

National Park Service  
U.S. Department of the Interior

Northeast Region  
Philadelphia, Pennsylvania



## **Vegetation Classification and Mapping at Appomattox Court House National Historical Park, Virginia**

Technical Report NPS/NER/NRTR—2008/125



**ON THE COVER**

Main photo: Cultural Meadow with split rail fence. Inset: Acidic Oak - Hickory Forest near Lee's Headquarters.  
Photographs by: Gary P. Fleming.

## **Vegetation Classification and Mapping at Appomattox Court House National Historical Park, Virginia**

Technical Report NPS/NER/NRTR—2008/125

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U.S. Department of the Interior  
National Park Service  
Northeast Region  
Philadelphia, Pennsylvania

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## Summary

Accurate and up-to-date vegetation maps are recognized by the National Park Service (NPS) Inventory and Monitoring Program as one of twelve basic data sets for every national park with significant natural resources. The National Park Service (NPS) and the U.S. Geological Survey (USGS) have put forth standards and protocols for classification and mapping of vegetation communities on NPS lands. The USGS-NPS Vegetation Mapping Program recognizes the United States National Vegetation Classification (USNVC) as the standard vegetation classification to be used in these mapping projects.

Vegetation data collected from seven national parks in Virginia were combined with over 2,000 existing plot samples from throughout the Mid-Atlantic Piedmont and Coastal Plain and used to refine the USNVC for the mid-Atlantic region. This classification was used to map and describe the vegetation at the seven national parks in Virginia.

This report documents the classification and mapping of vegetation at Appomattox Court House National Historical Park. Twenty map classes representing seventeen USNVC associations, two nonstandard, park-specific vegetation classes, and two Anderson Level II land-use categories were used to map the 705 ha (1,743 ac) park. Vegetation map classes were determined through extensive field reconnaissance, data collection, and analysis. Leaf-off aerial photography from 2000 served as the base map and field sampling was conducted from 2002–2004. Spatial data was digitized onscreen over digital orthophoto mosaics created from scanned color infrared, stereo pair 1:6,000 scale aerial photography using a 0.5 hectare minimum mapping unit.

Cultural map classes cover 40% (283.2 ha [699.9 ac]) of the park and include the Anderson land-use categories and other man-made or maintained areas in the park. Early successional or transitional vegetation covers 36% of the land in the park (251.3 ha [620.9 ac]). Seven map classes representing late successional vegetation cover just over 24% of the land in the park (169.4 ha [418.5 ac]) and can be broadly characterized based on different environmental settings as upland forests (four map classes) and forested wetlands (three map classes).

A vegetation map of Appomattox Court House National Historical Park was created following the USGS-NPS Vegetation Mapping Program protocols. Vegetation map classes were crosswalked to the Natural Communities of Virginia and to the USNVC in order to provide a regional and global context for the park's vegetation. All vegetation polygons on the map were surveyed either as part of the initial mapping effort or during accuracy assessment and their classification verified on the ground. One hundred and eighty-seven randomly selected accuracy assessment sampling points were collected throughout the park and used to assess the thematic accuracy of the map. The Kappa Index for the final vegetation map was  $80.9 \pm 5\%$ , with an overall accuracy of 84%.

A field key to the map classes and detailed descriptions for map classes or vegetation associations within a map class were developed to assist with field recognition and classification. Additional products associated with this project include: leaf-on and leaf-off orthophoto mosaics, database of vegetation plot data and accuracy assessment data, digital photos of vegetation associations, and spatial data files for the vegetation map, plot sample points, and accuracy

assessment sample points with associated Federal Geographic Data Committee (FGDC)-compliant metadata.

Products for Appomattox Court House National Historical Park and similar national park vegetation mapping projects can be accessed at the USGS-NPS Vegetation Mapping Program website: <http://biology.usgs.gov/npsveg/>.

Keywords: vegetation association, vegetation classification, vegetation mapping, Appomattox Court House National Historical Park.

## Introduction

### General Background

Effective management of natural resources in our national parks depends on park managers having access to comprehensive, scientifically credible information on species and habitats found in their parks. Accurate and up-to-date vegetation maps can form the foundation for resource management activities in the national parks and are recognized by the National Park Service (NPS) Inventory & Monitoring Program as one of twelve basic data sets for every park with significant natural resources (NPS 2003). Activities as diverse as park planning, fire management, wildlife research, habitat conservation/restoration, and visitor interpretation all can be informed by current maps of vegetation distribution. Additionally, a vegetation map attributed to a standard, nationally used classification system provides a way to assess how an individual park's biodiversity fits into the context of the entire region.

Since the early 1990's, the National Park Service and the U.S. Geological Survey (USGS) have worked cooperatively to classify, describe, and map vegetation communities in more than 250 national park units across the United States. At its inception, the USGS-NPS Vegetation Mapping Program (USGS-NPS VMP) put forth standards and protocols for classification and mapping of vegetation communities on NPS lands. These standards are outlined in four documents written by The Nature Conservancy and Environmental Systems Research Institute (TNC and ESRI 1994a, b, c, d) and available at <http://biology.usgs.gov/npsveg/standards.html>.

Products produced as part of the USGS-NPS VMP must meet Federal Geographic Data Committee (FGDC) standards for vegetation classification and metadata, and national standards for spatial accuracy and data transfer. Standard spatial data products include aerial photography, map classification, spatial databases of vegetation communities, hardcopy maps of vegetation communities, metadata for spatial databases, and complete accuracy assessment of the vegetation map. Vegetation information includes vegetation classification, dichotomous field key of vegetation classes, formal description of each vegetation class, ground photos of vegetation classes, and field data in database format. Mapping standards include a minimum mapping unit of 0.5 hectares (ha) and classification accuracy of 80% for each map class. The spatial databases are required to have a horizontal positional accuracy that meets National Map Accuracy Standards at the 1:24,000 scale. This means that each well-defined object in the spatial database will be within 1/50 of an inch of its actual location on the map or 40 ft (12.2 m) on the ground.

The FGDC standard for vegetation classification is the United States National Vegetation Classification (USNVC). Over the past twenty years, the USNVC has been developed and implemented by The Nature Conservancy (TNC), the network of Natural Heritage Programs, and, more recently, NatureServe. The USNVC is a subset of the larger International Vegetation Classification (IVC). In North America, the IVC consists of the U.S. National Vegetation Classification (USNVC) and the Canadian National Vegetation Classification (CNVC). The IVC has also been developed for the Caribbean region. Further developments are under way through various Latin American projects.

The USNVC is currently maintained and updated by NatureServe. Additional support has come from federal agencies, the FGDC, and the Ecological Society of America. Refinements to the classification occur in the process of application, leading to ongoing proposed revisions that are reviewed both locally and nationally. A two volume publication (Grossman et al. 1998) presenting the standardized classification and providing a thorough introduction to the classification, its structure, and the list of vegetation types found across the United States as of April 1997 can be found on the Internet at: <http://www.NatureServe.org/publications/library.jsp>. Volume II of this publication (the classification listing) has been superceded by the online database server, NatureServe Explorer®, <http://www.NatureServe.org/explorer><sup>1</sup>, which provides regular updates to ecological communities in the United States and Canada.

The USNVC is a hierarchical system that classifies vegetation using physiognomic (structural) features at the highest levels of the hierarchy and floristic features at the lower levels. The physiognomic units have a broad geographic perspective and the floristic units have local and site-specific perspectives (TNC and ESRI 1994a; Grossman et al. 1998). The USNVC includes most existing vegetation whether natural or cultural, but attention is focused on natural vegetation types. Natural vegetation, as defined in TNC and ESRI (1994a), includes types that “occur spontaneously without regular management, maintenance, or planting and have a strong component of native species.” Cultural vegetation includes planted/cultivated vegetation types such as orchards, pastures, forestry plantations, and vineyards.

The physiognomic-floristic classification includes all upland terrestrial vegetation and all wetland vegetation with rooted vascular plants. The hierarchy has five physiognomic levels and two floristic levels (Table 1). The basic unit of the physiognomic portion of the classification is the formation, a type defined by dominance of a given growth form in the uppermost stratum and characteristics of the environment (e.g., cold-deciduous alluvial forests). The physiognomic portion of the classification is based upon the United Nations Educational, Scientific, and Cultural Organization (UNESCO 1973) world physiognomic classification of vegetation, which was modified to provide greater consistency at all hierarchical levels and to include additional types.

The floristic levels include alliances and associations. The alliance is a physiognomically uniform group of plant associations that share dominant or diagnostic species, usually found in the uppermost strata of the vegetation. The association is the finest level of the USNVC. An association is defined as a plant community type that is relatively homogeneous in composition and structure and occurs in a uniform habitat. For example, Mid-Atlantic Mesic Mixed Hardwood Forest (*Fagus grandifolia* - *Quercus (alba, rubra)* - *Liriodendron tulipifera* / (*Ilex opaca* var. *opaca*) / *Polystichum acrostichoides* Forest) is a common forest type on well-drained, acidic midslopes in the Piedmont and Coastal Plain of Virginia. Associations are also assigned global rarity ranks that indicate their conservation status and relative risk of extirpation (Grossman et al. 1998). Associations from the USNVC are cross-referenced to communities in

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<sup>1</sup> As of this writing, cultural, early successional / ruderal, and exotic (i.e. nonnative plot species) dominated vegetation units defined in the USNVC are not served on NatureServe Explorer. Additional information on these types can be obtained from a NatureServe regional or national vegetation ecologist.

Table 1. United States National Vegetation Classification System physiognomic-floristic hierarchy for terrestrial vegetation (from Grossman et al. 1998).

Level	Primary Basis For Classification	Example
Class	Growth form and structure of vegetation	Forest
Subclass	Growth form characteristics (e.g., leaf phenology)	Deciduous forest
Group	Leaf types, corresponding to climate	Cold-deciduous forest
Subgroup	Relative human impact (natural/semi-natural or cultural)	Natural/semi-natural
Formation	Additional physiognomic and environmental factors, including hydrology	Lowland or submontane cold-deciduous forest
Alliance	Dominant/diagnostic species of uppermost or dominant stratum	White Oak - (Northern Red Oak, Hickory species) Forest Alliance
Association	Additional dominant/diagnostic species from any strata	Northern Red Oak / Umbrella Magnolia - Eastern Redbud / Black Cohosh - Heartleaf Foamflower Forest

state-specific vegetation classifications such as the Natural Communities of Virginia (Fleming et al. 2006), as well as to other regional and national classification systems.

In 2001, the Northeast Region of the NPS contracted separately with the Virginia Department of Conservation and Recreation, Division of Natural Heritage (VADNH), NatureServe, and North Carolina State University's Center for Earth Observation (NCSU-CEO) to apply the USGS-NPS VMP standards to the vegetation in seven NPS units in Virginia. These parks are within two NPS Inventory and Monitoring networks: the Mid-Atlantic Network and the Northeast Coastal and Barrier Network.

The goal of the study was to accurately map and classify, at least to the alliance level of the USNVC, the vegetation in Appomattox Court House National Historical Park, Booker T. Washington National Monument, Colonial National Historical Park, Fredericksburg and Spotsylvania National Military Park, George Washington Birthplace National Monument, Petersburg National Battlefield, and Richmond National Battlefield Park. The classification used to map these parks was developed regionally, using quantitative data that was collected from all seven park units and combined with existing data from throughout the Mid-Atlantic Piedmont and Coastal Plain.

The goal of the mapping effort at Appomattox Court House National Historical Park was to produce an up-to-date digital geospatial vegetation database for the park and to provide a plant species list, a dichotomous key to the vegetation, and descriptions of the vegetation in the park. Baseline information on plant community composition and rarity is critical to developing desired conditions and park management goals relating to native plant communities, nonnative plant and insect species, and effects of deer browse and other disturbances. Identification and description

of plant communities also provide habitat information important to understanding associated organisms, including animals, protozoa, bacteria, and fungi. A vegetation map can also allow inferences about the location and abundance of species that are characteristic of each community. This report also describes the park's vegetation in the context of a national and regional vegetation classification, the USNVC. Having the park's vegetation mapped and attributed to this standard will facilitate the comparison of vegetation types among other NPS units in the region and throughout the United States.

The success of this study depended on cooperative efforts of several government and private entities. VADNH and NatureServe worked cooperatively to develop the vegetation classification, the map class descriptions, and field keys to the map classes, and to ensure that the vegetation units were properly crosswalked to the USNVC. NCSU-CEO produced the photo mosaics, assessed their positional accuracy, and developed preliminary vegetation maps. VADNH took lead responsibility for field validation of the preliminary maps, editing the vegetation maps and labeling features with USNVC units, vegetation data collection and analysis, and writing the final reports. The Northeast Region of NPS funded the project and provided technical specifications and guidance.

#### Park-specific Information

Appomattox Court House National Historical Park is a 705 ha (1,743 ac) unit of the National Park Service located in Appomattox County, Virginia. It lies 5 km (3 mi) east of the town of Appomattox, Virginia and 40 km (25 mi) east of the city of Lynchburg, on state route 24 (Figure 1). Appomattox Court House National Historical Park commemorates the end of the American Civil War and preserves historic battlefields, the McLean home surrender site, and the village of Appomattox Court House. The Battle of Appomattox Court House was the final engagement of Confederate General Robert E. Lee's Army of Northern Virginia before surrendering to Union Lt. General Ulysses S. Grant on April 9, 1865, officially ending the four-year American Civil War. Appomattox Court House National Historical Park was established by an Act of Congress on August 13, 1935 and became a part of the National Park System on April 15, 1954. Today the park preserves 18 original structures from the 1790s to 1870s, as well as several reconstructed buildings within the historic village of Appomattox Court House. Additionally, miles of roads and trails from the same period are preserved and maintained, allowing visitors to explore this historic landscape. In 2006, nearly 146,000 people visited Appomattox Court House National Historical Park.

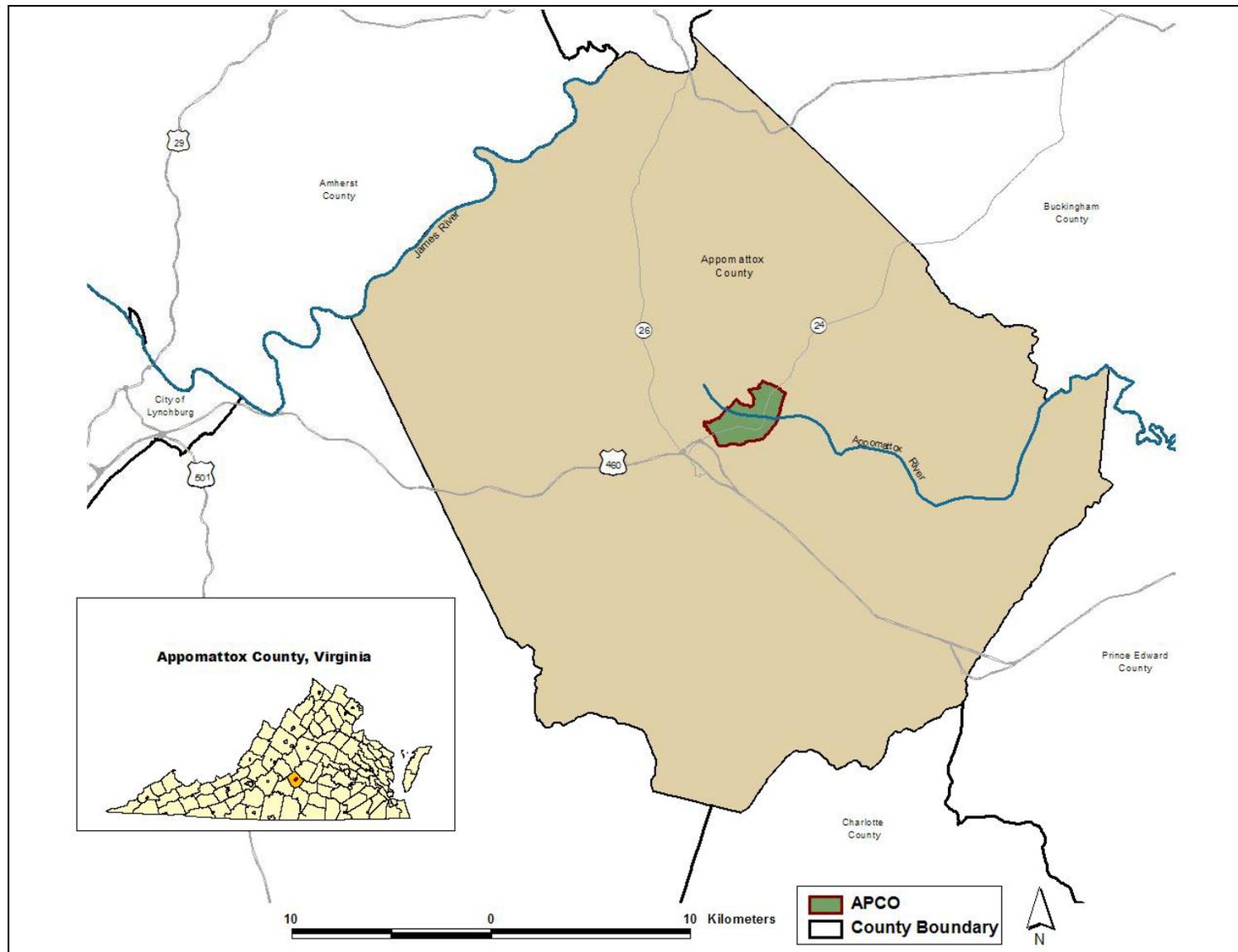


Figure 1. Location of Appomattox Court House National Historical Park (APCO), Virginia.

## Project Area

### Location and Regional Setting

Appomattox Court House National Historical Park is located within the southern Piedmont of Virginia (Figure 2). The park boundary falls within the Appomattox and Vera, Virginia USGS quadrangle maps (Figure 3). This portion of the southern Piedmont is known as the Lynchburg Belt subsection (Keys et al. 1995) and consists of irregular plains with elevations ranging from 30–396 m (100–1,300 ft). Soils are Kanhapludults, Hapludults, and Dystrachrepts of kaolinitic and mixed mineralogy with a thermic temperature and udic moisture regimes. Historic climate data from Appomattox, Virginia from the years 1948 through 2007 report the mean monthly minimum temperature as 6.7° C (44.1° F), and the mean monthly maximum temperature is 19.3° C (66.8° F), and mean total annual precipitation as 109.7 cm (43.2 in). The mean January minimum temperature is - 4.4° C (24.4° F), and the mean July maximum temperature is 30.3° C (86.5° F) (Southeast Regional Climate Center 2008).

The vegetation of the Piedmont Plateau has been severely altered by a long history of clearing, agriculture, logging, and other anthropogenic disturbances. Except in the increasingly large urban and suburban areas, the province currently has a patchwork of secondary forests, pastures, and fields used for the production of feed grains or tobacco. Most Piedmont forests have a history of repeated cutting or have regenerated on former agricultural lands, some of which were abandoned more than 150 years ago. Recently disturbed Piedmont forests tend to have a large component of pines, Virginia pine (*Pinus virginiana*) and/or shortleaf pine (*Pinus echinata*), and shade-intolerant hardwoods such as tuliptree (*Liriodendron tulipifera*) and sweetgum (*Liquidambar styraciflua*). The composition of more mature hardwood forest communities varies with soils and topography. Dry, acidic soils support oak / heath forests, while more basic upland soils usually support oak-hickory forests. White oak (*Quercus alba*) is a ubiquitous dominant in both groups. Mixed forests of American beech (*Fagus grandifolia*), oaks (*Quercus* spp.), and tuliptree (*Liriodendron tulipifera*) are common in mesic, acidic ravines throughout the Piedmont. Occurring more locally are rich mesophytic forests, which are generally confined to ravines and river slopes underlain by mafic rocks such as amphibolite, diabase, or gabbro. Upland forests of the western monadnocks resemble those of the Blue Ridge. Forests of silver maple (*Acer saccharinum*), American sycamore (*Platanus occidentalis*), American elm (*Ulmus americana*), boxelder (*Acer negundo*), and other flood-tolerant trees are well developed along the larger rivers that cross the Piedmont, particularly the Potomac, the Rappahannock, the James, and the Roanoke (Fleming et al. 2006).

### Park Environmental Attributes

Many environmental factors, such as geology, soils, hydrology, and topography, affect the types and distribution of vegetation within Appomattox Court House National Historical Park. The bedrock geology in the park is mapped as three units; Greenstone or amphibolite gneiss (24% of the park area); felsic metatuff, mica schist, and gneiss (13%); and a small area of the Fork Mountain Formation (VADMR 1993). These geologic units can include both mafic / ultramafic rocks (e.g. amphibole gneiss, greenstone) that weather to soils rich in calcium and magnesium,

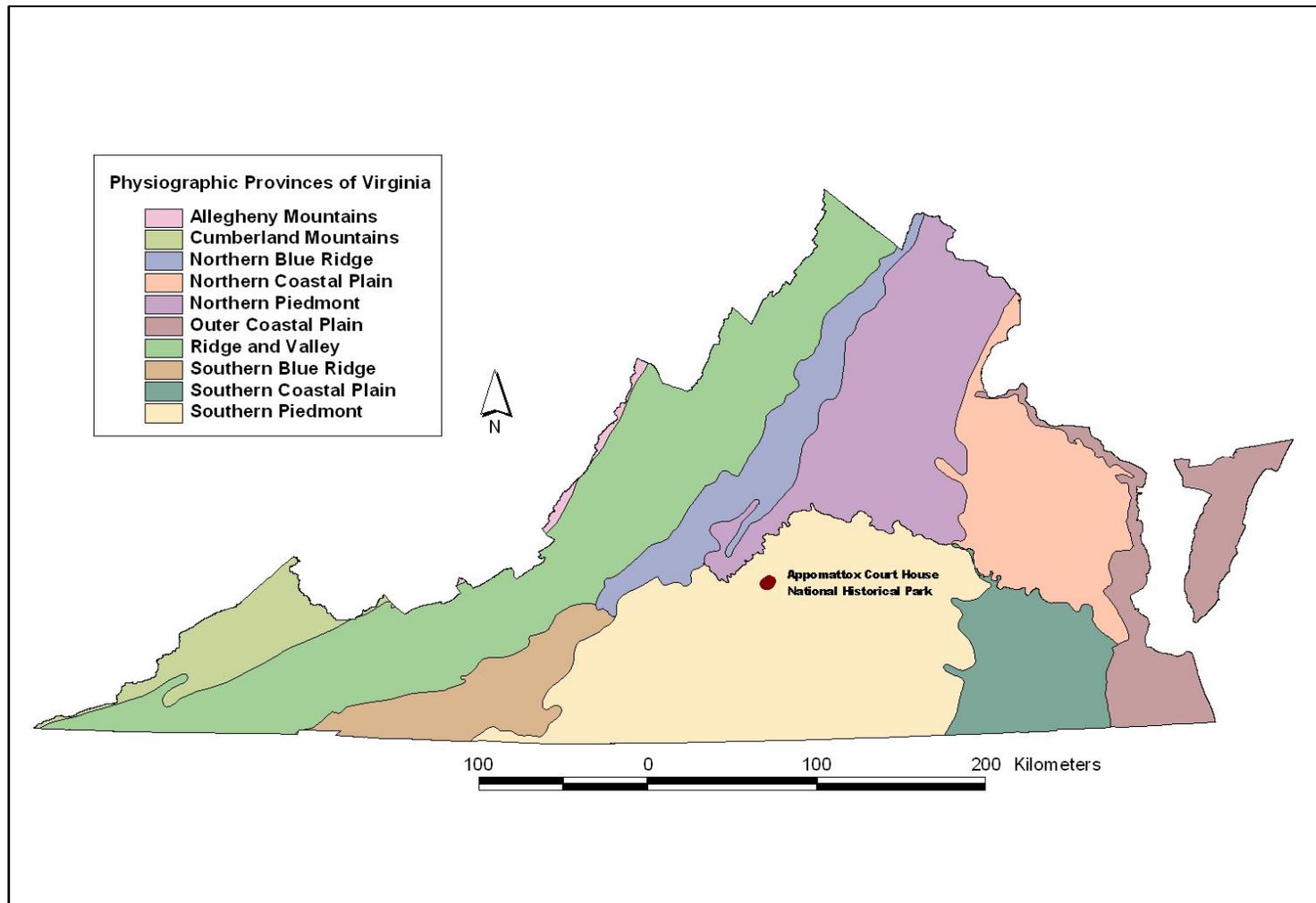


Figure 2. Physiographic provinces of Virginia showing the location of Appomattox Court House National Historical Park in the southern Piedmont.

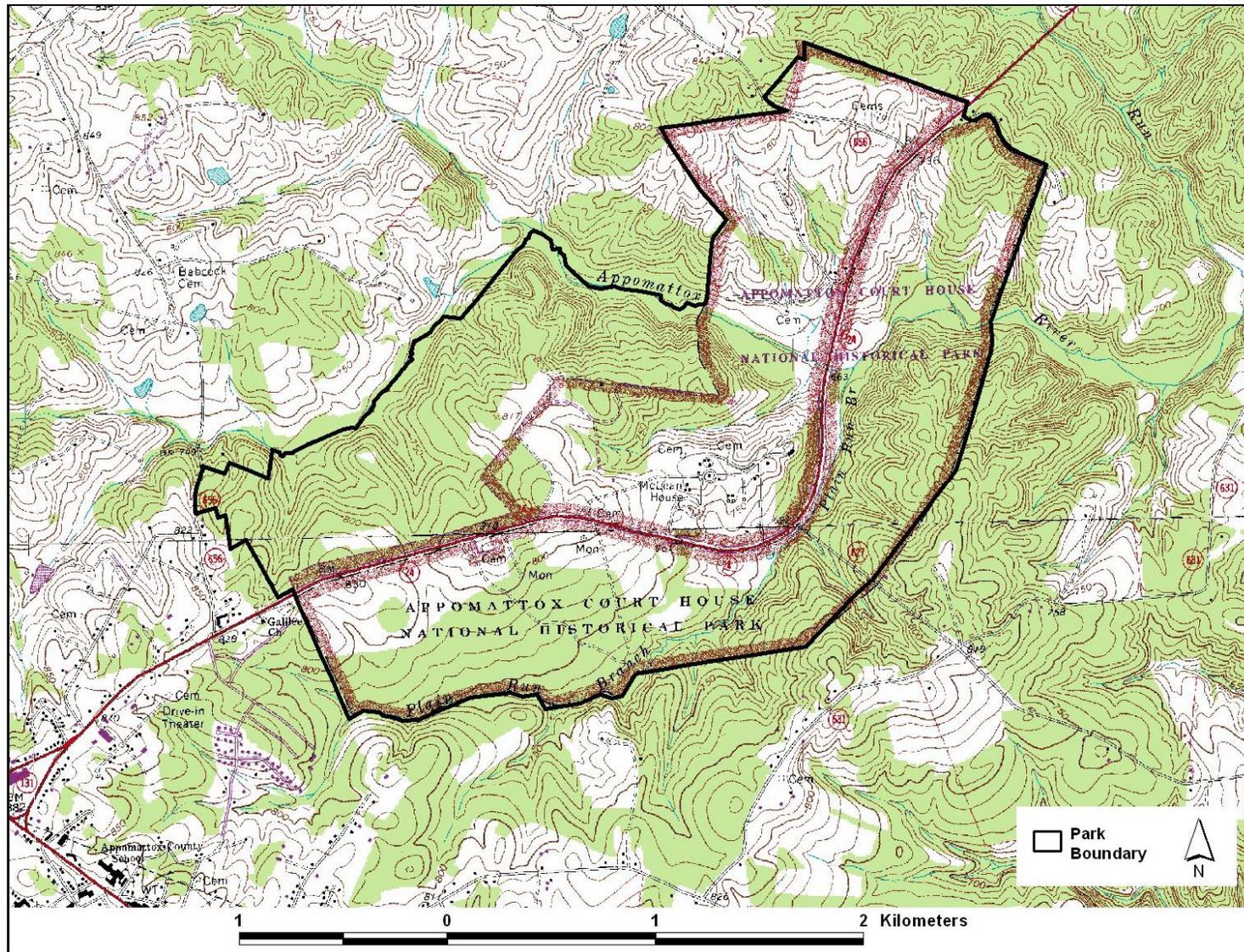


Figure 3. Location of Appomattox Court House National Historical Park on the Appomattox and Vera, VA 1:24000 USGS topographic quadrangle maps.

and more acidic rocks (e.g. felsic metatuff, biotite gneiss) that weather to the acidic soils more typical of the Piedmont region.

The Soil Survey Geographic (SSURGO) database for Appomattox County, Virginia (USDA, NRCS 1998) maps 12 soil series within the boundary of Appomattox Court House National Historical Park. The soils in the park are classed as Ultisols, Alfisols, and Inceptisols. Soils of active floodplains and well-drained stream terraces include Chewacla loam (an Inceptisol) and Altavista loam (an Ultisol). The only hydric soil mapped in the park is Wehadkee loam (an Inceptisol), a poorly drained soil that is saturated for some part of the year. The upland soils of the park include both soils weathered from mafic rocks (Alfisols) and those weathered from felsic parent material (Ultisols and one Inceptisol). About half the upland soils in the park are mapped as Alfisols and are found on steep to gentle slopes in the park. These include the series Iredell, Mecklenburg, and Poindexter and are deep, well-drained soils, with a relatively high base saturation and a strongly acid to circumneutral soil reaction (pH values 5.0–7.0). The remaining uplands in the park are mapped as the series Appomattox, Cecil, Cullen, Louisburg, Mattaponi, and Pacolet. These soils are all well-drained, very strongly to extremely acidic (pH values 4.5–6.0), sandy loams and clay loams, mostly weathered from felsic crystalline parent material and found on crests and gentle slopes in the park.

Appomattox Court House National Historical Park lies in the headwater region of the Appomattox River Watershed, part of the larger James River Watershed, and ultimately draining into the Chesapeake Bay. Approximately 13.5 km (8.4 mi) of the Appomattox River, including one main tributary (Plain Branch Run; 4.7 km [2.9 mi]) and several smaller tributaries, travel through the park. The watershed of the park is approximately 15.0 km<sup>2</sup> (5.8 mi<sup>2</sup>) (Davis et al. 2006). There are approximately 40 ha (98 ac) of wetlands within the park, and most are associated with the Appomattox River and its tributaries. A spring located near Lee's Headquarters was within the Confederate encampment area and likely served as a water source for Lee and his men. Several other springs occur within park boundaries but their locations are currently unmapped (Davis et al. 2006).

The topographic relief in the park is gentle, typical of the rolling uplands of the southern Piedmont. Elevations range from about 183 m (600 ft) at the Appomattox River to about 253 m (830 ft) along the western park boundary.

## Methods

### Project Scoping and Planning

In early 2001, the Northeast Region of the National Park Service approached VADNH to help develop a vegetation classification and maps for seven NPS units in the Piedmont and Coastal Plain of Virginia (Appomattox Court House National Historical Park, Booker T. Washington National Monument, Colonial National Historical Park, Fredericksburg and Spotsylvania National Military Park, George Washington Birthplace National Monument, Petersburg National Battlefield, and Richmond National Battlefield Park). Later that year a meeting was convened with representatives from the NPS Northeast Region Inventory and Monitoring Program, NatureServe (then the Association of Biodiversity Information), NCSU-CEO, and VADNH to identify the scope of the project and clarify roles and responsibilities.

The three entities and the NPS worked cooperatively to develop accurate vegetation maps and a regional vegetation classification to apply to the vegetation of all seven parks. Ecologists at VADNH took the primary role in field data collection, data analysis, regional classification development, and map validation and editing. They developed the local association descriptions, the field key to map classes, and wrote the final reports. NatureServe reviewed the vegetation classification developed by VADNH and ensured that the USNVC standard was followed. They also took responsibility for entering all new information into the USNVC databases and completed global association descriptions. They assisted in the development of, or reviewed, field keys to the mapping units in the parks, and provided in-the-field consultation on problematic vegetation types. Researchers at NCSU-CEO were responsible for aerial photography acquisition and processing, and preliminary photointerpretation. They also wrote the corresponding sections of the final reports.

### Preliminary Data Collection and Review of Existing Information

Previous studies conducted at Appomattox Court House National Historical Park were reviewed for information pertinent to the park's vegetation. These studies included a floristic survey (Lund and Rawinski 2000), a forest management plan (Hamilton et al. 1986), and a previous inventory by VADNH (Ludwig and Pague 1993). Existing aerial photography (Virginia Geographic Information Network 2002), topographic maps and digital raster graphics (DRGs), National Wetland Inventory maps, the soil survey for Appomattox County, Virginia, and digital soil survey data (SSURGO) were gathered for use in planning fieldwork and to use as ancillary data layers. A preliminary classification of vegetation in Virginia's Piedmont and inner Coastal Plain (Fleming 2001) was used to develop a list of vegetation likely to occur in the park. Lists of the USNVC formations and alliances likely to occur in the park were generated from NatureServe databases.

## Aerial Photography Acquisition and Processing

Two digital orthophoto mosaics, leaf-off and leaf-on, were created for Appomattox Court House National Historical Park. Air Photographics, Inc. acquired aerial photography for the leaf-off mosaic on December 18, 2000 and Kucera International acquired the photography for the leaf-on mosaic on October 22, 2001. Both sets of aerial photography are 1:6,000 scale color infrared, stereo pairs. The photography was delivered to the National Park Service (NPS), quality checked, accepted as provided, and sent to North Carolina State University (NCSU). Upon receipt at NCSU, the air photos were counted to make sure that none were missing, scanned, and saved in .tif format. Associated data and information include camera calibration certificates for both sets of photography and, for the leaf-on photography, airborne global positioning system (GPS) and inertial mapping unit (IMU) data files and a hardcopy flight report that crosswalks the airborne GPS and IMU data to the photo frame numbers.

The leaf-off mosaic was produced from 42 color infrared aerial photographs scanned at 600 dpi with 36-bit color depth. The scanned .tif images were imported into ERDAS IMAGINE .img format where a photo block was created using a digital elevation model obtained from the U.S. Geological Survey (USGS) and digital orthophoto quarter quadrangles obtained from the NPS as reference. In preparation for this step, the digital elevation model was resampled from 30 meters to 10 meters and the digital orthophoto quarter quadrangles were mosaicked. The photo block was manipulated until an acceptable triangulation solution was reached. At this point, single frame orthophotos (one for each aerial photograph) were generated and mosaicked in IMAGINE. Color balancing was performed manually in IMAGINE as part of the final mosaicking process. The final mosaic, in both IMAGINE .img and MrSID formats, is stored in the data archive maintained at NCSU for the NPS Northeast Region Inventory & Monitoring Program.

The leaf-on mosaic was produced from 37 color infrared aerial photographs scanned at 600 dpi with 24-bit color depth. The scanned .tif images were imported into ERDAS IMAGINE .img format where a photo block was created using the airborne GPS and IMU data that Kucera International supplied with the aerial photography. The photo block was manipulated until it could be triangulated with a root mean square error of less than 1. At this point, single frame orthophotos (one for each aerial photograph) were generated within IMAGINE and exported to IMAGINE .lan format. Then the .lan files were imported into ER Mapper's native (.ers) format, and an ER Mapper algorithm was created which contains color balancing information and cutlines for the final mosaic. Band interleaved by line (.bil) image and header files for the mosaic were generated in ER Mapper, the .bil image was imported into IMAGINE .img format, and, finally, the .img image was compressed using MrSID software with a 20:1 compression ratio. The final mosaic, in both IMAGINE .img and MrSID formats, is stored in the NCSU data archive.

## Preliminary Photointerpretation

A preliminary vegetation dataset for Appomattox Court House National Historical Park was created by interpreting the leaf-off digital orthophoto mosaic to delineate vegetation polygons to the formation level defined in the USNVC (FGDC 1997; Grossman et al. 1998). To create the formation-level vegetation dataset, a photointerpreter, viewing the mosaic in three dimensions in ERDAS Stereo Analyst, delineated visible areas of homogenous vegetation, land cover, and land

use. The minimum mapping unit was 0.5 ha (1.25 ac). After polygons were delineated for the entire park area, the photointerpreter created and populated two fields in the attribute table, entering the formation-level vegetation class or other land use/land cover code and a “possible alliance” code. The land use and land cover classification scheme developed by Anderson et al. (Anderson et al. 1976) was used to attribute non-vegetated land cover. The final formation-level vegetation dataset is archived in ESRI personal geodatabase and shapefile formats in the NCSU-CEO data archive.

### Field Data Collection

Leaf-on and leaf-off photomosaics and the formation-level line work were obtained from NCSU-CEO in May 2002. Ecologists from VADNH conducted field data collection in Appomattox Court House National Historical Park in May 2002, May and June 2003, and in April, May, and September 2004. The objectives of the fieldwork were to evaluate the formation-level line work and to collect information to help attribute and edit the line work to reflect the alliance level of the USNVC. Additionally, detailed quantitative data from the least disturbed areas of the park were needed to augment data available for a regional vegetation classification.

The evaluation and editing of the line work required extensive field reconnaissance throughout the park. Ecologists navigated to vegetation polygons represented on the formation-level map using a GarminMap76S GPS. Once within the target polygon, qualitative observations were made that described any variation of vegetation or environment within the polygon. The dominant vegetation class and any inclusion communities were noted following Fleming (2001). Dominant and characteristic vascular plant species were listed by strata with an indication of their prevalence in the stand (i.e. dominant, common, rare). When possible, the entire polygon was traversed and additional GPS points were collected to mark significant vegetation change within a polygon.

Additional detailed quantitative data were collected only in the highest quality stands of floristically and structurally homogeneous vegetation. These were middle-to-late successional stands with a composition of mostly native species and with a consistent environmental setting. Within these areas, specific plot locations were chosen subjectively in order to distribute plots across a range of site conditions and to capture vegetation types that were relatively dominant, homogenous, and covered at least the minimum mapping unit area of half a hectare. An attempt was made to find at least one undisturbed sampling location for each middle-to-late successional community type in the park. Early-successional forests and heavily disturbed areas within the park were not sampled using quantitative methods. These areas are spatially, temporally, and compositionally dynamic. Since their floristics are often in flux and subject to stochastic factors, groups of plots of heavily modified vegetation (even groups dominated by the same species) usually lack the compositional consistency to allow for ecologically meaningful patterns to be found using quantitative data analysis. Thus, sample plots from these types often perform as statistical outliers in quantitative analyses and frequently fail to aggregate into convincing groups by accepted statistical standards. Instead, qualitative data collected from vegetation polygons were used to describe and map early successional forests and heavily disturbed areas within the park.

In order to be maximally compatible with existing regional plot data, plots were sampled using the relevé method (*sensu* Peet et al. 1998), following standard procedures employed by VADNH and modified slightly to accommodate entry into the PLOTS database (NatureServe 2004). As a rule, 100 m<sup>2</sup> (119.59 yd<sup>2</sup>) plots with 10×10 m (32.8×32.8 ft) (or 5×20 m [16.4×65.6 ft]) configurations were used to sample shrubland or herbaceous vegetation and 400 m<sup>2</sup> (478.39 yd<sup>2</sup>) plots were used to sample forested vegetation. The configuration of the plot is flexible (e.g. 20×20 m [65.6×65.6 ft], 16×25 m [62.5×82 ft], 13.33×30 m [43.73×98.4 ft], 10×40 m [32.8×131.2 ft]) to accommodate special site conditions and vegetation pattern. If a forest had particularly large diameter trees or a diverse canopy composition, a 1000 m<sup>2</sup> plot (20×50 m [1,195.99 yd<sup>2</sup>]) was used to fully capture tree species composition.

Within each plot, the percent cover of each vascular plant taxon was visually estimated as a vertical projection of above-ground biomass onto the full plot area and assigned to one of nine numerical cover classes (Table 2). In addition to this total cover value, cover was estimated for each species in the following height/lifeform classes:

- herb (field) layer (all herbaceous plants, woody plants <0.5 m [1.64 ft])
- short shrub layer (woody plants 0.5–1 m [1.64–3.28 ft])
- tall shrub layer, >1–6 m (3.28–19.68 ft)
- tree layer, >6–10 m (19.68–32.8 ft)
- tree layer, >10–20 m (32.8–68.6 ft)
- tree layer, >20–35 m (68.6–114.8 ft)
- tree layer, >35 m (114.8 ft)

The overall cover of mosses, lichens, and liverworts was estimated, but the individual cover of non-vascular taxa was not estimated. The cover of vines climbing into the canopy or subcanopy was recorded in the maximum height stratum attained by the plant. Vascular plants thought to be characteristic of the sampled community, but located outside the plot, were recorded parenthetically if visible from the boundary, and assigned a cover class of 1.

Table 2. Cover-class scores used in field sampling and data analysis.

Cover Class	Percent Cover Range	Area of Coverage for a 400 m <sup>2</sup> plot	Cover Class Percent Cover Midpoint
1	<0.1%	<20 cm <sup>2</sup>	0.05
2	0.1–1%	20 cm <sup>2</sup> –4 m <sup>2</sup>	0.55
3	1–2%	4–8 m <sup>2</sup>	1.50
4	2–5%	8–20 m <sup>2</sup>	3.50
5	5–10%	20–40 m <sup>2</sup>	7.50
6	10–25%	40–100 m <sup>2</sup>	17.50
7	25–50%	100–200 m <sup>2</sup>	37.50
8	50–75%	200–300 m <sup>2</sup>	62.50
9	75–100%	300–400 m <sup>2</sup>	87.50

Additional vegetation information collected included the estimated height and total vegetative coverage of each stratum, the leaf type and leaf phenology of each stratum, and the physiognomic class represented by the stand. The maximum canopy height was measured using a clinometer.

A standard set of environmental data was measured or estimated at each plot (Table 3). Slope inclination was measured with a clinometer, and slope direction (aspect) was evaluated using a compass. Both measurements were taken to the nearest degree from the plot center. In plots with variable microtopography, slope was measured at several points and averaged. The percent cover of different surface substrates was estimated visually, with precision varying such that values sum to 100%. Topographic position, slope shape (both horizontally and vertically), soil drainage class, soil moisture regime, and inundation were assessed using scalar values. Landform was assessed at the landscape level using a topographic map and assigned to values from a standard landform classification (Driscoll et al. 1984). When conditions permitted, a digital photo was taken of each sampling location. Each vegetation sample was georeferenced using a GarminMap76s global positioning system (GPS), when possible. If a satellite reading could not be obtained, UTM coordinates were derived from the estimated position on a topographic quadrangle map. Elevation was also derived from the position on a topographic quadrangle map.

When possible, soil samples were collected from the top 10 cm (4 in) of mineral soil (below the surficial litter and humus). Depth of surface duff, soil color, and texture were evaluated in the field and recorded on the plot forms.

Evidence of any past or ongoing vegetation disturbance was carefully recorded at each sampling site. Other information was recorded in the form of a narrative qualitative assessment and notes. This narrative could include information concerning landscape context, estimated size of stand, hydrologic condition, approximate distance and direction to proximate water sources, spatial variation of vegetation pattern, or any other unusual features of the vegetation.

The plot survey form used to collect quantitative vegetation samples is provided in Appendix A.

All field data for quantitative vegetation samples were entered into the PLOTS database version 2.0 (NatureServe 2004) and are provided as a supplement to this report. Nomenclature follows the PLANTS 3.5 Database developed by the Natural Resource Conservation Service in cooperation with the Biota of North America Program (USDA, NRCS 2004).

In the context of this report a nonnative species (sometimes referred to as an exotic or alien species) is a species that is not thought to be a native component of Virginia's flora (Townsend 2007). Native species are those that occur in the region in which they evolved, changing over time in response to physical and biotic processes characteristic of a region. Plants that exhibit invasive tendencies and threaten rare native plants and natural communities are referred to as invasive. For this report, invasive nonnative plants species include those on the VADNH list of Invasive Exotic Plant Species in Virginia (Heffernan et al. 2001; VADCR 2003).

Table 3. Topographic / hydrologic environmental data recorded at each plot sample location.

<p><b>Topographic position:</b>          crest          upper slope          middle slope          lower slope          toe slope          plain/level/bottom          basin/depression</p>	<p><b>Soil Drainage Class:</b>          very poorly drained          poorly drained          somewhat poorly drained          moderately well drained          well drained          rapidly drained</p>
<p><b>Surface Substrate (% cover):</b>          bedrock          boulders and stones          gravel and cobbles          litter / organic matter          decaying wood          water          mineral soil / sand          other</p>	<p><b>Inundation:</b>          never          infrequently          regularly; for &lt; 6 months          regularly; for &gt; 6 months          always submerged by shallow water          (&lt; 30cm)          always submerged by deep water          (&gt;30 cm)</p>
<p><b>Measured Aspect (degrees)</b></p>	<p><b>Soil Moisture Regime:</b>          very xeric (moist for negligible time          after precipitation)          xeric (moist for brief time)          somewhat xeric (moist for short time)          submesic (mist for moderately short          time)          mesic (moist for significant time)          subhygric (wet for significant part of          growing season; mottle &lt;20cm)          hygric (wet for most of growing season;          permanent seepage/mottling)          subhydric (water table at or near surface          for most of the year)          hydric (water table at or above surface          year round)</p>
<p><b>Measured Slope (degrees)</b></p>	
<p><b>Slope shape:</b>          vertical              concave              convex              straight          horizontal              concave              convex              straight          hummock and hollow microtopography          irregular craggy / bouldery microtopography</p>	
<p><b>Hydrologic Regime:</b>          terrestrial (<i>i.e.</i> not a wetland)          non-tidal              permanently flooded              semipermanently flooded              seasonally flooded              intermittently flooded              temporarily flooded              saturated          tidal              irregularly exposed (&lt; diurnally)              regularly flooded ( diurnally)              irregularly flooded (&lt; diurnally)              wind tidally flooded              unknown hydrology</p>	

## Vegetation Classification and Characterization

The vegetation classification used to map seven mid-Atlantic NPS parks in Virginia was developed through successive approximations. The initial classification from 2001 (Fleming 2001) was improved upon by two additional analyses, in 2003 and in 2006, each progressively using a larger regional dataset, with the objective of producing a more robust classification.

All plot data collected in mid-Atlantic national parks as of November 2002 were combined into a regional data set of 1,342 plots from throughout the Virginia Piedmont and Coastal Plain and from selected NPS units in Maryland and the District of Columbia. The resulting preliminary vegetation classification was reviewed by NPS ecologists and Natural Heritage Program ecologists from Virginia, Maryland, and West Virginia. In December 2006, with the addition of plot data collected since 2002 from Virginia, Maryland, and West Virginia, a regional dataset of 2,250 plots was used to develop the final vegetation classification for the project.

All data were examined using a combination of cluster analysis, ordination, and tabular (statistical) analysis. In general, the analytical process was designed to progressively fragment the large datasets into more workable subsets, using cluster analysis to identify groups, statistical analysis to validate those groups, and, lastly, ordination studies to examine compositional gradients between groups and correlations with important environmental gradients. In practice, the process was iterative as increasingly finer groups were identified and analyzed.

The general steps included 1) data preparation and transformation, 2) numerical classification (cluster analysis), 3) summary statistics, 4) gradient analysis (ordination), and 5) assignment of classification units to the standard (crosswalking to USNVC). Each of these steps is outlined below.

### Data Preparation and Transformation

Plot data collected during field work were combined with existing data from throughout the Mid-Atlantic Coastal Plain and Piedmont using databases created with Microsoft Access 2000. The final dataset consisted of 2,250 plots (1,452 upland and palustrine wetland and 798 tidal).

Since individual plant taxa are not always identified to the same taxonomic level in plot sampling, botanical nomenclature for the whole analysis dataset was reviewed and standardized. As a rule, taxa were treated at the highest level of resolution possible, but treatment at the subspecific level was not always possible and a few groups of species had to be merged into “pseudospecies.” For example, various plots had *Polygonatum biflorum*, *Polygonatum biflorum* var. *biflorum*, or *Polygonatum biflorum* var. *commutatum*; these were merged at the species level. Species richness was calculated for each plot using all taxa (including unidentified species) rooted within plot boundaries. However, taxa identified only at generic or higher levels (e.g., “*Carex* sp.” or “unidentified woody seedling”) were deleted from the dataset prior to analysis to eliminate “noise” and potentially erroneous correlations between generic entities.

Prior to analysis, most environmental variables were transformed, either to normalize frequency distributions or to assign numeric values to categorical variables. Topographic position and slope were converted to ordinal variables (Table 4). Aspect was transformed using the cosine method of Beers et al. (1966), using the formula  $A' = \cos(45^\circ - A) + 1$ , where  $A'$  = transformed

Table 4. Ordinal values for topographic position and slope inclination used in data analysis.

Topographic Position	Slope Inclination
basin/depression = -1	0-3° = 1 (flat)
plain/level/bottom = 0	4-6° = 2 (gentle / undulating)
toe slope = 1	7-13° = 3 (sloping / rolling)
lower slope = 2	14-20° = 4 (moderate / hilly)
middle slope = 3	21-40° = 5 (steep)
upper slope = 4	41°+ = 6 (very steep)
crest = 5	

aspect and A = aspect in degrees. The Beers transformation is a commonly used formula for the conversion of the circular measure of slope aspect in degrees into linear values that can be used in correlation and regression analysis. Beers transformation yields values between 0 and 2 that are used to relate aspect to topographic moisture and solar exposure. Drier, solar-exposed slopes (SW, 225°) have the lowest values and moist, sheltered slopes (NE, 45°) the highest transformed values. Surface substrate values were converted to decimals and arcsine transformed to normalize their distributions.

A synthetic Topographic Relative Moisture Index (TRMI) was calculated for each plot using a procedure modified from Parker (1982). TRMI is a scalar index ranging from 0 (lowest moisture potential) to 50 (highest moisture potential) and is computed by combining three topographic variables that potentially influence water runoff, evapotranspiration, and soil moisture retention:

- Slope inclination (10-point scale; per Parker [1982])
- Aspect (20-point scale) = Beers-transformed aspect X 10
- Topographic position (20-point scale; per Parker [1982])

Normally, slope shape would be included as an additional 10-point scale but, unfortunately, data on slope shape were not consistently collected from the plots in this study. Because of this omission, as well as assumptions of the formula that may not apply as well to Piedmont and Coastal Plain topography as to montane topography, TRMI, as calculated for this study, should be regarded as strictly experimental.

Soil samples collected from plots were oven-dried, sieved (2 mm), and analyzed for pH, estimated nitrogen release (ENR), phosphorus (P), soluble sulfur (S), exchangeable cations (calcium [Ca], magnesium [Mg], potassium [K], and sodium [Na] in ppm), extractable micronutrients (boron [B], iron [Fe], manganese [Mn], copper [Cu], zinc [Zn], and aluminum [Al], in ppm), cation exchange capacity (CEC; m.e.q./100g), total base saturation (%TBS), and percent organic matter (%OM). Chemical analyses were conducted by Brookside Laboratories, Inc., New Knoxville, Ohio. Extractions were carried out using the Mehlich III method (Mehlich 1984) and percent organic matter was determined by loss on ignition. Values for all soil variables except pH were natural log-transformed to normalize their distributions and make the values more biologically interpretable (Palmer 1993). A calcium:magnesium ratio and a

synthetic fertility index ( $[\text{cation exchange capacity} \times \text{total base saturation}] / 100$ ) were also calculated for each plot.

### Cluster Analysis

In order to identify groups of compositionally similar plots samples, a hierarchical, agglomerative, polythetic, cluster analysis was implemented using the software program PC-ORD (version 5.0; McCune and Mefford 1999). In this type of numerical classification sample units (plots) are compared and joined into “clusters” based on their relative similarity. This type of cluster analysis results in a treelike diagram called a “dendrogram” that depicts the progressive joining of individual plots into larger and larger clusters. Ecologists can use the dendrogram to identify “classes” (subsets of plots) to subject to further analyses. In the context of this type of analysis, “hierarchical” means that large clusters are composed of smaller clusters. “Agglomerative” means that the analysis proceeds by joining clusters rather than by dividing clusters. “Polythetic” means that many attributes of the items are used to decide the optimum way to combine or divide clusters (McCune and Grace 2002).

Plot by species matrices for cluster analysis were constructed using raw species cover class scores. The Lance-Williams Flexible-Beta linkage method (Lance and Williams 1966, 1967) and either the Bray-Curtis (Sorensen) dissimilarity measure (Bray and Curtis 1957) or Relative Euclidian distance were used to identify compositionally similar groups of plots. The Flexible-Beta method is a generalized sorting strategy, the performance of which varies with user-specified emphasis (beta) on different measures of between-group distance. In general, beta settings ranging from the default of  $-0.25$  to  $-0.5$  produce optimal results with vegetation data, performing very similarly to minimum-variance clustering, i.e., Ward’s method (Ward 1963). The Bray-Curtis coefficient (also known as the Sorensen coefficient) has been used with demonstrable success in a wide range of ecological studies (Beals 1984). Among available measures of ecological “distance,” represented as a mathematical dissimilarity between samples, the Bray-Curtis coefficient is a balanced measure that places some emphasis on dominant (i.e., high-cover) species while still giving minor (i.e., low-cover) species considerable weight in the analysis (Gauch 1982). Relative Euclidian distance is conceptually similar, except that abundance values are relativized such that the total abundances for all plots are equal.

Using these procedures, the 2250-plot dataset was progressively fragmented by identifying one or more homogeneous subsets at each iteration, removing those subsets, and re-clustering the remaining plots. These data subsets were then subjected to more comprehensive cluster, statistical, and ordination analyses.

### Summary Statistics

Summary tables of compositional statistics were calculated to evaluate the adequacy of groups recognized in cluster analysis and ultimately to assist in naming and describing the community types. Total mean cover and total frequency across all plots were determined for every taxon. To compute mean cover, cover class scores were converted to the midpoints of their respective percent ranges, the midpoints were averaged, and resulting values were back-transformed to cover class scores. For each taxon in each group under consideration, the following summary statistics were then calculated:

- Frequency – the number of samples in a group in which a species occurs.
- Mean Cover – back-transformed cover class value corresponding to mean percent cover calculated from midpoint values of cover class ranges. All samples assigned to a group were considered when calculating mean cover, not just those in which a taxon was present; absences were assigned a cover value of 0.
- Relative Cover – the arithmetic difference between mean cover (for a given group of samples) and total mean cover (for the entire data set) (= Mean Cover – Total Mean Cover). Expressed by plus or minus symbols, this value provides a *relative* approximation of how much more, or less, abundant a particular species is in a community type compared to the overall data set.
- Constancy – the proportion of samples in a group in which a species occurs, expressed as a percentage (= [Frequency / Number of samples in group] X 100).
- Fidelity – the degree to which a species is restricted to a group, expressed as the proportion of total frequency that frequency in a given group constitutes (= [Frequency / Total Frequency] X 100). An accidental or nonnative species can have maximal (100) fidelity to a type if it occurs in only one sample in the entire data set. As a result, fidelity alone can perform poorly as a criterion for identifying characteristic species and distinguishing among types.
- Diagnostic Value (DV) (= [Constancy X Fidelity] / 100). A synthetic value indicating species that are both frequent within and relatively restricted to a group of plots.
- Diagnostic Value Adjusted by Cover, Scaled (Adj DV [scaled]) (= [Diagnostic Value X Mean Cover] / 9). By dividing DV x Mean Cover by 9, the maximum possible cover value, this statistic synthesizes information about frequency, diagnostic value, and mean abundance. A species entirely restricted to a particular community type, occurring in every sample of that type, and attaining maximum mean cover will have a Scaled Adjusted DV of 100 for that type. Empirically, taxa most characteristic of a type will have a much lower Adjusted DV, although the exact range of values in any given type or data set may vary considerably.
- Diagnostic Value Adjusted by Cover, Unscaled (Adj DV [unscaled]) (= Diagnostic Value X  $2^{\text{relative cover}}$ ). An alternative, unscaled synthetic measure of adjusted DV, using relative cover as the modifier of DV. Since cover classes form a logarithmic, rather than linear scale of values, Unscaled Adjusted DV is a statistically more legitimate means of incorporating information on cover, and has the advantage of not favoring only dominant species and better identifying species that are considerably more abundant within a given type than in the data set as a whole. This statistic is sensitive, however, to vegetation types containing few samples and to species with low overall frequency. Additionally, the following statistics were generated for each group:
- Mean Species Richness – the average number of species present per plot; only species rooted inside plot boundaries were included in this calculation.

- Homoteneity – the average constancy of the S-most constant species, where S = mean species richness for the type. This value (*sensu* Curtis 1959) can be considered an index of the relative uniformity of a group of plots; higher values for homoteneity indicate greater uniformity in species composition among plots. Although homoteneity is not independent of group size, often increasing as the number of group members decreases, it can be used to evaluate whether community types have been defined at an appropriate level.

### Environmental Summary Statistics

Mean values for continuous and ordinal environmental variables were calculated for each group to aid in describing the units and identifying the differences between them. These calculations were performed with raw (untransformed) values, which were averaged across all plots representing a given group. Environmental variables were summarized only for groups with at least half the plots containing data. Mean aspect was calculated as the average position along an arc defined by the range of aspect values.

### Ordination

The ordination method of non-metric multidimensional scaling (NMDS; Kruskal 1964) was used to examine classified units in a multidimensional space, detect compositional variation and trends that are obscured in cluster analysis, and aid in identifying the environmental gradients along which vegetation classes and community types are distributed. NMDS is a type of indirect gradient analysis that assigns samples to coordinates in ordination space in a way that maximizes, to the extent possible, the rank-order (i.e., non-parametric) correlation between inter-sample distance in ordination space and inter-sample dissimilarity (i.e., ecological distance; Minchin 1987). A detailed discussion of NMDS and other ordination techniques can be found in McCune and Grace (2002).

Ordination studies were conducted for each major compositional group identified in cluster analysis, as well as for selected smaller groups of closely related community types. The software program PC-ORD (version 5.0; McCune and Mefford 1999) was used to implement NMDS ordination analysis. The Bray-Curtis coefficient (Sorensen) or Relative Euclidian, the same measure used in cluster analysis, was used to calculate dissimilarity and VARIMAX rotation was employed to optimize axis placement in all ordination runs. Each ordination was computed using 100 random starting configurations, and configurations with the lowest stress levels were used for interpretation. Prior to running ordination analysis, outlier plots that would have undesirable effects on the ordination results were identified and removed using the outlier analysis function in PC-ORD.

Based on preliminary plots of stress vs. dimensionality, most ordinations were extracted in three dimensions (some were in two dimensions). Pearson's  $r^2$  correlations between environmental variables and ordination axes were calculated, and significant correlations were displayed through joint plot overlays. A joint plot is a diagram that shows the relationship of a set of variables and ordination scores. Radiating lines (vectors) representing environmental variables are depicted within ordination space. The angles and lengths of the radiating lines indicate the

direction and strength of the relationship between the variable and the ordination scores. The 19 soil variables and 10 topographic variables used in ordination analyses are listed in Table 5.

### Crosswalking Classification units to the USNVC

Vegetation classes developed through quantitative analysis were compared to existing units of the USNVC. All quantitatively-derived types were either assigned to a conceptually similar USNVC association, or used as the basis for a new USNVC association. In selecting nominals for new USNVC associations, high-constancy species (especially those with relatively high mean cover and high diagnostic value, if available) were favored to facilitate identification of the type in the field. A "constant" species was generally considered to be a species occurring in > 67% of plot samples within a classified type. In a few cases, species that were less constant in a type but had high mean cover and diagnostic value were selected as parenthetical nominals. The global USNVC descriptions for existing associations were edited, and global descriptions for new associations were drafted. All classifications, crosswalks, and new USNVC associations were reviewed by Natural Heritage Ecologists from Virginia, Maryland, North Carolina, West Virginia and NatureServe.

In addition to the vegetation classes derived from quantitative analysis, other vegetation classes used to describe the vegetation in the seven parks were developed from qualitative observations in the parks. Some of these qualitatively-derived units were crosswalked to the USNVC association level, while others (i.e. cultural or disturbed vegetation) were not appropriate for inclusion in the USNVC, and were described as nonstandard, park-specific vegetation classes.

### Characterization of Vegetation

Once the regional vegetation classification was complete, vegetation classes across all seven parks were assigned a common name based on the Natural Communities of Virginia (Fleming et al. 2006) or, if no appropriate name existed in Fleming et al. (2006), the USNVC common name was used, or a park-specific common name was assigned. Park-specific descriptions for all vegetation classes occurring at Appomattox Court House National Historical Park were drafted using data from field observation points and quantitative plots. A dichotomous key to vegetation classes occurring in the park was created for use by park natural resource managers and others.

A dichotomous key is a tool for identifying unknown entities, in this case, vegetation classes. It is structured by a series of couplets, two statements that describe different, mutually exclusive characteristics of the vegetation. Choosing the statement that best fits the vegetation in question leads the user to the correct vegetation class. The dichotomous key should be used in conjunction with the detailed vegetation class descriptions to confirm that the class selected with the key is appropriate.

Table 5. Environmental variables used in ordination joint plots. Only variables correlated with plot ordination scores are shown in the joint plot diagrams.

Topographic variables and percentage substrate	
Beers Aspect	transformed aspect (Beers et al. 1966)
Slope Value	ordinal value for slope
Topo position	ordinal value for topographic position
TRMI	Topographic Relative Moisture Index
Bedrock	percentage cover by bedrock in plot
Boulders and Stones	percentage cover by rocks > 10 cm in plot
Gravel and Cobbles	percentage cover by rocks 0.2 - 10 cm in plot
Decaying Wood	percentage cover by dead wood in plot
Water	percentage cover by water in plot
Mineral Soil_Sand	percentage cover by bare sand or mineral soil in plot

Soil chemistry variables	
Al	extractable aluminum (in parts-per-million)
B	extractable boron (in parts-per-million)
Base Saturation (%TBS)	percent total base saturation
Ca	exchangeable calcium (in parts-per-million)
CaMgRatio	calcium:magnesium ratio
CEC	cation exchange capacity (m.e.q. / 100 g)
Cu	extractable copper (in parts-per-million)
Fe	extractable iron (in parts-per-million)
Fertility	synthetic fertility index (= CEC X Base Saturation / 100)
K	exchangeable potassium (in parts-per-million)
Mg	exchangeable magnesium (in parts-per-million)
Mn	extractable manganese (in parts-per-million)
N	estimated nitrogen release (in lbs-per-acre)
Na	exchangeable sodium (in parts-per-million)
OM	% organic matter (by loss on ignition)
P	phosphorus (in parts-per-million)
pH	measure of acidity based on the activity of hydrogen
S	soluble sulphur (in parts-per-million)
Zn	extractable zinc (in parts-per-million)

## Vegetation Map Preparation

Spatial data from field observation points and quantitative plots were used to edit the formation-level map of Appomattox Court House National Historical Park to better reflect vegetation classes. Using ArcView 3.3, polygon boundaries were revised onscreen over leaf-off photography. Units used to label polygons on the map (i.e. map classes) are equivalent to one or more vegetation classes from the regional vegetation classification, or to a land-use class from the Anderson (Anderson et al. 1976) Level II classification system. Each polygon on the Appomattox Court House National Historical Park map was assigned to one of twenty map classes based on plot data, field observations, aerial photography signatures, and topographic maps. Occasionally, information from a digital soil survey or National Wetland Inventory was used to inform the mapping.

## Accuracy Assessment

Two sources of potential error in the vegetation map include: 1) horizontal positional accuracy, in which a location on the photomosaic does not accurately align with the same location on the ground due to errors in orthorectification or triangulation; and 2) thematic accuracy, in which the vegetation type assigned to a particular location on the map does not correctly represent the vegetation at the same location in the park due to mapping error. The USGS-NPS VMP protocols (The Nature Conservancy and Environmental Systems Research Institute 1994c) were followed to assess the horizontal positional accuracy of the digital photo mosaics (leaf-on and leaf-off) and the thematic accuracy of the vegetation map.

### Positional Accuracy Assessment

The horizontal positional accuracies of the leaf-off and leaf-on mosaics were assessed using guidelines of the USGS-NPS VMP (The Nature Conservancy and Environmental Systems Research Institute 1994c). Well-defined positional accuracy ground control points were placed throughout all quadrants of each mosaic in ArcView. Ground control points and zoomed-in screenshots of each point were plotted on hard copy maps with the mosaic as a background. These maps and plots were used to locate the ground control points in the field. NCSU-CEO field staff recorded the ground control point coordinates with a Trimble Pro XRS. The field crew collected accuracy assessment data at 39 ground control points for the leaf-off mosaic and 38 ground control points for the leaf-on mosaic. The coordinate data were collected with real time GPS and post processed with differential correction using Pathfinder Office software. Prior to calculating accuracy, one ground control point for the leaf-on mosaic was identified as an outlier with SAS's JMP program and removed. The field-collected GPS coordinates for the 39 points for the leaf-off mosaic and the remaining 37 points for the leaf-on mosaic were compared to the coordinates obtained from each mosaic viewed in ArcView. Both pairs of coordinates for each point were entered into a spreadsheet in order to calculate horizontal accuracy (in meters). The accuracy calculation formula for the leaf-off mosaic is based on Euclidean distance. Following completion of the leaf-off mosaic, USGS-NPS VMP standards for calculating positional accuracy changed and, therefore, the calculation formula for the leaf-on mosaic is based on the newer standard, root mean square error (FGDC 1998b; Minnesota Governor's Council on Geographic Information and Minnesota Land Management Information Center

1999). Figures 4 and 5 show the distribution of the ground control points for the leaf-off and leaf-on mosaics, respectively.

### Thematic Accuracy Assessment

Upon completion of the vegetation map, the number of polygons and acreage of each map class was assessed and evaluated against the accuracy assessment sampling recommendations in the USGS-NPS VMP protocols (The Nature Conservancy and Environmental Systems Research Institute 1994c). The USGS-NPS VMP protocols recommend 30 samples as the maximum sample size for abundant classes, and 5 samples for the rarest classes, and that any class too rare for five sample sites should be observed in its entirety (Table 6). Given the small size of the park, the relatively few vegetation polygons, and the fact that most map classes are rare (i.e. have few polygons and small acreages), a complete census was determined to be the best approach to validate the thematic accuracy of the vegetation map. Since 52 polygons were surveyed and verified as part of the initial vegetation mapping effort, random points within the remaining 74 polygons were selected to complete a census of all vegetation polygons. Polygons representing the Anderson Land-Use classes “Other Urban or Built-up Land” and “Transportation, Communications, and Utilities” were not included in the census. The ArcView 3.3 extension, Random Point Generator v. 1.3 (Jenness 2005), was used to randomly select the location of the accuracy assessment points within polygons of each map class. This extension generates random points within a specified distance for a set of input theme features (e.g. polygons), producing a new ArcView shapefile and/or a results table. Where possible, accuracy assessment points were generated so that they were at least 40 m (131 ft) from polygon edges. The size and linearity of some polygons, however, made it impossible to meet these criteria for all polygons. Decreasing edge buffer distances of 30 m, 20 m, or 10 m (98 ft, 66 ft, or 33 ft) were used as necessary based on polygon size and shape.

Field staff were provided with maps showing the boundaries of the target polygons and the location of accuracy assessment points, as well as a GPS unit preloaded with all the accuracy assessment point locations. From May through October 2005, each accuracy assessment point was located in the field using a Garmin Map76 WAAS enabled GPS. Field staff determined the map class at the accuracy assessment point using the dichotomous key and the detailed vegetation descriptions. Dominant and characteristic vascular plant species were listed by strata with an indication of their prevalence in the stand (i.e. dominant, common, or rare). Qualitative observations were made that described any variation of vegetation or environment within the polygon, such as the inclusion of more than one class in a polygon. Field staff also estimated the percentage of the target polygon observed and any problems using the key or interpreting the vegetation type in the polygon. The minimum area of observation around the sampling point was 0.5 ha (1.2 ac) or a circle with a radius of approximately 40 m (131 ft). The accuracy assessment data form used in this study is shown in Appendix B. Accuracy assessment data collected from these 74 points were entered into the PLOTS database version 2.0 (NatureServe 2004) and are provided as a supplement to this report.

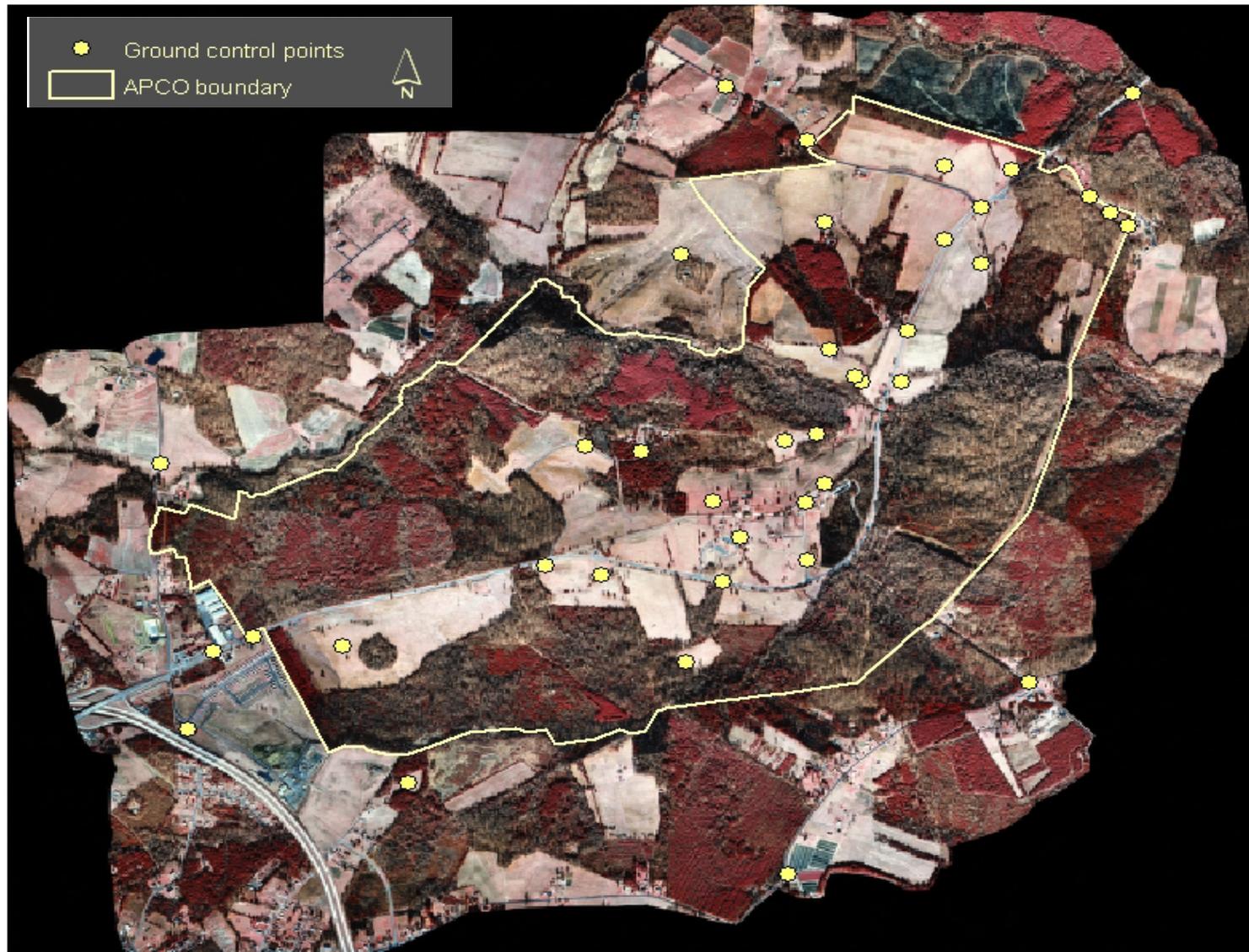


Figure 4. Ground control points used to calculate horizontal positional accuracy of the Appomattox Court House National Historical Park (APCO) leaf-off mosaic.

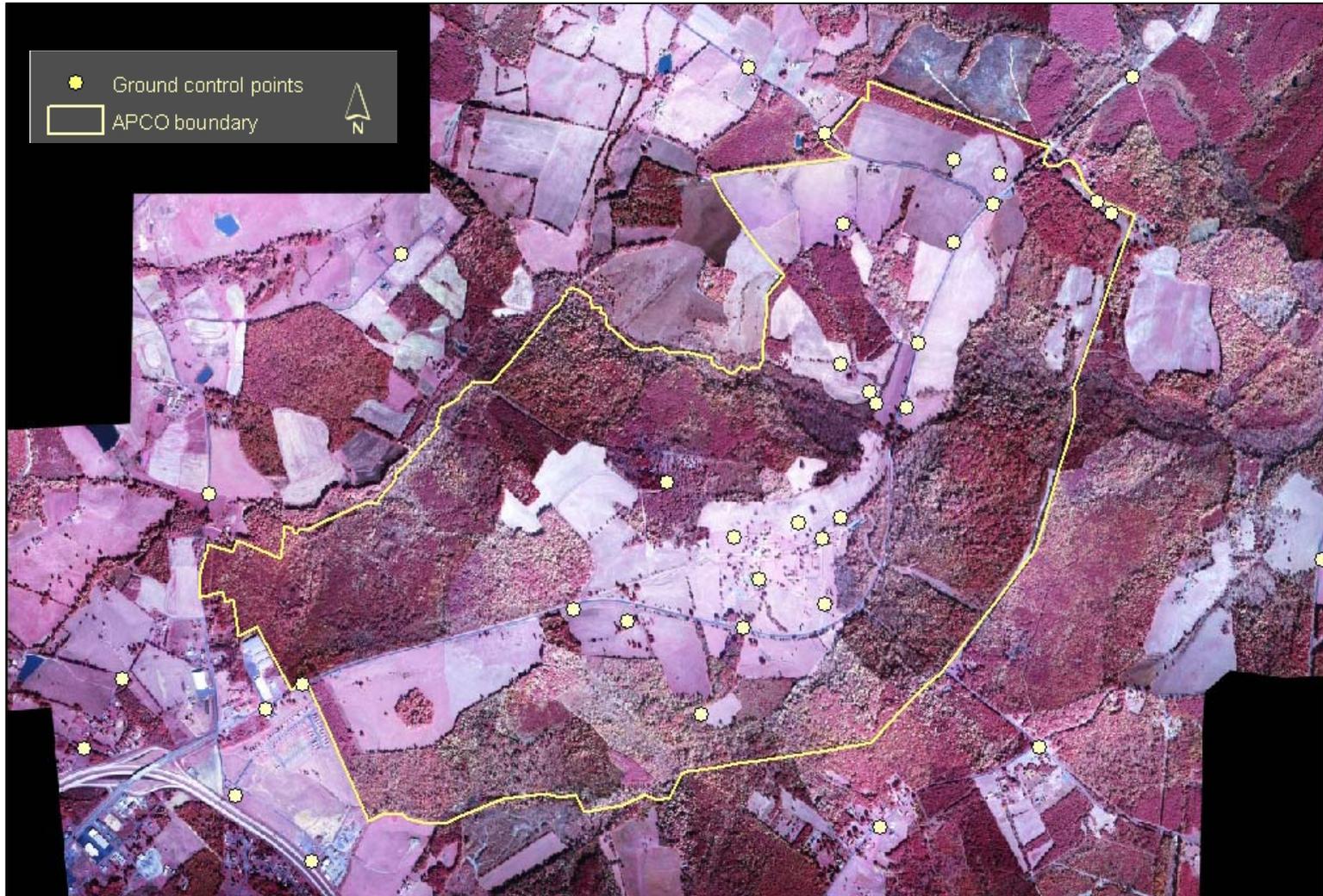


Figure 5. Ground control points used to calculate horizontal positional accuracy of the Appomattox Court House National Historical Park (APCO) leaf-on mosaic.

