

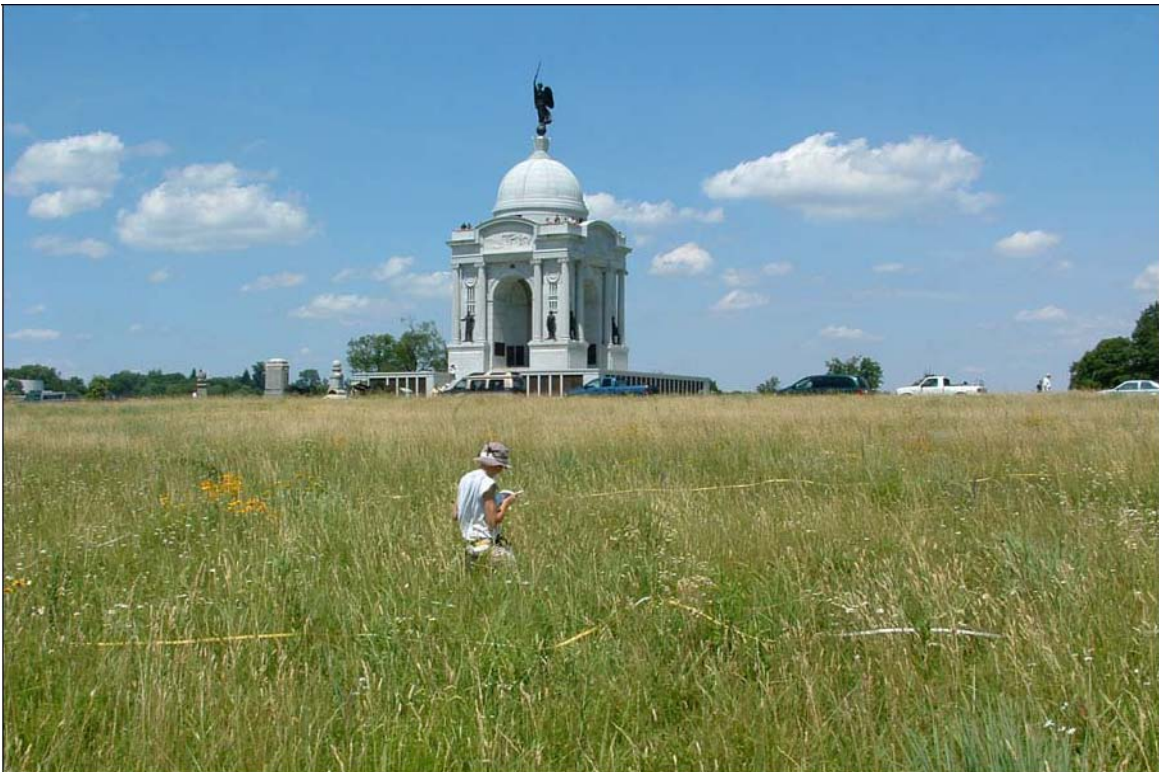
National Park Service  
U.S. Department of the Interior

Northeast Region Philadelphia, Pennsylvania



## **Vegetation Classification and Mapping at Gettysburg National Military Park and Eisenhower National Historic Site**

Technical Report NPS/NER/NRTR--2006/058



Vegetation sampling plot in a Successional Old Field near the Pennsylvania Memorial in Gettysburg National Military Park. Photograph by Gregory Podniesinski.

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

**USGS – NPS Vegetation Mapping Program**  
**Gettysburg National Military Park and Eisenhower National Historic Site**

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## Executive Summary

Vegetation classification and mapping was conducted at Gettysburg National Military Park and Eisenhower National Historic Site, creating a current digital geospatial vegetation database for the parks. Classification and mapping was completed jointly for these two parks because the parks are geographically contiguous and are managed by the same natural and cultural resource personnel. Fifteen vegetation associations, Chestnut Oak Forest, Dry Oak – Mixed Hardwood Forest, Tuliptree Forest, Modified Successional Forest, Conifer Plantation, Virginia Pine Successional Forest, Sycamore – Mixed Hardwood Floodplain Forest, Bottomland Mixed Hardwood Forest, Palustrine Shrub Thicket, Successional Old Field, Agricultural Field, Pasture, Orchard, Wet Meadow, and Reed Canary Grass Riverine Grassland, that occur within the parks were identified and described in detail. These vegetation types are strongly influenced by the varied environmental settings of the parks and the mandate to preserve the topographic, landscape, and cultural features as they were in 1863, such that visitors and historians can fully understand and appreciate the Battle of Gettysburg.

One of the most influential environmental factors on the parks' vegetation is the Gettysburg Sill, the large diabase intrusion that supports the forested areas of the Gettysburg National Military Park. Dry Oak – Mixed Hardwood Forest is the most abundant forest association in the parks. It is the primary vegetation association in the forested diabase sill area, but also occurs in the historic woodlots scattered throughout Gettysburg National Military Park. Chestnut Oak Forest and Tuliptree Forest are two other, less common, forest associations that occur in the diabase sill area. The low areas surrounding drainages and creeks are another environmental setting in which forested areas persist in the parks. Sycamore – Mixed Hardwood Floodplain Forest and Bottomland Mixed Hardwood Forest are typical of these topographically low areas.

The Modified Successional Forest association encompasses fragmented, disturbed forest stands that are dominated by early successional, weedy tree species, invasive plants, and vines. A few areas of Conifer Plantation remain where coniferous trees were planted, primarily on privately held lands. Virginia Pine Successional Forest occurs in two locations in Gettysburg National Military Park in which Virginia pine (*Pinus virginiana*) has become established.

The ongoing management to maintain the historic and cultural landscape strongly influences vegetation within the park. Agricultural Field is the most common vegetation association in the parks, covering over 40% of the parks' area. The rotation of grasses on the Agricultural Field areas, as well as the many Successional Old Field, inactive Pasture, Wet Meadow, and Reed Canary Grass Riverine Grassland areas, contributes to the abundance of grasslands in the parks. These large expanses of grasslands provide critical habitat for several species of birds and mammals, including bobolink (*Dolichonyx oryzivorus*), grasshopper sparrow (*Ammodramus saviarum*), eastern meadowlark (*Sturnella magna*), loggerhead shrike (*Lanius ludovicianus*), short-eared owl (*Asio flammeus*), upland sandpiper (*Bartramia longicauda*), northern harrier (*Circus cyaneus*), barn owl (*Tyto alba*), and least shrew (*Cryptotis parva*). The Wet Meadow and Successional Old Field associations also provide habitat for several rare plant species, including rigid sedge (*Carex tetanica*), bog rush (*Juncus biflorus*), whiteroot rush (*Juncus brachycarpus*), Buxbaum's sedge (*Carex buxbaumii*), low spearwort (*Ranunculus pusillus*), orange coneflower (*Rudbeckia fulgida*), hoary frostweed (*Helianthemum bicknellii*), Heller's

rosette grass (*Dichanthelium oligosanthes* var. *oligosanthes*), eastern smooth beardtongue (*Penstemon laevigatus*), and sidebeak pencilflower (*Stylosanthes biflora*).

Invasive exotic plant species, such as multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thunbergii*), tree of heaven (*Ailanthus altissima*), Asiatic tearthumb (*Polygonum perfoliatum*), Japanese stilt grass (*Microstegium vimineum*), Japanese honeysuckle (*Lonicera japonica*), Amur honeysuckle (*Lonicera maackii*), and Morrow's honeysuckle (*Lonicera morrowii*), are an important threat to the native vegetation at Gettysburg National Military Park and Eisenhower National Historic Site. Chemical and mechanical control of these species should continue in order to protect the native vegetation associations.

A map showing the locations of vegetation associations in the parks was created following the USGS/NPS Vegetation Mapping Program protocols (The Nature Conservancy and Environmental Systems Research Institute 1994a, b, c). These vegetation associations were also crosswalked to the Terrestrial and Palustrine Plant Communities of Pennsylvania (Fike 1999) and to the National Vegetation Classification System in order to provide a regional and global context for the parks' vegetation. A dichotomous field key was developed for these vegetation associations to assist with field recognition and classification.

This project documents the vegetation associations of Gettysburg National Military Park and Eisenhower National Historic Site based on 2003 aerial photography and 2004 field sampling, and completes one of 12 basic inventory data sets for the parks. However, battlefield rehabilitation in Gettysburg National Military Park has significantly altered the vegetation in many sections of the park; so much so, that the vegetation map was significantly out of date even before this report was published. Therefore, once the battlefield rehabilitation is completed, a new map of the vegetation associations should be completed based on the classification work presented in this report.

Keywords: vegetation association, vegetation classification, vegetation mapping, Gettysburg National Military Park, Eisenhower National Historic Site

## Introduction

### General Background

One of the goals of the National Park Service's Inventory and Monitoring Program is to provide the information and expertise needed by park managers for effective, long-term management of the natural resources held in trust (National Park Service 2003). The program recommends that 12 basic natural resource inventories be developed for each park that contains significant natural resources. These inventories provide crucial baseline information needed for proper park natural and cultural resource stewardship. A map of each park's vegetation, based on aerial photography less than five years old, is one of the 12 inventories recommended by the program (National Park Service 2003). To ensure that vegetation mapping is standardized across the National Park Service (NPS), The Nature Conservancy, in conjunction with NatureServe, the Federal Geographic Data Committee, and the Ecological Society of America Vegetation Subcommittee, developed a protocol for creating vegetation maps in national parks. This protocol was adopted by the United States Geological Survey (USGS)/NPS Vegetation Mapping Program as the standard (The Nature Conservancy and Environmental Systems Research Institute 1994a, b, c) and has been implemented at Gettysburg National Military Park and Eisenhower National Historic Site by the Pennsylvania Natural Heritage Program. Classification and mapping was completed jointly for these two parks because the parks are geographically contiguous and are managed by the same resource personnel.

The goal of the mapping effort at Gettysburg National Military Park and Eisenhower National Historic Site was to produce an up-to-date digital geospatial vegetation database for the parks and to provide a plant species list, a dichotomous key for vegetation associations, and descriptions of the vegetation associations in the parks. 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 provides habitat information important to understanding associated organisms, including animals, protozoans, bacteria, and fungi. A map of vegetation communities may allow inferences about the location and abundance of species that are characteristic of each community.

This report also describes the parks' vegetation in the context of a national and regional vegetation classification. The Nature Conservancy, in conjunction with NatureServe, the Federal Geographic Data Committee, and the Ecological Society of America Vegetation Subcommittee, developed the National Vegetation Classification System (NVCS) in order to standardize vegetation classification and facilitate the comparison of vegetation types throughout the United States and internationally. The NVCS is a systematic approach to classifying existing natural vegetation using physiognomics and floristics. This classification system has a hierarchical structure (Grossman et al. 1998).

The basic unit of vegetation classification in the NVCS is the association. 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, Northeastern Dry Oak – Hickory Forest is a common forest type on well-drained, acidic midslopes in the northeastern United States.

Associations are also assigned global rarity ranks that indicate their conservation status and relative risk of extirpation (Grossman et al. 1998). Associations from the NVCS are often equivalent to communities in state-specific vegetation classifications such as the Terrestrial and Palustrine Plant Communities of Pennsylvania (Fike 1999). Therefore, NVCS associations can be crosswalked with communities in these state classifications.

Several associations that share one or more dominant or characteristic species can be grouped to form an alliance. Alliances are generally more wide-ranging geographically than associations, covering multiple habitats and broader species composition. For example, the Northeastern Dry Oak – Hickory Forest association mentioned previously is grouped with other similar oak-dominated forest associations into the White Oak - (Northern Red Oak, Hickory species) Forest Alliance. An association with unique species composition or environmental niche can be assigned to its own alliance, such that the alliance only contains one association instead of multiple associations.

One level above alliance is the formation, representing vegetation types that share a common physiognomy within broadly defined environmental factors (Grossman et al. 1998). For example, Lowland or submontane cold-deciduous forest is a common formation that encompasses numerous forest types in the northeastern and midwestern United States, including the White Oak - (Northern Red Oak, Hickory species) Forest Alliance mentioned above.

#### Park-specific Information

The Battle of Gettysburg, fought on July 1–3, 1863, was the bloodiest single battle of the American Civil War. Victory for the Union Army at Gettysburg has been considered a major turning point in the war, ending the northward invasion by General Robert E. Lee's Confederate Army. Over 51,000 soldiers were killed, wounded, captured, or missing after the three-day battle. Preservation of significant sites began soon after the battle, and these lands were transferred to the federal government in 1895. As a memorial for the armies that fought in the battle, Gettysburg National Military Park was established by congress on February 11, 1895. Administration of the park was transferred to the National Park Service in 1933 (National Park Service 2005a).

Gettysburg National Military Park now covers 2,443 ha (6,034 ac) and incorporates a significant portion of land across which the battle, its aftermath, and the commemoration occurred. The park land consists of a Main Unit (2,171 ha [5,362 ac]) that surrounds the town of Gettysburg to the north and south, several small disjunct parcels within and nearby the town, and East Cavalry Field (272 ha [672 ac]) that lies approximately 5.5 m (3.5 mi) east of the town center. The majority of land parcels within the park boundary are owned by the federal government or the Friends of National Parks group, or are protected by easement. Only 17% of the park land, approximately 460 ha (1,136 ac), is in private ownership. Approximately 1.8 million people visit the park each year to enjoy hiking trails, scenic car tours, over 1,400 monuments and 400 cannons, and beautiful vistas overlooking the battlefield and the surrounding landscape (National Park Service 2005a).

Eisenhower National Historic Site preserves the presidential and retirement home of Dwight D. Eisenhower. The 76 ha (189 ac) farm was purchased by Eisenhower in 1950. During his

presidency he used the farm as a weekend retreat, temporary White House, and meeting place for world leaders, including Soviet Premier Nikita Khrushchev, President Charles De Gaulle, Prime Minister Winston Churchill, and Governor Ronald Reagan. During this time, the farm sported a putting green, a skeet range, and a show herd of Angus cattle. The site was designated as a National Historic Landmark in April 1966 and Eisenhower National Historic Site was created on November 27, 1967. The park now encompasses 280 ha (690 ac) and is maintained as a working farm (National Park Service 2005b).

Shapefiles of the parks' boundaries were obtained from the parks' GIS specialist in October 2003. All maps in this report used those shapefiles to depict the parks' boundaries.

## Project Area

### Location and Regional Setting

Gettysburg National Military Park and Eisenhower National Historic Site are located in the gently rolling hills of Adams County, adjacent to the town of Gettysburg, Pennsylvania (Figure 1). Gettysburg National Military Park is situated on the Gettysburg, PA and the Fairfield, PA 1:24,000 USGS topographic quad maps, while Eisenhower National Historic Site is situated only on the Fairfield, PA 1:24,000 USGS topographic quad map.

This area of the county occurs within the Gettysburg-Newark Lowland section of the Piedmont Province and is characterized by rolling lowlands with isolated hills and highlands (Schultz 1999). The predominant natural vegetation in the environs of Gettysburg National Military Park and Eisenhower National Historic Site is Appalachian Oak Forest, typically dominated by white oak (*Quercus alba*) and northern red oak (*Quercus rubra*), with sugar maple (*Acer saccharum*), sweet birch (*Betula lenta*), bitternut hickory (*Carya cordiformis*), American beech (*Fagus grandifolia*), and tuliptree (*Liriodendron tulipifera*) as associates (Cuff et al. 1989). However, very little forest cover remains in the Piedmont Province. Most of the forests have been cleared for agriculture and development or repeatedly logged for timber and fuel (Keever 1973).

### Park Environmental Attributes

Many environmental factors, such as geology, topography, soils, and hydrology, affect the types and distribution of vegetation within Gettysburg National Military Park and Eisenhower National Historic Site. The bedrock geology underlying the majority of Gettysburg National Military Park and all of Eisenhower National Historic Site is the Gettysburg Formation. This sedimentary rock from the late Triassic Period is composed of reddish-brown silty mudstone, siltstone, sandstone, and shales. These rocks were deposited in the lowlands around the Gettysburg area approximately 180 million years ago (Schultz 1999). The topography within these gently rolling hills and valleys generally varies between 150–175 m (500–580 ft) in elevation.

The topographic relief of the area is a result of diabase intrusions, bands of mafic igneous rocks from the Early Jurassic age that were thrust into the Gettysburg Formation. The largest of these



bands is the Gettysburg Sill, a 610 m (2,000 ft) thick slab of diabase that runs southwest to northeast through Gettysburg National Military Park. This sill forms the topographically high areas of Big Round Top, Little Round Top, Culp's Hill, Cemetery Ridge, and Cemetery Hill. These diabase outcrops can reach up to 240 m (785 ft) in elevation at the top of Big Round Top and 200 m (650 ft) at the top of Little Round Top. The Gettysburg Sill is composed of coarse-grained diabase and contains a large amount of feldspar, which is prone to weathering. Spheroidal weathering of the feldspar has created the large boulders characteristic of Devil's Den. Another 15 m (50 ft) thick dike, composed of very fine-grain, dense diabase, is oriented north to south and underlies Seminary Ridge. This diabase is much more resistant to weathering than the diabase of the Gettysburg Sill (Schultz 1999; National Park Service 2005a).

