf Int.	Upper Limit, 90% Conf. Int.
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S					
A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0000	0.0000	0.0000	0.0006	0.0018	1.92	0.0%	0.0%	16.7%
B	0.0000	0.0009	0.0000	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0013	1.42	66.7%	5.2%	100%
C	0.0000	0.0000	0.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0000	0.0000	0.0024	2.66	25%	0%	73.1%
D	0.0000	0.0000	0.0000	0.0019	0.0000	0.0010	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0039	4.28	50%	0.0%	100%
E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.17	0%	0%	50%
F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	1.05	100%	75%	100%
G	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0013	1.45	100%	75%	100%
H	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0051	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0051	5.65	100%	95%	100%
I	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0030	0.0865	0.0000	0.0000	0.0030	0.0000	0.0000	0.0000	0.0000	0.0209	0.0000	0.0000	0.1134	125.0	76.3%	63.7%	89.0%
J	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0489	0.0000	0.0019	0.0000	0.0000	0.0019	0.0075	0.0000	0.0000	0.0000	0.0602	66.4	81.3%	68.3%	94.2%
K	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0000	0.0000	0.0000	0.0000	0.0006	0.0006	0.0000	0.0000	0.0000	0.0018	1.85	0%	0%	16.7%
L	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3346	0.0152	0.0000	0.0000	0.0000	0.0608	0.0000	0.0000	0.4106	452.6	81.5%	67.3%	95.6%
M	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0045	0.0000	0.0000	0.0000	0.0075	0.0000	0.0000	0.0120	13.3	37.5%	3.1%	71.9%
N	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0017	1.91	0%	0%	16.7%
O	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0016	0.0000	0.0000	0.0000	0.0000	0.0016	1.77	100%	75%	100%
P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0086	0.0069	0.0000	0.0000	0.0172	105.65	50%	19%	81%
Q	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0200	0.0280	0.0000	0.0000	0.0000	0.0000	0.0040	0.0040	0.3044	0.0040	0.0000	0.3644	401.8	83.5%	76.6%	90.5%
R	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0%	0%	0%
S	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00	0%	0%	0%
Column Total	0.0000	0.0009	0.0006	0.0019	0.0004	0.0020	0.0013	0.0091	0.1065	0.0815	0.0006	0.3397	0.0197	0.0000	0.0093	0.0207	0.4011	0.0040	0.0006	**1.0**	**1188.88**			
Estimated True Map Class Area (Ha)	0.0	0.947	0.665	2.14	0.473	2.12	1.45	10.01	117.47	89.95	0.665	374.32	21.75	0.0	9.54	22.83	442.84	4.415	0.640					
Point Estimate, Mean Producer's Accuracy	0%	100%	100%	100%	0%	49.5%	100%	56.4%	81.2%	60%	0%	98.5%	22.9%	0%	18.6%	41.6%	75.8%	0%	0%					
Lower Limit, 90% Conf. Int.	0%	99.9%	99.9%	99.8%	0%	49.5%	100%	56.4%	79.8%	58.9%	0%	95.1%	21.5%	0%	18.5%	40.6%	72.6%	0%	0%					
Upper Limit, 90% Conf. Int.	10%	100%	100%	100%	0%	49.5%	100%	56.4%	82.6%	61.1%	0%	100%	24.4%	0%	18.6%	42.7%	78.9%	0%	0%					

Table Note: Point Estimate, Overall Accuracy (with 90% Confidence Interval): **80% (74.2%-85.8%)**. Point Estimate, Overal Accuracy Kappa Statistic (with 90% Confidence Interval): **68.2% (62.5%-73.9%)**.

Key to Map Class Codes

A = Black Willow Forest
B = Southern Woolgrass Bulrush Marsh
C = Black Willow Riverbank Shrubland
D = Virginia Pine / Granitic Flatrock Border Woodland
E = Common Rush Marsh
F =Southern Piedmont Mafic Shrubland
G = Smartweed Cutgrass Beaver Pond
H = Granitic Flatrock Complex, Perennial Zone/ Appalachian Low Elevation Granitic Dome
I = Mafic Xeric Piedmont Oak Forest / Xeric Ridgetop Chestnut Oak Forest
J = Upper Southeast Small Stream Sweetgum - Tuliptree Forest
K = Piedmont Low Elevtion Seepage Swamp
L = Early- to Mid-Successional Loblolly Pine Forest
M = Early-Successional Shortleaf Pine Forest
N = Successional Tuliptree - Loblolly Pine Forest
O = American Sycamore - Green Ash Floodplain Forest
P = Piedmont Acidic Mesic Mixed Hardwood Forest
Q = Piedmont Dry-Mesic Acidic Oak-Hickory Forest / Interior Southern Red Oak – White Oak Forest / Tuliptree Forest Alliance
R = Successional Water Oak Forest
S = Blackberry – Greenbrier Successional Shrubland Thicket

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

www.nature.nps.gov