Table 6. Recommended sample size for accuracy assessment points based on the stratified random sampling process (TNC and ESRI 1994c). Modification for Virginia cultural parks shown as scenario B2.

Scenario	Description	Polygons in class	Area occupied by class	Recommended number of samples in class
A	Abundant. Map class has many polygons that cover a large area.	$\geq 30$	$\geq 50$ ha	30
B	Relatively abundant. Map class has few polygons that cover a large area.	$< 30$	$\geq 50$ ha	20
B2	Regional modification to Scenario B	$\geq 5, \leq 20$	$\geq 50$ ha	10
C	Relatively rare. Map class has many polygons, but covers a small area.	$> 30$	$< 50$ ha	20
D	Rare. Map class has few polygons; most or all polygons are small.	$\geq 5, \leq 30$	$< 50$ ha	5
E	Very rare. Map class has too few polygons to permit statistical assessment.	$< 5$	$< 50$ ha	Visit all and confirm

Additional data collected in Appomattox Court House National Historic Park as part of a formation-level mapping effort (Harrell 2001) were reviewed to determine their utility as supplemental data for the vegetation map thematic accuracy assessment. In 2001, M. Harrell, working as a graduate student at NCSU-CEO, collected qualitative information on vegetation at 203 locations in and around Appomattox Court House National Historic Park. Field data forms and a shapefile of the Harrell (2001) accuracy assessment point locations were obtained from NCSU-CEO. A VADNH Ecologist reviewed the descriptive information on the field forms and assigned each to a map class. Only points falling within the park boundary were reviewed. Points with missing data forms or points that were classified as non-vegetation units (transportation or built-up land) were excluded. A total of 113 accuracy assessment points from the Harrell 2001 study were used to supplement the 74 primary accuracy assessment points collected by VADNH. Figure 6 shows the locations of the 74 primary and 113 supplemental accuracy assessment points. Table 7 summarizes the thematic accuracy assessment sampling strategy, showing the allocation of the 187 accuracy assessment points among the map classes. Two vegetation map classes, Coastal Plain / Piedmont Basic Seepage Swamp and Successional Tree-of-Heaven Forest, were not included in the thematic accuracy assessment because both are mapped as only a single, very small polygon that was observed in its entirety during the mapping phase of the project.

Data from the 187 accuracy assessment points were entered into an Excel spreadsheet listing accuracy assessment point ID, vegetation map polygon ID, vegetation map class, and first and second (if available) map class determination from accuracy assessment field observations. The thematic accuracy of the vegetation map was then tabulated using a contingency matrix that compares the map class observed on the ground (accuracy assessment observation) with the map class mapped at the same location on the final vegetation map (reference data). The contingency table lists reference data values in the columns and accuracy assessment observation values in the rows. The number of each reference data and accuracy assessment observation pair for all sampling locations is indicated at each row/column intersection in the matrix. Correct mappings are indicated on the table where the row and column values are the same and typically occur on

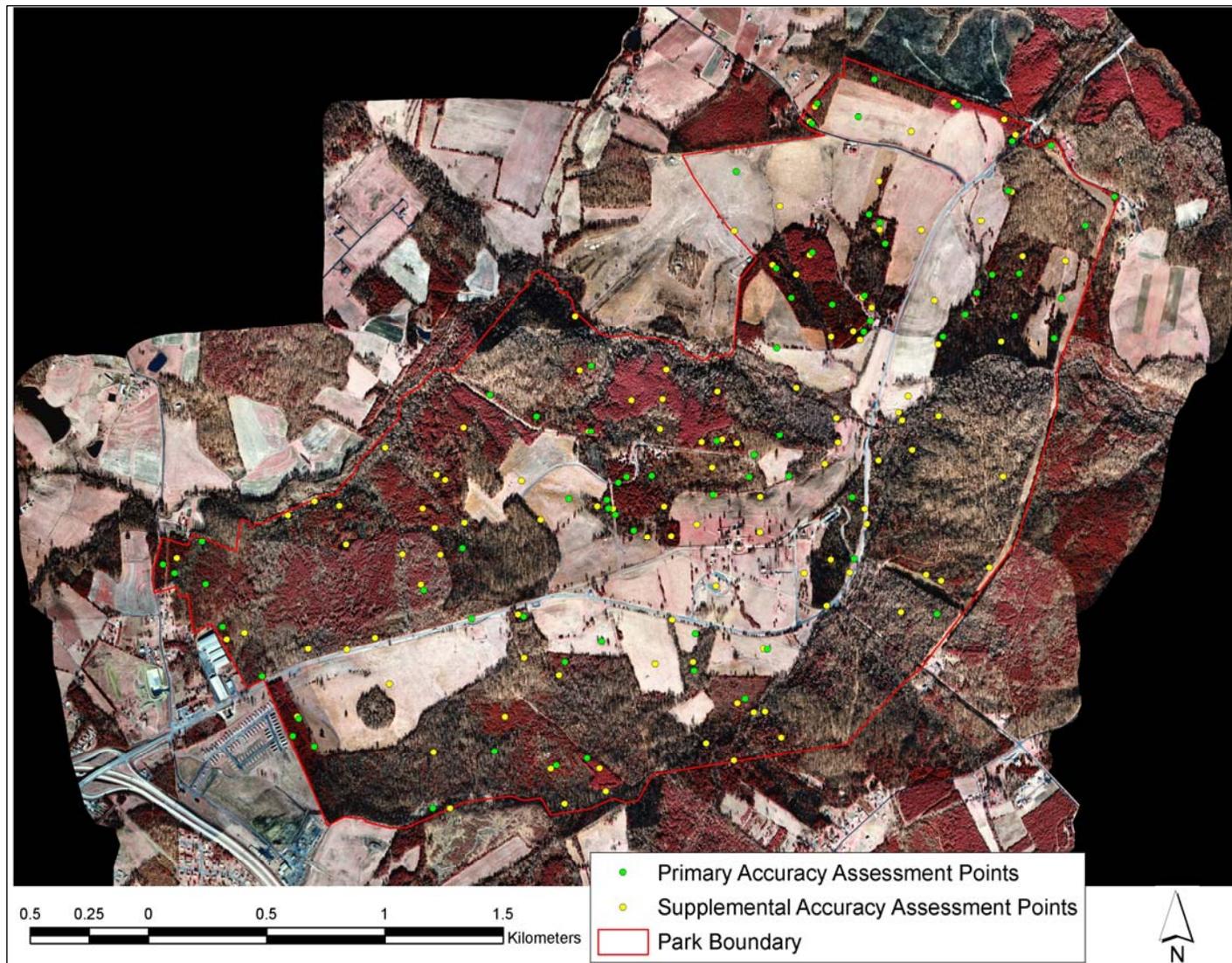


Figure 6. Locations of thematic accuracy assessment sampling points in Appomattox Court House National Historical Park.

Table 7. Thematic accuracy assessment (AA) strategy for Appomattox Court House National Historical Park, showing number of polygons, mapped hectares, and number of AA points sampled for each vegetation-map class.

Map Class	Number of Polygons	Mapped Hectares	Number of Polygons Surveyed during Initial Mapping Effort and Eliminated from Primary AA	Number of Primary AA Points	Number of Supplemental AA Points	Total Number of AA Points
Inner Piedmont / Lower Blue Ridge Basic Mesic Forest	2	14.4	2		1	1
Beaver Wetland Complex	2	3.9	1	1	3	4
Northern Piedmont / Lower New England Basic Seepage Swamp	1	0.7	1			0
Cultural Meadow	15	215.5	2	13	27	40
Dense Hardwood Regeneration	5	56.2	5		8	8
Grazed Woodlot	3	5.9	1	2	3	5
Loblolly Pine Plantation	9	19.2	1	8	10	18
Mesic Mixed Hardwood Forest	2	6.1	2		3	3
Oak - Hickory Forest	16	94.9	10	6	6	12
Piedmont / Low Elevation Mixed Oak / Heath Forest	3	2.8	2	1		1
Piedmont / Mountain Alluvial Forest	4	47.0	4		12	12
Successional Black Walnut Forest	3	6.0	3		1	1
Successional Red-cedar Forest	5	3.3	1	4	2	6
Successional Tree-of-Heaven Forest	1	0.1	1			0
Successional Tuliptree Forest	17	72.0	9	8	8	16
Successional Virginia Pine Forest	34	109.8	5	29	28	57
Upland Depression Swamp	3	3.4	2	1		1
Virginia Pine Plantation	2	4.8	0	1	1	2
<b>TOTAL</b>	<b>127</b>	<b>666.0</b>	<b>52</b>	<b>74</b>	<b>113</b>	<b>187</b>

the diagonal on the matrix. Overall percent accuracy and Kappa index were calculated for the map using equations from the USGS-NPS VMP accuracy assessment guidelines (The Nature Conservancy and Environmental Systems Research Institute 1994c). Overall percent accuracy was calculated by dividing the number of correctly classified accuracy assessment points by the total number of accuracy assessment points. The Kappa index is the preferred method of reporting overall thematic accuracy because it takes into account that a certain number of correct classifications will occur by chance (Foody 1992). The USGS-NPS VMP protocol requires that the Kappa index of vegetation maps exceed 80% (The Nature Conservancy and Environmental Systems Research Institute 1994c). To calculate the probability that a reference data observation has been correctly classified (producer's accuracy or omission error), the number of reference data points correctly classified is divided by the total number of reference data points in that map class. To calculate the probability that the mapped vegetation classes represent the vegetation actually found on the ground (user's accuracy or commission error), the number of correctly classified reference samples was divided by the total number of samples classified or mapped to that vegetation class. The errors of omission and errors of commission for mapped vegetation classes should exceed 80%, according to the USGS-NPS VMP protocol (The Nature Conservancy and Environmental Systems Research Institute 1994c).

#### Metadata Preparation

All map products are accompanied by detailed Federal Geographic Data Committee (FGDC) compliant metadata (FGDC 1998a). Metadata are data about data. They describe the content, quality, condition, and other characteristics of the data. Metadata are critical elements of each spatial dataset, allowing future users of the data to understand how the dataset was developed, its appropriate uses, and to locate specific information within the spatial dataset. Metadata records were prepared for each mosaic, for the vegetation map, and for the all georeferenced plot data and accuracy assessment point data.

Metadata records for each photo mosaic were prepared in accordance with the current Federal Geographic Data Committee standards (FGDC 1998a). Metadata were produced in notepad and parsed using the USGS metadata compiler (USGS 2004). After all errors and omissions identified by the parser were corrected, the metadata compiler was used to generate final TXT, HTML, and XML versions of each metadata record which are stored in the data archive. Key information for the leaf-on and leaf-off is summarized in Tables 8 and 9, respectively.

Metadata records for the vegetation map and for all georeferenced plot and accuracy assessment point data were created using a combination of the NPS Metadata Tools and Editor Version 1.1 and NPS Database Metadata Extractor MS Access Add-in Version 1.0 (NPS 2006). Each file was parsed using the USGS metadata compiler Metaparser (MP) v. 2.8.25 (Schweitzer 1995) and the Federal Geographic Data Committee (FGDC) configuration file. This process ensures that all elements required by the FGDC standard are included in the metadata files. All errors and omissions identified by the parser were corrected.

Table 8. Summary of key information for Appomattox Court House National Historical Park leaf-on mosaic.

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Title of metadata record:	Appomattox Court House National Historical Park Color Infrared Orthorectified Photomosaic - Leaf-on (ERDAS IMAGINE .img and MrSID formats)
Publication date of mosaic (from metadata):	October 1, 2002
Date aerial photography was acquired:	October 22, 2001
Vendor that provided aerial photography:	Kucera International
Scale of photography:	1:6,000
Type of photography:	Color infrared, stereo pairs
Number of air photos delivered:	37
Archive location of air photos, airborne GPS and IMU files, and camera calibration certificate:	North Carolina State University, Center for Earth Observation
Scanning specifications:	600 dpi, 24-bit color depth
Horizontal positional accuracy of mosaic:	0.860 meters, meets Class 1 National Map Accuracy Standard
Number of ground control points upon which estimated accuracy is based:	37
Method of calculating positional accuracy:	Root mean square error
Archive location of mosaic and metadata:	North Carolina State University, Center for Earth Observation
Formats of archived mosaic:	.img (uncompressed) and MrSID (20:1 compression)

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Table 9. Summary of key information for Appomattox Court House National Historical Park leaf-off mosaic.

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Title of metadata record:	Appomattox Court House National Historical Park Color Infrared Orthorectified Photomosaic - Leaf-on (ERDAS IMAGINE .img and MrSID formats)
Publication date of mosaic (from metadata):	June 22, 2001
Date aerial photography was acquired:	December 18, 2000
Vendor that provided aerial photography:	Air Photographics, Inc.
Scale of photography:	1:6,000
Type of photography:	Color infrared, stereo pairs
Number of air photos delivered:	50 (42 included in mosaic)
Archive location of air photos, airborne GPS and IMU files, and camera calibration certificate:	North Carolina State University, Center for Earth Observation
Scanning specifications:	600 dpi, 36-bit color depth
Horizontal positional accuracy of mosaic:	1.475 meters, meets Class 1 National Map Accuracy Standard
Number of ground control points upon which estimated accuracy is based:	39
Method of calculating positional accuracy:	Euclidean distance
Archive location of mosaic and metadata:	North Carolina State University, Center for Earth Observation
Formats of archived mosaic:	.img (uncompressed) and MrSID (20:1 compression)

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## Results

### Field Surveys

Field work was completed in Appomattox Court House National Historical Park in 2005. Data were collected from 14 quantitative vegetation plots located throughout the park (Figure 7). Species observed during quantitative plot sampling and in accuracy assessment observation points are listed in Appendix C. This list should not be considered a comprehensive flora for the park, but could be used to add to existing vascular plant lists for the area. Of the 281 vascular plant species noted during fieldwork, 30 were nonnative species, and, of those, 15 are considered invasive by the Virginia Department of Conservation and Recreation (VADCR 2003).

### Vegetation Classification and Characterization

Initial cluster analysis of the 2,250 plot regional dataset divided the data into 3 major subsets, upland forests (899 plots), non-tidal wetlands (553 plots), and tidal wetlands (798 plots). Subsequent cluster analysis divided these groups further into 22 subsets, each representing major branches on analysis dendrograms. More comprehensive cluster, statistical, and ordination analyses were conducted on these 22 subsets, resulting in a classification of over 100 vegetation associations. Over the course of the project, 20 new associations were described for the USNVC and 40 existing associations were revised.

A reduced dataset representing 11 major groupings in the original 2,250 plot cluster analysis was extracted and used to illustrate results pertaining to the seven national parks in Virginia. A table showing the distribution of vegetation classes across all seven parks, including Appomattox Court House National Historical Park is presented in Appendix D. Quantitative analysis classified 35 associations occurring in the seven national parks in Virginia. An additional 19 associations and 12 nonstandard park-specific vegetation classes representing disturbed, cultural, or exotic vegetation were also recognized from the seven parks, but were not represented by quantitative plot data and thus not included in the quantitative analyses. Global and subnational (state) conservation ranks used in Appendix D are defined in Appendix E, and a summary of select environmental variables by association is presented in Appendix F.

The major vegetation groups represented at Appomattox Court House National Historical Park are 1) oak / heath forests, 2) mesic acidic forests, 3) oak – hickory forests, 4) basic mesic and calcareous forests, 5) seepage wetlands, 6) alluvial forests, and 7) nonriverine forests. Cluster dendrograms, ordination scatterplots, and joint plots resulting from quantitative analysis of plots from these groups are presented in Appendix G. Compositional summary statistics for each association present in Appomattox Court House National Historical Park are presented in Appendix H.

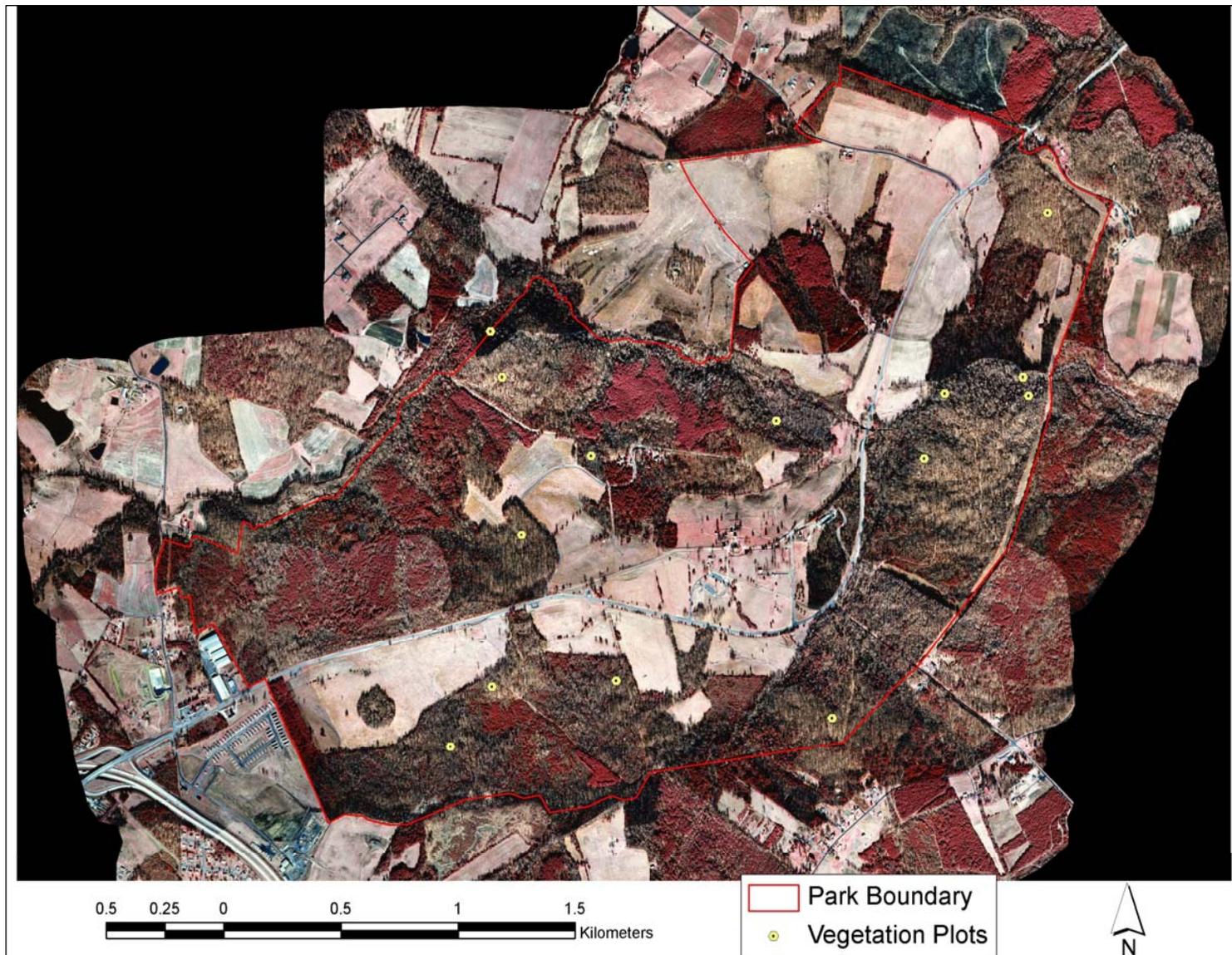


Figure 7. Locations of quantitative vegetation plots in Appomattox Court House National Historical Park.

The analysis results presented in Appendix G support the classification of plot samples into the seven major vegetation groups represented at Appomattox Court House National Historical Park. Classification dendrograms illustrate the compositional similarity among each group of plots in a vegetation association. The classifications are further supported by the ordination diagrams, which show the same groups of plots in ordination space. The percentage variance represented by each ordination for the major vegetation groups in the park is presented in Table 10. Environmental variables significantly correlated with ordinations axes are illustrated with joint plot diagrams. All vegetation associations resulting from the regional analysis are shown in the dendrograms and ordination diagrams, even those not present in Appomattox Court House National Historical Park. In this way, species and environmental relationships among associations can be examined in a regional context.

The classification of 93 oak / heath forest sample plots is illustrated in Figures G1-G2 of Appendix G. Plot samples cluster into two compositionally distinct groups in both the dendrogram and the three dimensional ordination (Appendix G, Figures G1 and G2). The two associations, Coastal Plain Mixed Oak / Heath Forest (CEGL006269) and Piedmont / Low Elevation Mixed Oak / Heath Forest (CEGL008521) separate along axis three of the ordination diagram. There were no environmental variables that were significantly correlated with the ordination axes. The single sample plot from Appomattox Court House National Historical Park is classified as Piedmont / Low Elevation Mixed Oak / Heath Forest (CEGL008521). Environmental variables from plot samples classified as Piedmont / Low Elevation Mixed Oak / Heath Forest are summarized in Appendix F. A compositional summary based on 75 sample plots of this association is presented in Appendix H, Table H6. The single plot from Appomattox Court House National Historical Park is compositionally representative of the association, lacking only one nominal species, black huckleberry (*Gaylussacia baccata*), and with many of the prevalent species. Piedmont / Low Elevation Mixed Oak / Heath Forest is found in three of the seven national parks included in this study (Appendix D). It is a widespread, matrix-forming forest community known from nutrient-poor uplands of Virginia's Piedmont and Inner Coastal Plain, and at low elevations in the northern Blue Ridge and Ridge and Valley. It also extends north into Maryland and south to low elevations of Tennessee's Cumberland Plateau.

Table 10. Proportion of variance represented by each axis, based on coefficients of determination ( $r^2$ ) between ordination distances and distances in the original n-dimensional space for the major vegetation groups at Appomattox Court House National Historical Park. Two-dimensional ordinations have "n/a" listed in Axis 3 column.

Vegetation Group	Increment			Cumulative
	Axis 1	Axis 2	Axis 3	
oak / heath forests	0.356	0.223	0.238	0.817
mesic acidic forests	0.124	0.426	0.233	0.783
oak - hickory forests	0.083	0.155	0.543	0.781
basic mesic and calcareous forests	0.341	0.272	0.215	0.828
seepage wetlands	0.329	0.531	n/a	0.860
alluvial forests	0.094	0.767	n/a	0.861
nonriverine forests	0.166	0.592	n/a	0.758

Classification results for the mesic acidic forest group are presented in Appendix G, Figures G3-G5. Plot samples cluster into two compositionally distinct groups in both the dendrogram and the three dimensional ordination (Appendix G, Figures G3 and G4). Axis three of the joint plot (Appendix G, Figure G5) is highly correlated with joint plot vectors representing pH, and the soil cations calcium, magnesium, manganese, and iron. The two associations classified within the mesic acidic forest group are Mesic Mixed Hardwood Forest (CEGL006075) and Piedmont / Coastal Plain Oak – Beech Heath Forest (CEGL006919). Although both associations can occur in the same landscape, Piedmont / Coastal Plain Oak – Beech Heath Forest is found on steeper, more exposed slopes with less fertile soils than Mesic Mixed Hardwood Forest. A summary of environmental variables for the two associations is presented in Appendix E. Only Mesic Mixed Hardwood Forest (CEGL006075) occurs at Appomattox Court House National Historical Park. A compositional summary for this association is presented in Appendix H, Table H5. Mesic Mixed Hardwood Forest was documented in five of the seven national parks included in this study. It is a common and wide-ranging community known from the Piedmont and Coastal Plain of Virginia and Maryland and ranging northward to southern New England.

The results of the regional analysis of the oak - hickory forest group are illustrated in Figures G6-G8 of Appendix G. Plot samples cluster into two compositionally distinct groups in both the dendrogram (Appendix G, Figure G6) and the three-dimensional ordination (Appendix G, Figure G7). Strong correlations of soil fertility variables with axis 3 of the ordination suggest that soil nutrients have an important influence on vegetation patterns within this group (Appendix G, Figure G8). Two associations, Acidic Oak - Hickory Forest and Basic Oak - Hickory Forest, were recognized in analysis and there is much variation within each group of plot samples along a gradual cline of site conditions, soil chemistry, and floristic composition. Nonetheless, homogeneity is high for both associations (Appendix H, Table H1 and H3). Basic Oak-Hickory Forest and Acidic Oak - Hickory Forest can occur in the same landscape, and both were documented at Appomattox Court House National Historical Park. Compared to Acidic Oak - Hickory Forest, Basic Oak - Hickory Forest is associated with soils that are more alkaline and characterized by high cation levels (Appendix F, Table F2). Compositional summaries for both associations are presented in Appendix H (Tables H1 and H3). Plot samples from Appomattox Court House National Historical Park for both oak - hickory forest associations have a lower than average species richness. Oak - hickory forest plot samples from Appomattox Court House National Historical Park have a mean species richness of 45 species per 400 m<sup>2</sup> plot. Plots from the regional dataset had average species richness values of 53 per 400 m<sup>2</sup> plot for Acidic Oak - Hickory Forest and 71 per 400 m<sup>2</sup> plot for Basic Oak - Hickory Forest. The lower than average species richness may be due to past land-use practices that depleted the topsoil or to impacts from herbivory by deer. Despite having all the nominal species for the type, the three Basic Oak - Hickory Forest plot samples from Appomattox Court House National Historical Park lack many of the species with high diagnostic values, thus making them more compositionally similar to plot samples classified as Acidic Oak - Hickory Forest (Appendix G, Figure G8; Appendix H, Table H1 and H3).

Although Basic Oak - Hickory Forest is widely distributed in the Piedmont from Virginia to Alabama, it is an uncommon community type that is strongly restricted to mafic substrates and subject to ongoing threats from cutting and conversion of hardwood stands to pine silvicultures. Acidic Oak - Hickory Forest is found on acidic soils that are common throughout the Piedmont and the association is a common matrix forest type in the Carolinas, Virginia, and south-central

Maryland. However, since most of the rolling upland landscape of the Piedmont has been logged more than once since European settlement, stands older than 80 years are uncommon. Of the seven national parks included in this study, Appomattox Court House National Historical Park is the only park that supports Basic Oak-Hickory Forest (Appendix D). Acidic Oak - Hickory Forest occurs in six of the seven national parks included in this study (Appendix D).

The classification of 77 basic mesic and calcareous forest sample plots is illustrated in Figures G9-G11 of Appendix G. Plot samples cluster into three compositionally distinct groups in both the dendrogram and the three-dimensional ordination (Appendix G, Figures G9 and G10). The association Inner Piedmont / Lower Blue Ridge Basic Mesic Forest (CEGL006186) is represented by two sample plots from Appomattox Court House National Historical Park. The other two associations are restricted to the Coastal Plain, occurring over Tertiary shell deposits, and are compositionally and environmentally distinct. All associations in this group have high soil fertility relative to all other upland forest types (Appendix F), but even within this group, soil nutrients have a strong influence on vegetation pattern. Axis 1 of the joint plot (Appendix G, Figure G11) is highly correlated with the joint plot vectors representing pH, calcium / magnesium ratio, and fertility index. In the context of this ordination, plot samples representing the Inner Piedmont / Lower Blue Ridge Basic Mesic Forest present at Appomattox Court House National Historical Park are not correlated with high soil fertility variables, but instead are associated with high values of TRMI and percent cover by boulders. Inner Piedmont / Lower Blue Ridge Basic Mesic Forest is known from steep, rocky sites of sub-montane landscapes in the western and northern Piedmont and on lower slopes of the Blue Ridge. This association occurs almost exclusively on clay-rich soils weathered from mafic rocks, often on very rocky sites. The two plot samples from Appomattox Court House National Historical Park are compositionally very typical of the association (Appendix H, Table H2), containing all the nominal species and having high species richness values. This association is also found at Booker T. Washington National Monument, but not at any of the other five parks included in this study (Appendix D).

Classification results for the seepage wetland group are presented in Figures G12-G14 of Appendix G. Plot samples from 72 seepage wetlands cluster into three compositionally distinct groupings in both the dendrogram and the two-dimensional ordination (Appendix G, Figures G12 and G13). Axis 1 of the joint plot (Appendix G, Figure G14) is highly correlated with the joint plot vectors representing pH, calcium / magnesium ratio, base saturation, and fertility index, while axis 2 is significantly correlated with high percentage cover of boulders. Together, these axes represent 86% of the variance in the data (Table 10). The only seepage wetland present in Appomattox Court House National Historical Park is Southern New England Red Maple Seepage Swamp (CEGL006406). Plots classified as this association have average soil pH values and levels of base cations that are intermediate within the group (Appendix E). A compositional summary of the association is presented in Table H4 of Appendix H. The single plot from the park is compositionally representative of the association, containing all nominal species and many of the most constant species. Of the seven parks included in this study, Appomattox Court House National Historical Park is the only park supporting this association (Appendix D). Southern New England Red Maple Seepage Swamp ranges from southern New England, south to Virginia and the example at Appomattox Court House National Historical Park is one of the southern-most occurrences of the association. While it is relatively common and secure throughout most of its range, it is considered state-imperiled in Virginia, where edge-of-range

occurrences are uncommon (Appendix D). The remaining two seepage wetland associations, Coastal Plain / Piedmont Acidic Seepage Swamp and Coastal Plain Calcareous Seepage Swamp, occur at opposite ends of the soil fertility gradient (Appendix G, Figure G14). Both of these seepage wetland associations are considered to be globally rare (Appendix D).

The regional analysis of alluvial forest sample plots is illustrated in Figures G15-G17 of Appendix G. Plot samples cluster into three compositionally distinct groups in both the dendrogram and the two-dimensional ordination (Figures G15 and G16 of Appendix G). Plot samples segregate along axis 2, which represents 77% of the variance in the data. The joint plot (Appendix G, Figure G17) shows the correlation of soil fertility variables with axis 2 of the ordination, suggesting that soil nutrients have an important influence on vegetation patterns within this group. The 14 plot samples representing the alluvial forest association found at Appomattox Court House National Historical Park, Piedmont / Mountain Alluvial Forest (CEGL006492), are at intermediate positions along the soil fertility gradient (Appendix G, Figure G17). This particular association is found on small-stream floodplains of the northern and western Piedmont of Virginia, ranging north into Maryland. Piedmont / Mountain Alluvial Forest is found on more fertile alluvium than Coastal Plain / Piedmont Small-Stream Floodplain Forest (CEGL004418), while Piedmont / Mountain Floodplain Forest (CEGL006217) is found on the large floodplains of major mid-Atlantic rivers over the most fertile alluvium (Appendix F). The single plot sample from Appomattox Court House National Historical Park is compositionally typical of the Piedmont / Mountain Alluvial Forest association, containing all the nominal species and all of the most constant species (Appendix H, Table H7). This association is also found at Booker T. Washington National Monument, but not at any of the other five parks included in this study (Appendix D).

The nonriverine forest group is presented in Appendix G, Figures G18-G20. Plot samples from 62 nonriverine forest plots cluster into four compositionally distinct groupings in the dendrogram, the two-dimensional ordination, and the three-dimensional ordination (Appendix G, Figures G18-G20). The associations show the most separation in terms of species composition along axis 2 of the ordinations (Table 10; Appendix G, Figure G19). Ordination scores were not significantly correlated with available environmental data, however, as a group, these forests have low values for soil chemistry variables, indicating acid soils with low fertility (Appendix F). Only one association, Upland Depression Swamp (CEGL007403), is found in Appomattox Court House National Historical Park. A compositional summary for this association is presented in Appendix H, Table H8. There are two plot samples classified as Upland Depression Swamp from Appomattox Court House National Historical Park. The plot sample APCO.14 is typical of the association, dominated by willow oak (*Quercus phellos*) and containing many of the most constant species. The sample plot APCO.3 is atypical of the association because of the presence of many species more typical of disturbed habitats such as hairy bittercress (*Cardamine hirsuta*), eastern daisy fleabane (*Erigeron annuus*), honeylocust (*Gleditsia triacanthos*), apple (*Malus* sp.), and black bindweed (*Polygonum convolvulus*). Both plots have greater than average cover by green ash (*Fraxinus pennsylvanica*). All four of the nonriverine forest associations recognized in this analysis are uncommon to rare in the mid-Atlantic region and three are globally rare (Appendix D). Upland Depression Swamp is a naturally uncommon community and considered globally rare (Appendix D). Much of the habitat that could support it has undergone drainage and conversion. Of the seven parks included in this study, Upland

Depression Swamp is only found in Appomattox Court House National Historical Park (Appendix D).

In addition to the vegetation classes derived from quantitative analysis, other vegetation classes used to describe the vegetation in the seven parks were developed from qualitative observations in the parks. Many of these qualitatively-derived units were crosswalked to the USNVC association level, while others were not appropriate for inclusion in the USNVC and were described as nonstandard, park-specific vegetation classes. A total of 19 associations and 12 nonstandard park-specific vegetation classes representing disturbed or cultural vegetation were recognized from the seven parks. Appomattox Court House National Historical Park had 11 of these cultural or disturbed vegetation classes. Nine of these vegetation classes were crosswalked to the association level of the USNVC and two represented vegetation that had no defined classification in the USNVC. These two vegetation classes were given nonstandard, park-specific names to describe the vegetation in Appomattox Court House National Historical Park. All vegetation classes from the regional classification, their relationship to the USNVC, and their distribution across all seven parks in this study are shown in Appendix D.

#### Vegetation Community Descriptions and Map Classes

Twenty map classes were used in the vegetation map for Appomattox Court House National Historical Park. Map classes are equivalent to one or more vegetation classes from the regional vegetation classification, or to a land-use class from the Anderson (Anderson et al. 1976) Level II classification system. Table 11 lists the 20 map classes used to map the park and shows the relationships to standard classifications and to the regional vegetation classes developed for the seven parks in this study. Sixteen of the 20 map classes were crosswalked to the finest level of the USNVC (association). Two of the 20 map classes were described as nonstandard, park-specific vegetation classes and two were crosswalked to the Anderson (Anderson et al. 1976) Level II classification. Detailed local descriptions for each USNVC association or other map class present at Appomattox Court House National Historical Park were written based on information collected within the park boundary. Polygons mapped as Oak - Hickory Forest may be either one of two USNVC associations. A detailed local description was written for each association within the Oak - Hickory Forest map class. All map classes crosswalked to the association level of the USNVC include range wide descriptions (i.e. global descriptions). Global descriptions of the USNVC associations were extracted from the September 27, 2007 version of the USNVC (NatureServe 2007).

Detailed local and global descriptions of the USNVC associations are contained in Appendix I. Local descriptions for other map classes (nonstandard vegetation classes and land-use classes) are also provided. The descriptions are indexed by the regional vegetation class or land-use class name. Representative photographs of the vegetation classes are provided after the descriptions except for Basic Oak - Hickory Forest where an acceptable photograph was not obtained. Photographs were taken by VADNH staff unless otherwise indicated. A bibliography for the sources cited in the global vegetation descriptions from the USNVC is also provided in Appendix I.

Fields used in the local and global descriptions are defined in Appendix J. Each USNVC association is also crosswalked to the state classification for Virginia (Fleming et. al 2006). The

Table 11. Vegetation-map classes and corresponding USNVC associations (NatureServe 2007) or other classification for Appomattox Court House National Historical Park. Where a map class represents more than one vegetation class in the regional classification, a unique common name is listed for each vegetation class.

Map Class	USNVC Association (association code)	Regional Vegetation or Land-use Class * (name source)
Inner Piedmont / Lower Blue Ridge Basic Mesic Forest	<i>Liriodendron tulipifera</i> - <i>Quercus rubra</i> - <i>Fraxinus americana</i> / <i>Asimina triloba</i> / <i>Actaea racemosa</i> - <i>Uvularia perfoliata</i> Forest (CEGL006186)	Inner Piedmont / Lower Blue Ridge Basic Mesic Forest (Fleming et al. 2006)
Beaver Wetland Complex	<i>Alnus serrulata</i> Swamp Shrubland (CEGL005082)	Beaver Wetland Complex (park-specific name)
Northern Piedmont / Lower New England Basic Seepage Swamp	<i>Acer rubrum</i> - <i>Fraxinus (pennsylvanica, americana)</i> / <i>Lindera benzoin</i> / <i>Symplocarpus foetidus</i> Forest (CEGL006406)	Northern Piedmont / Lower New England Basic Seepage Swamp (Fleming et al. 2006)
Cultural Meadow	<i>Dactylis glomerata</i> - <i>Phleum pratense</i> - <i>Festuca</i> spp. - <i>Solidago</i> spp. <i>Herbaceous Vegetation</i> (CEGL006107)	Cultural Meadow (park-specific name)
Dense Hardwood Regeneration	Not defined - nonstandard, park-specific vegetation class	Dense Hardwood Regeneration (park-specific name)
Grazed Woodlot	Not defined - nonstandard, park-specific vegetation class	Grazed Woodlot (park-specific name)
Loblolly Pine Plantation	<i>Pinus taeda</i> Planted Forest (CEGL007179)	Loblolly Pine Plantation (NatureServe 2007)
Mesic Mixed Hardwood Forest	<i>Fagus grandifolia</i> - <i>Quercus (alba, rubra)</i> - <i>Liriodendron tulipifera</i> / ( <i>Ilex opaca</i> var. <i>opaca</i> ) / <i>Polystichum acrostichoides</i> Forest (CEGL006075)	Mesic Mixed Hardwood Forest (Fleming et al. 2006)
Oak - Hickory Forest	<i>Quercus alba</i> - <i>Quercus rubra</i> - <i>Carya (ovata, carolinae-septentrionalis)</i> / <i>Cercis canadensis</i> Forest (CEGL007232)  OR <i>Quercus alba</i> - <i>Quercus rubra</i> - <i>Carya alba</i> / <i>Cornus florida</i> / <i>Vaccinium stamineum</i> / <i>Desmodium nudiflorum</i> Piedmont Forest (CEGL008475)	Basic Oak – Hickory Forest (Fleming et al. 2006)
		Acidic Oak – Hickory Forest (Fleming et al. 2006)
Piedmont / Low Elevation Mixed Oak / Heath Forest	<i>Quercus alba</i> - <i>Quercus (coccinea, velutina, prinus)</i> / <i>Gaylussacia baccata</i> Forest (CEGL008521)	Piedmont / Low Elevation Mixed Oak / Heath Forest (Fleming et al. 2006)
Other Urban or Built-up Land	Not defined - Anderson land-use class	Other Urban or Built-up Land (17) (Anderson et al. 1976)

Table 11. Vegetation-map classes and corresponding USNVC associations (NatureServe 2007) or other classification for Appomattox Court House National Historical Park (continued). Where a map class represents more than one vegetation class in the regional classification, a unique common name is listed for each vegetation class.

Map Class	USNVC Association (association code)	Regional Vegetation or Land-use Class * (name source)
Piedmont / Mountain Alluvial Forest	<i>Liriodendron tulipifera</i> - <i>Acer (rubrum, negundo)</i> - ( <i>Platanus occidentalis</i> ) / <i>Carpinus caroliniana</i> / <i>Polygonum virginianum</i> Forest (CEGL006492)	Piedmont / Mountain Alluvial Forest (Fleming et al. 2006)
Successional Black Walnut Forest	<i>Juglans nigra</i> / <i>Verbesina alternifolia</i> Forest (CEGL007879)	Successional Black Walnut Forest (NatureServe 2007)
Successional Red-cedar Forest	<i>Juniperus virginiana</i> Forest (CEGL006024)	Successional Red-cedar Forest (park-specific name)
Successional Tree-of-Heaven Forest	<i>Ailanthus altissima</i> Forest (CEGL007191)	Successional Tree-of-Heaven Forest (NatureServe 2007)
Successional Tuliptree Forest	<i>Liriodendron tulipifera</i> - <i>Quercus</i> spp. Forest (CEGL007221)	Successional Tuliptree Forest (park-specific name)
Successional Virginia Pine Forest	<i>Pinus virginiana</i> Successional Forest (CEGL002591)	Successional Virginia Pine Forest (park-specific name)
Transportation, Communications, and Utilities	Not defined - Anderson land-use class	Transportation, Communications, and Utilities (14) (Anderson et al. 1976)
Upland Depression Swamp	<i>Quercus phellos</i> / <i>Carex (albolutescens, intumescens, jorii)</i> / <i>Climacium americanum</i> Forest (CEGL007403)	Upland Depression Swamp (Fleming et al. 2006)
Virginia Pine Plantation	<i>Pinus virginiana</i> Planted Forest (CEGL004730)	Virginia Pine Plantation (NatureServe 2007)

\* Equivalent to the Common name (Park-specific) as used in detailed descriptions in Appendix I.

state conservation rank (S Rank), global conservation rank (G Rank), and classification confidence for state and global classifications are included in the descriptions. Definitions of the conservation ranks are listed in Appendix E.

A dichotomous key to the map classes of Appomattox Court House National Historical Park is presented in Appendix K. The key should be used in conjunction with the detailed descriptions.

### Vegetation Map Production

The final vegetation map for Appomattox Court House National Historical Park is shown in Figure 8 and a summary of the map class distribution and abundance is provided in Table 12.

Polygons attributed to the map class Oak - Hickory Forest may be one of two USNVC associations. Due to the difficulty of distinguishing Basic Oak - Hickory Forest and Acidic Oak - Hickory Forest on photography and in the field, these associations were combined into a single map class. Since both of these associations are in the same USNVC alliance, polygons in this map class were assigned to a USNVC alliance, but not to an association, in the map attribute table. The map class Successional Virginia Pine Forest is a relatively short-lived vegetation type and contains polygons at different stages of succession. Those stands that are transitional to Successional Tuliptree Forest, with significant succession by deciduous trees, are indicated in the comment field of the map attribute table. These transitional stands had at least 25% Virginia pine component at the time of the mapping and were included in the Successional Virginia Pine map class. The map class Cultural Meadow includes mowed roadsides larger than 0.5 ha. Those polygons representing mowed roadsides are indicated in the comment field of the map attribute table. Mowed roadsides smaller than 0.5 hectare are included either with the adjacent road (Anderson Level II class 14 - Transportation, Communication, and Utilities) or vegetation polygon. Polygons that were attributed with Anderson Level II class 14 (Transportation, Communication, and Utilities) are further attributed in the comment field to identify what finer feature they represent (road, utility line, etc).

A field was included in the map attribute table to indicate which United States Fish and Wildlife Service (USFWS) wetland system (*sensu* Cowardin et al. 1979) a map class represents. Polygons representing wetland formations (i.e. those with hydrologic modifiers of temporarily flooded, seasonally flooded, saturated, semipermanently flooded, or tidally flooded in the formation name) are tagged to the appropriate system in the USFWS wetland classification. Polygons representing vegetation that is not classed as a wetland have the value of “upland” in this field. A map of polygons representing the wetland map classes is shown in Figure 9. This is not a map of jurisdiction wetlands, but rather a map of the distribution of wetland map classes; those with USNVC formations containing wetland modifiers (temporarily flooded, seasonally flooded, or saturated). The hydrology of the map class may not represent the hydrology on the ground and small areas of wetlands may be included within polygons classed as “upland”. All wetland map classes in Appomattox Court House National Historical Park fall into the Palustrine System of the USFWS wetland classification.

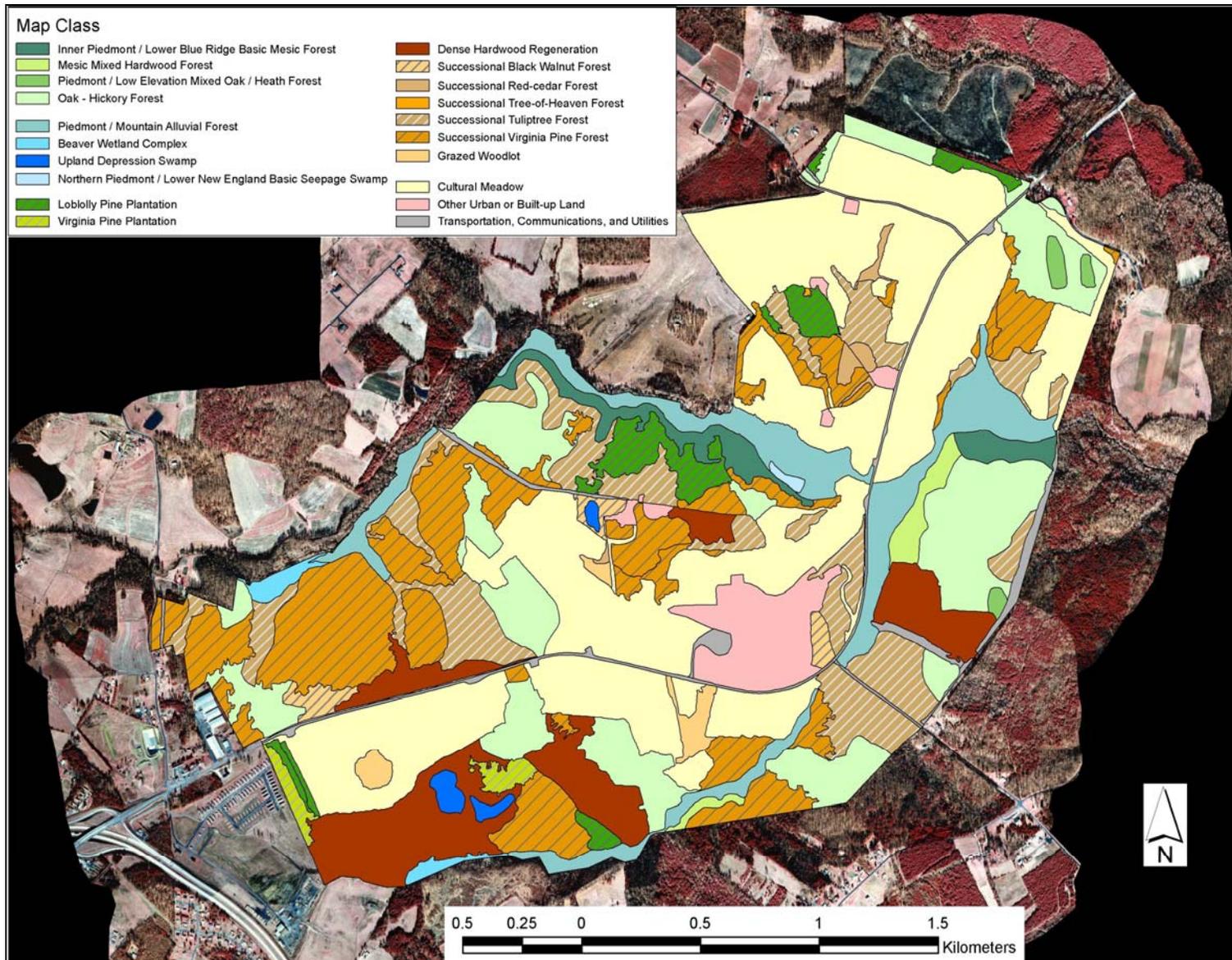


Figure 8. Vegetation and Anderson Level II map classes for Appomattox Court House National Historical Park.

Table 12. Number of polygons, total mapped hectares (acres), and number of quantitative plots sampled for 20 vegetation-map classes at Appomattox Court House National Historical Park.

Map Class - Local Name	Number of total polygons	Total mapped hectares	Total mapped acres	Number of plots sampled
Inner Piedmont / Lower Blue Ridge Basic Mesic Forest	2	14.4	35.7	2
Beaver Wetland Complex	2	3.9	9.7	0
Northern Piedmont / Lower New England Basic Seepage Swamp	1	0.7	1.7	1
Cultural Meadow	15	215.5	532.5	0
Dense Hardwood Regeneration	5	56.2	138.8	0
Grazed Woodlot	3	5.9	14.5	0
Loblolly Pine Plantation	9	19.2	47.4	0
Mesic Mixed Hardwood Forest	2	6.1	15.1	1
Oak - Hickory Forest	16	94.9	234.6	6
Piedmont / Low Elevation Mixed Oak / Heath Forest	3	2.8	7.0	1
Other Urban or Built-up Land	8	23.9	59.1	0
Piedmont / Mountain Alluvial Forest	4	47.0	116.2	1
Successional Black Walnut Forest	3	6.0	14.8	0
Successional Red-cedar Forest	5	3.3	8.1	0
Successional Tree-of-Heaven Forest	1	0.1	0.2	0
Successional Tuliptree Forest	17	72.0	178.0	0
Successional Virginia Pine Forest	34	109.8	271.2	0
Transportation, Communications, and Utilities	13	14.0	34.7	0
Upland Depression Swamp	3	3.4	8.3	2
Virginia Pine Plantation	2	4.8	11.7	0
TOTAL	148	703.9	1739.3	14

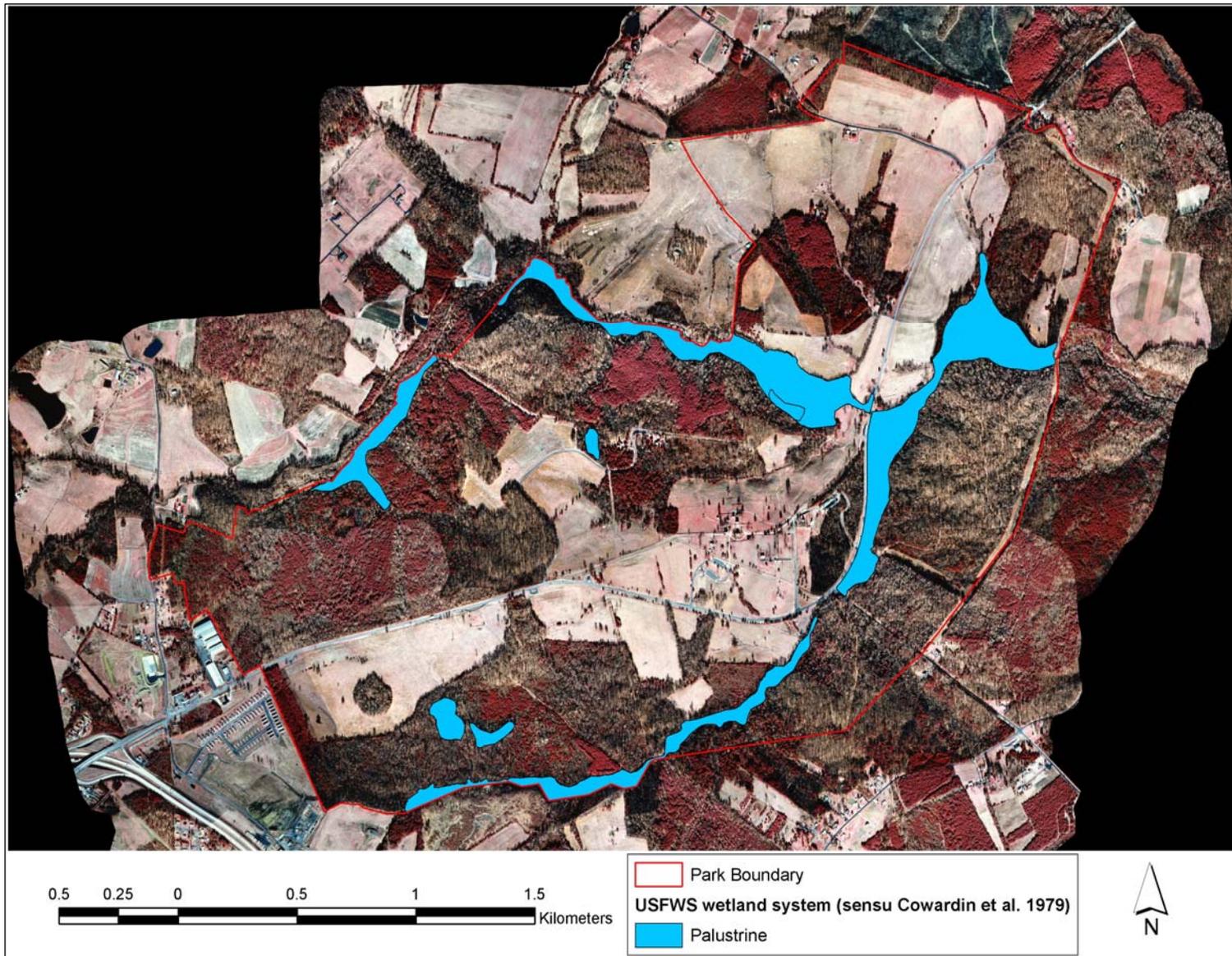


Figure 9. Distribution of wetland vegetation-map classes in Appomattox Court House National Historical Park.

## Accuracy Assessment

### Positional Accuracy

Positional accuracies of the leaf-off and leaf-on mosaics are 1.475 and 0.860 meters, respectively, both of which meet the Class 1 National Map Accuracy Standard (FGDC 1998b). A copy of the spreadsheet for each mosaic, containing the x and y coordinates for each ground control point and the accuracy calculation formula, is included in the data archive.

### Thematic Accuracy

The vegetation classification attribute of all polygons, except those representing the Anderson Land-Use classes of Other Urban or Built-up Land and Transportation, Communications, and Utilities, was validated in the field by a VADNH ecologist. Fifty-two polygons were surveyed and verified as part of the initial vegetation mapping effort, and random points within the remaining 74 polygons were surveyed and verified during an independent accuracy assessment exercise, resulting in 100% validation of the vegetation map (Table 7). A contingency matrix was constructed using the primary accuracy assessment points collected by VADNH and 113 supplemental accuracy assessment points from another study.

Based on the contingency matrix (Table 13) the Kappa Index for the vegetation map is  $80.9\% \pm 5.0\%$ , with an overall percent accuracy of 84%. This meets the USGS-NPS VMP requirement of 80%. The error of omission for 11 of the 16 map classes exceeds the USGS-NPS VMP requirement of 80% (Table 13). Four classes have errors of omission that fall below 80%; Dense Hardwood Regeneration (50%), Grazed Woodlot (40%), Oak – Hickory Forest (50%), and Piedmont / Mountain Alluvial Forest (75%). Errors of omission are errors in classifying the accuracy assessment observation and represent the probability that the ground samples have been classed correctly. Examination of the errors associated with each observation shows that they can be attributed to below minimum mapping unit inclusions of other vegetation types within the target polygons, problems with the field keys, or placement of the observation too close to the polygon edge, in ecotonal areas transitional to other vegetation types. Problems with the field keys were addressed by modifying the keys to better help the user make distinctions between similar vegetation types. Descriptions of map classes were modified, where needed, to include comments about the heterogeneous nature of disturbed map classes.

The error of omission for Successional Black Walnut Forest could not be calculated since the single data point was incorrectly identified as Cultural Meadow during accuracy assessment. This point was one of the supplemental data points and it fell at the edge of the target polygon within an inclusion of mowed roadside. All three polygons of Successional Black Walnut Forest were surveyed and validated during the mapping phase of the project.

Errors of commission are map errors and denote the probability that the mapped vegetation represents the vegetation actually found on the ground. The error of commission for 11 of the 16 map classes exceeds the USGS/NPS Vegetation Mapping Protocol requirement of 80% (Table 13). Four map classes have errors of commission that fall below 80%; Oak - Hickory Forest (50%), Piedmont / Low Elevation Mixed Oak / Heath Forest (25%), Successional Red-cedar

Table 13. Contingency matrix and calculated errors for the thematic accuracy assessment of the vegetation map for Appomattox Court House National Historical Park. Gray cells show the number of sampling points that were correct.

Mapped Vegetation Class (Reference Data)																		
Accuracy Assessment Observation	Inner Piedmont / Lower Blue Ridge Basic Mesic Forest	Beaver Wetland Complex	Cultural Meadow	Dense Hardwood Regeneration	Grazed Woodlot	Loblolly Pine Plantation	Mesic Mixed Hardwood Forest	Oak - Hickory Forest	Piedmont / Low Elevation Mixed Oak / Heath Forest	Piedmont / Mountain Alluvial Forest	Successional Black Walnut Forest	Successional Red-Cedar Forest	Successional Tuliptree Forest	Successional Virginia Pine Forest	Upland Depression Swamp	Virginia Pine Plantation	Grand Total	Error of Commission (Percent Correct)
Inner Piedmont / Lower Blue Ridge Basic Mesic Forest	1																1	100.0%
Beaver Wetland Complex		4															4	100.0%
Cultural Meadow			39	1	1					1	1						43	90.7%
Dense Hardwood Regeneration				4										1			5	80.0%
Grazed Woodlot					2												2	100.0%
Loblolly Pine Plantation						18								1			19	94.7%
Mesic Mixed Hardwood Forest							3										3	100.0%
Oak - Hickory Forest				2				6		1			1	2			12	50.0%
Piedmont / Low Elevation Mixed Oak / Heath Forest								3	1								4	25.0%
Piedmont / Mountain Alluvial Forest					1					9							10	90.0%
Successional Black Walnut Forest											0			2			2	N/A
Successional Red-Cedar Forest			1									5		1			7	71.4%
Successional Tuliptree Forest								3		1			15	3			22	68.2%
Successional Virginia Pine Forest				1	1							1		47			50	94.0%
Upland Depression Swamp															1		1	100.0%
Virginia Pine Plantation																2	2	100.0%
Grand Total	1	4	40	8	5	18	3	12	1	12	1	6	16	57	1	2	187	
Error of Omission (Percent Correct)	100.0%	100.0%	97.5%	50.0%	40.0%	100.0%	100.0%	50.0%	100.0%	75.0%	N/A	83.3%	93.8%	82.5%	100.0%	100.0%		

Total points correct            157  
 Overall Accuracy                    84.0%  
 Kappa Index                            80.9%  
 90% Confidence Interval        5.0%

Forest (71.4%), and Successional Tulip Poplar (68.2%). Six polygons classed as map classes other than Oak - Hickory Forest were keyed to Oak - Hickory Forest in the field (Table 13). These errors are evidence of the heterogeneous nature of the disturbed forests in Appomattox Court House National Historical Park, where polygons of disturbed vegetation may have below minimum mapping unit inclusions that can be mistaken for other forest types. The map classes Dense Hardwood Regeneration, Successional Tuliptree Forest, and Successional Virginia Pine Forest are all heterogeneous units that may have small areas that vary in structure or composition. The one observation that fell within Piedmont / Mountain Alluvial Forest and was keyed to Oak – Hickory Forest was placed close to the edge of the polygon, where the vegetation was transitional to the adjacent map class. Three accuracy assessment observations fell into polygons mapped as Oak – Hickory Forest, but were keyed to Piedmont / Low Elevation Mixed Oak / Heath Forest. This is an understandable error because these forests have virtually identical photo signatures and are difficult to distinguish on aerial photography. Additionally, in some areas, these two deciduous forest associations can be difficult to distinguish in the field. The field key was modified to help with field identification of these associations. The observation of Cultural Meadow that was keyed to Successional Red-cedar Forest was in a small, below minimum mapping unit, inclusion dominated by eastern red-cedar (*Juniperus virginiana* var. *virginiana*) within a large Cultural Meadow polygon. An observation in a polygon mapped as Successional Virginia Pine, but keyed as Successional Red-cedar, has field notes that indicate this polygon was transitional in composition between the two associations. The error of commission for Successional Black Walnut Forest could not be calculated since no observations correctly identified that map class. The two observations that keyed to Successional Black Walnut Forest were in polygons mapped as Successional Virginia Pine Forest. One of these observations was not located at the target point because of GPS error and the other was located within a small inclusion of black walnut (*Juglans nigra*) within a larger Successional Virginia Pine Forest polygon.

### Project Deliverables

Final products of the vegetation mapping project are shown in Table 14. All products have been delivered to the National Park Service by the Virginia Department of Conservation and Recreation, Division of Natural Heritage with this report or at an earlier date by NCSU-CEO.

Table 14. Summary of products resulting from the classification and mapping of vegetation at Appomattox Court House National Historical Park.

Product	FGCD-complaint spatial metadata
Park orthophoto mosaics (leaf-on and leaf-off)	Yes
Vegetation plot sampling data in the PLOTS 2.0 database	Not applicable
Vegetation plot point data (ArcView shapefile)	Yes
Thematic accuracy assessment sampling points (ArcView shapefile)	Yes
Digital photos representative of vegetation types	Not applicable
Association-level vegetation polygon map	Yes
Final report with vegetation keys and descriptions in digital and hardcopy format	Not applicable

## Discussion

### Vegetation Classification and Characterization

A comprehensive regional analysis resulted in the classification of over 100 USNVC associations, spanning nearly all major physiographic provinces in the region. Thirty-five of the associations are represented in the seven national parks included in this study. An additional 19 associations and 12 nonstandard, park-specific classes representing disturbed, cultural, or exotic vegetation were also recognized from the seven parks. This study at Appomattox Court House National Historical Park identified and characterized 20 map classes, representing 17 USNVC associations, two Anderson Level II land-use classes (Anderson et al. 1976), and two nonstandard, park-specific vegetation classes (Table 11).

Recent land-use history and ongoing management to maintain the historical and cultural landscape of the United States Civil War has significantly influenced the vegetation present in the park. Early successional or transitional vegetation or cultural map classes cover 76% of the land in Appomattox Court House National Historical Park. Cultural map classes alone represent 40% of the park's acreage (283.2 ha; 699.9 ac). Cultural Meadow is the most common map class in the park, covering 215.5 ha (532.5 ac). Cultural meadow includes all mowed or maintained fields in the park, such as fields under agricultural lease. Most of the cultural meadows are managed to maintain the open fields characteristic of Civil War battlefields. Other cultural map classes include Grazed Woodlot, Loblolly Pine Plantation, Other Urban or Built-up Land, Transportation, Communications, and Utilities, and Virginia Pine Plantation. These map classes are described in Appendix I.

Early successional or transitional vegetation covers 36% of the land in the park (251.3 ha; 620.9 ac). This vegetation is the result of relatively recent (20-80 years) abandonment of fields or tree canopy removal by disturbances such as pine bark beetle infestation, wind, beaver activity, or silvicultural practices. The upland stands are dominated by early successional, weedy tree species in the canopy and subcanopy, and can have high cover of nonnative plants in the shrub and herbaceous layers. Beaver disturbed areas typically occur as semipermanently flooded habitat variously dominated by trees, shrubs, herbs, or open water. All these map classes are rapidly changing in species composition and vegetation structure, and if invasive species and beaver activity can be kept in check or eliminated, the stands will eventually succeed into one of the later successional forest types mapped in the park. Map classes representing early successional or transitional vegetation are Beaver Wetland Complex, Dense Hardwood Regeneration, Successional Black Walnut Forest, Successional Red-cedar Forest, Successional Tree-of-Heaven Forest, Successional Tuliptree Forest, and Successional Virginia Pine Forest. Associations in these map classes are described in Appendix I.

Geology, topography, and hydrology have a primary influence on the occurrence and distribution of the later successional forests of the park. In the context of this study, late successional forests are mature forests found in the least disturbed areas in the park. These native vegetation assemblages or "natural communities" have the most stable species composition with a greater diversity of native flora than other map classes representing transitional, disturbed, or cultural vegetation. Seven map classes represent late successional vegetation and together they cover just

over 24% of the land in the park (169.4 ha; 418.5 ac). The seven map classes can be broadly characterized based on different environmental settings as upland forests (4 map classes) and forested wetlands (3 map classes).

Four upland forest map classes that represent later successional vegetation cover 118.3 ha (292.3 ac) or just under 17% of the park land. The most common upland forest map class is Oak – Hickory Forest which covers 13.5% (94.9 ha, 234.6 ac) of the park land and is found on the least disturbed rolling uplands that have not been converted to pine forests or other transitional vegetation. Polygons attributed to the map class Oak - Hickory Forest may be one of two associations. The associations were combined into a single map class due to the difficulty of distinguishing them on photography and in the field. Acidic Oak - Hickory Forest is found on convex slopes and ridges over acidic soils weathered from felsic rocks, while Basic Oak – Hickory Forest is associated with higher base status soils, weathered from mafic parent materials such as amphibolite and metabasalt (greenstone). The two associations are distinguished by differences in species composition related to the differences in soil fertility. However, plot samples from Appomattox Court House National Historical Park for both of these Oak - Hickory Forest associations have a lower than average species richness, and many examples lack important diagnostic species, thus making it difficult to distinguish the two associations in analysis or on the ground. The lower than average species richness in the Appomattox Court House National Historical Park Oak - Hickory Forests may be due to past land-use practices that depleted the topsoil and/or to impacts from herbivory by deer.

Throughout the mid-Atlantic region, American beech (*Fagus grandifolia*), American holly (*Ilex opaca* var. *opaca*), and red maple (*Acer rubrum*) are heavily invading the understories of some stands of Oak – Hickory Forest, likely due to the exclusion in recent decades of fires, logging, and other disturbances that favor oak regeneration (Abrams and Copenheaver 1999, Orwig and Abrams 1993). As a result, these stands appear to be succeeding to a more mesic forest composition, as is the case in some portions of Appomattox Court House National Historical Park. Some stands mapped as Oak – Hickory Forest in the park have high cover of American beech in the understory, making them compositionally similar to Mesic Mixed Hardwood Forest. Quantitative analysis placed plot APCO.7 in the Mesic Mixed Hardwood Forest association due to the high cover of American Beech in the understory. However, based on stand observations and photo interpretation, the sample is better classified as Oak – Hickory Forest and the area including that plot was mapped as Oak – Hickory Forest.

Also occurring on the rolling uplands, over thin, rocky, infertile soils is Piedmont / Low Elevation Mixed Oak / Heath Forest. The Piedmont / Low Elevation Mixed Oak / Heath Forest map class covers less than 1% of the land within Appomattox Court House National Historical Park. It is found in three small patches covering 2.8 ha (7.0 ac) on the northeast and eastern boundary of the park. The stands of this association in Appomattox Court House National Historical Park may be difficult to distinguish from the association Acidic Oak – Hickory Forest and are primarily recognized by the overwhelming canopy dominance by chestnut oak (*Quercus prinus*).

The upland forest map classes Inner Piedmont / Blue Ridge Basic Mesic Forest and Mesic Mixed Hardwood Forest are found on the cool, moist, north to northwest facing slopes over the Appomattox River and Plain Run Branch. Inner Piedmont / Blue Ridge Basic Mesic Forest is

associated with soils that have weathered from mafic rocks of greenstone or amphibolite gneiss, and are rich in calcium and magnesium. Inner Piedmont / Blue Ridge Basic Mesic Forest covers only about 2 percent (14.4 ha, 35.7 ac) of the park. Undisturbed examples of Inner Piedmont / Blue Ridge Basic Mesic Forest are characterized by a lush and diverse herbaceous stratum dominated by coarse forbs and ferns. This association is scattered in small to large patches throughout the lower Blue Ridge and northern and western Piedmont of Virginia, and much of the Maryland Piedmont and Blue Ridge. While not a naturally rare type (G4), this community has a restricted geographic distribution, mature examples are uncommon, and all stands are vulnerable to logging and degradation by introduced invasive weeds. Many examples are poorly buffered because of upslope land-use change and timber removal, or conversion of upslope forests to managed forest types. Some of the forested areas in Appomattox Court House National Historical Park that are mapped as Successional Tuliptree Forest may have been Inner Piedmont / Blue Ridge Basic Mesic Forest prior to canopy removal. Less fertile, acidic soils, weathered from felsic rocks support Mesic Mixed Hardwood Forest. Found in two small patches over Plain Run Branch, Mesic Mixed Hardwood Forest covers 6.1 ha (15.1 ac). This upland forest association is a common and widespread community in the Mid-Atlantic Piedmont and Coastal Plain and was documented in five of the seven parks in this study.

Forested wetlands cover 7.3% (51.1 ha, 162.2 ac) of the park area and include three map classes. The majority of the forested wetlands in the park (47 ha, 116.2 ac) are mapped as Piedmont / Mountain Alluvial Forest. This map class is found on the floodplains and terraces along the Appomattox River, Plain Run Branch, and on an unnamed tributary of the Appomattox River in the northwest section of the park. Forests of this map class occur over deep, sandy alluvial soils that are subject to occasional flooding, typically once or twice a year. The deep, fertile soils are highly susceptible to nonnative species invasion, and thus it is important not to site trails and roads in the active floodplain and to mitigate impacts from surrounding development. The association Piedmont / Mountain Alluvial Forest was first defined through the regional analysis for this project. It is not an uncommon forest (G4), but high quality, undisturbed examples are rare. It is the principal small floodplain forest in the northern and western Piedmont of Virginia and extends into Maryland.

Upland Depression Swamp, a forested wetland type, is mapped as three polygons covering 3.4 ha (8.3 ac). This globally rare community occurs in poorly drained, seasonally flooded soils in an otherwise upland setting (i.e. non-alluvial). The isolated hydrology and small size means that these forested wetlands are often exempt from protective wetland regulations, and much of the habitat throughout the Piedmont that could support this association has undergone drainage and conversion. One polygon classified as this association and located in the central portion of the park may not be a natural upland depression, but an artificial impoundment that has been abandoned and grown up in forest. This particular stand occurs on a soil mapped as Cullen clay loam, a well-drained upland soil type. Additionally, the presence of many species more typical of disturbed habitats lends credence to the idea that this pond may not be natural. The other two polygons classed as Upland Depression Swamp, located in the southwestern portion of the park, are mapped as a frequently flooded soil type, Wehadkee loam, and are natural upland depressions. The example of Upland Depression Swamp represented by these two polygons is quite large compared to other known examples of this association (2.8 ha, 6.9 ac). The forest is mature, probably at least 80 years in age, with large willow oaks (*Quercus phellos*) measuring 58 to 79 cm (22.8 to 31.1 in) diameter at breast height (1.4 m above the ground). While the species

composition is typical for the association, it does have moderately high cover by nonnative species and areas of canopy and soil disturbance from historic logging activities. While the hydrology has largely recovered from past logging activities, the surrounding landscape is very young, successional forests and hayfields, making the stand susceptible to further degradation by nonnative plant species. Nonnative species documented in this community include wild garlic (*Allium vineale*), hairy bittercress (*Cardamine hirsuta*), and Japanese honeysuckle (*Lonicera japonica*).

A forested wetland mapped as Northern Piedmont / Lower New England Basic Seepage Swamp is found on the broad floodplain of the Appomattox River, where groundwater seepage is discharged at the base of steep, riverside slopes. While this association is relatively common and secure throughout the bulk of its range, it is considered state-imperiled in Virginia, where it reaches the southern limit of its distribution. The example of Northern Piedmont / Lower New England Basic Seepage Swamp in the park is quite small (0.7 ha, 1.7 ac) compared to other known examples of this association in Virginia. It has many nonnative plant species, but overall is compositionally representative of the association, with a striking dominance by skunk cabbage (*Symplocarpus foetidus*), visible only early in the growing season. Nonnative species documented in this community include Amur peppervine (*Ampelopsis brevipedunculata*), Indian strawberry (*Duchesnea indica*), border privet (*Ligustrum obtusifolium*), Japanese honeysuckle (*Lonicera japonica*), Nepalese browntop (*Microstegium vimineum*), oriental ladysthumb (*Polygonum caespitosum* var. *longisetum*), and multiflora rose (*Rosa multiflora*).

Of the 20 map classes used to map the vegetation at Appomattox Court House National Historical Park, six are natural communities as defined in the Natural Communities of Virginia ([http://www.dcr.virginia.gov/natural\\_heritage/nctoc.shtml](http://www.dcr.virginia.gov/natural_heritage/nctoc.shtml)): Inner Piedmont / Blue Ridge Basic Mesic Forest, Northern Piedmont / Lower New England Basic Seepage Swamp, Mesic Mixed Hardwood Forest, Piedmont / Low Elevation Mixed Oak / Heath Forest, Piedmont / Mountain Alluvial Forest, and Upland Depression Swamp. One map class, Oak - Hickory Forest, represents two natural communities defined in the Natural Communities of Virginia, Acidic Oak – Hickory Forest and Basic Oak – Hickory Forest. Exemplary occurrences of these communities are tracked by Virginia’s Department of Conservation and Recreation, Division of Natural Heritage. In order to be considered an exemplary occurrence, stands have to meet strict type-specific criteria of size, condition, and landscape context. All globally rare (G1 or G2) or state rare (S1 or S2) communities are tracked, regardless of their size, condition, and landscape context. One globally rare community, Upland Depression Swamp, and one state rare community, Northern Piedmont / Lower New England Basic Seepage Swamp, were documented at the park as part of this study. The other six natural communities do not meet the criteria to be considered Natural Heritage exemplary natural community occurrences. Nonetheless, these native plant associations are an important part of the park’s natural resources and should be targets for conservation and management.

Invasive nonnative plant species are the main threat to the native vegetation at Appomattox Court House National Historical Park. Thirty nonnative plant species were noted in the quantitative plots and accuracy assessment observations. Cultural and successional map classes had the most diversity of nonnative plant species. Of the other map classes, forested wetlands had the highest cover by invasive, nonnative species. The most common and problematic species include Japanese honeysuckle (*Lonicera japonica*) and Nepalese browntop

(*Microstegium vimineum*). These species are particularly troublesome because of their shade tolerance and aggressive growth habits. These species can be opportunistic invaders of the older, more intact forest communities, getting a foothold where roads, trails, tip-up mounds, downfalls, and other gap-disturbances have disturbed mineral soil. Once established, colonies are able to more easily expand or spread into nearby microhabitats.

Japanese honeysuckle is especially destructive to native vegetation because of its rapid, twining growth and dense, semi-evergreen foliage that shades out competitors. Its vines frequently strangle shrubs and tree saplings, and over-grow more delicate herbs in a variety of settings. Nepalese browntop is the fastest spreading, most problematic exotic everywhere in Virginia today. Within the past two decades, it has abundantly invaded moist, openly shaded habitats throughout the mid-Atlantic region, forming monospecific carpets of tangled culms that tend to crowd out competing herbaceous species (Tu 2000). A recent study strongly suggests that Nepalese browntop responds to forest canopy disturbances with a sudden increase in biomass that impedes woody regeneration and lowers overall species diversity and stem densities (Oswalt et al. 2007). Other studies have demonstrated that once established, Nepalese browntop over-runs native herbaceous competitors and leads to dramatic declines of herb richness within a few years (Barden 1987, Hunt and Zaremba 1992).

Other highly invasive nonnative species noted in the park include tree of heaven (*Ailanthus altissima*), Amur peppervine (*Ampelopsis brevipedunculata*), Chinese yam (*Dioscorea oppositifolia*), Chinese lespedeza (*Lespedeza cuneata*), Chinese privet (*Ligustrum sinense*), and multiflora rose (*Rosa multiflora*). Coralberry (*Symphoricarpos orbiculatus*), while technically native to Virginia, is considered, based on historical botanical literature, an invasive, naturalized species east of the mountains in Virginia (VADNH, Ecologist, G. Fleming, pers. comm. 2007). It is a highly aggressive shrub that competes with native species in disturbed areas as well as in the understory of dry habitats such as rock outcrops and rocky forests. The species has a preference for high base status soils and is abundant in areas of Appomattox Court House National Historical Park. Coralberry was found as a dominant species in Successional Virginia Pine Forest, Successional Tuliptree Forest, Oak – Hickory Forest, and in the area around the “ice pond” (mapped as Upland Depression Forest). It was found in over half of the quantitative plot samples and noted in 35% of the accuracy assessment observations.

### Vegetation Map Production

The final map for Appomattox Court House National Historical Park depicts 20 map classes. Sixteen map classes are crosswalked to 17 USNVC vegetation associations, two are nonstandard, park-specific vegetation classes, and two are Anderson Level II land-use classes. Because of the difficulty of distinguishing between Basic Oak – Hickory Forest and Acidic Oak – Hickory Forest in the field or on photography, these associations are represented by a single map class, Oak – Hickory Forest. Each polygon representing a USNVC association was attributed with the appropriate USNVC formation and alliance based on the hierarchy of the USNVC. The final map table includes nine formations and 15 alliances.