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**Gettysburg National Military Park and Eisenhower National Historic Site**

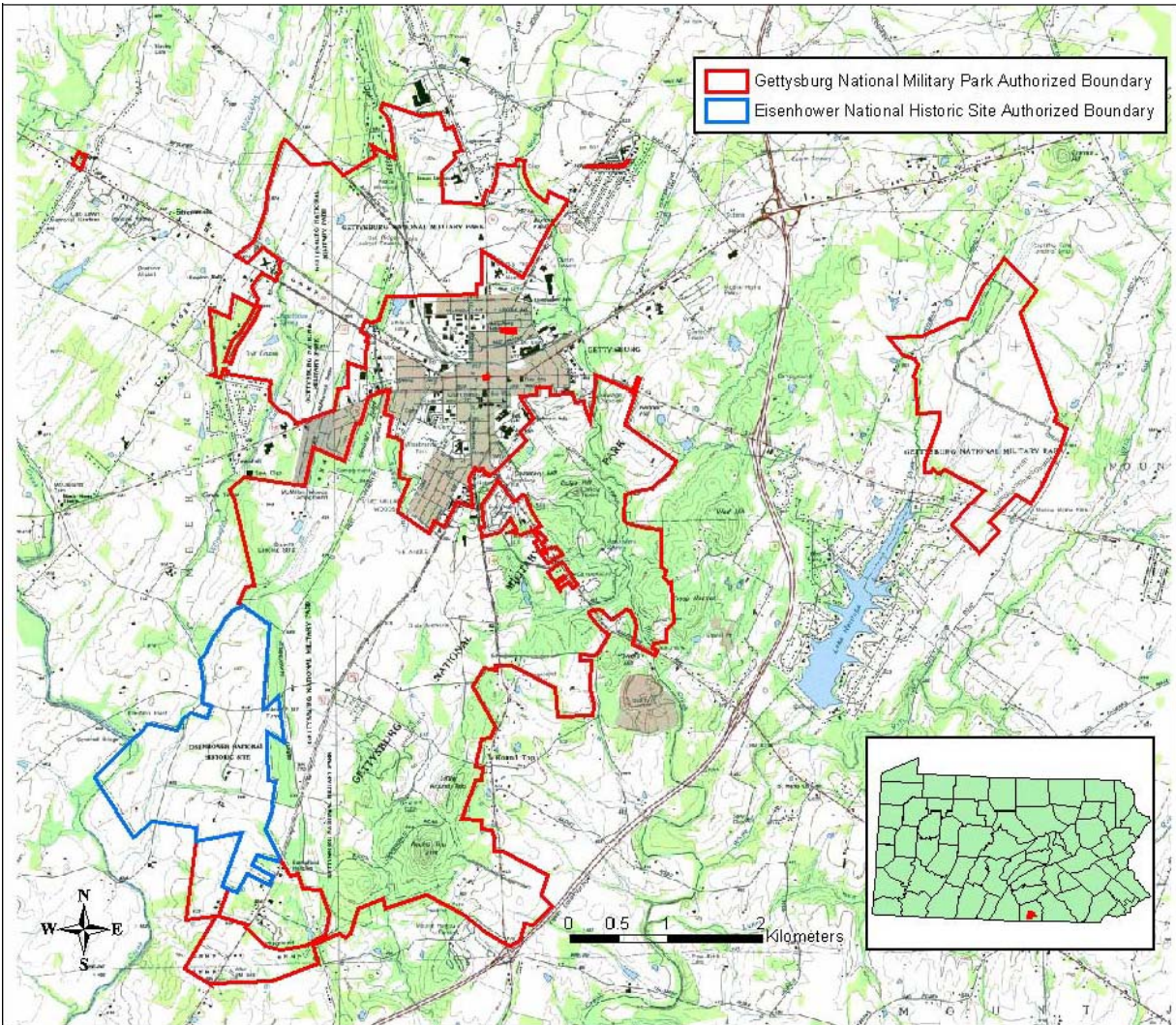


Figure 1. Location of Gettysburg National Military Park and Eisenhower National Historic Site, Adams County, Pennsylvania, on the Fairfield, PA and Gettysburg, PA 1:24,000 USGS topographic quad maps.

The most abundant soil in the parks is the Lehigh series, moderately well-drained to somewhat poorly drained silt loams that occur in the gently sloping uplands immediately adjacent to the diabase ridges. Lehigh soils can be very stony and can contain a few exposed boulders at the surface. The second most common soil series in the rolling lowlands is the Penn series that consist of deep, well-drained silt loams. Other common soils in the rolling lowlands are the Abottstown, Klimesville, Readington, Reaville, and Brecknock series. In general, these series contain shallow to deep, well-drained to somewhat poorly drained silt loams. The Croton series occurs in depressions, drainageways, and other level areas in the lowlands and contains deep, poorly drained silt loams. Within the floodplains of the larger creeks and streams in the parks, Hatboro, Bowansville, and Rowland series are common. These series contain moderately well-drained to poorly drained silt loam, gravelly loam, and sandy loam (Speir 1967).

The soils that occur over the diabase intrusions tend to be very stony and mineral-rich, and often support diverse herbaceous flora and several rare plant species. The most common soil over the diabase intrusions is the Neshaminy series, which contains deep, well-drained, very stony, channery silt loams. LeGorge and Mount Lucas series are other common soils. They are moderately deep to deep, somewhat poorly drained to well-drained channery silt loams that developed in material weathered from diabase. Stones and boulders can be common on the surface. Drainages over the diabase intrusions typically contain the Watchung series, deep, poorly-drained silty clay loams with occasional large diabase boulders (Speir 1967).

Larger creeks and smaller drainages locally called “runs” are common throughout the parks. In the northwest section of the Gettysburg National Military Park, Pitzer’s Run and Spangler’s Run drain into Willoughby Run. The main branch of Willoughby Run flows through Eisenhower National Historic Site and then joins Marsh Creek. A short stretch of the main branch of Marsh Creek also flows through the western border of Eisenhower National Historic Site. On the east side of Gettysburg National Military Park numerous small drainages, including Blocher’s Run, Stevens Run, Culp Run, Winebrenner’s Run, Jones Bridge Run, Spangler’s Spring Run, Guinn Run, and Wright Avenue Run, drain into Rock Creek. Sections of the main branch of Rock Creek also flow through the park. In the southcentral portion of Gettysburg National Military Park, Heagy’s Woods Run joins Plum Run, which is the prominent stream in that area. Plum Run eventually joins Rock Creek outside the park boundary. In the East Cavalry Field Unit of Gettysburg National Military Park, Plum Run (a different stream than the Plum Run mentioned above) joins White Run, which eventually flows into Rock Creek outside the park boundaries.

The landscape of Gettysburg National Military Park and Eisenhower National Historic Site is a mixture of agricultural fields, pastures, grasslands, woodlots, and forests. This landscape provides habitat for 187 bird, 34 mammal, 17 reptile, and 15 amphibian species that have been documented within the parks. Over 550 species of vascular plants have been inventoried within the parks, 410 of which are native species (National Park Service 2005a).

One of the primary goals of Gettysburg National Military Park is to preserve the topographic, landscape, and cultural features as they were in 1863, such that visitors and historians can fully understand and appreciate the Battle of Gettysburg. To this end, the 1999 Gettysburg National Military Park General Management Plan / Environmental Impact Statement outlined goals for rehabilitating the landscape. The rehabilitation will include replanting historic woodlots, orchards and grasslands; removing non-historic vegetation; restoring wetlands; fencing and

revegetating stream corridors; establishing original fencelines, lanes and trails; recreating historic viewsheds; and maintaining historic farms (National Park Service 2005a). If the rehabilitation plan is fully implemented, 336 ha (831 ac) of Gettysburg National Military Park, 14% of the park land, will have been altered. The implementation of the rehabilitation plan has been concurrent with the timeline of this vegetation classification and mapping project. Some evidence of woodlot removal can be seen in the 2003 aerial photography flown at the beginning of this project. Much additional work towards the rehabilitation goals has been completed during the intervening years, in many places significantly altering the vegetation.

## Materials and Methods

### Planning and Scoping

Several steps were taken to prepare for the mapping and classification of vegetation at Gettysburg National Military Park and Eisenhower National Historic Site. A planning and review meeting was held on April 25, 2003 with ecologists from the Pennsylvania Natural Heritage Program's Pennsylvania Science Office of The Nature Conservancy, National Park Service staff, and NatureServe staff. The project timeline, access issues, park resource management needs, rehabilitation of the battlefield, current vegetation management, and applicable previous research conducted at the parks were discussed. In addition, reconnaissance of the parks' vegetation types was conducted to estimate the number and distribution of vegetation associations in the parks.

### Preliminary Data Collection and Review of Existing Information

Previous studies conducted at Gettysburg National Military Park and Eisenhower National Historic Site were obtained from the parks' natural resource manager and reviewed for information pertinent to the parks' vegetation. These reports included previous vegetation cover-type mapping, research of historic woodlots and landscape features, and inventories of plant, amphibian, reptile, and bird species (Yahner et al. 1991; Storm et al. 1995; Yahner et al. 2001a; Yahner et al. 2001b; Storm et al. 2002). In addition, shapefiles containing digital information on bedrock geology, soils, streams, wetlands, park boundaries, and parcel ownership were obtained from the parks' GIS specialist.

### Aerial Photography Acquisition and Processing

Two digital orthophoto mosaics were produced for Gettysburg National Military Park (GETT) and Eisenhower National Historic Site (EISE) because aerial photography was acquired in two separate flights and because the file size of a single mosaic would be unmanageably large. One mosaic covers the western portion of Gettysburg National Military Park and all of Eisenhower

National Historic Site and is referred to below as the GETT/EISE mosaic. The second mosaic covers the eastern, East Cavalry Field (ECF) portion of Gettysburg National Military Park and is referred to below as the GETT/ECF mosaic. Color infrared, stereo pair 1:6,000 scale aerial photography for both mosaics was acquired from two overflights on April 13, 2003, during leaf-off conditions, by Kucera International. Both sets of photography with their corresponding airborne GPS/IMU files were delivered to the National Park Service (NPS) where the photography was 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 placed in the air photo archive maintained at NCSU for the NPS Northeast Region Inventory & Monitoring Program. The two sets of airborne GPS/IMU files, the camera calibration certificates, and a hard copy flight index map provided by Kucera International are also stored in the air photo archive.

The GETT/EISE and GETT/ECF mosaics were produced from 143 and 26 color infrared air photos, respectively, scanned at 600 dpi with 24-bit color depth. For each mosaic, scanned images of the relevant air photos were imported into ERDAS Imagine (.img) format where a photo block was created using airborne GPS and IMU data that Kucera International supplied with the aerial photography. Each 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 air photo) 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 the color balancing information and the cutlines created for each of the final mosaics. In ER Mapper, band interleaved by line (.bil) image and header files for each mosaic were generated, the .bil images were imported into Imagine .img format, and, finally, the .img images were compressed using MrSID software with a 20:1 compression ratio.

A metadata record for each mosaic was prepared according to current Federal Geographic Data Committee standards (FGDC 1998a). Metadata were produced in notepad and parsed using the USGS metadata compiler program (MP) to locate errors and omissions (USGS 2004). After all errors and omissions were corrected, MP was used to generate final TXT, HTML, and XML versions of each metadata record which are stored in the air photo archive. Key information for the GETT/EISE and GETT/ECF mosaics is summarized in Tables 1 and 2, respectively.

### Photointerpretation

After receiving the digital orthophoto mosaic from North Carolina State University, ecologists at the Pennsylvania Natural Heritage Program developed a formation-level vegetation map. Vegetation formations are the most general level in the NVCS and classify vegetation by structure and leaf phenology. This concept of a general level of classification that broadly differentiates between vegetation types is very useful for vegetation mapping, especially because vegetation structure and leaf phenology can be easily identified through aerial photograph interpretation. This concept of broad formation-level vegetation types was borrowed from the NVCS in order to guide the vegetation mapping process. A map of vegetation types, differentiated by vegetation structure and leaf phenology, was developed as a guide over which the vegetation sampling efforts would be distributed. This map was attributed with formation-

level names from the NVCS, solely as a guide. This map does not intend to identify specific NVCS formations for specific polygons, since each polygon's formation will be determined after the vegetation association classification and mapping according to the hierarchy of the NVCS.

The formation-level map was created through aerial photograph interpretation. Aerial photograph interpretation is the act of examining aerial photographs in order to identify objects, in this case vegetation types (Avery 1978). The diapositive photographs (color infrared, stereo pair, hard copy photographs) were examined through a stereoscope, which provides the viewer with a three-dimensional view of the photographs. The digital orthophoto mosaic was also examined onscreen in ArcView 3.2 (Environmental Systems Research Institute, Inc., 1992–2000). In addition, digital topographic quad maps were examined in ArcView 3.2. Using information gathered from the diapositives, the mosaic, and the topographic maps, polygons representing different vegetation types and land uses were identified. These polygons were digitized onscreen using ArcView 3.2. Polygons that represented vegetation were attributed with names of formation-level vegetation types borrowed from the National Vegetation Classification System. Polygons that represented other land uses, such as buildings and roads, were attributed with names modified from the Anderson level II categories (Anderson et al. 1976). To

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Table 1. Summary of key information for the Gettysburg National Military Park and Eisenhower National Historic Site mosaic.

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|   |  |
|---|--|
| Title of metadata record:   | Gettysburg National Military Park and Eisenhower National Historic Site Color Infrared Orthorectified Photomosaic (ERDAS Imagine .img and MrSID formats) |
| Publication date of mosaic (from metadata):   | September 15, 2004   |
| Date aerial photography was acquired:   | April 13, 2003 (leaf-off conditions)   |
| 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:   | 143  |
| Archive location of air photos, airborne GPS/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:   | 1.18 meters, meets Class 1 National Map Accuracy Standard  |
| Number of ground control points upon which estimated accuracy is based:                     | 63   |
| Method of calculating positional accuracy:  | Root mean square error (RMSE)  |
| Archive location of mosaic and metadata:  | North Carolina State University, Center for Earth Observation  |
| Format(s) of archived mosaic:   | .img (uncompressed);<br>MrSID (20:1 compression)   |

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Table 2. Summary of key information for the Gettysburg National Military Park/East Cavalry Field mosaic.

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|   |   |
|---|---|
| Title of metadata record:   | Gettysburg National Military Park/East Cavalry Field Color Infrared Orthorectified Photomosaic (ERDAS Imagine .img and MrSID formats) |
| Publication date of mosaic (from metadata):   | September 15, 2004  |
| Date aerial photography was acquired:   | April 13, 2003 (leaf-off conditions)  |
| 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:   | 26  |
| Archive location of air photos, airborne GPS/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:   | 0.93 meters, meets Class 1 National Map Accuracy Standard   |
| Number of ground control points upon which estimated accuracy is based:                     | 36  |
| Method of calculating positional accuracy:  | Root mean square error (RMSE)   |
| Archive location of mosaic and metadata:  | North Carolina State University, Center for Earth Observation   |
| Format(s) of archived mosaic:   | .img (uncompressed);<br>MrSID (20:1 compression)  |

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determine which formation-level vegetation types or modified Anderson level II categories should be assigned to each polygon, an aerial photography interpretation key (Appendix A) was used.

The resulting map (Figure 2) identified 764 map polygons each labeled with one of 19 different attributes (Table 3). Of these polygons, 192 represent built-up land, ponds, rivers, or transportation corridors. The remaining polygons were each attributed with one of 15 formation-level vegetation types. The number of total mapped hectares listed in Table 3 is larger than the size of the parks because the mapped polygons extend beyond the parks' boundaries. This formation-level vegetation map was used to guide vegetation plot sampling in the parks.

### Field Data Collection and Classification

All vegetation plot sampling followed the USGS/NPS Vegetation Mapping Program protocols (The Nature Conservancy and Environmental Systems Research Institute 1994b). The protocol suggests that each vegetation association should have been sampled at least three times in order to capture the naturally occurring variation within the parks. If each of the formation-level vegetation types listed in Table 3 represented only one association in Gettysburg National Military Park and Eisenhower National Historic Site, the minimum number of plots needed would have been 41. This assumed that areas labeled with modified Anderson level II categories would not be sampled, and that for formations with less than three polygons, one plot would be placed in each polygon. However, it is more likely that some formations represent multiple associations. Alternatively, a few of the formation-level vegetation types assigned to the map may actually represent a single association. This occurs because of significant variation in vegetation structure and leaf phenology caused by past land use, natural resource management, and environmental setting. This is contrary to the hierarchical nature of the NVCS, and illustrates why the formation-level map does not accurately reflect each polygon's NVCS formation. Regardless, the formation-level map is a useful guide to determine the intensity, distribution, and location of vegetation sampling.

Based on the formation-level map, our initial reconnaissance of these parks, and vegetation mapping efforts at other parks, we estimated that 112 plots was the maximum number of plots needed to sufficiently capture the range of vegetation types. One hundred and twelve polygons representing different aerial photograph signatures and formation-level vegetation types were then selected for sampling.

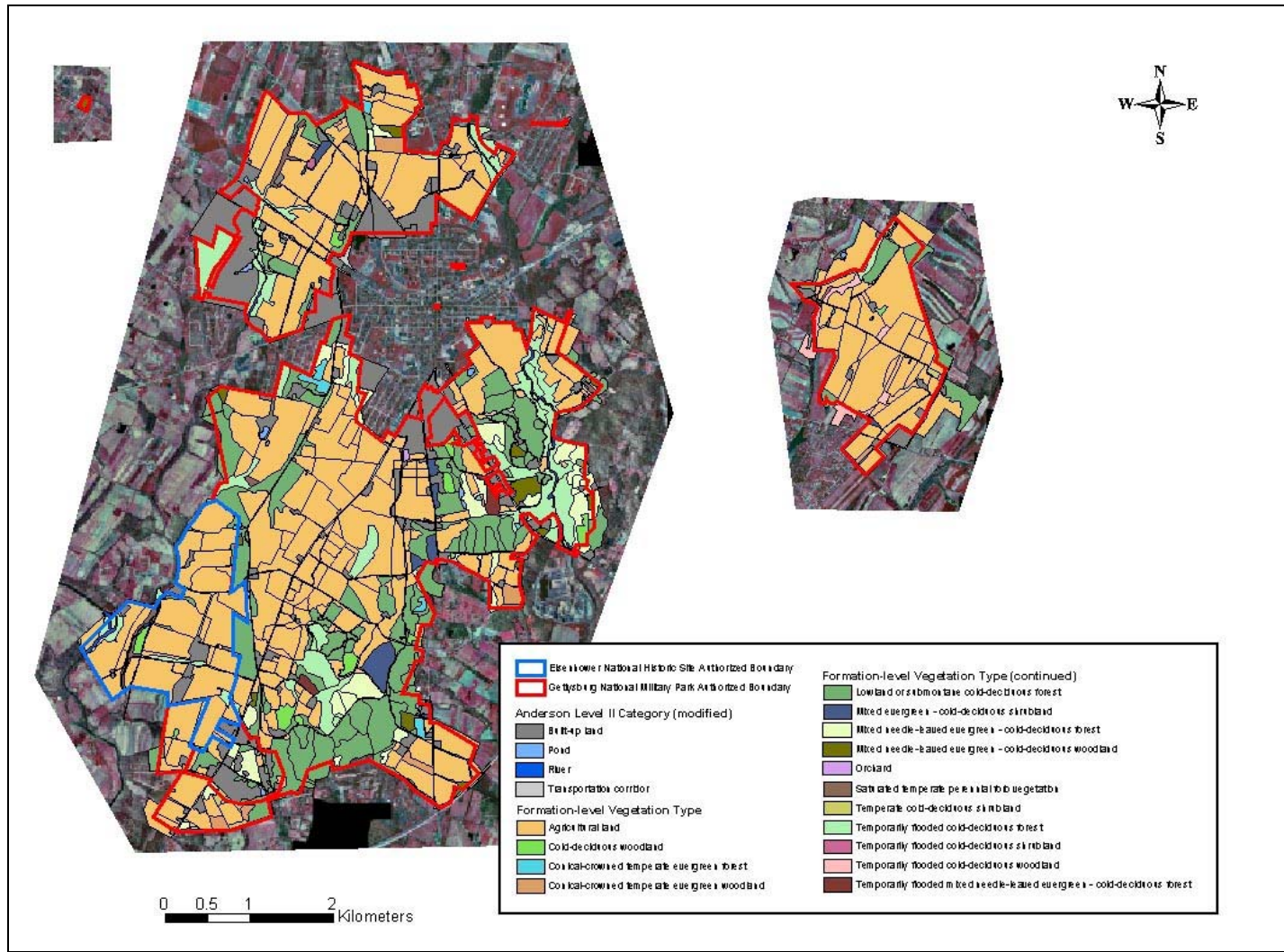


Figure 2. Formation-level vegetation types and Anderson level II categories (modified) for Gettysburg National Military Park and Eisenhower National Historic Site.

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Table 3. Number of polygons, total mapped hectares, mapped hectares within the park boundary, and number of plots sampled for formation-level vegetation types and Anderson level II categories (modified) at Gettysburg National Military Park and Eisenhower National Historic Site.

|   | Number of Polygons | Total Mapped Hectares | Mapped Hectares Within Park Boundaries | Number of Plots Sampled |
|---|--------------------|-----------------------|--|-------------------------|
| <b>Formation-level Vegetation Type</b>                                    |                    |                       |  |                         |
| Agricultural land   | 282                | 1,628.39              | 1,591.67                               | 15                      |
| Cold-deciduous woodland   | 15                 | 29.87                 | 29.68                                  | 1                       |
| Conical-crowned temperate evergreen forest                                | 11                 | 14.81                 | 14.03                                  | 2                       |
| Conical-crowned temperate evergreen woodland                              | 7                  | 22.46                 | 22.02                                  | 2                       |
| Lowland or submontane cold-deciduous forest                               | 123                | 516.04                | 435.51                                 | 23                      |
| Mixed evergreen - cold-deciduous shrubland                                | 8                  | 27.38                 | 27.35                                  | 4                       |
| Mixed needle-leaved evergreen - cold-deciduous forest                     | 31                 | 107.12                | 90.29                                  | 6                       |
| Mixed needle-leaved evergreen - cold-deciduous woodland                   | 17                 | 28.52                 | 25.73                                  | 1                       |
| Orchard   | 1                  | 0.84                  | 0.84                                   | 0                       |
| Saturated temperate perennial forb vegetation                             | 13                 | 13.28                 | 13.08                                  | 3                       |
| Temperate cold-deciduous shrubland  | 6                  | 6.58                  | 5.96                                   | 1                       |
| Temporarily flooded cold-deciduous forest                                 | 48                 | 204.06                | 186.63                                 | 12                      |
| Temporarily flooded cold-deciduous shrubland                              | 2                  | 0.91                  | 0.91                                   | 0                       |
| Temporarily flooded cold-deciduous woodland                               | 6                  | 18.69                 | 10.22                                  | 0                       |
| Temporarily flooded mixed needle-leaved evergreen – cold-deciduous forest | 2                  | 9.05                  | 8.78                                   | 0                       |
| <b>Anderson Level II Category</b>   |                    |                       |  |                         |
| Built-up land   | 151                | 349.91                | 215.56                                 | 0                       |
| Pond  | 18                 | 7.06                  | 6.05                                   | 0                       |
| River   | 7                  | 14.93                 | 11.79                                  | 0                       |
| Transportation corridor   | 16                 | 73.88                 | 59.57                                  | 0                       |
| <b>Total</b>  | <b>764</b>         | <b>3,074.77</b>       | <b>2,755.68</b>                        | <b>70</b>               |

## Field Survey

Within each polygon selected for sampling, a plot was established in an area that was most representative of the existing vegetation association (Mueller-Dombois and Ellenberg 1974). All vegetation data were collected following NatureServe's accepted natural heritage sampling protocols (Strakosch-Walz 2000), with 20x20-m (65x65 ft) plots in forests and woodlands, 10x10-m (33x33 ft) plots in shrublands, and 5x5-m (16x16 ft) plots in herbaceous vegetation. The plot sampling data form used in this project is shown in Appendix B. Abbreviated instructions for completing this form and definitions of the fields can be found in the NBS/NPS Vegetation Mapping Program: Field Methods for Vegetation Mapping manual (The Nature Conservancy and Environmental Systems Research Institute 1994b). The vegetation was visually divided into eight strata: emergent trees (variable height), tree canopy (variable height), tree subcanopy (>5 m [16 ft] in height), tall shrub (2–5 m [6–16 ft]), short shrub (<2 m [6 ft]), herbaceous, non-vascular, and vines. The percent cover was estimated for each species in each stratum using modified Braun – Blanquet cover classes (Strakosch-Walz 2000). Specimens of species that were not identifiable in the field were collected for later identification. In addition to floristic information, the following environmental variables were recorded at each plot: slope, aspect, topographic position, hydrologic regime, soil stoniness, average soil texture, and soil drainage. Any unvegetated area of the plot was characterized by the exposed substrate. Notes were taken on the plot representativeness of the surrounding vegetation and any other significant environmental information, such as landscape context, herbivory, stand health, recent disturbance, or evidence of historic disturbance. The vegetation profile and topographic position were sketched in cross-section to represent the location and setting of the plot. A digital photograph of each plot was also taken. The location of each plot was recorded with a Trimble Pocket Pathfinder attached to a Beacon-on-a-Belt global positioning system (GPS) unit, using a Compaq Ipaq Pocket PC as the interface. The datum on the GPS unit was set to North American 1983 (Conus) and the coordinate system was set to Universal Trans-Mercator (UTM) zone 18.

Plot sampling was conducted from May through August 2004. The diversity of vegetation types was significantly less than originally estimated; therefore, not all 112 vegetation plots were necessary to accurately capture the natural range of variation of the vegetation types in the parks. In polygons that were selected for sampling and that contained a vegetation type already adequately sampled in the park (>5 plots already collected), observations were recorded in lieu of collecting releve plot data. Observations were also recorded for some adjacent polygons that had not been selected for sampling. For these qualitative observations, the dominant plant species by strata, a provisional community type name, and general comments on the polygon's vegetation were recorded.

At the conclusion of plot sampling, 70 plots were sampled and observations were recorded for 81 additional polygons. Eight plots fell within the boundary of Eisenhower National Historic Site (GETT.46, GETT.47, GETT.64, GETT.65, GETT.66, GETT.67, GETT.68, AND GETT.69), and the remaining 62 plots were located in Gettysburg National Military Park (Figure 3). All vegetation types were sampled over a range of environmental variables. The distribution of plots by formation-level vegetation type is shown in Table 3. Four formation-level vegetation types, Orchard, Temporarily flooded cold-deciduous shrubland, Temporarily flooded cold-deciduous woodland, and Temporarily flooded mixed needle-leaved evergreen – cold-deciduous forest,

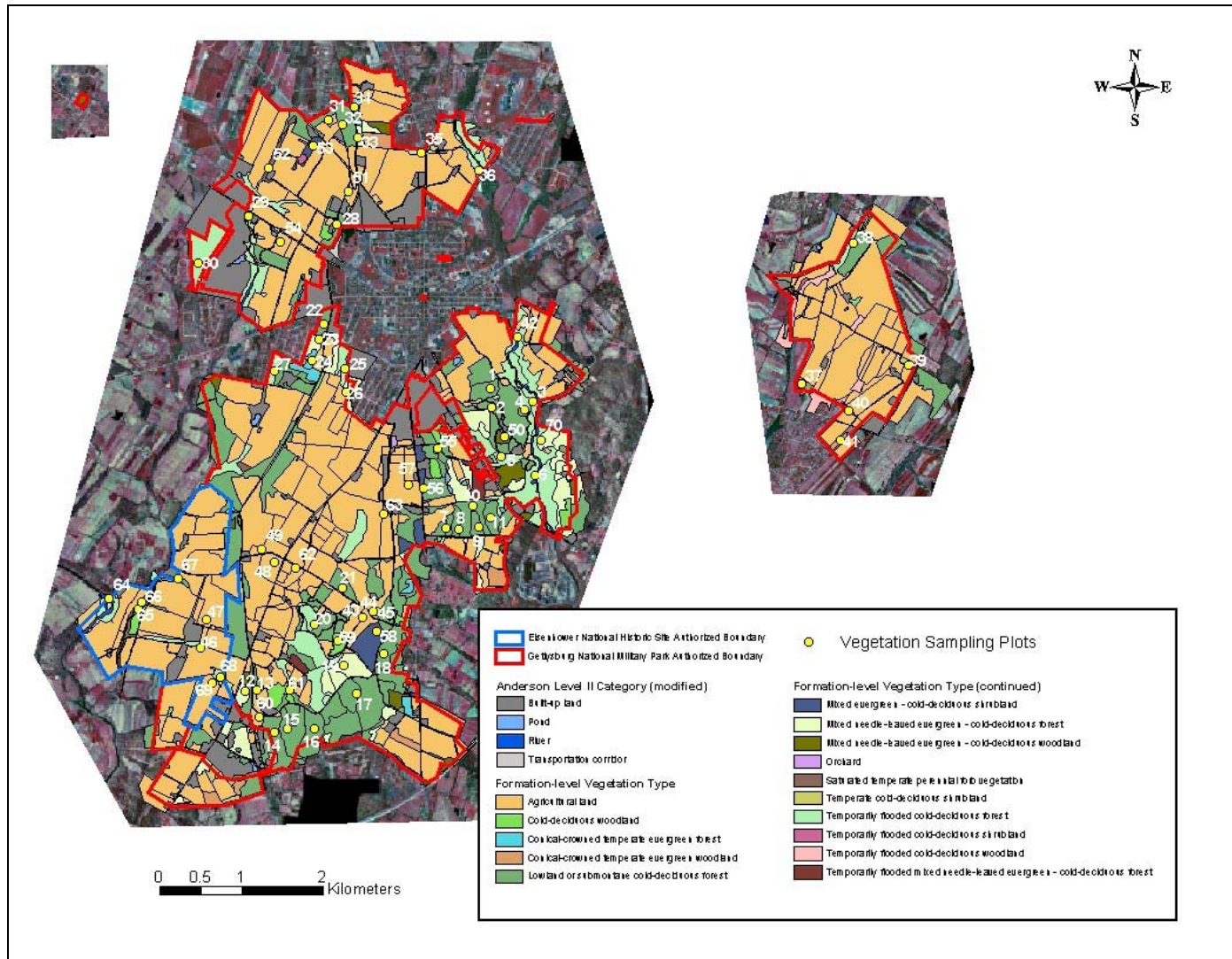


Figure 3. Locations of the 70 vegetation plots sampled in Gettysburg National Military Park and Eisenhower National Historic Site for vegetation classification and mapping.



were not sampled. The Orchard polygon was not sampled because it was a planted vegetation type not in need of further classification analysis. The Temporarily flooded cold-deciduous shrubland formation was not sampled because all of the polygons occurred on privately owned lands for which access was not available. The Temporarily flooded mixed needle-leaved evergreen – cold-deciduous forest polygons were not sampled because they contained vegetation types adequately sampled in polygons of other formations (i.e. this formation did not represent a unique vegetation type). The Temporarily flooded cold-deciduous woodland polygons either fell on private lands or were determined not to be unique vegetation types.

### Vegetation Classification and Characterization

Data from the 70 vegetation plots were entered into the NatureServe PLOTS 2.0 Database System on a Microsoft Access platform during September 2004. In the PLOTS 2.0 database, species were assigned standardized codes based on the *PLANTS Database, Version 3.5*, developed by the Natural Resource Conservation Service in cooperation with the Biota of North America Program (United States Department of Agriculture, National Resources Conservation Service 2006). For this report, some common names listed in the *PLANTS Database, Version 3.5*, were changed to reflect the common names typically used by ecologists and resource managers in this region. The common and scientific names of plants observed during the vegetation plot sampling are listed in Appendix C. Some tree and shrub seedlings and immature herbaceous plants could only be identified to the genus level and are therefore listed in the appendix as such. Environmental variables and species' percent cover data were exported from the PLOTS database into Excel in order to be manipulated into a format compatible with PC-ORD version 4.0 Multivariate Analysis software (McCune and Mefford 1999).

The vegetation plot data were analyzed using several multivariate statistical techniques available in the PC-ORD software. Different techniques were employed to provide multiple lines of evidence from which to interpret the results. For a detailed discussion of the statistical techniques used in this study, refer to McCune and Grace (2002). To classify the plot data into vegetation associations, a two-way indicator species analysis (TWINSPAN) was performed using the percent cover of species data. TWINSPAN successively divides the plots into groups that are similar in species composition (Hill and Gauch 1979). A non-metric multidimensional ordination analysis (NMS) was also performed using both the percent cover of species and the environmental variables from the plots. NMS is an ordination technique well suited to non-normal data sets (Kruskgal and Wish 1978). In this analysis, Sorensen distance measure, a random starting configuration, and a stability criterion of 0.005 were employed. Forty runs were performed with the real data, with a maximum of 400 iterations. A multi-response permutation procedure (MRPP) was also performed on the plots' environmental variables to determine if the differences between the vegetation associations classified by the TWINSPAN and NMS were statistically significant. Sorensen distance measure was used in the MRPP.

The results of the TWINSPAN and NMS analyses were evaluated and compared to the Terrestrial and Palustrine Plant Communities of Pennsylvania (Fike 1999), vegetation classifications at nearby national parks, and the ecologists' field experiences at Gettysburg National Military Park and Eisenhower National Historic Site. During this evaluation, it was determined that the plots that sampled palustrine forests were not grouping consistently in the analyses. Data from these palustrine forest plots (GETT.3, GETT.5, GETT.7, GETT.9,

GETT.20, GETT.21, GETT.25, GETT.27, GETT.29, GETT.35, GETT.36, GETT.40, GETT.42, GETT.67, and GETT.68) were then extracted from the whole data set. The TWINSpan and NMS were used to analyze these data.

Based on these analyses, park-specific local vegetation associations were identified and described in detail. These vegetation associations were then crosswalked to the Terrestrial and Palustrine Plant Communities of Pennsylvania (Fike 1999) and the National Vegetation Classification System (NVCS) (NatureServe 2006). The NVCS was developed by ecologists of the Natural Heritage Program network and The Nature Conservancy after many years of literature review, data collection, and data analysis. This collaborative effort culminated in the publication of *International Classification of Ecological Communities: Terrestrial Vegetation of the United States* (Grossman et al. 1998). The International Classification of Ecological Communities, now known as the International Vegetation Classification, of which the NVCS is a subset, has been revised and refined since 1998, and is now managed by NatureServe in continued collaboration with the network of Natural Heritage Programs. The classification is housed in the Biotics database and is updated regularly (NatureServe 2006). The upper levels of the NVCS were adopted as a standard by the Federal Geographic Data Committee to support the production of uniform statistics on vegetation at the national level (Federal Geographic Data Committee 1996). The USGS/NPS Vegetation Mapping Program adopted the alliance level, and where possible, the association level, as the mapping unit for national parks.

Based on the aforementioned analyses, the park-specific local vegetation associations were qualitatively compared to existing associations in the National Vegetation Classification System by searching for alliances sharing similar dominant species, as well as physiognomy and environmental setting. Total floristic composition was used to determine the appropriate association within the alliance. Global information on the associations from the NVCS was then appended to the local descriptions to provide resource managers with a broader context for the vegetation in the park.

Each vegetation association was assigned a common name based on the Terrestrial and Palustrine Plant Communities of Pennsylvania (Fike 1999). If no appropriate name existed in Fike (1999), the National Vegetation Classification System common name was used. A park-specific common name was created for successional and cultural vegetation types not easily handled by Fike (1999) or the NVCS.

A park-specific dichotomous key was created for the vegetation associations to guide accuracy assessment and for use by park natural resource managers and others (Appendix D). A dichotomous key is a tool for identifying unknown entities, in this case, vegetation associations. It is structured by a series of couplets, two statements that describe different, mutually exclusive characteristics of the associations. Choosing the statement that best fits the association in question leads the user to the correct association. The dichotomous key should be used in conjunction with the detailed vegetation association descriptions to confirm that the association selected with the key is appropriate.

## Vegetation Map Preparation

Following the vegetation data analysis, the formation-level vegetation map was further edited and refined to develop an association-level vegetation map. Using ArcView 3.2, polygon boundaries were revised onscreen based on the plot data and additional field observations. Each polygon was attributed with the name of a vegetation association based on plot data, field observations, classification analyses, aerial photography signatures, and topographic maps.

Several polygons were labeled as mosaics of two associations because both types were present in the polygons and clear boundaries between the two associations could not be delineated. The category of Cleared Land was added as an Anderson level II category (modified) for polygons that had recently undergone woodlot removal as part of the battlefield rehabilitation. An aerial photograph interpretation key for the vegetation associations and Anderson level II categories (modified) is located in Appendix A. After the vegetation association map was completed, the thematic accuracy of this map was assessed.

## 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 Vegetation Mapping Program protocols (The Nature Conservancy and Environmental Systems Research Institute 1994c) were followed to assess the positional and thematic accuracy of the Gettysburg National Military Park and Eisenhower National Historic Site vegetation map.