Either during the initial mapping effort or as part of accuracy assessment, all polygons on the vegetation map were surveyed and their classification verified on the ground. After the census of all polygons had been completed, additional data from a separate mapping project was

discovered and used to supplement the primary accuracy assessment data and further assess the accuracy of the map. The Kappa index for the final vegetation map meets the USGS-NPS VMP protocol requirement of 80%. Errors of commission and omission reported for seven map classes fall below the USGS-NPS VMP protocol requirement of 80%. Examination of the errors associated with each observation shows that they can be attributed to below minimum mapping unit inclusions of other vegetation types within the target polygons, problems with the field keys, or placement of the observation too close to the polygon edge, in ecotonal areas transitional to other vegetation types. Some of these errors were introduced by the supplemental accuracy assessment points, which were selected independently from the final vegetation polygons, and may have had inadequate buffers. Other errors reflect the heterogeneous nature of the disturbed and transitional vegetation in Appomattox Court House National Historical Park. Inadequate sample size for some map classes led to low error of commission values, particularly in classes with few polygons. Modifications made to the field key and vegetation descriptions will help future users of the vegetation map distinguish between similar vegetation classes.

Aerial photography flown in December 2000 served as the base map for the final vegetation map. Since that time, the vegetation in the park has continued to change. The temporal progression of early successional forest types will continue to alter the mapped vegetation, as will the park's ongoing management of invasive species. Despite these changes, the vegetation map produced by this project provides crucial baseline data for the park resource managers.

#### Recommendations for Future Projects

Invasive nonnative plant species are the main threat to the native vegetation associations at Appomattox Court House National Historical Park and, in most cases, represent species that were not present in the historical landscapes of the Civil War. Continued monitoring and management of invasive species in and around all the natural communities in the park should be a priority for the park's resource managers. Control of invasive nonnative species on forest edges and along trails and roads can help prevent new invasions. The most common and problematic species include Japanese honeysuckle (*Lonicera japonica*), and Nepalese browntop (*Microstegium vimineum*). Dormant season herbicide application can be effective in treating Japanese honeysuckle infestations, but timing is critical. As a rule, foliar application of 1.5% glyphosate (*e.g.*, Roundup) after the first killing frost and before the first hard frost is most effective (Nuzzo 1997). The annual, Nepalese browntop, is a prolific seed-producer, and seed banks can persist for at least five years (Tu 2000). Control of the species can be very labor intensive (*i.e.*, hand-pulling) or destructive to non-target plants (*i.e.*, herbicide application). Since the species can germinate following early-season removal, removal two or more times a season to more quickly deplete the seed bank has shown promise as a technique for discrete, high-priority sites (The Nature Conservancy, Maryland Field Office, Invasive Species Biologist, Mary Travaglini, pers. comm. 2007). Twelve species of fungi and eight arthropod species are reported as natural enemies of Nepalese browntop in Asia, but no biological controls are currently available (Zheng et al. 2006). Eradication of the species from large sites where it is well established is not a realistic goal with the tools now available. However, reducing populations to manageable or non-invasive levels, especially in rare habitats and vegetation types, should be a high priority for the National Park Service. While not a long-term solution, keeping Nepalese browntop in check while more effective biological controls are developed is the best strategy available at present and is critical to avoiding drastic declines in biodiversity and forest health in the near future.

Stands of Oak – Hickory Forest at Appomattox Court House National Historical Park lacked many herbaceous species that are typical for associations within that map class. Deer browse can be a factor, reducing the vigor and reproduction of many woodland herbs. Studies utilizing deer exclosures could help quantify the impact of herbivory on the reproduction of woody plants and the distribution/abundance of herbaceous plants. Results from these studies could help park staff monitor the impact of deer herbivory over time and develop effective management plans.

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Appendix A. Quantitative vegetation plot sampling form.

VA DEPT. OF CONSERVATION AND RECREATION - DIV. OF NATURAL HERITAGE

rev. 2004-05-03 KDP

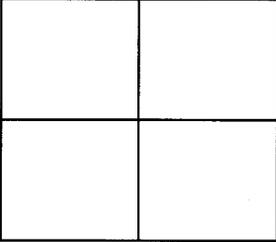
P.1

<b>GENERAL INFORMATION</b> PLOT: _____ Project: <u>Mid atlantic Veg mapping</u> Date: _____ Surveyors: _____ Plot dimensions: _____ by _____ m Sample area _____ sq. m		<b>PLOT LOCATION</b> Managed Area (Park): _____ Survey Site: _____ Quad: _____ County: _____ GPS unit: Garmin GPSMAP76 UTM zone: _____ Datum: <u>WGS 84</u> GPS pointname or file: _____ est accuracy: _____ m/ft # of sats fixed: _____ Receiver status: 2D / 3D / 2D WAAS / 3D WAAS Field UTM X _____ E _____ Y _____ N LAT _____ Long _____ Marked est. location on toposheet _____ yes																							
<b>PLOT DOCUMENTATION</b> Source Code: _____ Film Roll: _____ Frames: _____ Description of pic(s): _____ <b>Relative Stand Size</b> A - extensive (> 100x plot size) B - large (10-100x plot size) C - small (3-10x plot size) D - very small (1-3x plot size) U - Unknown																									
<b>SITE CHARACTERISTICS</b> compass: <u>magnetic</u> corrected _____																									
Elevation _____ m/ft via GPS _____ map _____ altimeter _____																									
<b>Slope</b> (o) _____ single measure. _____ avg of _____ or: A - 0-3% (level or nearly so) B - 3-8% (gentle/undulating) C - 8-16% (sloping/rolling) D - 16-30% (moderate/hilly) E - 30-65% (steep) F - 65-75% (very steep) G - 75+% (extremely steep)		<b>Slope Shape (V w/ slope)</b> VERTICALLY HORIZONTALLY C - concave C - concave X - convex X - convex S - straight S - straight H - hummock (____%) and hollow (____%) microtopography I - irregular craggy/ bouldery microtopography																							
		<b>Aspect</b> (N = 0o): _____ single measure. _____ avg of _____ F (flat) N 338-22 ° NE 23-67 ° V (variable) E 68-112 ° SE 113-157 ° S 158-202 ° SW 203-247 ° W 248-292 ° NW 293-337 °																							
<b>Topographic Position</b> A - crest B - upper slope C - middle slope D - lower slope E - toe slope F - plain/level/bottom G - basin/depression		<b>Landform</b> IF - interfluvium G - gap/saddle SS - side slope SB - slope bench FP - fan piedmont C - cove E - escarpment/face O - bedrock outcrop DS - debris slope H - hill/monadnock U - rolling upland OTHER: _____																							
		<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Surface Substrate</th> <th>% Cover</th> </tr> </thead> <tbody> <tr><td>bedrock</td><td></td></tr> <tr><td>boulders and stones</td><td></td></tr> <tr><td>gravel and cobbles</td><td></td></tr> <tr><td>litter / organic matter</td><td></td></tr> <tr><td>decaying wood</td><td></td></tr> <tr><td>water</td><td></td></tr> <tr><td>mineral soil / sand</td><td></td></tr> <tr><td>other</td><td></td></tr> <tr><td>(bryophytes and lichens)</td><td></td></tr> <tr><td>TOTAL</td><td>100%</td></tr> </tbody> </table>		Surface Substrate	% Cover	bedrock		boulders and stones		gravel and cobbles		litter / organic matter		decaying wood		water		mineral soil / sand		other		(bryophytes and lichens)		TOTAL	100%
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other																									
(bryophytes and lichens)																									
TOTAL	100%																								
<b>Soil Drainage Class</b> A - very poorly drained B - poorly drained C - somewhat poorly drained D - moderately well drained E - well drained F - rapidly drained <b>Inundation</b> A - never B - infrequently C - regularly: for <6 mos. D - regularly: for >6 mos. E - always submerged by shallow water (<30cm) F - always submerged by deep water (>30cm)		<b>Soil Moisture Regime</b> A - very xeric (moist for neglq. time after ppt) B - xeric (moist for brief time) C - somewhat xeric (moist for short time) D - submesic (moist for moderately short time) E - mesic (moist for significant time) F - subhyqric (wet for significant part of growing season; mottles <20cm) G - hyqric (wet for most of growing season; permanent seepage/mottling) H - subhydic (water table at or near surface for most of the year) I - hydric (water table at or above surface year round) - ephemeral seepage/subsurface water present locally in plot																							
		<b>Hydrologic Regime</b> _____ Terrestrial (i.e. not a wetland) <b>Tidal</b> A - Irregularly exposed B - Regularly flooded C - Irregularly flooded D - Wind tidally flooded <b>Non-Tidal</b> A - Permanently flooded B - Semipermanently flooded C - Seasonally flooded D - Intermittently flooded E - Temporarily flooded F - Saturated Salinity/Halinity A - Saltwater Refractometer B - Brackish Measurement: C - Oligohaline _____ D - Freshwater _____																							
Cowardin System _____ Upland _____ Riverine _____ Lacustrine _____ Estuarine _____ Palustrine _____																									
Soil Sample _____ Single Sample _____ Composite Sample _____ Mean of _____																									
<b>Soil Profile Description</b> Horizon/ Depth(cm) Description (texture, structure, consistency)																									
0- _____																									

**PLOT CONFIGURATION, MAP SKETCH, AND DIRECTIONS FOR RELOCATING PLOT**

P.2

The template below is a standard modular layout for a 400m<sup>2</sup> plot. Freehand sketch any alternative configurations, indicate the plot architecture, points where GPS positions were collected, locations of permanent stakes (if any), modules and corners sampled, locations of soil samples, locations and bearings of photopoints, and directions and distances to landmarks (include species and dbh of witness trees). Use the symbols in the key below for GPS points, permanent markers, and photos. Also provide complete directions for relocating permanently marked plots, accompanied if possible by a sketch showing plot orientation and depicting roads, trails, etc., as well as distinctive features of the vegetation. Attach copy of USGS topographic quad map indicating location of plot.

___ ° bearing of centerline		20 x 20 m	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; width: 40px;"></td> <td>GPS position</td> </tr> <tr> <td style="text-align: center;"></td> <td>centerline with bearing</td> </tr> <tr> <td style="text-align: center;"></td> <td></td> </tr> </table>		GPS position		centerline with bearing		
	GPS position								
	centerline with bearing								

**Evidence of Disturbance**

logging \_\_\_ fire \_\_\_ exotic plants \_\_\_ erosion \_\_\_ trails/roads \_\_\_ clearing \_\_\_  
 grazing/browsing \_\_\_ wind/ice damage \_\_\_ ditching/hydrologic alteration \_\_\_  
 chestnut blight \_\_\_ pine bark beetle \_\_\_ dogwood anthracnose \_\_\_ oak decline \_\_\_  
 hemlock adelgid \_\_\_ gypsy moth \_\_\_ spruce decline \_\_\_ Other: \_\_\_\_\_  
 Disturbance Comments:

Provisional Community name (floristic description of sample):

**QUALITATIVE ASSESSMENT AND NOTES**

Write a brief word picture of community. Describe variation within occurrence in terms of veg structure and environment. Note vertical stratification or horizontal zonation patterns. Describe dominant and characteristic species and inclusion communities (if present). If community occurs as a mosaic describe spatial distribution and associated community types. Include landscape context information (adjacent communities). Describe any special or unusual features of the vegetation. If possible, note the origin and (for moderately even-aged forests) approximate age of the stand. Record also the presence at the site of species not sampled in the plot. Note, where appropriate, the approximate distance and direction to proximate water sources, such as river channels, perennial streams, intermittent streams, and seepage or runoff areas. For riparian sites note the height of primary and secondary water marks and the presence of fluvial features.

<u>PHYSIOGNOMY (entire stand)</u>	<u>DOMINANT LEAF PHENOLOGY(entire stand)</u>	<u>STRATA STRUCTURE</u>
Forest            Woodland	Deciduous (< 25% evergreen)	% cover   height (m)
Shrubland	Mixed deciduous (25-49% evergreen)	Tree (>6m woody)
Herbaceous with sparse tree layer	Mixed evergreen (25-49% deciduous)	Shrub (0.5-6m woody)
Herbaceous with sparse shrub layer	Evergreen (< 25% deciduous)	Herb (all herbs+ <0.5 woody)
Herbaceous	Perennial graminoid	Bryophyte/Lichen
Nonvascular        Bryophyte        Lichen	Perennial forb	
Sparsely Vegetated	Perennial mixed	
	Annual herbaceous	
	Not applicable	



Appendix B. Accuracy assessment data form for the vegetation map of Appomattox Court House National Historical Park.

**APPOMATTOX COURT HOUSE NATIONAL HISTORICAL PARK  
VEGETATION MAPPING ACCURACY ASSESSMENT FIELD FORM**

**I. IDENTIFIERS AND LOCATION DATA**

1. AA Point Code AA                      2. Park Code: APCO                      3. Date (y/m/d): 2006 /   /  
4. Observer(s) \_\_\_\_\_  
5. GPS unit (*circle*): Garmin GPSMap76 / Garmin GPSMap76s  
6. DATUM (*circle*): WGS84 / other (*specify* \_\_\_\_\_)                      7. GPS file name \_\_\_\_\_  
8. Estimated accuracy \_\_\_\_\_ m                      9. Number of points averaged \_\_\_\_\_  
10. Receiver status (*circle*): 2D / 3D / 2D WAAS / 3D WAAS / no signal (*estimated location marked on DRG*)  
11. Field UTM X \_\_\_\_\_ m E    Y \_\_\_\_\_ m N  
OR Lat \_\_\_\_\_ Long \_\_\_\_\_

**II. ENVIRONMENTAL / SITE DESCRIPTION**

1. Environmental Comments (*if site is a wetland, indicate type of hydrology, e.g., seepage wetland, temporarily flooded stream bottom, seasonally flooded pond, etc.*)

**III. VEGETATION DESCRIPTION** (*observation is within a 0.5 ha area – approx. a 40 m radius circle*)

1. Prevalent vegetation association within 0.5 ha of observation area, based on field key:
2. Other vegetation associations present within 0.5 ha observation area:
3. Representativeness: is the vegetation within the 0.5 ha observation area representative of vegetation in the surrounding mapped polygon? If vegetation of the AA point is an anomalous inclusion in the polygon, please note
4. Approximately what percentage of the mapped polygon did you observe? OR approximate size of area observed? (*This may be also be drawn on a map. Include with form*)



## INSTRUCTIONS FOR APPOMATTOX COURT HOUSE NATIONAL HISTORICAL PARK VEGETATION MAP ACCURACY ASSESSEMENT

This observation point field form was developed for the mid-Atlantic Vegetation mapping project. Its purpose is to generate record observations at vegetation polygons and compare them to the mapped data. The general procedure you will follow is to navigate to the pre-selected point using a Garmin GPSMap76 or GPSMap76s GPS unit. Try to navigate as close as possible to the pre-selected point. The species list is collected at that point and the 0.5 ha surrounding the point. Comments re: the vegetation within the entire polygon are also recorded on this form. Once at the pre-selected observation point, you will record your location by collecting a waypoint with the GPS unit and record the required data in the order that it appears on the field form.

The materials you should have before you begin are 1) plots of the 7.5' DRG (and photos if helpful) showing the polygon boundaries, but no information about polygon attributes; 2) pre-selected AA point coordinates loaded into your GPS unit; 3) the field key to vegetation types, and 4) vegetation type descriptions. You should also carry a compass. A measure tape may help for distances and heights. Once you have navigated to an observation point, you should closely observe the vegetation within the prescribed data collection area, which in most cases will be a approximated circular 0.5 ha area (radius = ca. 40 m). You can simply pace one or more radii of 40 meters from the point to assist in gauging the extent of the observation area. Keep the observations within the defined polygon and adjust the area surveyed accordingly (i.e. if the polygon is linear or less than 0.5 ha, keep the observation within the polygon)

In cases where an observation point falls in an ecotone, or contains two distinctly different vegetation types, describe the type that covers the larger area and provide notes (see section III3) on the second type. In the rare instance where an observation area is equally divided between two vegetation types, you will have to complete observation point field forms for each type. During navigation to and from a point, generally observe the vegetation in the mapped polygon so that you can answer section III2 (see below).

### Specific Instructions for completing the AA field form:

I.1-4. Self explanatory

I.5-11. Indicate GPS unit used and record the file name for the location data that you collect. Record the number of points averaged, accuracy, and either UTM or Lat/Long coordinates displayed by the GPS unit. In the event that GPS locational data cannot be obtained, mark your estimated location on a 7.5' USGS quad or DRG.

II.1. Make note of any other environmental characteristics that might assist in interpreting the site. Also use this space to record general information on hydrology, if the site is a wetland.

III.1. Use the field key to determine the vegetation type prevalent at the site.

III.2. If one or more additional vegetation types occur within the sample site, record them.

III.3. To the extent possible, and based on general observations made navigating to and from the point, note whether the prevalent vegetation of the sample site is representative of the larger polygon in which it is located. It is especially important to note instances where the vegetation of the site is an anomaly or local inclusion within the polygon.

III.4. Provide a rough estimate of the percentage of the larger polygon that you observed (*e.g.*, 10%, 20%, etc.). or draw the area on your map and include with this form.

IV. Check the maximum cover class for each vertical vegetation stratum indicated on the table. The heights in the left column indicate the maximum height of each stratum. The lowest stratum contains all woody plants < 0.5 m tall and all herbaceous plants, regardless of height.

V. List species you would consider to be characteristic of the vegetation at the site. These generally include dominant species and less abundant species that are indicative of specific site conditions such as soil chemistry or

hydrologic regime. Write the species in the left column and note its status in the appropriate layer(s) using the symbols “D” for dominant, “P” for present, and “R” for rare (1-3 individuals).

VI. Use this space to record any additional information or comments about vegetation structure or composition that would assist in interpreting this site.

VII. Use this space to record any additional information about vegetation classification. It is especially important to note if problems were encountered applying the field key or interpreting the vegetation.

Appendix C. Vascular plants observed in quantitative vegetation plots and accuracy assessment observation points in Appomattox Court House National Historical Park, 2002–2005.

Nomenclature follows the PLANTS 3.5 Database developed by the Natural Resource Conservation Service in cooperation with the Biota of North America Program (USDA, NRCS 2004).

Family	Scientific Name	Common Name
Aceraceae	<i>Acer negundo</i>	boxelder
	<i>Acer rubrum</i>	red maple
	<i>Acer saccharinum</i>	silver maple
Alismataceae	<i>Sagittaria latifolia</i>	broadleaf arrowhead
Anacardiaceae	<i>Rhus copallinum</i>	flameleaf sumac
	<i>Toxicodendron radicans</i>	eastern poison ivy
Annonaceae	<i>Asimina triloba</i>	pawpaw
Apiaceae	<i>Cryptotaenia canadensis</i>	Canadian honewort
	<i>Sanicula canadensis</i>	Canadian blacksnakeroot
	<i>Thaspium barbinode</i>	hairyjoint meadowparsnip
	<i>Thaspium trifoliatum</i>	purple meadowparsnip
Apocynaceae	<i>Apocynum cannabinum</i>	Indianhemp
	<i>Vinca</i> sp.	a periwinkle
Aquifoliaceae	<i>Ilex opaca</i> var. <i>opaca</i>	American holly
	<i>Ilex verticillata</i>	common winterberry
Araceae	<i>Arisaema triphyllum</i>	Jack in the pulpit
	<i>Symplocarpus foetidus</i>	skunk cabbage
Aristolochiaceae	<i>Aristolochia serpentaria</i>	Virginia snakeroot
Aspleniaceae	<i>Asplenium platyneuron</i>	ebony spleenwort
Asteraceae	<i>Antennaria plantaginifolia</i>	woman's tobacco
	<i>Coreopsis verticillata</i>	whorled tickseed
	<i>Elephantopus carolinianus</i>	Carolina elephantsfoot
	<i>Erigeron annuus</i>	eastern daisy fleabane
	<i>Eupatorium fistulosum</i>	trumpetweed
	<i>Eurybia divaricata</i>	white wood aster
	<i>Gamochaeta purpurea</i>	spoonleaf purple everlasting
	<i>Helianthus decapetalus</i>	thinleaf sunflower
	<i>Helianthus divaricatus</i>	woodland sunflower
	<i>Hieracium paniculatum</i>	Allegheny hawkweed
	<i>Hieracium venosum</i>	rattlesnakeweed
	<i>Krigia dandelion</i>	potato dwarf dandelion
	<i>Lactuca canadensis</i>	Canada lettuce
	<i>Lactuca floridana</i>	woodland lettuce
	<i>Leucanthemum vulgare</i>	oxeye daisy <sup>c</sup>
	<i>Prenanthes altissima</i>	tall rattlesnakeroot
	<i>Solidago bicolor</i>	white goldenrod
	<i>Solidago caesia</i>	wreath goldenrod
	<i>Solidago juncea</i>	early goldenrod
	<i>Solidago rugosa</i>	wrinkleleaf goldenrod
	<i>Solidago speciosa</i> var. <i>speciosa</i>	showy goldenrod
	<i>Symphyotrichum cordifolium</i>	common blue wood aster
	<i>Symphyotrichum lateriflorum</i>	calico aster
	<i>Symphyotrichum undulatum</i>	waxy leaf aster
	<i>Taraxacum officinale</i>	common dandelion <sup>c</sup>
	<i>Verbesina alternifolia</i>	wingstem
	Balsaminaceae	<i>Impatiens capensis</i>

USGS-NPS Vegetation Mapping Program  
 Appomattox Court House National Historical Park

Family	Scientific Name	Common Name
Berberidaceae	<i>Podophyllum peltatum</i>	mayapple
Betulaceae	<i>Alnus serrulata</i>	hazel alder
	<i>Carpinus caroliniana</i>	American hornbeam
	<i>Corylus americana</i>	American hazelnut
Bignoniaceae	<i>Campsis radicans</i>	trumpet creeper
Boraginaceae	<i>Myosotis macrosperma</i>	largeseed forget-me-not
Brassicaceae	<i>Cardamine hirsuta</i>	hairy bittercress <sup>c</sup>
	<i>Cardamine pensylvanica</i>	Pennsylvania bittercress
Caprifoliaceae	<i>Lonicera japonica</i>	Japanese honeysuckle <sup>ch</sup>
	<i>Sambucus nigra</i> ssp. <i>canadensis</i>	common elderberry
	<i>Symphoricarpos orbiculatus</i>	coralberry
	<i>Viburnum acerifolium</i>	mapleleaf viburnum
	<i>Viburnum dentatum</i>	southern arrowwood
	<i>Viburnum prunifolium</i>	blackhaw
Caryophyllaceae	<i>Stellaria media</i>	common chickweed
	<i>Stellaria pubera</i>	star chickweed
Celastraceae	<i>Euonymus americana</i>	strawberry bush
Clusiaceae	<i>Hypericum hypericoides</i> ssp. <i>multicaule</i>	St. Andrew's cross
	<i>Hypericum punctatum</i>	spotted St. Johnswort
Commelinaceae	<i>Commelina</i> sp.	a dayflower
Convolvulaceae	<i>Ipomoea pandurata</i>	man of the earth
Cornaceae	<i>Cornus amomum</i>	silky dogwood
	<i>Cornus florida</i>	flowering dogwood
Cupressaceae	<i>Juniperus virginiana</i> var. <i>virginiana</i>	eastern redcedar
Cyperaceae	<i>Carex albicans</i> var. <i>australis</i>	stellate sedge
	<i>Carex amphibola</i>	eastern narrowleaf sedge
	<i>Carex blanda</i>	eastern woodland sedge
	<i>Carex crinita</i>	fringed sedge
	<i>Carex digitalis</i>	slender woodland sedge
	<i>Carex festucacea</i>	fescue sedge
	<i>Carex glaucoidea</i>	blue sedge
	<i>Carex gracillima</i>	graceful sedge
	<i>Carex hirsutella</i>	fuzzy wuzzy sedge
	<i>Carex laevivaginata</i>	smoothsheath sedge
	<i>Carex laxiculmis</i> var. <i>laxiculmis</i>	spreading sedge
	<i>Carex laxiflora</i> var. <i>laxiflora</i>	broad looseflower sedge
	<i>Carex normalis</i>	greater straw sedge
	<i>Carex radiata</i>	eastern star sedge
	<i>Carex rosea</i>	rosy sedge
	<i>Carex squarrosa</i>	squarrose sedge
	<i>Carex striatula</i>	lined sedge
	<i>Carex styloflexa</i>	bent sedge
	<i>Carex swanii</i>	Swan's sedge
	<i>Carex trichocarpa</i>	hairyfruit sedge
	<i>Carex typhina</i>	cattail sedge
	<i>Schoenoplectus purshianus</i>	weakstalk bulrush
	<i>Scirpus cyperinus</i>	woolgrass
Dennstaedtiaceae	<i>Dennstaedtia punctilobula</i>	eastern hayscented fern
Dioscoreaceae	<i>Dioscorea oppositifolia</i>	Chinese yam <sup>ch</sup>
	<i>Dioscorea quaternata</i>	fourleaf yam
Dryopteridaceae	<i>Athyrium filix-femina</i>	common ladyfern
	<i>Onoclea sensibilis</i>	sensitive fern
	<i>Polystichum acrostichoides</i>	Christmas fern
Ebenaceae	<i>Diospyros virginiana</i>	common persimmon
Ericaceae	<i>Kalmia latifolia</i>	mountain laurel

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Family	Scientific Name	Common Name
Ericaceae (cont.)	<i>Oxydendrum arboreum</i>	sourwood
	<i>Rhododendron periclymenoides</i>	pink azalea
	<i>Vaccinium fuscatum</i>	black highbush blueberry
	<i>Vaccinium pallidum</i>	Blue Ridge blueberry
	<i>Vaccinium stamineum</i>	deerberry
Euphorbiaceae	<i>Euphorbia corollata</i>	flowering spurge
Fabaceae	<i>Amphicarpaea bracteata</i>	American hogpeanut
	<i>Cercis canadensis</i> var. <i>canadensis</i>	eastern redbud
	<i>Chamaecrista nictitans</i>	partridge pea
	<i>Desmodium nudiflorum</i>	nakedflower ticktrefoil
	<i>Desmodium paniculatum</i> var. <i>paniculatum</i>	panickedleaf ticktrefoil
	<i>Desmodium rotundifolium</i>	prostrate ticktrefoil
	<i>Gleditsia triacanthos</i>	honeylocust
	<i>Lespedeza cuneata</i>	Chinese lespedeza <sup>e#</sup>
	<i>Lespedeza hirta</i> ssp. <i>hirta</i>	hairy lespedeza
	<i>Lespedeza violacea</i>	violet lespedeza
	<i>Medicago lupulina</i>	black medick <sup>c</sup>
	<i>Robinia pseudoacacia</i>	black locust
	<i>Trifolium campestre</i>	field clover <sup>c</sup>
	<i>Trifolium repens</i>	white clover <sup>c</sup>
	<i>Vicia sativa</i> ssp. <i>nigra</i>	garden vetch <sup>c</sup>
Fagaceae	<i>Castanea dentata</i>	American chestnut
	<i>Fagus grandifolia</i>	American beech
	<i>Quercus alba</i>	white oak
	<i>Quercus coccinea</i>	scarlet oak
	<i>Quercus falcata</i>	southern red oak
	<i>Quercus marilandica</i>	blackjack oak
	<i>Quercus phellos</i>	willow oak
	<i>Quercus prinus</i>	chestnut oak
	<i>Quercus rubra</i>	northern red oak
	<i>Quercus stellata</i>	post oak
<i>Quercus velutina</i>	black oak	
Geraniaceae	<i>Geranium maculatum</i>	spotted geranium
Hamamelidaceae	<i>Hamamelis virginiana</i>	American witchhazel
	<i>Liquidambar styraciflua</i>	sweetgum
Hydrophyllaceae	<i>Hydrophyllum virginianum</i>	Shawnee salad
Iridaceae	<i>Hypoxis hirsuta</i>	common goldstar
	<i>Sisyrinchium angustifolium</i>	narrowleaf blue-eyed grass
Juglandaceae	<i>Carya alba</i>	mockernut hickory
	<i>Carya glabra</i>	pignut hickory
	<i>Carya ovalis</i>	red hickory
	<i>Carya ovata</i>	shagbark hickory
	<i>Juglans nigra</i>	black walnut
Juncaceae	<i>Juncus effusus</i>	common rush
	<i>Luzula echinata</i>	hedgehog woodrush
Lamiaceae	<i>Collinsonia canadensis</i>	richweed
	<i>Lycopus virginicus</i>	Virginia water horehound
	<i>Salvia lyrata</i>	lyreleaf sage
	<i>Scutellaria elliptica</i>	hairy skullcap
	<i>Scutellaria integrifolia</i>	helmet flower
Lauraceae	<i>Scutellaria serrata</i>	showy skullcap
	<i>Lindera benzoin</i>	northern spicebush
	<i>Sassafras albidum</i>	sassafras
Liliaceae	<i>Allium vineale</i>	wild garlic <sup>e#</sup>
	<i>Chamaelirium luteum</i>	fairywand

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Family	Scientific Name	Common Name
	<i>Hemerocallis fulva</i>	orange daylily <sup>c</sup>
Liliaceae (cont.)	<i>Maianthemum racemosum</i> ssp. <i>racemosum</i>	feathery false lily of the vally
	<i>Polygonatum biflorum</i>	smooth Solomon's seal
	<i>Uvularia perfoliata</i>	perfoliate bellwort
Lycopodiaceae	<i>Lycopodium digitatum</i>	fan clubmoss
Magnoliaceae	<i>Liriodendron tulipifera</i>	tuliptree
Moraceae	<i>Morus rubra</i>	red mulberry
Nyssaceae	<i>Nyssa sylvatica</i>	blackgum
Oleaceae	<i>Chionanthus virginicus</i>	white fringetree
	<i>Fraxinus americana</i>	white ash
	<i>Fraxinus pennsylvanica</i>	green ash
	<i>Ligustrum obtusifolium</i>	border privet <sup>e#</sup>
	<i>Ligustrum sinense</i>	Chinese privet <sup>e#</sup>
Onagraceae	<i>Circaea lutetiana</i> ssp. <i>canadensis</i>	broadleaf enchanter's nightshade
Ophioglossaceae	<i>Botrychium virginianum</i>	rattlesnake fern
	<i>Ophioglossum vulgatum</i>	southern adderstongue
Orchidaceae	<i>Aplectrum hyemale</i>	Adam and Eve
	<i>Goodyera pubescens</i>	downy rattlesnake plantain
	<i>Liparis liliifolia</i>	brown widelip orchid
Orobanchaceae	<i>Conopholis americana</i>	American squawroot
	<i>Epifagus virginiana</i>	beechnuts
Osmundaceae	<i>Osmunda cinnamomea</i> var. <i>cinnamomea</i>	cinnamon fern
	<i>Osmunda regalis</i> var. <i>spectabilis</i>	royal fern
Oxalidaceae	<i>Oxalis stricta</i>	common yellow oxalis
	<i>Oxalis violacea</i>	violet woodsorrel
Papaveraceae	<i>Sanguinaria canadensis</i>	bloodroot
Pinaceae	<i>Pinus taeda</i>	loblolly pine
	<i>Pinus virginiana</i>	Virginia pine
Plantaginaceae	<i>Plantago lanceolata</i>	narrowleaf plantain <sup>c</sup>
	<i>Plantago rugelii</i>	blackseed plantain
Platanaceae	<i>Platanus occidentalis</i>	American sycamore
Poaceae	<i>Agrostis perennans</i>	upland bentgrass
	<i>Andropogon virginicus</i>	broomsedge bluestem
	<i>Anthoxanthum odoratum</i>	sweet vernalgrass <sup>c</sup>
	<i>Brachyelytrum erectum</i>	bearded shorthusk
	<i>Bromus inermis</i>	smooth brome <sup>c</sup>
	<i>Bromus pubescens</i>	hairy woodland brome
	<i>Cinna arundinacea</i>	sweet woodreed
	<i>Dactylis glomerata</i>	orchardgrass <sup>e#</sup>
	<i>Danthonia spicata</i>	poverty oatgrass
	<i>Dichanthelium boscii</i>	Bosc's panicgrass
	<i>Dichanthelium clandestinum</i>	deertongue
	<i>Dichanthelium dichotomum</i>	cypress panicgrass
	<i>Elymus hystrix</i> var. <i>hystrix</i>	eastern bottlebrush grass
	<i>Elymus virginicus</i> var. <i>virginicus</i>	Virginia wildrye
	<i>Festuca rubra</i>	red fescue
	<i>Festuca subverticillata</i>	nodding fescue
	<i>Glyceria striata</i>	fowl mannagrass
	<i>Leersia virginica</i>	whitegrass
	<i>Lolium arundinaceum</i>	tall fescue <sup>c</sup>
	<i>Lolium pratense</i>	meadow ryegrass <sup>e#</sup>
	<i>Microstegium vimineum</i>	Nepalese browntop <sup>e#</sup>
	<i>Poa autumnalis</i>	autumn bluegrass
	<i>Poa compressa</i>	Canada bluegrass <sup>e#</sup>
	<i>Poa cuspidata</i>	early bluegrass

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Family	Scientific Name	Common Name	
	<i>Poa pratensis</i>	Kentucky bluegrass	
Poaceae (cont.)	<i>Tridens flavus</i>	purpletop tridens	
Polygonaceae	<i>Polygonum arifolium</i>	halberdleaf tearthumb	
	<i>Polygonum caespitosum</i> var. <i>longisetum</i>	oriental ladysthumb <sup>e#</sup>	
	<i>Polygonum convolvulus</i>	black bindweed	
	<i>Polygonum virginianum</i>	jumpseed	
Primulaceae	<i>Lysimachia ciliata</i>	fringed loosestrife	
	<i>Lysimachia quadrifolia</i>	whorled yellow loosestrife	
Pteridaceae	<i>Adiantum pedatum</i>	northern maidenhair	
Pyrolaceae	<i>Chimaphila maculata</i>	striped prince's pine	
	<i>Chimaphila umbellata</i> ssp. <i>cisatlantica</i>	pipsissewa	
Ranunculaceae	<i>Cimicifuga racemosa</i>	black bugbane	
	<i>Clematis virginiana</i>	devil's darning needles	
	<i>Hepatica nobilis</i> var. <i>obtusata</i>	roundlobe hepatica	
	<i>Ranunculus abortivus</i>	littleleaf buttercup	
	<i>Ranunculus bulbosus</i>	St. Anthony's turnip <sup>c</sup>	
	<i>Ranunculus recurvatus</i>	blisterwort	
	<i>Thalictrum thalictroides</i>	rue anemone	
	Rosaceae	<i>Agrimonia parviflora</i>	harvestlice
		<i>Agrimonia rostellata</i>	beaked agrimony
		<i>Amelanchier arborea</i>	common serviceberry
<i>Amelanchier stolonifera</i>		running serviceberry	
<i>Duchesnea indica</i>		Indian strawberry <sup>c</sup>	
<i>Geum canadense</i>		white avens	
<i>Geum virginianum</i>		cream avens	
<i>Malus</i> sp.		an Apple	
<i>Potentilla canadensis</i>		dwarf cinquefoil	
<i>Prunus americana</i>		American plum	
<i>Prunus serotina</i> var. <i>serotina</i>		black cherry	
<i>Rosa carolina</i> var. <i>carolina</i>		Carolina rose	
<i>Rosa multiflora</i>		multiflora rose <sup>e#</sup>	
<i>Rosa palustris</i>		swamp rose	
<i>Rubus argutus</i>		sawtooth blackberry	
<i>Rubus flagellaris</i>	northern dewberry		
<i>Rubus occidentalis</i>	black raspberry		
<i>Rubus pensilvanicus</i>	Pennsylvania blackberry		
Rubiaceae	<i>Cephalanthus occidentalis</i>	common buttonbush	
	<i>Galium aparine</i>	stickywilly	
	<i>Galium circaezans</i>	licorice bedstraw	
	<i>Galium triflorum</i>	fragrant bedstraw	
	<i>Houstonia caerulea</i>	azure bluet	
	<i>Houstonia purpurea</i> var. <i>purpurea</i>	Venus' pride	
Saxifragaceae	<i>Heuchera americana</i>	American alumroot	
	<i>Tiarella cordifolia</i>	heartleaf foamflower	
Scrophulariaceae	<i>Aureolaria virginica</i>	downy yellow false foxglove	
	<i>Chelone glabra</i>	white turtlehead	
	<i>Paulownia tomentosa</i>	princesstree <sup>e#</sup>	
	<i>Penstemon laevigatus</i>	eastern smooth beardtongue	
	<i>Veronica arvensis</i>	corn speedwell <sup>c</sup>	
Simaroubaceae	<i>Ailanthus altissima</i>	tree of heaven <sup>e#</sup>	
Smilacaceae	<i>Smilax glauca</i>	cat greenbrier	
	<i>Smilax herbacea</i>	smooth carrionflower	
	<i>Smilax pulverulenta</i>	downy carrionflower	
	<i>Smilax rotundifolia</i>	roundleaf greenbrier	
Sparganiaceae	<i>Sparganium americanum</i>	American bur-reed	

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Family	Scientific Name	Common Name
Thelypteridaceae	<i>Thelypteris noveboracensis</i>	New York fern
Ulmaceae	<i>Celtis occidentalis</i>	common hackberry
	<i>Ulmus alata</i>	winged elm
	<i>Ulmus americana</i>	American elm
	<i>Ulmus rubra</i>	slippery elm
Urticaceae	<i>Boehmeria cylindrica</i>	smallspike false nettle
	<i>Pilea pumila</i>	Canadian clearweed
Verbenaceae	<i>Phryma leptostachya</i>	American lopseed
Violaceae	<i>Viola palmata</i>	early blue violet
	<i>Viola sororia</i>	common blue violet
Vitaceae	<i>Ampelopsis brevipedunculata</i>	Amur peppervine <sup>e#</sup>
	<i>Parthenocissus quinquefolia</i>	Virginia creeper
	<i>Vitis aestivalis</i>	summer grape
	<i>Vitis rotundifolia</i>	muscadine
	<i>Vitis vulpina</i>	frost grape

<sup>e</sup> Species not native to Virginia.

<sup>#</sup> Species considered to be invasive nonnative species by the VADCR (VADCR 2003).

Appendix D. Distribution of vegetation classes, derived from the analysis of regional quantitative plot data, across seven national parks in Virginia.

Vegetation was classified and mapped in seven national park units in Virginia: Appomattox Court House National Historical Park (APCO), Booker T. Washington National Monument (BOWA), Colonial National Historical Park (COLO), Fredericksburg and Spotsylvania National Military Park (FRSP), George Washington Birthplace National Monument (GEWA), Petersburg National Battlefield (PETE), and Richmond National Battlefield Park (RICH). The classification used to map these parks was developed regionally, using quantitative data that were collected from all seven parks and combined with existing data from throughout the Mid-Atlantic Piedmont and Coastal Plain. Quantitative analysis classified 35 associations occurring in the seven parks. An additional 19 associations and 12 nonstandard park-specific vegetation classes representing disturbed, cultural, or exotic vegetation were also recognized from the seven parks, but were not represented by quantitative data. The relationship of all vegetation classes to the map classes used to map Appomattox Court House National Historical Park can be found in Table 11 of the main report. Vegetation classes listed with USNVC codes are equivalent to associations in the United States National Vegetation Classification (NatureServe 2007). Global and state conservation ranks are defined in Appendix E.

Appendix D. Distribution of vegetation classes across seven national parks in Virginia.

	USNVC code	Global/State Conservation Ranks	BOWA	APCO	FRSP	RICH	PETE	COLO	GEWA	Plots in regional analysis
<b>UPLAND FORESTS</b>										
<b>Oak / Heath Forests</b>										<b>93</b>
Coastal Plain Mixed Oak / Heath Forest	CEGL006269	G4G5/S4			x	x	x			18
Piedmont / Low Elevation Mixed Oak / Heath Forest	CEGL008521	G5/S5		x	x			x		75
<b>Pine - Oak Forests</b>										<b>25</b>
Coastal Plain Loblolly Pine - Oak Forest	CEGL004766	GNR/SNR						x		8
Eastern White Pine - Hardwood Forest	CEGL008539	G4/S4?			x					17
<b>Mesic Acidic Forests</b>										<b>196</b>
Mesic Mixed Hardwood Forest	CEGL006075	G5/S5		x	x	x	x	x		170
Piedmont / Coastal Plain Oak - Beech / Heath Forest	CEGL006919	GNR/SNR						x		26
<b>Oak - Hickory Forests</b>										<b>137</b>
Acidic Oak - Hickory Forest	CEGL008475	G4G5/S4	x	x	x	x	x	x		121
Basic Oak - Hickory Forest	CEGL007232	G3G4/S3		x						16
<b>Basic Mesic and Calcareous Forests</b>										<b>77</b>
Inner Piedmont / Lower Blue Ridge Basic Mesic Forest	CEGL006186	G4/S4	x	x						31
Coastal Plain Mesic Calcareous Ravine Forest	CEGL007181	G2/S2						x		22
Coastal Plain Dry Calcareous Forest	CEGL007748	G1/S1						x	x	24
<b>NON-TIDAL WETLANDS</b>										
<b>Seepage Wetlands</b>										<b>72</b>
Coastal Plain / Piedmont Acidic Seepage Swamp	CEGL006238	G3/S3?			x	x	x		x	39
Northern Piedmont / Lower New England Basic Seepage Swamp	CEGL006406	G4G5/S2?		x						18
Coastal Plain Calcareous Seepage Swamp	CEGL006413	G2/S1S2						x		15
<b>Alluvial Forests</b>										<b>100</b>
Coastal Plain / Piedmont Small-Stream Floodplain Forest	CEGL004418	G4/S4			x	x	x	x		48
Piedmont / Mountain Alluvial Forest	CEGL006492	G4/S4	x	x						14
Piedmont / Mountain Floodplain Forest	CEGL006217	G4/S4			x					38
<b>Swamp Forests</b>										<b>70</b>
Coastal Plain / Piedmont Floodplain Swamp Forest (Mixed Oak - Red Maple Type)	CEGL006605	G3G4/S3			x		x			47
Coastal Plain / Piedmont Floodplain Swamp Forest (Green Ash - Red Maple Type)	CEGL006606	GNR/SNR						x		23
<b>Nonriverine Forests</b>										<b>62</b>
Upland Depression Swamp	CEGL007403	G2G3/S2		x						9
Coastal Plain Depression Wetland (Red Maple - Sweetgum - Willow Oak Type)	CEGL006110	G4G5/S3			x			x		14
Coastal Plain Depression Wetland (Swamp Tupelo Type)	CEGL006223	G2S2						x		18
Non-Riverine Saturated Forest	CEGL004644	G2/S2			x	x		x	x	21
<b>TIDAL WETLANDS</b>										
<b>Tidal Herbaceous Marshes</b>										<b>133</b>
Tidal Freshwater Marsh	CEGL004706	G3G4/SNR						x		18
Tidal Mesohaline and Polyhaline Marsh (Low Salt Marsh)	CEGL006586	GNR/SNR						x	x	13
Tidal Mesohaline and Polyhaline Marsh (Transitional Marsh)	CEGL006418	GNR/SNR						x		18
Tidal Oligohaline Marsh (Common Reed Tidal Marsh)	CEGL004187	GNA/SNA						x	x	7
Tidal Oligohaline Marsh (Interior Depression Marsh)	CEGL006578	GNR/SNR						x		13
Tidal Oligohaline Marsh (Big Cordgrass Type)	CEGL004195	G4/SNR						x	x	18
Tidal Oligohaline Marsh (Mixed Forbs Type)	CEGL006181	GNR/SNR						x	x	32
Tidal Oligohaline Marsh (Saltmeadow Cordgrass - Olney Three-Square Low Interior Marsh Type)	CEGL006612	GNR/SNR						x		14
<b>Tidal Forests and Shrublands</b>										<b>97</b>
Salt Scrub	CEGL003921	G5/SNR						x		13
Tidal Shrub Swamp (Iva Type)	CEGL006848	G5/SNR							x	30
Tidal Shrub Swamp (Wax Myrtle Type)	CEGL004656	G4/SNR						x		49
Tidal Bald Cypress Forest / Woodland	CEGL004654	G2S2						x		5

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	USNVC code	Global/State Conservation Ranks	BOWA	APCO	FRSP	RICH	PETE	COLO	GEWA	Plots in regional analysis
<b>DISTURBED, CULTURAL, EXOTIC VEGETATION</b>										
<b>Upland Forests and Shrublands</b>										
Dense Hardwood Regeneration	nonstandard		x	x				x		0
Disturbed Acidic Slope Forest	CEGL007726	GNA/SNA							x	0
Disturbed Calcareous Forest	nonstandard						x	x	x	0
Early-Successional Loblolly Pine Forest	CEGL006011	GNA/SNA					x		x	0
Golden Bamboo Shrubland	CEGL008560	GNA/SNA						x		0
Loblolly Pine - Hardwood Forest	CEGL008462	GNA/SNA				x	x		x	0
Loblolly Pine Plantation	CEGL007179	GNA/SNA		x	x	x	x	x	x	0
Successional Black Locust Forest	CEGL007279	GNA/SNA							x	0
Successional Black Walnut Forest	CEGL007879	GNA/SNA		x		x		x		0
Successional Mixed Scrub	nonstandard				x	x	x	x		0
Successional Red-cedar Forest	CEGL006024	GNA/SNA		x	x	x			x	0
Successional Sweetgum Forest	CEGL007216	GNA/SNA					x	x	x	0
Successional Tree-of-Heaven Forest	CEGL007191	GNA/SNA		x				x		0
Successional Tuliptree - Loblolly Pine Forest	CEGL007521	GNA/SNA						x		0
Successional Tuliptree Forest	CEGL007221	GNA/SNA	x	x	x	x	x			0
Successional Virginia Pine Forest	CEGL002591	GNA/SNA	x	x	x					0
Virginia Pine Plantation	CEGL004730	GNA/SNA		x						0
White Pine Plantation	CEGL007178	GNA/SNA	x							0
<b>Wetland Vegetation</b>										
Beaver Wetland Complex	CEGL005082	G4G5/SNR		x	x	x	x			0
Successional River Birch - Red Maple Floodplain Forest	CEGL006976	GNR/SNR			x					0
Successional Tuliptree Floodplain Forest	CEGL007330	GNA/SNA			x					0
Disturbed Depressional Wetland	nonstandard							x		0
Disturbed Seepage Swamp	nonstandard							x		0
Disturbed Tidal Hardwood Swamp	nonstandard							x		0
Non-Riverine Saturated Forest - pine subtype	nonstandard					x				0
Successional Shrub Swamp	nonstandard					x				0
<b>Cultural Vegetation</b>										
Cultural Meadow	CEGL006107	GNA/SNA	x	x	x	x	x	x	x	0
Forested Earthworks	nonstandard					x	x			0
Grazed Woodlot	nonstandard			x						0
Open Earthworks	nonstandard					x	x			0
Semipermanent Impoundment	nonstandard				x		x	x	x	0

## Appendix E. Definitions of global and subnational (state) conservation ranks.

NatureServe and the Network of Natural Heritage Programs and Conservation Data Centers work together to assign conservation status ranks to elements of biodiversity (plants, animals, and ecological communities). These ranks have been developed using range-wide data collected by the Natural Heritage Network for nearly three decades and are critical in setting conservation priorities. Community types are ranked on a global (G), national (N), and subnational (S) scale of 1 to 5, with 1 indicating critical imperilment due to rarity, endemism, and/or threats, and 5 indicating little or no risk of extirpation or elimination.

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

Additional factors have been used in arriving at an assessment of a community's range-wide (global) rank include the geographic range over which the type occurs, the long term decline of the type across this range, the degree of site specificity exhibited by the type, and the rarity across the range based on state ranks assigned by state Natural Heritage Programs.

To learn more about Natural Heritage Methodology, go to <http://www.natureserve.org/prodServices/heritagemethodology.jsp>.

### Global Rank Codes and Definitions

Global ranks (i.e. range-wide conservation status ranks) are assigned at NatureServe's Headquarters or by a designated lead office in the Heritage/Conservation Data Center Network.

**GX - Extirpated** - Eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic species.

**GH - Historical** - Presumed eliminated throughout its range, with no or virtually no likelihood that it will be rediscovered, but with potential for restoration (e.g., *Castanea dentata* Forest)

**G1 - Critically Imperiled** - Critically imperiled globally. Generally 5 or fewer occurrences and/or very few remaining acres or very vulnerable to elimination throughout its range due to other factor(s)

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

**G3 - Vulnerable** - Rare or uncommon. Generally 21-100 occurrences; either very rare and local throughout its range or found locally, even abundantly, within a restricted range or vulnerable to elimination throughout its range due to specific factor(s)

**G4 - Apparently Secure** - Uncommon but not rare. Apparently secure, but with cause for long-term concern. May be quite rare in parts of its range, especially at the periphery; apparently not vulnerable in most of its range

**G5 - Secure** - Demonstrably widespread, abundant and secure. Common, widespread, and abundant, although it may be quite rare in parts of its range, especially at the periphery; not vulnerable in most of its range

**GNA - Rank not applicable** – Common cultural, ruderal, planted, modified, managed, invasive, and/or non-natural type that is not a suitable target for conservation activities.

**GNR - Not Yet Ranked** – Status has not yet been assessed

**GU - Unrankable** - Status cannot be determined at this time

**G#G# - Rank Range** – The actual rank of the element is within the range specified by the numbers, however the exact status of the rarity of the element is uncertain. For example, G2G3 indicates that the rank may be either G2 or G3.

### State Rank Codes and Definitions

State ranks are assigned by the Virginia Division of Natural Heritage and apply to an element only as it exists in each state, regardless of its range-wide status.

**SX - Extirpated** - Presumed extirpated from the state. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

**SH - Historical** - Possibly extirpated (Historical). Historically known from the state, but not verified for an extended period, usually > 15 years; this rank is used primarily when inventory has been attempted recently.

**S1 - Critically Imperiled** - Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state; generally with 5 or fewer occurrences state-wide, and/or covering less than 50 ha (124 ac) in aggregate; or covering larger area but highly threatened with destruction or modification.

**S2 - Imperiled** - Imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state. Generally with 6 to 20 occurrences state-wide, and/or covering less than 250 ha (618 ac) in aggregate; or covering larger area but threatened with destruction or modification.

**S3 - Vulnerable** - Vulnerable in the state either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Generally with 21 to 100 occurrences state-wide; or with a larger number of occurrences subject to relatively high levels of threat; may be of relatively frequent occurrence in specific localities or geographic parts of the state.

**S4 - Apparently Secure** - Uncommon but not rare, and usually widespread in the state. Some cause for long-term concern due to declines or other factors.

**S5 - Secure** - Demonstrably widespread, abundant, and secure in the state, and essentially ineradicable under present conditions.

**SNA - Rank not applicable** – Common cultural, ruderal, planted, modified, managed, invasive, and/or non-natural type that is not a suitable target for conservation activities.

**SNR - Not Ranked** – Status has not yet been assessed. As the state vegetation classifications are further revised by additional information, the SNR will be changed to a numeric rank based on available data.

**SU - Unrankable**; Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

**S#S# - Rank Range** – The actual rank of the element is within the range specified by the numbers, however the exact status of the rarity of the element is uncertain. For example, S1S3 indicates that the rank may be either S1, S2, or S3.

### **Global and State Rank Qualifiers**

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

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

Appendix F. Environmental variable averages for associations derived from the analysis of regional quantitative plot data.

Mean values for selected continuous and ordinal environmental variables were calculated for the 35 associations occurring in seven national parks in Virginia that were derived from the analysis of quantitative plot data. Calculations were performed with raw (untransformed) values by taking the average across all plots representing a given association. Environmental variables were only summarized if at least half the plots in a given association contained data; otherwise the table cells are shaded. Mean aspect was calculated as the average position along an arc defined by the range of aspect values. Topographic variables and percentage substrate are presented in a separate table from soil chemistry variables.

Column headings are as follows:

Topographic variables

- Aspect
- Slope Inclination (see Table 4)
- Topographic Position (see Table 4)
- TRMI = Topographic Relative Moisture Index

Percentage substrate

- %Bedrock = percentage cover by bedrock in plot
- %Large Rocks = percentage cover by boulders and stones (rocks > 10 cm) in plot
- %Small Rocks = percentage cover by gravel and cobble (rocks 0.2 - 10 cm) in plot
- %Min. Soil = percentage cover by bare sand or mineral soil in plot
- %Litter&Duff = percentage cover by leaf litter and duff in plot
- %Wood = percentage cover by dead wood in plot
- %Water = percentage cover by water in plot
- %NonVasc = percentage cover by nonvascular plants in plot

Soil chemistry variables are as defined in Table 5.

Associations present in Appomattox Court House National Historical Park are listed in bold font.

Table F1. Environmental variable averages by association – topographic variables and percentage substrate.

	USNVC code	Aspect	Slope Inclination	Topographic Position	TRMI	% Bedrock	% Large Rocks	% Small Rocks	% Min. Soil	% Litter & Duff	% Wood	% Water	% NonVasc
<b>Oak / Heath Forests</b>													
Coastal Plain Mixed Oak / Heath Forest	CEGL006269	flat to SW	gentle to moderate	lower to middle slope	26.7	0	0	0	6	91	3	0	1
<b>Piedmont / Low Elevation Mixed Oak / Heath Forest</b>	<b>CEGL008521</b>	<b>S</b>	<b>gentle</b>	<b>upper slope</b>	<b>24.6</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>94</b>	<b>4</b>	<b>0</b>	<b>0</b>
<b>Pine - Oak Forests</b>													
Coastal Plain Loblolly Pine - Oak Forest	CEGL004766	flat	level to gentle	plain/level/bottom - lower slope	31.5	0	0	0	1	96	4	0	1
Eastern White Pine - Hardwood Forest	CEGL008539	NNW	moderate to steep	middle slope	25.9	<1	2	<1	1	95	2	0	3
<b>Mesic Acidic Forests</b>													
<b>Mesic Mixed Hardwood Forest</b>	<b>CEGL006075</b>	<b>NNE</b>	<b>moderate</b>	<b>lower to middle slope</b>	<b>29.7</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>94</b>	<b>3</b>	<b>0</b>	<b>1</b>
Piedmont / Coastal Plain Oak – Beech / Heath Forest	CEGL006919	N	steep	middle slope	26.4	0	0	0	2	95	3	0	4
<b>Oak - Hickory Forests</b>													
<b>Acidic Oak - Hickory Forest</b>	<b>CEGL008475</b>	<b>WSW</b>	<b>moderate</b>	<b>middle slope</b>	<b>25.5</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>91</b>	<b>3</b>	<b>0</b>	<b>3</b>
<b>Basic Oak - Hickory Forest</b>	<b>CEGL007232</b>	<b>S</b>	<b>gentle to moderate</b>	<b>lower to middle slope</b>	<b>26.5</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>7</b>	<b>87</b>	<b>3</b>	<b>0</b>	<b>1</b>
<b>Basic Mesic and Calcareous Forests</b>													
<b>Inner Piedmont / Lower Blue Ridge Basic Mesic Forest</b>	<b>CEGL006186</b>	<b>ESE</b>	<b>steep</b>	<b>middle slope</b>	<b>32.6</b>	<b>1</b>	<b>10</b>	<b>0</b>	<b>2</b>	<b>82</b>	<b>5</b>	<b>0</b>	<b>7</b>
Coastal Plain Mesic Calcareous Ravine Forest	CEGL007181	NE	moderate to steep	lower to middle slope	27.2	0	0	0	9	89	2	0	4
Coastal Plain Dry Calcareous Forest	CEGL007748	S	moderate to steep	middle to upper slope	19.4	0	0	0	15	79	5	1	0
<b>Seepage Wetlands</b>													
Coastal Plain / Piedmont Acidic Seepage Swamp	CEGL006238	flat	level to gentle	plain/level/bottom	38.2	0	0	0	3	85	3	9	13
<b>Northern Piedmont / Lower New England Basic Seepage Swamp</b>	<b>CEGL006406</b>	<b>flat</b>	<b>level to gentle</b>	<b>plain/level/bottom - toe slope</b>	<b>37.6</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>15</b>	<b>68</b>	<b>3</b>	<b>6</b>	<b>1</b>
Coastal Plain Calcareous Seepage Swamp	CEGL006413	flat	level	plain/level/bottom	40.8	1	0	0	5	89	2	4	2
<b>Alluvial Forests</b>													
Coastal Plain / Piedmont Small-Stream Floodplain Forest	CEGL004418	flat	level	plain/level/bottom	40.5	0	0	0	2	93	3	2	1
<b>Piedmont / Mountain Alluvial Forest</b>	<b>CEGL006492</b>	<b>flat</b>	<b>level</b>	<b>plain/level/bottom</b>	<b>41.2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>14</b>	<b>82</b>	<b>4</b>	<b>0</b>	<b>0</b>
Piedmont / Mountain Floodplain Forest	CEGL006217	flat	level to gentle	plain/level/bottom	41.6	0	<1	0	39	58	3	0	<1
<b>Swamp Forests</b>													
Coastal Plain / Piedmont Floodplain Swamp Forest (Mixed Oak – Red Maple Type)	CEGL006605	flat	level to basin / depression	plain/level/bottom	40.0	0	0	0	7	88	4	1	2
Coastal Plain / Piedmont Floodplain Swamp Forest (Green Ash – Red Maple Type)	CEGL006606	flat	level to basin / depression	plain/level/bottom	40.4	0	0	0	15	72	2	11	1

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	USNVC code	Aspect	Slope Inclination	Topographic Position	TRMI	% Bedrock	% Large Rocks	% Small Rocks	% Min. Soil	% Litter & Duff	% Wood	% Water	% NonVasc
<b>Nonriverine Forests</b>													
<b>Upland Depression Swamp</b>	<b>CEGL007403</b>	<b>flat</b>	<b>level to basin / depression</b>	<b>various</b>	<b>35.1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>92</b>	<b>5</b>	<b>2</b>	<b>3</b>
Coastal Plain Depression Wetland (Red Maple – Sweetgum – Willow Oak Type)	CEGL006110	flat	level to basin / depression	various	37.1	0	0	0	4	86	4	6	16
Coastal Plain Depression Wetland (Swamp Tupelo Type)	CEGL006223	flat	level to basin / depression	basin/depression	40.0	0	0	0	1	98	2	0	0
Non-Riverine Saturated Forest	CEGL004644	flat	level	plain/level/bottom	40.0	0	0	0	1	89	7	3	4
<b>Tidal Marshes</b>													
Tidal Freshwater Marsh	CEGL004706	flat	level to gentle	plain/level/bottom	40.0	0	0	0	62	19	0	19	0
Tidal Mesohaline and Polyhaline Marsh (Low Salt Marsh)	CEGL006586	flat	level	plain/level/bottom	40.0	0	0	0	14	17	0	69	0
Tidal Mesohaline and Polyhaline Marsh (Transitional Marsh)	CEGL006418	flat	level to gentle	plain/level/bottom	40.0	0	0	0	43	28	0	28	0
Tidal Oligohaline Marsh (Common Reed Tidal Marsh)	CEGL004187	flat	level	plain/level/bottom	40.0								
Tidal Oligohaline Marsh (Interior Depression Marsh)	CEGL006578	flat	level	plain/level/bottom	40.0	0	0	0	25	67	0	8	0
Tidal Oligohaline Marsh (Big Cordgrass Type)	CEGL004195	flat	level	plain/level/bottom	40.0								
Tidal Oligohaline Marsh (Mixed Forbs Type)	CEGL006181	flat	level	plain/level/bottom	40.0	0	0	0	20	53	0	27	0
<b>Tidal Marshes (cont)</b>													
Tidal Oligohaline Marsh (Saltmeadow Cordgrass – Olney Three-Square Low Interior Marsh Type)	CEGL006612	Flat	level to gentle	plain/level/bottom	40.0	0	0	0	5	71	0	24	0
<b>Tidal Forests and Shrublands</b>													
Salt Scrub	CEGL003921	flat	level	plain/level/bottom	40.0								
Tidal Shrub Swamp (Iva Type)	CEGL006848	flat	level	plain/level/bottom	40.0								
Tidal Shrub Swamp (Wax Myrtle Type)	CEGL004656	flat	level	plain/level/bottom	40.0								
Tidal Bald Cypress Forest/Woodland	CEGL004654	flat	level	plain/level/bottom	40.0	0	0	0	0	9	1	90	0

Table F2. Environmental variable averages by association – soil chemistry variables.

	USNVC code	pH	N	P	S	Ca	Mg	K	Na	B	Fe	Mn	Cu	Zn	Al	CEC	TBS	OM	CaMgRatio	Fertility
<b>Oak / Heath Forests</b>																				
Coastal Plain Mixed Oak / Heath Forest	CEGL006269	4.2	79	31	31	132	31	28	12	0.60	282	10	0.41	1.1	634	8.1	19.2	3.3	4.3	1.0
<b>Piedmont / Low Elevation Mixed Oak / Heath Forest</b>	<b>CEGL008521</b>	<b>4.2</b>	<b>90</b>	<b>14</b>	<b>31</b>	<b>135</b>	<b>28</b>	<b>35</b>	<b>12</b>	<b>0.41</b>	<b>295</b>	<b>14</b>	<b>0.57</b>	<b>1.4</b>	<b>764</b>	<b>10.3</b>	<b>12.1</b>	<b>4.6</b>	<b>4.7</b>	<b>1.1</b>
<b>Pine – Oak Forests</b>																				
Coastal Plain Loblolly Pine – Oak Forest	CEGL004766	4.1	90	25	40	165	52	34	11	0.80	324	64	0.59	1.5	697	12.1	13.5	4.1	3.3	1.4
Eastern White Pine – Hardwood Forest	CEGL008539	4.2	95	13	35	205	44	47	12	0.5	297	43	0.6	1.6	852	14.4	10.2	6.1	5.0	1.5
<b>Mesic Acidic Forests</b>																				
<b>Mesic Mixed Hardwood Forest</b>	<b>CEGL006075</b>	<b>4.4</b>	<b>92</b>	<b>28</b>	<b>34</b>	<b>303</b>	<b>68</b>	<b>55</b>	<b>14</b>	<b>0.46</b>	<b>186</b>	<b>66</b>	<b>0.90</b>	<b>2.3</b>	<b>776</b>	<b>11.4</b>	<b>23.3</b>	<b>4.6</b>	<b>4.9</b>	<b>2.3</b>
Piedmont / Coastal Plain Oak – Beech / Heath Forest	CEGL006919	4.2	88	19	29	155	39	39	12	0.40	279	9	0.53	1.3	746	11.2	15.2	4.2	5.6	1.2
<b>Oak – Hickory Forests</b>																				
<b>Acidic Oak – Hickory Forest</b>	<b>CEGL008475</b>	<b>4.6</b>	<b>99</b>	<b>18</b>	<b>33</b>	<b>320</b>	<b>80</b>	<b>60</b>	<b>13</b>	<b>0.39</b>	<b>204</b>	<b>80</b>	<b>1.69</b>	<b>2.4</b>	<b>908</b>	<b>10.1</b>	<b>27.1</b>	<b>5.6</b>	<b>4.3</b>	<b>2.5</b>
<b>Basic Oak – Hickory Forest</b>	<b>CEGL007232</b>	<b>5.3</b>	<b>106</b>	<b>32</b>	<b>29</b>	<b>1508</b>	<b>241</b>	<b>108</b>	<b>12</b>	<b>0.62</b>	<b>175</b>	<b>215</b>	<b>2.03</b>	<b>3.0</b>	<b>740</b>	<b>14.3</b>	<b>63.5</b>	<b>6.4</b>	<b>7.3</b>	<b>9.9</b>
<b>Basic Mesic and Calcareous Forests</b>																				
<b>Inner Piedmont / Lower Blue Ridge Basic Mesic Forest</b>	<b>CEGL006186</b>	<b>5.5</b>	<b>110</b>	<b>29</b>	<b>30</b>	<b>1712</b>	<b>281</b>	<b>139</b>	<b>11</b>	<b>0.72</b>	<b>149</b>	<b>172</b>	<b>2.24</b>	<b>4.0</b>	<b>774</b>	<b>15.2</b>	<b>69.9</b>	<b>8.9</b>	<b>6.0</b>	<b>11.2</b>
Coastal Plain Mesic Calcareous Ravine Forest	CEGL007181	5.7	93	34	34	2246	96	75	18	0.76	131	78	0.86	2.9	538	14.7	81.5	4.5	24.1	12.3
Coastal Plain Dry Calcareous Forest	CEGL007748	6.5	100	40	39	4707	116	113	31	1.10	158	67	1.10	3.7	403	27.4	86.3	5.9	40.7	24.9
<b>Seepage Wetlands</b>																				
Coastal Plain / Piedmont Acidic Seepage Swamp	CEGL006238	4.6	96	19	45	318	90	38	30	0.52	343	13	0.95	3.6	470	34.1	34.0	8.0	4.0	2.5
<b>Northern Piedmont / Lower New England Basic Seepage Swamp</b>	<b>CEGL006406</b>	<b>5.2</b>	<b>110</b>	<b>24</b>	<b>88</b>	<b>1071</b>	<b>195</b>	<b>58</b>	<b>33</b>	<b>0.74</b>	<b>417</b>	<b>64</b>	<b>2.50</b>	<b>7.1</b>	<b>425</b>	<b>13.0</b>	<b>56.5</b>	<b>7.3</b>	<b>6.4</b>	<b>7.3</b>
Coastal Plain Calcareous Seepage Swamp	CEGL006413	6.1	114	29	104	3327	93	56	52	1.23	554	31	1.29	9.82	222	21.4	83.5	15	46.6	17.8
<b>Alluvial Forests</b>																				
Coastal Plain / Piedmont Small-Stream Floodplain Forest	CEGL004418	4.5	88	20	35	603	119	62	25	0.54	264	82	1.51	3.7	585	10.9	42.4	4.4	5.5	4.1
<b>Piedmont / Mountain Alluvial Forest</b>	<b>CEGL006492</b>	<b>5.3</b>	<b>94</b>	<b>32</b>	<b>23</b>	<b>1127</b>	<b>180</b>	<b>62</b>	<b>25</b>	<b>0.67</b>	<b>204</b>	<b>119</b>	<b>3.02</b>	<b>5.8</b>	<b>520</b>	<b>11.1</b>	<b>69.0</b>	<b>4.8</b>	<b>6.3</b>	<b>7.4</b>
Piedmont / Mountain Floodplain Forest	CEGL006217	6.7	79	44	42	2570	169	63	19	0.8	242	106	3.0	14.4	309	14.9	97.8	3.8	16.8	14.2
<b>Swamp Forests</b>																				
Coastal Plain / Piedmont Floodplain Swamp Forest (Mixed Oak – Red Maple Type)	CEGL006605	4.5	91	27	47	388	82	53	18	0.57	381	67	1.57	4.5	668	11.6	27.3	4.7	5.5	2.8
Coastal Plain / Piedmont Floodplain Swamp Forest (Green Ash – Red Maple Type)	CEGL006606	5.2	101	28	99	1471	155	55	44	0.58	343	70	1.87	7.2	447	14.1	62.8	6.6	11.9	9.0
<b>Nonriverine Forests</b>																				
<b>Upland Depression Swamp</b>	<b>CEGL007403</b>	<b>4.3</b>	<b>110</b>	<b>47</b>	<b>61</b>	<b>501</b>	<b>130</b>	<b>55</b>	<b>39</b>	<b>0.52</b>	<b>395</b>	<b>23</b>	<b>1.29</b>	<b>4.3</b>	<b>1052</b>	<b>16.0</b>	<b>29.2</b>	<b>7.3</b>	<b>3.8</b>	<b>3.0</b>
Coastal Plain Depression Wetland (Red Maple – Sweetgum – Willow Oak Type)	CEGL006110	4.1	109	48	56	193	68	53	17	0.53	297	30	0.90	2.4	890	17.3	10.9	7.0	3.1	1.7
Coastal Plain Depression Wetland (Swamp Tupelo Type)	CEGL006223																			
Non-Riverine Saturated Forest	CEGL004644	4.3	99	32	53	288	62	43	26	0.72	333	6	0.60	2.0	614	14.3	17.8	4.3	6.1	2.3

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	USNVC code	pH	N	P	S	Ca	Mg	K	Na	B	Fe	Mn	Cu	Zn	Al	CEC	TBS	OM	CaMgRatio	Fertility
<b>Tidal Marshes</b>																				
Tidal Freshwater Marsh	CEGL004706																			
Tidal Mesohaline and Polyhaline Marsh (Low Salt Marsh)	CEGL006586																			
Tidal Mesohaline and Polyhaline Marsh (Transitional Marsh)	CEGL006418																			
Tidal Oligohaline Marsh (Common Reed Tidal Marsh)	CEGL004187																			
Tidal Oligohaline Marsh (Interior Depression Marsh)	CEGL006578	4.5	126	33	1189	986	990	249	1504	1.25	507	100	2.41	29.6	523	31.2	63.3	15.9	1.4	20.4
Tidal Oligohaline Marsh (Big Cordgrass Type)	CEGL004195																			
Tidal Oligohaline Marsh (Mixed Forbs Type)	CEGL006181	4.6	128	27	906	937	930	206	1845	1.3	560	162	1.29	14.9	487	32.5	65.3	20.7	1.1	21.0
Tidal Oligohaline Marsh (Saltmeadow Cordgrass – Olney Three-Square Low Interior Marsh Type)	CEGL006612																			
<b>Tidal Forests and Shrublands</b>																				
Salt Scrub	CEGL003921																			
Tidal Shrub Swamp (Iva Type)	CEGL006848																			
Tidal Shrub Swamp (Wax Myrtle Type)	CEGL004656																			
Tidal Bald Cypress Forest/Woodland	CEGL004654																			

Appendix G. Cluster dendrograms, ordination scatterplots, and joint plots resulting from regional quantitative analysis of regional plot data for seven major vegetation groups present at Appomattox Court House National Historical Park.

Major vegetation groups are presented as follows:

- Oak / Heath Forests (Figures G1–G2)
- Mesic Acidic Forests (Figures G3–G5)
- Oak - Hickory Forests (Figures G6–G8)
- Basic Mesic and Calcareous Forests (Figures G9–G11)
- Seepage Wetlands (Figures G12–G14)
- Alluvial Forests (Figures G15–G17)
- Nonriverine Forests (Figures G18–G19)

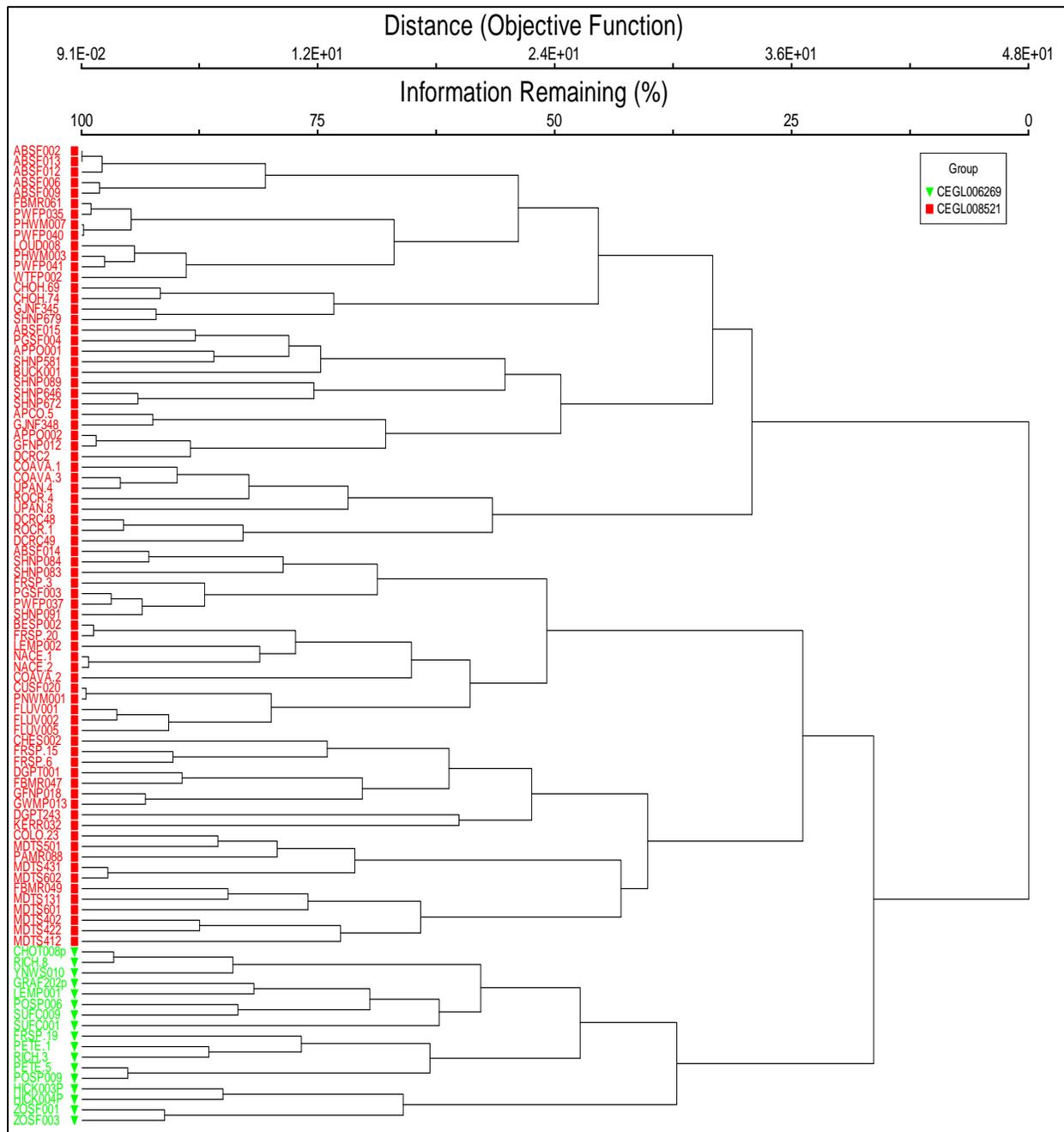


Figure G1. Dendrogram resulting from cluster analysis of species coverage data from 93 oak / heath forest plots. Plot membership in two oak / heath forest associations is shown. CEGL006269 = Coastal Plain Mixed Oak / Heath Forest; CEGL008521 = Piedmont Low Elevation Mixed Oak / Heath Forest. Distance on the dendrogram scale is Wishart's objective function (Wishart 1979).