### Positional Accuracy Assessment

Well-defined positional accuracy ground-control points were placed throughout all quadrants of each final mosaic in ArcMap. 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. For each plotted ground-control point, field staff noted any alterations to the locations in the field, and then recorded the coordinates with a Trimble Pro XR/XRS or GeoXT. Mapped ground-control points that were physically inaccessible were also noted. The field crew correctly located and collected accuracy assessment data at 66 ground-control points for the GETT/EISE mosaic and at 38 ground-control points for the GETT/ECF mosaic. The coordinate data were collected with real time GPS and post processed with differential correction using Pathfinder Office software. Prior to calculating accuracy, three ground-control points for the GETT/EISE mosaic and two ground-control points for the GETT/ECF mosaic were identified as outliers with SAS's JMP program and removed. The field-collected "true" or "reference" GPS coordinates for the remaining 63 points for the GETT/EISE mosaic and 36 points for the GETT/ECF mosaic were compared to the coordinates obtained from each mosaic viewed in ArcMap. Both pairs of coordinates for each point were entered into a spreadsheet in order to calculate horizontal accuracy (in meters). The accuracy calculation formula is based on root mean square error (FGDC 1998b; Minnesota Governor's Council on Geographic Information and Minnesota Land Management Information Center



1999). Horizontal positional accuracy of the mosaics should meet Class 1 National Map Accuracy Standards (FGDC 1998b). Figures 4 and 5 show the distribution of the ground-control points for the GETT/EISE and GETT/ECF mosaics, respectively.

### Thematic Accuracy Assessment

The thematic accuracy of the vegetation map was assessed by the Pennsylvania Natural Heritage Program. A stratified random sampling approach was used, distributing the sampling effort across the vegetation associations (Table 4). Polygons labeled with modified Anderson level II categories were not included in the thematic accuracy assessment sampling. The thematic accuracy of the Dry Oak – Mixed Hardwood Forest (disturbed) polygons was assessed separately from the accuracy of the Dry Oak – Mixed Hardwood Forest polygons to determine if the disturbed stands could be reliably distinguished on aerial photography. Refer to the Vegetation Classification and Characterization results section within for complete discussions of the Dry Oak – Mixed Hardwood Forest (disturbed) map label. The polygons labeled as a mosaic of Wet Meadow and one of three other vegetation associations were lumped with the Wet Meadow polygons for the thematic accuracy assessment sampling plan. Since mosaics are not unique associations, they should not be sampled separately in thematic accuracy assessment. The Wet Meadow mosaic polygons were lumped with the Wet Meadow polygons instead of the Agricultural Field, Pasture, or Successional Old Field polygons because Wet Meadow is the least abundant of the four associations. Lumping the mosaic polygons with the least abundant association provides additional sampling opportunities for the rare association and thus increases the statistical power of the sample. Refer to the Vegetation Map Production results section within for complete discussions of the Wet Meadow mosaic map labels.

The number of samples per association varied according to the rarity of the vegetation type, both in terms of number of polygons and polygon size. The following rules were used to determine the number of points assigned to each association (The Nature Conservancy and Environmental Systems Research Institute 1994c):

- Scenario A: The association class is abundant. It covers more than 50 ha (124 ac) of the total area and consists of at least 30 polygons. In this case, it is recommended that 30 polygons be selected at random from the set of the association's polygons. One sampling point will be assigned to each of the 30 selected polygons.
  
- Scenario B: The association class is relatively abundant. It covers more than 50 ha (124 ac) of the total area but consists of fewer than 30 polygons. In this case, it is recommended that 20 polygons be selected at random from the set of the association's polygons, and that one sampling point be assigned to each of the 20 selected polygons. If the association contains less than 20 polygons, some polygons will contain multiple sampling points. The number of sampling points assigned to each polygon is determined by the relative area of that polygon compared with the other polygon in that association.

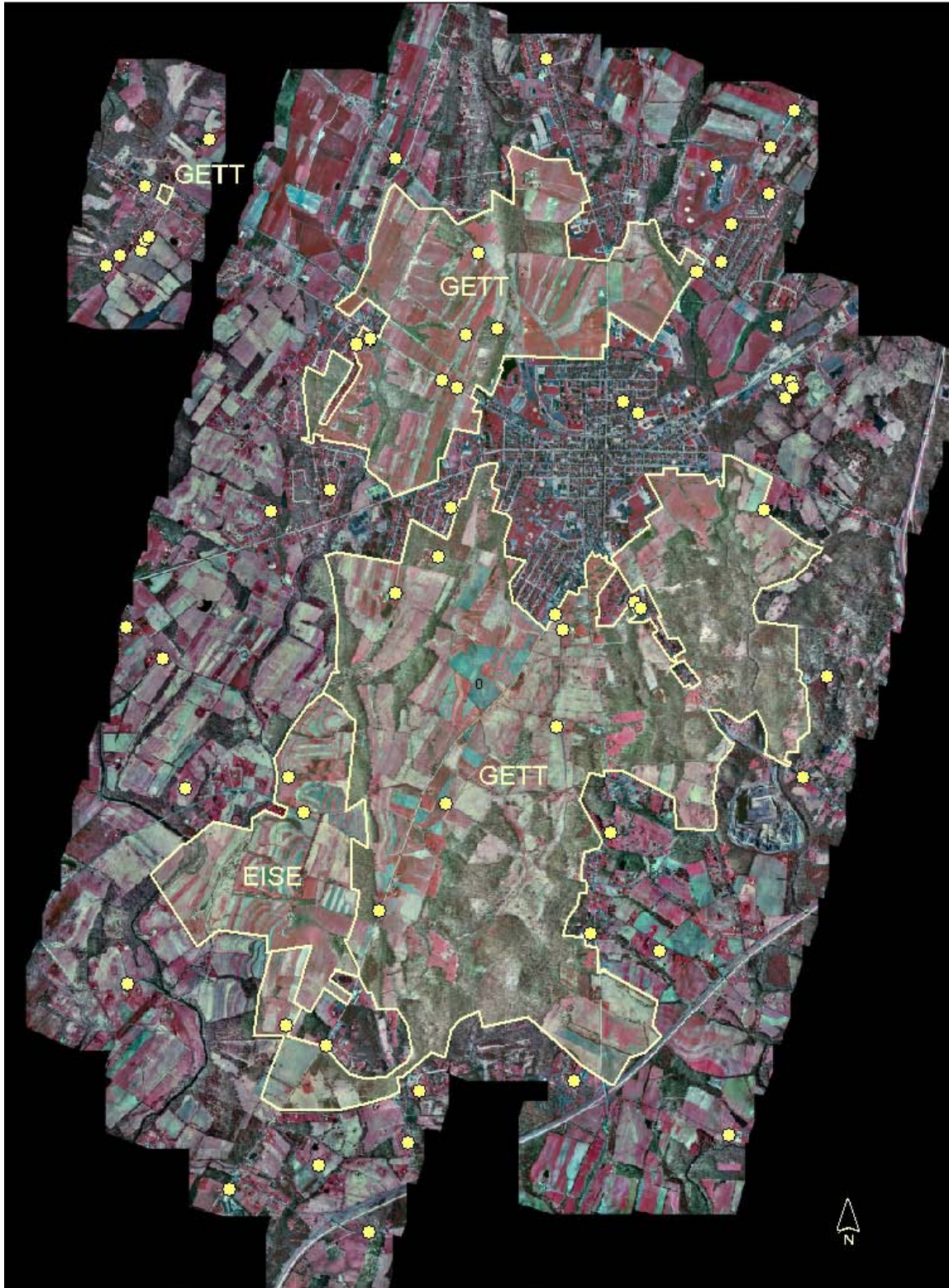


Figure 4. Ground control points used to calculate horizontal positional accuracy of the Gettysburg National Military Park and Eisenhower National Historic Site (GETT/EISE) mosaic.



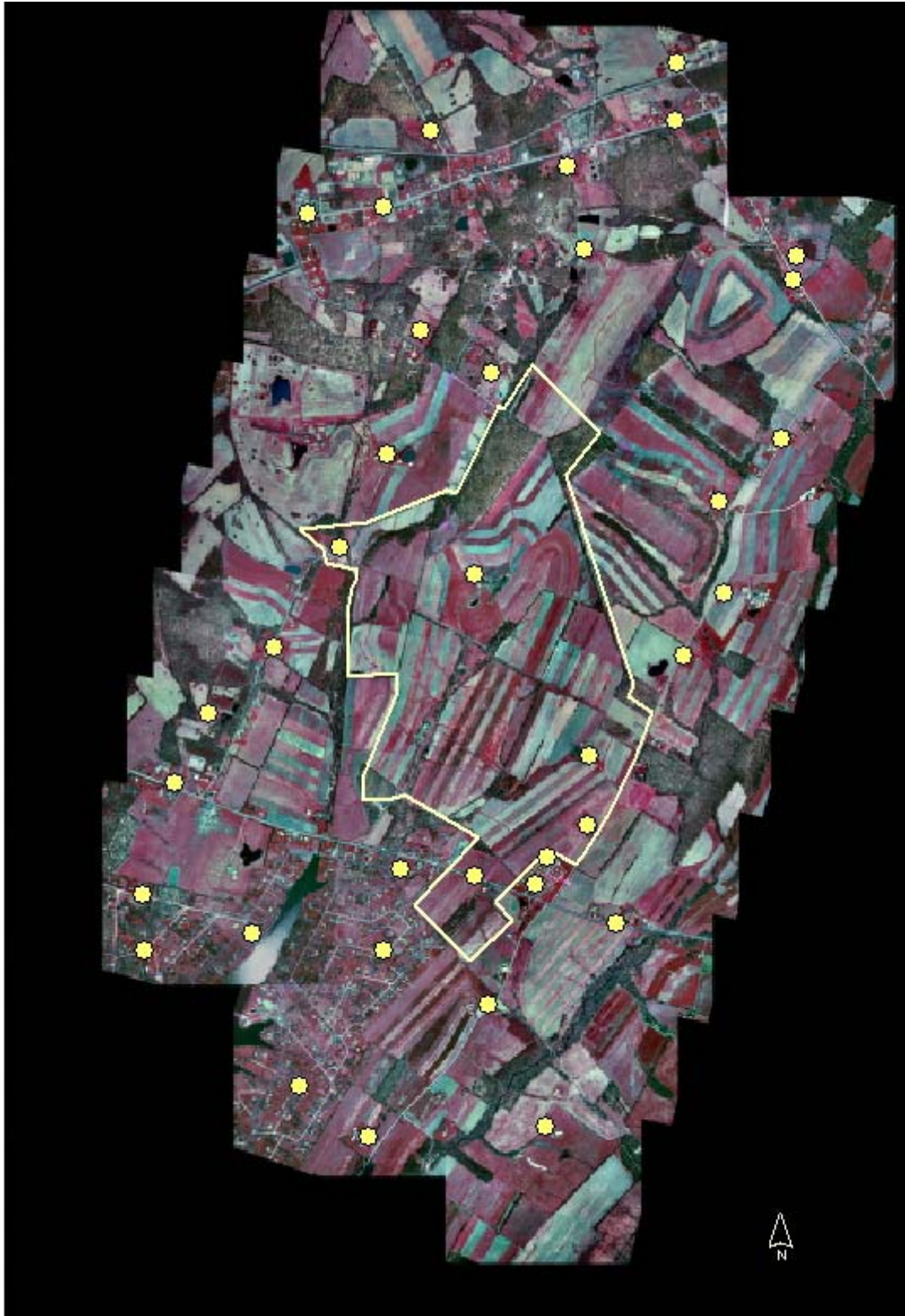


Figure 5. Ground control points used to calculate horizontal positional accuracy of the Gettysburg National Military Park/East Cavalry Field (GETT/ECF) mosaic.

**USGS – NPS Vegetation Mapping Program**  
**Gettysburg National Military Park and Eisenhower National Historic Site**

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Table 4. Thematic accuracy assessment (AA) sampling strategy for Gettysburg National Military Park and Eisenhower National Historic Site.

| Vegetation Association   | Number of Polygons | Mapped Hectares within Park Boundary | Number of AA points Recommended by Protocol <sup>1</sup> | Number of AA points Sampled |
|--|--------------------|--------------------------------------|--|-----------------------------|
| Agricultural Field   | 188                | 1,204.05                             | 30   | 30                          |
| Bottomland Oak - Hardwood Palustrine Forest <sup>2</sup>   | 39                 | 103.07                               | 30   | 28                          |
| Conifer Plantation   | 5                  | 10.24                                | 5  | 1                           |
| Chestnut Oak Forest  | 1                  | 3.12                                 | 1  | 1                           |
| Dry Oak - Mixed Hardwood Forest  | 64                 | 381.60                               | 30   | 30                          |
| Dry Oak - Mixed Hardwood Forest (disturbed) <sup>3</sup>   | 23                 | 143.80                               | 20   | 17                          |
| Green Ash Palustrine Forest <sup>2</sup>   | 5                  | 13.28                                | 5  | 5                           |
| Modified Successional Forest   | 64                 | 154.20                               | 30   | 30                          |
| Orchard  | 3                  | 6.96                                 | 3  | 3                           |
| Palustrine Shrub Thicket   | 1                  | 0.58                                 | 1  | 0                           |
| Pasture  | 25                 | 186.96                               | 20   | 19                          |
| Reed Canary Grass Riverine Grassland   | 5                  | 5.40                                 | 5  | 5                           |
| Successional Old Field   | 100                | 204.30                               | 30   | 30                          |
| Sycamore - Mixed Hardwood Floodplain Forest  | 6                  | 14.21                                | 5  | 4                           |
| Tuliptree Forest   | 2                  | 22.68                                | 2  | 2                           |
| Virginia Pine Successional Forest  | 2                  | 9.36                                 | 2  | 2                           |
| Wet Meadow and Mosaics of Wet Meadow with Agricultural Field, Pasture, or Successional Old Field | 26                 | 139.80                               | 20   | 20                          |
| <b>Total</b>   | <b>559</b>         | <b>2,603.61</b>                      | <b>239</b>   | <b>227</b>                  |

<sup>1</sup> The Nature Conservancy and Environmental Systems Research Institute. 1994 (c). NBS/NPS Vegetation Mapping Program: Accuracy Assessment Procedures. 71pp. Report to the National Biological Survey and the National Park Service. Arlington, VA and Redlands, CA. <http://biology.usgs.gov/npsveg/standards.html>. Last accessed 17 March 2005.

<sup>2</sup> Green Ash Palustrine Forest and Bottomland Oak – Hardwood Palustrine Forest associations were later lumped into a single association, Bottomland Mixed Hardwood Forest.

<sup>3</sup> Same association as Dry Oak – Mixed Hardwood Forest.

- Scenario C: The association class is relatively rare. It covers less than 50 ha (124 ac) of the total area but consists of more than 30 polygons. In this case, it is recommended that 20 polygons be selected at random from the set of the association's polygons. One sampling point will be assigned to each of the 20 selected polygons.
- Scenario D: The association class is rare. It has 5 – 30 polygons and covers less than 50 ha (124 ac) of the area. In this case, it is recommended that five polygons be selected at random from the set of the association's polygons. One sampling point will be assigned to each of the five selected polygons.
- Scenario E: The association class is very rare. It has fewer than five polygons and occupies less than 50 ha (124 ac) of the total area. In this case, it is recommended that one sampling point be assigned to each polygon.

In order to randomly select the polygons in Scenarios A, B, and D, the Create Random Selection tool in Hawth's Analysis Tools was used in ArcGIS (Environmental Systems Research Institute 1999; Beyer 2004). For all of the scenarios, the Generate Random Points tool in Hawth's Analysis Tools was used to randomly determine the location of the sampling points in the polygon. Scenario C was not used for this sampling design because no association met the criteria of that scenario.

The number of sampling points was reduced from that recommended by the protocol for Bottomland Oak - Hardwood Palustrine Forest, Conifer Plantation, Dry Oak – Mixed Hardwood Forest (disturbed), Palustrine Shrub Thicket, Pasture, and Sycamore – Mixed Hardwood Floodplain Forest because many of the polygons of these associations did not occur on park lands, but rather on inaccessible privately owned lands. The resulting 227 thematic accuracy assessment sampling points are shown in Figure 6.

From July through September 2005, each accuracy assessment point was located in the field using one of the following GPS units: Trimble Pocket Pathfinder attached to a Beacon-on-a-Belt with a Compaq Ipaq Pocket PC interface, Garmin 76C, or Garmin GPS map 76. The datum on the GPS units was set to North America 1983 (Conus) and the coordinate system was set to Universal Trans-Mercator (UTM) zone 18. The vegetation association at that location was then determined using the dichotomous key and the detailed vegetation descriptions. The minimum area of observation around the sampling point was a circle with a radius of 50 m (164 ft). The accuracy assessment data form used in this study is shown in Appendix E. Data from the 227 accuracy assessment points were then entered into the NatureServe PLOTS 2.0 Database System on a Microsoft Access platform during September 2005. In the PLOTS database, species were assigned standardized codes based on the *PLANTS Database, Version 3.5* (United States Department of Agriculture, National Resources Conservation Service 2006). For this report, some common names listed in the *PLANTS Database, Version 3.5* were changed to reflect the common names typically used by ecologists and resource managers in this region. The common and scientific names of plants observed during thematic accuracy assessment sampling are listed in Appendix C. Some tree and shrub seedlings and immature herbaceous plants could only be identified to the genus level and are therefore listed in the appendix as such.