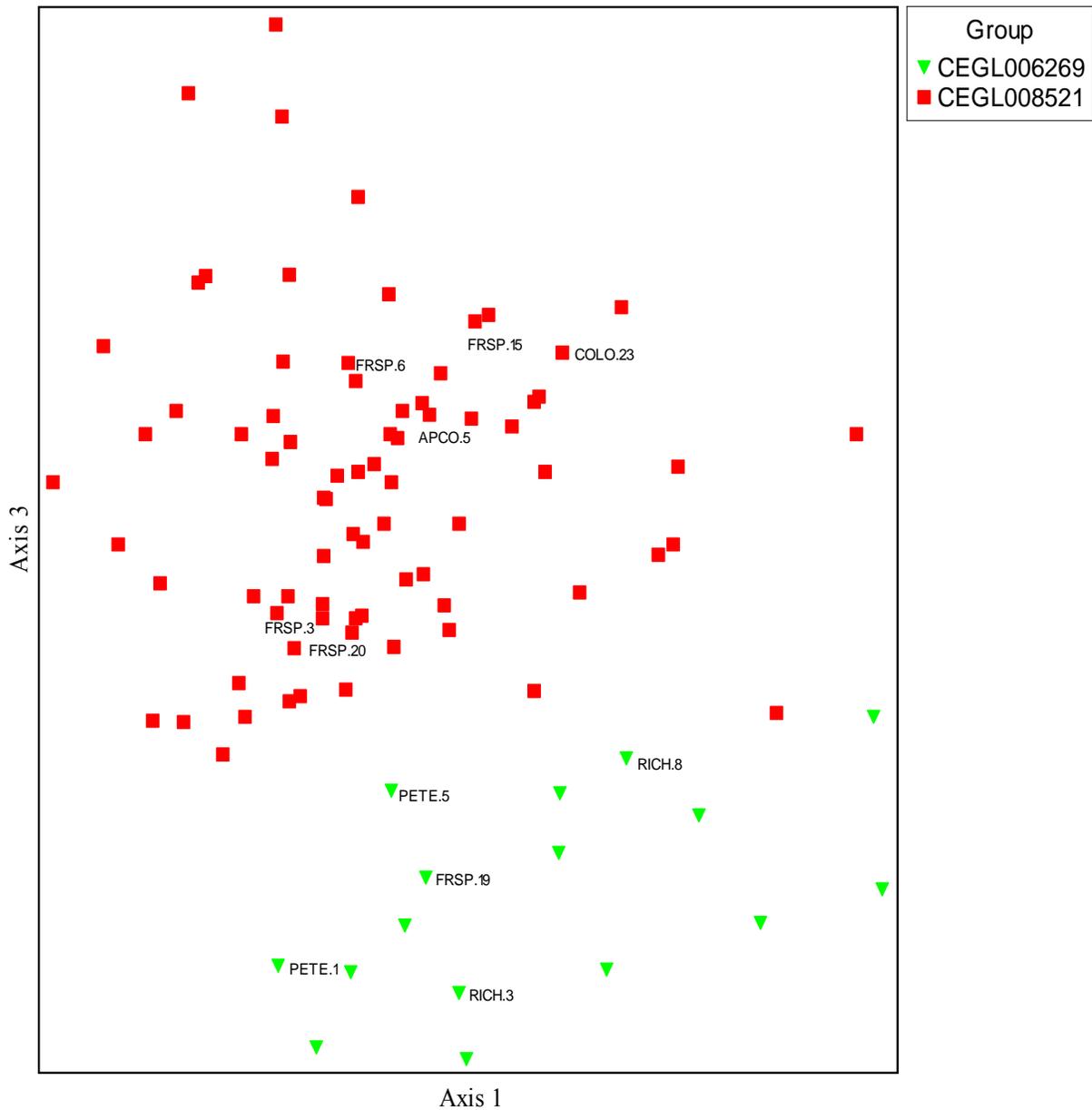


Figure G2. Scatterplot diagram for three-dimensional NMDS ordination of 92 oak/heath forest plots, showing Axis 1 and 3. Plot membership in two oak/heath forest associations is based on cluster analysis. CEGL006269 = Coastal Plain Mixed Oak / Heath Forest; CEGL008521 = Piedmont Low Elevation Mixed Oak / Heath Forest. Plots from the seven Virginia national parks are labeled to the right of or below the symbol. One plot was determined to be an outlier and eliminated from the dataset prior to ordination.

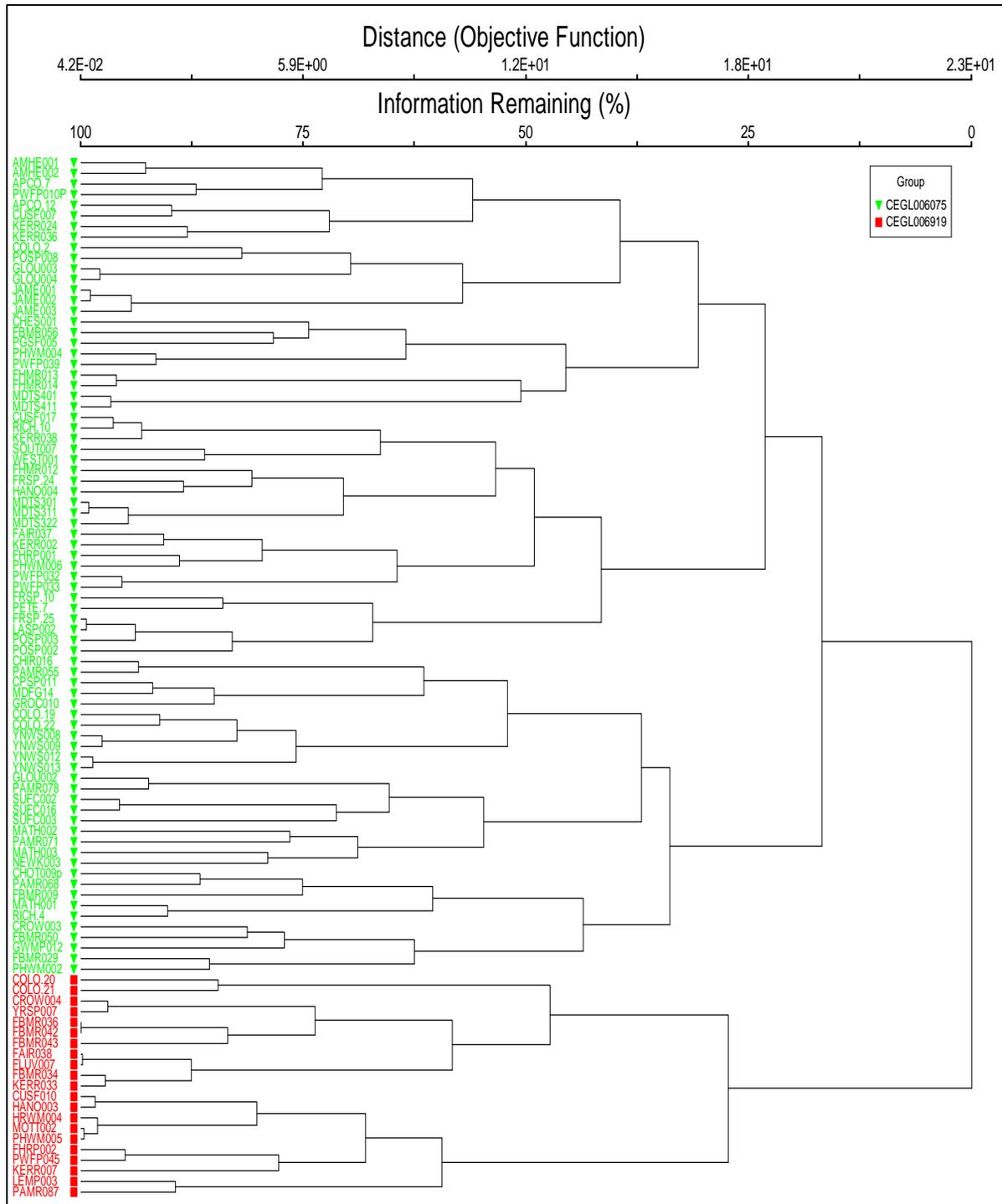


Figure G3. Dendrogram resulting from cluster analysis of species coverage data from 98 mesic acidic forest plots. Plot membership in two mesic acidic forest associations is shown. CEGL006075 = Mesic Mixed Hardwood Forest; CEGL006919 = Piedmont / Coastal Plain Oak – Beech / Heath Forest. Distance on the dendrogram scale is Wishart’s objective function (Wishart 1979). 196 plots of this type were originally identified in the regional analysis. A reduced dataset is used here for graphical depiction.

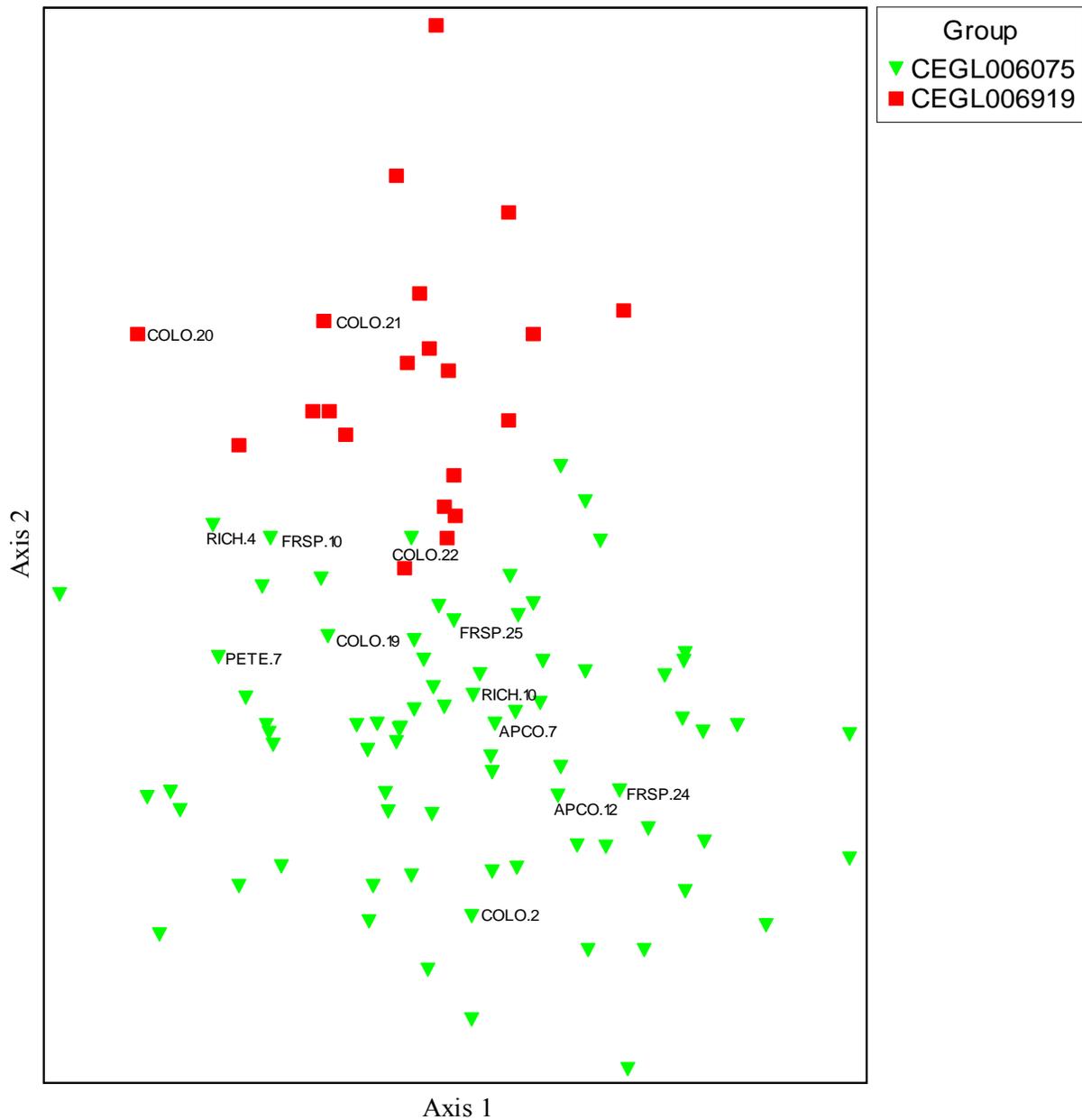


Figure G4. Scatterplot diagram for three-dimensional NMDS ordination of 98 mesic acidic forest plots, showing Axis 1 and 2. Plot membership in two mesic acidic forest associations is based on cluster analysis. CEGL006075 = Mesic Mixed Hardwood Forest; CEGL006919 = Piedmont / Coastal Plain Oak – Beech / Heath Forest. Plots from the seven Virginia national parks are labeled to the right of or below the symbol.

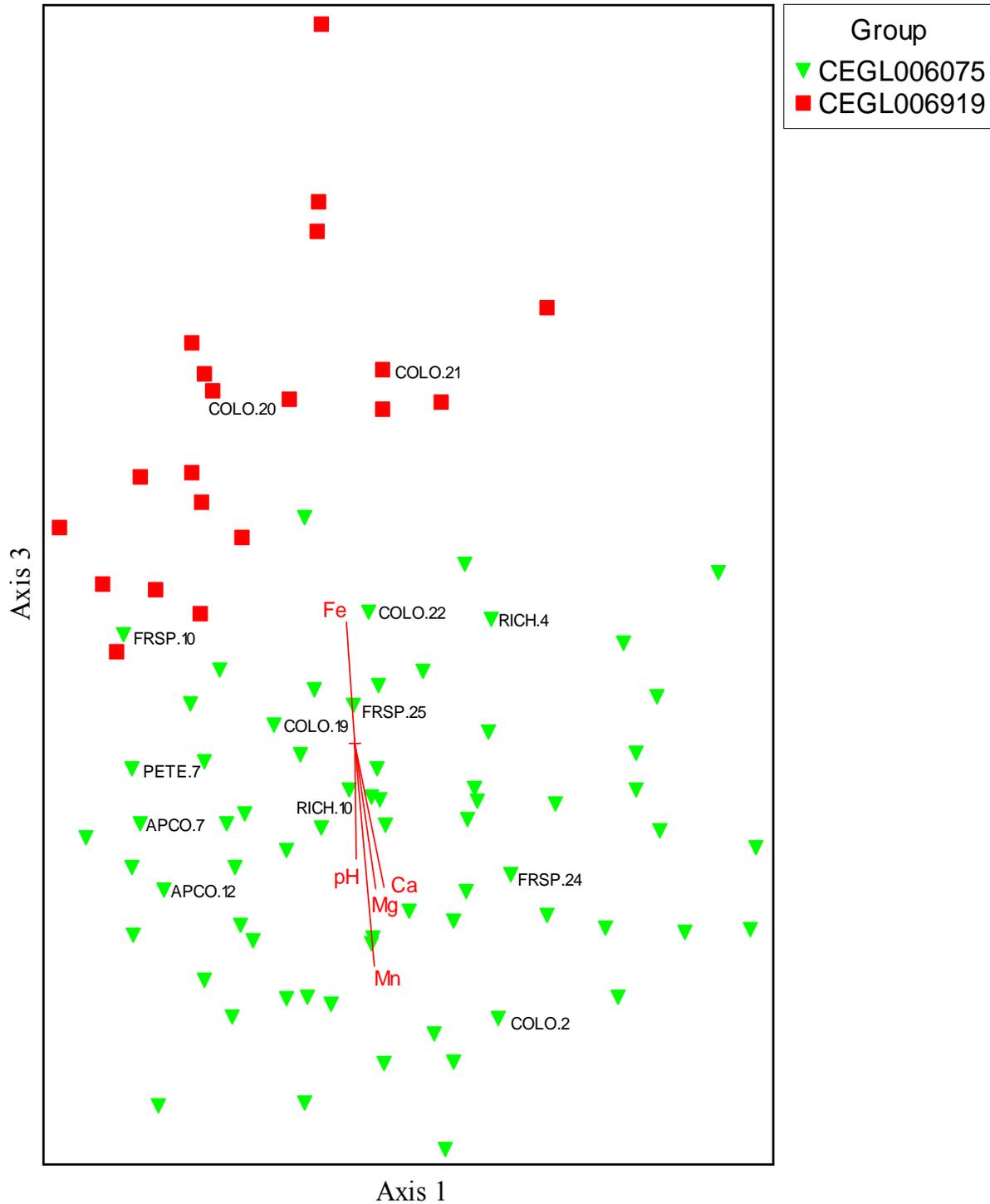


Figure G5. Joint plot showing significant correlations ( $r^2 = 0.20$ ) of 19 soil variables with ordination scores for 87 mesic acidic forest plots on Axis 1 and Axis 3 of the NMDS ordination. The angles and lengths of the radiating lines indicate the direction and strength of the relationship. Environmental variables used in joint plots are listed in Table 5. Only the 87 plots in this group with complete soil chemistry data were included in the ordination. Plots from the seven Virginia national parks are labeled to the right of or below the symbol.

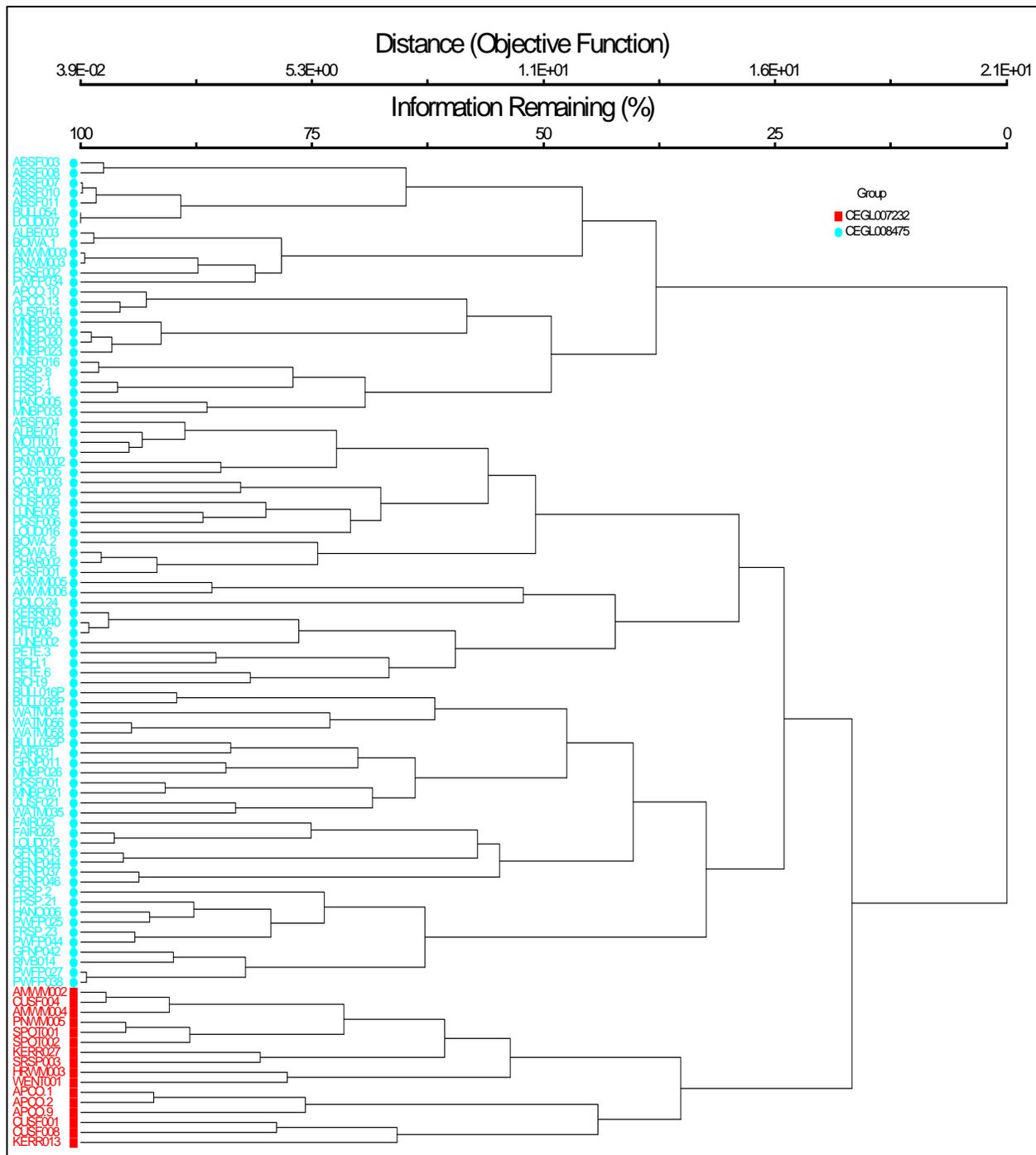


Figure G6. Dendrogram resulting from cluster analysis of species coverage data from 99 oak-hickory forest plots. Plot membership in two oak-hickory forest associations is shown. CEGL007232 = Basic Oak - Hickory Forest; CEGL008475 = Acidic Oak - Hickory Forest. Distance on the dendrogram scale is Wishart's objective function (Wishart 1979). 137 plots of this type were originally identified in the regional analysis. A reduced dataset is used here for graphical depiction.

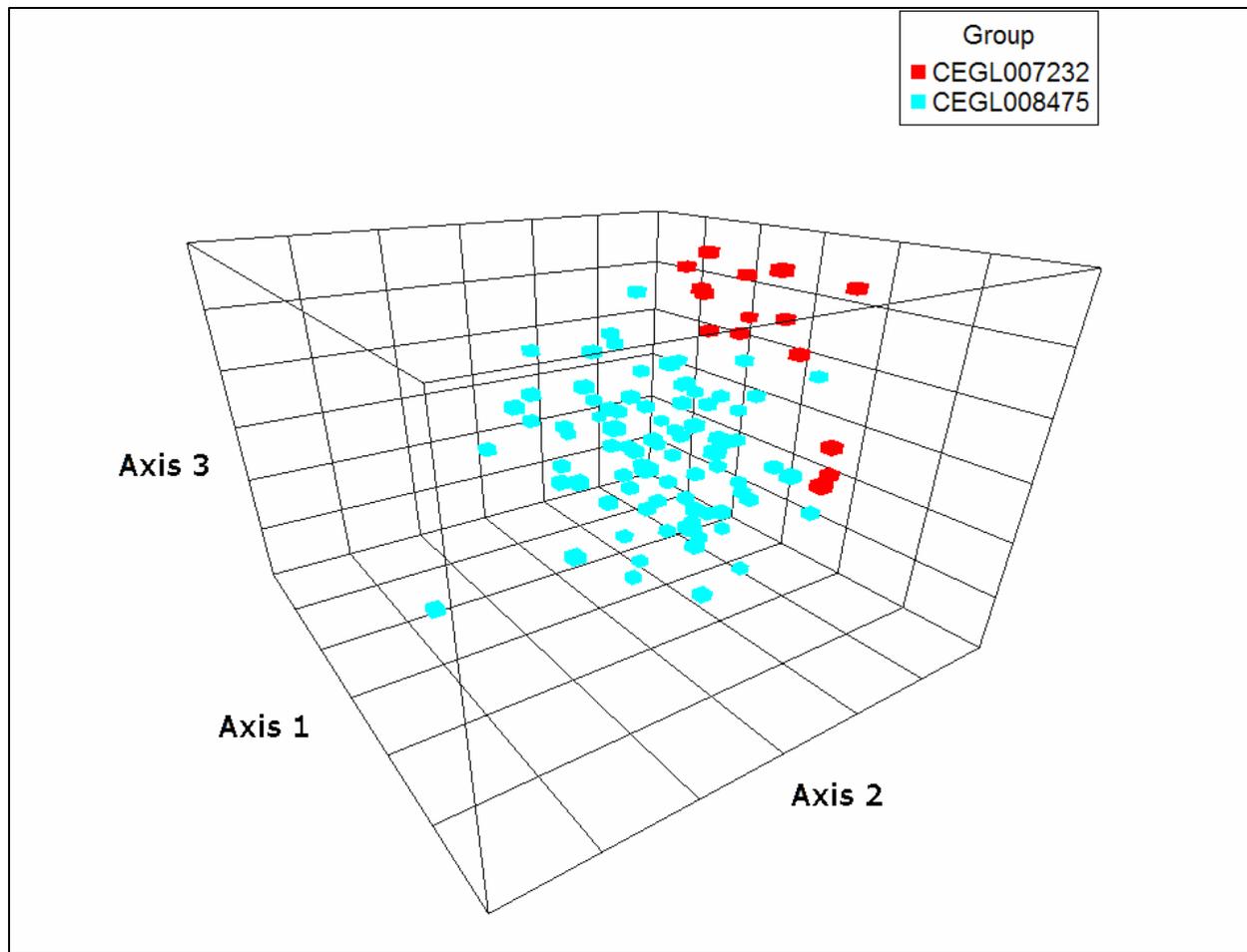


Figure G7. Scatterplot diagram for three-dimensional NMS ordination of 98 oak-hickory forest plots. Plot membership in two oak-hickory forest associations is based on cluster analysis. CEGL007232 = Basic Oak - Hickory Forest; CEGL008475= Acidic Oak - Hickory Forest. One plot was determined to be an outlier and eliminated from the dataset prior to ordination.

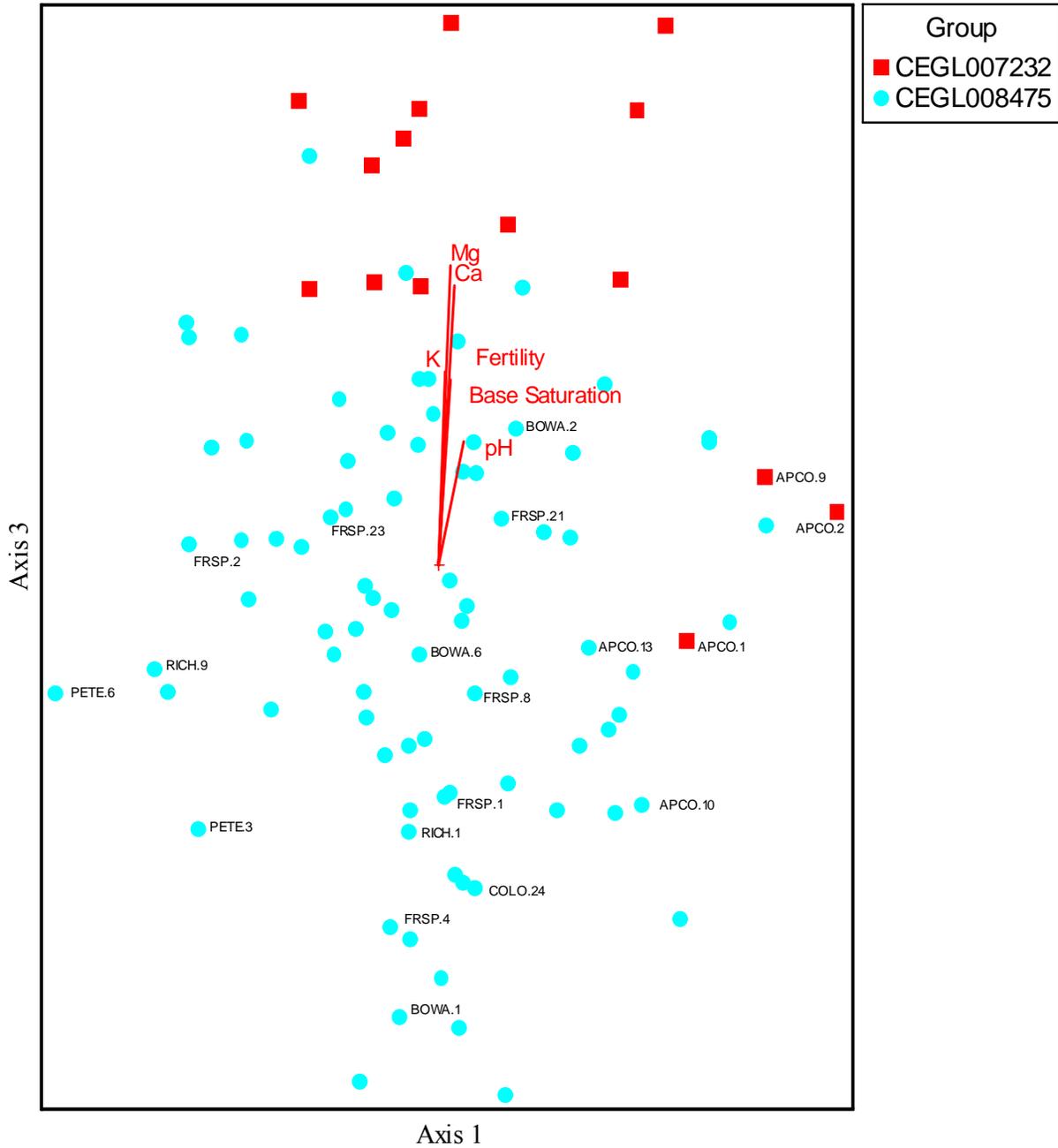


Figure G8. Joint plot showing significant correlations ( $r^2 = 0.20$ ) of environmental variables with ordination scores for 98 oak-hickory forest plots on Axis 1 and Axis 3 of the NMDS ordination. The angles and lengths of the radiating lines indicate the direction and strength of the relationship. Environmental variables used in joint plots are listed in Table 5. Plots from the seven Virginia national parks are labeled to the right of or below the symbol.

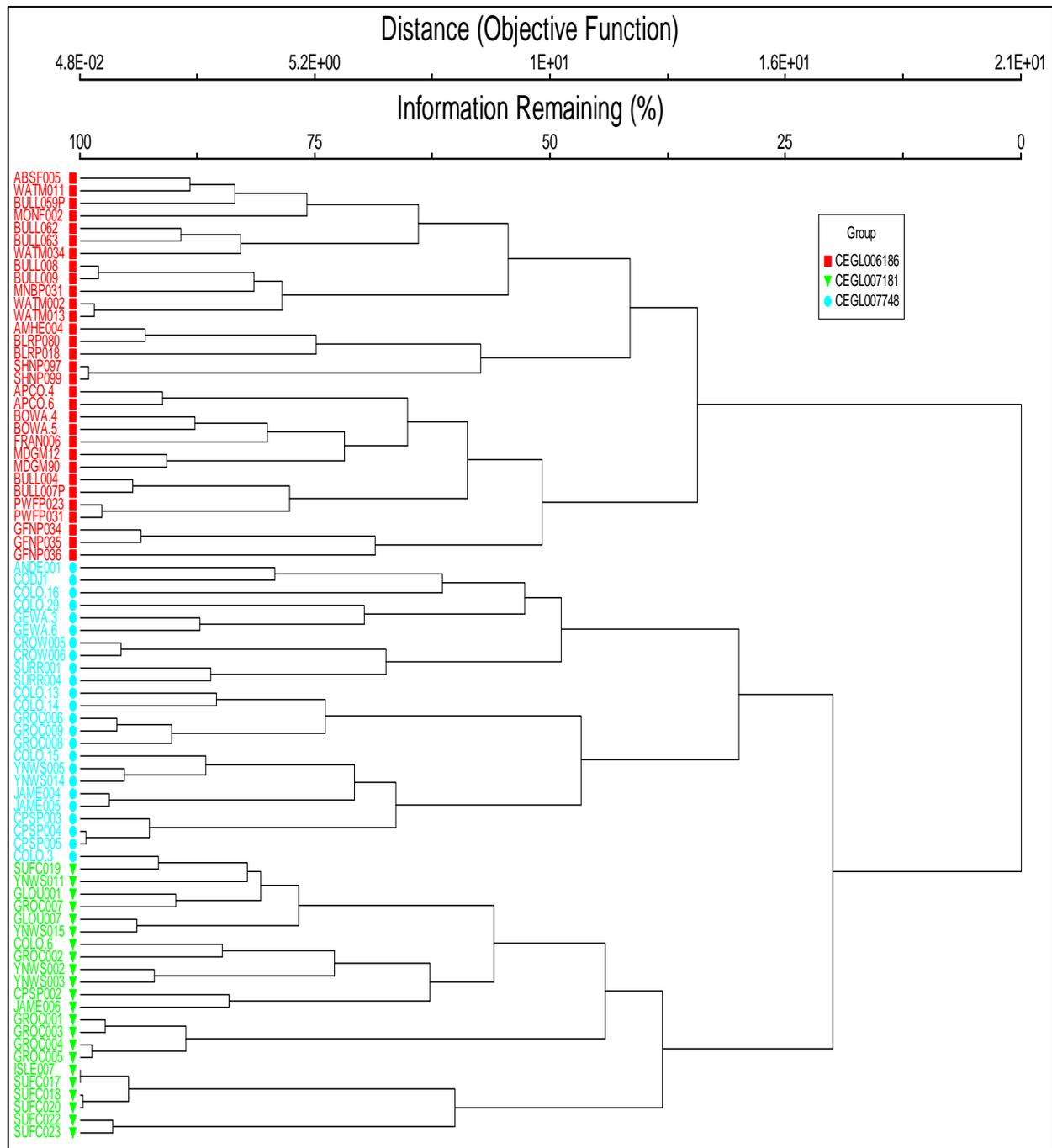


Figure G9. Dendrogram resulting from cluster analysis of species coverage data from 77 basic mesic and calcareous forest plots. Plot membership in three basic mesic and calcareous forest associations is shown. CEGL006186 = Inner Piedmont / Lower Blue Ridge Basic Mesic Forest; CEGL007181 = Coastal Plain Mesic Calcareous Ravine Forest; CEGL007748 = Coastal Plain Dry Calcareous Forest. Distance on the dendrogram scale is Wishart's objective function (Wishart 1979).

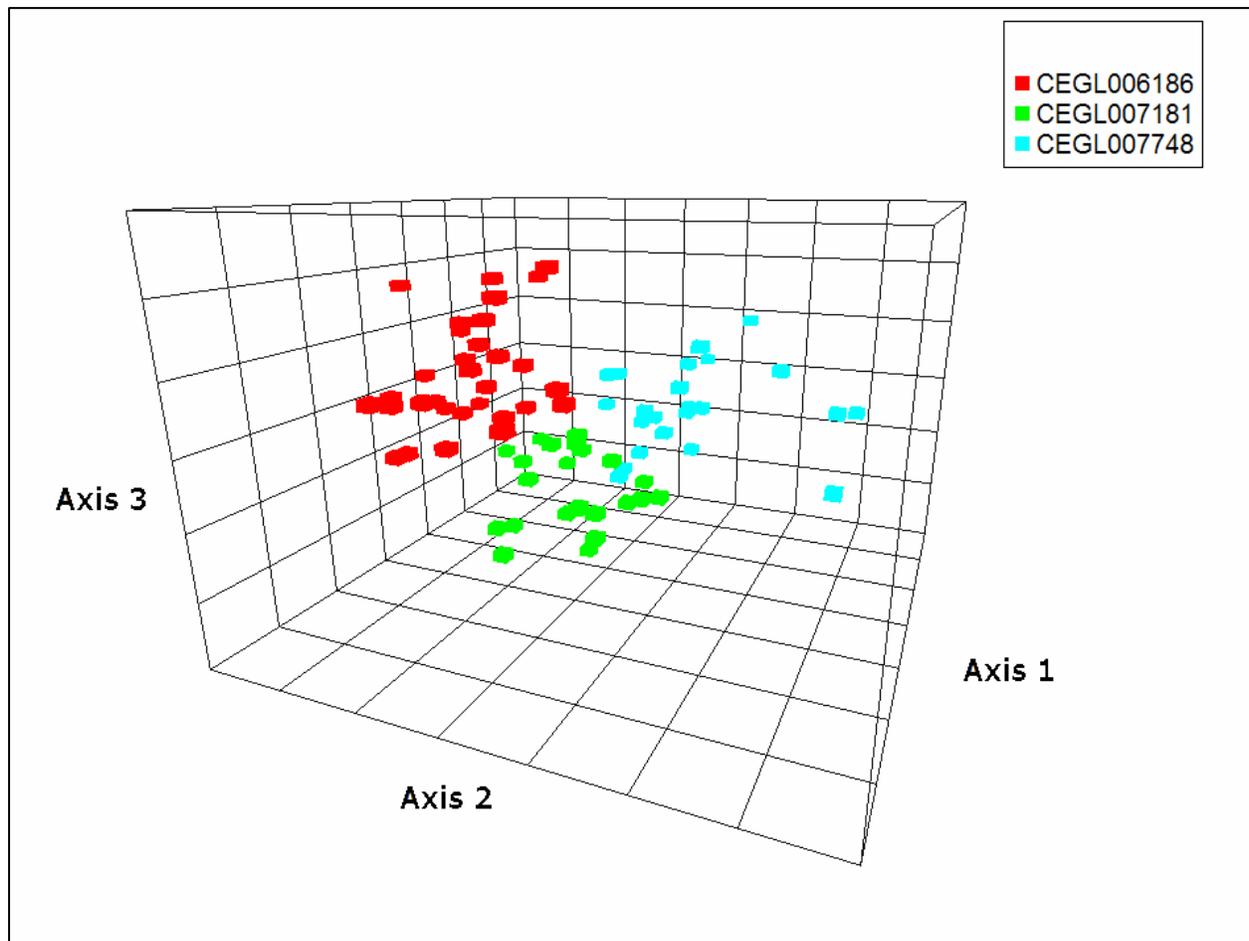


Figure G10. Scatterplot diagram for three-dimensional NMDS ordination of 76 basic mesic and calcareous forest plots. Plot membership in three basic mesic and calcareous forest associations is based on cluster analysis. CEGL006186 = Inner Piedmont / Lower Blue Ridge Basic Mesic Forest; CEGL007181 = Coastal Plain Mesic Calcareous Ravine Forest; CEGL007748 = Coastal Plain Dry Calcareous Forest. One plot was determined to be an outlier and eliminated from the dataset prior to ordination.

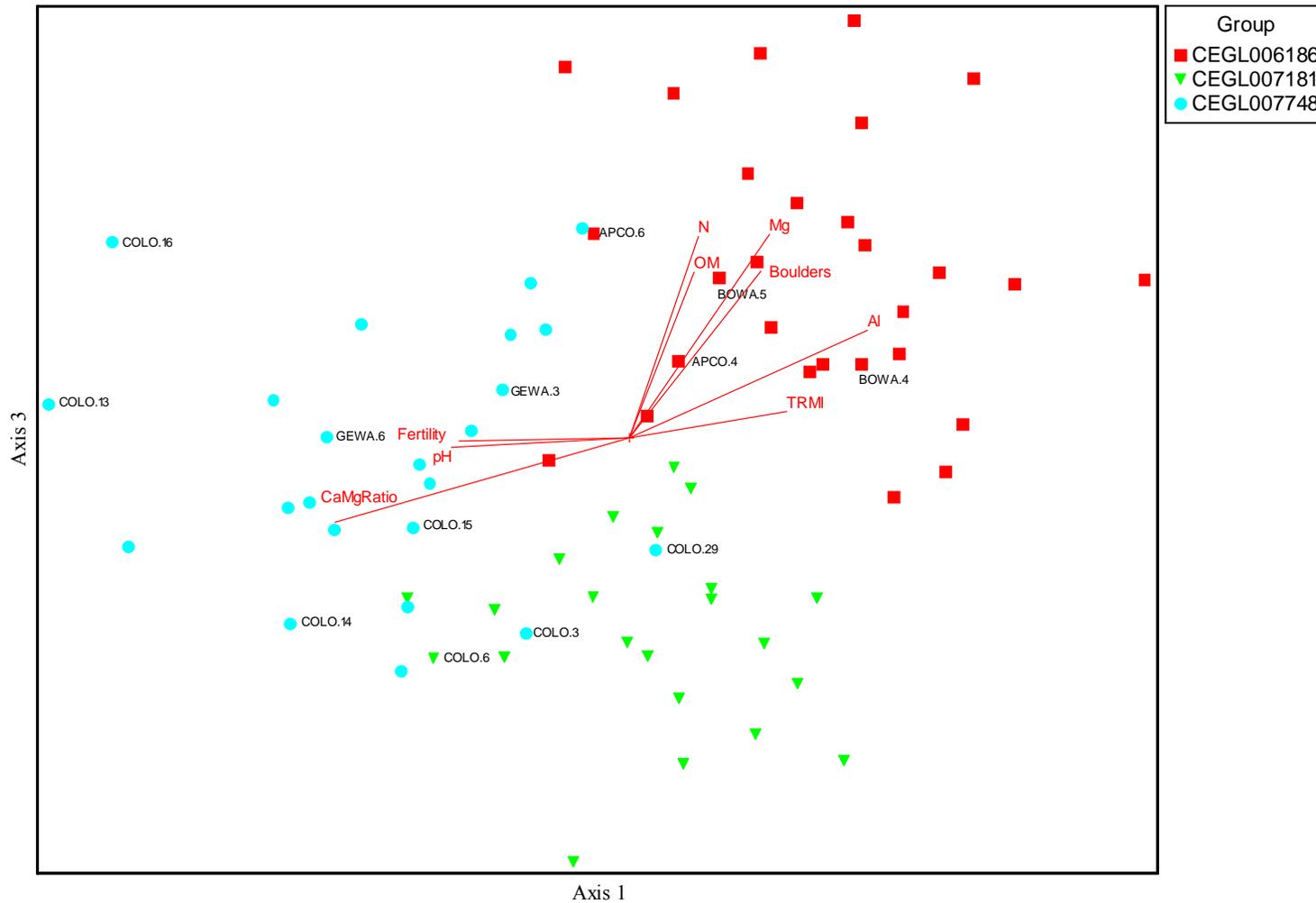


Figure G11. Joint plot showing significant correlations ( $r^2 = 0.290$ ) of environmental variables with ordination scores for 73 basic mesic and calcareous forest plots on Axis 1 and Axis 3 of the NMDS ordination. The angles and lengths of the radiating lines indicate the direction and strength of the relationship. Boron and Na were also significantly correlated in the same direction as pH and Fertility, but were removed from the graphic for clarity. Environmental variables used in joint plots are listed in Table 5. Plots from the seven Virginia national parks are labeled to the right of or below the symbol. Only the 73 plots in this group with complete environmental data were included in the ordination.

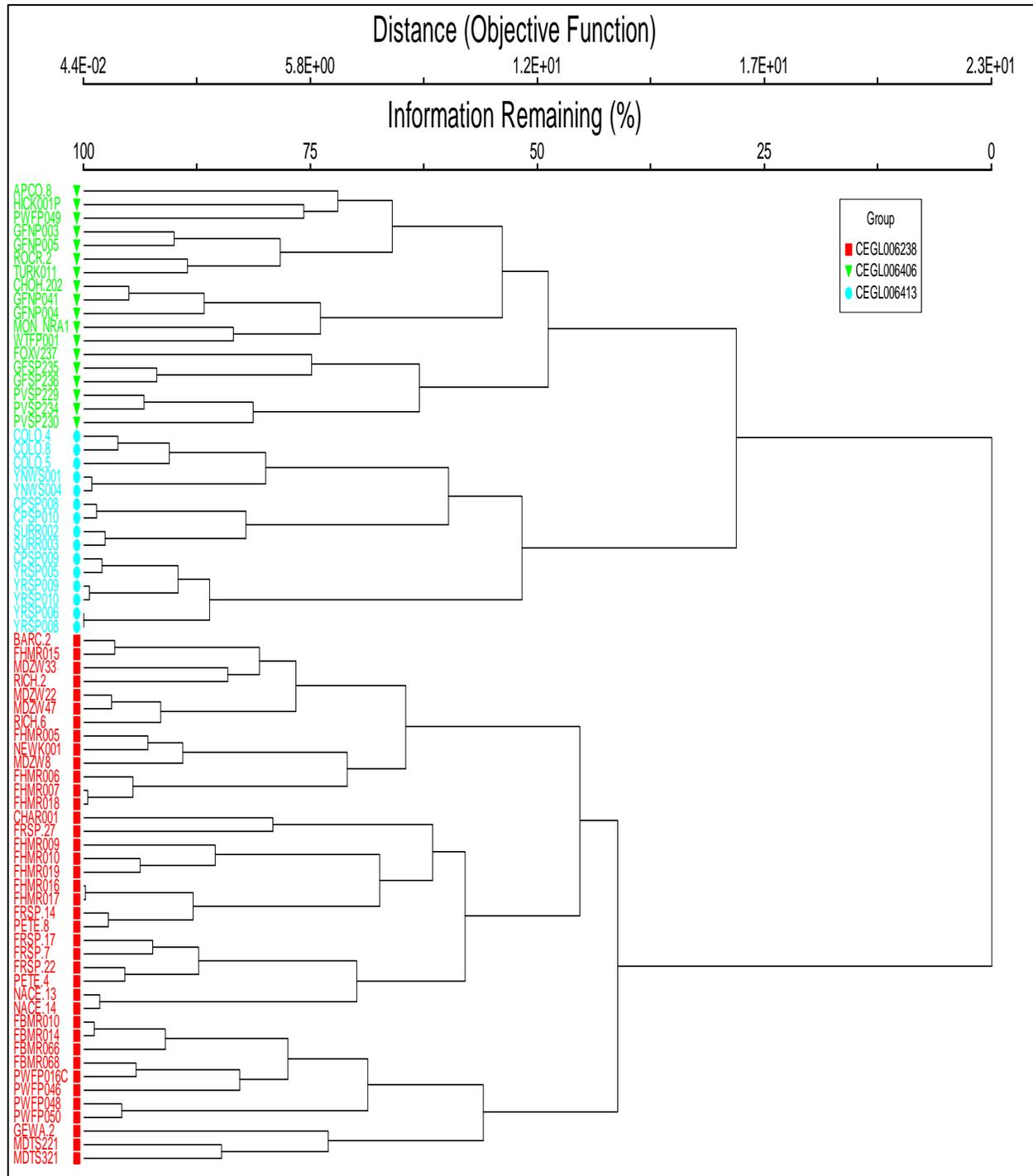


Figure G12. Dendrogram resulting from cluster analysis of species coverage data from 72 seepage wetland plots. Plot membership in three seepage wetland associations is shown. CEGL006238 = Coastal Plain / Piedmont Acidic Seepage Swamp; CEGL006406 = Northern Piedmont / Lower New England Basic Seepage Swamp; CEGL006413 = Coastal Plain Calcareous Seepage Swamp. Distance on the dendrogram scale is Wishart's objective function (Wishart 1979).

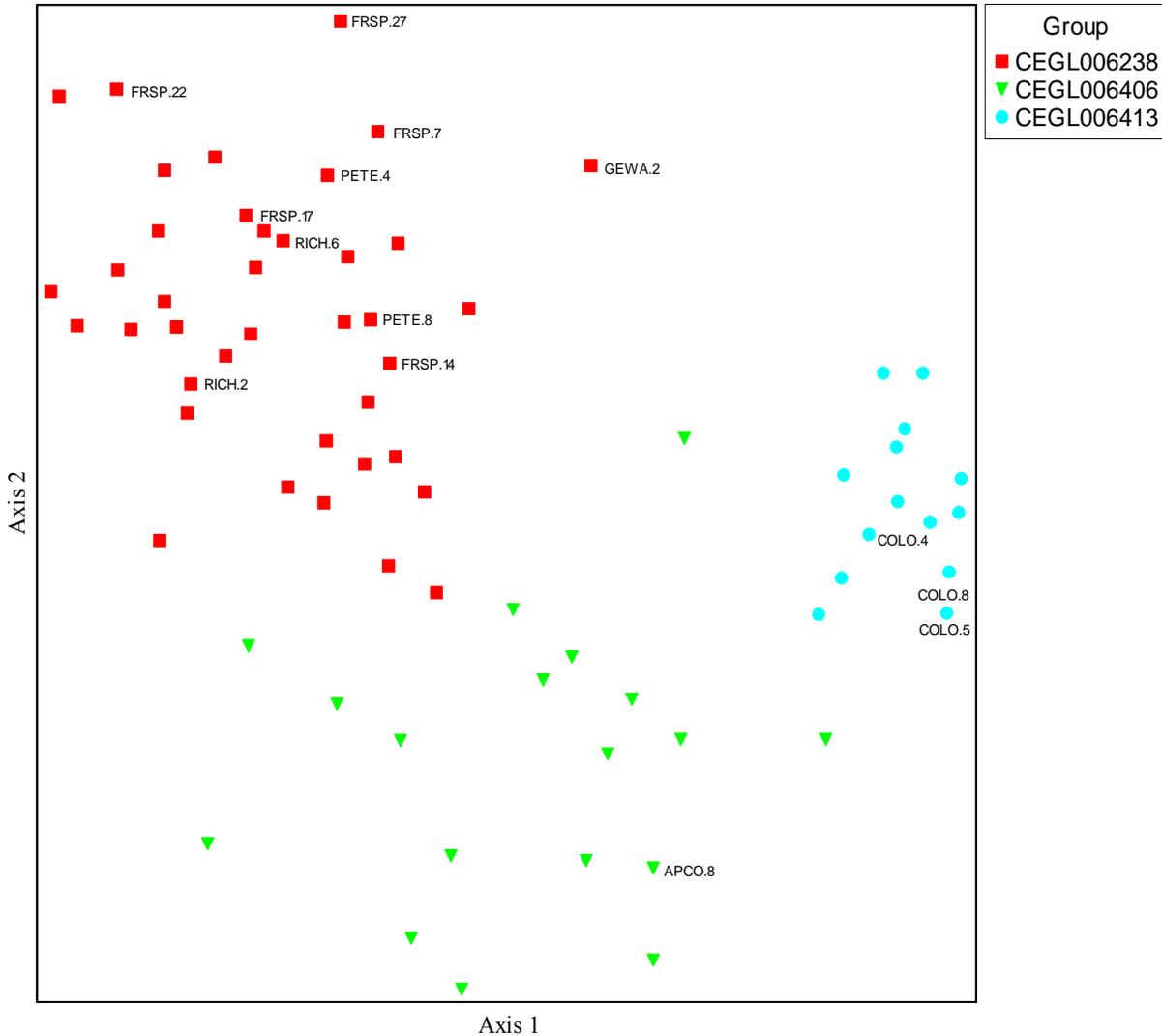


Figure G13. Scatterplot diagram for two-dimensional NMDS ordination of 71 seepage wetland plots. Plot membership in three seepage wetland associations is based on cluster analysis. CEGL006238 = Coastal Plain / Piedmont Acidic Seepage Swamp; CEGL006406 = Northern Piedmont / Lower New England Basic Seepage Swamp; CEGL006413 = Coastal Plain Calcareous Seepage Swamp. Plots from the seven Virginia national parks are labeled to the right of or below the symbol. One plot was determined to be an outlier and was eliminated from the dataset prior to ordination.

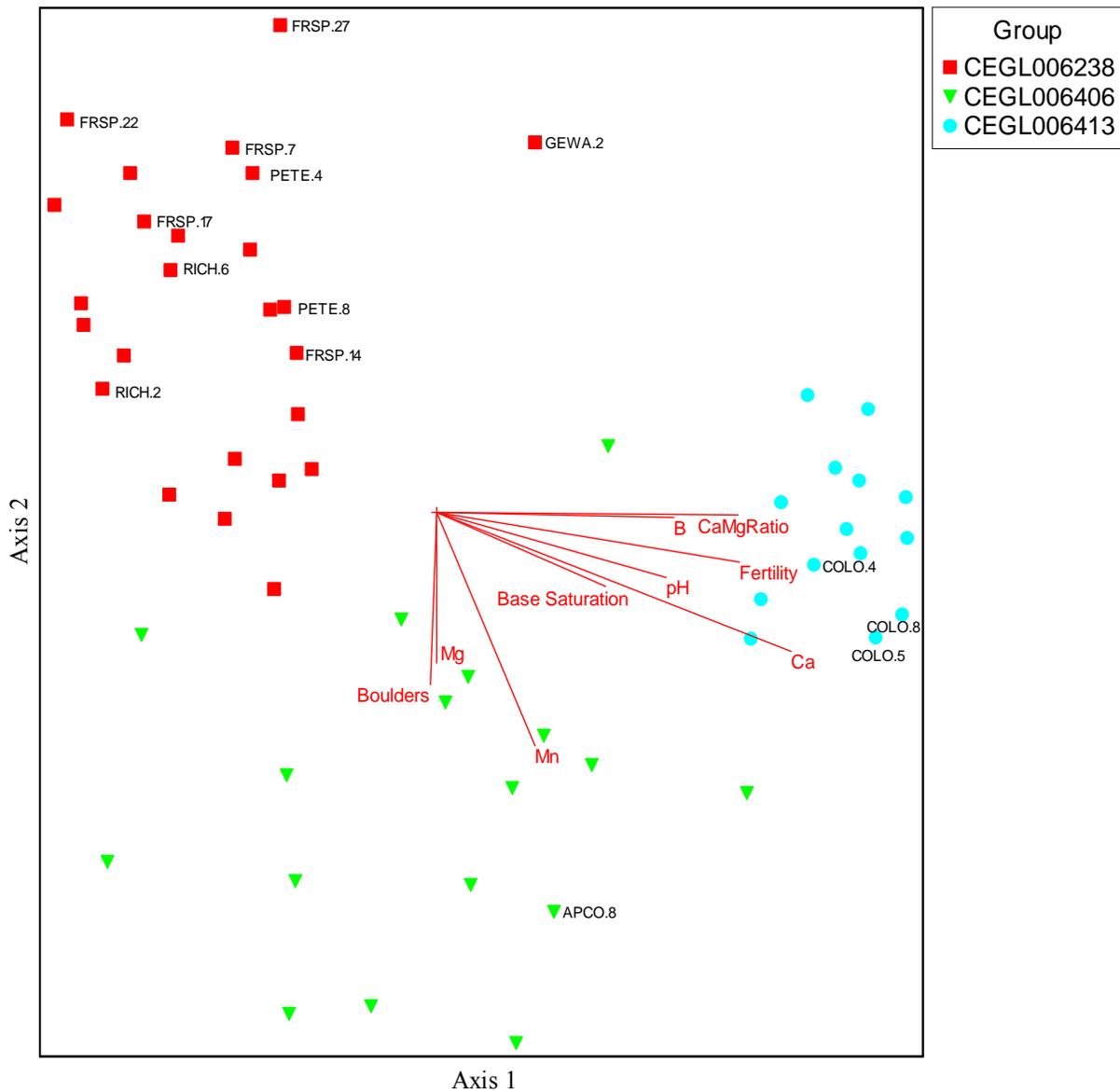


Figure G14. Joint plot showing significant correlations ( $r^2 = 0.290$ ) of environmental variables with ordination scores for 56 seepage wetland plots on Axis 1 and Axis 2 of the NMDS ordination. The angles and lengths of the radiating lines indicate the direction and strength of the relationship. Environmental variables used in joint plots are listed in Table 5. Plots from the seven Virginia national parks are labeled to the right of or below the symbol. Only the 56 plots in this group with complete environmental data were included in the ordination.

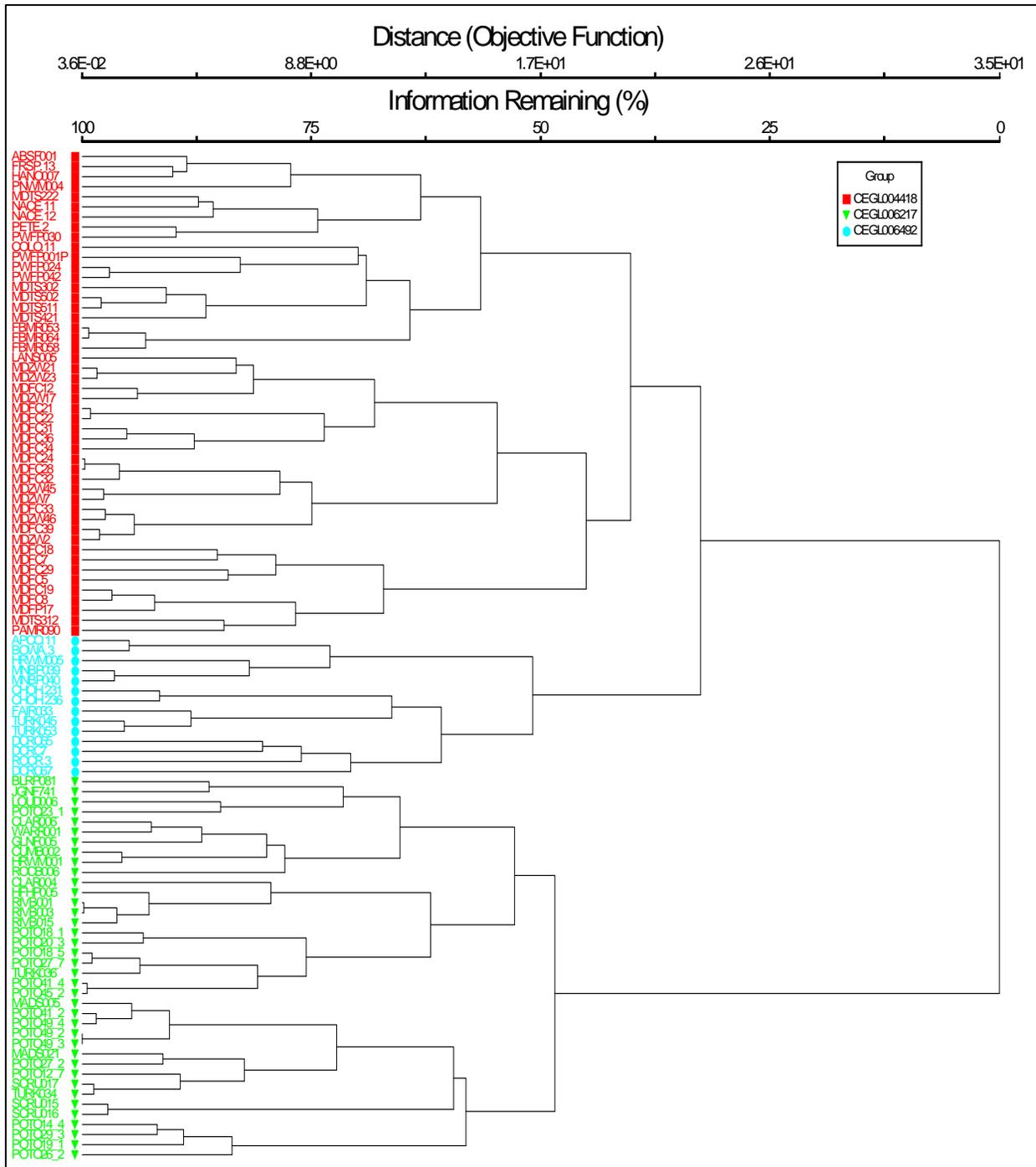


Figure G15. Dendrogram resulting from cluster analysis of species coverage data from 100 alluvial forest plots. Plot membership in three alluvial forest associations is shown. CEGL004418 = Coastal Plain / Piedmont Small-Stream Floodplain Forest; CEGL006217= Piedmont / Mountain Floodplain Forest; CEGL006492= Piedmont / Mountain Alluvial Forest. Distance on the dendrogram scale is Wishart's objective function (Wishart 1979).

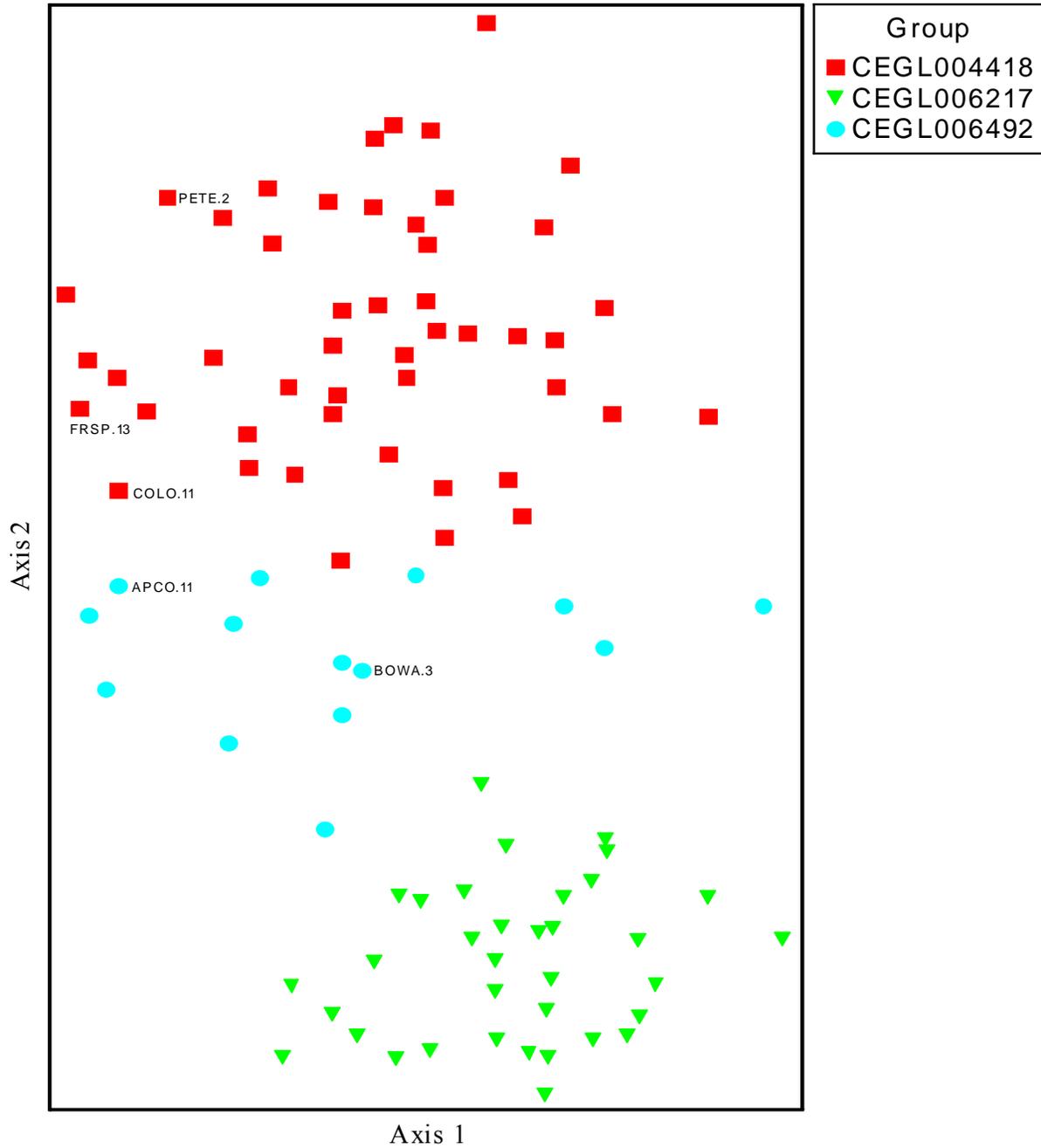


Figure G16. Scatterplot diagram for two-dimensional NMDS ordination of 97 alluvial forest plots. Plot membership in three alluvial forest associations is based on cluster analysis. CEGL004418 = Coastal Plain / Piedmont Small-Stream Floodplain Forest; CEGL006217= Piedmont / Mountain Floodplain Forest; CEGL006492 = Piedmont / Mountain Alluvial Forest. Three plots were determined to be outliers and eliminated from the dataset prior to ordination. Plots from the seven Virginia national parks are labeled to the right of or below the symbol.

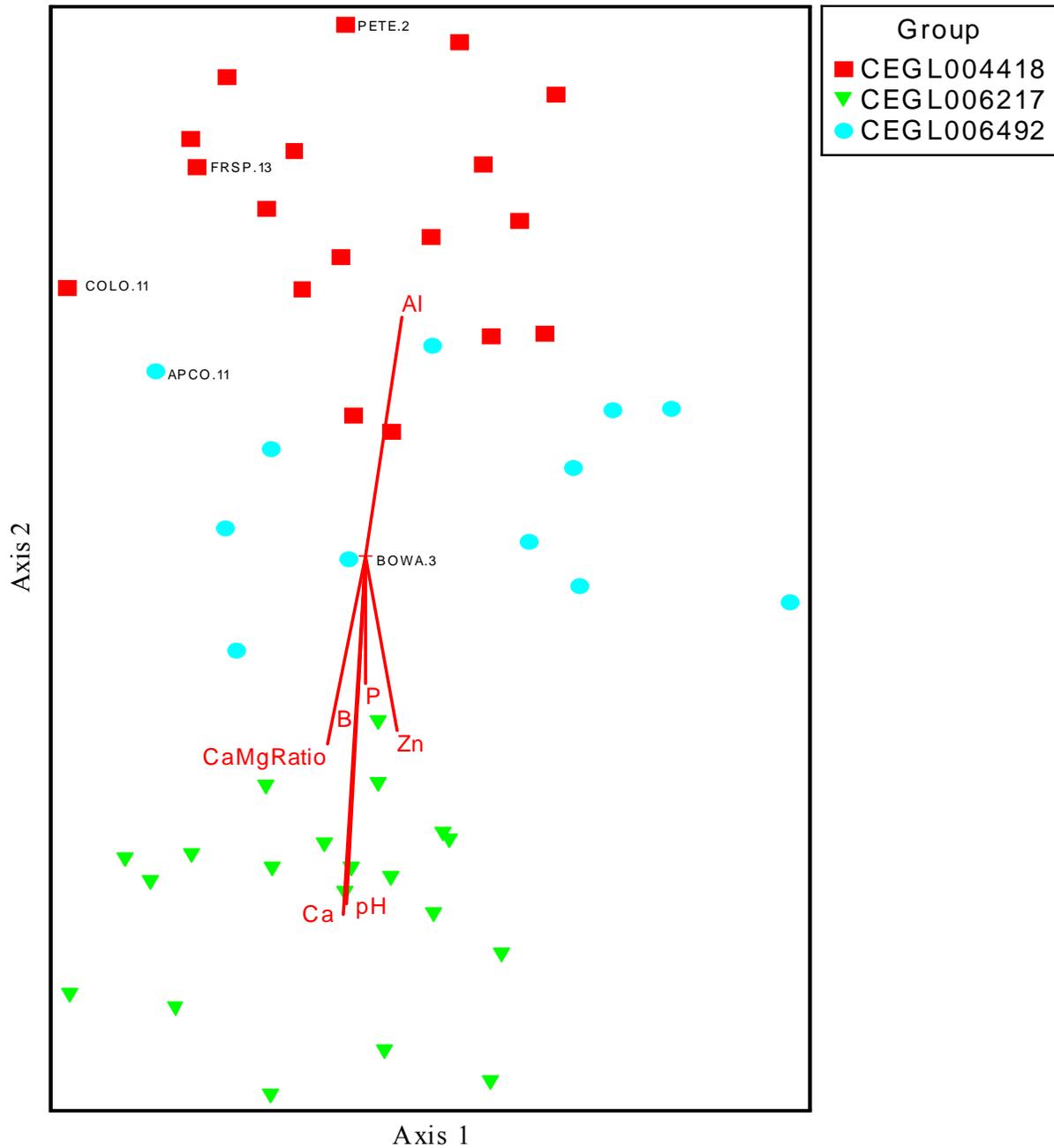


Figure G17. Joint plot showing significant correlations ( $r^2 = 0.20$ ) of environmental variables with ordination scores for 50 alluvial forest plots on Axis 1 and Axis 2 of the NMDS ordination. The angles and lengths of the radiating lines indicate the direction and strength of the relationship. Environmental variables used in joint plots are listed in Table 5. Plots from the seven Virginia national parks are labeled to the right of the symbol. Only the 50 plots with complete environmental data were included in the ordination.

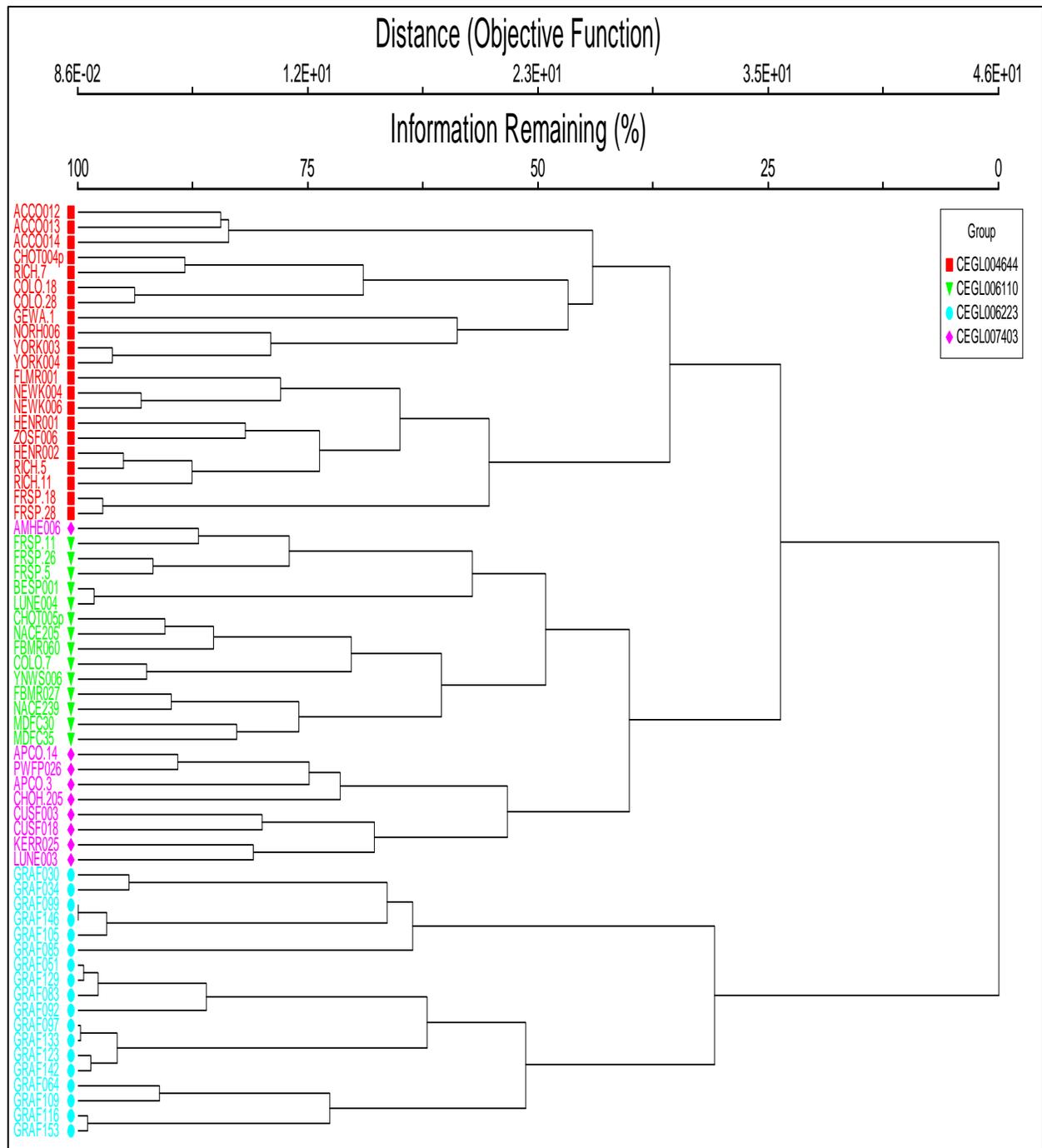


Figure G18. Dendrogram resulting from cluster analysis of species coverage data from 62 nonriverine forest plots. Plot membership in four nonriverine forest associations is shown. CEGL004644 = Non-Riverine Saturated Forest; CEGL006110 = Coastal Plain Depression Wetland (Red Maple – Sweetgum – Willow Oak Type); CEGL006223 = Coastal Plain Depression Wetland (Swamp Tupelo Type); CEGL007403 = Upland Depression Swamp. Distance on the dendrogram scale is Wishart’s objective function (Wishart 1979).

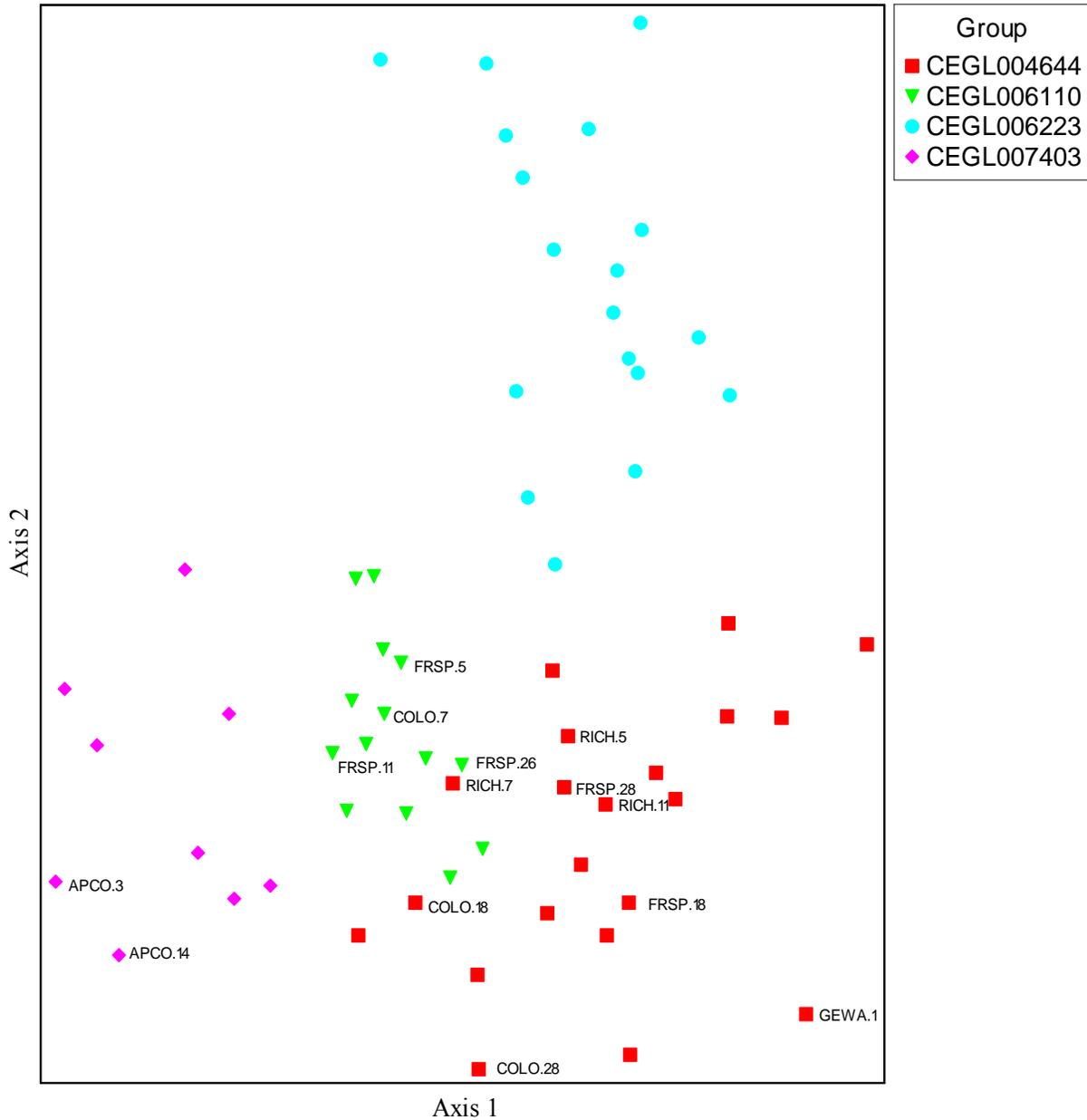


Figure G19. Scatterplot diagram for two-dimensional NMDS ordination of 62 nonriverine forest plots. Plot membership in four nonriverine forest associations is based on cluster analysis. CEGL004644 = Non-Riverine Saturated Forest; CEGL006110 = Coastal Plain Depression Wetland (Red Maple – Sweetgum – Willow Oak Type); CEGL006223 = Coastal Plain Depression Wetland (Swamp Tupelo Type); CEGL007403 = Upland Depression Swamp. Plots from the seven Virginia national parks are labeled to the right of or below the symbol.

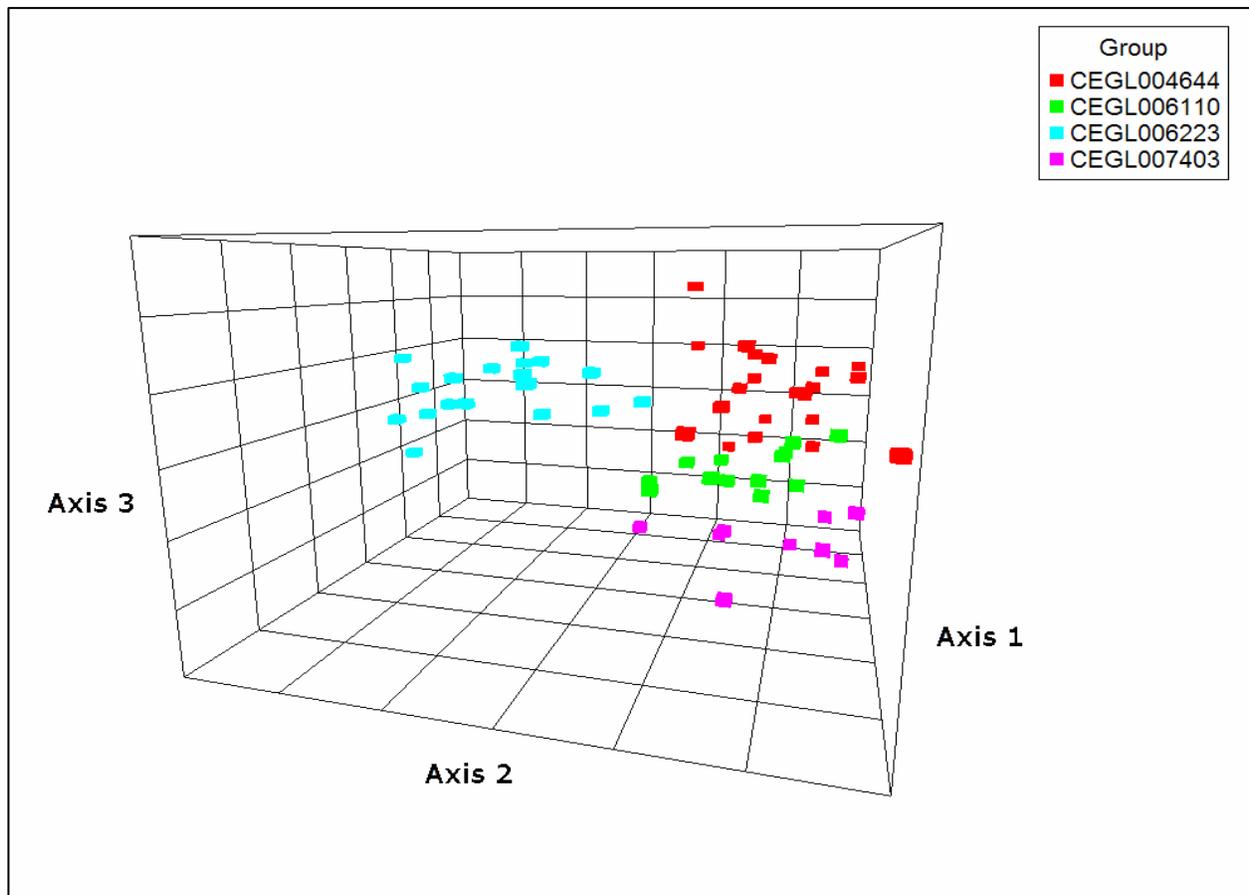


Figure G20. Scatterplot diagram for three-dimensional NMDS ordination of 62 nonriverine forest plots. Plot membership in four nonriverine forest associations is based on cluster analysis. CEGL004644 = Non-Riverine Saturated Forest; CEGL006110 = Coastal Plain Depression Wetland (Red Maple – Sweetgum – Willow Oak Type); CEGL006223 = Coastal Plain Depression Wetland (Swamp Tupelo Type); CEGL007403 = Upland Depression Swamp.

Appendix H. Compositional summary statistics for vegetation associations within Appomattox Court House National Historical Park derived from the analysis of regional quantitative plot data.

Compositional statistics were calculated to evaluate the adequacy of groups recognized in cluster analysis and ultimately to assist in naming and describing vegetation associations. Only associations derived from quantitative analysis of the regional plot data are shown. Total mean cover and total frequency were determined for every taxon across the entire dataset.

Compositional statistics are shown only for prevalent species in each vegetation association, except for those associations where mean species richness is less than or equal to 10 species. Prevalence is an attribute assigned to a portion of the species within a vegetation type (Curtis 1959). Prevalence is determined by ranking the species of a vegetation type in order of descending constancy then, beginning with the most constant species, selecting as prevalent, a number of species equal to the mean species richness for the vegetation type. Species shaded in green were chosen as primary nominals in the association name, while those in blue are parenthetical nominals.

See Methods - Vegetation Classification and Characterization – Summary Statistics section for an explanation of variables shown in each table.

Vegetation associations are presented as follows:

Acidic Oak - Hickory Forest .....	Table H1
Basic Oak - Hickory Forest .....	Table H3
Inner Piedmont / Lower Blue Ridge Basic Mesic Forest .....	Table H2
Mesic Mixed Hardwood Forest .....	Table H5
Northern Piedmont / Lower New England Basic Seepage Swamp .....	Table H4
Piedmont / Low Elevation Mixed Oak / Heath Forest .....	Table H6
Piedmont / Mountain Alluvial Forest .....	Table H7
Upland Depression Swamp .....	Table H8

Table H1. Compositional summary statistics from the regional analysis of Acidic Oak - Hickory Forest (CEGL008475).

Mean Species Richness	53
Homoteneity	0.598
Number of Plots	121

Species	Total Freq.	Total Mean Cover	Mean Cover	Relative Cover	Constancy	Fidelity	Diagnostic Value	Adj DV (scaled)	Adj DV (unscaled)
<i>Quercus alba</i>	720	6	7	+	98	16	16	13	32
<i>Acer rubrum</i>	1090	6	6	0	96	11	10	7	10
<i>Cornus florida</i>	626	4	6	++	94	18	17	11	68
<i>Parthenocissus quinquefolia</i>	899	2	2	0	90	12	11	2	11
<i>Nyssa sylvatica</i>	810	5	5	0	88	13	11	6	11
<i>Vaccinium pallidum</i>	527	4	4	0	87	20	17	8	17
<i>Polygonatum biflorum</i>	462	2	2	0	85	22	19	4	19
<i>Quercus rubra</i>	668	5	6	+	83	15	12	8	25
<i>Vaccinium stamineum</i>	373	2	4	++	83	27	22	10	88
<i>Maianthemum racemosum</i> ssp. <i>racemosum</i>	481	2	2	0	81	20	16	4	16
<i>Prunus serotina</i> var. <i>serotina</i>	619	2	2	0	80	16	12	3	12
<i>Liriodendron tulipifera</i>	753	5	5	0	79	13	10	6	10
<i>Desmodium nudiflorum</i>	307	2	4	++	79	31	24	11	98
<i>Chimaphila maculata</i>	412	2	2	0	79	23	18	4	18
<i>Carya alba</i>	410	4	6	++	78	23	18	12	72
<i>Fraxinus americana</i>	509	4	4	0	77	18	14	6	14
<i>Quercus velutina</i>	428	4	5	+	76	21	16	9	32
<i>Sassafras albidum</i>	520	3	3	0	76	18	13	4	13
<i>Galium circaezans</i>	384	2	2	0	71	22	16	3	16
<i>Carya glabra</i>	437	4	5	+	66	18	12	7	24
<i>Juniperus virginiana</i> var. <i>virginiana</i>	353	2	2	0	65	22	14	3	14
<i>Carex albicans</i>	290	2	2	0	61	25	15	3	15
<i>Vitis vulpina</i>	384	2	2	0	61	19	12	3	12
<i>Smilax glauca</i>	528	2	2	0	61	14	8	2	8
<i>Amelanchier arborea</i>	387	2	3	+	59	18	11	4	22
<i>Rubus flagellaris</i>	329	2	2	0	56	20	11	3	11
<i>Fagus grandifolia</i>	630	6	5	-	53	10	5	3	3
<i>Danthonia spicata</i>	255	2	2	0	53	25	13	3	13
<i>Viburnum prunifolium</i>	361	2	2	0	52	17	9	2	9
<i>Toxicodendron radicans</i>	747	3	2	-	52	8	4	1	2
<i>Viburnum acerifolium</i>	319	2	4	++	51	19	10	4	39
<i>Dioscorea quaternata</i>	339	2	2	0	51	18	9	2	9
<i>Smilax rotundifolia</i>	797	3	2	-	48	7	3	1	2
<i>Solidago caesia</i>	232	2	2	0	47	24	11	3	11
<i>Euonymus americanus</i>	433	2	2	0	47	13	6	1	6
<i>Carya ovalis</i>	160	4	5	+	43	33	14	8	28
<i>Dichanthelium boscii</i>	248	2	3	+	43	21	9	3	18
<i>Uvularia perfoliata</i>	219	2	2	0	43	24	10	2	10
<i>Carex digitalis</i>	268	2	2	0	43	19	8	2	8
<i>Dichanthelium dichotomum</i>	270	2	2	0	43	19	8	2	8
<i>Rhododendron periclymenoides</i>	275	2	2	0	43	19	8	2	8
<i>Diospyros virginiana</i>	292	2	2	0	43	18	8	2	8
<i>Carpinus caroliniana</i>	497	4	4	0	42	10	4	2	4
<i>Quercus prinus</i>	396	5	5	0	41	12	5	3	5
<i>Rosa carolina</i> var. <i>carolina</i>	138	1	2	+	39	34	13	3	27
<i>Quercus coccinea</i>	212	4	4	0	38	21	8	4	8
<i>Polystichum acrostichoides</i>	414	3	2	-	38	11	4	1	2

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Species	Total Freq.	Total Mean Cover	Mean Cover	Relative Cover	Constancy	Fidelity	Diagnostic Value	Adj DV (scaled)	Adj DV (unscaled)
<i>Cercis canadensis</i> var. <i>canadensis</i>	248	3	3	0	36	17	6	2	6
<i>Houstonia purpurea</i> var. <i>purpurea</i>	125	1	2	+	36	34	12	3	25
<i>Scutellaria elliptica</i>	135	1	2	+	36	32	11	3	23
<i>Ilex opaca</i> var. <i>opaca</i>	575	4	2	-	36	7	3	1	1
<i>Gaylussacia baccata</i>	224	4	3	-	34	18	6	2	3
<i>Aristolochia serpentaria</i>	153	1	2	+	33	26	9	2	17
<i>Vitis aestivalis</i>	151	2	2	0	33	26	9	2	9

Table H2. Compositional summary statistics from the regional analysis of Inner Piedmont / Lower Blue Ridge Basic Mesic Forest (CEGL006186).

Mean Species Richness	59
Homoteneity	0.606
Number of Plots	31

Species	Total Freq.	Total Mean Cover	Mean Cover	Relative Cover	Constancy	Fidelity	Diagnostic Value	Adj DV (scaled)	Adj DV (unscaled)
<i>Quercus rubra</i>	147	6	6	0	100	21	20	14	20
<i>Parthenocissus quinquefolia</i>	158	3	4	+	100	20	19	8	38
<i>Liriodendron tulipifera</i>	142	6	7	+	91	20	19	14	37
<i>Fraxinus americana</i>	154	6	6	0	91	19	17	11	17
<i>Lindera benzoin</i>	128	5	6	+	88	22	19	13	38
<i>Botrychium virginianum</i>	91	2	2	0	88	31	27	6	27
<i>Polystichum acrostichoides</i>	126	4	5	+	84	21	18	10	36
<i>Cornus florida</i>	110	4	5	+	81	24	19	11	38
<i>Galium circaeans</i>	105	2	2	0	81	25	20	4	20
<i>Maianthemum racemosum</i> ssp. <i>racemosum</i>	113	2	2	0	81	23	19	4	19
<i>Cimicifuga racemosa</i>	87	4	4	0	78	29	22	10	22
<i>Toxicodendron radicans</i>	123	2	3	+	78	20	16	5	32
<i>Circaea lutetiana</i> ssp. <i>canadensis</i>	104	3	3	0	78	24	19	6	19
<i>Galium triflorum</i>	84	2	2	0	78	30	23	5	23
<i>Asimina triloba</i>	122	6	6	0	75	20	15	10	15
<i>Cercis canadensis</i> var. <i>canadensis</i>	73	4	5	+	75	33	25	14	49
<i>Arisaema triphyllum</i>	115	3	4	+	75	21	16	7	31
<i>Phryma leptostachya</i>	67	2	2	0	75	36	27	6	27
<i>Sanicula canadensis</i>	87	2	2	0	75	28	21	5	21
<i>Acer rubrum</i>	119	5	5	0	72	19	14	8	14
<i>Smilax rotundifolia</i>	89	2	2	0	72	26	19	4	19
<i>Lonicera japonica</i>	90	3	2	-	72	26	18	4	9
<i>Vitis vulpina</i>	71	2	2	0	69	31	21	5	21
<i>Carya alba</i>	64	4	5	+	66	33	22	12	43
<i>Nyssa sylvatica</i>	67	4	4	0	66	31	21	9	21
<i>Uvularia perfoliata</i>	67	2	3	+	66	31	21	7	41
<i>Dioscorea quaternata</i>	70	2	2	0	66	30	20	4	20
<i>Carya ovalis</i>	45	4	5	+	63	44	28	15	56
<i>Amphicarpaea bracteata</i>	68	4	5	+	63	29	18	10	37
<i>Desmodium nudiflorum</i>	38	2	2	0	63	53	33	7	33
<i>Sanguinaria canadensis</i>	85	2	2	0	63	24	15	3	15
<i>Ulmus rubra</i>	92	4	4	0	59	21	12	5	12
<i>Prunus serotina</i> var. <i>serotina</i>	104	2	2	0	59	18	11	2	11
<i>Quercus alba</i>	90	5	5	0	56	20	11	6	11
<i>Polygonatum biflorum</i>	97	2	2	0	56	19	10	2	10
<i>Viburnum acerifolium</i>	66	2	3	+	53	26	14	5	27
<i>Thalictrum thalictroides</i>	44	2	2	0	47	34	16	4	16
<i>Carex digitalis</i>	54	2	2	0	47	28	13	3	13
<i>Festuca subverticillata</i>	101	2	2	0	47	15	7	2	7
<i>Carpinus caroliniana</i>	78	4	5	+	44	18	8	4	16
<i>Fagus grandifolia</i>	108	6	5	-	44	13	6	3	3
<i>Asplenium platyneuron</i>	52	2	2	0	44	27	12	3	12
<i>Brachyelytrum erectum</i>	57	2	2	0	44	25	11	2	11
<i>Viola sororia</i>	82	2	2	0	44	17	7	2	7
<i>Stellaria pubera</i>	86	2	2	0	44	16	7	2	7
<i>Adiantum pedatum</i>	45	2	4	++	41	29	12	5	47
<i>Celtis occidentalis</i>	54	2	3	+	41	24	10	3	20
<i>Dichantheium boscii</i>	47	2	2	0	41	28	11	2	11
<i>Viburnum prunifolium</i>	47	2	2	0	41	28	11	2	11

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Species	Total Freq.	Total Mean Cover	Mean Cover	Relative Cover	Constancy	Fidelity	Diagnostic Value	Adj DV (scaled)	Adj DV (unscaled)
<i>Aristolochia serpentaria</i>	25	1	1	0	41	52	21	2	21
<i>Carya cordiformis</i>	114	5	3	-0-	38	11	4	1	1
<i>Rubus flagellaris</i>	37	1	2	+	38	32	12	3	24
<i>Collinsonia canadensis</i>	32	2	2	0	38	38	14	3	14
<i>Carex laxiflora</i> var. <i>laxiflora</i>	49	2	2	0	38	24	9	2	9
<i>Sassafras albidum</i>	57	2	2	0	38	21	8	2	8
<i>Agrimonia rostellata</i>	25	1	2	+	34	44	15	3	30
<i>Symphoricarpos orbiculatus</i>	19	2	2	0	34	58	20	4	20
<i>Geranium maculatum</i>	38	2	2	0	34	29	10	2	10
<i>Solidago caesia</i>	54	2	2	0	34	20	7	2	7

Table H3. Compositional summary statistics from the regional analysis of Basic Oak - Hickory Forest (CEGL007232).

Mean Species Richness	71
Homoteneity	0.637
Number of Plots	16

Species	Total Freq.	Total Mean Cover	Mean Cover	Relative Cover	Constancy	Fidelity	Diagnostic Value	Adj DV (scaled)	Adj DV (unscaled)
<i>Quercus alba</i>	720	6	7	+	100	2	2	2	4
<i>Cornus florida</i>	626	4	6	++	100	3	3	2	10
<i>Parthenocissus quinquefolia</i>	899	2	5	+++	100	2	2	1	14
<i>Galium circaezans</i>	384	2	2	0	100	4	4	1	4
<i>Cercis canadensis</i> var. <i>canadensis</i>	248	3	6	+++	94	6	6	4	45
<i>Desmodium nudiflorum</i>	307	2	5	+++	94	5	5	3	37
<i>Fraxinus americana</i>	509	4	5	+	94	3	3	2	6
<i>Maianthemum racemosum</i> ssp. <i>racemosum</i>	481	2	4	++	94	3	3	1	12
<i>Acer rubrum</i>	1090	6	4	--	94	1	1	1	0
<i>Uvularia perfoliata</i>	219	2	2	0	94	7	6	1	6
<i>Polygonatum biflorum</i>	462	2	2	0	94	3	3	1	3
<i>Carya alba</i>	410	4	5	+	88	3	3	2	6
<i>Juniperus virginiana</i> var. <i>virginiana</i>	353	2	4	++	88	4	3	2	14
<i>Agrimonia rostellata</i>	123	1	2	+	88	11	10	2	20
<i>Viburnum prunifolium</i>	361	2	2	0	88	4	3	1	3
<i>Prunus serotina</i> var. <i>serotina</i>	619	2	2	0	88	2	2	0	2
<i>Amphicarpaea bracteata</i>	261	2	5	+++	81	5	4	2	32
<i>Vitis vulpina</i>	384	2	3	+	75	3	2	1	5
<i>Viola palmata</i>	114	1	2	+	75	11	8	2	16
<i>Aristolochia serpentaria</i>	153	1	2	+	75	8	6	1	12
<i>Euonymus americanus</i>	433	2	2	0	75	3	2	0	2
<i>Carpinus caroliniana</i>	497	4	6	++	69	2	2	1	6
<i>Fagus grandifolia</i>	630	6	6	0	69	2	1	1	1
<i>Quercus rubra</i>	668	5	6	+	69	2	1	1	2
<i>Liriodendron tulipifera</i>	753	5	6	+	69	1	1	1	2
<i>Dichanthelium boscii</i>	248	2	4	++	69	4	3	1	12
<i>Polystichum acrostichoides</i>	414	3	4	+	69	3	2	1	4
<i>Lonicera japonica</i>	516	2	4	++	69	2	1	1	6
<i>Nyssa sylvatica</i>	810	5	4	-	69	1	1	0	0
<i>Botrychium virginianum</i>	206	1	2	+	69	5	4	1	7
<i>Solidago caesia</i>	232	2	2	0	69	5	3	1	3
<i>Liquidambar styraciflua</i>	472	4	4	0	63	2	1	1	1
<i>Morus rubra</i>	120	1	2	+	63	8	5	1	10
<i>Galium triflorum</i>	258	2	2	0	63	4	2	1	2
<i>Festuca subverticillata</i>	268	2	2	0	63	4	2	1	2
<i>Carex albicans</i>	290	2	2	0	63	3	2	0	2
<i>Sanicula canadensis</i>	307	2	2	0	63	3	2	0	2
<i>Chimaphila maculata</i>	412	2	2	0	63	2	2	0	2
<i>Ulmus alata</i>	79	2	5	+++	56	11	6	4	51
<i>Vernonia glauca</i>	43	1	2	+	56	21	12	3	24
<i>Geum virginianum</i>	100	1	2	+	56	9	5	1	10
<i>Phryma leptostachya</i>	149	1	2	+	56	6	3	1	7
<i>Carex rosea</i>	152	1	2	+	56	6	3	1	7
<i>Rubus flagellaris</i>	329	2	2	0	56	3	2	0	2
<i>Toxicodendron radicans</i>	747	3	2	-	56	1	1	0	0
<i>Carya ovata</i>	47	2	6	++++	50	17	9	6	136
<i>Corylus americana</i>	45	1	4	+++	50	18	9	4	71

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Species	Total Freq.	Total Mean Cover	Mean Cover	Relative Cover	Constancy	Fidelity	Diagnostic Value	Adj DV (scaled)	Adj DV (unscaled)
<i>Carya cordiformis</i>	289	3	4	+	50	3	1	1	3
<i>Symphoricarpos orbiculatus</i>	87	1	2	+	50	9	5	1	9
<i>Podophyllum peltatum</i>	207	2	2	0	50	4	2	0	2
<i>Dioscorea quaternata</i>	339	2	2	0	50	2	1	0	1
<i>Smilax rotundifolia</i>	797	3	2	-	50	1	1	0	0
<i>Juglans nigra</i>	97	2	3	+	44	7	3	1	6
<i>Chrysogonum virginianum</i> var. <i>virginianum</i>	14	1	2	+	44	50	22	5	44
<i>Smilax pulverulenta</i>	54	1	2	+	44	13	6	1	11
<i>Melica mutica</i>	55	1	2	+	44	13	6	1	11
<i>Houstonia purpurea</i> var. <i>purpurea</i>	125	1	2	+	44	6	2	1	5
<i>Carex laxiflora</i> var. <i>laxiflora</i>	140	1	2	+	44	5	2	0	4
<i>Asplenium platyneuron</i>	156	1	2	+	44	4	2	0	4
<i>Vitis rotundifolia</i>	169	2	2	0	44	4	2	0	2
<i>Viola sororia</i>	252	2	2	0	44	3	1	0	1
<i>Vaccinium stamineum</i>	373	2	2	0	44	2	1	0	1
<i>Smilax glauca</i>	528	2	2	0	44	1	1	0	1
<i>Carya ovalis</i>	160	4	6	++	38	4	1	1	6
<i>Cimicifuga racemosa</i>	106	2	4	++	38	6	2	1	8
<i>Desmodium perplexum</i>	50	1	2	+	38	12	5	1	9
<i>Geranium maculatum</i>	63	1	2	+	38	10	4	1	7
<i>Carex hirsutella</i>	98	1	2	+	38	6	2	1	5
<i>Oxalis dillenii</i>	120	1	2	+	38	5	2	0	4
<i>Scutellaria elliptica</i>	135	1	2	+	38	4	2	0	3
<i>Sassafras albidum</i>	520	3	1	--	38	1	0	0	0

Table H4. Compositional summary statistics from the regional analysis of Northern Piedmont / Lower New England Basic Seepage Swamp (CEGL006406).

Mean Species Richness	51
Homogeneity	0.549
Number of Plots	18

Species	Total Freq.	Total Mean Cover	Mean Cover	Relative Cover	Constancy	Fidelity	Diagnostic Value	Adj DV (scaled)	Adj DV (unscaled)
<i>Acer rubrum</i>	1090	6	7	+	100	2	2	1	3
<i>Impatiens capensis</i>	203	2	5	+++	100	9	9	5	71
<i>Symplocarpus foetidus</i>	80	3	8	+++++	94	21	20	18	642
<i>Lindera benzoin</i>	456	4	6	++	94	4	4	2	14
<i>Arisaema triphyllum</i>	405	2	4	++	89	4	4	2	14
<i>Liriodendron tulipifera</i>	753	5	6	+	78	2	1	1	3
<i>Microstegium vimineum</i>	255	2	5	+++	78	5	4	2	34
<i>Toxicodendron radicans</i>	747	3	3	0	72	2	1	0	1
<i>Boehmeria cylindrica</i>	226	2	2	0	72	6	4	1	4
<i>Carpinus caroliniana</i>	497	4	5	+	67	2	2	1	3
<i>Chelone glabra</i>	81	1	2	+	67	15	10	2	20
<i>Ranunculus recurvatus</i>	101	1	2	+	67	12	8	2	16
<i>Parthenocissus quinquefolia</i>	899	2	2	0	67	1	1	0	1
<i>Ilex verticillata</i>	194	2	5	+++	61	6	3	2	28
<i>Osmunda cinnamomea</i>	129	2	4	++	61	9	5	2	21
<i>Asimina triloba</i>	519	5	4	-	61	2	1	1	1
<i>Viburnum dentatum</i>	236	2	3	+	61	5	3	1	6
<i>Lonicera japonica</i>	516	2	3	+	61	2	1	0	3
<i>Cardamine pensylvanica</i>	41	1	2	+	61	27	16	4	33
<i>Smilax rotundifolia</i>	797	3	2	-	61	1	1	0	0
<i>Glyceria striata</i>	152	2	4	++	56	7	4	2	15
<i>Lycopus virginicus</i>	179	1	2	+	56	6	3	1	6
<i>Leersia virginica</i>	201	2	2	0	56	5	3	1	3
<i>Cinna arundinacea</i>	229	3	2	-	56	4	2	1	1
<i>Fraxinus americana</i>	509	4	5	+	50	2	1	0	2
<i>Fagus grandifolia</i>	630	6	4	--	50	1	1	0	0
<i>Pilea pumila</i>	106	2	3	+	50	8	4	1	8
<i>Circaea lutetiana</i> ssp. <i>canadensis</i>	247	2	2	0	50	4	2	0	2
<i>Saururus cernuus</i>	91	2	6	++++	44	9	4	3	63
<i>Quercus rubra</i>	668	5	5	0	44	1	1	0	1
<i>Carex laevivaginata</i>	46	1	3	++	44	17	8	3	31
<i>Carex prasina</i>	38	2	3	+	44	21	9	3	19
<i>Polygonum arifolium</i>	55	2	3	+	44	15	6	2	13
<i>Nyssa sylvatica</i>	810	5	3	--	44	1	0	0	0
<i>Sambucus nigra</i> ssp. <i>canadensis</i>	94	1	2	+	44	9	4	1	8
<i>Onoclea sensibilis</i>	95	1	2	+	44	8	4	1	7
<i>Geum canadense</i>	170	2	2	0	44	5	2	0	2
<i>Amphicarpaea bracteata</i>	261	2	2	0	44	3	1	0	1
<i>Polystichum acrostichoides</i>	414	3	2	-	44	2	1	0	0
<i>Fraxinus pennsylvanica</i>	238	4	6	++	39	3	1	1	5
<i>Thalictrum pubescens</i>	59	1	2	+	39	12	5	1	9
<i>Viola cucullata</i>	89	2	2	0	39	8	3	1	3
<i>Polygonum caespitosum</i> var. <i>longisetum</i>	122	2	2	0	39	6	2	0	2
<i>Athyrium filix-femina</i> var. <i>asplenioides</i>	157	2	2	0	39	4	2	0	2
<i>Rosa multiflora</i>	99	1	2	+	33	6	2	0	4
<i>Carex radiata</i>	146	2	2	0	33	4	1	0	1
<i>Festuca subverticillata</i>	268	2	2	0	33	2	1	0	1

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Species	Total Freq.	Total Mean Cover	Mean Cover	Relative Cover	Constancy	Fidelity	Diagnostic Value	Adj DV (scaled)	Adj DV (unscaled)
<i>Symphotrichum lateriflorum</i>	308	2	2	0	33	2	1	0	1
<i>Viburnum prunifolium</i>	361	2	2	0	33	2	1	0	1
<i>Chrysosplenium americanum</i>	23	2	5	+++	28	22	6	3	48
<i>Veratrum viride</i>	30	2	4	++	28	17	5	2	19

Table H5. Compositional summary statistics from the regional analysis of Mesic Mixed Hardwood Forest (CEGL006075).

Mean Species Richness	42
Homoteneity	0.573
Number of Plots	170

Species	Total Freq	Total Mean Cover	Mean Cover	Relative Cover	Constancy	Fidelity	Diagnostic Value	Adj DV (scaled)	Adj DV (unscaled)
<i>Fagus grandifolia</i>	630	6	7	+	97	26	25	20	51
<i>Acer rubrum</i>	1090	6	6	0	92	14	13	9	13
<i>Liriodendron tulipifera</i>	753	5	6	+	92	21	19	13	38
<i>Parthenocissus quinquefolia</i>	899	2	2	0	89	17	15	3	15
<i>Quercus alba</i>	720	6	6	0	84	20	16	11	16
<i>Cornus florida</i>	626	4	5	+	82	22	18	10	37
<i>Quercus rubra</i>	668	5	6	+	77	20	15	10	30
<i>Nyssa sylvatica</i>	810	5	5	0	77	16	12	7	12
<i>Prunus serotina</i> var. <i>serotina</i>	619	2	2	0	75	21	15	3	15
<i>Toxicodendron radicans</i>	747	3	2	-	75	17	13	3	6
<i>Ilex opaca</i> var. <i>opaca</i>	575	4	5	+	73	22	16	9	31
<i>Polystichum acrostichoides</i>	414	3	4	+	71	29	20	9	41
<i>Maianthemum racemosum</i> ssp. <i>racemosum</i>	481	2	2	0	64	23	15	3	15
<i>Polygonatum biflorum</i>	462	2	2	0	63	23	15	3	15
<i>Smilax rotundifolia</i>	797	3	2	-	62	13	8	2	4
<i>Asimina triloba</i>	519	5	4	-	61	20	12	5	6
<i>Euonymus americanus</i>	433	2	2	0	61	24	15	3	15
<i>Smilax glauca</i>	528	2	2	0	60	19	12	3	12
<i>Carya alba</i>	410	4	4	0	58	24	14	6	14
<i>Carpinus caroliniana</i>	497	4	4	0	58	20	12	5	12
<i>Mitchella repens</i>	395	2	2	0	55	24	13	3	13
<i>Vaccinium pallidum</i>	527	4	2	--	52	17	9	2	2
<i>Carya glabra</i>	437	4	4	0	51	20	10	5	10
<i>Carex digitalis</i>	268	2	2	0	51	32	16	4	16
<i>Chimaphila maculata</i>	412	2	2	0	49	20	10	2	10
<i>Sassafras albidum</i>	520	3	2	-	49	16	8	2	4
<i>Desmodium nudiflorum</i>	307	2	2	0	48	27	13	3	13
<i>Viburnum acerifolium</i>	319	2	3	+	46	24	11	4	22
<i>Galium circaeazans</i>	384	2	2	0	45	20	9	2	9
<i>Dioscorea quaternata</i>	339	2	2	0	45	22	10	2	10
<i>Fraxinus americana</i>	509	4	2	--	45	15	7	1	2
<i>Lonicera japonica</i>	516	2	2	0	44	14	6	1	6
<i>Liquidambar styraciflua</i>	472	4	4	0	42	15	6	3	6
<i>Quercus velutina</i>	428	4	4	0	42	17	7	3	7
<i>Vitis vulpina</i>	384	2	2	0	40	18	7	2	7
<i>Lindera benzoin</i>	456	4	3	-	39	14	6	2	3
<i>Amelanchier arborea</i>	387	2	2	0	36	16	6	1	6
<i>Quercus prinus</i>	396	5	5	0	34	15	5	3	5
<i>Epifagus virginiana</i>	107	1	2	+	34	54	18	4	37
<i>Carex albicans</i>	290	2	2	0	33	19	6	1	6
<i>Medeola virginiana</i>	175	1	2	+	29	28	8	2	16
<i>Eurybia divaricata</i>	236	2	2	0	28	20	6	1	6

Table H6. Compositional summary statistics from the regional analysis of Piedmont / Low Elevation Mixed Oak / Heath Forest (CEGL008521).

Mean Species Richness	25
Homoteneity	0.663
Number of Plots	75

Species	Total Freq.	Total Mean Cover	Mean Cover	Relative Cover	Constancy	Fidelity	Diagnostic Value	Adj DV (scaled)	Adj DV (unscaled)
<i>Nyssa sylvatica</i>	810	5	6	+	99	9	9	6	18
<i>Vaccinium pallidum</i>	528	4	6	++	97	14	13	9	53
<i>Acer rubrum</i>	1090	6	6	0	97	7	6	4	6
<i>Quercus alba</i>	721	6	7	+	93	10	9	7	18
<i>Gaylussacia baccata</i>	225	4	7	+++	89	29	26	20	209
<i>Sassafras albidum</i>	521	3	4	+	85	12	10	5	21
<i>Vaccinium stamineum</i>	373	2	5	+++	82	16	13	7	108
<i>Quercus velutina</i>	429	4	5	+	82	14	12	7	23
<i>Chimaphila maculata</i>	412	2	2	0	74	13	10	2	10
<i>Quercus coccinea</i>	212	4	6	++	70	25	17	11	69
<i>Quercus prinus</i>	396	5	7	++	69	13	9	7	36
<i>Smilax glauca</i>	528	2	2	0	66	9	6	1	6
<i>Amelanchier arborea</i>	388	2	4	++	61	12	7	3	28
<i>Pinus virginiana</i>	182	2	4	++	59	24	14	6	57
<i>Carya glabra</i>	437	4	4	0	58	10	6	3	6
<i>Smilax rotundifolia</i>	798	3	2	-	54	5	3	1	1
<i>Carya alba</i>	411	4	4	0	50	9	5	2	5
<i>Prunus serotina</i> var. <i>serotina</i>	620	2	2	0	50	6	3	1	3
<i>Ilex opaca</i> var. <i>opaca</i>	576	4	4	0	47	6	3	1	3
<i>Fagus grandifolia</i>	631	6	4	--	47	6	3	1	1
<i>Rhododendron periclymenoides</i>	275	2	3	+	46	12	6	2	11
<i>Cornus florida</i>	627	4	3	-	46	5	2	1	1
<i>Diospyros virginiana</i>	293	2	2	0	46	12	5	1	5
<i>Quercus falcata</i>	178	3	4	+	45	19	8	4	17
<i>Kalmia latifolia</i>	281	4	4	0	42	11	5	2	5

Table H7. Compositional summary statistics from the regional analysis of Piedmont / Mountain Alluvial Forest (CEGL006492).

Mean Species Richness	51
Homoteneity	0.567
Number of Plots	14

Species	Total Freq.	Total Mean Cover	Mean Cover	Relative Cover	Constancy	Fidelity	Diagnostic Value	Adj DV (scaled)	Adj DV (unscaled)
<i>Parthenocissus quinquefolia</i>	899	2	3	+	100	2	2	1	3
<i>Lindera benzoin</i>	456	4	6	++	93	3	3	2	11
<i>Lonicera japonica</i>	516	2	5	+++	93	3	3	1	20
<i>Toxicodendron radicans</i>	747	3	4	+	93	2	2	1	3
<i>Liriodendron tulipifera</i>	753	5	7	++	87	2	1	1	6
<i>Carpinus caroliniana</i>	497	4	6	++	87	3	2	2	9
<i>Microstegium vimineum</i>	255	2	5	+++	80	5	4	2	30
<i>Arisaema triphyllum</i>	405	2	4	++	80	3	2	1	9
<i>Geum canadense</i>	170	2	3	+	80	7	6	2	11
<i>Acer negundo</i>	132	2	6	++++	73	8	6	4	98
<i>Polygonum virginianum</i>	203	2	4	++	73	5	4	2	16
<i>Carya cordiformis</i>	289	3	3	0	73	4	3	1	3
<i>Carex amphibola</i>	88	2	4	++	67	11	8	3	30
<i>Circaea lutetiana</i> ssp. <i>canadensis</i>	247	2	4	++	67	4	3	1	11
<i>Alliaria petiolata</i>	130	2	3	+	67	8	5	2	10
<i>Duchesnea indica</i>	51	1	2	+	67	20	13	3	26
<i>Asimina triloba</i>	519	5	6	+	60	2	1	1	2
<i>Acer rubrum</i>	1090	6	6	0	60	1	0	0	0
<i>Fraxinus pennsylvanica</i>	238	4	5	+	60	4	2	1	5
<i>Verbesina alternifolia</i>	52	1	4	+++	60	17	10	5	83
<i>Carex radiata</i>	146	2	4	++	60	6	4	2	15
<i>Prunus serotina</i> var. <i>serotina</i>	619	2	2	0	60	1	1	0	1
<i>Ulmus americana</i>	238	3	5	++	53	3	2	1	7
<i>Celastrus orbiculatus</i>	111	1	4	+++	53	7	4	2	31
<i>Carex blanda</i>	156	2	3	+	53	5	3	1	5
<i>Impatiens capensis</i>	203	2	2	0	53	4	2	0	2
<i>Boehmeria cylindrica</i>	226	2	2	0	53	4	2	0	2
<i>Viola sororia</i>	252	2	2	0	53	3	2	0	2
<i>Symphytotrichum lateriflorum</i>	308	2	2	0	53	3	1	0	1
<i>Platanus occidentalis</i>	85	2	5	+++	47	8	4	2	31
<i>Juglans nigra</i>	97	2	5	+++	47	7	3	2	27
<i>Polygonum caespitosum</i> var. <i>longisetum</i>	122	2	4	++	47	6	3	1	11
<i>Viburnum prunifolium</i>	361	2	3	+	47	2	1	0	2
<i>Rosa multiflora</i>	99	1	2	+	47	7	3	1	7
<i>Podophyllum peltatum</i>	207	2	2	0	47	3	2	0	2
<i>Polystichum acrostichoides</i>	414	3	2	-	47	2	1	0	0
<i>Smilax rotundifolia</i>	797	3	2	-	47	1	0	0	0
<i>Fagus grandifolia</i>	630	6	4	--	40	1	0	0	0
<i>Claytonia virginica</i>	124	2	3	+	40	5	2	1	4
<i>Amphicarpaea bracteata</i>	261	2	3	+	40	2	1	0	2
<i>Galium aparine</i>	148	2	2	0	40	4	2	0	2
<i>Leersia virginica</i>	201	2	2	0	40	3	1	0	1
<i>Festuca subverticillata</i>	268	2	2	0	40	2	1	0	1
<i>Glechoma hederacea</i>	30	1	3	++	33	17	6	2	22
<i>Berberis thunbergii</i>	51	1	2	+	33	10	3	1	7
<i>Allium vineale</i>	51	1	2	+	33	10	3	1	7
<i>Ranunculus abortivus</i>	106	1	2	+	33	5	2	0	3
<i>Celtis occidentalis</i>	205	2	2	0	33	2	1	0	1
<i>Sanicula canadensis</i>	307	2	2	0	33	2	1	0	1
<i>Rubus flagellaris</i>	329	2	2	0	33	2	1	0	1
<i>Vitis vulpina</i>	384	2	2	0	33	1	0	0	0

Table H8. Compositional summary statistics from the regional analysis of Upland Depression Swamp (CEGL007403).

Mean Species Richness	35
Homoteneity	0.527
Number of Plots	9

Species	Total Freq.	Total Mean Cover	Mean Cover	Relative Cover	Constancy	Fidelity	Diagnostic Value	Adj DV (scaled)	Adj DV (unscaled)
<i>Acer rubrum</i>	1090	6	7	+	100	1	1	1	2
<i>Quercus phellos</i>	238	4	7	+++	100	4	4	3	30
<i>Smilax rotundifolia</i>	797	3	6	+++	100	1	1	1	9
<i>Nyssa sylvatica</i>	810	5	5	0	78	1	1	0	1
<i>Fraxinus pennsylvanica</i>	238	4	5	+	67	3	2	1	3
<i>Liquidambar styraciflua</i>	472	4	5	+	67	1	1	0	2
<i>Juniperus virginiana</i> var. <i>virginiana</i>	353	2	4	++	67	2	1	1	5
<i>Parthenocissus quinquefolia</i>	899	2	2	0	67	1	0	0	0
<i>Smilax glauca</i>	528	2	2	0	67	1	1	0	1
<i>Ulmus alata</i>	79	2	4	++	56	6	4	2	14
<i>Carex typhina</i>	47	2	3	+	56	11	6	2	12
<i>Quercus alba</i>	720	6	3	---	56	1	0	0	0
<i>Toxicodendron radicans</i>	747	3	3	0	56	1	0	0	0
<i>Cinna arundinacea</i>	229	3	2	-	56	2	1	0	1
<i>Euonymus americanus</i>	433	2	2	0	56	1	1	0	1
<i>Carex albolutescens</i>	31	1	4	+++	44	13	6	3	46
<i>Carex festucea</i>	31	1	3	++	44	13	6	2	23
<i>Ilex verticillata</i>	194	2	3	+	44	2	1	0	2
<i>Lonicera japonica</i>	516	2	3	+	44	1	0	0	1
<i>Agrostis perennans</i>	129	1	2	+	44	3	1	0	3
<i>Asplenium platyneuron</i>	156	1	2	+	44	3	1	0	2
<i>Dichanthelium dichotomum</i>	270	2	2	0	44	1	1	0	1
<i>Diospyros virginiana</i>	292	2	2	0	44	1	1	0	1
<i>Juncus effusus</i>	121	1	2	+	44	3	1	0	3
<i>Rubus flagellaris</i>	329	2	2	0	44	1	1	0	1
<i>Symphotrichum lateriflorum</i>	308	2	2	0	44	1	1	0	1
<i>Scutellaria integrifolia</i>	50	1	1	0	44	8	4	0	4
<i>Campsis radicans</i>	208	2	4	++	33	1	0	0	2
<i>Ulmus americana</i>	238	3	4	+	33	1	0	0	1
<i>Carex glaucodea</i>	30	1	3	++	33	10	3	1	13
<i>Amelanchier arborea</i>	387	2	2	0	33	1	0	0	0
<i>Carex hirsutella</i>	98	1	2	+	33	3	1	0	2
<i>Carpinus caroliniana</i>	497	4	2	--	33	1	0	0	0
<i>Danthonia spicata</i>	255	2	2	0	33	1	0	0	0
<i>Erechtites hieraciifolia</i> var. <i>hieraciifolia</i>	112	1	2	+	33	3	1	0	2

## Appendix I. Local and global descriptions of vegetation associations and other vegetation-map classes for Appomattox Court House National Historical Park.

This appendix contains detailed local descriptions for vegetation associations and other vegetation-map classes present at Appomattox Court House National Historical Park based on information collected within the park boundary. Of the 20 map classes used to map Appomattox Court House National Historical Park, sixteen were crosswalked to the finest level of the USNVC (association), two were described as a nonstandard, park-specific vegetation class, and two were crosswalked to Anderson (Anderson et al. 1976) level II classification. One map class is crosswalked to more than one association and both associations are described in this appendix.

All map classes crosswalked to the association level of the USNVC also include range-wide descriptions (i.e. global descriptions). Information in the global descriptions of the associations was extracted from the September 27, 2007 version of the NatureServe central databases (NatureServe 2007). A copywrite notice precedes the report.

Fields used in the local and global descriptions are defined in Appendix J. Vascular plant species nomenclature within the local and global descriptions follows the nationally standardized list of Kartesz (1999), with very few exceptions. This nomenclature differs from PLANTS 3.5 in only a very few cases, and when this difference occurs, synonymy is indicated parenthetically in the local description information. Nomenclature for nonvascular plants follows Anderson (1990) and Anderson et al. (1990) for mosses, Egan (1987, 1989, 1990, 1991) and Esslinger and Egan (1995) for lichens, and Stotler and Crandall-Stotler (1977) for liverworts/hornworts. English names for associations and alliances use NatureServe Central Ecology-accepted names and may differ slightly from PLANTS 3.5 common names that are used within the local description information and throughout the rest of the report. Sources cited in the local and global vegetation descriptions are included in the literature section at the end of this appendix. Representative photographs of the vegetation types are provided after the descriptions except for Basic Oak – Hickory Forest where an acceptable photograph was not obtained. Photographs were taken by VADNH staff unless otherwise indicated.

Each association is crosswalked to the Ecological Group level of the state classification for Virginia (Fleming et al. 2006), which is the level that is currently tracked in the NatureServe databases from which this appendix was created. Ecological Groups contain multiple associations, some rare and some common, so a state rank is not appropriate for this level of classification. The state name (Sname) field within "Subnational Distribution with Crosswalk Data" crosswalks the USNVC association to the Ecological Group level of the Virginia Classification of Ecological Communities and the subnational ranking information is qualified with a \* , indicating that the ranking information is not at the association level. State ranks for USNVC associations are managed within the Virginia Division of Natural Heritage and the state/subnational conservation rank (SRank) and global conservation rank (GRank) for all associations are provided in Appendix D. Definitions of the conservation ranks are in Appendix E. Values for the relationship (Rel) and crosswalk confidence (Conf) are defined in Appendix J.

The dichotomous key to the Appomattox Court House National Historical Park map classes is presented in Appendix K. The key should be used in conjunction with the detailed descriptions.

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**Citations:**

*The following citation should be used in any published materials which reference ecological system and/or International Vegetation Classification (IVC hierarchy) and association data:*

NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 27 September 2007.

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## **UPLAND DECIDUOUS FORESTS**

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**COMMON NAME (PARK-SPECIFIC): LOBLOLLY PINE PLANTATION**

**SYNONYMS**

**USNVC English Name:** Loblolly Pine Planted Forest  
**USNVC Scientific Name:** *Pinus taeda* Planted Forest  
**USNVC Identifier:** C EGL007179

**LOCAL INFORMATION**

**Environmental Description:** Loblolly Pine Plantation is an evergreen forest that results from planting *Pinus taeda* (loblolly pine). Stands are found on gentle slopes and flats throughout Appomattox Court House National Historical Park.

**Vegetation Description:** Loblolly Pine Plantation is an evergreen forest that results from planting *Pinus taeda* (loblolly pine). Stands can occur as perfect rows of planted *Pinus taeda* (loblolly pine) or as dense, young stands. These stands support almost no other tree species in the overstory and typically very little understory and no herbaceous species. Loblolly Pine Plantation in Appomattox Court House National Historical Park may have small areas with associated *Pinus virginiana* (Virginia pine) or *Liriodendron tulipifera* (tuliptree), or other small hardwood trees, but *Pinus taeda* (loblolly pine) is always dominant.

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Pinus taeda</i> (loblolly pine)

**Characteristic Species:** *Pinus taeda* (loblolly pine).

**Other Noteworthy Species:** Information not available.

**Subnational Distribution with Crosswalk Data:**

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
VA	SNA	.	.	[not crosswalked]	.

**Local Range:** Loblolly Pine Plantation is mapped as nine polygons covering 19.2 hectares (47.4 acres). Stands range in size from 0.3 to 9.5 hectares (0.8 to 23.3 acres).

**Classification Comments:** Loblolly Pine Plantation is distinguished from other vegetation in Appomattox Court House National Historical Park by being dominated by *Pinus taeda* (loblolly pine).

**Other Comments:** *Pinus taeda* (Loblolly Pine) is only native in Virginia from the eastern Piedmont, east through the Coastal Plain. In the central Piedmont, and in Appomattox Court House National Historical Park, it only grows in plantations or as trees that have naturalized from plantations.

**Local Description Authors:** K. D. Patterson.

**Plots:** None.

**Appomattox Court House National Historical Park Inventory Notes:** Information not available.

## GLOBAL INFORMATION

### USNVC 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	Planted/Cultivated temperate or subpolar needle-leaved evergreen forest (I.A.8.C.)
Formation	Planted/cultivated temperate or subpolar needle-leaved evergreen forest (I.A.8.C.x.)
Alliance	<i>Pinus taeda</i> Planted Forest Alliance (A.99)
Alliance (English name)	Loblolly Pine Planted Forest Alliance
Association	<i>Pinus taeda</i> Planted Forest
Association (English name)	Loblolly Pine Planted Forest
<b>Ecological System(s):</b>	Information not available.

### GLOBAL DESCRIPTION

**Concept Summary:** This association represents young, monospecific planted stands of *Pinus taeda* (loblolly pine). Due to the commercial value of this species, this type is widely distributed across much of the southeastern United States from the Interior Highlands to the Coastal Plain, including areas outside the natural range of the species. The core concept of stands attributable to this type are those which support dense, often perfect rows of planted *Pinus taeda* (loblolly pine) or otherwise dense, young stands which are established, managed, and/or maintained for the extraction of forest products (usually pulpwood). In most cases these stands support almost no other tree species in the overstory. Understory composition and density can vary widely depending upon location, management history, and stand age. Stands are typically established with mechanical planting, but may also be established through other means. This association rarely exceeds 20-40 years of age on most timberlands. Excluded from this association are plantation stands which have "broken up" with age or thinning to approximate a more natural structure. Dense planting in rows, if successful, tends to result in nearly complete canopy closure which persists until the stand has either been regenerated or transitions into a different association. Herbaceous ground cover of any kind tends to be sparse due to reduction during site preparation, the typically dense canopy cover, and to the fact that many young plantations are infrequently burned at best.

**Environmental Description:** Environmental setting varies widely by site. Stands often occur on level to gently sloping areas, on soils that range from dry to poorly drained.

**Vegetation Description:** There is considerable local variation among stands of this planted vegetation type across its broad range (from the Interior Highlands to the Coastal Plain, including areas outside the natural range of the species). In the Ouachita Mountains planted loblolly is found with a variable amount of *Quercus alba* (white oak), *Quercus falcata* (southern red oak), *Quercus marilandica* (blackjack oak), *Quercus stellata* (post oak), and *Quercus velutina* (black oak); on drier sites *Pinus echinata* (shortleaf pine), *Carya alba* (mockernut hickory), and *Carya texana* (black hickory); and *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), and *Quercus nigra* (water oak) on wetter sites. The understory can be thick especially after thinning and/or burning. Common understory species are *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium arboreum* (farkleberry), *Vaccinium stamineum* (deerberry), *Cornus florida* (flowering dogwood), *Ulmus alata* (winged elm), and others. Vines are an important component, including *Berchemia scandens* (Alabama supplejack), *Lonicera japonica* (Japanese honeysuckle), *Parthenocissus quinquefolia* (Virginia creeper), *Vitis* spp.

(grapes), *Smilax* spp. (greenbriers), and *Toxicodendron radicans* (eastern poison ivy). In dense stands the herbaceous layer is suppressed by dense needle litter. In thinned and burned stands the plantations are often grazed. Herbaceous species can include *Solidago ulmifolia* (elmleaf goldenrod), *Chasmanthium sessiliflorum* (longleaf woodoats), *Schizachyrium scoparium* (little bluestem), *Danthonia spicata* (poverty oatgrass), *Tephrosia virginiana* (Virginia tephrosia), *Lespedeza* spp. (lespedezas), *Symphotrichum patens* (late purple aster), *Eupatorium* spp. (thoroughworts), and others. In Oklahoma, associates include *Rhus copallinum* (flameleaf sumac), *Hypericum densiflorum* (bushy St. Johnswort), *Liquidambar styraciflua* (sweetgum) and *Toxicodendron radicans* (eastern poison ivy) (Hoagland 2000). Additional data on several stands on the Croatan National Forest can be found in Doyle and Allard (1990).

**Most Abundant Species:** Information not available.

**Characteristic Species:** Information not available.

**Other Noteworthy Species:** Information not available.

**USFWS Wetland System:** Not applicable.

#### DISTRIBUTION

**Range:** This association is found throughout the southeastern United States.

**States/Provinces:** AL, AR, DE, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA.

**Federal Lands:** DOD (Arnold, Fort Benning, Fort Bragg, Fort Gordon, Fort Stewart); DOE (Savannah River Site); NPS (Appomattox Court House, Chickamauga-Chattanooga?, Colonial, Fredericksburg-Spotsylvania, George Washington Birthplace, Natchez Trace, Obed, Petersburg, Richmond, Vicksburg); USFS (Angelina, Bankhead?, Bienville, Cherokee, Conecuh, Croatan, Davy Crockett, De Soto, Delta, Francis Marion, Holly Springs, Kisatchie, Land Between the Lakes, Oconee, Ouachita, Ouachita (Coastal Plain), Ouachita (Mountains), Ozark, Sabine, Sam Houston, St. Francis?, Sumter, Sumter (Mountains), Sumter (Piedmont), Talladega, Talladega (Oakmulgee), Talladega (Talladega), Tombigbee, Tuskegee); USFWS (Blackwater, Chesapeake Marshlands, Eufaula, Prime Hook).

#### CONSERVATION STATUS

**Rank:** GNA (cultural) (8-Aug-2000).

**Reasons:** This community represents vegetation which has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation. It is not a conservation priority and does not receive a conservation rank.

#### CLASSIFICATION INFORMATION

**Status:** Standard.

**Confidence:** 2 - Moderate.

**Comments:** At Arnold Air Force Base, Coffee and Franklin counties, Tennessee, *Pinus taeda* (loblolly pine) is near the edge of its putative natural range and was apparently absent prior to being planted there between 1945 and 1950 on abandoned agricultural land and along roadsides. Older plantings have not been intensively managed, and many have become "modified" vegetation (e.g., CEGLO07109) and are no longer regarded as plantations. More recently (1998-2001) some of these older pine stands have been harvested and replaced with true *Pinus taeda* (loblolly pine) plantations. *Pinus taeda* (loblolly pine) also invades seasonally wet hardwood depressions, but these stands remain recognizable as to their natural identity (e.g., CEGLO07364). Associations occur as plantations and on old fields on Kisatchie and Sumter national forests and after blowdowns on the Kisatchie. South Carolina information after Jones et

al. (1981). In the Coastal Plain of South Carolina, there are mature loblolly plantations, often with *Prunus serotina* var. *serotina* (black cherry) in the understory, that have been prescribed burned (based on seven plots at Savannah River Site) - such stands are presumably better covered under *Pinus taeda* (loblolly pine) Forest Alliance (A.130). Plantations occur in obvious rows in the aerial photos of the Delmarva Peninsula in Maryland.

**Similar Associations:**

- *Pinus taeda* - *Liriodendron tulipifera* / *Acer saccharum* Successional Forest (CEGL007105).
- *Pinus taeda* - *Quercus (falcata, hemisphaerica, nigra)* - *Liquidambar styraciflua* / *Rhus copallinum* - *Vaccinium stamineum* Forest (CEGL008450).
- *Pinus taeda* / *Liquidambar styraciflua* - *Acer rubrum* var. *rubrum* / *Vaccinium stamineum* Forest (CEGL006011)--develops when stands develop typical two-layered structure with well-developed subcanopy.
- *Pinus taeda* / *Rhus copallinum* Managed Forest (CEGL007108)--may replace this association as stands mature.
- *Pinus taeda* / *Saccharum alopecuroidum* - (*Andropogon* spp.) Forest (CEGL007109).

**Related Concepts:**

- Loblolly Pine: 81 (Eyre 1980) B

**SOURCES**

**Description Authors:** A. S. Weakley, mod. L. A. Sneddon.

**References:** ALNHP 2002, Doyle and Allard 1990, Eyre 1980, Hoagland 1998, Hoagland 2000, Jones et al. 1981, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC 1998a.

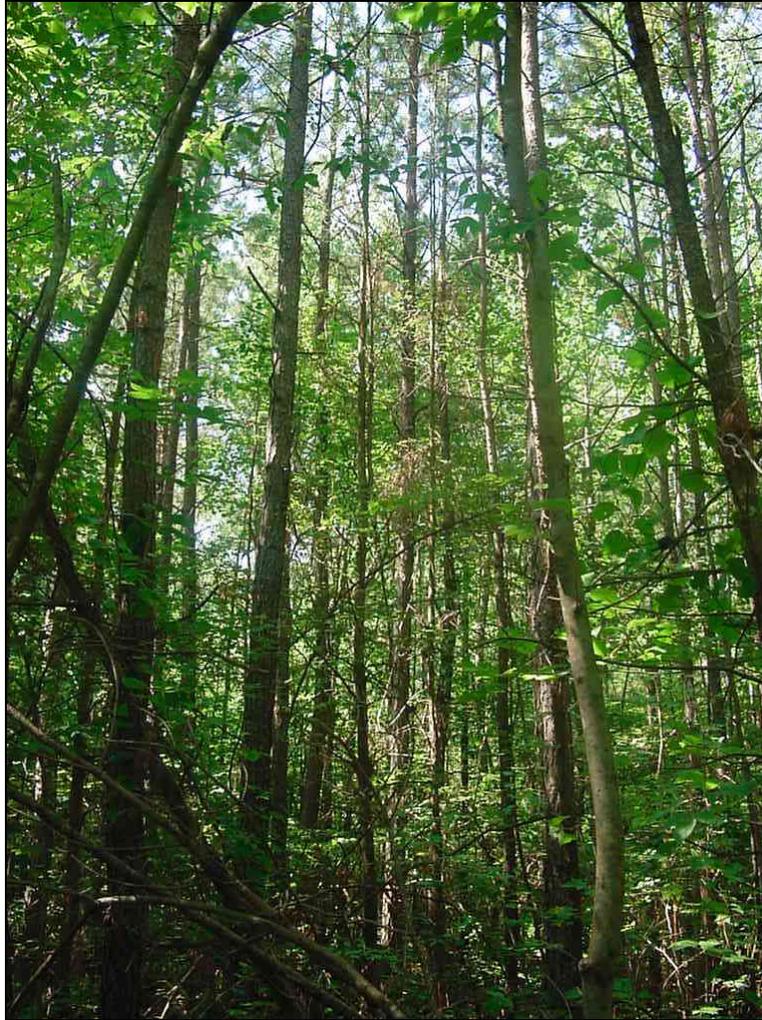


Figure 11. Loblolly Pine Plantation at Appomattox Court House National Historical Park. August 2007. NAD 1983 / UTM easting 694625, northing 4138058. Photo by Robert Tillotson.

**COMMON NAME (PARK-SPECIFIC): VIRGINIA PINE PLANTATION**

**SYNONYMS**

**USNVC English Name:** Virginia Pine Planted Forest  
**USNVC Scientific Name:** *Pinus virginiana* Planted Forest  
**USNVC Identifier:** C EGL004730

**LOCAL INFORMATION**

**Environmental Description:** Information not available.

**Vegetation Description:** Virginia Pine Plantation is an evergreen forest that results from planting *Pinus virginiana* (Virginia pine). Stands occur as perfect rows of planted *Pinus virginiana* (Virginia pine) or as dense young stands. These stands support no other tree species in the overstory and typically have no understory development and no herbaceous species.

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Pinus virginiana</i> (Virginia pine)

**Characteristic Species:** *Pinus virginiana* (Virginia pine).

**Other Noteworthy Species:** Information not available.

**Subnational Distribution with Crosswalk Data:**

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
VA	SNA			[not crosswalked]	

**Local Range:** Two polygons are mapped as Virginia Pine Plantation. They cover a total of 4.8 hectares (11.7 acres).

**Classification Comments:** Virginia Pine Plantation is distinguished from Successional Virginia Pine Forest by having trees planted in rows or as very dense young stands and lacking any structural complexity.

**Other Comments:** Information not available.

**Local Description Authors:** K. D. Patterson.

**Plots:** None.

**Appomattox Court House National Historical Park Inventory Notes:** Both of the stands of Virginia Pine Plantation were observed in the field.

**GLOBAL INFORMATION**

**USNVC 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	Planted/Cultivated temperate or subpolar needle-leaved evergreen forest (I.A.8.C.)
Formation	Planted/cultivated temperate or subpolar needle-leaved evergreen forest (I.A.8.C.x.)
Alliance	<i>Pinus virginiana</i> Planted Forest Alliance (A.100)
Alliance (English name)	Virginia Pine Planted Forest Alliance
Association	<i>Pinus virginiana</i> Planted Forest
Association (English name)	Virginia Pine Planted Forest
Ecological System(s):	Information not available.

**GLOBAL DESCRIPTION**

**Concept Summary:** This association includes planted stands of *Pinus virginiana* (Virginia pine) which have little understory, but they may have admixtures of other native or off-site pines

(e.g., *Pinus echinata* (shortleaf pine), *Pinus strobus* (eastern white pine), *Pinus taeda* (loblolly pine)). These are cultivated forests and are not considered natural or near-natural vegetation. They are maintained as plantations for the harvest of forest products, or for production of Christmas trees and on strip-mined sites. Stands have suffered some damage from southern pine beetle (*Dendroctonus frontalis*). Stands are planted in the Inner Coastal Plain for Christmas tree production.

**Environmental Description:** These are cultivated forests and are not considered natural or near-natural vegetation. They are maintained as plantations for the harvest of forest products. Stands are planted in the Inner Coastal Plain for Christmas tree production.

**Vegetation Description:** This association includes planted stands of *Pinus virginiana* (Virginia pine) with little understory, but may have admixtures of other native or off-site pines (e.g., *Pinus echinata* (shortleaf pine), *Pinus strobus* (eastern white pine), *Pinus taeda* (loblolly pine)). At Arnold Air Force Base, Coffee and Franklin counties, Tennessee, *Pinus virginiana* (Virginia pine) is dominant in dry-mesic, low to mid-slope forests. *Pinus strobus* (eastern white pine) is scattered throughout, with *Juniperus virginiana* var. *virginiana* (eastern redcedar) occurring in patches. The subcanopy contains *Acer rubrum* (red maple), *Cornus florida* (flowering dogwood), and *Liquidambar styraciflua* (sweetgum). The tall-shrub layer includes *Sassafras albidum* (sassafras), *Cornus florida* (flowering dogwood), *Cercis canadensis* (eastern redbud), *Liquidambar styraciflua* (sweetgum), and *Quercus stellata* (post oak). The herbaceous layer is sparse or nearly absent, and contains *Polystichum acrostichoides* (Christmas fern), Asteraceae sp. (Asters), *Carex* spp. (sedges), *Botrychium biternatum* (sparselobe grapefern), and exotic *Lonicera japonica* (Japanese honeysuckle).

**Most Abundant Species:** Information not available.

**Characteristic Species:** Information not available.

**Other Noteworthy Species:** Information not available.

**USFWS Wetland System:** Not applicable.

#### DISTRIBUTION

**Range:** This alliance is found throughout the Piedmont of the southeastern United States and ranges into part of the Cumberland Plateau, Interior Low Plateau, Inner Coastal Plain, and the Southern Blue Ridge. It is known to occur in Alabama, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia, and may possibly range into Mississippi.

**States/Provinces:** AL, GA, KY, MS?, NC, SC, TN, VA.

**Federal Lands:** DOD (Arnold, Fort Gordon, Fort Stewart?); NPS (Appomattox Court House, Chickamauga-Chattanooga); USFS (Chattahoochee, Chattahoochee (Piedmont), Chattahoochee (Southern Blue Ridge), Cherokee, Daniel Boone, Land Between the Lakes?, Nantahala?, Pisgah?, Uwharrie?).

#### CONSERVATION STATUS

**Rank:** GNA (cultural) (8-Aug-2000).

**Reasons:** This community represents vegetation which has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation. It is not a conservation priority and does not receive a conservation rank.

#### CLASSIFICATION INFORMATION

**Status:** Standard.

**Confidence:** 2 – Moderate.

**Comments:** Stands have suffered some damage from the Southern Pine Beetle (*Dendroctonus frontalis*).

**Similar Associations:** Information not available.

**Related Concepts:**

- IF3b. Plantation (Hardwood or Conifer) (Allard 1990) B
- Virginia Pine: 79 (Eyre 1980) B

**SOURCES**

**Description Authors:** M. Pyne.

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

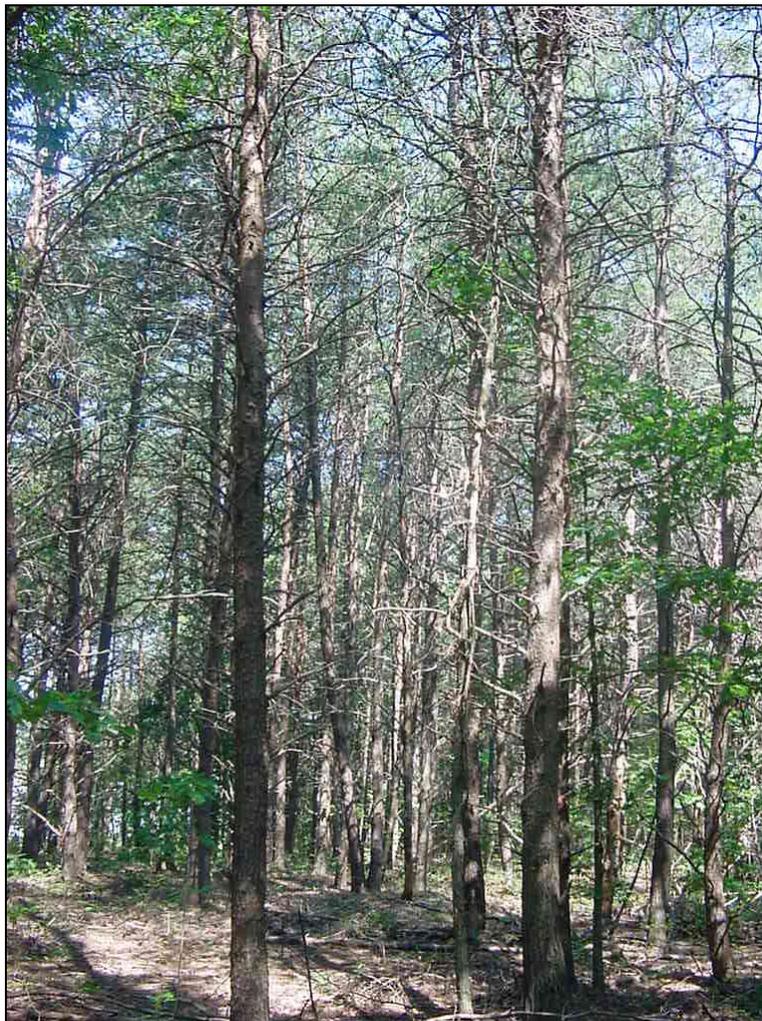


Figure 12. Virginia Pine Plantation at Appomattox Court House National Historical Park. August 2007. NAD 1983 / UTM easting 693262, northing 4138264. Photo by Robert Tillotson.

**COMMON NAME (PARK-SPECIFIC):** SUCCESSIONAL VIRGINIA PINE FOREST

**SYNONYMS**

**USNVC English Name:** Virginia Pine Successional Forest  
**USNVC Scientific Name:** *Pinus virginiana* Successional Forest  
**USNVC Identifier:** C EGL002591

**LOCAL INFORMATION**

**Environmental Description:** Stands of Successional Virginia Pine Forest occur on gentle slopes in Appomattox Court House National Historical Park and develop after field abandonment. They are short-lived, generally persisting less than 75 years. In many stands, *Pinus virginiana* (Virginia pine) is dead or dying and there are often many fallen trees and snags.

**Vegetation Description:** Successional Virginia Pine Forest includes stands of pure *Pinus virginiana* (Virginia pine), as well as older stands where the *Pinus virginiana* (Virginia pine) is decadent and the evergreen canopy is breaking up with hardwood succession. Stands of Successional Virginia Pine Forest develop after field abandonment and are short-lived, generally less than 75 years. This forest typically has a very dense canopy of *Pinus virginiana* (Virginia pine), often with a mix of successional deciduous trees. Deciduous species can comprise up to 75% of the canopy composition and can be almost any species from surrounding forests. Some common associates include *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), *Juniperus virginiana* var. *virginiana* (eastern redcedar), *Prunus serotina* var. *serotina* (black cherry), *Quercus alba* (white oak), *Carya alba* (mockernut hickory), *Cornus florida* (flowering dogwood), *Nyssa sylvatica* (blackgum), and *Robinia pseudoacacia* (black locust). In these stands, the *Pinus virginiana* (Virginia pine) can be mostly dead or dying, and there may be fallen trees and standing dead stems. Woody shrubs and vines can have high cover and often include *Parthenocissus quinquefolia* (Virginia creeper), *Symphoricarpos orbiculatus* (coralberry), *Lonicera japonica* (Japanese honeysuckle), *Vaccinium stamineum* (deerberry) and *Toxicodendron radicans* (eastern poison ivy). Typically pine litter covers the ground and herbs are sparse to absent, although some stands have an herb layer dominated by the invasive plant *Microstegium vimineum* (Nepalese browntop) or seedlings of tree species.

The structure of Successional Virginia Pine Forest varies greatly within Appomattox Court House National Historical Park depending mostly on stand age. Most typically, this type occurs with decadent *Pinus virginiana* (Virginia pine) forming a patchy emergent canopy over dense hardwood regeneration. It can also occur as a tall, pure evergreen forest with no understory or herb layer. Less frequently in Appomattox Court House National Historical Park, this type is found as a dense shrubland, about 4-6 m tall, with a mix of *Pinus virginiana* (Virginia pine) and successional hardwood species.

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Pinus virginiana</i> (Virginia pine)

**Characteristic Species:** *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Lonicera japonica* (Japanese honeysuckle), *Pinus virginiana* (Virginia pine).

**Other Noteworthy Species:**

<u>Species</u>	<u>G</u> Rank	<u>Type</u>	<u>Note</u>
<i>Lonicera japonica</i> (Japanese honeysuckle)	-	plant	invasive nonnative
<i>Microstegium vimineum</i> (Nepalese browntop)	-	plant	invasive nonnative
<i>Symphoricarpos orbiculatus</i> (coralberry)	-	plant	invasive

**Subnational Distribution with Crosswalk Data:**

<u>State</u>	<u>S</u> Rank	<u>Rel</u>	<u>Conf</u>	<u>S</u> Name	<u>Reference</u>
VA	SNA	.	.	[not crosswalked]	.

**Local Range:** Successional Virginia Pine Forest covers 110 hectares (271 acres) in 34 polygons. It is found throughout Appomattox Courthouse National Historical Park.

**Classification Comments:** Successional Virginia Pine Forest could be confused with the mapping units Successional Tuliptree Forest and Dense Hardwood Regeneration. Successional Virginia Pine Forest can be distinguished from these two mapping units by having a canopy comprised of 25-100% *Pinus virginiana* (Virginia pine).

Even though this association is placed within an Evergreen Forest Class of the USNVC, stands in Appomattox Court House National Historical Park can have up to a 75% deciduous canopy. Stands transitional to Successional Tuliptree Forest with a mixed to mostly deciduous photo-signature are included in this map class but are tagged as "transitional" in the attribute table. If left undisturbed, stands mapped as Successional Virginia Pine will eventually succeed to Successional Tuliptree Forest and later to Oak - Hickory Forest.

**Other Comments:** Information not available.

**Local Description Authors:** K. D. Patterson

**Plots:** None.

**Appomattox Court House National Historical Park Inventory Notes:** All 34 polygons of this association were observed in the field.

**GLOBAL INFORMATION**

**USNVC 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	<i>Pinus virginiana</i> Forest Alliance (A.131)
Alliance (English name)	Virginia Pine Forest Alliance
Association	<i>Pinus virginiana</i> Successional Forest
Association (English name)	Virginia Pine Successional Forest
<b>Ecological System(s):</b>	Central Appalachian Dry Oak-Pine Forest (CES202.591). Northeastern Interior Dry-Mesic Oak Forest (CES202.592). Southern Appalachian Low-Elevation Pine Forest (CES202.332).

**GLOBAL DESCRIPTION**

**Concept Summary:** This successional Virginia pine forest of the southeastern states occurs in areas where canopy removal has created dry, open conditions and bare mineral soil, allowing for the establishment of *Pinus virginiana* (Virginia pine). These habitats include old fields, old pastures, clearcuts, and burned or eroded areas. This forest typically has a very dense canopy of *Pinus virginiana* (Virginia pine) and little understory vegetation. The dense canopy may also

include admixtures of 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), *Prunus serotina* var. *serotina* (black cherry), *Liriodendron tulipifera* (tuliptree)). Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species. Shrub and herb layers are frequently very sparse. Stands are short-lived, generally less than 75 years.

**Environmental Description:** This community occurs in areas where canopy removal has created open conditions and bare mineral soil, allowing for the establishment of *Pinus virginiana* (Virginia pine). These conditions can include old fields, old pastures, clearcuts, and burned or eroded areas. In the Ridge and Valley of Tennessee, northeastern Monroe County, early successional forests with *Pinus virginiana* (Virginia pine) dominance were found on low slopes in areas that were cleared for agriculture prior to the 1970s, when Tellico Lake was created (Andreu and Tukman 1995). In the Central Appalachians, this vegetation occurs where soft shales have been farmed (primarily in valleys), resulting in stands with nothing but successional species in the understory. Soils underlying these communities are of two general types, i.e., those derived in residuum from calcareous shale and calcareous sandstone of the Middle Ordovician and those of some other origin. Series of the former type include Dandridge (Lithic Ruptic-Alfic Eutrochrepts), Tellico (Typic Rhododults), and Steekee (Ruptic-Ultic Dystrochrepts). Other soil series that this forest type may occur on include Litz, Dewey, Alcoa, Bland, Etowah, Lobdell and Neubert. All of these soils are well-drained and range in pH from moderate acid to very strongly acidic.

**Vegetation Description:** This forest typically has a very dense canopy of *Pinus virginiana* (Virginia pine) and little understory vegetation. *Pinus taeda* (loblolly pine) or *Pinus echinata* (shortleaf pine) may co-occur with *Pinus virginiana* (Virginia pine) in the canopy. The canopy can also have significant admixtures of early-successional deciduous trees (e.g., *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), *Prunus serotina* var. *serotina* (black cherry), *Liriodendron tulipifera* (tuliptree)). Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species; *Lonicera japonica* (Japanese honeysuckle) and *Rosa multiflora* (multiflora rose) are common. Shrub and herb strata are absent to sparse in coverage. In eastern Tennessee, 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), *Lonicera japonica* (Japanese honeysuckle), and *Microstegium vimineum* (Nepalese browntop) (Andreu and Tukman 1995). In the Central Appalachians, associates include *Pinus taeda* (loblolly pine), *Pinus echinata* (shortleaf pine), and *Pinus rigida* (pitch pine). Some stands may have a dense ericaceous shrub stratum containing *Vaccinium* spp. (blueberries), *Gaylussacia* spp. (huckleberries), *Kalmia latifolia* (mountain laurel), and *Rhododendron* spp. (rhododendrons).

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Pinus virginiana</i> (Virginia pine)
Tree subcanopy	Needle-leaved tree	<i>Juniperus virginiana</i> var. <i>virginiana</i> (eastern redcedar)
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple), <i>Cornus florida</i> (flowering dogwood), <i>Nyssa sylvatica</i> (blackgum), <i>Oxydendrum arboreum</i> (sourwood)
Tall shrub/sapling	Broad-leaved deciduous tree	<i>Cornus florida</i> (flowering dogwood), <i>Nyssa sylvatica</i> (blackgum), <i>Oxydendrum arboreum</i> (sourwood)
Tall shrub/sapling	Broad-leaved evergreen tree	<i>Vaccinium arboreum</i> (farkleberry)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Vaccinium stamineum</i> (deerberry)
Short shrub/sapling	Broad-leaved deciduous tree	<i>Cercis canadensis</i> (eastern redbud), <i>Cornus florida</i> (flowering dogwood), <i>Oxydendrum arboreum</i> (sourwood), <i>Quercus alba</i> (white oak), <i>Sassafras albidum</i> (sassafras)
Herb (field)	Vine/Liana	<i>Lonicera japonica</i> (Japanese honeysuckle), <i>Smilax glauca</i> (cat greenbrier), <i>Toxicodendron radicans</i> (eastern poison ivy)

**Characteristic Species:** *Pinus virginiana* (Virginia pine).

**Other Noteworthy Species:** Information not available.

**USFWS Wetland System:** Not applicable.

**DISTRIBUTION**

**Range:** This successional community is possible in the Piedmont from Pennsylvania south to Alabama and ranges west into the Appalachians, Ridge and Valley, the Cumberland Plateau, and in scattered locales of the Interior Low Plateau.