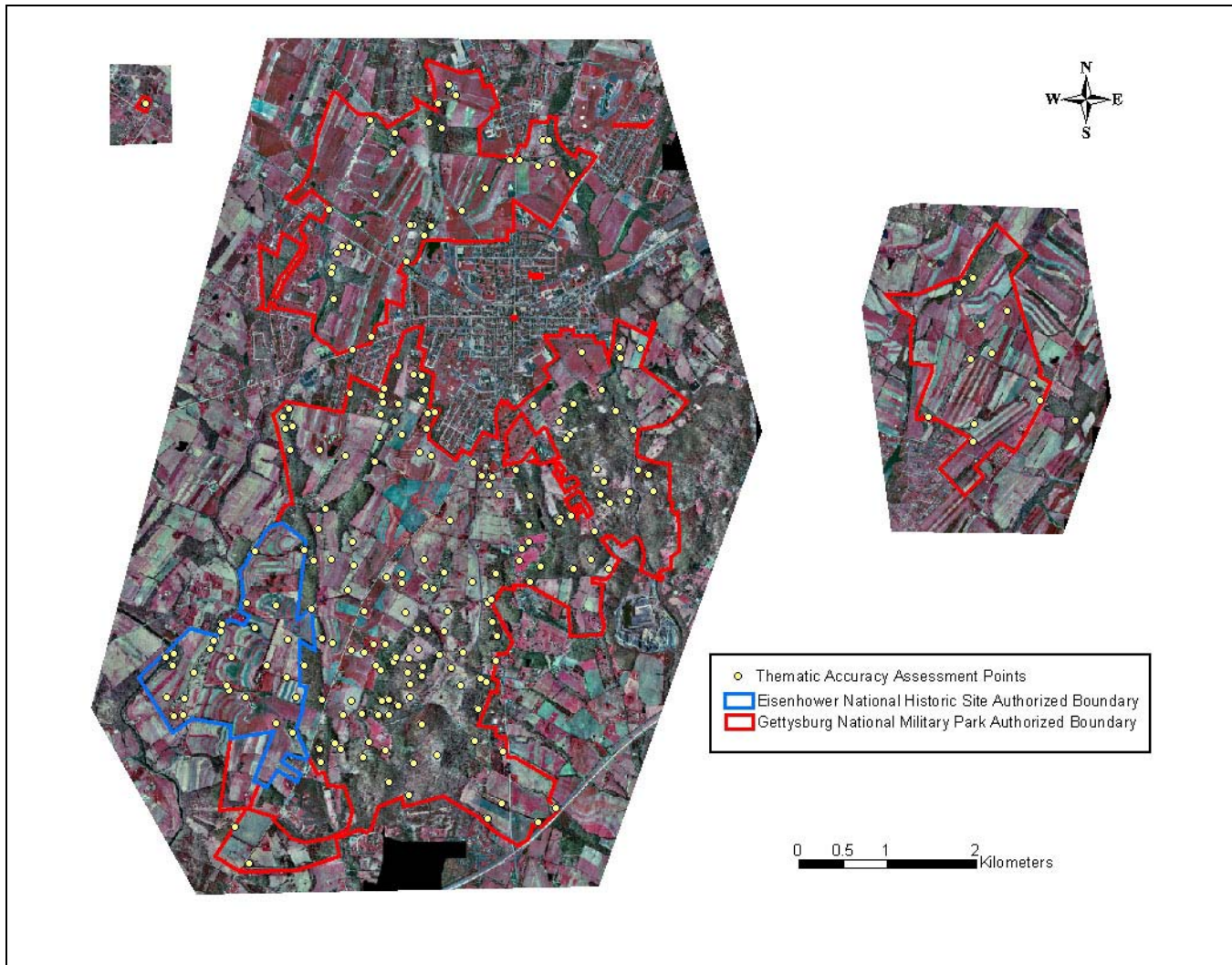


Figure 6. Locations of the 227 thematic accuracy assessment sampling points in Gettysburg National Military Park and Eisenhower National Historic Site.

The thematic accuracy was then tabulated using a contingency matrix that compared the mapped vegetation associations with the actual vegetation associations observed in the field. Overall percent accuracy and the Kappa index were calculated (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 vegetation mapping protocol requires that the Kappa index of vegetation associations maps exceed 80% (The Nature Conservancy and Environmental Systems Research Institute 1994c).

Errors of omission and errors of commission were also calculated for each vegetation association. Both of these errors are calculated by dividing the number of correctly classified points in one association by the total number of points sampled in that association. Errors of omission indicate the probability that an accuracy assessment point classification will be correct and are calculated by mapped vegetation type. Errors of commission indicate the probability that a mapped vegetation type actually represents the vegetation on the ground. This error is calculated by observed vegetation type. The errors of omission and errors of commission for mapped vegetation associations should exceed 80%, according to the USGS/NPS Vegetation Mapping Protocol (The Nature Conservancy and Environmental Systems Research Institute 1994c).

## Results

### Vegetation Classification and Characterization

The vegetation associations of Gettysburg National Military Park and Eisenhower National Historic Site were classified using TWINSpan and NMS analyses. The results of these two analyses were evaluated and compared to the Terrestrial and Palustrine Plant Communities of Pennsylvania (Fike 1999), vegetation classifications at nearby national parks, and the ecologists' field experiences at Gettysburg National Military Park and Eisenhower National Historic Site. Based on this evaluation, the dendrogram of the TWINSpan results was interpreted (Figure 7). The evaluation determined that 14 of the 70 vegetation sampling plots were misclassified in the original dendrogram output. Two associations, Modified Successional Forest and Bottomland Oak – Mixed Hardwood Palustrine Forest, contained 10 of the 14 misclassified plots. This is typical of associations with wide variation in species composition and vegetation structure, as is found in these associations. Plots from Pasture and Agricultural Field polygons were grouped together in the TWINSpan analysis because they share many common plant species.

The NMS analysis recommended a two-dimensional ordination (Figure 8). For each axis,  $p = 0.0196$  in which  $p$  is equal to the proportion of randomized runs in which the stress is less than or



equal to the observed stress. Stress in NMS analysis is calculated based on the distances between data points in the ordination space as compared to the same distances in higher-dimensionality space (McCune and Grace 2002). The cumulative  $r^2$  for the three axes was 0.504. Table 5 lists several environmental and physiognomic variables that showed strong correlations with the axes. As would be expected from these correlations, the palustrine associations tend to occur in the left side of the ordination diagram, while terrestrial associations occur in the right side of the diagram. Forests and woodlands tend to fall to the lower portion of the ordination, whereas shrublands occur in the central section of the diagram. Associations dominated by graminoids and herbs fell in the upper portion of the ordination (Figure 8). Figure 8 shows the ordination diagram with the plots grouped into vegetation associations as determined by the evaluation. The MRPP indicated that the differences between the associations identified by the evaluation were statistically significant ( $p=0.01$ ,  $A=0.08$ ,  $T=-2.49$ ).

In the initial TWINSpan and NMS analyses, plots sampled in palustrine forests did not group consistently. Data from these palustrine forest plots were then extracted from the whole data set and TWINSpan and NMS were used to analyze the palustrine forest data subset. The results from the palustrine forest TWINSpan and NMS analyses were not illustrative or significant. Given the ambiguity in the statistical analyses, the classification of the palustrine forest types was then based on the ecologist's experiences at Gettysburg National Military Park and Eisenhower National Historic Site and other vegetation classification and mapping projects. Two palustrine forest associations, Bottomland Oak – Hardwood Palustrine Forest and Green Ash Palustrine Forest, were identified. These two palustrine associations were described and mapped within the parks. However, during the thematic accuracy assessment it was determined that these two types frequently intergrade and co-occur even in very small polygons. Therefore, these two types were lumped into one generic association, Bottomland Mixed Hardwood Forest for the final classification and association map.



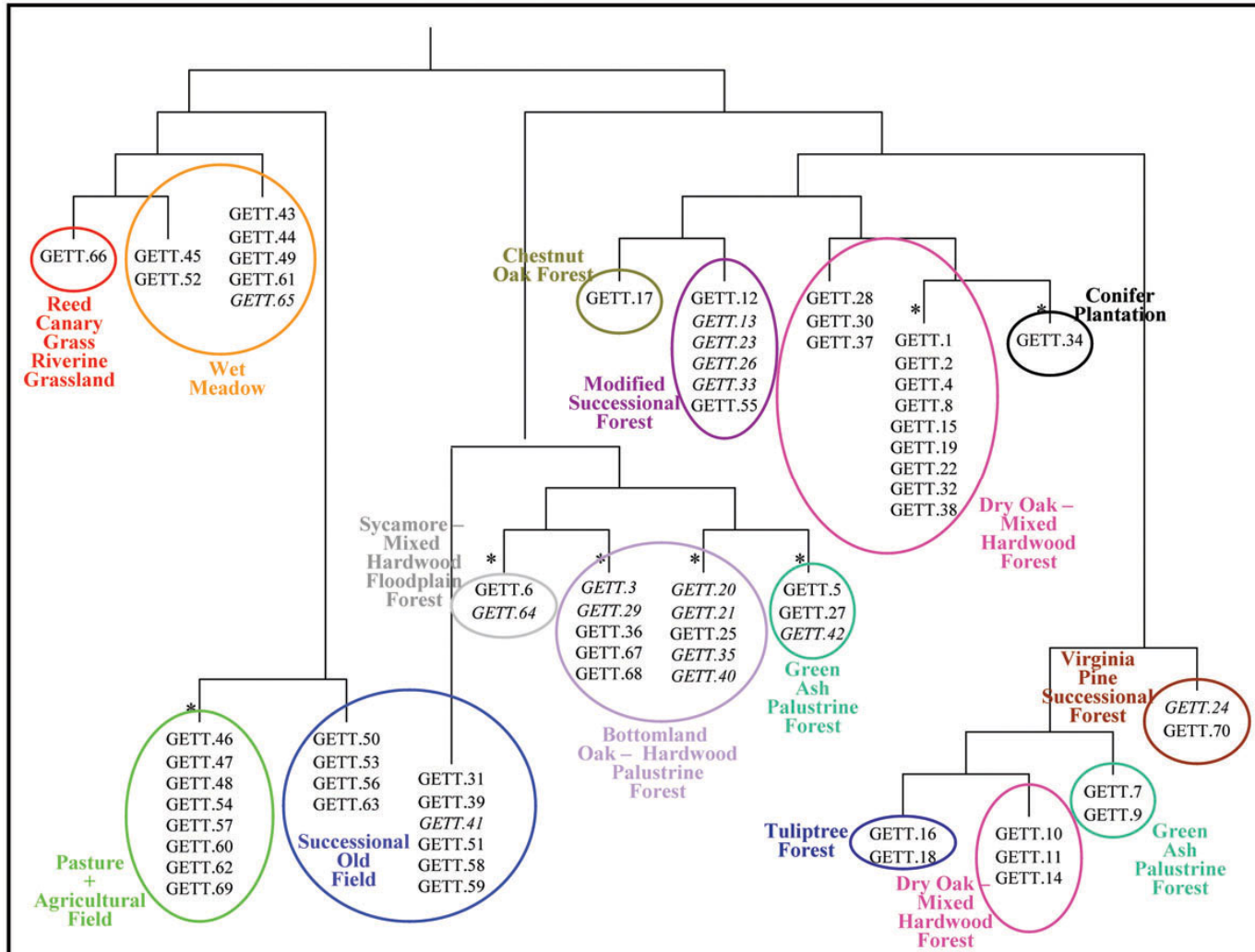


Figure 7. Dendrogram interpreted from the two-way indicator species analysis (TWINSPAN) results for vegetation data from Gettysburg National Military Park and Eisenhower National Historic Site. The plots that were determined through the results evaluation to be misclassified by the analysis are labeled in italics and are shown correctly classified. The branches of the dendrogram in which the misclassified plots were originally incorrectly located are marked with asterisks (\*). Please note that the Green Ash Palustrine Forest and Bottomland Oak – Hardwood Palustrine Forest associations were later lumped into a single association, Bottomland Mixed Hardwood Forest.

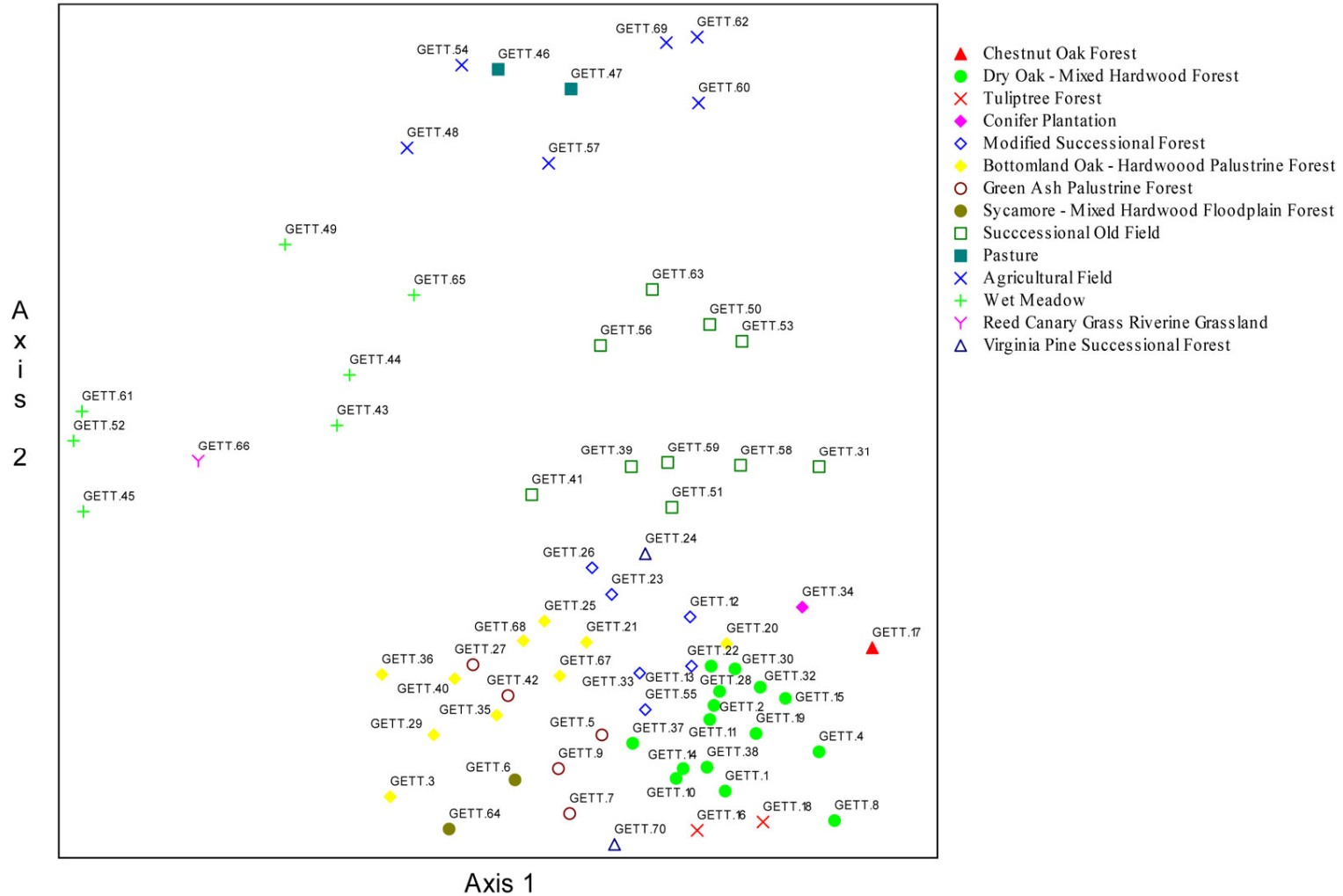


Figure 8. Ordination diagram from the non-metric multidimensional ordination analysis (NMS) showing vegetation associations in Gettysburg National Military Park and Eisenhower National Historic Site. Please note that the Green Ash Palustrine Forest and Bottomland Oak – Hardwood Palustrine Forest associations were later lumped into a single association, Bottomland Mixed Hardwood Forest.

Table 5. Correlations (r values) between measured variables and the two axes calculated in the non-metric multidimensional ordination analysis (NMS).

| Measured Variable                 | Axis 1 | Axis 2 |
|-----------------------------------|--------|--------|
| Percent cover of tree canopy      | 0.389  | -0.815 |
| Percent cover of subcanopy        | 0.316  | -0.714 |
| Percent cover of tall shrubs      | 0.216  | -0.523 |
| Percent cover of short shrubs     | 0.466  | -0.599 |
| Percent cover of herbaceous layer | -0.580 | 0.613  |
| Percent cover of vines            | 0.333  | -0.562 |
| Unvegetated Surface in Plot       |        |        |
| Percent cover of wood             | 0.363  | -0.635 |
| Percent cover of water            | -0.616 | 0.104  |

The data from Dry Oak – Mixed Hardwood Forest plots and field observations of that association indicated that many stands of Dry Oak – Mixed Hardwood Forest are significantly disturbed. These disturbed stands contain abundant invasive plant species, vines, and weedy tree species as associates in the canopy and subcanopy. However, the canopy and subcanopy of these disturbed stands are dominated by oaks (*Quercus* spp.) and hickories (*Carya* spp.) and therefore more closely resemble Dry Oak – Mixed Hardwood Forest than Modified Successional Forest in which the canopy and subcanopy are dominated by early successional weedy tree species such as eastern red-cedar (*Juniperus virginiana*), white ash (*Fraxinus americana*), black cherry (*Prunus serotina*), black walnut (*Juglans nigra*), and black locust (*Robinia pseudoacacia*) with oaks and hickories as occasional associates. Since Dry Oak – Mixed Hardwood Forest is the most abundant forest type in the parks, it is important to distinguished between high quality stands and disturbed stands of this forest type. Therefore, the qualifier Dry Oak – Mixed Hardwood Forest (disturbed) was used for these disturbed stands. Dry Oak – Mixed Hardwood Forest (disturbed) is not a unique vegetation association and therefore does not have a unique association description. Descriptions of the disturbed stands are included in the Dry Oak – Mixed Hardwood Forest description. However, mapped polygons that represent disturbed stands are identified with the Dry Oak – Mixed Hardwood Forest (disturbed) label.

The Palustrine Shrub Thicket and Orchard associations were not identified in the data analyses because these types were not sampled. The only example of the Palustrine Shrub Thicket association that existed during vegetation plot sampling occurred on inaccessible private lands. However, more examples of this association are being planted during the battlefield rehabilitation; therefore, this type was described based on roadside field observations of the one occurrence and the list of species that will be used in the rehabilitation. The Orchard association was not sampled because it was a planted vegetation type not in need of further classification analysis; however, it is an important vegetation type in Gettysburg National Military Park and the park resource managers requested that it be described and included in the association map.

Based on these analyses of multiple lines of evidence, field observations, and discussions with park resource managers, it was determined that the vegetation at Gettysburg National Military Park and Eisenhower National Historic Site can be described by 15 vegetation associations: Chestnut Oak Forest, Dry Oak – Mixed Hardwood Forest, Tuliptree Forest, Modified Successional Forest, Conifer Plantation, Virginia Pine Successional Forest, Sycamore – Mixed

Hardwood Floodplain Forest, Bottomland Mixed Hardwood Forest, Palustrine Shrub Thicket, Successional Old Field, Agricultural Field, Pasture, Orchard, Wet Meadow, and Reed Canary Grass Riverine Grassland.

### Vegetation Association Descriptions

Detailed local descriptions for the 15 vegetation associations were written based on plot data, photographs of each plot, thematic accuracy assessment data, and the ecologists' field observations at Gettysburg National Military Park and Eisenhower National Historic Site. When possible, these vegetation associations were then crosswalked to the Terrestrial and Palustrine Plant Communities of Pennsylvania (Fike 1999) and the National Vegetation Classification System (NVCS). Detailed local and global descriptions of the vegetation associations follow. Cultural vegetation types, such as Agricultural Field, Pasture, Orchard, and Palustrine Shrub Thicket, are not represented in the NVCS and therefore are not attributed with global descriptions. Representative photographs of the vegetation types are provided after the descriptions, except for the Palustrine Shrub Thicket and Orchard associations. An index of these photos is located in Appendix F. A bibliography for the sources cited in the global vegetation descriptions from the NVCS is provided in Appendix G. A list of the 469 plants found during the vegetation plot sampling and thematic accuracy assessment sampling is located in Appendix C.