**States/Provinces:** AL, GA, IN, KY, MD, NC, NJ, PA, SC, TN, VA, WV.

**Federal Lands:** NPS (Appomattox Court House, Big South Fork, Blue Ridge Parkway?, Booker T. Washington, Cumberland Gap, Fredericksburg-Spotsylvania, Gettysburg, Great Smoky Mountains, Kings Mountain, Lincoln Birthplace, Little River Canyon?, Mammoth Cave, Natchez Trace, New River Gorge, Obed, Shenandoah, Shiloh, Thomas Stone); TVA (Tellico); USFS (Bankhead, Chattahoochee, Chattahoochee (Piedmont), Chattahoochee (Southern Blue Ridge), Cherokee, Daniel Boone, George Washington, Jefferson, Sumter, Sumter (Mountains), Sumter (Piedmont), Uwharrie?).

**CONSERVATION STATUS**

**Rank:** GNA (ruderal) (13-Jun-2000).

**Reasons:** This forest represents early-successional vegetation and is thus not of conservation concern.

**CLASSIFICATION INFORMATION**

**Status:** Standard.

**Confidence:** 1 – Strong.

**Comments:** Early successional *Pinus virginiana* (Virginia pine) vegetation occurring over calcareous substrates is classed in *Pinus virginiana* - *Juniperus virginiana* var. *virginiana* - *Ulmus alata* Forest (CEGL007121) and has species indicative of calcareous substrates.

**Similar Associations:**

- *Pinus echinata* Early-Successional Forest (CEGL006327)--occurs in similar environments but is dominated (>50% of canopy) by *Pinus echinata* instead of *Pinus virginiana*.
- *Pinus taeda* - *Liquidambar styraciflua* Semi-natural Forest (CEGL008462)--is commonly found in the same area as CEGL002591 in the Piedmont. CEGL008462 contains at least 50% *Pinus taeda* in the canopy, whereas CEGL002591 is mostly *Pinus virginiana*.
- *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 virginiana*.
- *Pinus virginiana* - *Juniperus virginiana* var. *virginiana* - *Ulmus alata* Forest (CEGL007121)--on more calcareous or circumneutral substrates.
- *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. CEGL002591 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.

**Related Concepts:**

- *Pinus virginiana* forest (Vanderhorst 2001b) =
- IA7c. Xeric Virginia Pine Ridge Forest (Allard 1990) B
- Pine-Oak Association of the Western Shore District (Shreve et al. 1910) B
- Unclassified Old-Field Successional Forest (Fleming and Moorhead 2000) ?
- Virginia Pine - Oak: 78 (Eyre 1980) B
- Virginia Pine Type (Schmalzer and DeSelm 1982) B
- Virginia Pine, RV (Pyne 1994) B
- Virginia Pine: 79 (Eyre 1980) B
- Virginia pine successional forest (Collins and Anderson 1994) =
- Xeric Pine Forest (Ambrose 1990) B

**SOURCES**

**Description Authors:** M. Andreu and M. Tukman, mod. K. D. Patterson and S. C. Gawler.

**References:** Allard 1990, Ambrose 1990, Andreu and Tukman 1995, Collins and Anderson 1994, Eyre 1980, Fike 1999, Fleming and Coulling 2001, Fleming and Moorhead 2000, Hall and Mathews 1974, Nelson 1986, Patterson et al. 1999, Pyne 1994, Schmalzer and DeSelm 1982, Schotz pers. comm., Shreve et al. 1910, Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC 1998a, Vanderhorst 2001b, Vanderhorst et al. 2007.



Figure 13. Successional Virginia Pine Forest at Appomattox Court House National Historical Park. August 2007. NAD 1983 / UTM easting 695104, northing 4138122. Photo by Robert Tillotson.

**COMMON NAME (PARK-SPECIFIC):**    **SUCCESSIONAL RED-CEDAR FOREST**

**SYNONYMS**

**USNVC English Name:**        **Eastern Red-cedar Forest**  
**USNVC Scientific Name:**    *Juniperus virginiana* Forest  
**USNVC Identifier:**            **CEGL006024**

**LOCAL INFORMATION**

**Environmental Description:** Successional Red-cedar Forest includes stands dominated by *Juniperus virginiana* var. *virginiana* (eastern redcedar), typically on former fields and around former homesites.

**Vegetation Description:** The canopy is of low-statured *Juniperus virginiana* var. *virginiana* (eastern redcedar) trees which may be widely spaced or occur as a dense thicket. This forest may have stems of successional species such as *Sassafras albidum* (sassafras), *Prunus serotina* var. *serotina* (black cherry), and *Juglans nigra* (black walnut), but it is always dominated by *Juniperus virginiana* var. *virginiana* (eastern redcedar). The herb layer is often dominated by grasses, such as *Andropogon virginicus* (broomsedge bluestem) and *Lolium pratense* (meadow ryegrass), with mixtures of exotic species and other species typical of open disturbed areas, including *Eupatorium* sp. (a thoroughwort), *Lespedeza* sp. (a lespedeza), *Lonicera japonica* (Japanese honeysuckle), *Microstegium vimineum* (Nepalese browntop), *Rosa multiflora* (multiflora rose), *Rubus* sp. (blackberry), *Symphoricarpos orbiculatus* (coralberry), *Toxicodendron radicans* (eastern poison ivy), and *Vicia* sp. (a vetch). Some stands mapped as Successional Red-cedar Forest may have small areas (less than 0.5 ha) dominated by *Pinus virginiana* (Virginia pine) or other disturbed early-successional vegetation.

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Juniperus virginiana</i> var. <i>virginiana</i> (eastern redcedar)

**Characteristic Species:** *Juniperus virginiana* var. *virginiana* (eastern redcedar).

**Other Noteworthy Species:** Information not available.

**Subnational Distribution with Crosswalk Data:**

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
VA	SNA	.	.	[not crosswalked]	.

**Local Range:** Successional Red-cedar Forest is mapped as five polygons, covering 3.3 hectares (8.1 acres), ranging in size from 0.2 to 1.0 hectare (0.6 to 2.5 acres).

**Classification Comments:** Successional Red-cedar Forest is distinguished from other evergreen forests in Appomattox Court House National Historical Park by being dominated by *Juniperus virginiana* var. *virginiana* (eastern redcedar).

**Other Comments:** Areas smaller than 0.5 ha and dominated by *Juniperus virginiana* var. *virginiana* (eastern redcedar) often occur in the middle of Cultural Meadow and were not mapped separately.

**Local Description Authors:** K. D. Patterson.

**Plots:** None.

**Appomattox Court House National Historical Park Inventory Notes:** Information not available.

## GLOBAL INFORMATION

### USNVC 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	Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c.)
Alliance	<i>Juniperus virginiana</i> Semi-natural Forest Alliance (A.137)
Alliance (English name)	Eastern Red-cedar Forest Alliance
Association	<i>Juniperus virginiana</i> Forest
Association (English name)	Eastern Red-cedar Forest
<b>Ecological System(s):</b>	Information not available.

### GLOBAL DESCRIPTION

**Concept Summary:** This association is a broadly defined old-field early-successional community occurring in a variety of environmental settings in the northeastern states. Canopy closure and height are variable, as are shrub and herbaceous associates. *Juniperus virginiana* var. *virginiana* (eastern redcedar) dominates the canopy layer. Common associates, typically occurring as scattered individuals, may include *Pinus strobus* (eastern white pine), *Acer rubrum* (red maple), *Quercus* spp. (oaks), and *Prunus serotina* var. *serotina* (black cherry). Shrub cover varies, with the most forested stands having little or no shrub cover. Exotic shrubs such as *Elaeagnus umbellata* (autumn olive), *Lonicera morrowii* (Morrow's honeysuckle), and *Rosa multiflora* (multiflora rose) are characteristic, along with *Rubus* spp. (blackberries). Herbaceous cover likewise varies. Common species in the more open-canopy stands include old-field denizens such as *Schizachyrium scoparium* (little bluestem), *Festuca rubra* (red fescue), *Anthoxanthum odoratum* (sweet vernalgrass), *Agrostis gigantea* (redtop), *Andropogon virginicus* (broomsedge bluestem), *Elymus repens* (quackgrass), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago gigantea* (giant goldenrod), *Euthamia graminifolia* (flat-top goldentop), *Monarda fistulosa* (wild bergamot), *Toxicodendron radicans* (eastern poison ivy), *Achillea millefolium* (common yarrow), and *Daucus carota* (Queen Anne's lace). In dense forest stands, herbs may be absent or limited to scattered shade-tolerant species such as *Alliaria petiolata* (garlic mustard) and *Allium vineale* (wild garlic), and *Dennstaedtia punctilobula* (eastern hayscented fern). These forests are often young and result from the colonization of old agricultural fields by *Juniperus virginiana* var. *virginiana* (eastern redcedar) over native and exotic forbs and grasses. These stands may eventually succeed to other forest types as mid- and late-successional canopy species colonize and subsequently overtop the *Juniperus* (juniper).

**Environmental Description:** This is a broadly defined old-field early-successional community occurring in a variety of environmental settings, typically on former agricultural land and other disturbed or degraded environmental settings. Soils are mesic to dry-mesic and moderately well-drained to well-drained.

**Vegetation Description:** *Juniperus virginiana* var. *virginiana* (eastern redcedar) dominates the canopy layer in stands of this type, which ranges from broadly spaced woodlands to dense and nearly impenetrable thickets. Common associates, typically occurring as scattered individuals, may include *Pinus strobus* (eastern white pine), *Acer rubrum* (red maple), *Quercus* spp. (oaks), and *Prunus serotina* var. *serotina* (black cherry). Shrub cover varies according to canopy closure, with the most forested stands having little or no shrub cover. Exotic shrubs such as *Elaeagnus umbellata* (autumn olive), *Lonicera morrowii* (Morrow's honeysuckle), and *Rosa*

*multiflora* (multiflora rose) are most characteristic, along with *Rubus* spp. (blackberries). Herbaceous cover likewise varies. Common species in the more open-canopy stands include old-field denizens such as *Schizachyrium scoparium* (little bluestem), *Andropogon virginicus* (broomsedge bluestem), *Festuca rubra* (red fescue), *Anthoxanthum odoratum* (sweet vernalgrass), *Agrostis gigantea* (redtop), *Elymus repens* (quackgrass), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago gigantea* (giant goldenrod), *Euthamia graminifolia* (flat-top goldentop), *Monarda fistulosa* (wild bergamot), *Toxicodendron radicans* (eastern poison ivy), *Achillea millefolium* (common yarrow), and *Daucus carota* (Queen Anne's lace). In dense forest stands, herbs may be absent or limited to scattered shade-tolerant species such as *Alliaria petiolata* (garlic mustard), *Allium vineale* (wild garlic), and *Dennstaedtia punctilobula* (eastern hayscented fern).

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Juniperus virginiana</i> var. <i>virginiana</i> (eastern redcedar)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Lonicera morrowii</i> (Morrow's honeysuckle)
Tall shrub/sapling	Needle-leaved tree	<i>Juniperus virginiana</i> var. <i>virginiana</i> (eastern redcedar)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Elaeagnus umbellata</i> (autumn olive)
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Rosa multiflora</i> (multiflora rose), <i>Toxicodendron radicans</i> (eastern poison ivy)
Herb (field)	Forb	<i>Solidago rugosa</i> (wrinkleleaf goldenrod)
Herb (field)	Graminoid	<i>Schizachyrium scoparium</i> (little bluestem)

**Characteristic Species:** *Elaeagnus umbellata* (autumn olive), *Juniperus virginiana* var. *virginiana* (eastern redcedar), *Lonicera morrowii* (Morrow's honeysuckle), *Rosa multiflora* (multiflora rose), *Schizachyrium scoparium* (little bluestem), *Solidago rugosa* (wrinkleleaf goldenrod), *Toxicodendron radicans* (eastern poison ivy).

**Other Noteworthy Species:** Information not available.

**USFWS Wetland System:** Not applicable.

**DISTRIBUTION**

**Range:** This association is of broad distribution, occurring widely throughout the northeastern U.S. It has been documented from only a limited range but is undoubtedly more widely distributed.

**States/Provinces:** MA, NJ, NY, PA, VA.

**Federal Lands:** NPS (Appomattox Court House, Boston Harbor Islands, Cape Cod, Delaware Water Gap, Fire Island, Fredericksburg-Spotsylvania, George Washington Birthplace, Richmond).

**CONSERVATION STATUS**

**Rank:** GNA (ruderal) (10-Oct-2001).

**Reasons:** This forest represents early-successional, modified, or silviculturally managed vegetation and is thus not of conservation concern and does not receive a conservation status rank. This vegetation may be easily restorable by either management, time, or restoration of ecological processes.

**CLASSIFICATION INFORMATION**

**Status:** Standard.

**Confidence:** 3 – Weak.

**Comments:** This association is currently very generally defined.

**Similar Associations:** Information not available.

**Related Concepts:** Information not available.

**SOURCES**

**Description Authors:** L. A. Sneddon, mod. R. E. Zaremba, M. Pyne, S. C. Gawler.

**References:** Clark 1986, Eastern Ecology Working Group n.d., Sneddon and Lundgren 2001.



Figure I4. Successional Red-cedar Forest at Appomattox Court House National Historical Park. August 2007. NAD 1983 / UTM easting 695654, northing 4140065. Photo by Robert Tillotson.

**COMMON NAME (PARK-SPECIFIC):** **SUCCESSIONAL TREE-OF-HEAVEN FOREST**

**SYNONYMS**

**NVC English Name:** **Tree-of-Heaven Forest**  
**NVC Scientific Name:** *Ailanthus altissima* Forest  
**NVC Identifier:** **CEGL007191**

**LOCAL INFORMATION**

**Environmental Description:** Typically these forests occur on rich substrates, in disturbed situations on slopes, urban abandoned lands, and on rocky limestone slopes. In Appomattox Court House National Historical Park, it occurs as a single small patch surrounded by Loblolly Pine Plantation.

**Vegetation Description:** Successional Tree-of-Heaven Forest includes stands dominated by the alien tree *Ailanthus altissima* (tree of heaven).

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Ailanthus altissima</i> (tree of heaven)

**Characteristic Species:** *Ailanthus altissima* (tree of heaven).

**Other Noteworthy Species:** Information not available.

**Subnational Distribution with Crosswalk Data:**

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
VA	SNA	.	.	[not crosswalked]	.

**Local Range:** There is only one very small stand (0.08 hectare [0.2 acre]) of this in the Appomattox Court House National Historical Park. It is well below minimum mapping unit and was mapped because of its management implications.

**Classification Comments:** This mapping unit is distinguished by the dominance of *Ailanthus altissima* (tree of heaven).

**Other Comments:** Information not available.

**Local Description Authors:** K. D. Patterson.

**Plots:** None.

**Appomattox Court House National Historical Park Inventory Notes:** Information not available.

**GLOBAL INFORMATION**

**USNVC 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	<i>Ailanthus altissima</i> Forest Alliance (A.221)
Alliance (English name)	Tree-of-Heaven Forest Alliance
Association	<i>Ailanthus altissima</i> Forest
Association (English name)	Tree-of-Heaven Forest
<b>Ecological System(s):</b>	Central Appalachian Alkaline Glade and Woodland (CES202.602).

**GLOBAL DESCRIPTION**

**Concept Summary:** This southeastern forest association, strongly dominated by the alien *Ailanthus altissima* (tree of heaven), occurs generally on nutrient-rich substrates, in disturbed situations on slopes, urban abandoned lands, and on rocky limestone slopes.

**Environmental Description:** Information not available.

**Vegetation Description:** Information not available.

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Ailanthus altissima</i> (tree of heaven)

**Characteristic Species:** *Ailanthus altissima* (tree of heaven).

**Other Noteworthy Species:** Information not available.

**USFWS Wetland System:** Not applicable.

#### DISTRIBUTION

**Range:** *Ailanthus altissima* (tree of heaven) Forest occurs throughout the Appalachians, the Piedmont, the Interior Low Plateau, eastern Kentucky, and in the Ozarks and Ouachita Mountains, and probably other areas in the northeastern United States.

**States/Provinces:** AR, KY, NC, PA, TN, VA, WV.

**Federal Lands:** NPS (Appomattox Court House, Colonial, Great Smoky Mountains, Natchez Trace); USFS (Ouachita (Mountains)?, Ouachita?, Ozark?).

#### CONSERVATION STATUS

**Rank:** GNA (invasive) (4-Jan-2000).

**Reasons:** This vegetation is dominated by an invasive, alien species and is thus not a conservation priority.

#### CLASSIFICATION INFORMATION

**Status:** Standard.

**Confidence:** 1 – Strong.

**Comments:** Information not available.

**Similar Associations:** Information not available.

**Related Concepts:** Information not available.

#### SOURCES

**Description Authors:** A. S. Weakley.

**References:** Patterson 1976, Southeastern Ecology Working Group n.d., TDNH unpubl. data.



Figure 15. Successional Tree-of-Heaven Forest at Appomattox Court House National Historical Park. August 2007. NAD 1983 / UTM easting 695465 northing 4140369. Photo by Robert Tillotson.

**COMMON NAME (PARK-SPECIFIC): MESIC MIXED HARDWOOD FOREST**

**SYNONYMS**

**USNVC English Name:** American Beech - (White Oak, Northern Red Oak) - Tuliptree / (American Holly) / Christmas Fern Forest

**USNVC Scientific Name:** *Fagus grandifolia* - *Quercus (alba, rubra)* - *Liriodendron tulipifera* / (*Ilex opaca* var. *opaca*) / *Polystichum acrostichoides* Forest

**USNVC Identifier:** CEGLO06075

**LOCAL INFORMATION**

**Environmental Description:** This mesic deciduous forest occurs on steep, lower, east facing slopes in Appomattox Court House National Historical Park.

**Vegetation Description:** The canopy is strongly dominated by *Fagus grandifolia* (American beech). Other canopy species may include *Quercus alba* (white oak), *Carya ovalis* (red hickory), and *Quercus rubra* (northern red oak). The shrub stratum may be very open to moderately dense with species such as *Viburnum acerifolium* (mapleleaf viburnum), *Carpinus caroliniana* (American hornbeam), *Chionanthus virginicus* (white fringetree), and *Fagus grandifolia* (American beech). The herb layer is typically sparse but has clumps of *Polystichum acrostichoides* (Christmas fern) or *Eurybia divaricata* (white wood aster) locally dominant. Other typical herb species include *Desmodium nudiflorum* (nakedflower ticktrefoil), *Epifagus virginiana* (beechdrops), *Geranium maculatum* (spotted geranium), and *Goodyera pubescens* (downy rattlesnake plantain). Stands of this type in Appomattox Court House National Historical Park are largely consistent in species composition. The density of the shrub layer may vary from stand to stand.

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Fagus grandifolia</i> (American beech)

**Characteristic Species:** *Epifagus virginiana* (beechdrops), *Fagus grandifolia* (American beech), *Polystichum acrostichoides* (Christmas fern), *Quercus alba* (white oak), *Quercus rubra* (northern red oak).

**Other Noteworthy Species:**

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Lonicera japonica</i> (Japanese honeysuckle)	-	plant	invasive nonnative
<i>Paulownia tomentosa</i> (princesstree)	-	plant	invasive nonnative

**Subnational Distribution with Crosswalk Data:**

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
VA	SNR*	B	1	Mesic Mixed Hardwood Forest	Fleming et al. 2001

**Local Range:** Mesic Mixed Hardwood forest covers 6.1 hectares (15.1 acres) on the slopes over Plain Run Branch. It is mapped as two polygons of 4.9 and 1.2 hectare (2.9 and 12.1 acres).

**Classification Comments:** Mesic Mixed Hardwood Forest lacks the diverse herb layer of Inner Piedmont / Blue Ridge Basic Mesic Forest and has a canopy strongly dominated by *Fagus grandifolia* (American beech).

**Other Comments:** Information not available.

**Local Description Authors:** K. D. Patterson.

**Plots:** APCO.12.

**Appomattox Court House National Historical Park Inventory Notes:** Both stands of Mesic Mixed Hardwood were observed and one was quantitatively sampled.

## GLOBAL INFORMATION

### USNVC 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	<i>Fagus grandifolia</i> - <i>Quercus rubra</i> - <i>Quercus alba</i> Forest Alliance (A.229)
Alliance (English name)	American Beech - Northern Red Oak - White Oak Forest Alliance
Association	<i>Fagus grandifolia</i> - <i>Quercus</i> (alba, rubra) - <i>Liriodendron tulipifera</i> / ( <i>Ilex opaca</i> var. <i>opaca</i> ) / <i>Polystichum acrostichoides</i> Forest
Association (English name)	American Beech - (White Oak, Northern Red Oak) - Tuliptree / (American Holly) / Christmas Fern Forest
<b>Ecological System(s):</b>	Atlantic Coastal Plain Mesic Hardwood Forest (CES203.242). Northern Atlantic Coastal Plain Hardwood Forest (CES203.475).

### GLOBAL DESCRIPTION

**Concept Summary:** This forest of mesic to submesic, well-drained soils occurs in the Piedmont and Coastal Plain of Virginia and Maryland, extending north to southern New England on the Coastal Plain. It also occurs occasionally at low elevations of the Blue Ridge and adjacent Ridge and Valley in Virginia and Maryland. It is characteristically a mixed forest dominated by *Fagus grandifolia* (American beech), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), and *Liriodendron tulipifera* (tuliptree) in various proportions. Overstory associates over the range include *Quercus velutina* (black oak), *Quercus falcata* (southern red oak), *Quercus coccinea* (scarlet oak), *Liquidambar styraciflua* (sweetgum), *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), and *Fraxinus americana* (white ash). The subcanopy is characterized by young *Fagus grandifolia* (American beech), *Acer rubrum* (red maple), *Carpinus caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), and *Sassafras albidum* (sassafras). *Ilex opaca* var. *opaca* (American holly) is particularly characteristic and abundant on the Coastal Plain. The shrub layer varies from very sparse to well-developed and can include *Asimina triloba* (pawpaw), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum dentatum* (southern arrowwood), and *Euonymus americanus* (strawberry bush). Heath shrubs, such as *Vaccinium corymbosum* (highbush blueberry) and *Vaccinium pallidum* (Blue Ridge blueberry), may be common but not abundant. Vines are common, including *Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (cat greenbrier), and *Toxicodendron radicans* (eastern poison ivy). In the southern part of the range, *Oxydendrum arboreum* (sourwood) and *Vitis rotundifolia* (muscadine) may be conspicuous members of the understory. The herb layer is comprised of *Polystichum acrostichoides* (Christmas fern), *Thelypteris noveboracensis* (New York fern), *Uvularia perfoliata* (perfoliate bellwort), *Cypripedium acaule* (moccasin flower), *Mitchella repens* (partridgeberry), *Tipularia discolor* (crippled crane fly), *Goodyera pubescens* (downy rattlesnake plantain), *Eurybia divaricata* (white wood aster), *Chimaphila maculata* (striped prince's pine), *Carex swanii* (Swan's sedge), *Medeola virginiana* (Indian cucumber), *Athyrium filix-femina* (common ladyfern), *Carex digitalis* (slender woodland sedge), *Carex willdenowii* (Willdenow's sedge), *Epifagus virginiana* (beechdrops), *Maianthemum canadense* (Canada mayflower), *Desmodium*

*nudiflorum* (nakedflower ticktrefoil), *Polygonatum biflorum* (smooth Solomon's seal), *Podophyllum peltatum* (mayapple), *Arisaema triphyllum* (Jack in the pulpit), and *Maianthemum racemosum* (feathery false lily of the valley).

**Environmental Description:** This forest association occurs on mesic to submesic slopes or gentle gradients. Ravines in dissected topography are particularly typical sites in the Piedmont and parts of the Inner Coastal Plain. The type also occupies rolling uplands with deep soils. Soils are typically well-drained, acidic sandy and silt loams derived from parent material of low to moderate fertility. This association is found throughout the Piedmont from south-central Virginia to New Jersey and Pennsylvania, and on the Mid-Atlantic Coastal Plain from southeastern Virginia northward.

**Vegetation Description:** Rangelwide, this vegetation type is characteristically a mixed mesophytic forest dominated by *Fagus grandifolia* (American beech), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), and *Liriodendron tulipifera* (tuliptree) in various proportions. Overstory associates over the range include *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Quercus velutina* (black oak), *Quercus falcata* (southern red oak), *Quercus coccinea* (scarlet oak), *Liquidambar styraciflua* (sweetgum), *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), and *Fraxinus americana* (white ash). The subcanopy is characterized by young *Fagus grandifolia* (American beech), *Acer rubrum* (red maple), *Carpinus caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), *Ilex opaca* var. *opaca* (American holly), and *Sassafras albidum* (sassafras). The shrub layer varies from very sparse to well-developed and can include *Asimina triloba* (pawpaw), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum dentatum* (southern arrowwood), and *Euonymus americanus* (strawberry bush). Heath shrubs, such as *Vaccinium corymbosum* (highbush blueberry) and *Vaccinium pallidum* (Blue Ridge blueberry), may be common but not abundant. Vines are common, including *Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (cat greenbrier), and *Toxicodendron radicans* (eastern poison ivy). The herb layer is comprised of *Polystichum acrostichoides* (Christmas fern), *Uvularia perfoliata* (perfoliate bellwort), *Cypripedium acaule* (moccasin flower), *Mitchella repens* (partridgeberry), *Tipularia discolor* (crippled crane-fly), *Goodyera pubescens* (downy rattlesnake plantain), *Eurybia divaricata* (white wood aster), *Chimaphila maculata* (striped prince's pine), *Carex swanii* (Swan's sedge), *Medeola virginiana* (Indian cucumber), *Athyrium filix-femina* (common ladyfern), *Carex digitalis* (slender woodland sedge), *Carex willdenowii* (Willdenow's sedge), *Epifagus virginiana* (beechdrops), *Maianthemum canadense* (Canada mayflower), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Polygonatum biflorum* (smooth Solomon's seal), *Podophyllum peltatum* (mayapple), *Arisaema triphyllum* (Jack in the pulpit), and *Maianthemum racemosum* (feathery false lily of the valley).

Several intergrading compositional variants have been noted in regional and local landscape analyses. On more submesic, convex slopes, *Fagus grandifolia* (American beech), *Quercus alba* (white oak), *Cornus florida* (flowering dogwood), and *Vaccinium pallidum* (Blue Ridge blueberry) tend to be prominent, while pronounced mesophytes such as *Carpinus caroliniana* (American hornbeam) and herbaceous species in general are usually sparse. Coastal Plain stands tend to have understories heavily dominated by *Ilex opaca* var. *opaca* (American holly), while Piedmont stands generally have only scattered *Ilex opaca* var. *opaca* (American holly) as well as slightly higher herbaceous richness.

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Fagus grandifolia</i> (American beech), <i>Liriodendron tulipifera</i> (tuliptree), <i>Quercus alba</i> (white oak)
Tree subcanopy	Broad-leaved deciduous tree	<i>Cornus florida</i> (flowering dogwood)
Tree subcanopy	Broad-leaved evergreen tree	<i>Ilex opaca</i> var. <i>opaca</i> (American holly)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Viburnum acerifolium</i> (mapleleaf viburnum)
Shrub/sapling (tall & short)	Vine/Liana	<i>Parthenocissus quinquefolia</i> (Virginia creeper)
Herb (field)	Forb	<i>Podophyllum peltatum</i> (mayapple), <i>Polygonatum biflorum</i> (smooth Solomon's seal)
Herb (field)	Fern or fern ally	<i>Polystichum acrostichoides</i> (Christmas fern)

**Characteristic Species:** *Carex laxiculmis* var. *laxiculmis*, *Fagus grandifolia* (American beech), *Ilex opaca* var. *opaca* (American holly), *Quercus alba* (white oak), *Viburnum acerifolium* (mapleleaf viburnum).

**Other Noteworthy Species:** Information not available.

**USFWS Wetland System:** Not applicable.

**DISTRIBUTION**

**Range:** This association is currently described from Virginia northward to Long Island, New York. The type is characteristic of the Coastal Plain throughout its range and of the Piedmont from south-central Virginia through much of Maryland. Small outliers of this vegetation occur at low elevations on both flanks of the Blue Ridge in Virginia and Maryland.

**States/Provinces:** DC, DE:S5, MD, NJ:S3, NY, PA:S1, VA:S5.

**Federal Lands:** DOD (Fort A.P. Hill, Fort Belvoir, Kerr Reservoir, Yorktown); NPS (Appomattox Court House, C&O Canal, Colonial, Fredericksburg-Spotsylvania, George Washington Parkway, National Capital-East, Petersburg, Prince William, Richmond, Rock Creek, Sagamore Hill, Shenandoah, Thomas Stone); USFWS (James River, Prime Hook).

**CONSERVATION STATUS**

**Rank:** G5 (31-Jan-2007).

**Reasons:** This association is common and widespread on the northeastern Coastal Plain and the Piedmont in Virginia and Maryland.

**CLASSIFICATION INFORMATION**

**Status:** Standard.

**Confidence:** 2 – Moderate.

**Comments:** The regional circumscription of this type is very robust and supported by 170 plots from Virginia, Maryland, and the District of Columbia. These were analyzed by VDNH with a 1300-plot regional dataset compiled for the NCR and mid-Atlantic national parks vegetation mapping projects.

**Similar Associations:**

- *Fagus grandifolia* - *Betula lenta* - *Quercus (alba, rubra)* / *Carpinus caroliniana* Forest (CEGL006921).
- *Fagus grandifolia* - *Quercus alba* - (*Acer barbatum*) / Mixed Herbs Forest (CEGL007206).
- *Fagus grandifolia* - *Quercus alba* - *Quercus rubra* Forest (CEGL006377).
- *Fagus grandifolia* - *Quercus rubra* / *Cornus florida* / *Polystichum acrostichoides* - *Hexastylis virginica* Forest (CEGL008465).
- *Quercus alba* - *Carya glabra* / Mixed Herbs Coastal Plain Forest (CEGL007226).

**Related Concepts:**

- *Fagus grandifolia* - *Liriodendron tulipifera* - *Quercus (alba, rubra)* / *Polystichum acrostichoides* - *Aster divaricatus* Forest (Fleming 2001) ?
- *Fagus grandifolia* - *Quercus (alba, rubra)* - *Liriodendron tulipifera* / *Ilex opaca* var. *opaca* - (*Asimina triloba*) Forest (Patterson pers. comm.) ?
- *Fagus grandifolia* - *Quercus alba* - *Liriodendron tulipifera* - *Liquidambar styraciflua* Forest (Bartgis 1986) ?
- *Quercus* spp. - *Carya* spp. / *Cornus florida* - *Ilex opaca* Mesic Forest (Clancy 1993) ?
- CNE Mesic hardwood Forest on acidic bedrock / till (Rawinski 1984) ?
- Coastal Plain Forest (Smith 1983) B
- Maritime forest (Rawinski 1984) ?
- Mesic Coastal Plain mixed oak forest, mixed oak - beech forest subtype (Breden 1989) ?
- Mixed oak forest of the south Jersey mesic uplands (Robichaud and Buell 1973) ?
- Southern New England oak / pine forest on sandy / gravelly soils (Rawinski 1984) ?

**SOURCES**

**Description Authors:** S. L. Neid, mod. G. Fleming and L. A. Sneddon.

**References:** Bartgis 1986, Berdine 1998, Bernard and Bernard 1971, Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1993, Clancy 1996, Davis et al. 1992, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fleming 2001, Fleming et al. 2001, Fleming pers. comm., Harrison 2004, Lea 2003, McCoy and Fleming 2000, Metzler and Barrett 2001, Patterson pers. comm., Rawinski 1984, Robichaud and Buell 1973, Smith 1983, Soil Conservation Service 1987.



Figure I6. Mesic Mixed Hardwood Forest (plot APCO.12) at Appomattox Court House National Historical Park. June 2003. NAD 1983 / UTM easting 696036, northing 4139697.

**COMMON NAME (PARK-SPECIFIC):**    **SUCCESSIONAL BLACK WALNUT FOREST**

**SYNONYMS**

**USNVC English Name:**        **Black Walnut / Wingstem Forest**  
**USNVC Scientific Name:**    ***Juglans nigra* / *Verbesina alternifolia* Forest**  
**USNVC Identifier:**            **CEGL007879**

**LOCAL INFORMATION**

**Environmental Description:** Successional Black Walnut Forest is an open forest that often occurs around former homesites or on otherwise disturbed flats over calcareous or high base status soils.

**Vegetation Description:** In Appomattox Court House National Historical Park, these forests have canopies with *Juglans nigra* (black walnut) sometimes mixed with *Robinia pseudoacacia* (black locust) and/or *Celtis occidentalis* (common hackberry). Other trees and shrubs with minor cover can include *Juniperus virginiana* var. *virginiana* (eastern redcedar), *Morus rubra* (red mulberry), *Acer saccharinum* (silver maple), and *Cercis canadensis* (eastern redbud). The low-shrub and herb layer is often dominated by *Symphoricarpos orbiculatus* (coralberry) and *Lonicera japonica* (Japanese honeysuckle). One stand within Appomattox Court House National Historical Park is primarily *Celtis occidentalis* (common hackberry) with lesser amounts of *Juglans nigra* (black walnut) and standing dead *Robinia pseudoacacia* (black locust). In another stand *Robinia pseudoacacia* (black locust) is locally dominant.

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Juglans nigra</i> (black walnut)
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Symphoricarpos orbiculatus</i> (coralberry)

**Characteristic Species:** *Juglans nigra* (black walnut), *Juniperus virginiana* var. *virginiana* (eastern redcedar), *Robinia pseudoacacia* (black locust).

**Other Noteworthy Species:**

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Lonicera japonica</i> (Japanese honeysuckle)	-	plant	invasive nonnative
<i>Microstegium vimineum</i> (Nepalese browntop)	-	plant	invasive nonnative
<i>Symphoricarpos orbiculatus</i> (coralberry)	-	plant	invasive

**Subnational Distribution with Crosswalk Data:**

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
VA	SNA	.	.	[not crosswalked]	.

**Local Range:** Successional Black Walnut Forest is mapped as three polygons covering 6 hectares (14.8 acres), ranging in size from 1.6 to 2.7 hectares (4 to 6.5 acres).

**Classification Comments:** This vegetation is distinguished by having a canopy dominated by *Juglans nigra* (black walnut), *Robinia pseudoacacia* (black locust), or *Celtis occidentalis* (common hackberry).

**Other Comments:** Information not available.

**Local Description Authors:** K. D. Patterson.

**Plots:** None.

**Appomattox Court House National Historical Park Inventory Notes:** All three polygons of Successional Black Walnut Forest were inventoried.

## GLOBAL INFORMATION

### USNVC 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	<i>Juglans nigra</i> Forest Alliance (A.1932)
Alliance (English name)	Black Walnut Forest Alliance
Association	<i>Juglans nigra</i> / <i>Verbesina alternifolia</i> Forest
Association (English name)	Black Walnut / Wingstem Forest
<b>Ecological System(s):</b>	South-Central Interior Large Floodplain (CES202.705). Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898).

### GLOBAL DESCRIPTION

**Concept Summary:** This successional black walnut forest of the Southeast, ranging from Virginia to Georgia, occurs largely on former homesites, usually on disturbed soils having a neutral to basic pH. The community was originally defined from former homesites in Great Smoky Mountains National Park, where this association is an open, successional forest. It has since been found on some old pasture sites, associated with former settlement, and is potentially a wide-ranging type. The canopy can be closed to somewhat open. *Juglans nigra* (black walnut) is often the sole canopy tree, though *Liriodendron tulipifera* (tuliptree), *Juglans cinerea* (butternut), *Robinia pseudoacacia* (black locust), *Morus rubra* (red mulberry), and *Aesculus flava* (yellow buckeye) are codominants in some examples. Associates can also include *Platanus occidentalis* (American sycamore), *Fraxinus americana* (white ash), and *Ulmus rubra* (slippery elm); *Sassafras albidum* (sassafras) may be present as a small tree. The herb stratum is dominated by *Verbesina alternifolia* (wingstem) and/or *Ageratina altissima* (white snakeroot). Other herbs include *Amphicarpaea bracteata* (American hogpeanut), *Agrimonia pubescens* (soft agrimony), *Galium triflorum* (fragrant bedstraw), *Osmorhiza longistylis* (longstyle sweetroot), *Viola striata* (striped cream violet), and *Ambrosia trifida* (great ragweed). The exotics *Rosa multiflora* (multiflora rose) and *Microstegium vimineum* (Nepalese browntop) can be common in this community.

**Environmental Description:** This community often occurs on former homesites along streams or on slopes, possibly in association with circumneutral soils. It was originally defined from former homesites in Great Smoky Mountains National Park, where this association is an open, successional forest. This community was sampled on former homesites along streams, possibly in association with circumneutral soils, at 460-610 m (1500-2000 feet) elevation in the Smokies, as well as on ridgetops, slopes, and stream areas in the Cumberlands and Alleghenies at 460-1070 m (1500-3500 feet). In addition, the association was sampled from the Piedmont of South Carolina in low-lying, poor-drainage areas from approximately 170-200 m (550-650 feet) in elevation.

**Vegetation Description:** *Juglans nigra* (black walnut) is often the sole canopy tree, though *Liriodendron tulipifera* (tuliptree), *Juglans cinerea* (butternut), *Celtis occidentalis* (common hackberry), and *Aesculus flava* (yellow buckeye) are dominant or codominant in some examples. Associates can also include *Platanus occidentalis* (American sycamore), *Fraxinus americana* (white ash), and *Ulmus rubra* (slippery elm); *Sassafras albidum* (sassafras) or *Cercis canadensis* (eastern redbud) may be present as small trees. The herb stratum is highly variable, often dominated by *Verbesina alternifolia* (wingstem) and/or *Verbesina alternifolia* (wingstem). Other

herbs include *Amphicarpaea bracteata* (American hogpeanut), *Agrimonia pubescens* (soft agrimony), *Galium triflorum* (fragrant bedstraw), *Osmorhiza longistylis* (longstyle sweetroot), *Viola striata* (striped cream violet), and *Ambrosia trifida* (great ragweed). The exotic *Rosa multiflora* (multiflora rose) can be common in this community.

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Juglans nigra</i> (black walnut)
Herb (field)	Forb	<i>Verbesina alternifolia</i> (wingstem)

**Characteristic Species:** *Cercis canadensis* (eastern redbud), *Juglans nigra* (black walnut), *Rosa multiflora* (multiflora rose), *Verbesina alternifolia* (wingstem).

**Other Noteworthy Species:** Information not available.

**USFWS Wetland System:** Not applicable.

**DISTRIBUTION**

**Range:** This potentially widespread association is currently known from Tennessee and Kentucky east to the Carolinas and north to Virginia and West Virginia. It may range into adjacent states.

**States/Provinces:** GA, KY, NC, SC, TN, VA, WV.

**Federal Lands:** DOD (Camp Dawson); NPS (Appomattox Court House, Big South Fork, Blue Ridge Parkway, Chickamauga-Chattanooga, Colonial, Cumberland Gap, Great Smoky Mountains, Kings Mountain, Mammoth Cave, Ninety Six, Richmond).

**CONSERVATION STATUS**

**Rank:** GNA (ruderal) (2-Apr-2001).

**Reasons:** This vegetation represents vegetation created by anthropogenic disturbance and is thus not a conservation priority. Rank changed from GW to GD 2001-04-02 MP.

**CLASSIFICATION INFORMATION**

**Status:** Standard.

**Confidence:** 3 – Weak.

**Comments:** This association was originally described from Great Smoky Mountains National Park where this association can be distinguished with aerial photography.

**Similar Associations:**

- *Prunus serotina* - *Liriodendron tulipifera* - *Acer rubrum* - *Fraxinus americana* Forest (CEGL006599)--is a modified successional forest that may also have a large component of *Juglans nigra* and occurs on disturbed sites, but it is largely dominated by early-successional trees in the canopy.

**Related Concepts:**

- Successional black walnut forest (Vanderhorst 2001a) =

**SOURCES**

**Description Authors:** K. D. Patterson, mod. R. White and S. C. Gawler.

**References:** NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst 2001a.



Figure 17. Successional Black Walnut Forest at Appomattox Court House National Historical Park. August 2007. NAD 1983 / UTM easting 695464, northing 4138827. Photo by Robert Tillotson.

**COMMON NAME (PARK-SPECIFIC):**    **INNER PIEDMONT / LOWER BLUE RIDGE  
BASIC MESIC FOREST**

**SYNONYMS**

**USNVC English Name:**    **Tuliptree - Northern Red Oak - White Ash / Common Pawpaw  
/ Black Cohosh / Perfoliate Bellwort Forest**

**USNVC Scientific Name:**    ***Liriodendron tulipifera* - *Quercus rubra* - *Fraxinus americana* /  
*Asimina triloba* / *Actaea racemosa* - *Uvularia perfoliata* Forest**

**USNVC Identifier:**    **CEGL006186**

**LOCAL INFORMATION**

**Environmental Description:** This deciduous forest community occurs on steep, north-facing slopes above the Appomattox River.

**Vegetation Description:** Inner Piedmont / Lower Blue Ridge Basic Mesic Forest is a deciduous forest with a distinctive suite of species indicative of high levels of base cations in the soil. The canopy is dominated by *Quercus rubra* (northern red oak), *Carya ovalis* (red hickory), and *Liriodendron tulipifera* (tuliptree). *Liriodendron tulipifera* (tuliptree) dominates the canopy in younger stands. Other species that can have high cover in the canopy and subcanopy include *Carya ovata* (shagbark hickory), *Carya glabra* (pignut hickory), *Fraxinus americana* (white ash), and *Fagus grandifolia* (American beech). The short- and tall-shrub layers can be moderately to very dense. Typical shrub and small tree species include *Cercis canadensis* var. *canadensis* (eastern redbud), *Carpinus caroliniana* (American hornbeam), and *Lindera benzoin* (northern spicebush). The herb layer can be sparse to moderately dense and is dominated by a mix of graminoids and rich-site forbs. The herb layer is diverse and no one species is dominant, but *Polystichum acrostichoides* (Christmas fern) can have high cover (5-25%). *Adiantum pedatum* (northern maidenhair) and *Sanguinaria canadensis* (bloodroot) are herbs that are particularly indicative of this community, but they occur with low cover. Other low-cover herbs typical of this community are *Collinsonia canadensis* (richweed), *Carex albicans* var. *australis* (stellate sedge), *Carex laxiculmis* var. *laxiculmis* (spreading sedge), *Carex rosea* (rosy sedge), *Actaea racemosa* (= *Cimicifuga racemosa*, black bugbane), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Poa cuspidata* (early bluegrass), *Scutellaria serrata* (showy skullcap), *Thalictrum thalictroides* (rue anemone), and *Tiarella cordifolia* (heartleaf foamflower). Samples in this community tend to be quite species-rich with upwards of 60 species per 400 square meters. The predominance of *Quercus* spp. (oaks) in the canopy varies throughout the Inner Piedmont / Lower Blue Ridge Basic Mesic Forests in Appomattox Court House National Historical Park. Younger stands tend to have more *Liriodendron tulipifera* (tuliptree).

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Carya ovalis</i> (red hickory), <i>Liriodendron tulipifera</i> (tuliptree), <i>Quercus rubra</i> (northern red oak)

**Characteristic Species:** *Adiantum pedatum* (northern maidenhair), *Collinsonia canadensis* (richweed), *Lindera benzoin* (northern spicebush), *Quercus rubra* (northern red oak), *Sanguinaria canadensis* (bloodroot).

**Other Noteworthy Species:**

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Lonicera japonica</i> (Japanese honeysuckle)	-	plant	invasive nonnative

**Subnational Distribution with Crosswalk Data:**

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
VA	SNR*	B	1	Basic Mesic Forest	Fleming et al. 2001

**Local Range:** Inner Piedmont / Blue Ridge Basic Mesic Forest that is mapped as two polygons, covering 14.4 hectares (36 acres), 4.3 and 10.2 hectares (10.6 and 25.1 acres) each.

**Classification Comments:** This community is distinguished from other deciduous forests in Appomattox Court House National Historical Park by the presence of species associated with high base status soils. Although not all of these species are present in every example, such species include *Adiantum pedatum* (northern maidenhair), *Aplectrum hyemale* (Adam and Eve), *Asimina triloba* (pawpaw), *Carpinus caroliniana* (American hornbeam), *Carya ovata* (shagbark hickory), *Cercis canadensis* var. *canadensis* (eastern redbud), *Chionanthus virginicus* (white fringetree), *Actaea racemosa* (= *Cimicifuga racemosa*, black bugbane), *Collinsonia canadensis* (richweed), *Fraxinus americana* (white ash), *Juglans nigra* (black walnut), *Lindera benzoin* (northern spicebush), *Podophyllum peltatum* (mayapple), *Sanguinaria canadensis* (bloodroot), and *Scutellaria serrata* (showy skullcap).

Inner Piedmont / Lower Blue Ridge Basic Mesic Forest shares some species in common with Basic Oak - Hickory Forest, but can be distinguished by their landscape position (steep slopes over floodplains) and the predominance of *Quercus rubra* (northern red oak), *Liriodendron tulipifera* (tuliptree), and other species characteristic of mesic habitats.

Successional Tuliptree Forest is distinguished from Inner Piedmont / Lower Blue Ridge Basic Mesic Forest by having canopy associates that are mainly early-successional species such as *Acer rubrum* (red maple), *Robinia pseudoacacia* (black locust), *Prunus serotina* var. *serotina* (black cherry), *Pinus taeda* (loblolly pine), and *Pinus virginiana* (Virginia pine) and exotic and weedy species in the field layer such as *Lonicera japonica* (Japanese honeysuckle) and *Microstegium vimineum* (Nepalese browntop), and lacking an abundance of high base status species mentioned above. Some very disturbed stands of Inner Piedmont / Lower Blue Ridge Basic Mesic Forest may be mapped as Successional Tuliptree Forest.

**Other Comments:** Many indicator species of this association are spring ephemerals that are only visible early in the growing season. Sampling / survey of this association is ideally done in April or May.

**Local Description Authors:** K. D. Patterson.

**Plots:** APCO.4, APCO.6.

**Appomattox Court House National Historical Park Inventory Notes:** Both polygons of Inner Piedmont / Blue Ridge Basic Mesic Forest were quantitatively sampled.

## GLOBAL INFORMATION

### USNVC 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	<i>Liriodendron tulipifera</i> Forest Alliance (A.236)
Alliance (English name)	Tuliptree Forest Alliance
Association	<i>Liriodendron tulipifera</i> - <i>Quercus rubra</i> - <i>Fraxinus americana</i> / <i>Asimina triloba</i> / <i>Actaea racemosa</i> - <i>Uvularia perfoliata</i> Forest
Association (English name)	Tuliptree - Northern Red Oak - White Ash / Common Pawpaw / Black Cohosh / Perfoliate Bellwort Forest
Ecological System(s):	Information not available.

### GLOBAL DESCRIPTION

**Concept Summary:** This community is a mesic rich forest occurring in the Piedmont and lower-elevation Appalachians of Virginia and Maryland and possibly extending into adjacent West Virginia, Pennsylvania, and Delaware. These forests are dominated by *Liriodendron tulipifera* (tuliptree), occurring with or codominating with *Quercus rubra* (northern red oak) or *Fraxinus americana* (white ash). This community type occupies fertile, well-drained soils of mesic lower slopes and ravines, often in areas underlain by metabasalt of the Catoctin Formation but also on a variety of igneous metamorphic and metasedimentary rocks. Occasionally, stands occur on well-weathered boulder "streams" that have been deposited in low-elevation ravine bottoms and slope concavities. Other species possible in the overstory include *Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Carya ovalis* (red hickory), *Carya alba* (mockernut hickory), *Carya cordiformis* (bitternut hickory), *Ulmus rubra* (slippery elm), *Nyssa sylvatica* (blackgum), *Fagus grandifolia* (American beech), and *Juglans nigra* (black walnut). Subcanopy tree layers contain representatives of the overstory species and *Acer rubrum* (red maple). The lowest tree and shrub layers usually contain small to large colonies of *Asimina triloba* (pawpaw) and *Lindera benzoin* (northern spicebush), along with *Cercis canadensis* (eastern redbud) and *Cornus florida* (flowering dogwood). The herb layer is usually lush and dense, except where boulder streams prevail or deer grazing is severe. Patch-dominance of ferns and leafy forbs is characteristic; species achieving local abundance in the type include *Adiantum pedatum* (northern maidenhair), *Amphicarpaea bracteata* (American hogpeanut), *Arisaema triphyllum* (Jack in the pulpit), *Asarum canadense* (Canadian wildginger), *Actaea racemosa* (= *Cimicifuga racemosa*, black bugbane), *Deparia acrostichoides* (silver false spleenwort), *Hydrastis canadensis* (goldenseal), *Phegopteris hexagonoptera* (broad beechfern), *Polystichum acrostichoides* (Christmas fern), and *Uvularia perfoliata* (perfoliate bellwort). Other constant or characteristic herbaceous species include *Botrychium virginianum* (rattlesnake fern), *Carex laxiflora* var. *laxiflora* (broad looseflower sedge), *Circaea lutetiana* ssp. *canadensis* (broadleaf enchanter's nightshade), *Collinsonia canadensis* (richweed), *Cypripedium parviflorum* var. *pubescens* (greater yellow lady's slipper), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Galearis spectabilis* (showy orchid), *Galium circaezans* (licorice bedstraw), *Galium triflorum* (fragrant bedstraw), *Hepatica nobilis* var. *obtusata* (roundlobe hepatica), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Phryma leptostachya* (American lopseed), *Podophyllum peltatum* (mayapple), *Sanguinaria canadensis* (bloodroot), *Sanicula canadensis* (Canadian blacksnakeroot), and *Stellaria pubera* (star chickweed). This association is

distinguished from more montane rich cove forests by its lower-elevation habitats, shrub layer dominance by *Asimina triloba* (pawpaw) (a low-elevation species in the mid-Atlantic region), and the absence or unimportance of many common species of montane cove forests, e.g., *Acer saccharum* (sugar maple), *Tilia americana* (American basswood), *Caulophyllum thalictroides* (blue cohosh), *Laportea canadensis* (Canadian woodnettle), *Osmorhiza claytonii* (Clayton's sweetroot), *Impatiens pallida* (pale touch-me-not), and *Trillium grandiflorum* (snow trillium).

**Environmental Description:** This community type occupies fertile, well-drained soils of mesic lower slopes and ravines. It is most extensive in areas underlain by metabasalt of the Catoclin Formation but also occurs on a variety of igneous metamorphic and metasedimentary rocks. Slopes vary from moderate to steep (range = 7 to 30 degrees) and are typically straight or concave. The surface substrate usually has less than 10% exposed boulder and stone cover, and more than 90% cover of leaf litter and other humic material. However, a small number of stands occur on well-weathered boulder "streams" that have been deposited in low-elevation ravine bottoms and slope concavities. Soils are deep, dark loams or sandy loams of colluvial origin. Soil samples collected from representative stands were moderately acidic (mean pH is about 5.5 to 5.9), with moderately high Ca and high Mg, Mn, K, Cu, B, and total base saturation.

**Vegetation Description:** The typical stand structure of this community type consists of a tall, closed overstory, with very open understory tree layers, and a variably dense shrub layer. The overstory of most stands is dominated by tall, straight *Liriodendron tulipifera* (tuliptree) often exceeding 35 m in height. *Fraxinus americana* (white ash) and *Quercus rubra* (northern red oak) are the most frequent overstory associates and often codominate. Less frequent overstory associates include *Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Carya ovalis* (red hickory), *Carya alba* (mockernut hickory), *Carya cordiformis* (bitternut hickory), *Ulmus rubra* (slippery elm), *Nyssa sylvatica* (blackgum), *Fagus grandifolia* (American beech), and *Juglans nigra* (black walnut). Subcanopy tree layers contain representatives of the overstory species and *Acer rubrum* (red maple). The lowest tree and shrub layers usually contain small to large colonies of *Asimina triloba* (pawpaw) and *Lindera benzoin* (northern spicebush), along with *Cercis canadensis* (eastern redbud) and *Cornus florida* (flowering dogwood). More locally important small trees and shrubs include *Carpinus caroliniana* (American hornbeam) and *Hamamelis virginiana* (American witchhazel). High-climbing vines of *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy), and *Vitis* spp. (grapes) are common. The herb layer is usually lush and dense, except where boulder streams prevail or deer grazing is severe. Patch-dominance of ferns and leafy forbs is characteristic; species achieving local abundance in the type include *Adiantum pedatum* (northern maidenhair), *Amphicarpaea bracteata* (American hogpeanut), *Arisaema triphyllum* (Jack in the pulpit), *Asarum canadense* (Canadian wildginger), *Actaea racemosa* (= *Cimicifuga racemosa*, black bugbane), *Deparia acrostichoides* (silver false spleenwort), *Hydrastis canadensis* (goldenseal), *Phegopteris hexagonoptera* (broad beechfern), *Polystichum acrostichoides* (Christmas fern), and *Uvularia perfoliata* (perfoliate bellwort). The most constant, low-cover herbs in 22 Virginia and Maryland plots of the type are *Botrychium virginianum* (rattlesnake fern), *Circaea lutetiana* ssp. *canadensis* (broadleaf enchanter's nightshade), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Galium circaezans* (licorice bedstraw), *Galium triflorum* (fragrant bedstraw), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Phryma leptostachya* (American lopseed), *Sanguinaria canadensis* (bloodroot), and *Sanicula canadensis* (Canadian blacksnakeroot). Additional characteristic herbs include *Carex laxiflora* var. *laxiflora* (broad looseflower sedge), *Collinsonia canadensis* (richweed), *Cypripedium parviflorum* var. *pubescens*

(greater yellow lady's slipper), *Galearis spectabilis* (showy orchid), *Hepatica nobilis* var. *obtusata* (roundlobe hepatica), *Podophyllum peltatum* (mayapple), and *Stellaria pubera* (star chickweed).

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Fraxinus americana</i> (white ash), <i>Liriodendron tulipifera</i> (tuliptree), <i>Quercus rubra</i> (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Asimina triloba</i> (pawpaw), <i>Lindera benzoin</i> (northern spicebush)
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Lindera benzoin</i> (northern spicebush)
Herb (field)	Vine/Liana	<i>Parthenocissus quinquefolia</i> (Virginia creeper), <i>Toxicodendron radicans</i> (eastern poison ivy)
Herb (field)	Fern or fern ally	<i>Botrychium virginianum</i> (rattlesnake fern)

**Characteristic Species:** *Actaea racemosa* (= *Cimicifuga racemosa*, black bugbane), *Asimina triloba* (pawpaw), *Lindera benzoin* (northern spicebush), *Liriodendron tulipifera* (tuliptree).

**Other Noteworthy Species:** Information not available.

**USFWS Wetland System:** Not applicable.

**DISTRIBUTION**

**Range:** This vegetation type is scattered in small to large patches throughout the lower Blue Ridge and northern and western Piedmont of Virginia, and much of the Maryland Piedmont and Blue Ridge. It may also occur in eastern West Virginia, Pennsylvania, and the Piedmont portion of Delaware.

**States/Provinces:** DE?, MD, PA, VA, WV?

**Federal Lands:** NPS (Appomattox Court House, Blue Ridge Parkway, Booker T. Washington, C&O Canal, Catoctin Mountain, George Washington Parkway, Gettysburg, Harpers Ferry, Manassas, Prince William, Rock Creek?).

**CONSERVATION STATUS**

**Rank:** G4? (24-Jan-2005).

**Reasons:** While not a naturally rare type, this community has a restricted geographic distribution, mature examples are uncommon, and all stands are vulnerable to logging and degradation by introduced invasive weeds. Many examples are poorly buffered because of upslope land-use change, timber removal, or conversion of upslope forests to managed forest types.

**CLASSIFICATION INFORMATION**

**Status:** Standard.

**Confidence:** 2 – Moderate.

**Comments:** This description is based on analysis of 32 plots from Virginia and Maryland. This association is distinguished from more montane rich cove forests by its lower-elevation habitats, shrub-layer dominance by *Asimina triloba* (pawpaw) (a low-elevation species in the mid-Atlantic region), and the absence or unimportance of many common species of montane cove forests, e.g., *Acer saccharum* (sugar maple), *Tilia americana* (American basswood), *Caulophyllum thalictroides* (blue cohosh), *Laportea canadensis* (Canadian woodnettle), *Osmorhiza claytonii* (Clayton's sweetroot), *Impatiens pallida* (pale touch-me-not), and *Trillium grandiflorum* (snow trillium).

**Similar Associations:**

- *Fagus grandifolia* - *Liriodendron tulipifera* - *Carya cordiformis* / *Lindera benzoin* / *Podophyllum peltatum* Forest (CEGL006055)--is associated with fertile ravines of the outer Piedmont and Inner Coastal Plain in Maryland and Virginia. It differs from CEGL006186 in having *Fagus grandifolia* and *Carya cordiformis* as major overstory components, as well as a number of more coastal-ranging species such as *Ilex opaca* var. *opaca*.
- *Liriodendron tulipifera* - *Aesculus flava* - (*Fraxinus americana*, *Tilia americana*) / *Actaea racemosa* - *Laportea canadensis* Forest (CEGL007710)--occurs at higher elevations in more montane landscapes and contains many species more characteristic of the Appalachians; it lacks several low-elevation species (e.g., *Asimina triloba*, *Cercis canadensis*) that are characteristic of CEGL006186.

**Related Concepts:**

- *Liriodendron tulipifera* - *Quercus rubra* / *Asimina triloba* / *Arisaema triphyllum* - *Cimicifuga racemosa* Forest (Fleming 2002) =
- Yellow-Poplar - White Oak - Northern Red Oak: 59 (Eyre 1980) B
- Yellow-Poplar: 57 (Eyre 1980) B

**SOURCES**

**Description Authors:** G. P. Fleming and K. D. Patterson.

**References:** Busing 1995, Davis 1993, Eastern Ecology Working Group n.d., Eyre 1980, Fleming 2002, Fleming et al. 2004, Orwig and Abrams 1994, Townsend 2006, VDNH 2003.



Figure 18. Inner Piedmont / Lower Blue Ridge Basic Mesic Forest (plot APCO.4) at Appomattox Court House National Historical Park. May 2002. NAD 1983 / UTM 694094 easting, 4139962 northing.

**COMMON NAME (PARK-SPECIFIC):**    **SUCCESSIONAL TULIPTREE FOREST**

**SYNONYMS**

**USNVC English Name:**        **Tuliptree - Oak species Forest**  
**USNVC Scientific Name:**    ***Liriodendron tulipifera* - *Quercus* spp. Forest**  
**USNVC Identifier:**            **CEGL007221**

**LOCAL INFORMATION**

**Environmental Description:** Successional Tuliptree Forest is an upland deciduous forest that develops on areas which were once clearcut, old fields, or cleared by fire or other natural disturbances.

**Vegetation Description:** The canopy is typically even-aged *Liriodendron tulipifera* (tuliptree), sometimes occurring with other early-successional trees such as *Acer rubrum* (red maple), *Juglans nigra* (black walnut), *Robinia pseudoacacia* (black locust), *Prunus serotina* var. *serotina* (black cherry), *Pinus virginiana* (Virginia pine), and *Pinus taeda* (loblolly pine). Other deciduous trees, including *Quercus alba* (white oak), *Fraxinus americana* (white ash), and *Carya alba* (mockernut hickory), may occur in the canopy, but these species do not dominate. Successional Virginia Pine Forest is often the precursor of this type, thus standing dead or fallen *Pinus virginiana* (Virginia pine) is often present. If a distinct subcanopy has developed, typical trees include *Cornus florida* (flowering dogwood), *Acer rubrum* (red maple), *Sassafras albidum* (sassafras), and *Viburnum prunifolium* (blackhaw). Shrubs are mostly *Smilax* (greenbrier) vines, *Lonicera japonica* (Japanese honeysuckle), *Rosa multiflora* (multiflora rose), *Symphoricarpos orbiculatus* (coralberry), and sometimes *Lindera benzoin* (northern spicebush). The ground layer is usually a mix of mesic forest herbs and species typical of disturbed areas, as well as exotic vines, shrubs, and herbs. Typical species include *Botrychium virginianum* (rattlesnake fern), *Carex* spp. (sedges), *Galium aparine* (stickywilly), *Desmodium* sp. (ticktrefoil), *Lonicera japonica* (Japanese honeysuckle), *Lycopodium digitatum* (fan clubmoss), *Microstegium vimineum* (Nepalese browntop), *Polystichum acrostichoides* (Christmas fern), *Symphoricarpos orbiculatus* (coralberry), and *Viola* spp. (violets).

The composition of Successional Tuliptree Forest varies greatly within Appomattox Court House National Historical Park depending mostly on stand age and topographic position. Stands on or near disturbed floodplains may have *Platanus occidentalis* (American sycamore) in the canopy. Former Successional Virginia Pine stands that have developed >75% deciduous canopy are included in this mapping unit and may have scattered *Pinus virginiana* (Virginia pine) in the canopy. Stands that were former pastures may have open grown *Quercus* (oak) species in the canopy, formerly pasture shade trees.

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Liriodendron tulipifera</i> (tuliptree)
Shrub/sapling (tall & short)	Vine/Liana	<i>Lonicera japonica</i> (Japanese honeysuckle)

**Characteristic Species:** *Liriodendron tulipifera* (tuliptree), *Lonicera japonica* (Japanese honeysuckle), *Lycopodium digitatum* (fan clubmoss), *Microstegium vimineum* (Nepalese browntop).

### Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Lonicera japonica</i> (Japanese honeysuckle)	-	plant	invasive nonnative
<i>Microstegium vimineum</i> (Nepalese browntop)	-	plant	invasive nonnative
<i>Rosa multiflora</i> (multiflora rose)	-	plant	invasive nonnative
<i>Symphoricarpos orbiculatus</i> (coralberry)	-	plant	invasive

### Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
VA	SNA	.	.	[not crosswalked]	.

**Local Range:** Successional Tuliptree Forest occurs throughout the park and is mapped as 17 polygons, covering 72 hectares (178 acres), ranging in size from 0.6 to 12.5 hectares.

**Classification Comments:** Successional Tuliptree Forest is distinguished from other upland deciduous forest types in Appomattox Court House National Historical Park by having a canopy dominated or codominated by *Liriodendron tulipifera* (tuliptree) and species-poor shrub and herb strata composed of primarily weedy and exotic species. Hardwood inclusions within decadent Successional Virginia Pine Forest may be mistaken for this type.

**Other Comments:** Information not available.

**Local Description Authors:** K. D. Patterson.

**Plots:** None.

**Appomattox Court House National Historical Park Inventory Notes:** All 17 polygons of Successional Tuliptree Forest were observed in the field.

## GLOBAL INFORMATION

### USNVC 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	<i>Liriodendron tulipifera</i> Forest Alliance (A.236)
Alliance (English name)	Tuliptree Forest Alliance
Association	<i>Liriodendron tulipifera</i> - <i>Quercus</i> spp. Forest
Association (English name)	Tuliptree - Oak species Forest
<b>Ecological System(s):</b>	Southern Coastal Plain Mesic Slope Forest (CES203.476). Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898). East Gulf Coastal Plain Northern Dry Upland Hardwood Forest (CES203.483). Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359).

### GLOBAL DESCRIPTION

**Concept Summary:** This broadly defined semi-natural or successional community is one of several described upland associations dominated by *Liriodendron tulipifera* (tuliptree). It ranges from the southern Cumberland Plateau, Piedmont, and Interior Low Plateau of the southeastern U.S. north to the northern Piedmont of New Jersey. These successional forests often follow cropping, clearcut logging, or other severe disturbance, and are successional to mixed oak-hickory forests. Examples are common across large areas of the upland landscape which have previously been disturbed. Soils usually exhibit evidence of disturbance and may have little to no organic horizon development. Environmental setting is variable, ranging from level to gently sloping uplands to well-drained floodplains and stream terraces. Species found in stands attributable to this type may include a fairly diverse and varied composition. *Acer rubrum* (red maple), *Quercus* spp. (oaks), and occasionally *Liquidambar styraciflua* (sweetgum) or *Robinia*

*pseudoacacia* (black locust) may be common in stands of this type; *Betula lenta* (sweet birch) often occurs at the northern end of the range. The oaks in these stands are frequently multi-stemmed, resulting from coppicing. Shrub composition is variable but may include *Sambucus canadensis* (= *Sambucus nigra* ssp. *canadensis*, common elderberry) and *Vaccinium pallidum* (Blue Ridge blueberry). Herbs are likewise variable; West Virginia samples feature *Dioscorea quaternata* (fourleaf yam), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Maianthemum racemosum* (feathery false lily of the valley), *Solidago curtisii* (mountain decumbent goldenrod), *Symphotrichum prenanthoides* (crookedstem aster), and *Geranium maculatum* (spotted geranium). This association differs from other described types in the alliance based on the lack of a significant pine component [see *Liriodendron tulipifera* - *Pinus taeda* Forest (CEGL007521)] and the absence of species affiliated with circumneutral conditions [see *Liriodendron tulipifera* / (*Cercis canadensis*) / (*Lindera benzoin*) Forest (CEGL007220)]; it is later successional and more diverse than *Liriodendron tulipifera* Forest (CEGL007218) or *Liriodendron tulipifera* - *Robinia pseudoacacia* Forest (CEGL007219).

**Environmental Description:** These semi-natural upland deciduous forests are found primarily in areas which were once clearcuts, old fields, or were cleared by fire or other natural disturbances. These successional forests often follow cropping, clearcut logging, or other severe disturbance, and are successional to mixed oak-hickory forests. Examples are common across large areas of the upland landscape which have previously been disturbed. Soils usually exhibit evidence of disturbance and may have little to no organic horizon development. Environmental setting is variable, ranging from level to gently sloping uplands to well-drained floodplains and stream terraces.

**Vegetation Description:** The canopy of this semi-natural upland association is dominated by *Liriodendron tulipifera* (tuliptree). *Quercus* (oak) species (*Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus falcata* (southern red oak), *Quercus nigra* (water oak), *Quercus velutina* (black oak)) are often present; additional associates may include *Acer rubrum* (red maple), *Carya* spp. (hickories), *Fagus grandifolia* (American beech), *Nyssa sylvatica* (blackgum), *Cornus florida* (flowering dogwood), and *Robinia pseudoacacia* (black locust). *Betula lenta* (sweet birch) is a common associate at the northern range limit. Shrub layers may include saplings of the canopy species and *Acer pensylvanicum* (striped maple), *Amelanchier arborea* (common serviceberry), *Hamamelis virginiana* (American witchhazel), *Lindera benzoin* (northern spicebush) (in small amounts), and *Vaccinium pallidum* (Blue Ridge blueberry). Herbs vary across the range but may include *Actaea racemosa* (= *Cimicifuga racemosa*, black bugbane), *Dichanthelium clandestinum* (deertongue), *Dioscorea quaternata* (fourleaf yam), *Galium circaezans* (licorice bedstraw), *Geranium maculatum* (spotted geranium), *Goodyera pubescens* (downy rattlesnake plantain), *Medeola virginiana* (Indian cucumber), *Potentilla simplex* (common cinquefoil), *Scutellaria serrata* (showy skullcap), *Thelypteris noveboracensis* (New York fern), and *Uvularia perfoliata* (perfoliate bellwort). *Lycopodium digitatum* (fan clubmoss) may be abundant in some stands.

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	<i>Liriodendron tulipifera</i> (tuliptree)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Cornus florida</i> (flowering dogwood)
Herb (field)	Fern or fern ally	<i>Lycopodium digitatum</i> (fan clubmoss)

**Characteristic Species:** *Acer pensylvanicum* (striped maple), *Acer rubrum* (red maple), *Actaea racemosa* (= *Cimicifuga racemosa*, black bugbane), *Amelanchier arborea* (common serviceberry), *Carya glabra* (pignut hickory), *Dichanthelium clandestinum* (deertongue), *Fagus grandifolia* (American beech), *Galium circaezans* (licorice bedstraw), *Geranium maculatum* (spotted geranium), *Goodyera pubescens* (downy rattlesnake plantain), *Hamamelis virginiana* (American witchhazel), *Lycopodium digitatum* (fan clubmoss), *Medeola virginiana* (Indian cucumber), *Nyssa sylvatica* (blackgum), *Quercus falcata* (southern red oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Robinia pseudoacacia* (black locust), *Thelypteris noveboracensis* (New York fern), *Uvularia perfoliata* (perfoliate bellwort), *Vaccinium pallidum* (Blue Ridge blueberry).

**Other Noteworthy Species:** Information not available.

**USFWS Wetland System:** Not applicable.

#### DISTRIBUTION

**Range:** This association is known from the southern Cumberland Plateau, Piedmont, and Interior Low Plateau of the southeastern U.S. and may also occur in the Upper East Gulf Coastal Plain. It ranges north to the northern Piedmont of New Jersey and adjacent Pennsylvania. It is also known from Alabama, Georgia, Kentucky, Maryland, North Carolina, South Carolina, Tennessee, West Virginia, and possibly Virginia and Delaware.

**States/Provinces:** AL, DE?, GA, KY, MD, NC, NJ, PA, SC, TN, VA, WV.

**Federal Lands:** DOD (Camp Dawson, Fort Benning); NPS (Appomattox Court House, Big South Fork, Blue Ridge Parkway, Booker T. Washington, Chickamauga-Chattanooga?, Cowpens, Cumberland Gap, Fredericksburg-Spotsylvania, Guilford Courthouse, Kennesaw Mountain, Kings Mountain, Mammoth Cave, Morristown, Natchez Trace, New River Gorge, Ninety Six, Obed, Petersburg, Richmond, Shiloh, Valley Forge); USFS (Bankhead, Daniel Boone, Oconee?, Talladega, Talladega (Oakmulgee)?, Talladega (Talladega)).

#### CONSERVATION STATUS

**Rank:** GNA (ruderal) (19-Aug-2002).

**Reasons:** This forest represents early-successional vegetation and is thus not of conservation concern. This is a successional vegetation type composed of native species. Its conservation value is limited, but mature examples could provide buffer for communities of greater conservation value.

#### CLASSIFICATION INFORMATION

**Status:** Standard.

**Confidence:** 2 - Moderate.

**Comments:** Within its range, it differs from other described types based on the lack of a significant pine component [see *Liriodendron tulipifera* - *Pinus taeda* Forest (CEGL007521)] and the absence of species affiliated with circumneutral conditions [see *Liriodendron tulipifera* / (*Cercis canadensis*) / (*Lindera benzoin*) Forest (CEGL007220)]; it is later successional and more diverse than *Liriodendron tulipifera* Forest (CEGL007218) and tends to be found on more stable soil substrates and less steep slopes than *Liriodendron tulipifera* - *Robinia pseudoacacia* Forest (CEGL007219).

**Similar Associations:**

- *Liriodendron tulipifera* - *Acer negundo* Forest (CEGL007184)--a bottomland type.
- *Liriodendron tulipifera* - *Robinia pseudoacacia* Forest (CEGL007219)--is generally found on steeper slopes and/or shallow soils and with a more intense history of disturbance.
- *Liriodendron tulipifera* / (*Cercis canadensis*) / (*Lindera benzoin*) Forest (CEGL007220)--is generally found on calcareous or at least pH neutral soils.
- *Prunus serotina* - *Liriodendron tulipifera* - *Acer rubrum* - *Fraxinus americana* Forest (CEGL006599).
- *Prunus serotina* - *Sassafras albidum* - (*Fraxinus americana*) / *Juniperus virginiana* Forest (CEGL004133).

**Related Concepts:**

- Successional forest of low-elevation plateaus (Vanderhorst 2001a) B
- Tulip Poplar Type (Schmalzer and DeSelm 1982) B
- Yellow poplar community (Ehrenfeld 1977) =

**SOURCES**

**Description Authors:** R. E. Evans and M. Pyne, mod. L. A. Sneddon, R. White, S. C. Gawler.

**References:** Ehrenfeld 1977, Gallyoun et al. 1996, Keever 1973, NatureServe Ecology - Southeastern U.S. unpubl. data, Overlease 1987, Russell and Schuyler 1988, Schmalzer and DeSelm 1982, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst 2001a, Vanderhorst and Streets 2006.



Figure 19. Successional Tuliptree Forest photographed at Booker T. Washington National Monument. August 2007.

**COMMON NAME (PARK-SPECIFIC): BASIC OAK - HICKORY FOREST**

**SYNONYMS**

**USNVC English Name:** White Oak - Northern Red Oak - (Shagbark Hickory, Carolina Shagbark Hickory) / Eastern Redbud Forest

**USNVC Scientific Name:** *Quercus alba* - *Quercus rubra* - *Carya (ovata, caroliniae-septentrionalis)* / *Cercis canadensis* Forest

**USNVC Identifier:** C EGL007232

**LOCAL INFORMATION**

**Environmental Description:** Basic Oak - Hickory Forest occurs on rolling uplands and is often associated with soils mapped as Alfisols, which are weathered from rocks with a mafic geology.

**Vegetation Description:** This deciduous forest occurs on rolling uplands throughout the park in areas that have been continuously forested for the past 80 years. Overstory composition varies somewhat from stand to stand, but is dominated by mixtures of oaks and hickories, typically *Quercus alba* (white oak), *Carya alba* (mockernut hickory), *Carya ovata* (shagbark hickory), *Carya glabra* (pignut hickory), and *Carya ovalis* (red hickory). Other canopy trees can include *Liriodendron tulipifera* (tuliptree), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Acer rubrum* (red maple), and *Nyssa sylvatica* (blackgum). *Cercis canadensis* var.

*canadensis* (eastern redbud) is a common understory species, although other species, such as *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Juniperus virginiana* var. *virginiana* (eastern redcedar), and *Oxydendrum arboreum* (sourwood), can also occur. The shrub stratum is typically quite open, with species from the overstory occurring as woody saplings.

Other scattered shrubs can include *Vaccinium stamineum* (deerberry), *Vaccinium pallidum* (Blue Ridge blueberry), and *Viburnum dentatum* (southern arrowwood). Herb layers are very sparse or patchy but can be quite species-rich and support diverse mixtures of both mesophytic and dry-site species. Sedges such as *Carex albicans* var. *australis* (stellate sedge), *Carex glaucoidea* (blue sedge), *Carex hirsutella* (fuzzy wuzzy sedge), *Carex laxiflora* var. *laxiflora* (broad looseflower sedge), and *Carex striatula* (lined sedge) are typical. Other typical herb species can include *Aristolochia serpentaria* (Virginia snakeroot), *Botrychium virginianum* (rattlesnake fern), *Chimaphila maculata* (striped prince's pine), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Galium circaezans* (licorice bedstraw), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Polygonatum biflorum* (smooth Solomon's seal), *Uvularia perfoliata* (perfoliate bellwort), and *Viola palmata* var. *triloba* (= *Viola palmata*, early blue violet).

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Quercus alba</i> (white oak)

**Characteristic Species:** *Carya ovata* (shagbark hickory), *Cercis canadensis* var. *canadensis* (eastern redbud), *Quercus alba* (white oak).

**Other Noteworthy Species:**

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Lonicera japonica</i> (Japanese honeysuckle)	-	plant	invasive nonnative
<i>Symphoricarpos orbiculatus</i> (coralberry)	-	plant	invasive

**Subnational Distribution with Crosswalk Data:**

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
VA	SNR*	B	1	Basic Oak - Hickory Forest	Fleming et al. 2001

**Local Range:** Basic Oak - Hickory Forest is included in the map class Oak – Hickory Forest, which represents two associations. Oak – Hickory Forest is mapped as 16 polygons, covering 94.9 hectares (234.6 acres), ranging in size from 0.2 to 22.7 hectares (0.5 to 56.0 acres).

**Classification Comments:** Typically, stands of this association will have a much greater species richness and higher base status soils than stands of Acidic Oak - Hickory Forest. However, in Appomattox Court House National Historical Park, stands of this association have fewer species and more acidic soils than expected. Soil compaction and local species extirpations from grazing and topsoil loss from agriculture may have contributed to the change in species composition of these forests.

**Other Comments:** In Appomattox Court House National Historical Park, this association was mapped as part of the larger map class, Oak - Hickory Forest, which represents the Alliance level of the USNVC. Presumably due to land-use history, it is difficult to use floristics to distinguish between the two associations in the Oak - Hickory Forest map class. In order to increase map accuracy, the two associations were grouped into one mapping unit.

**Local Description Authors:** K. D. Patterson.

**Plots:** APCO.1, APCO.2, APCO.9.

**Appomattox Court House National Historical Park Inventory Notes:** Information not available.

## GLOBAL INFORMATION

### USNVC 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	<i>Quercus alba</i> - ( <i>Quercus rubra</i> , <i>Carya</i> spp.) Forest Alliance (A.239)
Alliance (English name)	White Oak - (Northern Red Oak, Hickory species) Forest Alliance
Association	<i>Quercus alba</i> - <i>Quercus rubra</i> - <i>Carya</i> ( <i>ovata</i> , <i>caroliniae-septentrionalis</i> ) / <i>Cercis canadensis</i> Forest
Association (English name)	White Oak - Northern Red Oak - (Shagbark Hickory, Carolina Shagbark Hickory) / Eastern Redbud Forest
<b>Ecological System(s):</b>	Southern Piedmont Dry Oak-(Pine) Forest (CES202.339).

### GLOBAL DESCRIPTION

**Concept Summary:** This dry-mesic forest occurs on base-rich, well-drained soils in the southern Piedmont. Stands are dominated by *Quercus alba* (white oak) and often *Quercus rubra* (northern red oak), *Carya ovata* (shagbark hickory), or *Carya caroliniae-septentrionalis* (southern shagbark hickory) in combination with other species of *Quercus* (oak) and *Carya* (hickory) (i.e., *Quercus velutina* (black oak), *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory)). Other overstory and understory species that may occur include *Fraxinus americana* (white ash), *Liquidambar styraciflua* (sweetgum), *Carya ovalis* (red hickory), *Liriodendron tulipifera* (tuliptree), *Juniperus virginiana* var. *virginiana* (eastern redcedar), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Viburnum rafinesquianum* (downy arrowwood), *Viburnum prunifolium* (blackhaw), *Ostrya virginiana* (hophornbeam), *Chionanthus virginicus* (white fringetree), *Ulmus americana* (American elm), *Carpinus caroliniana* (American hornbeam), *Pinus taeda* (loblolly pine), and *Pinus echinata* (shortleaf pine). Proportions of *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera*

(tuliptree), *Acer rubrum* (red maple), and *Pinus* spp. (pines) increase following disturbance. Herbaceous species and vines that may occur within this community include *Desmodium nudiflorum* (nakedflower ticktrefoil), *Galium circaezans* (licorice bedstraw), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Polygonatum biflorum* var. *biflorum* (smooth Solomon's-seal), *Uvularia perfoliata* (perfoliate bellwort), *Aristolochia serpentaria* (Virginia snakeroot), *Scleria oligantha* (littlehead nutrush), *Botrychium virginianum* (rattlesnake fern), *Agrimonia rostellata* (beaked agrimony), *Bromus pubescens* (hairy woodland brome), *Carex albicans* (whitening sedge), *Carex laxiflora* var. *laxiflora* (broad looseflower sedge), *Carex planispicata*, *Dichanthelium boscii* (Bosc's panicgrass), *Elymus hystrix* var. *hystrix* (eastern bottlebrush grass), *Festuca subverticillata* (nodding fescue), *Scutellaria elliptica* (hairy skullcap), and *Tiarella cordifolia* var. *collina* (heartleaf foamflower). Other stands have high cover of scrambling vines, such *Parthenocissus quinquefolia* (Virginia creeper), *Bignonia capreolata* (crossvine), and *Vitis rotundifolia* (muscadine), that preclude a diversity of herbaceous species.

**Environmental Description:** This dry-mesic forest occurs on base-rich, well-drained soils in the southern Piedmont. It is typically associated with sites underlain by diabase, amphibolite, gabbro, basalt, and other mafic rocks. It commonly occurs on mid- to low slopes where conditions are somewhat ameliorated over upper slopes, i.e., in dry-mesic as opposed to dry conditions, but it can occur in most topographic positions with basic soils that are well-drained. Soils generally are in the order Alfisol and have moderately high to high levels of calcium, magnesium, manganese, iron, and aluminum. However, the abundant iron and aluminum tend to lower pH into the strongly acidic range; e.g., the mean pH of samples collected from 16 Virginia plots was 5.3.

**Vegetation Description:** Stands of this forest are dominated by *Quercus alba* (white oak) and often *Quercus rubra* (northern red oak), *Carya ovata* (shagbark hickory), and *Carya caroliniana-septentrionalis* (southern shagbark hickory) in combination with other species of *Quercus* (oak) and *Carya* (hickory) (i.e., *Quercus velutina* (black oak), *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory)). Other overstory and understory species that may occur include *Liquidambar styraciflua* (sweetgum), *Carya ovalis* (red hickory), *Fraxinus americana* (white ash), *Liriodendron tulipifera* (tuliptree), *Juniperus virginiana* var. *virginiana* (eastern redcedar), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Viburnum rafinesquianum* (downy arrowwood), *Viburnum prunifolium* (blackhaw), *Ostrya virginiana* (hophornbeam), *Chionanthus virginicus* (white fringetree), *Ulmus americana* (American elm), *Carpinus caroliniana* (American hornbeam), *Pinus taeda* (loblolly pine), and *Pinus echinata* (shortleaf pine). Proportions of *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), and *Pinus* spp. (pines) increase following disturbance. Occurrences usually have closed canopies and moderately well-developed subcanopy and shrub layers. Herbaceous cover in this association may vary considerably with site conditions, land-use history, and levels of deer herbivory. Some stands have rather sparse herb layers with <25% total cover and only scattered patches of dry-mesophytic forbs and graminoids such as *Desmodium nudiflorum* (nakedflower ticktrefoil), *Galium circaezans* (licorice bedstraw), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Polygonatum biflorum* var. *biflorum* (smooth Solomon's-seal), *Uvularia perfoliata* (perfoliate bellwort), *Aristolochia serpentaria* (Virginia snakeroot), *Scleria oligantha* (littlehead nutrush), *Botrychium virginianum* (rattlesnake fern), *Agrimonia rostellata* (beaked agrimony), *Bromus pubescens* (hairy woodland brome), *Carex albicans* (whitening sedge), *Carex laxiflora* var. *laxiflora* (broad looseflower

sedge), *Carex planispicata*, *Dichanthelium boscii* (Bosc's panicgrass), *Elymus hystrix* var. *hystrix* (eastern bottlebrush grass), *Festuca subverticillata* (nodding fescue), *Scutellaria elliptica* (hairy skullcap), and *Tiarella cordifolia* var. *collina* (heartleaf foamflower). Other stands have high cover of scrambling vines, such *Parthenocissus quinquefolia* (Virginia creeper), *Bignonia capreolata* (crossvine), and *Vitis rotundifolia* (muscadine), that preclude a diversity of herbaceous species. On the best sites, especially those not subject to heavy deer grazing, stands may have well-developed herb layers with >50% cover and impressive species richness (e.g., >80 taxa per 400 square meters). A number of species with Piedmont distributions restricted to calcium- or magnesium-rich soils have been documented in this association in both Virginia and North Carolina, including *Blephilia ciliata* (downy pagoda-plant), *Clematis ochroleuca* (curlyheads), *Matelea decipiens* (oldfield milkvine), *Matelea obliqua* (climbing milkvine), *Polygala senega* (Seneca snakeroot), *Ruellia purshiana* (Pursh's wild petunia), *Salvia urticifolia* (nettleleaf sage), *Scutellaria nervosa*, *Scutellaria ovata* (heartleaf skullcap), *Scutellaria serrata* (showy skullcap), and *Triosteum angustifolium* (yellowfruit horse-gentian).

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Carya alba</i> (mockernut hickory), <i>Carya ovata</i> (shagbark hickory), <i>Fraxinus americana</i> (white ash), <i>Quercus alba</i> (white oak), <i>Quercus stellata</i> (post oak)
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple), <i>Cornus florida</i> (flowering dogwood), <i>Ulmus alata</i> (winged elm)
Tall shrub/sapling	Broad-leaved deciduous tree	<i>Ilex decidua</i> (possumhaw)
Short shrub/sapling	Broad-leaved deciduous tree	<i>Asimina triloba</i> (pawpaw)
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Viburnum prunifolium</i> (blackhaw)

**Characteristic Species:** Information not available.

**Other Noteworthy Species:**

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Agastache nepetoides</i> (yellow giant hyssop)	-	plant	
<i>Berberis canadensis</i> (American barberry)	G3	plant	
<i>Buchnera americana</i> (American bluehearts)	-	plant	
<i>Cirsium carolinianum</i> (soft thistle)	-	plant	
<i>Hexalectris spicata</i> (spiked crested coralroot)	-	plant	
<i>Lathyrus venosus</i> (veiny pea)	-	plant	
<i>Lotus unifoliolatus</i> var. <i>helleri</i> (heller's bird's-foot)	G5T3	plant	
<i>Nestronia umbellula</i> (leechbrush)	-	plant	
<i>Polygala senega</i> (Seneca snakeroot)	-	plant	
<i>Porteranthus stipulatus</i> (Indian physic)	-	plant	
<i>Ruellia purshiana</i> (Pursh's wild petunia)	G3	plant	
<i>Silphium terebinthinaceum</i> (prairie rosinweed)	-	plant	
<i>Sisyrinchium dichotomum</i> (wishbone blue-eyed-grass)	G2	plant	
<i>Smilax biltmoreana</i> (Biltmore's carrionflower)	-	plant	
<i>Smilax lasioneura</i> (Blue Ridge carrionflower)	-	plant	

**USFWS Wetland System:** Not applicable.

### DISTRIBUTION

**Range:** This forest occurs in the Piedmont of Virginia, North Carolina, South Carolina, Georgia, and Alabama. In Virginia, there is a rare inner Coastal Plain occurrence (New Kent County) on a slope with outcrops of hard shell concretions.

**States/Provinces:** AL:S2S3, GA, NC, SC, VA.

**Federal Lands:** DOD (Kerr Reservoir); NPS (Appomattox Court House); USFS (Oconee, Sumter, Sumter (Piedmont), Uwharrie?).

### CONSERVATION STATUS

**Rank:** G3G4 (15-Feb-2007).

**Reasons:** Although widely distributed in the Piedmont from Virginia to Alabama, this is an uncommon community type that is strongly restricted to mafic substrates and subject to ongoing threats from cutting and conversion of hardwood stands to pine silviculture.

### CLASSIFICATION INFORMATION

**Status:** Standard.

**Confidence:** 2 – Moderate.

**Comments:** This association was renamed and merged with *Quercus alba* - *Quercus rubra* - *Carya glabra* - *Carya ovata* / *Viburnum rafinesquianum* / *Viola tripartita* Forest (CEGL007236) in February 2007. This association is differentiated from non-basic oak-hickory forests by lacking such species as *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium tenellum* (small black blueberry), *Oxydendrum arboreum* (sourwood), and most other members of the Ericaceae. In addition, *Quercus falcata* (southern red oak), *Nyssa sylvatica* (blackgum), and *Ilex opaca* var. *opaca* (American holly) tend to be much less abundant or absent. *Fraxinus americana* (white ash), *Carya* spp. (hickories), *Acer leucoderme* (chalk maple), *Cercis canadensis* (eastern redbud), and *Viburnum* spp. (viburnums) are much more abundant. This forest is not found in Kentucky or Tennessee. See *Quercus alba* - *Carya alba* - (*Quercus velutina*) / *Desmodium nudiflorum* - (*Carex picta*) Forest (CEGL007795) for related vegetation of these states in the Interior Low Plateau. Also compare to *Quercus rubra* - *Quercus alba* - *Carya glabra* / *Geranium maculatum* Forest (CEGL007237) and *Quercus alba* - *Quercus rubra* - *Carya alba* / *Cornus florida* / *Vaccinium stamineum* / *Desmodium nudiflorum* Piedmont Forest (CEGL008475).

### Similar Associations:

- *Quercus alba* - *Carya alba* - (*Quercus velutina*) / *Desmodium nudiflorum* - (*Carex picta*) Forest (CEGL007795)--of Tennessee and Kentucky.
- *Quercus alba* - *Carya alba* / *Euonymus americanus* / *Hexastylis arifolia* Forest (CEGL006227)--has an overlapping range but is presumably acidic.
- *Quercus alba* - *Quercus rubra* - *Carya alba* / *Cornus florida* / *Vaccinium stamineum* / *Desmodium nudiflorum* Piedmont Forest (CEGL008475)--a non-basic type with an overlapping range.
- *Quercus alba* - *Quercus rubra* - *Quercus prinus* - *Tilia americana* var. *caroliniana* / *Ostrya virginiana* Forest (CEGL004542).
- *Quercus alba* - *Quercus stellata* - *Carya carolinae-septentrionalis* / *Acer leucoderme* - *Cercis canadensis* Forest (CEGL007773)--is a related mafic type with overlapping distribution, apparently somewhat drier.
- *Quercus rubra* - *Quercus alba* - *Carya glabra* / *Geranium maculatum* Forest (CEGL007237)-slightly more nutrient-rich and species-rich.

- *Quercus rubra* / *Magnolia tripetala* - *Cercis canadensis* / *Actaea racemosa* - *Tiarella cordifolia* Forest (CEGL003949).

**Related Concepts:**

- *Quercus alba* - *Carya alba* - *Carya ovata* / *Cercis canadensis* Forest (VDNH 2003) =
- *Quercus alba* - *Quercus rubra* - *Carya (ovata, cordiformis)* / *Cercis canadensis* var. *canadensis* / *Ruellia purshiana* Forest (Fleming pers. comm.) ?
- IA6j. Interior Calcareous Oak - Hickory Forest (Allard 1990) B
- Permesotrophic Forest (Rawinski 1992) B
- Submesic Broadleaf Deciduous Forest (Ambrose 1990) B
- White Oak (54) (USFS 1988) ?
- White Oak - Black Oak - Northern Red Oak (53) (USFS 1988) ?
- White Oak - Black Oak - Northern Red Oak: 52 (Eyre 1980) B

**SOURCES**

**Description Authors:** S. Landaal, mod. G. P. Fleming.

**References:** Allard 1990, Ambrose 1990, Eyre 1980, Fleming et al. 2001, Fleming pers. comm., Golden 1979, Nelson 1986, Oberholster 1993, Peet and Christensen 1980, Peet et al. unpubl. data 2002, Rawinski 1992, Schafale and Weakley 1990, Schotz pers. comm., Southeastern Ecology Working Group n.d., USFS 1988, VDNH 2003.

**COMMON NAME (PARK-SPECIFIC): ACIDIC OAK - HICKORY FOREST**

**SYNONYMS**

**USNVC English Name:** White Oak - Northern Red Oak - Mockernut Hickory / Flowering Dogwood / Deerberry / Naked-stem Tick-trefoil Piedmont Forest

**USNVC Scientific Name:** *Quercus alba* - *Quercus rubra* - *Carya alba* / *Cornus florida* / *Vaccinium stamineum* / *Desmodium nudiflorum* Piedmont Forest

**USNVC Identifier:** CEGLO08475

**LOCAL INFORMATION**

**Environmental Description:** Acidic Oak - Hickory Forest is found on convex slopes and ridges over acidic soils throughout Appomattox Courthouse National Historical Park.

**Vegetation Description:** This deciduous forest occurs on rolling uplands throughout the park in areas that have been continuously forested for the past 80 years. Overstory composition varies somewhat from stand to stand, but is dominated by mixtures of oaks and hickories, typically *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), and *Carya ovalis* (red hickory). Other canopy trees can include *Liriodendron tulipifera* (tuliptree), *Quercus velutina* (black oak), *Quercus prinus* (chestnut oak), *Acer rubrum* (red maple), and *Nyssa sylvatica* (blackgum). *Cornus florida* (flowering dogwood) is often dominant in the understory, although other species, such as *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Juniperus virginiana* var. *virginiana* (eastern redcedar), and *Oxydendrum arboreum* (sourwood), can also occur. The shrub stratum is typically quite open, with species from the overstory occurring as woody saplings. Ericaceous species such as *Vaccinium stamineum* (deerberry), *Vaccinium pallidum* (Blue Ridge blueberry), and *Rhododendron periclymenoides* (pink azalea) can be locally dominant, occurring as short shrubs. Herb layers are very sparse or patchy but can be quite species-rich and support diverse mixtures of both mesophytic and dry-site species. Some typical herb species found in these forests include *Aristolochia serpentaria* (Virginia snakeroot), *Botrychium virginianum* (rattlesnake fern), *Carex albicans* var. *australis* (stellate sedge), *Carex hirsutella* (fuzzy wuzzy sedge), *Chimaphila maculata* (striped prince's pine), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Galium circaezans* (licorice bedstraw), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Polygonatum biflorum* (smooth Solomon's seal), *Uvularia perfoliata* (perfoliate bellwort), and *Viola palmata* var. *triloba* (= *Viola palmata*, early blue violet).

Stands of Acidic Oak - Hickory vary across the Appomattox Court House National Historical Park landscape. Dominant oaks may vary and, in some stands, *Quercus prinus* (chestnut oak) can codominate with other oaks. Younger portions of these forests may have more coverage by *Liriodendron tulipifera* (tuliptree).

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Quercus alba</i> (white oak)
Tree subcanopy	Broad-leaved deciduous tree	<i>Cornus florida</i> (flowering dogwood)

**Characteristic Species:** *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Cornus florida* (flowering dogwood), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Polygonatum biflorum* (smooth Solomon's seal), *Quercus alba* (white oak), *Vaccinium pallidum* (Blue Ridge blueberry).

**Other Noteworthy Species:**

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Lonicera japonica</i> (Japanese honeysuckle)	-	plant	invasive nonnative
<i>Microstegium vimineum</i> (Nepalese browntop)	-	plant	invasive nonnative
<i>Symphoricarpos orbiculatus</i> (coralberry)	-	plant	invasive

**Subnational Distribution with Crosswalk Data:**

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
VA	SNR*	B	1	Acidic Oak - Hickory Forest	Fleming et al. 2001

**Local Range:** Acidic Oak - Hickory Forest is included in the map class Oak – Hickory Forest, which represents two associations. Oak – Hickory Forest is mapped as 16 polygons, covering 94.9 hectares (234.6 acres), ranging in size from 0.2 to 22.7 hectares (0.5 to 56.0 acres).

**Classification Comments:** Although Acidic Oak - Hickory Forest can contain *Quercus prinus* (chestnut oak), it is distinguished from Piedmont / Low Elevation Oak / Heath Forest by lacking *Quercus prinus* (chestnut oak) dominance. Acidic Oak - Hickory Forest is distinguished from Basic Oak - Hickory by lacking or having low coverage of basophilic species such as *Cercis canadensis* var. *canadensis* (eastern redbud), *Fraxinus americana* (white ash), and *Carya ovata* (shagbark hickory) and having greater cover by ericaceous shrubs. Quantitative analysis placed plot APCO.7 in the Mesic Mixed Hardwood Forest association due to the high cover of *Fagus grandifolia* (American beech) in the understory. However, based on stand observations and photointerpretation, the sample is better classified as Acidic Oak – Hickory Forest and the area including that plot was mapped as Acidic Oak – Hickory Forest.

**Other Comments:** In Appomattox Court House National Historical Park, this association was mapped as part of the larger map class, Oak - Hickory Forest, which represents the Alliance level of the USNVC. Presumably due to land-use history, it is difficult to use floristics to distinguish between the two associations in the Oak - Hickory Forest map class. In order to increase map accuracy, the two associations were grouped into one map class.

**Local Description Authors:** K. D. Patterson.

**Plots:** APCO.7, APCO.10, APCO.13.

**Appomattox Court House National Historical Park Inventory Notes:** Information not available.

## GLOBAL INFORMATION

### USNVC 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	<i>Quercus alba</i> - ( <i>Quercus rubra</i> , <i>Carya</i> spp.) Forest Alliance (A.239)
Alliance (English name)	White Oak - (Northern Red Oak, Hickory species) Forest Alliance
Association	<i>Quercus alba</i> - <i>Quercus rubra</i> - <i>Carya alba</i> / <i>Cornus florida</i> / <i>Vaccinium stamineum</i> / <i>Desmodium nudiflorum</i> Piedmont Forest
Association (English name)	White Oak - Northern Red Oak - Mockernut Hickory / Flowering Dogwood / Deerberry / Naked-stem Tick-trefoil Piedmont 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).

## GLOBAL DESCRIPTION

**Concept Summary:** This forest is found on submesic to subxeric upland sites throughout the Piedmont of the Carolinas, Virginia, south-central Maryland, and possibly Georgia. 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* spp. (hickories) 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* spp. (pines) may codominate. In Virginia examples, *Quercus prinus* (chestnut oak) is inconstant but sometimes important. In addition, *Pinus* spp. (pines), *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* var. *opaca* (American holly), and *Nyssa sylvatica* (blackgum). Shrubs include *Vaccinium stamineum* (deerberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum rafinesquianum* (downy arrowwood), 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* spp. (heartleaf), *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 crane-fly), 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:** 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:** 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* spp. (hickories) 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* spp. (pines), *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* var. *opaca* (American holly), and *Nyssa sylvatica* (blackgum). Shrubs include *Vaccinium stamineum* (deerberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum rafinesquianum* (downy arrowwood), 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* spp. (heartleaf), *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 crane-fly), *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:**

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

**Characteristic Species:** *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* var. *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 crane fly), *Toxicodendron radicans* (eastern poison ivy), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum rafinesquianum* (downy arrowwood), *Viola hastata* (halberdleaf yellow violet), *Vitis rotundifolia* (muscadine).

**Other Noteworthy Species:** Information not available.

**USFWS Wetland System:** Not applicable.

#### DISTRIBUTION

**Range:** This association occurs throughout the Piedmont of the Carolinas, Virginia, south-central Maryland, and possibly Georgia. In northern Virginia and Maryland, it also occurs occasionally in the Coastal Plain.

**States/Provinces:** GA?, MD, NC, SC, VA.

**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, Kings Mountain, Manassas, Ninety Six, Petersburg, Prince William, Richmond, Rock Creek); USFS (Oconee?, Uwharrie).

#### CONSERVATION STATUS

**Rank:** G4G5 (15-Feb-2007).

**Reasons:** 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 INFORMATION

**Status:** Standard.

**Confidence:** 1 – Strong.

**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.

#### 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 elliotii* 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 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).

**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 1990) 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) ?

**SOURCES**

**Description Authors:** M. P. Schafale and G. P. Fleming.

**References:** Allard 1990, Ambrose 1990, 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.

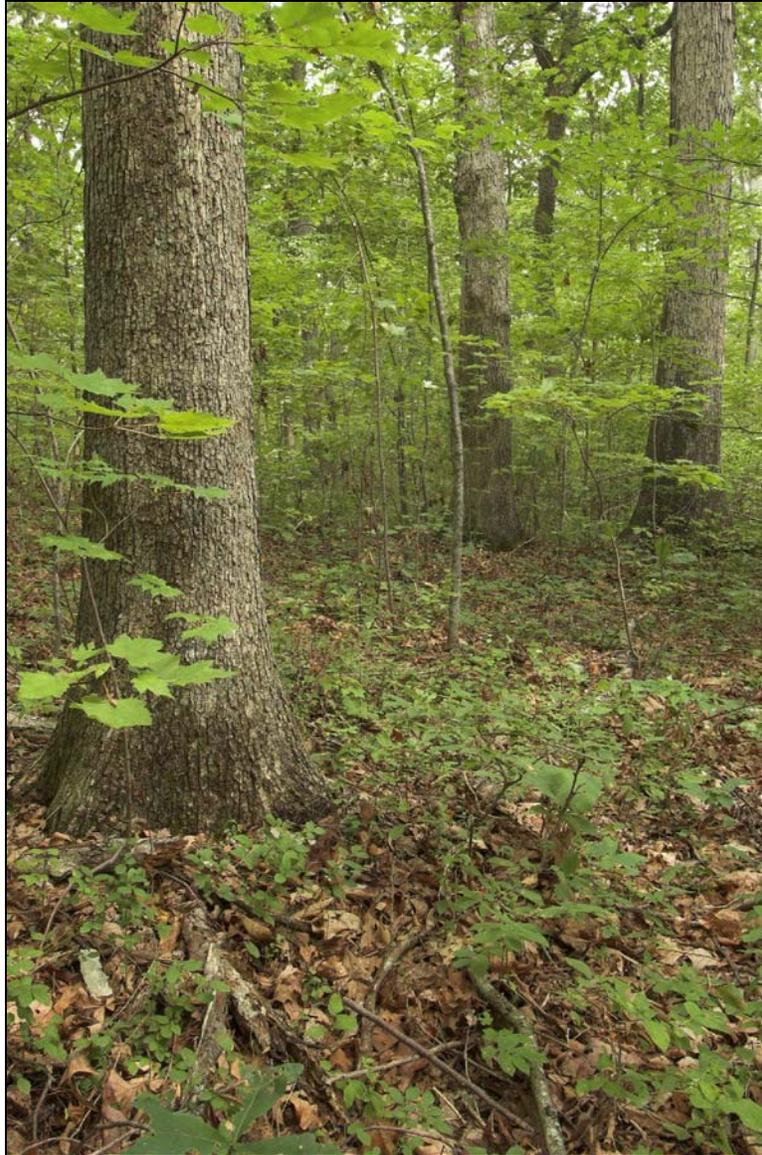


Figure I10. Acidic Oak - Hickory Forest at Appomattox Court House National Historical Park. August 2007. NAD 1983 / UTM 696281 easting, 4140616 northing.



Figure I11. Acidic Oak - Hickory Forest (plot APCO.13) at Appomattox Court House National Historical Park. June 2003. NAD 1983 / UTM 695555 easting, 4138304 northing.

**COMMON NAME (PARK-SPECIFIC):**   **PIEDMONT / LOW ELEVATION MIXED OAK /  
HEATH FOREST**

**SYNONYMS**

**USNVC English Name:**   **White Oak - (Scarlet Oak, Black Oak, Chestnut Oak) / Black  
Huckleberry Forest**

**USNVC Scientific Name:**   ***Quercus alba* - *Quercus (coccinea, velutina, prinus)* /  
*Gaylussacia baccata* Forest**

**USNVC Identifier:**       **CEGL008521**

**LOCAL INFORMATION**

**Environmental Description:** This forest occurs on thin, rocky soils on convex slopes in Appomattox Court House National Historical Park.

**Vegetation Description:** The canopy is dominated by *Quercus prinus* (chestnut oak) with lesser amounts of *Quercus coccinea* (scarlet oak) and *Quercus alba* (white oak). Other *Quercus* spp. (oaks) may be present but do not dominate the canopy. The shrub layer may be sparse and patchy to dense and continuous and is dominated by the ericaceous shrubs *Kalmia latifolia* (mountain laurel), *Vaccinium stamineum* (deerberry), and/or *Vaccinium pallidum* (Blue Ridge blueberry). Herbs are absent to very sparse. *Chimaphila maculata* (striped prince's pine) is typical. Stands of this forest vary in the species and coverage of heath (ericaceous shrubs).

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad leaved deciduous tree	<i>Quercus alba</i> (white oak), <i>Quercus prinus</i> (chestnut oak)
Tall shrub/sapling	Broad leaved evergreen shrub	<i>Kalmia latifolia</i> (mountain laurel)
Short shrub/sapling	Broad leaved deciduous shrub	<i>Vaccinium pallidum</i> (Blue Ridge blueberry)

**Characteristic Species:** *Chimaphila maculata* (striped prince's pine), *Kalmia latifolia* (mountain laurel), *Quercus prinus* (chestnut oak), *Vaccinium pallidum* (Blue Ridge blueberry).

**Other Noteworthy Species:** Information not available.

**Subnational Distribution with Crosswalk Data:**

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
VA	SNR*	B	1	Oak / Heath Forest	Fleming et al. 2006

**Local Range:** This association is in the map class Oak / Heath Forest that is mapped as small patches along the northeastern boundary of the park. It covers a total of 2.8 hectares (7 acres) and is mapped as three polygons ranging from 0.7 to 1.4 hectares (1.9 to 3.5 acres) in size.

**Classification Comments:** Piedmont / Low Elevation Mixed Oak / Heath Forest is distinguished from Oak - Hickory Forest by the absent or lack of importance of *Carya* spp. (hickories) and by the canopy dominance of *Quercus prinus* (chestnut oak).

**Other Comments:** Information not available.

**Local Description Authors:** K. D. Patterson.

**Plots:** APCO.5.

**Appomattox Court House National Historical Park Inventory Notes:** All three polygons of the map class Oak / Heath Forest in the park were examined and one was quantitatively sampled.

## GLOBAL INFORMATION

### USNVC 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	<i>Quercus velutina</i> - <i>Quercus alba</i> - ( <i>Quercus coccinea</i> ) Forest Alliance (A.1911)
Alliance (English name)	Black Oak - White Oak - (Scarlet Oak) Forest Alliance
Association	<i>Quercus alba</i> - <i>Quercus (coccinea, velutina, prinus)</i> / <i>Gaylussacia baccata</i> Forest
Association (English name)	White Oak - (Scarlet Oak, Black Oak, Chestnut Oak) / Black Huckleberry Forest
<b>Ecological System(s):</b>	Northern Atlantic Coastal Plain Hardwood Forest (CES203.475). Central Appalachian Dry Oak-Pine Forest (CES202.591). Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359).

### GLOBAL DESCRIPTION

**Concept Summary:** This community is a matrix forest of dry, nutrient-poor uplands of the Mid-Atlantic Piedmont Plateau, occurring locally in similar low-elevation landscapes of the northern Blue Ridge and Ridge and Valley, Cumberland Plateau and Mid-Atlantic Coastal Plain provinces. The type is well-documented across Virginia, and to a lesser extent in Tennessee and Maryland, but probably also occurs at similar sites in West Virginia and Pennsylvania. Stands are located between 30 and 700 m (100-2300 feet) elevation on rolling to sublevel sites of Piedmont and inner Coastal Plain uplands, mountain valleys and lower mountain slope benches. In the mountains, many documented occurrences are located on ancient alluvial fan deposits, which are especially extensive along the western foot of the Blue Ridge. The vegetation is a closed to very open oak forest with mixed and variable canopy dominance by *Quercus alba* (white oak), *Quercus velutina* (black oak), *Quercus coccinea* (scarlet oak), and *Quercus prinus* (chestnut oak). Various *Pinus* spp. (pines), including *Pinus virginiana* (Virginia pine), *Pinus echinata* (shortleaf pine), *Pinus strobus* (eastern white pine), and *Pinus rigida* (pitch pine), are frequent overstory associates, particularly following fire or logging disturbances. *Quercus falcata* (southern red oak), *Quercus stellata* (post oak), *Carya glabra* (pignut hickory), and *Carya alba* (mockernut hickory) are infrequent canopy trees. *Nyssa sylvatica* (blackgum), *Amelanchier arborea* (common serviceberry) and, in the southern part of the range, *Oxydendrum arboreum* (sourwood) attain exceptional abundance and stature in these forests, dominating the subcanopy layers and occasionally reaching the overstory. *Acer rubrum* (red maple) and *Sassafras albidum* (sassafras) are other common understory trees. In typical stands, the shrub layer is dominated by deciduous ericaceous species, herbaceous species are sparse, and species-richness is moderate to very low.

**Environmental Description:** Stands are located between 30 and 700 m (100-2300 feet) elevation on rolling to sublevel sites of Piedmont and inner Coastal Plain uplands, mountain valleys and lower mountain slope benches. The type is generally distributed in nutrient-poor soils of the Piedmont uplands. In the mountains, many documented occurrences are located on ancient alluvial fan deposits, which are especially extensive along the western foot of the Blue Ridge from Page County south to Rockbridge County, Virginia. Similar but smaller fans are common where incising streams drain "piedmont" landforms at the foot of Ridge and Valley strike ridges (Harbor 1996). Slopes of plot-sampled stands range from 1-13 degrees (mean = 6 degrees), with aspects essentially flat to westerly. Soils of these sites are deep, very oligotrophic, gravelly loams

with low pH and base status. Exposed rocks of any kind (outcrops, boulders, or stones) are usually sparse to absent. Most sites appear to have a history of fires.

**Vegetation Description:** The vegetation is a closed to very open oak forest with mixed and variable canopy dominance by *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), and *Quercus prinus* (chestnut oak). Various *Pinus* spp. (pines), including *Pinus virginiana* (Virginia pine), *Pinus echinata* (shortleaf pine), *Pinus strobus* (eastern white pine), and *Pinus rigida* (pitch pine), are frequent overstory associates, particularly following fire or logging disturbances. *Quercus falcata* (southern red oak), *Quercus stellata* (post oak), *Carya glabra* (pignut hickory), and *Carya alba* (mockernut hickory) are infrequent canopy trees. *Nyssa sylvatica* (blackgum), *Amelanchier arborea* (common serviceberry) and, in the southern part of the range, *Oxydendrum arboreum* (sourwood) attain exceptional abundance and stature in these forests, dominating the subcanopy layers and occasionally reaching the overstory. *Acer rubrum* (red maple) and *Sassafras albidum* (sassafras) are other common understory trees. The shrub layer is typically dominated by deciduous ericaceous species, with *Gaylussacia baccata* (black huckleberry), *Vaccinium pallidum* (Blue Ridge blueberry), and/or *Vaccinium stamineum* (deerberry) consistently forming dense colonies. Less abundant or constant shrubs and vines include *Castanea pumila* (chinkapin), *Quercus ilicifolia* (bear oak), *Kalmia latifolia* (mountain laurel), *Rhododendron periclymenoides* (pink azalea), *Lyonia ligustrina* (maleberry), *Vaccinium stamineum* (deerberry), *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), and *Cornus florida* (flowering dogwood). Despite high shrub densities, a number of low-cover herbs and subshrubs occur in the type, including *Chimaphila maculata* (striped prince's pine), *Isotria verticillata* (purple fiveleaf orchid), *Uvularia puberula* (mountain bellwort), *Epigaea repens* (trailing arbutus), *Pteridium aquilinum* var. *latiusculum* (western brackenfern), *Cypripedium acaule* (moccasin flower), *Gentiana villosa* (striped gentian), *Comandra umbellata* (bastard toadflax), *Angelica venenosa* (hairy angelica), and *Iris verna* (dwarf violet iris). Mean species richness of 54 Virginia, Maryland, and District of Columbia plot samples is 25 taxa per 400 square meters.

**Most Abundant Species:** Information not available.

**Characteristic Species:** *Amelanchier arborea* (common serviceberry), *Castanea pumila* (chinkapin), *Gaylussacia baccata* (black huckleberry), *Isotria verticillata* (purple fiveleaf orchid), *Nyssa sylvatica* (blackgum), *Oxydendrum arboreum* (sourwood), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Quercus prinus* (chestnut oak), *Quercus velutina* (black oak), *Rhododendron periclymenoides* (pink azalea).

**Other Noteworthy Species:** Information not available.

**USFWS Wetland System:** Not applicable.

## DISTRIBUTION

**Range:** This community is a matrix forest of dry, nutrient-poor uplands of the Mid-Atlantic Piedmont Plateau, occurring locally in similar low-elevation landscapes of the northern Blue Ridge and Ridge and Valley provinces of the Central Appalachians, and the Cumberland Plateau in Tennessee. In Maryland and northern Virginia, the type also occurs on uplands of the dissected Inner Coastal Plain. The type is well-documented through quantitative analysis in Virginia, and qualitatively in Maryland, but probably also occurs at similar sites in West Virginia and Pennsylvania.

**States/Provinces:** KY?, MD, PA?, TN, VA:S5, WV?

**Federal Lands:** DOD (Fort Belvoir, Kerr Reservoir); NPS (Appomattox Court House, Big South Fork, C&O Canal, Colonial, Fredericksburg-Spotsylvania, George Washington Parkway, National Capital-East, Obed, Prince William, Rock Creek, Shenandoah, Thomas Stone); USFS (Daniel Boone?, George Washington, Jefferson, Sumter (Piedmont)?, Sumter?).

**CONSERVATION STATUS**

**Rank:** G5 (24-Jan-2005).

**Reasons:** This community is a matrix-forming vegetation type in the Virginia and Maryland Piedmont and is probably more widespread at low elevations of the central Appalachian Mountains than documentation indicates.

**CLASSIFICATION INFORMATION**

**Status:** Standard.

**Confidence:** 2 – Moderate.

**Comments:** This unit is distinct among Virginia's oak/heath forests in its occurrence on low-elevation, rolling to sub-level, usually non-rocky terrain of the Piedmont and mountains. *Quercus alba* (white oak), normally a minor tree in montane oak/heath forests, is characteristic and usually codominant, while the prevalence of deciduous ericads and the presence of the low-elevation oaks *Quercus falcata* (southern red oak) and *Quercus stellata* (post oak) further distinguish the type. *Quercus prinus* (chestnut oak) and *Kalmia latifolia* (mountain laurel), although present and occasionally abundant, are not as important in this unit as in related Central Appalachian oak/heath vegetation types, particularly *Quercus prinus* - (*Quercus coccinea*, *Quercus rubra*) / *Kalmia latifolia* / *Vaccinium pallidum* Forest (CEGL006299). The latter is generally associated with relatively steep, often rocky terrain of the Central Appalachians and dissected topography in the Piedmont. Originally, the concept of this type (CEGL008521) was restricted to "Piedmont"-like landscapes in the mountains. However, additional quantitative data analysis of a statewide (Virginia) set of 180 oak/heath plots led to a broader conceptual interpretation that includes both montane and Piedmont stands. The type is represented by 54 plots from Virginia, and 20 from Maryland and the District of Columbia. Attempts to split this unit based on the presence or absence of *Quercus prinus* (chestnut oak) have proven unworkable because significant environmental or floristic differences between the putative groups are lacking.

**Similar Associations:**

- *Quercus (pinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271)--of southern Appalachians.
- *Quercus alba - Quercus falcata - (Carya pallida) / Gaylussacia frondosa* Forest (CEGL006269)--of the Mid-Atlantic Coastal Plain.
- *Quercus alba - Quercus falcata / Vaccinium (arboreum, hirsutum, pallidum)* Forest (CEGL008567)--described from southeastern Tennessee, with similar understory and associated species but with prominent *Quercus falcata*.
- *Quercus prinus - (Quercus coccinea, Quercus rubra) / Kalmia latifolia / Vaccinium pallidum* Forest (CEGL006299)--of the Central Appalachians and northern Piedmont.

**Related Concepts:**

- *Quercus alba - Quercus falcata - Carya tomentosa / Cornus florida* Association (Rawinski et al. 1996) ?
- *Quercus coccinea - Quercus velutina - Quercus alba / Amelanchier arborea / Gaylussacia baccata* Forest (Fleming and Coulling 2001) F

- *Quercus coccinea* - *Quercus velutina* - *Quercus alba* / *Amelanchier arborea* / *Gaylussacia baccata* Forest (Fleming et al. 2004) =
- White Oak - Black Oak - Northern Red Oak: 52 (Eyre 1980) B
- White Oak - Scarlet Oak - Pine Type (Schmalzer and DeSelm 1982) =

**SOURCES**

**Description Authors:** G. P. Fleming and P. Coulling, mod. L. A. Sneddon.

**References:** Eyre 1980, Fleming and Coulling 2001, Fleming et al. 2001, Fleming et al. 2004, Hall and Mathews 1974, Harbor 1996, Harrison 2004, Rawinski et al. 1996, Schmalzer and DeSelm 1982, TDNH unpubl. data.



Figure I12. Piedmont / Low Elevation Mixed Oak / Heath Forest photographed at Fredericksburg and Spotsylvania National Military Park. June 2004.

**COMMON NAME (PARK-SPECIFIC):**    **PIEDMONT / MOUNTAIN ALLUVIAL FOREST**

**SYNONYMS**

**USNVC English Name:**    **Tuliptree - (Red Maple, Box-elder) - (Sycamore) / American Hornbeam / Jumpseed Forest**

**USNVC Scientific Name:**    *Liriodendron tulipifera* - *Acer (rubrum, negundo)* - (*Platanus occidentalis*) / *Carpinus caroliniana* / *Polygonum virginianum* Forest

**USNVC Identifier:**    **CEGL006492**

**LOCAL INFORMATION**

**Environmental Description:** Piedmont / Mountain Alluvial Forest occurs on the floodplains and stream terraces along the Appomattox River and other small drainages in the park.

**Vegetation Description:** These deciduous forests have dense shrub layers and species-rich herbaceous openings composed of a mixture of wetland and mesic forest graminoids and coarse forbs. The vegetation is often rank and can have high cover by exotic species. The forest canopy is dominated by *Liriodendron tulipifera* (tuliptree) and *Fraxinus pennsylvanica* (green ash) occurring with *Juglans nigra* (black walnut), *Platanus occidentalis* (American sycamore), *Ulmus rubra* (slippery elm), and *Acer rubrum* (red maple). Vines such as *Toxicodendron radicans* (eastern poison ivy), *Parthenocissus quinquefolia* (Virginia creeper), and *Smilax rotundifolia* (roundleaf greenbrier) often reach up into the canopy. A distinct subcanopy is not always present, but subcanopy species will include *Juglans nigra* (black walnut), *Cercis canadensis* var. *canadensis* (eastern redbud), *Juniperus virginiana* var. *virginiana* (eastern redcedar), and *Acer rubrum* (red maple). The most common dominant shrub species are *Carpinus caroliniana* (American hornbeam) and *Lindera benzoin* (northern spicebush); however, other common shrubs species include *Acer negundo* (boxelder), *Cercis canadensis* var. *canadensis* (eastern redbud), *Juniperus virginiana* var. *virginiana* (eastern redcedar), and *Lonicera japonica* (Japanese honeysuckle). The herb stratum of this community is very diverse with no one dominant species. Herb species that often have high cover include *Arisaema triphyllum* (Jack in the pulpit), *Elymus virginicus* (Virginia wildrye), *Microstegium vimineum* (Nepalese browntop), *Polygonum virginianum* (jumpseed), and *Verbesina alternifolia* (wingstem). Other herbaceous species indicative of this community include *Amphicarpaea bracteata* (American hogpeanut), *Boehmeria cylindrica* (smallspike false nettle), *Carex amphibola* (eastern narrowleaf sedge), *Carex gracillima* (graceful sedge), *Carex radiata* (eastern star sedge), *Carex squarrosa* (squarrose sedge), *Cryptotaenia canadensis* (Canadian honewort), *Geum canadense* (white avens), *Hydrophyllum virginianum* (Shawnee salad), and *Phryma leptostachya* (American lopseed). Some very disturbed stands, or stands near forest edges, may have high cover of *Pinus virginiana* (Virginia pine). In areas where woody exotic vines like *Lonicera japonica* (Japanese honeysuckle) dominate, herb cover and diversity will be lower.

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Juglans nigra</i> (black walnut), <i>Liriodendron tulipifera</i> (tuliptree)
Tree subcanopy	Broad-leaved deciduous tree	<i>Carpinus caroliniana</i> (American hornbeam)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Lindera benzoin</i> (northern spicebush)
Herb (field)	Forb	<i>Polygonum virginianum</i> (jumpseed), <i>Verbesina alternifolia</i> (wingstem)

**Characteristic Species:** *Carpinus caroliniana* (American hornbeam), *Juglans nigra* (black walnut), *Lindera benzoin* (northern spicebush), *Liriodendron tulipifera* (tuliptree), *Platanus occidentalis* (American sycamore), *Polygonum virginianum* (jumpseed), *Ulmus rubra* (slippery elm), *Verbesina alternifolia* (wingstem).

**Other Noteworthy Species:**

<u>Species</u>	<u>G</u> Rank	<u>Type</u>	<u>Note</u>
<i>Allium vineale</i> (wild garlic)	-	plant	invasive nonnative
<i>Dioscorea oppositifolia</i> (Chinese yam)	-	plant	invasive nonnative
<i>Duchesnea indica</i> (Indian strawberry)	-	plant	invasive nonnative
<i>Hemerocallis fulva</i> (orange daylily)	-	plant	nonnative
<i>Lonicera japonica</i> (Japanese honeysuckle)	-	plant	invasive nonnative
<i>Microstegium vimineum</i> (Nepalese browntop)	-	plant	invasive nonnative

**Subnational Distribution with Crosswalk Data:**

<u>State</u>	<u>S</u> Rank	<u>Rel</u>	<u>Conf</u>	<u>S</u> Name	<u>Reference</u>
VA	SNR*	F	1	Piedmont / Mountain Alluvial Forest	.

**Local Range:** Piedmont / Mountain Alluvial Forest is mapped as four polygons, totaling 47 hectares (116 acres), ranging in size from approximately 5 to 15 hectares (12.8 to 48 acres). It is found along the Appomattox River, Plain Run Branch, and on an unnamed tributary of the Appomattox River in the northwest section of the park.

**Classification Comments:** Piedmont / Mountain Alluvial Forest can be recognized by its occurrence on floodplains and stream terraces, its distinctive canopy composition, and its temporarily flooded hydrology.

**Other Comments:** Information not available.

**Local Description Authors:** K. D. Patterson.

**Plots:** APCO.11.

**Appomattox Court House National Historical Park Inventory Notes:** All four polygons of Piedmont / Mountain Alluvial Forest were observed in the field. One was quantitatively sampled.

**GLOBAL INFORMATION**

**USNVC 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 - (Liquidambar styraciflua, Liriodendron tulipifera) (A.289) Temporarily Flooded Forest Alliance
Alliance (English name)	Sycamore - (Sweetgum, Tuliptree) Temporarily Flooded Forest Alliance
Association	Liriodendron tulipifera - Acer (rubrum, negundo) - (Platanus occidentalis) / Carpinus caroliniana / Polygonum virginianum Forest
Association (English name)	Tuliptree - (Red Maple, Box-elder) - (Sycamore) / American Hornbeam / Jumpseed Forest
<b>Ecological System(s):</b>	Information not available.

**GLOBAL DESCRIPTION**

**Concept Summary:** This community occupies floodplains and terraces of medium-sized streams (large streams and small rivers) in the Piedmont of Maryland and Virginia. These floodplains are moderately extensive and subject to frequent overflow, but topographically fairly homogeneous. In these habitats, the alluvial landforms (e.g., levees, backswamps) are poorly

developed or occur at very small scales. Hydrologic regime is temporarily flooded. Soils are generally alluvial silt loams and sands washed from various metamorphic and igneous rocks. This association is a closed forest with consistent overstory codominance by *Liriodendron tulipifera* (tuliptree) in variable combinations with other trees. *Acer negundo* (boxelder), *Acer rubrum* (red maple), or both are characteristic in the overstory or understory. *Platanus occidentalis* (American sycamore) varies from codominant to absent. Other trees that may be important in some stands include *Juglans nigra* (black walnut), *Fraxinus pennsylvanica* (green ash), *Fraxinus americana* (white ash), *Carya cordiformis* (bitternut hickory), *Ulmus americana* (American elm), *Betula nigra* (river birch), and *Quercus palustris* (pin oak). *Lindera benzoin* (northern spicebush), *Carpinus caroliniana* (American hornbeam), and, less constantly, *Asimina triloba* (pawpaw) and/or *Viburnum prunifolium* (blackhaw) dominate the shrub layer. Vines of *Toxicodendron radicans* (eastern poison ivy) and other species may occur. Relatively diverse herb layers are composed of both mesophytic and hydrophytic species. Common herbs include *Arisaema triphyllum* (Jack in the pulpit), *Geum canadense* (white avens), *Polygonum virginianum* (jumpseed), *Carex amphibola* (eastern narrowleaf sedge), *Circaea lutetiana* ssp. *canadensis* (broadleaf enchanter's nightshade), *Verbesina alternifolia* (wingstem), *Carex radiata* (eastern star sedge), *Carex blanda* (eastern woodland sedge), *Impatiens capensis* (jewelweed), *Boehmeria cylindrica* (smallspike false nettle), *Viola sororia* (common blue violet), and *Symphotrichum lateriflorum* (calico aster). Although less constant, *Elymus virginicus* (Virginia wildrye), *Claytonia virginica* (Virginia springbeauty), and *Erythronium americanum* (dogtooth violet) form dominance patches in some stands. Because land-use effects (agriculture, grazing, utility corridors in and near the floodplain, excessively frequent flooding and sediment deposition following watershed development) frequently disturb the habitat, the herb layer is often weedy and is commonly dominated by the exotic grass *Microstegium vimineum* (Nepalese browntop).

**Environmental Description:** This community occupies floodplains and terraces of medium-sized streams (large streams and small rivers). These floodplains are moderately extensive and subject to frequent overflow, but topographically fairly homogeneous. In these habitats, the alluvial landforms (e.g., levees, backswamps) are poorly developed or occur at very small scales. Hydrologic regime is temporarily flooded, and the mean flood return interval is thought to be roughly once or twice a year, but may vary with stream order and position in the watershed. Soils are generally alluvial silt loams and sands washed from various metamorphic and igneous rocks. Samples collected from plots have moderately high calcium, magnesium, and total base saturation levels.

**Vegetation Description:** This association is a closed forest with consistent overstory codominance by *Liriodendron tulipifera* (tuliptree) in variable combinations with other trees. *Acer negundo* (boxelder), *Acer rubrum* (red maple), or both are characteristic in the overstory or understory. *Platanus occidentalis* (American sycamore) varies from codominant to absent. Other trees that may be important in some stands include *Juglans nigra* (black walnut), *Fraxinus pennsylvanica* (green ash), *Fraxinus americana* (white ash), *Carya cordiformis* (bitternut hickory), *Ulmus americana* (American elm), *Betula nigra* (river birch), and *Quercus palustris* (pin oak). *Lindera benzoin* (northern spicebush), *Carpinus caroliniana* (American hornbeam), and, less constantly, *Asimina triloba* (pawpaw) and/or *Viburnum prunifolium* (blackhaw) dominate the shrub layer. Vines of *Toxicodendron radicans* (eastern poison ivy) and other species may occur. Relatively diverse herb layers are composed of both mesophytic and hydrophytic species. The most constant herbs in 15 Virginia and Maryland plot samples were

*Arisaema triphyllum* (Jack in the pulpit), *Geum canadense* (white avens), *Polygonum virginianum* (jumpseed), *Carex amphibola* (eastern narrowleaf sedge), *Circaea lutetiana* ssp. *canadensis* (broadleaf enchanter's nightshade), *Verbesina alternifolia* (wingstem), *Carex radiata* (eastern star sedge), *Carex blanda* (eastern woodland sedge), *Impatiens capensis* (jewelweed), *Boehmeria cylindrica* (smallspike false nettle), *Viola sororia* (common blue violet), and *Symphotrichum lateriflorum* (calico aster). Although less constant, *Elymus virginicus* (Virginia wildrye), *Claytonia virginica* (Virginia springbeauty), and *Erythronium americanum* (dogtooth violet) form dominance patches in some stands. Because land-use effects (agriculture, grazing, utility corridors in and near the floodplain, excessively frequent flooding and sediment deposition following watershed development) frequently disturb the habitat, the herb layer is often weedy and is commonly dominated by the exotic grass *Microstegium vimineum* (Nepalese browntop).

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Liriodendron tulipifera</i> (tuliptree)
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer negundo</i> (boxelder), <i>Acer rubrum</i> (red maple)
Shrub/sapling (tall & short)	Vine/Liana	<i>Toxicodendron radicans</i> (eastern poison ivy)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Carpinus caroliniana</i> (American hornbeam), <i>Lindera benzoin</i> (northern spicebush)
Herb (field)	Forb	<i>Arisaema triphyllum</i> (Jack in the pulpit), <i>Boehmeria cylindrica</i> (smallspike false nettle), <i>Circaea lutetiana</i> ssp. <i>canadensis</i> (broadleaf enchanter's nightshade), <i>Geum canadense</i> (white avens), <i>Impatiens capensis</i> (jewelweed), <i>Polygonum virginianum</i> (jumpseed), <i>Symphotrichum lateriflorum</i> (calico aster), <i>Verbesina alternifolia</i> (wingstem), <i>Viola sororia</i> (common blue violet)
Herb (field)	Graminoid	<i>Carex amphibola</i> (eastern narrowleaf sedge), <i>Carex blanda</i> (eastern woodland sedge), <i>Carex radiata</i> (eastern star sedge)

**Characteristic Species:** *Betula nigra* (river birch), *Carpinus caroliniana* (American hornbeam), *Carya cordiformis* (bitternut hickory), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), *Juglans nigra* (black walnut), *Lindera benzoin* (northern spicebush), *Quercus palustris* (pin oak), *Ulmus americana* (American elm).

**Other Noteworthy Species:** Information not available.

**USFWS Wetland System:** Palustrine.

**DISTRIBUTION**

**Range:** This association is known from the Piedmont of Maryland and Virginia. In Virginia, it is the principal small floodplain forest in the northern and western Piedmont.

**States/Provinces:** MD, VA.

**Federal Lands:** NPS (Appomattox Court House, Booker T. Washington, C&O Canal, George Washington Parkway, Manassas, Rock Creek).

**CONSERVATION STATUS**

**Rank:** G4 (16-Apr-2007).

**Reasons:** More information is needed to rank this community.

**CLASSIFICATION INFORMATION**

**Status:** Standard.

**Confidence:** 3 – Weak.

**Comments:** Classification of this type is supported by 15 Virginia and Maryland plot samples analyzed during the Nation Capital Region vegetation mapping project, plus additional observational data. The collection of additional data from across the full range would assist in refining the description of this type and its full range of compositional variation. However, the smaller floodplains supporting this type are typically low priorities for sampling or research, in part because they are highly disturbed and good examples are hard to locate.

**Similar Associations:**

- *Liquidambar styraciflua* - *Liriodendron tulipifera* / *Lindera benzoin* / *Arisaema triphyllum* Forest (CEGL004418)--on average occurs on smaller-order streams and floodplains with more nutrient-poor soils; its distribution in the mid-Atlantic states is more coastal and southern.
- *Liriodendron tulipifera* - *Acer negundo* Forest (CEGL007184)--a more southern successional forest developing on formerly cleared floodplains and uplands.
- *Platanus occidentalis* - *Acer negundo* - *Juglans nigra* / *Asimina triloba* / *Mertensia virginica* Forest (CEGL004073)--occurs on larger streams with more calcareous soils.
- *Platanus occidentalis* - *Liquidambar styraciflua* / *Carpinus caroliniana* - *Asimina triloba* Forest (CEGL007340)--southern Piedmont analogue of CEGL006492; habitats and composition are similar, but austral species such as *Liquidambar styraciflua*, *Quercus phellos*, *Ilex decidua*, *Aesculus sylvatica*, and *Arundinaria gigantea* are prominent.

**Related Concepts:** Information not available.

**SOURCES**

**Description Authors:** G. P. Fleming.

**References:** Eastern Ecology Working Group n.d., Fleming et al. 2006, Harrison 2004, Lea 2004, NRCS 2006.

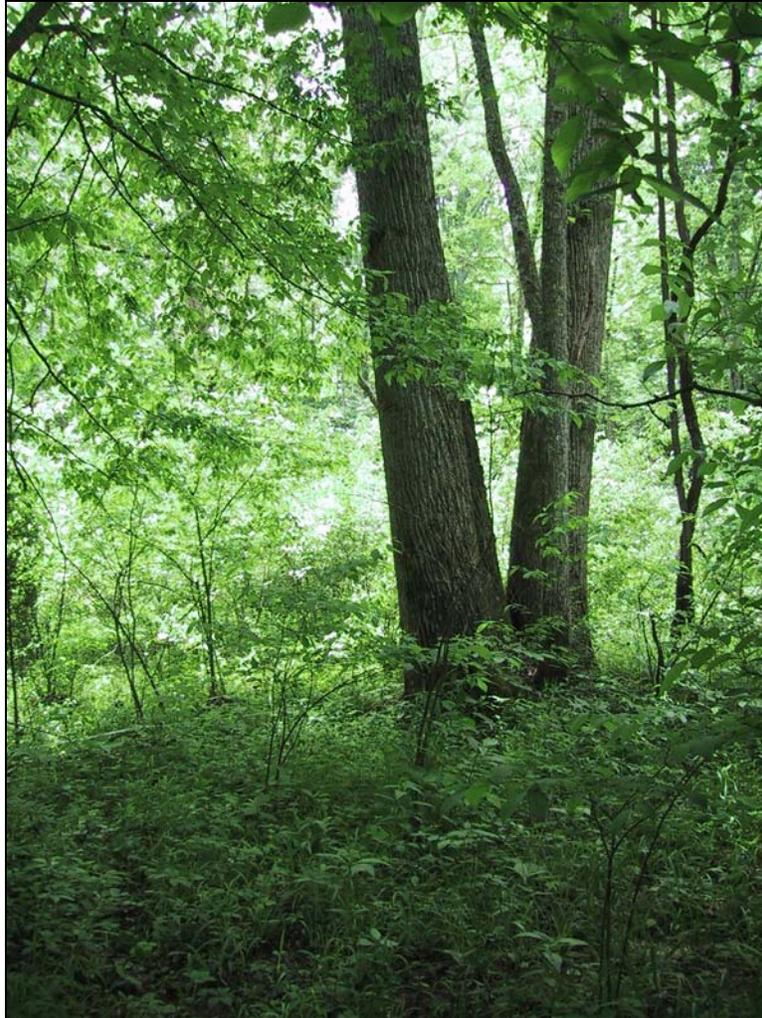


Figure I13. Piedmont / Mountain Alluvial Forest (plot APCO.11) at Appomattox Court House National Historical Park. May 2003. NAD 1983 / UTM 696370 easting, 4139766 northing.

**COMMON NAME (PARK-SPECIFIC): UPLAND DEPRESSION SWAMP**

**SYNONYMS**

**NVC English Name:** Willow Oak / (Greenish-white Sedge, Greater Bladder Sedge, Cypress Swamp Sedge) / Tree Moss Forest  
**NVC Scientific Name:** *Quercus phellos* / *Carex (albolutescens, intumescens, jorii)* / *Climacium americanum* Forest  
**NVC Identifier:** C EGL007403

**LOCAL INFORMATION**

**Environmental Description:** Upland Depression Swamp occurs in the park on upland areas with poorly drained, seasonally flooded soils.

**Vegetation Description:** This deciduous forest has an open shrub layer and a graminoid-dominated herb layer with areas of bare or litter-covered soil and with standing water in ruts and depressions at least during the winter and spring months. The canopy of this forest is dominated by large-diameter *Quercus phellos* (willow oak) occurring with *Acer rubrum* (red maple) and with understory *Fraxinus pennsylvanica* (green ash) and *Nyssa sylvatica* (blackgum). Tangles of *Smilax rotundifolia* (roundleaf greenbrier) are scattered in the tall-shrub layer, and *Lonicera japonica* (Japanese honeysuckle) and *Toxicodendron radicans* (eastern poison ivy) occur as vines on the ground and climbing into the subcanopy. Characteristic herbaceous species include the sedges *Carex blanda* (eastern woodland sedge), *Carex festucacea* (fescue sedge), *Carex glaucoidea* (blue sedge), *Carex radiata* (eastern star sedge), *Carex rosea* (rosy sedge), *Carex styloflexa* (bent sedge), and *Carex typhina* (cattail sedge) and the grasses *Cinna arundinacea* (sweet woodreed), *Glyceria striata* (fowl mannagrass) and *Leersia virginica* (whitegrass).

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Quercus phellos</i> (willow oak)
Tree subcanopy	Broad-leaved deciduous tree	<i>Fraxinus pennsylvanica</i> (green ash)
Tall shrub/sapling	Vine/Liana	<i>Smilax rotundifolia</i> (roundleaf greenbrier)

**Characteristic Species:** *Carex festucacea* (fescue sedge), *Carex glaucoidea* (blue sedge), *Carex styloflexa* (bent sedge), *Quercus phellos* (willow oak), *Smilax rotundifolia* (roundleaf greenbrier).

**Other Noteworthy Species:**

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Allium vineale</i> (wild garlic)	-	plant	invasive nonnative
<i>Cardamine hirsuta</i> (hairy bittercress)	-	plant	nonnative

**Subnational Distribution with Crosswalk Data:**

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
VA	SNR*	B	1	Upland Depression Swamp	Fleming et al. 2001

**Local Range:** Upland Depression Swamp is mapped as three polygons covering 3.4 hectares (8.3 acres) and ranging in size from 0.6 to 1.8 hectares (1.4 to 4.4 acres). It is found in the southwestern portion of the park in a stand that was logged historically, perhaps more than 80 years ago. Another stand is in the central portion of the park and is thought to have once been an ice pond.

**Classification Comments:** This community is distinguished by the dominance of *Quercus phellos* (willow oak) in the canopy and by its seasonally flooded hydrology in an upland (non-alluvial) landscape position. Some grazed woodlots in the park are dominated by *Quercus*

*phellos* (willow oak) but have compacted soils and lack the diverse wetland herbaceous layer of the Upland Depression Swamp.

**Other Comments:** One polygon classified as this association may not be a natural upland depression, but an artificial impoundment that has been abandoned and grown up in forest (see figure I15). This particular stand occurs on a soil mapped as Cullen clay loam, a well-drained upland soil type. The other two polygons are mapped as a frequently flooded soil type, Wehadkee loam.

**Local Description Authors:** K. D. Patterson.

**Plots:** APCO.3, APCO.14.

**Appomattox Court House National Historical Park Inventory Notes:** All three polygons of this association were inventoried, two were quantitatively sampled.

## GLOBAL INFORMATION

### USNVC 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	Seasonally flooded cold-deciduous forest (I.B.2.N.e.)
Alliance	<i>Quercus phellos</i> Seasonally Flooded Forest Alliance (A.330)
Alliance (English name)	Willow Oak Seasonally Flooded Forest Alliance
Association	<i>Quercus phellos</i> / <i>Carex</i> ( <i>albolutescens</i> , <i>intumescens</i> , <i>joorii</i> ) / <i>Climacium americanum</i> Forest
Association (English name)	Willow Oak / (Greenish-white Sedge, Greater Bladder Sedge, Cypress Swamp Sedge) / Tree Moss Forest
<b>Ecological System(s):</b>	Atlantic Coastal Plain Large River Floodplain Forest (CES203.066). Piedmont Upland Depression Swamp (CES202.336).

### GLOBAL DESCRIPTION

**Concept Summary:** This association represents upland depression swamps found in the Piedmont of the Carolinas, Virginia, and the Potomac Valley region of Maryland. It also occurs in limited areas of the adjacent inner Coastal Plain of the Carolinas. Examples are usually dominated by an almost pure canopy of *Quercus phellos* (willow oak), sometimes with codominant *Quercus lyrata* (overcup oak) or *Liquidambar styraciflua* (sweetgum); scattered individuals of other tree species may be present. Shrubs are generally sparse and not particularly diagnostic of this community. The most characteristic component of the understory are wetland sedges such as *Carex albolutescens* (greenwhite sedge), *Carex intumescens* (greater bladder sedge), and *Carex jorii* (cypress swamp sedge), but a number of other species may also be encountered. *Sphagnum lescurii* (Lescur's sphagnum), *Climacium americanum* (American climacium moss), and *Polytrichum* spp. (polytrichum mosses) are important moss species. These ponds are important amphibian breeding areas.

**Environmental Description:** This upland depression swamp forest of the Piedmont and inner Coastal Plain is found in small depressional features with hydrologic regimes controlled by fluctuating groundwater or seasonal pooling of rainwater over impermeable substrates. Sites are usually located on areas underlain by fine-grained mafic rocks, slate, or metasiltstone, and typically have dense clay subsoils that impede drainage. They are typically flooded to a depth up to about 50 cm during the winter and early part of the growing season but draw down by late summer. Below the surficial organic matter, soils are usually gleyed or mottled and have a sticky

consistency. Although the parent material is often basic, the soils of these swamps are largely leached of bases and are extremely acidic with moderately low cation levels and base saturation. Occurrences on mafic and acidic substrates appear to be indistinguishable. These are important amphibian breeding areas, but they depend on having intact upland areas as habitat for the adults.

**Vegetation Description:** This upland depression swamp forest is usually dominated by an almost pure canopy of *Quercus phellos* (willow oak), sometimes with codominant *Quercus lyrata* (overcup oak), and with *Quercus bicolor* (swamp white oak) or *Liquidambar styraciflua* (sweetgum). In addition, *Pinus taeda* (loblolly pine), *Ulmus alata* (winged elm), *Quercus stellata* (post oak), *Nyssa biflora* (swamp tupelo), *Quercus nigra* (water oak), *Quercus pagoda* (cherrybark oak), *Diospyros virginiana* (common persimmon), *Magnolia virginiana* (sweetbay), *Quercus michauxii* (swamp chestnut oak), *Ulmus alata* (winged elm), *Acer rubrum* var. *rubrum* (red maple), and other species may be present. Generally there are patchy or peripheral herbaceous and vine/liana layers of *Chasmanthium sessiliflorum* (longleaf woodoats), *Carex jorii* (cypress swamp sedge), *Rhynchospora glomerata* (clustered beaksedge), *Mitchella repens* (partridgeberry), *Gelsemium sempervirens* (evening trumpetflower), *Juncus coriaceus* (leathery rush), *Smilax tamnoides* (bristly greenbrier), *Smilax bona-nox* (saw greenbrier), *Trachelospermum difforme* (climbing dogbane), *Ampelopsis arborea* (peppervine), *Smilax tamnoides* (bristly greenbrier), *Vitis rotundifolia* (muscadine), *Toxicodendron radicans* (eastern poison ivy), *Bignonia capreolata* (crossvine), and likely others. Shrubs include *Ilex decidua* (possumhaw), *Ilex verticillata* (common winterberry), *Nyssa sylvatica* (blackgum), *Vaccinium fuscatum* (black highbush blueberry), *Carpinus caroliniana* (American hornbeam), and abundant *Smilax rotundifolia* (roundleaf greenbrier). Common herbs include *Carex albolutescens* (greenwhite sedge), *Carex brevior* (shortbeak sedge), *Carex caroliniana* (Carolina sedge), *Carex crinita* (fringed sedge), *Carex festucacea* (fescue sedge), *Carex intumescens* (greater bladder sedge), *Carex jorii* (cypress swamp sedge), *Carex louisianica* (Louisiana sedge), *Carex typhina* (cattail sedge), *Carex squarrosa* (squarrose sedge), *Carex pellita* (woolly sedge) (mafic only), *Glyceria striata* (fowl mannagrass), *Scirpus cyperinus* (woolgrass), *Juncus tenuis* (poverty rush), *Juncus coriaceus* (leathery rush), *Chasmanthium laxum* (slender woodoats), and *Trachelospermum difforme* (climbing dogbane). *Sphagnum lescurii* (Lescur's sphagnum) and *Climacium americanum* (American climacium moss) are important moss species. Other *Sphagnum* spp. (sphagnum mosses) and *Polytrichum* spp. (polytrichum mosses) are also found. Exotic plants, especially *Lonicera japonica* (Japanese honeysuckle), sometimes become dense in peripheral zones.

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Liquidambar styraciflua</i> (sweetgum), <i>Quercus bicolor</i> (swamp white oak), <i>Quercus lyrata</i> (overcup oak), <i>Quercus phellos</i> (willow oak)
Herb (field)	Graminoid	<i>Carex albolutescens</i> (greenwhite sedge), <i>Carex brevior</i> (shortbeak sedge), <i>Carex caroliniana</i> (Carolina sedge), <i>Carex crinita</i> (fringed sedge), <i>Carex festucacea</i> (fescue sedge), <i>Carex intumescens</i> (greater bladder sedge), <i>Carex jorii</i> (cypress swamp sedge), <i>Carex louisianica</i> (Louisiana sedge), <i>Carex squarrosa</i> (squarrose sedge), <i>Carex typhina</i> (cattail sedge), <i>Chasmanthium laxum</i> (slender woodoats), <i>Glyceria striata</i> (fowl mannagrass), <i>Juncus coriaceus</i> (leathery rush), <i>Juncus tenuis</i> (poverty rush), <i>Scirpus cyperinus</i> (woolgrass)

**Characteristic Species:** *Carex albolutescens* (greenwhite sedge), *Carex brevior* (shortbeak sedge), *Carex caroliniana* (Carolina sedge), *Carex crinita* (fringed sedge), *Carex festucacea* (fescue sedge), *Carex intumescens* (greater bladder sedge), *Carex jorii* (cypress swamp sedge), *Carex louisianica* (Louisiana sedge), *Carex squarrosa* (squarrose sedge), *Carex typhina* (cattail sedge), *Carpinus caroliniana* (American hornbeam), *Chasmanthium laxum* (slender woodoats), *Climacium americanum* (American climacium moss), *Glyceria striata* (fowl mannagrass), *Ilex decidua* (possumhaw), *Ilex verticillata* (common winterberry), *Juncus coriaceus* (leathery rush), *Juncus tenuis* (poverty rush), *Nyssa sylvatica* (blackgum), *Quercus bicolor* (swamp white oak), *Quercus lyrata* (overcup oak), *Quercus phellos* (willow oak), *Scirpus cyperinus* (woolgrass), *Smilax rotundifolia* (roundleaf greenbrier), *Sphagnum lescurii* (Lescur's sphagnum), *Trachelospermum difforme* (climbing dogbane), *Vaccinium fuscatum* (black highbush blueberry).

**Other Noteworthy Species:** Information not available.

**USFWS Wetland System:** Palustrine.

**DISTRIBUTION**

**Range:** This vegetation is reported from the Atlantic Coastal Plain of South Carolina and ranges through the Piedmont of the Carolinas and Virginia into the Potomac Valley of Maryland.

Throughout its range, this is primarily a Piedmont type.

**States/Provinces:** AL, GA?, MD, NC, SC, VA:S2?

**Federal Lands:** DOD (Kerr Reservoir); NPS (Appomattox Court House, C&O Canal, Congaree Swamp, Prince William); USFS (Uwharrie); USFWS (Eufaula).

**CONSERVATION STATUS**

**Rank:** G2G3 (25-Jan-2001).

**Reasons:** This was never a common community. The small size of examples and their poor drainage for development and economic uses make them a bit less susceptible to conversion than most Piedmont communities, but logging and landscape isolation degrade many that are not destroyed. Their isolated hydrology and small size means they often are exempted from wetland regulations. Much of the habitat for this community has undergone drainage and conversion.

Two of the occurrences at Congaree Swamp National Monument showed evidence of drainage

of the sites (TNC 1998b). Some extensive losses and degradation in the Piedmont are due to urbanization (e.g., in the vicinities of Charlotte and Butner, NC, some of the largest concentrations of this association).

**CLASSIFICATION INFORMATION**

**Status:** Standard.

**Confidence:** 2 – Moderate.

**Comments:** Regional classification conducted by VDNH for the NCR and mid-Atlantic national parks vegetation mapping projects contained a group of 8 Virginia plots and one Maryland plot belonging to this type. The attribution of plots in the Congaree Swamp National Monument has made this mainly Piedmont upland depression pond type also affiliated with a depression in a large river floodplain, which creates a contradiction as far as its attribution to ecological systems. This association is also known to occur in Campbell County, Virginia, in the western Piedmont. In contrast to related ponds in central Tennessee, *Nyssa biflora* (swamp tupelo) is lacking and *Cephalanthus occidentalis* (common buttonbush) is uncommon. Carolina Vegetation Survey plot data exist for this association.

**Similar Associations:**

- *Liquidambar styraciflua* - *Acer rubrum* - *Quercus phellos* / *Leucothoe racemosa* Forest (CEGL006110)--is a closely related type defined for the Chesapeake ecoregion; this accommodates the Ecoregion 58 range formerly accommodated here.
- *Quercus palustris* - *Quercus bicolor* / *Viburnum prunifolium* / *Leersia virginica* - *Impatiens capensis* Forest (CEGL004643).
- *Quercus phellos* - *Liquidambar styraciflua* / *Chasmanthium laxum* Cumberland / Southern Ridge and Valley Forest (CEGL008441).
- *Quercus phellos* - *Nyssa biflora* / *Panicum hemitomom* - *Carex* spp. - *Woodwardia virginica* Forest [Provisional] (CEGL004104).
- *Quercus phellos* - *Quercus (michauxii, shumardii)* - *Fraxinus americana* / (*Quercus oglethorpensis*) / *Zephyranthes atamasca* Gabbro Upland Depression Forest (CEGL008484)--over gabbroic Iredell soils in the Georgia Piedmont.

**Related Concepts:**

- *Quercus phellos* - *Liquidambar styraciflua* / *Smilax rotundifolia* / *Carex (albolutescens, festucacea)* Seasonally Flooded Woodland [Provisional] (Patterson pers. comm.) ?
- *Quercus phellos* / *Smilax rotundifolia* / *Carex (albolutescens, festucacea)* Woodland (VDNH 2003) =

**SOURCES**

**Description Authors:** A. S. Weakley, mod. G. P. Fleming.

**References:** ALNHP 2002, Fleming et al. 2001, Fleming pers. comm., Patterson pers. comm., Peet et al. unpubl. data 2002, Schafale and Weakley 1990, Schotz pers. comm., Southeastern Ecology Working Group n.d., TNC 1998b, VDNH 2003.



Figure I14. Upland Depression Swamp (plot APCO.3) at Appomattox Court House National Historical Park. April 2004. NAD 1983 / UTM 694525 easting, 4139427 northing.

**COMMON NAME (PARK-SPECIFIC):**    **NORTHERN PIEDMONT / LOWER NEW  
ENGLAND BASIC SEEPAGE SWAMP**

**SYNONYMS**

**USNVC English Name:**    **Red Maple - (Green Ash, White Ash) / Northern Spicebush /  
Skunk-cabbage Forest**

**USNVC Scientific Name:**    ***Acer rubrum* - *Fraxinus (pennsylvanica, americana)* / *Lindera  
benzoin* / *Symplocarpus foetidus* Forest**

**USNVC Identifier:**    **CEGL006406**

**LOCAL INFORMATION**

**Environmental Description:** This saturated, deciduous forest occurs on the broad floodplain of the Appomattox River, where the floodplain meets the upland slope. This seepage forest receives groundwater discharged from the base of an adjoining slope.

**Vegetation Description:** Northern Piedmont / Lower New England Basic Seepage Swamp is an open forest with dense to open shrub layers and a dense, continuous herb layer dominated by a mix of wetland graminoids and forbs. Canopy trees are mostly *Fraxinus pennsylvanica* (green ash) with some *Acer rubrum* (red maple). Trees may be absent in the wettest parts of this community but rooted around the margins of the seep. *Lindera benzoin* (northern spicebush) dominates the tall-shrub stratum. Other common shrubs are *Alnus serrulata* (hazel alder) and *Ligustrum obtusifolium* (border privet). Herbaceous dominance varies from *Symplocarpus foetidus* (skunk cabbage) (visible only early in the growing season) to *Carex trichocarpa* (hairyfruit sedge). *Glyceria striata* (fowl mannagrass), *Cinna arundinacea* (sweet woodreed), and *Microstegium vimineum* (Nepalese browntop) can also have high cover. Other typical species that may occur with lower cover include *Carex laevivaginata* (smoothsheath sedge), *Chelone glabra* (white turtlehead), *Impatiens capensis* (jewelweed), *Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* var. *cinnamomea* (cinnamon fern), *Osmunda regalis* var. *spectabilis* (royal fern), *Oxalis stricta* (common yellow oxalis), *Pilea pumila* (Canadian clearweed), *Polygonum arifolium* (halberdleaf tearthumb), *Polygonum caespitosum* var. *longisetum* (oriental ladythumb), and *Sagittaria latifolia* (broadleaf arrowhead).