A dichotomous key was also developed for these vegetation associations (Appendix D). The dichotomous key should be used in conjunction with the detailed vegetation community descriptions to confirm that the community selected with the key is appropriate. This key and the detailed vegetation community descriptions were used in the thematic accuracy assessment and may be used by park resource managers and others to identify vegetation communities in the parks.

**Common Name (Park-specific): Chestnut Oak Forest**

**SYNONYMS**

- NVC English Name:** Chestnut Oak - (White Oak, Scarlet Oak, Black Oak) / Mapleleaf Viburnum - (Mountain Laurel) Forest
- NVC Scientific Name:** *Quercus prinus* - *Quercus (alba, coccinea, velutina)* / *Viburnum acerifolium* - (*Kalmia latifolia*) Forest
- NVC Identifier:** C EGL005023

**LOCAL INFORMATION**

**Environmental Description:** This association occurs above 200 m in elevation on the summit of Big Round Top. This forest type is found on xeric, acidic sites over shallow, rocky Neshaminy channery silt loam.

**Vegetation Description:** The closed canopy is dominated by chestnut oak (*Quercus prinus*) with associates of black oak (*Quercus velutina*), scarlet oak (*Quercus coccinea*), and/or white oak (*Quercus alba*). Other canopy and subcanopy tree species include mockernut hickory (*Carya alba*), pignut hickory (*Carya glabra*), red hickory (*Carya ovalis*), common serviceberry (*Amelanchier arborea*), sassafras (*Sassafras albidum*), blackgum (*Nyssa sylvatica*), black cherry (*Prunus serotina*), and red maple (*Acer rubrum*). Canopy trees tend to extend 25–30 m in height, while subcanopy trees are typically 10–15 m in height. A sparse tall-shrub layer contains eastern redbud (*Cercis canadensis*), white ash (*Fraxinus americana*), and species from the canopy. The short-shrub layer contains mostly ericaceous species, predominantly Blue Ridge blueberry (*Vaccinium pallidum*), with occasional mountain laurel (*Kalmia latifolia*), northern lowbush blueberry (*Vaccinium angustifolium*), and black huckleberry (*Gaylussacia baccata*). Mapleleaf viburnum (*Viburnum acerifolium*) is another prominent short shrub, along with northern dewberry (*Rubus flagellaris*) and seedlings of canopy trees. Owing largely to the thick, resistant oak/ericad leaf litter, the herbaceous layer is generally sparse. Common constituents include white snakeroot (*Ageratina altissima* var. *altissima*), wreath goldenrod (*Solidago caesia*), smooth Solomon's seal (*Polygonatum biflorum*), feathery false lily of the valley (*Maianthemum racemosum* ssp. *racemosum*), and whitetinge sedge (*Carex albicans*). Virginia creeper (*Parthenocissus quinquefolia*) may be an abundant vine in this forest type.

**Most Abundant Species:**

| <u>Stratum</u>      | <u>Lifeform</u>              | <u>Species</u>   |
|---------------------|------------------------------|--|
| Tree canopy         | Broad-leaved deciduous tree  | <i>Quercus prinus</i>  |
| Tree subcanopy      | Broad-leaved deciduous tree  | <i>Carya alba</i>  |
| Tall shrub/sapling  | Broad-leaved deciduous shrub | <i>Cercis canadensis</i>   |
| Short shrub/sapling | Broad-leaved deciduous shrub | <i>Vaccinium pallidum</i> , <i>Viburnum acerifolium</i>                      |
| Herb (field)        | Vine/Liana                   | <i>Parthenocissus quinquefolia</i>   |
| Herb (field)        | Forb                         | <i>Ageratina altissima</i> var. <i>altissima</i> ,<br><i>Solidago caesia</i> |
| Herb (field)        | Graminoid                    | <i>Carex albicans</i>  |

**Characteristic Species:** *Carya alba*, *Quercus prinus*, *Vaccinium pallidum*.

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

**Subnational Distribution with Crosswalk Data:**

| <u>State</u> | <u>State Rank</u> | <u>Confidence</u> | <u>State Name</u>      | <u>Reference</u> |
|--------------|-------------------|-------------------|------------------------|------------------|
| PA           | S4S5              | 1                 | Dry oak - heath forest | Fike 1999        |

**Local Range:** This forest type occurs only near the summit of Big Round Top.

**Classification Comments:** The dominance of chestnut oak in the canopy and ericaceous shrubs in the understory distinguishes this forest type from Dry Oak-Mixed Hardwood Forest that is dominated by white oak and red oak and lacks a prominent ericaceous layer.

**Other Comments:** Information not available.

**Local Description Authors:** S. Perles.

**Plots:** GETT.17.

**Gettysburg National Military Park and Eisenhower National Historic Site Inventory Notes:** Information not available.

**GLOBAL INFORMATION**

**NVC CLASSIFICATION**

|                              |  |
|------------------------------|--|
| Physiognomic Class           | Forest (I)   |
| Physiognomic Subclass        | Deciduous forest (I.B.)  |
| Physiognomic Group           | Cold-deciduous forest (I.B.2.)   |
| Physiognomic Subgroup        | Natural/Semi-natural cold-deciduous forest (I.B.2.N.)  |
| Formation                    | Lowland or submontane cold-deciduous forest (I.B.2.N.a.)   |
| Alliance                     | Quercus prinus - (Quercus coccinea, Quercus velutina) Forest Alliance (A.248)  |
| Alliance (English name)      | Chestnut Oak - (Scarlet Oak, Black Oak) Forest Alliance  |
| Association                  | <i>Quercus prinus</i> - <i>Quercus (alba, coccinea, velutina)</i> / <i>Viburnum acerifolium</i> - ( <i>Kalmia latifolia</i> ) Forest |
| Association (English name)   | Chestnut Oak - (White Oak, Scarlet Oak, Black Oak) / Mapleleaf Viburnum - (Mountain Laurel) Forest                                   |
| <b>Ecological System(s):</b> | Central Appalachian Dry Oak-Pine Forest (CES202.591)   |

**GLOBAL DESCRIPTION**

**Concept Summary:** This chestnut oak - mixed oak forest community is found in the Allegheny Plateau region of Ohio, Pennsylvania and West Virginia. Stands occur on dry to xeric upper slopes and narrow ridgetops. Soils are shallow and occur over non-calcareous bedrock of sandstone, conglomerate, or shale. Tree species commonly include *Quercus prinus* and *Quercus coccinea*, along with *Quercus alba*, *Quercus rubra*, and *Quercus velutina*. *Castanea dentate* was a major component in the past and may be evident as root sprouts and/or decaying stumps and logs. Other associates can include *Acer rubrum* var. *rubrum*, *Carya alba*, *Nyssa sylvatica*, *Oxydendrum arboreum*, and occasional *Pinus* spp. (*Pinus echinata*, *Pinus rigida*, *Pinus virginiana*). Tall shrubs and small trees can include *Cornus florida*, *Sassafras albidum*, and *Viburnum acerifolium*. Characteristic dwarf-shrubs and vines include *Gaylussacia baccata*, *Gaultheria procumbens*, *Smilax glauca*, *Smilax rotundifolia*, *Vaccinium pallidum*, *Vaccinium stamineum*, and, more locally, *Kalmia latifolia*. The herbaceous layer includes *Antennaria plantaginifolia*, *Symphotrichum cordifolium*, *Carex pensylvanica*, *Cypripedium acaule*, *Danthonia spicata*, *Epigaea repens*, *Helianthus divaricatus*, *Helianthus hirsutus*, *Dichanthelium dichotomum*, *Polystichum acrostichoides*, and others. Lichens (*Cladina* spp. and *Cladonia* spp.) and mosses can form a prominent layer.

**Environmental Description:** Stands occur on dry/xeric upper slopes and narrow ridgetops. Soils are typically shallow and occur over non-calcareous bedrock of sandstone, conglomerate, or shale. In the glaciated region of the Allegheny Plateau, stands are more isolated, but have been reported over dry glacial features, such as kames or gravel knobs (Anderson 1996).

**Vegetation Description:** Tree species commonly include *Quercus prinus* and *Quercus coccinea*, along with *Quercus alba*, *Quercus rubra* and *Quercus velutina*. *Castanea dentata* was a major component in the past. Other associates can include *Acer rubrum*, *Carya alba*, *Nyssa sylvatica*, *Oxydendrum arboreum*, and occasional *Pinus* spp. (*Pinus echinata*, *Pinus rigida*, *Pinus virginiana*). Tall shrubs and small trees can include *Cornus florida*, *Sassafras albidum*, and *Viburnum acerifolium*. Characteristic dwarf-shrubs and vines include *Gaylussacia baccata*, *Gaultheria procumbens*, *Smilax glauca*, *Smilax rotundifolia*, *Vaccinium pallidum*, *Vaccinium stamineum*, and, more locally, *Kalmia latifolia*. The herbaceous layer includes *Antennaria plantaginifolia*, *Symphotrichum cordifolium*, *Carex pensylvanica*, *Cypripedium acaule*, *Dichantherium dichotomum* var. *dichotomum*, *Danthonia spicata*, *Epigaea repens*, *Helianthus divaricatus*, *Helianthus hirsutus*, *Polystichum acrostichoides*, and others. Lichens (*Cladonia* spp. and *Cladonia* spp.) and mosses can form a prominent layer (Anderson 1996, Fike 1999).

**Most Abundant Species:**

| <u>Stratum</u>     | <u>Lifeform</u>              | <u>Species</u>  |
|--------------------|------------------------------|---|
| Tree canopy        | Broad-leaved deciduous tree  | <i>Quercus coccinea</i> , <i>Quercus prinus</i>                                       |
| Tree subcanopy     | Broad-leaved deciduous tree  | <i>Cornus florida</i> , <i>Sassafras albidum</i>                                      |
| Tall shrub/sapling | Broad-leaved deciduous shrub | <i>Viburnum acerifolium</i>   |
| Herb (field)       | Dwarf-shrub                  | <i>Gaultheria procumbens</i> , <i>Gaylussacia baccata</i> , <i>Vaccinium pallidum</i> |
| Herb (field)       | Vine/Liana                   | <i>Smilax glauca</i> , <i>Smilax rotundifolia</i>                                     |
| Herb (field)       | Forb                         | <i>Ageratina altissima</i> var. <i>altissima</i> , <i>Solidago caesia</i>             |
| Herb (field)       | Graminoid                    | <i>Carex albicans</i>   |

**Characteristic Species:** *Gaultheria procumbens*, *Gaylussacia baccata*, *Quercus prinus*, *Smilax glauca*, *Smilax rotundifolia*, *Vaccinium pallidum*.

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

**USFWS Wetland System:** Not applicable.

**DISTRIBUTION**

**Range:** This chestnut oak - mixed oak forest community is found in the United States from Ohio, Pennsylvania and West Virginia. It is not found in Kentucky, which is south of its range.

**States/Provinces:** OH, PA, WV.

**Federal Lands:** NPS (Gettysburg).

**CONSERVATION STATUS**

**Rank:** G4? (1-Feb-2001).

**Reasons:** This is a widespread type; *Quercus prinus* replaces itself after canopy removal, seeds germinate in the shade of parent trees, and stands can also replace themselves from stump sprouts.

**CLASSIFICATION INFORMATION**

**Status:** Standard.

**Confidence:** 2 – Moderate.

**Comments:** This is the historic chestnut oak forest after loss of chestnut. *Quercus alba* may often be a codominant. *Quercus velutina* and *Quercus rubra* may be as common as *Quercus coccinea* in Ohio stands. In Ohio the type apparently occurs on both the glaciated and unglaciated portions of the Allegheny Plateau. Distinguishing this type from *Quercus alba* – *Quercus rubra* - *Carya ovata* Glaciated Forest (CEGL002068) may require some minimum cutoff values for the dominance of *Quercus prinus* and *Quercus coccinea* (perhaps at least 20% cover or basal area of either), or ground layer species, such as *Vaccinium* or the lichens and mosses. Dominance by *Acer saccharum* (perhaps at least 25%) would place a stand in *Quercus alba* - *Quercus rubra* - *Quercus prinus* - *Acer saccharum* / *Lindera benzoin* Forest (CEGL002059), the Appalachian oak - maple type. Compare this type with *Quercus prinus* – *Quercus (rubra, velutina)* / *Vaccinium angustifolium* Forest (CEGL006282) and *Quercus prinus* / *Smilax* spp. Forest (CEGL005022).

**Similar Associations:**

- *Pinus virginiana* - *Pinus (rigida, echinata)* - (*Quercus prinus*) / *Vaccinium pallidum* Forest (CEGL007119).
- *Quercus (pinus, coccinea)* / *Kalmia latifolia* / (*Galax urceolata, Gaultheria procumbens*) Forest (CEGL006271).
- *Quercus alba* - (*Quercus prinus*) / (*Hydrangea quercifolia*) - *Viburnum acerifolium* / *Carex picta* - *Piptochaetium avenaceum* Forest (CEGL008430).
- *Quercus alba* - *Quercus rubra* - *Carya ovata* Glaciated Forest (CEGL002068).
- *Quercus alba* - *Quercus rubra* - *Quercus prinus* - *Acer saccharum* / *Lindera benzoin* Forest (CEGL002059)--(Appalachian oak-maple).
- *Quercus prinus* - (*Quercus coccinea*) / *Carya pallida* / *Vaccinium arboreum* – *Vaccinium pallidum* Forest (CEGL008431).
- *Quercus prinus* - *Quercus (rubra, velutina)* / *Vaccinium angustifolium* Forest (CEGL006282)--a more eastern equivalent?
- *Quercus prinus* - *Quercus* spp. / *Vaccinium arboreum* - (*Kalmia latifolia, Styrax grandifolius*) Forest (CEGL007700)--a southern equivalent primarily of the Interior Low Plateau.
- *Quercus prinus* - *Quercus velutina* / *Oxydendrum arboreum* - *Cornus florida* Forest (CEGL008522).
- *Quercus prinus* / *Smilax* spp. Forest (CEGL005022)--is perhaps a more xeric type.
- *Quercus rubra* - *Acer saccharum* - *Liriodendron tulipifera* Forest (CEGL006125).

**Related Concepts:** Information not available.

**SOURCES**

**Description Authors:** D. Faber-Langendoen, mod. M. Pyne.

**References:** Anderson 1996, Fike 1999, Midwestern Ecology Working Group n.d.





Figure 9. Chestnut Oak Forest in Gettysburg National Military Park (plot GETT.17). May 2004.  
NAD 1983 / UTM easting 308263, northing 4406511.

## Common Name (Park-specific): Dry Oak – Mixed Hardwood Forest

### SYNONYMS

**NVC English Name:** (White Oak, Northern Red Oak, Black Oak) / Flowering Dogwood / Mapleleaf Viburnum Forest

**NVC Scientific Name:** *Quercus (alba, rubra, velutina)* / *Cornus florida* / *Viburnum acerifolium* Forest

**NVC Identifier:** C EGL006336

### LOCAL INFORMATION

**Environmental Description:** This common forest type occurs on upland slopes on silt loam soils from the Lehigh, Neshaminy, Watchung, Mount Lucas, Penn, and Brecknock series. Large boulders and rock outcrops can be common. Evidence of heath cuts or herbicide treatments on invasive species may be present.

**Vegetation Description:** The canopy is dominated by white oak (*Quercus alba*) and/or northern red oak (*Quercus rubra*), with associates pignut hickory (*Carya glabra*), black oak (*Quercus velutina*), white ash (*Fraxinus americana*), mockernut hickory (*Carya alba*), and shagbark hickory (*Carya ovata*). Disturbed stands of this forest type can also have tuliptree (*Liriodendron tulipifera*) as a codominant. Eastern white pine (*Pinus strobus*) can be an occasional canopy associate. Canopy trees usually extend from 20–35 m in height and cover 60–90% of the area. In stands where clearing has occurred, the canopy will be more open, resembling a woodland. The subcanopy reaches from 5–20 m in height and can cover 25–50% of the area. Typical subcanopy trees include red maple (*Acer rubrum*), shagbark hickory, pignut hickory, sweet cherry (*Prunus avium*), black cherry (*Prunus serotina*), American elm (*Ulmus americana*), sassafras (*Sassafras albidum*), and blackgum (*Nyssa sylvatica*). Dead or declining subcanopy eastern red-cedar (*Juniperus virginiana*) are common in disturbed stands. The tall-shrub layer can be sparse (5–20% cover) or dense (40–60% cover) and contains flowering dogwood (*Cornus florida*), blackhaw (*Viburnum prunifolium*), northern spicebush (*Lindera benzoin*), American witch-hazel (*Hamamelis virginiana*), and species from the canopy and subcanopy. White ash seedlings, northern spicebush, northern dewberry (*Rubus flagellaris*), eastern redbud (*Cercis canadensis*), and mapleleaf viburnum (*Viburnum acerifolium*) are common species in the short-shrub layer that covers 10–50% of the area. The invasive species multiflora rose (*Rosa multiflora*) and Japanese barberry (*Berberis thunbergii*) can also be abundant in the short-shrub layer in disturbed examples of this type. The herbaceous layer is generally sparse and covers approximately 30% of the area, although the percent cover of the herbaceous layer can vary from 15–90%. Common constituents include broadleaf enchanter's nightshade (*Circaea lutetiana* ssp. *canadensis*), jewelweed (*Impatiens capensis*), licorice bedstraw (*Galium circaezans*), Jack in the pulpit (*Arisaema triphyllum*), rue anemone (*Thalictrum thalictroides*), Virginia springbeauty (*Claytonia virginica*), feathery false lily of the valley (*Maianthemum racemosum* ssp. *racemosum*), smooth Solomon's seal (*Polygonatum biflorum*), naked-flower tick-trefoil (*Desmodium nudiflorum*), American lopseed (*Phryma leptostachya*), and upland boneset (*Eupatorium sessilifolium*). Virginia creeper (*Parthenocissus quinquefolia*) is a typical vine. The invasive species Japanese honeysuckle (*Lonicera japonica*), garlic mustard (*Alliaria petiolata*), Japanese stilt grass (*Microstegium vimineum*), and oriental ladythumb (*Polygonum caespitosum*) may be abundant in this forest type.