The canopy of Northern Piedmont / Lower New England Basic Seepage Swamp can vary in composition and structure. Some occurrences may be dominated by *Acer rubrum* (red maple) or *Liriodendron tulipifera* (tuliptree). The canopy closure varies from mostly open to closed. Very disturbed examples, effected by cattle trampling and surrounded by pasture, still have the typical canopy species and wetland *Carex* spp. (sedges) as well as additional species introduced by disturbance, such as *Diospyros virginiana* (common persimmon), *Morus rubra* (red mulberry), and *Prunus serotina* var. *serotina* (black cherry).

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple), <i>Fraxinus pennsylvanica</i> (green ash)
Tree subcanopy	Broad-leaved deciduous shrub	<i>Lindera benzoin</i> (northern spicebush)

**Characteristic Species:** *Acer rubrum* (red maple), *Alnus serrulata* (hazel alder), *Carex trichocarpa* (hairyfruit sedge), *Fraxinus pennsylvanica* (green ash), *Lindera benzoin* (northern spicebush), *Symplocarpus foetidus* (skunk cabbage).

### Other Noteworthy Species:

<u>Species</u>	<u>G</u> Rank	<u>Type</u>	<u>Note</u>
<i>Ampelopsis brevipedunculata</i> (Amur peppervine)	-	plant	invasive nonnative
<i>Duchesnea indica</i> (Indian strawberry)	-	plant	nonnative
<i>Lonicera japonica</i> (Japanese honeysuckle)	-	plant	invasive nonnative
<i>Microstegium vimineum</i> (Nepalese browntop)	-	plant	invasive nonnative
<i>Polygonum caespitosum</i> var. <i>longisetum</i> (oriental ladysthumb)	-	plant	invasive nonnative
<i>Rosa multiflora</i> (multiflora rose)	-	plant	invasive nonnative

### Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>S</u> Rank	<u>Rel</u>	<u>Conf</u>	<u>S</u> Name	<u>Reference</u>
VA	SNR*	B	1	Coastal Plain / Piedmont Basic Seepage Swamp	Fleming et al. 2006

**Local Range:** Northern Piedmont / Lower New England Basic Seepage Swamp is mapped as a single polygon of 0.68 hectares (1.7 acres).

**Classification Comments:** Northern Piedmont / Lower New England Basic Seepage Swamp can be distinguished from similar communities by its landscape position, non-alluvial hydrology, and the composition of its herbaceous layer. In Appomattox Court House National Historical Park, the wetland community, Upland Depression Swamp, can have *Fraxinus pennsylvanica* (green ash) in the canopy, but lacks many of the herbaceous species found in Northern Piedmont / Lower New England Basic Seepage Swamp, and is seasonally flooded rather than saturated.

**Other Comments:** Information not available.

**Local Description Authors:** K. D. Patterson.

**Plots:** APCO.8.

**Appomattox Court House National Historical Park Inventory Notes:** The single polygon of this type was quantitatively sampled.

## GLOBAL INFORMATION

### USNVC 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	<i>Acer rubrum</i> - <i>Fraxinus pennsylvanica</i> Saturated Forest Alliance (A.3035)
Alliance (English name)	Red Maple - Green Ash Saturated Forest Alliance
Association	<i>Acer rubrum</i> - <i>Fraxinus</i> ( <i>pennsylvanica</i> , <i>americana</i> ) / <i>Lindera benzoin</i> / <i>Symplocarpus foetidus</i> Forest
Association (English name)	Red Maple - (Green Ash, White Ash) / Northern Spicebush / Skunk-cabbage Forest
<b>Ecological System(s):</b>	North-Central Appalachian Acidic Swamp (CES202.604). Central Appalachian Stream and Riparian (CES202.609).

### GLOBAL DESCRIPTION

**Concept Summary:** This association is a seepage swamp dominated by *Acer rubrum* (red maple) and ranging from southern New England to Virginia. It generally occurs in saturated situations on slightly sloping hillsides, along small streams, or in basins that receive overland flooding in addition to groundwater influence. In general, these swamps are moderately acidic to moderately basic and have some seepage indicators but are not particularly species-rich. Soils are shallow to moderately deep mucks over mineral soils. *Acer rubrum* (red maple) dominates the canopy; *Fraxinus pennsylvanica* (green ash) or *Fraxinus americana* (white ash) are usually also found in the canopy. *Fraxinus nigra* (black ash) is not generally associated with this type and, if

present, occurs only as scattered individuals. Other canopy or subcanopy associates may include *Liriodendron tulipifera* (tuliptree), *Quercus bicolor* (swamp white oak), *Quercus palustris* (pin oak), *Prunus serotina* var. *serotina* (black cherry), *Fagus grandifolia* (American beech), *Betula lenta* (sweet birch), *Ulmus americana* (American elm), and *Ulmus rubra* (slippery elm). Conifers such as *Tsuga canadensis* (eastern hemlock) or *Pinus strobus* (eastern white pine) are generally absent or occur in very low abundance. The shrub layer may be fairly open to quite dense, depending on the amount of canopy closure. Shrub species commonly include *Ilex verticillata* (common winterberry), *Rhododendron viscosum* (swamp azalea), *Clethra alnifolia* (coastal sweetpepperbush), *Lindera benzoin* (northern spicebush), *Cornus amomum* (silky dogwood), *Alnus serrulata* (hazel alder), and less commonly *Vaccinium corymbosum* (highbush blueberry), *Lyonia ligustrina* (maleberry), *Ilex montana* (mountain holly), *Toxicodendron vernix* (poison sumac), *Viburnum dentatum* (southern arrowwood), and *Viburnum nudum* var. *cassinoides* (withe-rod). The herbaceous layer is variable in cover; *Symplocarpus foetidus* (skunk cabbage) and *Osmunda cinnamomea* (cinnamon fern) are nearly always present. In some areas, tall ferns (*Osmunda cinnamomea* (cinnamon fern), *Onoclea sensibilis* (sensitive fern), *Osmunda regalis* (royal fern), *Thelypteris palustris* (eastern marsh fern), *Thelypteris noveboracensis* (New York fern)) form an herbaceous canopy within which other species are scattered. Microtopography is generally pronounced, resulting from tip-ups. Tree seedlings and *Sphagnum* (sphagnum) mosses are common on hummocks but do not in general form extensive carpets. Additional nonvascular species can include *Plagiomnium cuspidatum* (toothed plagiomnium moss) and *Calliergon* spp. (calliergon mosses). Invasive shrubs and herbs, including *Berberis thunbergii* (Japanese barberry), *Rosa multiflora* (multiflora rose), *Lonicera morrowii* (Morrow's honeysuckle), *Alliaria petiolata* (garlic mustard), and *Microstegium vimineum* (Nepalese browntop), may be abundant.

**Environmental Description:** This association is a seepage swamp dominated by *Acer rubrum* (red maple) and ranging from southern New England to Virginia. It generally occurs in saturated soils on slightly sloping hillsides, along small headwater streams, or in depressions at the edges of floodplains that receive overland flooding in addition to groundwater inputs. In general, these swamps are moderately acidic to moderately basic and have some seepage indicators but are not particularly species-rich. Soils are shallow to moderately deep mucks over mineral soils. Microtopography is generally pronounced, resulting from tip-ups and the braided character of the drainage. Soil samples collected from 18 Maryland and Virginia plot samples are "intermediate" in chemistry, i.e., mean pH = 5.2, mean Ca = 1071 ppm, mean Mg = 195 ppm, mean total base saturation = 57%, but are more "basic" than "acidic" in their calcium and magnesium content.

**Vegetation Description:** *Acer rubrum* (red maple) dominates the canopy; *Fraxinus pennsylvanica* (green ash) or *Fraxinus americana* (white ash) are usually also found in the canopy. *Fraxinus nigra* (black ash) is not generally associated with this type and, if present, occurs only as scattered individuals. Other canopy or subcanopy associates may include *Liriodendron tulipifera* (tuliptree), *Quercus bicolor* (swamp white oak), *Quercus palustris* (pin oak), *Prunus serotina* var. *serotina* (black cherry), *Fagus grandifolia* (American beech), *Betula lenta* (sweet birch), *Ulmus americana* (American elm), and *Ulmus rubra* (slippery elm). Conifers such as *Tsuga canadensis* (eastern hemlock) or *Pinus strobus* (eastern white pine) are generally absent or occur in very low abundance. The shrub layer may be fairly open to quite dense, depending on the amount of canopy closure. Shrub species commonly include *Ilex verticillata* (common winterberry), *Rhododendron viscosum* (swamp azalea), *Clethra alnifolia* (coastal sweetpepperbush), *Lindera benzoin* (northern spicebush), *Cornus amomum* (silky dogwood),

*Alnus serrulata* (hazel alder), *Carpinus caroliniana* (American hornbeam), and less commonly *Vaccinium corymbosum* (highbush blueberry), *Lyonia ligustrina* (maleberry), *Ilex montana* (mountain holly), *Toxicodendron vernix* (poison sumac), *Viburnum dentatum* (southern arrowwood), and *Viburnum nudum* var. *cassinoides* (withe-rod). The herbaceous layer is variable in cover; *Symplocarpus foetidus* (skunk cabbage) and *Osmunda cinnamomea* (cinnamon fern) are nearly always present. In some areas, tall ferns (*Osmunda cinnamomea* (cinnamon fern), *Onoclea sensibilis* (sensitive fern), *Osmunda regalis* (royal fern), *Thelypteris palustris* (eastern marsh fern), *Thelypteris noveboracensis* (New York fern)) form an herbaceous canopy within which other species are scattered. These other herbaceous species include *Impatiens capensis* (jewelweed), *Galium aparine* (stickywilly), *Geum canadense* (white avens), *Arisaema triphyllum* (Jack in the pulpit), *Carex stricta* (upright sedge), *Carex gracillima* (graceful sedge), *Carex intumescens* (greater bladder sedge), *Carex radiata* (eastern star sedge), *Carex laevivaginata* (smoothsheath sedge), *Veratrum viride* (green false hellebore), *Boehmeria cylindrica* (smallspike false nettle), *Chelone glabra* (white turtlehead), *Cardamine pensylvanica* (Pennsylvania bittercress), *Pilea pumila* (Canadian clearweed), and *Glyceria* spp. (mannagrasses). At the southern end of the range in Maryland and Virginia, *Symplocarpus foetidus* (skunk cabbage) is usually greatly dominant (>50% cover) early in the growing season, with *Saururus cernuus* (lizard's tail) frequently assuming patch-dominance during the summer. Tree seedlings and *Sphagnum* (sphagnum) mosses are common on hummocks but do not in general form extensive carpets. Additional nonvascular species can include *Plagiomnium cuspidatum* (toothed plagiomnium moss) and *Calliergon* spp. (calliergon mosses). Invasive shrubs and herbs, including *Berberis thunbergii* (Japanese barberry), *Rosa multiflora* (multiflora rose), *Lonicera morrowii* (Morrow's honeysuckle), *Alliaria petiolata* (garlic mustard), and *Microstegium vimineum* (Nepalese browntop), may be abundant.

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Ilex verticillata</i> (common winterberry), <i>Lindera benzoin</i> (northern spicebush)
Herb (field)	Forb	<i>Symplocarpus foetidus</i> (skunk cabbage)
Herb (field)	Fern or fern ally	<i>Osmunda cinnamomea</i> (cinnamon fern)

**Characteristic Species:** *Acer rubrum* (red maple), *Clethra alnifolia* (coastal sweetpepperbush), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), *Lindera benzoin* (northern spicebush), *Osmunda cinnamomea* (cinnamon fern), *Rhododendron viscosum* (swamp azalea), *Symplocarpus foetidus* (skunk cabbage).

**Other Noteworthy Species:** Information not available.

**USFWS Wetland System:** Palustrine.

**DISTRIBUTION**

**Range:** This vegetation occurs in southern New England south through the mid-Atlantic states to Virginia.

**States/Provinces:** CT, DE?, MA, MD, NH, NJ:S3S5, NY, PA, RI, VA, VT.

**Federal Lands:** NPS (Appomattox Court House, C&O Canal, Delaware Water Gap, Fort Necessity, Gateway, George Washington Parkway, Minute Man, Morristown, Prince William, Rock Creek, Saratoga, Upper Delaware, Weir Farm, Wolf Trap); USFWS (Great Meadows?).

### CONSERVATION STATUS

**Rank:** G4G5 (30-Jan-2007).

**Reasons:** Although this is a small-patch community, its environmental requirements are quite general, and it occurs where acidic groundwater seepage emerges on the headwaters of stream drainages. The range extent crosses several ecoregions and 10 states. The major threat to this community is housing development, with disruption of groundwater source a lesser threat.

### CLASSIFICATION INFORMATION

**Status:** Standard.

**Confidence:** 1 – Strong.

**Comments:** Classification of this type at the southern end of the range is supported by analysis of a 1250-plot regional dataset compiled for the NCR and mid-Atlantic national parks vegetation mapping project. In that analysis, this association was represented a group of 18 Maryland and Virginia plots.

### Similar Associations:

- *Acer rubrum* - *Betula alleghaniensis* / *Lindera benzoin* Forest (CEGL006936).
- *Acer rubrum* - *Fraxinus nigra* - (*Tsuga canadensis*) / *Tiarella cordifolia* Forest (CEGL006502).
- *Acer rubrum* / *Nemopanthus mucronatus* - *Vaccinium corymbosum* Forest (CEGL006220).
- *Acer rubrum* / *Rhododendron viscosum* - *Clethra alnifolia* Forest (CEGL006156).

### Related Concepts:

- Inland Red Maple Swamp (Breden 1989) B
- Palustrine Broad-leaved Deciduous Forested Wetlands (PFO1) (Cowardin et al. 1979) ?
- Red or Silver Maple-Green Ash Swamp (Thompson 1996) ?
- Southern New England stream bottom forest (Rawinski 1984) ?

### SOURCES

**Description Authors:** L. A. Sneddon, mod. S. C. Gawler and G. P. Fleming.

**References:** Breden 1989, Breden et al. 2001, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Ehrenfeld 1977, Enser 1993, Golet et al. 1993, Harrison 2004, Metzler and Barrett 2001, NRCS 2001, NRCS 2004, Rawinski 1984, Reschke 1990, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000.



Figure I15. Northern Piedmont / Lower New England Basic Seepage Swamp (plot APCO.8) at Appomattox Court House National Historical Park. May 2002. NAD 1983 / UTM 695316 easting, 4139580 northing.

**COMMON NAME (PARK-SPECIFIC): BEAVER WETLAND COMPLEX**

**SYNONYMS**

**USNVC English Name:** Smooth Alder Swamp Shrubland  
**USNVC Scientific Name:** *Alnus serrulata* Swamp Shrubland  
**USNVC Identifier:** C EGL005082

**LOCAL INFORMATION**

**Environmental Description:** Beaver Wetland Complex includes disturbed vegetation associated with beaver activities within a small stream floodplain. These areas usually have open standing water due to hydrologic alterations. Areas without open water have saturated soil conditions.

**Vegetation Description:** Beaver Wetland Complex includes a physiognomic complex of saturated deciduous forest, saturated shrubland, saturated herbaceous vegetation and open water. Forested areas are dominated by *Acer rubrum* (red maple). The shrubland areas are typically dominated by *Alnus serrulata* (hazel alder), although other species may occur, such as *Platanus occidentalis* (American sycamore). Typical herbaceous species include *Carex* spp. (sedges), *Impatiens capensis* (jewelweed), *Sparganium americanum* (American bur-reed), *Scirpus cyperinus* (woolgrass), and *Schoenoplectus purshianus* (weakstalk bulrush).

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Alnus serrulata</i> (hazel alder)

**Characteristic Species:** *Acer rubrum* (red maple), *Alnus serrulata* (hazel alder), *Sparganium americanum* (American bur-reed).

**Other Noteworthy Species:** Information not available.

**Subnational Distribution with Crosswalk Data:**

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
VA	SNR	.	.	[not crosswalked]	.

**Local Range:** Beaver Wetland Complex is found along Plain Run Branch on the southwestern border of the park and along an unnamed tributary of the Appomattox River in the western boundary of the park. It is mapped as two polygons covering a total of 3.9 hectares (9.7 acres).

**Classification Comments:** Beaver Wetland Complex is distinguished from other wetlands by its association with beaver activities along a stream channel and by usually having open water. Another wetland community, Northern Piedmont / Lower New England Basic Seepage Swamp is different because it is influence by overland seepage and occurs well away from the stream channel. These types are further distinguished by distinct species composition.

**Other Comments:** Information not available.

**Local Description Authors:** K. D. Patterson.

**Plots:** None.

**Appomattox Court House National Historical Park Inventory Notes:** Both polygons of Beaver Wetland Complex were observed in the field.

## GLOBAL INFORMATION

### USNVC 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.e.)
Formation	Seasonally flooded cold-deciduous shrubland (III.B.2.N.e.)
Alliance	<i>Alnus serrulata</i> Seasonally Flooded Shrubland Alliance (A.994)
Alliance (English name)	Smooth Alder Seasonally Flooded Shrubland Alliance
Association	<i>Alnus serrulata</i> Swamp Shrubland
Association (English name)	Smooth Alder Swamp Shrubland
<b>Ecological System(s):</b>	Central Appalachian River Floodplain (CES202.608). Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582).

### GLOBAL DESCRIPTION

**Concept Summary:** This alder swamp is found widely throughout the northeastern United States south of near-boreal regions. These shrublands are found on muck overlying mineral soils (peat deposits are not typical) of upland marsh borders, at the edges of red maple swamps, or in acidic colluvium at bases of slopes. The pH of these systems is broadly circumneutral to somewhat calcareous. The vegetation is dominated by tall shrubs, characterized and usually dominated by *Alnus serrulata* (hazel alder), sometimes in a mixture with (or rarely replaced by) *Alnus incana* (gray alder). Associate shrubs vary somewhat with geography and include *Cornus sericea* (redosier dogwood), *Rosa palustris* (swamp rose), *Physocarpus opulifolius* (common ninebark), *Viburnum recognitum* (southern arrowwood), and *Salix* spp. (willows). Saplings of *Acer rubrum* (red maple) are typical. Short shrubs include *Spiraea alba* var. *latifolia* (white meadowsweet) and *Lindera benzoin* (northern spicebush). Less frequent shrubs include *Cephalanthus occidentalis* (common buttonbush), *Decodon verticillatus* (swamp loosestrife), *Ilex verticillata* (common winterberry), *Rhododendron viscosum* (swamp azalea), and *Sambucus canadensis* (= *Sambucus nigra* ssp. *canadensis*, common elderberry). Herbaceous associates include *Calamagrostis canadensis* (bluejoint), *Osmunda regalis* (royal fern), *Glyceria striata* (fowl mannagrass), *Thelypteris palustris* (eastern marsh fern), *Galium* spp. (bedstraws), *Typha latifolia* (broadleaf cattail), *Polygonum hydropiper* (marshpepper knotweed), *Bidens cernua* (nodding beggartick), *Galium tinctorium* (stiff marsh bedstraw), *Cicuta maculata* (spotted water hemlock), *Peltandra virginica* (green arrow arum), and *Carex stricta* (upright sedge).

**Environmental Description:** These shrublands are found on muck overlying mineral soils (peat deposits are not typical) of upland marsh borders, small upland depressions, at the edges of red maple swamps or other ponded drainages, or in colluvium at bases of slopes. The pH of these systems is broadly circumneutral to somewhat calcareous (Fike 1999).

**Vegetation Description:** The vegetation is dominated by tall shrubs and characterized by *Alnus serrulata* (hazel alder), *Alnus incana* (gray alder), *Physocarpus opulifolius* (common ninebark), *Viburnum recognitum* (southern arrowwood), *Cornus amomum* (silky dogwood), and *Salix* spp. (willows). Saplings of *Acer rubrum* (red maple) are typical. Short shrubs include *Spiraea alba* var. *latifolia* (white meadowsweet) and *Lindera benzoin* (northern spicebush). Other shrubs present include *Cephalanthus occidentalis* (common buttonbush), *Decodon verticillatus* (swamp loosestrife), *Ilex verticillata* (common winterberry), *Rhododendron viscosum* (swamp azalea), and *Sambucus canadensis* (= *Sambucus nigra* ssp. *canadensis*, common elderberry) (Anderson 1996, Fike 1999). Herbaceous associates include *Calamagrostis canadensis* (bluejoint), *Osmunda regalis* (royal fern), *Glyceria striata* (fowl mannagrass), *Thelypteris palustris* (eastern

marsh fern), *Galium* spp. (bedstraws), *Typha latifolia* (broadleaf cattail), *Polygonum hydropiper* (marshpepper knotweed), *Bidens cernua* (nodding beggartick), *Galium tinctorium* (stiff marsh bedstraw), *Cicuta maculata* (spotted water hemlock), *Peltandra virginica* (green arrow arum), and *Carex stricta* (upright sedge).

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Alnus incana</i> (gray alder)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Alnus serrulata</i> (hazel alder), <i>Physocarpus opulifolius</i> (common ninebark), <i>Viburnum recognitum</i> (southern arrowwood)
Herb (field)	Forb	<i>Peltandra virginica</i> (green arrow arum)
Herb (field)	Graminoid	<i>Calamagrostis canadensis</i> (bluejoint)
Herb (field)	Fern or fern ally	<i>Osmunda regalis</i> (royal fern)

**Characteristic Species:** *Alnus serrulata* (hazel alder), *Cornus amomum* (silky dogwood), *Physocarpus opulifolius* (common ninebark), *Viburnum recognitum* (southern arrowwood).

**Other Noteworthy Species:** Information not available.

**USFWS Wetland System:** Palustrine.

**DISTRIBUTION**

**Range:** This alder swamp is found widely throughout the northeastern United States, ranging from central New England south to New Jersey, and west to Ohio and Pennsylvania.

**States/Provinces:** CT, DE?, MA, MD?, ME, NH, NJ, NY, OH, PA, QC?, RI, VA, VT.

**Federal Lands:** NPS (Appomattox Court House, Delaware Water Gap, Fredericksburg-Spotsylvania, Minute Man, Petersburg, Richmond).

**CONSERVATION STATUS**

**Rank:** G4G5 (22-Mar-1999).

**Reasons:** Information not available.

**CLASSIFICATION INFORMATION**

**Status:** Standard.

**Confidence:** 3 – Weak.

**Comments:** This type overlaps with *Alnus incana* Swamp Shrubland (CEGL002381) where the ranges abut in Ohio, Pennsylvania, southern New England, and southern New York. Where both alder species are present, this type is distinguished from the *Alnus incana* (gray alder) nominal type by the presence of species with a somewhat more Central Appalachian / Alleghenian affinity such as *Physocarpus opulifolius* (common ninebark), *Rhododendron viscosum* (swamp azalea), *Peltandra virginica* (green arrow arum), compared to CEGL002381 which is characterized by somewhat more northern species such as *Nemopanthus mucronatus* (catberry) and *Myrica gale* (sweetgale). Where they overlap, the relative dominance of the two alder species should be expected to vary. If *Alnus serrulata* (hazel alder) is present in more than token amounts, consider this type as opposed to CEGL002381.

**Similar Associations:**

- *Alnus incana* Swamp Shrubland (CEGL002381).
- *Alnus serrulata* Southeastern Seasonally Flooded Shrubland (CEGL008474).

**Related Concepts:**

- Smooth alder shrub thicket (CAP pers. comm. 1998) ?

**SOURCES**

**Description Authors:** L. A. Sneddon, mod. D. Faber-Langendoen and S. C. Gawler.

**References:** Anderson 1996, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Fike 1999, Swain and Kearsley 2001.



Figure I16. Beaver Wetland Complex at Appomattox Court House National Historical Park. August 2007. NAD 1983 / UTM easting 693260, northing 4139202. Photo by Robert Tillotson.

**COMMON NAME (PARK-SPECIFIC): CULTURAL MEADOW**

**SYNONYMS**

**USNVC English Name:** Orchard Grass - Timothy - Fescue species - Goldenrod species  
Herbaceous Vegetation

**USNVC Scientific Name:** *Dactylis glomerata* - *Phleum pratense* - *Festuca* spp. - *Solidago*  
spp. Herbaceous Vegetation

**USNVC Identifier:** CEGL006107

**LOCAL INFORMATION**

**Environmental Description:** This mapping unit includes herbaceous-dominated vegetation that is maintained as fields, pastures, agricultural leases, lawns, and mowed roadsides.

**Vegetation Description:** These areas are vegetated by a mix of native and European grasses and forbs. Fields tend to be dense stands of sod-forming grasses such as *Lolium pratense* (meadow ryegrass), *Andropogon virginicus* (broomsedge bluestem), and *Dactylis glomerata* (orchardgrass). Pastured lands have these grasses along with other grasses and sun-loving forbs such as *Poa pratensis* (Kentucky bluegrass), *Tridens flavus* (purpletop tridens), *Ranunculus bulbosus* (St. Anthony's turnip), *Solidago rugosa* (wrinkleleaf goldenrod), *Trifolium pratense* (red clover), *Trifolium repens* (white clover), and *Vicia sativa* (garden vetch). In areas that are mowed more closely, *Dactylis glomerata* (orchardgrass) are common.

Areas mapped as Cultural Meadow may have scattered trees and below minimum mapping unit inclusions of tree-dominated windrows and shrub-dominated ditches or small, disturbed seepages. Minor roads may also cut through areas mapped as Cultural Meadow.

**Most Abundant Species:** Information not available.

**Characteristic Species:** Information not available.

**Other Noteworthy Species:** Information not available.

**Subnational Distribution with Crosswalk Data:**

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
VA	SNA	.	.	[not crosswalked]	.

**Local Range:** Cultural Meadow occurs throughout Appomattox Court House National Historical Park and covers 215.5 hectares (532.5 acres), over 15 polygons. The largest polygon is 51 hectares (126 acres).

**Classification Comments:** Cultural Meadow is an herbaceous-dominated mapping unit. It is distinguished from other mapping units by its physiognomy.

**Other Comments:** The map class Cultural Meadow includes open fields, lawns, and mowed roadsides greater than 0.5 hectare. Those polygons representing mowed roadsides are indicated in the comment field of the map attribute table. Mowed roadsides smaller than 0.5 hectare are included either with the adjacent road or vegetation polygon.

**Local Description Authors:** K. D. Patterson.

**Plots:** None.

**Appomattox Court House National Historical Park Inventory Notes:** Information not available.

## GLOBAL INFORMATION

### USNVC 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	<i>Dactylis glomerata</i> - <i>Rumex acetosella</i> Herbaceous Alliance (A.1190)
Alliance (English name)	Orchard Grass - Common Sheep Sorrel Herbaceous Alliance
Association	<i>Dactylis glomerata</i> - <i>Phleum pratense</i> - <i>Festuca</i> spp. - <i>Solidago</i> spp. Herbaceous Vegetation
Association (English name)	Orchard Grass - Timothy - Fescue species - Goldenrod species Herbaceous Vegetation
Ecological System(s):	Information not available.

### GLOBAL DESCRIPTION

**Concept Summary:** This broadly defined vegetation type includes pastures and post-agricultural fields and is largely composed of nonnative cool-season grasses and herbs (generally of European origin) in the early stages of succession. The fields are typically mowed at least annually. Physiognomically, these grasslands are generally comprised of mid-height (1-3 feet tall) grasses and forbs, with occasional scattered shrubs. Species composition varies from site to site, depending on land-use history and perhaps soil type, but in general this vegetation is quite wide-ranging in northeastern and midwestern states and at higher elevations (610-1220 m [2000-4000 feet]) in the southeastern states. Dominant grasses vary from site to site but generally feature the nominal species. Other graminoid associates may include *Agrostis stolonifera* (creeping bentgrass), *Agrostis hyemalis* (winter bentgrass), *Elymus repens* (quackgrass), *Bromus inermis* (smooth brome), *Bromus tectorum* (cheatgrass), *Lolium perenne* (perennial ryegrass), *Poa pratensis* (Kentucky bluegrass), *Poa compressa* (Canada bluegrass), *Schizachyrium scoparium* (little bluestem) (not in abundance), and *Anthoxanthum odoratum* (sweet vernalgrass). Forbs scattered among the grasses are varied but include *Hieracium* spp. (hawkweeds), *Oxalis stricta* (common yellow oxalis), *Achillea millefolium* (common yarrow), *Asclepias syriaca* (common milkweed), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago nemoralis* (gray goldenrod), *Solidago juncea* (early goldenrod), *Solidago canadensis* (Canada goldenrod), *Solidago altissima* (tall goldenrod), *Euthamia graminifolia* (flat-top goldentop), *Cerastium arvense* (field chickweed), *Oenothera biennis* (common evening-primrose), *Potentilla simplex* (common cinquefoil), *Symphyotrichum lateriflorum* (calico aster), *Symphyotrichum novae-angliae* (New England aster), *Symphyotrichum lanceolatum* (white panicle aster), *Daucus carota* (Queen Anne's lace), *Ambrosia artemisiifolia* (annual ragweed), *Vicia cracca* (bird vetch), *Trifolium* spp. (clovers), and many others.

**Environmental Description:** This association occurs on pastures and land that has been tilled. Generally the fields are mowed at least annually.

**Vegetation Description:** In addition to *Dactylis glomerata* (orchardgrass) and *Phleum pratense* (timothy), these grassy fields are characterized by graminoids including *Agrostis stolonifera* (creeping bentgrass), *Agrostis hyemalis* (winter bentgrass), *Elymus repens* (quackgrass), *Bromus inermis* (smooth brome), *Bromus tectorum* (cheatgrass), *Lolium perenne* (perennial ryegrass), *Poa pratensis* (Kentucky bluegrass), *Poa compressa* (Canada bluegrass), *Schizachyrium scoparium* (little bluestem) (not in abundance), and *Anthoxanthum odoratum* (sweet vernalgrass). Forbs scattered among the grasses are varied but include *Hieracium* spp. (hawkweeds), *Oxalis*

*stricta* (common yellow oxalis), *Achillea millefolium* (common yarrow), *Asclepias syriaca* (common milkweed), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago nemoralis* (gray goldenrod), *Solidago juncea* (early goldenrod), *Solidago canadensis* (Canada goldenrod), *Solidago altissima* (tall goldenrod), *Euthamia graminifolia* (flat-top goldentop), *Cerastium arvense* (field chickweed), *Oenothera biennis* (common evening-primrose), *Potentilla simplex* (common cinquefoil), *Symphotrichum lateriflorum* (calico aster), *Symphotrichum novae-angliae* (New England aster), *Symphotrichum lanceolatum* (white panicle aster), *Daucus carota* (Queen Anne's lace), *Ambrosia artemisiifolia* (annual ragweed), *Vicia cracca* (bird vetch), *Trifolium* spp. (clovers), and many others.

**Most Abundant Species:**

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Forb	<i>Rumex acetosella</i> (common sheep sorrel)
Herb (field)	Graminoid	<i>Dactylis glomerata</i> (orchardgrass), <i>Festuca rubra</i> (red fescue), <i>Phleum pratense</i> (timothy)

**Characteristic Species:** *Achillea millefolium* (common yarrow), *Anthoxanthum odoratum* (sweet vernalgrass), *Dactylis glomerata* (orchardgrass), *Euthamia graminifolia* (flat-top goldentop), *Phleum pratense* (timothy), *Rumex acetosella* (common sheep sorrel), *Solidago altissima* (tall goldenrod), *Solidago canadensis* (Canada goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod).

**Other Noteworthy Species:** Information not available.

**USFWS Wetland System:** Not applicable.

**DISTRIBUTION**

**Range:** This vegetation is quite wide-ranging in northeastern and midwestern states and possibly occurs at higher elevations in the southeastern states.

**States/Provinces:** CT, DE, KY, MA, MD, ME, NB?, NH, NJ, NS?, NY, PA, QC?, RI, TN, VA, VT, WV.

**Federal Lands:** NPS (Allegheny Portage Railroad, Appomattox Court House, Booker T. Washington, Boston Harbor Islands, Cape Cod, Colonial, Delaware Water Gap, Fire Island, Fort Necessity, Fredericksburg-Spotsylvania, Friendship Hill, Gateway, George Washington Birthplace, Gettysburg, Johnstown Flood, Marsh-Billings-Rockefeller, Minute Man, Morristown, Petersburg, Richmond, Saint-Gaudens, Saratoga, Upper Delaware, Valley Forge, Weir Farm); USFWS (Aroostook, Assabet River, Carlton Pond, Erie, Great Meadows, Moosehorn, Nulhegan Basin, Oxbow, Parker River).

**CONSERVATION STATUS**

**Rank:** GNA (modified/managed) (8-Dec-2005).

**Reasons:** This vegetation type includes pasture and post-agricultural fields and is largely composed of nonnative grasses and herbs (generally of European origin).

**CLASSIFICATION INFORMATION**

**Status:** Standard.

**Confidence:** 3 – Weak.

**Comments:** *Schizachyrium scoparium* - (*Andropogon virginicus*) - *Solidago* spp. Herbaceous Vegetation (CEGL006333) is similar to this type but is dominated by warm-season grasses.

**Similar Associations:**

- *Lolium (arundinaceum, pratense)* Herbaceous Vegetation (CEGL004048).
- *Phleum pratense - Bromus pubescens - Helenium autumnale* Herbaceous Vegetation (CEGL004018).
- *Schizachyrium scoparium - (Andropogon virginicus) - Solidago* spp. Herbaceous Vegetation (CEGL006333)--has a greater component of native species and occurs on drier soils.

**Related Concepts:** Information not available.

**SOURCES**

**Description Authors:** S. C. Gawler.

**References:** Clark 1986, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Ehrenfeld 1977, Elliman 2003, Keever 1979, Newbold et al. 1988, Perles et al. 2006a, Perles et al. 2006b, Perles et al. 2006c, Perles et al. 2007, Sneddon et al. 1995, TDNH unpubl. data.



Figure I17. Cultural Meadow at Appomattox Court House National Historical Park. August 2007. NAD 1983 / UTM easting 695460, northing 4139860. Photo by Robert Tillotson.



Figure I18. Cultural Meadow at Appomattox Court House National Historical Park. August 2007. NAD 1983 / UTM easting 695350, northing 4139198. Photo by Robert Tillotson.

**COMMON NAME (PARK-SPECIFIC): DENSE HARDWOOD REGENERATION**

**SYNONYMS**

**USNVC English Name:** Not applicable  
**USNVC Scientific Name:** Not applicable  
**USNVC Identifier:** Nonstandard

**LOCAL INFORMATION**

**Environmental Description:** This mapping unit includes dense, shrubby, regeneration of hardwood species on areas that have been clearcut in the recent past (less than 20 years).

**Vegetation Description:** Deciduous sprouts from stumps and small trees form an impenetrable thicket 4-6 m tall, often intertwined with woody vines. Occasional mature trees, left during logging operations, may be scattered in the canopy. Species composition varies from stand to stand, but typical species include *Acer rubrum* (red maple), *Carpinus caroliniana* (American hornbeam), *Carya alba* (mockernut hickory), *Cornus florida* (flowering dogwood), *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Nyssa sylvatica* (blackgum), *Prunus serotina* var. *serotina* (black cherry), *Quercus phellos* (willow oak), *Quercus rubra* (northern red oak), *Robinia pseudoacacia* (black locust), *Rubus argutus* (sawtooth blackberry), *Smilax* spp. (greenbriers), and *Viburnum prunifolium* (blackhaw). Species composition varies depending on original forest and composition of surrounding forest.

**Most Abundant Species:** Information not available.

**Characteristic Species:** Information not available.

**Other Noteworthy Species:** Information not available.

**Subnational Distribution with Crosswalk Data:**

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
VA	NA	.	.	[not crosswalked, not ranked]	.

**Local Range:** Dense Hardwood Regeneration is mapped as five polygons covering 56.2 hectares (138.8 acres).

**Classification Comments:** This mapping unit is deciduous and has a shrubby structure with no significant canopy stratification.

**Other Comments:** Some stands mapped as Dense Hardwood Regeneration may have formerly been Successional Virginia Pine Forest.

**Local Description Authors:** K. D. Patterson.

**Plots:** None.

**Appomattox Court House National Historical Park Inventory Notes:** All five polygons of Dense Hardwood Regeneration were observed in the field.

**GLOBAL INFORMATION**

Dense Hardwood Regeneration is a park-specific, nonstandard type and has no global information.



Figure I19. Dense Hardwood Regeneration at Appomattox Court House National Historical Park. August 2007. NAD 1983 / UTM easting 694013, northing 4138749.

**COMMON NAME (PARK-SPECIFIC): GRAZED WOODLOT**

**SYNONYMS**

**USNVC English Name:** Not applicable  
**USNVC Scientific Name:** Not applicable  
**USNVC Identifier:** Nonstandard

**LOCAL INFORMATION**

**Environmental Description:** Grazed Woodlot is a mapping unit used for deciduous forests impacted by cattle trampling.

**Vegetation Description:** The impacts to these forests have affected species composition so as to make identification to a natural vegetation type impossible. These forests have exposed, severely impacted soil with little to no herbaceous cover. Common canopy species are *Quercus phellos* (willow oak), *Acer rubrum* (red maple), and *Carya ovata* (shagbark hickory). There is no understory or regeneration. In Appomattox Court House National Historical Park, it is possible that these areas were formerly Basic Oak-Hickory Forest. In Appomattox Court House National Historical Park, one stand is dominated by *Acer rubrum* (red maple) and is along a small stream. The other two have *Quercus phellos* (willow oak) and *Acer rubrum* (red maple) as canopy components.

**Most Abundant Species:** Information not available.

**Characteristic Species:** Information not available.

**Other Noteworthy Species:** Information not available.

**Subnational Distribution with Crosswalk Data:**

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
VA	NA	.	.	[not crosswalked, not ranked]	.

**Local Range:** Three polygons are mapped as Grazed Woodlot, covering a total of 5.9 hectares (14.5 acres), ranging in size from 0.8 to 3.1 hectares (2 to 7.8 acres).

**Classification Comments:** This mapping unit is distinguished by its bare compacted soils and by other evidence of current or past cattle use.

**Other Comments:** One stand (2 hectares) mapped as Grazed Woodlot is thought to have been forested since the time of the Civil War (Hamilton et al. 1986), and grazing has been excluded from the stand recently. However, impacts from grazing are still evident, and currently species composition is not typical of any later successional forest type.

**Local Description Authors:** K. D. Patterson.

**Plots:** None.

**Appomattox Court House National Historical Park Inventory Notes:** All three stands mapped as Grazed Woodlot were observed in the field.

**GLOBAL INFORMATION**

Grazed Woodlot is a park-specific, nonstandard type and has no global information.



Figure 120. Grazed Woodlot at Appomattox Court House National Historical Park. August 2007. NAD 1983 / UTM easting 695046 northing 4138685. Photo by Robert Tillotson.

**COMMON NAME (PARK-SPECIFIC): OTHER URBAN OR BUILT-UP LAND**

**SYNONYMS**

**USNVC English Name:** Not applicable

**USNVC Scientific Name:** Not applicable

**USNVC Identifier:** Not applicable

**LOCAL INFORMATION**

**Local Range:** Other Urban or Built-up Land is concentrated in the northern half of the park.

**Classification Comments:** This map class includes areas with buildings associated with park maintenance and historic interpretation or residences. This map class includes all buildings, walkways, minor roads, and their associated lawns and vegetation. This map class is equal to Anderson (Anderson et al. 1976) Level II unit 17, Other Urban or Built-up Land.

**Other Comments:** Lawns and other mowed areas greater than 0.5 hectare are mapped as Cultural Meadow.

**Local Description Authors:** K. D. Patterson.

**Plots:** None.

**Appomattox Court House National Historical Park Inventory Notes:** Information not available.

**Citation:** Anderson et al. 1976.

**COMMON NAME (PARK-SPECIFIC):** TRANSPORTATION, COMMUNICATIONS, AND UTILITIES

**SYNONYMS**

**USNVC English Name:** Not applicable

**USNVC Scientific Name:** Not applicable

**USNVC Identifier:** Not applicable

**LOCAL INFORMATION**

**Local Range:** Areas mapped as Transportation, Communications, and Utilities occur in throughout Appomattox Courthouse National Historical Park.

**Classification Comments:** This map class includes major paved roads and parking areas and utility line corridors. This map class is equal to the Anderson (Anderson et al. 1976) Level II unit 14, Transportation, Communications, and Utilities.

**Other Comments:** The comment field in the map attribute table indicates if a polygon represents transportation or utilities.

**Local Description Authors:** K. D. Patterson.

**Plots:** None.

**Appomattox Court House National Historical Park Inventory:** Information not available.

**Citation:** Anderson et al. 1976.

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## Appendix J. Field definitions for local and global descriptions of vegetation associations and other vegetation-map classes.

Local descriptions describe vegetation associations and other vegetation-map classes as they occur at specific national parks. Data from field observation points and quantitative plots were used to write the local, park-specific descriptions. These descriptions were entered into NatureServe Central Databases and reports with local and global descriptions for each association were generated for each park. The following document lists the content of those reports with definitions of each field in the report.

**COMMON NAME (PARK-SPECIFIC):** A common or colloquial name for the Association or map class. These names follow the Natural Communities of Virginia (Fleming et al 2006) or, if no appropriate name exists in Fleming et al (2006), the Association common name from the U.S. National Vegetation Classification (USNVC) was used, or a park-specific common name was assigned. Names for map classes not representing natural or semi-natural vegetation follow the Anderson Level II land use and land cover classification scheme (Anderson et al. 1976).

### SYNONYMS

**USNVC English Name:** The standard Association name from USNVC databases, but with a translation of the scientific names using standard NatureServe Central Ecology-accepted common names for the plant taxa used in the name (see below).

**USNVC Scientific Name:** The standard Association name from USNVC databases, based on Latin names of dominant and diagnostic plant species. The Association is the finest level of the USNVC. Species occurring in the same stratum are separated by a hyphen ( - ), and those occurring in different strata are separated by a slash ( / ). Species occurring in the uppermost strata are listed first, followed successively by those in lower strata. Within the same stratum, the order of species names generally reflects decreasing levels of dominance, constancy, or indicator value. In physiognomic types where there is a dominant herbaceous layer with a scattered woody layer, Association names can be based on species found in either the herbaceous layer or the woody layer, whichever is more diagnostic of the type. If both layers are used, then the uppermost layer is always listed first, regardless of which may be more diagnostic.

Species less consistently found in all occurrences of the Association are placed in parentheses ( ). In cases where a particular genus is dominant or diagnostic but individual species of the genus may vary among occurrences, only the specific epithets are placed in parentheses. Association names conclude with the Class Name in which they are classified.

In cases where diagnostic species are unknown or in question, a more general term may be used as a species placeholder (e.g., *Sphagnum* spp., Mixed Herbs, Mesic Graminoids). An environmental or geographic term, or one that is descriptive of the height of the vegetation (e.g., Dwarf Forest, Northern Shrubland), can also be used as a modifier when such a term is necessary to adequately characterize the Association. For reasons of standardization and brevity, however,

this is kept to a minimum. For Provisional Associations, [Provisional] is added at the end of the name (ex. *Salix wolfii* Shrubland [Provisional]).

Vascular plant species nomenclature for Association and Alliance names follows the nationally standardized list of Kartesz (1999), with very few exceptions. Nomenclature for nonvascular plants follows Anderson (1990) and Anderson et al. (1990) for mosses, Egan (1987, 1989, 1990, 1991) and Esslinger and Egan (1995) for lichens, and Stotler and Crandall-Stotler (1977) for liverworts/hornworts.

**USNVC Identifier:** A unique identifier code for the Association from USNVC databases. Associations have a code that begins with the string “CEGL” (Community Element Global) followed by a unique 6-digit number. Units that are not defined in the USNVC are listed as “nonstandard” in this field.

## LOCAL INFORMATION

**Environmental Description:** A summary of available information on the environmental conditions associated with the Association and any other important aspects of the environment which affect this particular type within the park, including elevation ranges and, where relevant, information on large landscape context, geology, and soils.

**Vegetation Description:** A summary of available information on the vegetation, species composition (including dominant and diagnostic taxa, as well as problematic exotic species), structure (defining strata and their heights and percent cover), and variability of the vegetation of this Association as it occurs in the park.

**Most Abundant Species:** Component plant species that are dominant (i.e., most abundant in terms of percent cover) for the Association as it occurs in the park.

Stratum: For each component plant species, the stratum (or strata) in which it occurs in the Association within the park. Values for Stratum are:

Tree (canopy & subcanopy)	Short shrub/sapling
Tree canopy	Herb (field)
Tree subcanopy	Nonvascular
Shrub/sapling (tall & short)	Floating aquatic
Tall shrub/sapling	Submerged aquatic

Lifeform: The lifeform of each component plant species that is present within each designated stratum of the community as it occurs within the park. Lifeform definitions are from Table 3.1, page 37, of Whittaker, R. H. 1975. *Communities and ecosystems*. Second edition. Macmillan Publishing Co. New York. 387 pp. Values for Lifeform are:

Needle-leaved tree	Palm shrub
Broad-leaved deciduous tree	Dwarf-shrub
Broad-leaved evergreen tree	Semi-shrub
Thorn tree	Succulent shrub
Evergreen sclerophyllous tree	Ephiphyte

Succulent tree	Vine/Liana
Palm tree	Forb
Tree fern	Graminoid
Bamboo	Succulent forb
Needle-leaved shrub	Aquatic herb (floating & submergent)
Broad-leaved deciduous shrub	Moss
Broad-leaved evergreen shrub	Alga
Thorn shrub	Lichen
Evergreen sclerophyllous shrub	Fern or fern ally
Other/unknown	Other herbaceous
Other shrub	Liverwort/hornwort

Species: Global scientific name (and common name) for each floristic component species of the Association as it occurs within the park.

**Characteristic Species:** Component plant species that are characteristic for the Association as it occurs within the park.

**Other Noteworthy Species:** Other noteworthy species (i.e., species that are not necessarily diagnostic of the Association, but that are worth noting for some other reasons, such as those that are rare species or nonnative invasives) that are found within the Association in the park.

### Subnational Distribution with Crosswalk Data

State: The two-letter postal code of the for U.S. state(s) in which the park occurs.

State Rank (SRank): The Heritage Conservation Subnational Rank that best characterizes the relative rarity or endangerment of the Association within the specified state. Values for State Rank are listed in Appendix D. An asterisk (\*) indicates that the Subnational Rank is for the Natural Heritage Program (NHP) Element (nonstandard), not the USNVC Association (standard) (see below).

Relationship (Rel): The State Name (see below) is the name that the state NHP applies to their community Element. The Relationship to Standard is a value that indicates the relationship between the NHP (Nonstandard) Element and the related Standard Association (USNVC). Values for Relationship to Standard are:

- = – Equivalent: NHP community is equivalent to the standard Association
- B – Broader: the NHP community is more broadly classified than the standard Association
- F – Finer: the NHP community is more finely classified than the standard Association
- I – Intersecting: the NHP community is not clearly broader or finer than this standard Association; the standard and NHP communities are related in a way that is more complex than a simple broader/finer relationship
- ? – Undetermined: the relationship between the NHP community and this standard Association is unknown

**Confidence (Conf):** Values for Confidence are: C - Certain; S - Somewhat certain; N - Not certain (null) - Not assessed or unknown.

**State Name (SName):** If the USNVC Association has been crosswalked to a state classification type and it is equivalent to the USNVC type, the State Name is the name that the Natural Heritage Program applies to the same community. A value of [gname] indicates that the State Name is the same as the Global Name. A value of [not crosswalked] indicates that no state type representing the concept of the USNVC Association has been identified. If a state type has been identified that is NOT equivalent to the USNVC Association (Standard), then the subnational type is considered a Nonstandard community. In this case, the State Name is the name of the nonstandard community.

**Reference:** This is the primary reference for the Natural Heritage Program classification that contains the State Name and confirms the presence of the Association in the state.

**Local Range:** A description of the total range (including present and historic, if known) of the Association within the park.

**Classification Comments:** Comments about classification criteria used to define the Association or description of any remaining issues associated with its classification in the park.

**Other Comments:** Additional comments about the Association within the park.

**Local Description Authors:** Name(s) of the person(s) primarily responsible for authorship of the current description of this Association in the park.

**Plots:** List of plot codes for plots used in the identification and classification of the Association in the park.

**Inventory Notes:** Information regarding the sampling of the Association in the park.

## GLOBAL INFORMATION

### USNVC Classification

**Physiognomic Class:** The second level of the USNVC which is a vegetation structural classification adapted from UNESCO 1973 and Driscoll et al. 1984. This level is based on the structure of the vegetation. This is determined by the height and relative percentage of cover of the dominant life-forms: tree, shrub, dwarf-shrub, herbaceous, and nonvascular.

**Physiognomic Subclass:** The third level of the USNVC. This level is determined by the predominant leaf phenology of classes defined by a tree, shrub, or dwarf-shrub stratum, the persistence and growth form of herbaceous and nonvascular vegetation, and particle size of the substrate for sparse vegetation (e.g., consolidated rocks, gravel/cobble).

**Physiognomic Group:** The fourth level of the USNVC. The group generally represents a grouping of vegetation units based on leaf characters, such as broad-leaf, needle-leaf,

microphyllous, and xeromorphic. These units are identified and named with broadly defined macroclimatic types to provide a structural-geographic orientation, but the ecological climate terms do not define the groups per se.

**Physiognomic Subgroup:** The fifth level of the USNVC represents a distinction between natural vegetation, including natural, semi-natural and some modified vegetation, and cultural vegetation (planted/cultivated).

**Formation:** The sixth level of the USNVC; represents a grouping of community types that share a definite physiognomy or structure and broadly defined environmental factors, such as elevation and hydrologic regime.

**Classification Code (parenthetical following each of the above levels):** The U. S. National Vegetation Classification (USNVC) Standard Classification code for the respective level of the hierarchy. Classification codes for the different levels are comprised of the following:

Class: Roman numerals (I-VII)

Subclass: Class code plus an uppercase letter (A-Z)

Group: Subclass code plus an Arabic number

Subgroup: Group code plus either the uppercase letter N (Natural/Semi-natural) or the uppercase letter C (Planted/Cultivated)

Formation: Subgroup code plus a lowercase letter (a-z)

**Alliance:** Level of USNVC reflecting a physiognomically uniform group of plant Associations sharing one or more diagnostic species (dominant, differential, indicator, or character), which (generally) are found in the uppermost stratum of the vegetation. The names of dominant and diagnostic species are the foundation of the Alliance Name. At least one species from the dominant and/or uppermost stratum is included. In rare cases, where the combination of species in the upper and lower strata is strongly diagnostic, species from other strata are included in the name. Species occurring in the same stratum are separated by a hyphen ( - ), and those occurring in a different strata are separated by a slash ( / ). Species occurring in the uppermost stratum are listed first, followed successively by those in lower strata. In physiognomic types where there is a dominant herbaceous layer with a scattered woody layer, alliance names can be based on species found in the herbaceous layer and/or the woody layer, whichever is more diagnostic of the type.

Species less consistently found in all associations of the alliance may be placed in parentheses, and these parenthetical names are generally listed alphabetically. In cases where a particular genus is dominant or diagnostic but the presence of individual species of the genus may vary among associations, only the specific epithets are placed in parentheses.

Nomenclature for vascular plant species follows a nationally standardized list (Kartesz 1999), with very few exceptions. Nomenclature for nonvascular plants follows Anderson (1990), Anderson et al. (1990), Egan (1987, 1989, 1990), Esslinger and Egan (1995), and Stotler and Crandall-Stotler (1977).

**Alliance Key** (parenthetical following Alliance): A unique identifier from the USNVC central database for each Alliance that begins with the string “A.” followed by a unique 3- or 4-digit number.

**Alliance (English name)**: A repeat of the Alliance name with a translation of the scientific names using standard NatureServe Central Ecology-accepted common names for the plant taxa in the name.

**Association**: The Association name includes the scientific names of dominant and diagnostic species. Species occurring in the same stratum are separated by a hyphen ( - ), and those occurring in different strata are separated by a slash ( / ). Species occurring in the uppermost strata are listed first, followed successively by those in lower strata. Within the same stratum, the order of species names generally reflects decreasing levels of dominance, constancy, or diagnostic value. In physiognomic types where there is a dominant herbaceous layer with a scattered woody layer, Association names can be based on species found in either the herbaceous layer or the woody layer, whichever is more diagnostic of the type. If both layers are used, then the uppermost layer is always listed first, regardless of which may be more diagnostic.

Species less consistently found in all occurrences of the Association are placed in parentheses (). In cases where a particular genus is dominant or diagnostic but individual species of the genus may vary among occurrences, only the specific epithets are placed in parentheses. Association names conclude with the Class Name in which they are classified.

In cases where diagnostic species are unknown or in question, a more general term may be used as a species placeholder (e.g., *Sphagnum* spp., Mixed Herbs, Mesic Graminoids). An environmental or geographic term, or one that is descriptive of the height of the vegetation (e.g., Dwarf Forest, Northern Shrubland), can also be used as a modifier when such a term is necessary to adequately characterize the Association. For reasons of standardization and brevity, however, this is kept to a minimum. For Provisional Associations, [Provisional] is added at the end of the name (ex. *Salix wolfii* Shrubland [Provisional]).

Vascular plant species nomenclature for Association and Alliance names follows the nationally standardized list of Kartesz (1999), with very few exceptions. Nomenclature for nonvascular plants follows Anderson (1990) and Anderson et al. (1990) for mosses, Egan (1987, 1989, 1990, 1991) and Esslinger and Egan (1995) for lichens, and Stotler and Crandall-Stotler (1977) for liverworts/hornworts.

**Association (English name)**: A repeat of the Association Name, but with a translation of the scientific names using standard Central Ecology-accepted common names for the plant taxa used in the name.

**Ecological System(s)**: A list of the Ecological Systems of which the Association is a member (NatureServe 2003). Ecological Systems are groups of plant associations unified by similar ecological conditions and processes (e.g., fire, riverine flooding), underlying environmental features (e.g., shallow soils, serpentine geology), and/or environmental gradients (e.g., elevation, hydrology in coastal zones). They should form relatively robust, cohesive, and distinguishable

units on the ground. In most landscapes, the Ecological System will manifest itself on the ground as a spatial aggregation at an intermediate scale (e.g., between the USNVC Alliance and Formation scales).

## GLOBAL DESCRIPTION

**Concept Summary:** A description of the range, structure, composition, environmental setting, and dynamics associated with the community. Information includes a general understanding of the type, often with some concept of its distribution; environmental setting in which the type occurs, and a summary of the important disturbance regimes, successional status, and temporal dynamics for this community rangewide; community structure/physiognomy; species by strata (dominant and diagnostic taxa); and key diagnostic characteristics that distinguish it from similar types.

**Environmental Description:** A summary of available information on the environmental conditions of the Association rangewide and any other important aspects of the environment which affect this particular type, including elevation ranges and, where relevant, information on large landscape context, geology, and soils.

**Vegetation Description:** A summary of available information on the leaf type and phenology, species composition (including dominant and diagnostic taxa, as well as problematic exotic species), structure (defining strata and their heights and percent cover), and variability of the vegetation of this Association rangewide, and any additional comments relating to the vegetation.

**Most Abundant Species:** Component plant species that are dominant (i.e., most abundant in terms of percent cover) for the Association as it occurs rangewide.

Stratum: For each component plant species, the stratum (or strata) in which it occurs in the Association rangewide. Values for Stratum are:

Tree (canopy & subcanopy)	Short shrub/sapling
Tree canopy	Herb (field)
Tree subcanopy	Nonvascular
Shrub/sapling (tall & short)	Floating aquatic
Tall shrub/sapling	Submerged aquatic

Lifeform: The lifeform of each component plant species that is present within each designated stratum of the community as it occurs rangewide. Lifeform definitions are from Table 3.1, page 37, of Whittaker, R. H. 1975. *Communities and ecosystems*. Second edition. Macmillan Publishing Co. New York. 387 pp. Values for Lifeform are:

Needle-leaved tree	Palm shrub
Broad-leaved deciduous tree	Dwarf-shrub
Broad-leaved evergreen tree	Semi-shrub
Thorn tree	Succulent shrub
Evergreen sclerophyllous tree	Ephiphyte

Succulent tree	Vine/Liana
Palm tree	Forb
Tree fern	Graminoid
Bamboo	Succulent forb
Needle-leaved shrub	Aquatic herb (floating & submergent)
Broad-leaved deciduous shrub	Moss
Broad-leaved evergreen shrub	Alga
Thorn shrub	Lichen
Evergreen sclerophyllous shrub	Fern or fern ally
Other/unknown	Other herbaceous
Other shrub	Liverwort/hornwort

Species: Global scientific name (and common name) for each floristic component species of the Association as it occurs rangewide.

**Characteristic Species:** Component plant species that are characteristic for the Association as it occurs rangewide.

**Other Noteworthy Species:** Other noteworthy species (i.e., species that are not necessarily diagnostic of the Association, but that are worth noting for some other reasons, such as those that are rare species or nonnative invasives) that are found within the Association rangewide.

**USFWS Wetland System:** Systems developed for the classification of wetlands by the U.S. Fish and Wildlife Service. System refers to a complex of wetlands and deepwater habitats that share the influence of similar hydrologic, geomorphic, chemical, or biological factors. As defined in Cowardin et al. (1979), the values are:

Marine - consists of open ocean overlying the continental shelf and its associated high-energy coastline.

Estuarine - consists of deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land.

Riverine - includes all wetlands and deepwater habitats contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean-derived salts in excess of 0.5%.

Lacustrine - includes wetlands and deepwater habitats with all of the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses, or lichens with greater than 30% areal coverage; and (3) total area exceeds 8 ha (20 ac).

Palustrine - includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5%.

## DISTRIBUTION

**Range:** A description of the total range (present and historic, if known) of the Association rangewide, using names of nations, subnations or states, ecoregions, etc.

**States/Provinces:** The two-letter postal codes for U.S. states and Canadian provinces in which the Association occurs. Mexican two-letter state abbreviations are preceded by “MX”. When the occurrence of the Association in a state/province is uncertain, a ? is appended. The state code may be followed by the State Rank when known.

**Federal Lands:** List of federal lands where the Association occurs or is believed to occur. Names used are shortened versions of the official name of the Federal land unit with “National Park, National Forest,” etc., dropped from the name. A ? indicates that presence is uncertain.

Federal Agency Abbreviations are:

BIA = Bureau of Indian Affairs  
BLM = Bureau of Land Management  
COE = U.S. Army Corps of Engineers  
DOD = Department of Defense  
DOE = Department of Energy  
NPS = National Park Service  
PC = Parks Canada  
TVA = Tennessee Valley Authority  
USFS = U.S. Forest Service  
USFWS = U.S. Fish and Wildlife Service

## CONSERVATION STATUS

**Rank:** The Heritage Conservation Status Global Rank which best characterizes the relative rarity or endangerment of the Association worldwide and the date the Global Rank was last reviewed (regardless of whether the rank was changed); values for Global Rank are listed in Appendix D.

For non-natural types, a Global Rank of GNA = Rank not applicable is assigned. They are further identified as one from the following:

Cultural - indicates that the Association is cultivated. Planted/cultivated areas are defined as being dominated by vegetation that has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation. The majority of these areas are planted and/or maintained for the production of food, feed, fiber, or seed.

Ruderal - indicates that the Association is considered ruderal. Ruderal communities are vegetation resulting from succession following anthropogenic disturbance of an area. They are generally characterized by unnatural combinations of species (primarily native species, though they often contain slight to substantial numbers and amounts of species alien to the region as well). In many landscapes, ruderal communities occupy

large areas - sometimes more than any other category of communities - and can provide important biodiversity functions.

Modified/Managed - indicates that the Association is modified or managed.

Modified/managed communities are vegetation resulting from the management or modification of natural/near-natural vegetation, but producing a structural and floristic combination not clearly known to have a natural analogue. Modified vegetation may be easily restorable by either management, time, or restoration of ecological processes. It is not yet clear how to deal with these communities in the USNVC.

Invasive - indicates that the Association is weedy and invasive. Invasive communities are dominated by invasive alien species. Although these communities are often casually considered as “planted/cultivated,” they are spontaneous, self-perpetuating, and not the (immediate) result of planting, cultivation, or human maintenance. Land occupied by invasive communities is generally permanently altered (converted) unless restoration efforts are undertaken. It is also important to recognize that these communities are novel; they are not merely a community “transplanted” from the native range of the dominant species. *Melaleuca* in south Florida, kudzu in the southeastern United States, tamarisk in the western United States, and red mangrove in Hawaii all form communities which have no equivalent in the native range of the dominant species (associated species, processes, landscape context, fauna, etc., are all significantly different).

**Reasons:** Reasons that the Heritage Conservation Status Global Rank for the Association was assigned, including key ranking variables and other considerations used.

#### CLASSIFICATION INFORMATION

**Status:** The status of the Association in relation to the standard USNVC. Values for Classification Status are:

Standard - the Association has been formally recognized, described, and accepted by NatureServe Central Ecology as a standard Association in the USNVC.

Nonstandard - the Association has not been accepted by NatureServe Central Ecology as a standard Association (i.e., it does not follow the standard classification).

Provisional\* - the Association is a candidate for acceptance into the standard classification but has not yet been comprehensively reviewed by NatureServe Central Ecology.

**Confidence:** The degree of confidence associated with the classification of the Association. This confidence is based on the quality and type of data used in the analysis, as well as the extent to which the entire (or potential) range of the Association was considered. Values for Circumscription Confidence are:

1 – Strong: Classification is based on quantitative analysis of verifiable, high-quality field data (species lists and associated environmental information) from plots that are published in full or are archived in a publicly accessible database. A sufficient

number of high-quality plots covering the expected geographic distribution and habitat variability of the vegetation type, as well as plots from related types across the region, have been used in the analysis.

- 2 – Moderate: Classification is based either on quantitative analysis of a limited data set of high-quality, published/accessible plots, and/or plots from only part of the geographic range, or on a more qualitative assessment of published/accessible field data of sufficient quantity and quality.
- 3 – Weak: Classification is based on limited, or unpublished/inaccessible plot data or insufficient analysis, anecdotal information, or community descriptions that are not accompanied by plot data. These types have often been identified by local experts. Although there is a high level of confidence that these types represent recognized vegetation entities, it is not known whether they would meet national standards for floristic types in concept or in classification approach if sufficient data were available.

**Comments:** Comments about classification criteria used to define the Association, or to describe any remaining issues associated with the classification. Any potentially confusing relationships with other existing Associations should be indicated if there is a potential that further scrutiny may result in a change in the classification of the Association. Discussion of any atypical occurrences and why they are included in this Association concept may also be addressed. In addition, rationale for choosing nominal species that are not dominant and other comments about nominal species pertaining to the classification of the Association should be included. Comments may explain confusion about the similarity between types that may not be distinguishable.

**Similar Associations:** The Global Name and Elcode of any closely related or apparently similar USNVC association(s) which may be mistaken for this Association. They may be in the same or different Formation or Alliance. This includes only types whose classification is not at issue (e.g., two types have similar sounding names but are differentiated by the degree of canopy closure and lower frequency of associated light-requiring species). Notes regarding the relationship and/or distinction of each particular Similar Association may follow.

**Related Concepts:** Name used by agencies or other published or unpublished classification systems to describe Associations that may be related to this Association. These might include Society of American Foresters (SAF) cover types, Kuchler PNV types, U.S. Fish and Wildlife Service (USFWS) wetland types, or other local or regional vegetation classifications. The Other Community Name is followed by the associated Reference and Relationship. The Related Concept Reference is the source reference for the Related Concept. Relationship indicates whether the type designated in Other Community Name is more, less, or equally inclusive of the USNVC Association concept. Values for Relationship are:

- B – Broader: the concept of the Other Community is broader than the Association concept
- F – Finer: the concept of the Other Community is finer (more narrow) than the Association concept

- I – Intersects: the concepts of the Other Community and the Association overlap (i.e., neither fully includes the other) and are related in a way that is more complex than a simple “broader/finer” relationship
- = – Equivalent: concept designated in Other Community Name is equivalent to the Association concept
- ? – Unknown: the relationship of the Other Community to the Association has not been determined

Note: Names used by the NHPs are listed in the section entitled Subnational Distribution with Crosswalk data.

## SOURCES

**Description Authors:** Name(s) of the person(s) primarily responsible for authorship of the current version of the Association’s *description* and *characterization* including descriptions in Environment, Vegetation, and Dynamics. The abbreviation mod. before a name indicates that modifications were subsequently made to the original description by the person(s) listed.

**References:** Short citations of all references used in documenting the classification/concept and characterization of this Association.

Appendix K. Key to the vegetation-map classes for Appomattox Court House National Historical Park.

1a	Land covered with vegetation with no buildings, paved roads, or utility lines. ....	2
1b	Land use includes buildings, paved areas, or utility lines. ....	25
2a	Forested vegetation: vegetation dominated by trees (tall single-stemmed woody plants) with canopy coverage of at least 25%. ....	3
2b	Non-forested vegetation: vegetation dominated by shrubs (multi-stemmed woody plants) and / or herbs with less than 25% tree cover. ....	22
3a	Upland forests; lacking wetland plants and soils. ....	4
3b	Wetland forests; vegetation influenced by groundwater or surface flooding. ....	19
4a	Mature, mostly deciduous forests comprised of oaks ( <i>Quercus</i> spp.), American beech ( <i>Fagus grandifolia</i> ), tuliptree ( <i>Liriodendron tulipifera</i> ), hickories ( <i>Carya</i> spp.), or other late-successional tree species in varying proportions; early-successional species such as black walnut ( <i>Juglans nigra</i> ), black locust ( <i>Robinia pseudoacacia</i> ), tree of heaven ( <i>Ailanthus altissima</i> ), and red maple ( <i>Acer rubrum</i> ) absent or of low cover. ....	5
4b	Young forests comprised of early successional deciduous trees such as black walnut ( <i>Juglans nigra</i> ), black locust ( <i>Robinia pseudoacacia</i> ), red maple ( <i>Acer rubrum</i> ), or of pines ( <i>Pinus</i> spp.) or eastern redcedar ( <i>Juniperus virginiana</i> var. <i>virginiana</i> ). ....	10
5a	Northern red oak ( <i>Quercus rubra</i> ), tulipree ( <i>Liriodendron tulipifera</i> ), or American beech ( <i>Fagus grandifolia</i> ) dominant or of high cover. ....	6
5b	White oak ( <i>Quercus alba</i> ), willow oak ( <i>Quercus phellos</i> ) or chestnut oak ( <i>Quercus prinus</i> ) dominant. ....	8
6a	American beech ( <i>Fagus grandifolia</i> ) strongly dominant. ....	<b>Mesic Mixed Hardwood Forest</b>
6b	American beech ( <i>Fagus grandifolia</i> ) minor, in subcanopy only, or absent. ....	7
7a	Tuliptree ( <i>Liriodendron tulipifera</i> ) strongly dominant and usually even-aged; nonnative weeds and vines often prevalent in the herb and shrub layers. ....	<b>Successional Tuliptree Forest</b>
7b	Mixed hardwood forest of steep slopes; canopy characterized by northern red oak ( <i>Quercus rubra</i> ), tuliptree ( <i>Liriodendron tulipifera</i> ), pignut hickory ( <i>Carya glabra</i> ); herb layer containing species indicating high base status, such as northern maidenhair ( <i>Adiantum pedatum</i> ) and bloodroot ( <i>Sanguinaria canadensis</i> ). ....	<b>Inner Piedmont / Lower Blue Ridge Basic Mesic Forest</b>
8a	Forest of thin rocky soils on slopes; chestnut oak ( <i>Quercus prinus</i> ) dominant; hickories ( <i>Carya</i> spp.) not important; prominent shrub layer dominated by heaths; few if any herbaceous plants. ....	<b>Piedmont / Low Elevation Mixed Oak / Heath Forest</b>

8b	Chestnut oak ( <i>Quercus prinus</i> ) not dominant, but can be present; heaths not forming a dense shrub layer but may be patchy; herb strata sparse in cover, but can be diverse in species. ....	9
9a	Willow oak ( <i>Quercus phellos</i> ) dominant; herbaceous layer poorly developed to absent, compacted soils. ....	<b>Grazed Woodlot</b>
9b	Mixtures of oak species; white oak ( <i>Quercus alba</i> ), northern red oak ( <i>Quercus rubra</i> ), chestnut oak ( <i>Quercus prinus</i> ), black oak ( <i>Quercus velutina</i> ) and hickories ( <i>Carya</i> spp.) dominate the canopy. ....	<b>Oak – Hickory Forest<sup>2</sup></b>
10a	Evergreen or mixed evergreen - deciduous young forests. ....	11
10b	Young forests, mostly deciduous. ....	14
11a	Eastern redcedar ( <i>Juniperus virginiana</i> var. <i>virginiana</i> ) dominant; other deciduous trees such as black cherry ( <i>Prunus serotina</i> var. <i>serotina</i> ) or black walnut ( <i>Juglans nigra</i> ) may be present; canopy may be closed to scattered, over an herbaceous layer of grasses or forbs. Nonnative herbs may be common. ....	<b>Successional Red-cedar Forest</b>
11b	Pines dominant. ....	12
12a	Loblolly pine ( <i>Pinus taeda</i> ) dominant, growing in obvious rows. ....	<b>Loblolly Pine Plantation</b>
12b	Virginia pine ( <i>Pinus virginiana</i> ) dominant. ....	13
13a	Virginia pine ( <i>Pinus virginiana</i> ) growing in obvious rows; no other canopy associates, with poorly developed to absent shrub and herb layer. ....	<b>Virginia Pine Plantation</b>
13b	Virginia pine ( <i>Pinus virginiana</i> ) dominant, sometimes with an admixture of a variety of deciduous trees; older stands may exhibit an emergent canopy of senescent pines with a main canopy of deciduous trees; shrub layer often dense cover of vines, and herbaceous layer absent or poorly developed. ....	<b>Successional Virginia Pine Forest</b>
14a	Tree of heaven ( <i>Ailanthus altissima</i> ) dominant. ....	<b>Successional Tree-of-Heaven Forest</b>
14b	Tree of heaven ( <i>Ailanthus altissima</i> ) minor or absent. ....	15
15a	Canopy with black walnut ( <i>Juglans nigra</i> ) or common hackberry ( <i>Celtis occidentalis</i> ) dominant; often occurs on old homesites. ....	<b>Successional Black Walnut Forest</b>
15b	Canopy closed, often dense. ....	16

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<sup>2</sup> This map class encompasses two associations that are difficult to differentiate in the field at APCO, presumably due to land use history. Generally, Acidic Oak – Hickory Forest (*Quercus alba* - *Quercus rubra* - *Carya alba* / *Cornus florida* / *Vaccinium stamineum* / *Desmodium nudiflorum* Piedmont Forest - CEG008475) occurs on drier, convex sites and is characterized by a patchy understory of heaths and maple-leaved viburnum; redbud is generally sparse to absent. Basic Oak – Hickory Forest (*Quercus alba* - *Quercus rubra* - *Carya (ovata, carolinae-septentrionalis)* / *Cercis canadensis* Forest – CEG007232) is characterized by more mesic setting, higher relative cover of hickories, and the presence of redbud.

16a	Tuliptree ( <i>Liriodendron tulipifera</i> ) abundant. ....	17
16b	Tuliptree ( <i>Liriodendron tulipifera</i> ) absent or of low cover. ....	18
17a	Tuliptree ( <i>Liriodendron tulipifera</i> ) strongly dominant or mixed with other deciduous trees; Virginia pine ( <i>Pinus virginiana</i> ), if present, a minor component. ....	<b>Successional Tuliptree Forest</b>
17b	Virginia pine ( <i>Pinus virginiana</i> ) forming a sparse emergent canopy, but trees not vigorous, many dying. ....	<b>Successional Virginia Pine Forest (decadent stands)</b>
18a	Dense thicket of young trees and vines; stumps evident; variable composition but may include red maple ( <i>Acer rubrum</i> ), black cherry ( <i>Prunus serotina</i> var. <i>serotina</i> ), American hornbeam ( <i>Carpinus carolinana</i> ) hickories ( <i>Carya</i> sp.), flowering dogwood ( <i>Cornus florida</i> ), sweetgum ( <i>Liquidambar styraciflua</i> ), tuliptree ( <i>Liriodendron tulipifera</i> ), black gum ( <i>Nyssa sylvatica</i> ), and others. ....	<b>Dense Hardwood Regeneration</b>
18b	Red maple ( <i>Acer rubrum</i> ) dominant or growing with willow oak ( <i>Quercus phellos</i> ); understory sparse; soil very compacted. ....	<b>Grazed Woodlot</b>
19a	Non-alluvial wetlands; vegetation seepage-fed (although often in close proximity to or originating with small streams); rarely if ever flooded by rivers or streams. ....	20
19b	Alluvial wetlands; vegetation associated with banks or channels of rivers and streams, receiving at least occasional flooding. ....	21
20a	Willow oak ( <i>Quercus phellos</i> ) dominant, red maple ( <i>Acer rubrum</i> ), green ash ( <i>Fraxinus pennsylvanica</i> ), and black gum ( <i>Nyssa sylvatica</i> ) associated in the canopy; vines common, and herbaceous layer characterized by a variety of sedges ( <i>Carex</i> spp.). ....	<b>Upland Depression Swamp</b>
20b	Green ash ( <i>Fraxinus pennsylvanica</i> ) and red maple ( <i>Acer rubrum</i> ) dominant; Northern spicebush ( <i>Lindera benzoin</i> ) common in shrub layer; skunk cabbage ( <i>Symplocarpus foetidus</i> ) prominent in early season; jewelweed ( <i>Impatiens capensis</i> ), white turtlehead ( <i>Chelone glabra</i> ), Canadian clearweed ( <i>Pilea pumila</i> ), and sedges ( <i>Carex</i> spp.) characterize herb layer. ....	<b>Northern Piedmont / Lower New England Basic Seepage Swamp</b>
21a	Variable mix of red maple ( <i>Acer rubrum</i> ) swamp, hazel alder ( <i>Alnus serrulata</i> ) shrublands, herbaceous vegetation and open water formed by beaver activity on small stream floodplains. ....	<b>Beaver Wetland Complex</b>
21b	Wetland forest of floodplains and stream terraces; vegetation often dense, and exotic species may form high cover; trees include green ash ( <i>Fraxinus pennsylvanica</i> ), tuliptree ( <i>Liriodendron tulipifera</i> ), and American sycamore ( <i>Platanus occidentalis</i> ). ....	<b>Piedmont / Mountain Alluvial Forest</b>
22a	Vegetation dominated by herbs; trees and shrubs, if present, occur at less than 25% cover. ....	23
22b	Vegetation woody; shrubs, vines and scattered trees characteristic. ....	24
23a	Wetland herbaceous vegetation. ....	<b>Beaver Wetland Complex</b>
23b	Upland herbaceous vegetation. ....	<b>Cultural Meadow</b>

- 24a Upland vegetation dominated by shrubs and small trees. .... **Dense Hardwood Regeneration**
- 24b Wetland vegetation dominated by shrubs and small trees. .... **Beaver Wetland Complex**
  
- 25a Land use includes buildings and maintained lawns and  
plantings. .... **Other Urban or Built-Up Land**
- 25b Land use is primarily a transportation corridor with paved roadway,  
parking areas, or a maintained utility line. .... **Transportation, Communications, and Utilities**

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