**Most Abundant Species:**

| <u>Stratum</u>      | <u>Lifeform</u>              | <u>Species</u>   |
|---------------------|------------------------------|--|
| Tree canopy         | Broad-leaved deciduous tree  | <i>Quercus alba</i> , <i>Quercus rubra</i>                                     |
| Tree subcanopy      | Broad-leaved deciduous tree  | <i>Acer rubrum</i>   |
| Tall shrub/sapling  | Broad-leaved deciduous shrub | <i>Cornus florida</i>  |
| Short shrub/sapling | Broad-leaved deciduous shrub | <i>Lindera benzoin</i>   |
| Herb (field)        | Vine/Liana                   | <i>Lonicera japonica</i>   |
| Herb (field)        | Forb                         | <i>Circaea lutetiana</i> ssp. <i>canadensis</i> ,<br><i>Impatiens capensis</i> |

**Characteristic Species:** *Carya glabra*, *Circaea lutetiana* ssp. *canadensis*, *Galium circaezans*, *Quercus alba*, *Thalictrum thalictroides*.

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

**Subnational Distribution with Crosswalk Data:**

| <u>State</u> | <u>State Rank</u> | <u>Confidence</u> | <u>State Name</u>               | <u>Reference</u> |
|--------------|-------------------|-------------------|---------------------------------|------------------|
| PA           | S4                | 1                 | Dry oak – mixed hardwood forest | Fike 1999        |

**Local Range:** This common association occurs throughout the park in woodlots and forested areas.

**Classification Comments:** The dominance of white oak and northern red oak in this forest type distinguishes it from Chestnut Oak Forest that is dominated by chestnut oak and contains a heath layer of ericaceous species. Also, in Dry Oak-Mixed Hardwood Forest, tuliptree never exceeds 50% cover in the canopy, in contrast to Tuliptree Forest in which tuliptree is clearly dominant.

**Other Comments:** Information not available.

**Local Description Authors:** S. Perles.

**Plots:** GETT.1, GETT.2, GETT.4, GETT.8, GETT.10, GETT.11, GETT.14, GETT.15, GETT.19, GETT.22, GETT.28, GETT.30, GETT.32, GETT.37, GETT.38.

**Gettysburg National Military Park and Eisenhower National Historic Site Inventory Notes:** Information not available.

**GLOBAL INFORMATION**

**NVC CLASSIFICATION**

|                              |   |
|------------------------------|---|
| Physiognomic Class           | Forest (I)  |
| Physiognomic Subclass        | Deciduous forest (I.B.)   |
| Physiognomic Group           | Cold-deciduous forest (I.B.2.)  |
| Physiognomic Subgroup        | Natural/Semi-natural cold-deciduous forest (I.B.2.N.)   |
| Formation                    | Lowland or submontane cold-deciduous forest (I.B.2.N.a.)  |
| Alliance                     | <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, rubra, velutina)</i> / <i>Cornus florida</i> / <i>Viburnum acerifolium</i> Forest                         |
| Association (English name)   | (White Oak, Northern Red Oak, Black Oak) / Flowering Dogwood / Mapleleaf <i>Viburnum</i> Forest                             |
| <b>Ecological System(s):</b> | Northern Atlantic Coastal Plain Dry Hardwood Forest (CES203.475)<br>Northeastern Interior Dry-Mesic Oak Forest (CES202.592) |

**GLOBAL DESCRIPTION**

**Concept Summary:** This northeastern oak-hickory forest occurs on well-drained loamy sand of mid or upper slopes. This vegetation is ecologically transitional between dry-rich oak-hickory forests of relatively high diversity and dry, acidic oak-species-poor forests. *Quercus rubra*, *Quercus alba*, and *Quercus velutina* are prominent in the canopy. *Quercus prinus* and *Quercus coccinea* are less frequent canopy associates, more likely in the southern portion of the range. Typical hickory species include *Carya glabra*, *Carya ovata*, *Carya alba*, and *Carya ovalis*. Other canopy associates may include *Acer rubrum*, *Fraxinus americana*, *Sassafras albidum*, and *Amelanchier arborea*. At the northern range limit of this type, *Pinus strobus* and *Betula lenta* also occur as minor associates. *Cornus florida* is a characteristic understory tree in portions of the range. The shrub layer is characterized by *Viburnum acerifolium*, with other frequent associates including *Hamamelis virginiana*, *Vaccinium corymbosum*, *Corylus cornuta*, and *Corylus americana*. A dwarf-shrub layer may be present, but generally is not well-developed, and is characterized by *Vaccinium pallidum* and *Gaylussacia baccata*, with *Vaccinium angustifolium* occurring more frequently to the north. The herbaceous layer is generally well-developed and is characterized by a mixture of sedges and scattered forbs: *Carex pensylvanica*, *Carex rosea*, *Maianthemum racemosum*, *Aralia nudicaulis*, *Hieracium venosum*, *Solidago bicolor*, *Desmodium glutinosum*, *Desmodium paniculatum*, *Melampyrum lineare*, *Chimaphila maculata*, *Eurybia divaricata*, *Sericocarpus asteroides*, *Danthonia spicata*, *Aureolaria* spp., and *Helianthemum canadense*.

**Environmental Description:** This forest type occurs on well-drained loamy sand of midslopes.

**Vegetation Description:** This vegetation is ecologically transitional between dry-rich oak-hickory forests of relatively high diversity and dry, acidic oak-species-poor forests. *Quercus rubra*, *Quercus alba*, and *Quercus velutina* are prominent in the canopy. Typical hickory species include *Carya glabra*, *Carya ovata*, *Carya alba*, and *Carya ovalis*. Other canopy associates may include *Acer rubrum*, *Sassafras albidum*, and *Amelanchier arborea*. At the northern range limit of this type, *Pinus strobus* and *Betula lenta* also occur as minor associates. *Cornus florida* is a characteristic understory tree in portions of the range. The shrub layer is characterized by *Viburnum acerifolium*, with other frequent associates including *Hamamelis virginiana*, *Vaccinium corymbosum*, *Corylus cornuta*, and *Corylus americana*. A dwarf-shrub layer may be common but generally not abundant, characterized by *Vaccinium pallidum* and *Gaylussacia baccata*, with *Vaccinium angustifolium* occurring more frequently to the north. The herbaceous layer is characterized by *Carex pensylvanica*, *Maianthemum racemosum*, *Aralia nudicaulis*, *Hieracium venosum*, *Solidago bicolor*, *Desmodium glutinosum*, *Desmodium paniculatum*, *Melampyrum lineare*, *Chimaphila maculata*, *Eurybia divaricata*, *Danthonia spicata*, *Aureolaria* spp., and *Helianthemum canadense*.

**Most Abundant Species:**

| <u>Stratum</u>      | <u>Lifeform</u>              | <u>Species</u>   |
|---------------------|------------------------------|--|
| Tree canopy         | Broad-leaved deciduous tree  | <i>Quercus rubra</i> , <i>Quercus velutina</i>           |
| Tall Shrub/sapling  | Broad-leaved deciduous tree  | <i>Cornus florida</i> , <i>Viburnum acerifolium</i>      |
| Short shrub/sapling | Broad-leaved deciduous shrub | <i>Gaylussacia baccata</i> , <i>Viburnum acerifolium</i> |
| Herb (field)        | Graminoid                    | <i>Carex pensylvanica</i>                                |

**Characteristic Species:** *Aralia nudicaulis*, *Carex pensylvanica*, *Cornus florida*, *Gaylussacia baccata*, *Maianthemum racemosum*, *Vaccinium pallidum*, *Viburnum acerifolium*.

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

**USFWS Wetland System:** Not applicable

#### DISTRIBUTION

**Range:** This association occurs from Maine to Virginia.

**States/Provinces:** CT, DE:S3?, MA, MD, ME, NH, NJ:S4S5, NY:S3, PA, RI, VA, VT.

**Federal Lands:** NPS (Booker T. Washington, Cape Cod, Delaware Water Gap, Fort Necessity, Fredericksburg-Spotsylvania, Gettysburg, Minute Man, Morristown, Prince William?, Weir Farm); USFWS (Great Meadows).

#### CONSERVATION STATUS

**Rank:** G4G5 (24-Jan-2005).

**Reasons:** This type is not naturally rare and has a wide geographic distribution. Mature stands, however, are uncommon and most stands are subject to logging disturbances or even complete destruction if located in rapidly developing suburban areas.

#### CLASSIFICATION INFORMATION

**Status:** Standard.

**Confidence:** 2 – Moderate.

**Comments:** Information not available.

#### Similar Associations:

- *Acer saccharum* - *Betula alleghaniensis* - *Quercus rubra* / *Viburnum acerifolium* Forest (CEGL006943).
- *Carya (glabra, ovata)* - *Fraxinus americana* - *Quercus* spp. Forest (CEGL006236).
- *Pinus strobus* - *Quercus (rubra, velutina)* - *Fagus grandifolia* Forest (CEGL006293)--can intergrade with this type in New England but is characterized by *Fagus grandifolia* (more or less absent in CEGL006336), a greater amount of *Pinus strobus* in the canopy (usually >20%), and little or no *Carya*.
- *Quercus alba* - *Quercus (rubra, coccinea)* - *Carya (alba, glabra)* / *Vaccinium pallidum* Piedmont Dry-Mesic Forest (CEGL008475)--is more diverse and occupies soils with slightly higher base status. *Quercus velutina* is not as characteristic of this type. A number of southern herbs such as *Aristolochia serpentaria* are not found in CEGL006375.
- *Quercus alba* - *Quercus rubra* - *Carya (alba, ovata)* / *Cornus florida* Acid Forest (CEGL002067)--also contains *Actaea racemosa* and can occur on cherty limestone, and *Quercus velutina* is not characteristic.
- *Quercus coccinea* - *Quercus velutina* / *Sassafras albidum* / *Vaccinium pallidum* Forest (CEGL006375)--lacks *Viburnum acerifolium* and *Cornus florida* and in general is less diverse and occurring on relatively more nutrient-poor soils.
- *Quercus prinus* - *Quercus (rubra, velutina)* / *Vaccinium angustifolium* Forest (CEGL006282).
- *Quercus velutina* - *Quercus alba* - *Carya (glabra, ovata)* Forest (CEGL002076)--also contains *Quercus ellipsoidal* or *Quercus macrocarpa* and is of shorter stature and more open canopy.
- *Quercus velutina* / *Carex pensylvanica* Forest (CEGL002078)--is drier and more infertile, and lacks *Viburnum acerifolium*, *Hamamelis virginiana* and other shrubs.



**Related Concepts:**

- *Quercus (alba, rubra, velutina) / Cornus florida - Viburnum acerifolium* Forest (Bartgis 1986) =
- *Quercus montana - Quercus rubra - Carya (ovalis, glabra) / Viburnum acerifolium* Forest (Fleming pers. comm.) ?
- Mesic Coastal Plain mixed oak forest (Breden 1989) ?
- Northeastern Acidic Oak-Hickory Forest (Fleming et al. 2004) ?
- SNE mesic central hardwood forest on acidic till (Rawinski 1984) ?

**SOURCES**

**Description Authors:** S. L. Neid and L. A. Sneddon.

**References:** Bartgis 1986, Berdine 1998, Breden 1989, Breden et al. 2001, Clancy 1996, Damman 1977, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fike 1999, Fleming et al. 2001, Fleming et al. 2004, Fleming pers. comm., Gawler 2002, Harrison 2004, Hunt 1997a, MENHP 1991, McCoy and Fleming 2000, Metzler and Barrett 2001, Patterson pers. comm., Rawinski 1984, Sperduto 1997b, Sperduto and Nichols 2004, Swain and Kearsley 2001, VDNH 2003.



Figure 10. Dry Oak – Mixed Hardwood Forest in Gettysburg National Military Park (plot GETT.15). May 2004. NAD 1983 / UTM easting 307426, northing 4406076.



Figure 11. Dry Oak – Mixed Hardwood Forest (disturbed) in Gettysburg National Military Park (plot GETT.11). May 2004. NAD 1983 / UTM easting 309898, northing 4408674.



**Common Name (Park-specific): Tuliptree Forest**

**SYNONYMS**

- NVC English Name:** Tuliptree - Northern Red Oak - White Ash / Common Pawpaw / Black Cohosh / Perfoliate Bellwort Forest  
**NVC Scientific Name:** *Liriodendron tulipifera* - *Quercus rubra* - *Fraxinus americana* / *Asimina triloba* / *Actaea racemosa* – *Uvularia perfoliata* Forest  
**NVC Identifier:** C EGL006186

**LOCAL INFORMATION**

**Environmental Description:** This common forest type occurs on upland slopes on well-drained Neshaminy channery silt loam. Large boulders and rock outcrops can be common.

**Vegetation Description:** Tuliptree (*Liriodendron tulipifera*) is dominant in the canopy and subcanopy, covering greater than 50% of the forest canopy. Common canopy associates include oaks (*Quercus velutina*, *Quercus rubra*, *Quercus alba*, *Quercus prinus*) and mockernut hickory (*Carya alba*), while subcanopy associates are white ash (*Fraxinus americana*) and red maple (*Acer rubrum*). Canopy trees usually range in height from 30–35 m, and subcanopy trees reach 10–25 m in height. Northern spicebush (*Lindera benzoin*) is typically dominant in the tall- and short-shrub layers, which can be sparse to moderately dense (20–60% cover). Other common shrubs include blackhaw (*Viburnum prunifolium*), American witch-hazel (*Hamamelis virginiana*), and seedlings and saplings of the canopy trees. The invasive species multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thunbergii*), and wine raspberry (*Rubus phoenicolasius*) can also be abundant in the short-shrub layer. The herbaceous layer is composed of broadleaf enchanter's nightshade (*Circaea lutetiana* ssp. *canadensis*), Jack in the pulpit (*Arisaema triphyllum*), wild comfrey (*Cynoglossum virginianum*), licorice bedstraw (*Galium circaezans*), jewelweed (*Impatiens capensis*), perfoliate bellwort (*Uvularia perfoliata*), and downy yellow violet (*Viola pubescens*). Virginia creeper (*Parthenocissus quinquefolia*) is often present as a vine. The invasive species Japanese honeysuckle (*Lonicera japonica*), garlic mustard (*Alliaria petiolata*), Japanese stilt grass (*Microstegium vimineum*), and oriental ladythumb (*Polygonum caespitosum*) may be abundant in this forest type.

**Most Abundant Species:**

| <u>Stratum</u>      | <u>Lifeform</u>              | <u>Species</u>   |
|---------------------|------------------------------|--|
| Tree canopy         | Broad-leaved deciduous tree  | <i>Liriodendron tulipifera</i>   |
| Tree subcanopy      | Broad-leaved deciduous tree  | <i>Acer rubrum</i>   |
| Tall shrub/sapling  | Broad-leaved deciduous shrub | <i>Lindera benzoin</i>   |
| Short shrub/sapling | Broad-leaved deciduous shrub | <i>Lindera benzoin</i>   |
| Herb (field)        | Vine/Liana                   | <i>Lonicera japonica</i> , <i>Parthenocissus quinquefolia</i>                |
| Herb (field)        | Forb                         | <i>Arisaema triphyllum</i> , <i>Circaea lutetiana</i> ssp. <i>canadensis</i> |

**Characteristic Species:** *Lindera benzoin*, *Liriodendron tulipifera*.

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

**Subnational Distribution with Crosswalk Data:**

| <u>State</u> | <u>State Rank</u> | <u>Confidence</u> | <u>State Name</u> | <u>Reference</u> |
|--------------|-------------------|-------------------|-------------------|------------------|
| PA           | NA                | NA                | no crosswalk      | Fike 1999        |



**Local Range:** This association occurs primarily in the forested areas near Big Round Top and Little Round Top.

**Classification Comments:** In Dry Oak-Mixed Hardwood Forest, tuliptree never exceeds 50% cover in the canopy, in contrast to Tuliptree Forest in which tuliptree is clearly dominant.

**Other Comments:** Information not available.

**Local Description Authors:** S. Perles.

**Plots:** GETT.16, GETT.18.

**Gettysburg National Military Park and Eisenhower National Historic Site Inventory Notes:** Information not available.

## GLOBAL INFORMATION

### NVC CLASSIFICATION

|                            |   |
|----------------------------|---|
| Physiognomic Class         | Forest (I)  |
| Physiognomic Subclass      | Deciduous forest (I.B.)   |
| Physiognomic Group         | Cold-deciduous forest (I.B.2.)  |
| Physiognomic Subgroup      | Natural/Semi-natural cold-deciduous forest (I.B.2.N.)   |
| Formation                  | Lowland or submontane cold-deciduous forest (I.B.2.N.a.)  |
| Alliance                   | Liriodendron tulipifera Forest Alliance (A.236)   |
| Alliance (English name)    | Tuliptree Forest Alliance   |
| Association                | Liriodendron tulipifera - Quercus rubra - Fraxinus americana<br>Asimina triloba / Actaea racemosa - Uvularia perfoliata<br>Forest |
| Association (English name) | Tuliptree - Northern Red Oak - White Ash / Common Pawpaw /<br>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*, occurring with or codominating with *Quercus rubra* or *Fraxinus americana*. This community type occupies fertile, well-drained soils of mesic lower slopes and ravines, often in areas underlain by metabasalt of the Catoclin 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*, *Quercus prinus*, *Carya ovalis*, *Carya alba*, *Carya cordiformis*, *Ulmus rubra*, *Nyssa sylvatica*, *Fagus grandifolia*, and *Juglans nigra*. Subcanopy tree layers contain representatives of the overstory species and *Acer rubrum*. The lowest tree and shrub layers usually contain small to large colonies of *Asimina triloba* and *Lindera benzoin*, along with *Cercis canadensis* and *Cornus florida*. 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*, *Amphicarpaea bracteata*, *Arisaema triphyllum*, *Asarum canadense*, *Actaea racemosa*, *Deparia acrostichoides*, *Hydrastis canadensis*, *Phegopteris hexagonoptera*, *Polystichum acrostichoides*, and *Uvularia perfoliata*. Other constant or characteristic herbaceous species include *Botrychium virginianum*, *Carex laxiflora* var. *laxiflora*,

*Circaea lutetiana* ssp. *canadensis*, *Collinsonia canadensis*, *Cypripedium parviflorum* var. *pubescens*, *Desmodium nudiflorum*, *Galearis spectabilis*, *Galium circaezans*, *Galium triflorum*, *Hepatica nobilis* var. *obtusata*, *Maianthemum racemosum* ssp. *racemosum*, *Phryma leptostachya*, *Podophyllum peltatum*, *Sanguinaria canadensis*, *Sanicula canadensis*, and *Stellaria pubera*.

This association is distinguished from more montane rich cove forests by its lower-elevation habitats, shrub layer dominance by *Asimina triloba* (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*, *Tilia americana*, *Caulophyllum thalictroides*, *Laportea canadensis*, *Osmorhiza claytonii*, *Impatiens pallida*, and *Trillium grandiflorum*.

**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 Catoctin 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* often exceeding 35 m in height. *Fraxinus americana* and *Quercus rubra* are the most frequent overstory associates and often codominate. Less frequent overstory associates include *Quercus alba*, *Quercus prinus*, *Carya ovalis*, *Carya alba*, *Carya cordiformis*, *Ulmus rubra*, *Nyssa sylvatica*, *Fagus grandifolia*, and *Juglans nigra*. Subcanopy tree layers contain representatives of the overstory species and *Acer rubrum*. The lowest tree and shrub layers usually contain small to large colonies of *Asimina triloba* and *Lindera benzoin*, along with *Cercis canadensis* and *Cornus florida*. More locally important small trees and shrubs include *Carpinus caroliniana* and *Hamamelis virginiana*. High-climbing vines of *Parthenocissus quinquefolia*, *Toxicodendron radicans*, and *Vitis* spp. 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*, *Amphicarpaea bracteata*, *Arisaema triphyllum*, *Asarum canadense*, *Actaea racemosa*, *Deparia acrostichoides*, *Hydrastis canadensis*, *Phegopteris hexagonoptera*, *Polystichum acrostichoides*, and *Uvularia perfoliata*. The most constant, low-cover herbs in 22 Virginia and Maryland plots of the type are *Botrychium virginianum*, *Circaea lutetiana* ssp. *canadensis*, *Desmodium nudiflorum*, *Galium circaezans*, *Galium triflorum*, *Maianthemum racemosum* ssp. *racemosum*, *Phryma leptostachya*, *Sanguinaria canadensis*, and *Sanicula canadensis*. Additional characteristic herbs include *Carex laxiflora* var. *laxiflora*, *Collinsonia canadensis*, *Cypripedium parviflorum* var. *pubescens*, *Galearis spectabilis*, *Hepatica nobilis* var. *obtusata*, *Podophyllum peltatum*, and *Stellaria pubera*.

**Most Abundant Species:**

| <u>Stratum</u>      | <u>Lifeform</u>              | <u>Species</u>  |
|---------------------|------------------------------|---|
| Tree canopy         | Broad-leaved deciduous tree  | <i>Fraxinus americana</i> , <i>Liriodendron tulipifera</i> , <i>Quercus rubra</i> |
| Tree subcanopy      | Broad-leaved deciduous tree  | <i>Acer rubrum</i>  |
| Tall shrub/sapling  | Broad-leaved deciduous shrub | <i>Asimina triloba</i> , <i>Lindera benzoin</i>                                   |
| Short shrub/sapling | Broad-leaved deciduous shrub | <i>Lindera benzoin</i>  |
| Herb (field)        | Vine/Liana                   | <i>Parthenocissus quinquefolia</i> ,<br><i>Toxicodendron radicans</i>             |
| Herb (field)        | Fern or fern ally            | <i>Botrychium virginianum</i>   |

**Characteristic Species:** *Actaea racemosa*, *Asimina triloba*, *Lindera benzoin*, *Liriodendron tulipifera*.

**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, Booker T. Washington, C&O Canal, Catoclin Mountain, George Washington Parkway, Gettysburg, Harpers Ferry, Manassas, 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:** Information not available.

**Comments:** This description is based on analysis of 22 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* (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*, *Tilia americana*, *Caulophyllum thalictroides*, *Laportea canadensis*, *Osmorhiza claytonii*, *Impatiens pallida*, and *Trillium grandiflorum*.

**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*.

**Related Concepts:**

- *Liriodendron tulipifera* - *Quercus rubra* / *Asimina triloba* / *Arisaema triphyllum* - *Cimicifuga racemosa* Forest (Fleming 2002b) =
- 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 2002b, Fleming et al. 2004, Orwig and Abrams 1994, VDNH 2003.



Figure 12. Tuliptree Forest in Gettysburg National Military Park (plot GETT.16). May 2004. NAD 1983 / UTM easting 307745, northing 4406082.





Figure 13. Tuliptree Forest in Gettysburg National Military Park (plot GETT.18). May 2004. NAD 1983 / UTM easting 308605, northing 4407000.

## Common Name (Park-specific): Modified Successional Forest

### SYNONYMS

**NVC English Name:** Black Cherry - Tuliptree - Red Maple - White Ash Forest

**NVC Scientific Name:** *Prunus serotina* - *Liriodendron tulipifera* - *Acer rubrum* - *Fraxinus americana* Forest

**NVC Identifier:** C EGL006599

### LOCAL INFORMATION

**Environmental Description:** This forest type occurs on upland silt loam soils in the Watchung, Neshaminy, Croton, Lehigh and Reaville series. This association is often found in disturbed woodlots and fragmented wooded areas. This forest type may also surround small drainages.

**Vegetation Description:** This association is variable both in vegetation structure and species composition. Land-use history as well as past and current management greatly affect the composition of each forest stand. In general, the canopy and subcanopy are dominated by early-successional and weedy species, often with small diameters at breast height (<15 cm). Eastern red-cedar (*Juniperus virginiana*) is often abundant in the subcanopy, although these trees may experience decline as they are shaded by canopy trees. Common canopy and subcanopy trees include white ash (*Fraxinus americana*), black cherry (*Prunus serotina*), black walnut (*Juglans nigra*), black locust (*Robinia pseudoacacia*), eastern redbud (*Cercis canadensis*), sassafras (*Sassafras albidum*), American elm (*Ulmus americana*), red maple (*Acer rubrum*), honeylocust (*Gleditsia triacanthos*), eastern white pine (*Pinus strobus*), quaking aspen (*Populus tremuloides*), northern catalpa (*Catalpa speciosa*), and several oak species (*Quercus rubra*, *Quercus velutina*, *Quercus palustris*). Canopy trees typically extend 20–30 m in height and cover 30–70% of the stand. Subcanopy trees usually range from 5–15 m in height and cover 20–80% of the stand. Blackhaw (*Viburnum prunifolium*), northern spicebush (*Lindera benzoin*), eastern redbud, and flowering dogwood (*Cornus florida*) make up the tall-shrub layer (20–50% cover). The short-shrub layer (20–50% cover) is composed of black raspberry (*Rubus occidentalis*), Allegheny blackberry (*Rubus allegheniensis*), northern dewberry (*Rubus flagellaris*), and seedlings of the canopy trees. The herbaceous layer (20–80% cover) is composed of jewelweed (*Impatiens capensis*), eastern narrowleaf sedge (*Carex amphibola*), wild garlic (*Allium vineale*), broadleaf enchanter's nightshade (*Circaea lutetiana* ssp. *canadensis*), sweet vernalgrass (*Anthoxanthum odoratum*), eastern star sedge (*Carex radiata*), common yellow oxalis (*Oxalis stricta*), white snakeroot (*Ageratina altissima* var. *altissima*), Jack in the pulpit (*Arisaema triphyllum*), licorice bedstraw (*Galium circaeans*), Indian strawberry (*Duchesnea indica*), and common selfheal (*Prunella vulgaris*). Invasive species are abundant in the tall-shrub, short-shrub and herbaceous layers of this forest type. The most common invasives include Japanese honeysuckle (*Lonicera japonica*), multiflora rose (*Rosa multiflora*), garlic mustard (*Alliaria petiolata*), European privet (*Ligustrum vulgare*), Morrow's honeysuckle (*Lonicera morrowii*), and wine raspberry (*Rubus phoenicolasius*). Vines can be sparse or abundant (10–70% cover), with such common species as Virginia creeper (*Parthenocissus quinquefolia*), grape (*Vitis* spp.), and eastern poison ivy (*Toxicodendron radicans*).

**Most Abundant Species:**

| <u>Stratum</u>      | <u>Lifeform</u>              | <u>Species</u>   |
|---------------------|------------------------------|--|
| Tree canopy         | Broad-leaved deciduous tree  | <i>Fraxinus americana</i> , <i>Juglans nigra</i> ,<br><i>Prunus serotina</i> , <i>Robinia pseudoacacia</i> |
| Tree subcanopy      | Needle-leaved tree           | <i>Juniperus virginiana</i>  |
| Tall shrub/sapling  | Broad-leaved deciduous shrub | <i>Rosa multiflora</i> , <i>Viburnum prunifolium</i>   |
| Short shrub/sapling | Broad-leaved deciduous shrub | <i>Rosa multiflora</i>   |
| Herb (field)        | Vine/Liana                   | <i>Lonicera japonica</i> , <i>Parthenocissus</i><br><i>quinquefolia</i>                                    |
| Herb (field)        | Forb                         | <i>Allium vineale</i> , <i>Circaea lutetiana</i> ssp.<br><i>canadensis</i> , <i>Impatiens capensis</i>     |
| Herb (field)        | Graminoid                    | <i>Carex amphibola</i>   |

**Characteristic Species:** *Juniperus virginiana*, *Rosa multiflora*.

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

**Subnational Distribution with Crosswalk Data:**

| <u>State</u> | <u>State Rank</u> | <u>Confidence</u> | <u>State Name</u> | <u>Reference</u> |
|--------------|-------------------|-------------------|-------------------|------------------|
| PA           | NA                | NA                | no crosswalk      | Fike 1999        |

**Local Range:** This forest type occurs throughout the park in disturbed woodlots and forested areas.

**Classification Comments:** Despite the variation in species composition and vegetation structure, this forest type is identifiable by the dominance of early-successional and weedy species as well as the abundance of invasive plant species. This type is distinguished from Successional Old Fields by greater than 50% cover of trees in the canopy and subcanopy combined. **Other Comments:** Information not available.

**Local Description Authors:** S. Perles.

**Plots:** GETT.12, GETT.13, GETT.23, GETT.26, GETT.33, GETT.55. **Gettysburg National Military Park and Eisenhower National Historic Site Inventory Notes:**

Information not available.

**GLOBAL INFORMATION**

**NVC CLASSIFICATION**

|                              |  |
|------------------------------|--|
| Physiognomic Class           | Forest (I)   |
| Physiognomic Subclass        | Deciduous forest (I.B.)  |
| Physiognomic Group           | Cold-deciduous forest (I.B.2.)   |
| Physiognomic Subgroup        | Natural/Semi-natural cold-deciduous forest (I.B.2.N.)  |
| Formation                    | Lowland or submontane cold-deciduous forest (I.B.2.N.a.)   |
| Alliance                     | <i>Prunus serotina</i> - <i>Acer rubrum</i> - <i>Amelanchier canadensis</i> –<br><i>Quercus</i> spp. Forest Alliance (A.237) |
| Alliance (English name)      | Black Cherry - Red Maple - Canada Serviceberry - Oak species<br>Forest   |
| Alliance Association         | <i>Prunus serotina</i> - <i>Liriodendron tulipifera</i> - <i>Acer rubrum</i> -<br><i>Fraxinus americana</i> Forest           |
| Association (English name)   | Black Cherry - Tuliptree - Red Maple - White Ash Forest  |
| <b>Ecological System(s):</b> | Central Appalachian Dry Oak-Pine Forest (CES202.591)<br>Northeastern Interior Dry-Mesic Oak Forest (CES202.592)              |

**GLOBAL DESCRIPTION**

**Concept Summary:** This early-successional woody vegetation of the northeastern United States occurs on sites that have generally been cleared for agriculture. Environmental setting varies, but generally sites are dry-mesic to mesic, with small seepage inclusions in some examples. Physiognomy of this vegetation is highly variable, ranging from closed forest, open forest, tall dense shrubland, to more open tall shrubland. Early-successional woody species dominate the canopy in a widely variable mix, depending on geographic location. Tree species may include *Prunus serotina*, *Liriodendron tulipifera*, *Fraxinus americana*, and *Acer rubrum*. Other associates can include *Juglans nigra*, *Sassafras albidum*, *Betula populifolia*, *Juniperus virginiana*, *Acer negundo*, *Acer saccharinum*, *Ailanthus altissima*, *Ulmus americana*, *Quercus* spp., *Betula lenta*, *Amelanchier* spp., and *Robinia pseudoacacia*. Other woody species may contribute to the canopy or form a tall-shrub layer, including *Lindera benzoin* and *Carpinus caroliniana*. The low-shrub layer, if present, is usually characterized by the presence of *Rubus* spp. such as *Rubus flagellaris*, *Rubus allegheniensis*, *Rubus phoenicolasius*, or *Rubus hispidus*. This layer is often dominated by exotic species such as *Lonicera tatarica*, *Lonicera japonica*, *Rhamnus cathartica*, *Crataegus* spp., *Rosa multiflora*, and *Berberis thunbergii*. The herbaceous layer is variable, often containing grasses and forbs of both native and exotic origin.

**Environmental Description:** This vegetation occurs on sites that have been cleared for agriculture or otherwise heavily modified in the past. Generally sites are dry-mesic and may have small seepage inclusions in some examples.

**Vegetation Description:** Early-successional woody species dominate the canopy in a widely variable mix, depending on geographic location. Tree species may include *Prunus serotina*, *Liriodendron tulipifera*, *Fraxinus americana*, and *Acer rubrum*. Other associates can include *Juglans nigra*, *Sassafras albidum*, *Betula populifolia*, *Juniperus virginiana*, *Acer negundo*, *Acer saccharinum*, *Ailanthus altissima*, *Ulmus americana*, *Quercus* spp., *Betula lenta*, *Amelanchier* spp., and *Robinia pseudoacacia*. Other woody species may contribute to the canopy or form a tall-shrub layer, including *Lindera benzoin* and *Carpinus caroliniana*. The low-shrub layer, if present, is usually characterized by the presence of *Rubus* spp. such as *Rubus flagellaris*, *Rubus allegheniensis*, *Rubus phoenicolasius*, or *Rubus hispidus*. This layer is often dominated by exotic species such as *Lonicera tatarica*, *Lonicera japonica*, *Rhamnus cathartica*, *Crataegus* spp., *Rosa multiflora*, and *Berberis thunbergii*. The herbaceous layer is variable, often containing grasses and forbs of both native and exotic origin.

**Most Abundant Species:**

| <u>Stratum</u>     | <u>Lifeform</u>              | <u>Species</u>  |
|--------------------|------------------------------|---|
| Tree canopy        | Broad-leaved deciduous tree  | <i>Acer rubrum</i> , <i>Fraxinus americana</i> ,<br><i>Liriodendron tulipifera</i> , <i>Prunus serotina</i> |
| Tree subcanopy     | Broad-leaved deciduous tree  | <i>Acer rubrum</i>  |
| Tall shrub/sapling | Broad-leaved deciduous tree  | <i>Carpinus caroliniana</i>   |
| Tall shrub/sapling | Broad-leaved deciduous shrub | <i>Lindera benzoin</i>  |

**Characteristic Species:** *Acer rubrum*, *Fraxinus americana*, *Liriodendron tulipifera*, *Prunus serotina*, *Robinia pseudoacacia*.

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

**USFWS Wetland System:** Not applicable.

**DISTRIBUTION**

**Range:** This vegetation is currently described from Pennsylvania but is of broader distribution in the northeastern U.S.



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

**Federal Lands:** NPS (Allegheny Portage Railroad, Delaware Water Gap, Fort Necessity, Friendship Hill, Gettysburg, Johnstown Flood, Morristown, Valley Forge).

**CONSERVATION STATUS**

**Rank:** GNA (ruderal) (29-Nov-2004).

**Reasons:** This vegetation is modified by human activity and not of conservation concern.

**CLASSIFICATION INFORMATION**

**Status:** Standard.

**Confidence:** 3 – Weak.

**Comments:** This vegetation is broadly defined and varies widely in composition across its range, presenting a classification challenge at the alliance level.

**Similar Associations:**

- *Robinia pseudoacacia* Forest (CEGL007279).

**Related Concepts:** Information not available.

**SOURCES**

**Description Authors:** L. A. Sneddon.

**References:** Eastern Ecology Working Group n.d., Fike 1999, Perles et al. 2006c, Perles et al. 2006.



Figure 14. Modified Successional Forest in Gettysburg National Military Park (plot GETT.23). May 2004. NAD 1983 / UTM easting 307809, northing 4410843.



Figure 15. Modified Successional Forest in Gettysburg National Military Park (plot GETT.13).  
May 2004. NAD 1983 / UTM easting 307053, northing 4406556.



## Common Name (Park-specific): Conifer Plantation

### SYNONYMS

**NVC English Name:** Pine species Planted Forest  
**NVC Scientific Name:** *Pinus* spp. Planted Forest  
**NVC Identifier:** C EGL006313

### LOCAL INFORMATION

**Environmental Description:** This forest type occurs on upland silt loam soils in the Croton, Abbottstown and Mount Lucas series. These sites are typically flat and often surrounded by other disturbed or managed vegetation types.

**Vegetation Description:** This association is variable both in vegetation structure and species composition. Land use history as well as past and current management greatly affect the composition of each forest stand. The canopy is typically dominated by conifers, most commonly eastern white pine (*Pinus strobus*), however, red pine (*Pinus resinosa*), Norway spruce (*Picea abies*), Scotch pine (*Pinus sylvestris*), or blue spruce (*Picea pungens*) are also common. Canopy trees reach 20 – 35 meters in height and cover 70 – 90% of the stand. Managed stands may have a sparser canopy. The subcanopy can vary widely. Trees are typically 6 – 20 meters tall and can cover 5 – 80% of the stand. Eastern red-cedar (*Juniperus virginiana*) is the most common subcanopy tree. Adventitious hardwoods such as white ash (*Fraxinus americana*), flowering dogwood (*Cornus florida*), red maple (*Acer rubrum*), black cherry (*Prunus serotina*), American beech (*Fagus grandifolia*), American hornbeam (*Carpinus caroliniana*), sweet birch (*Betula lenta*), oaks (*Quercus* spp.) and hickories (*Carya* spp.) are among the common subcanopy associates. Managed stands may contain these adventitious hardwoods in the canopy as well. The tall shrub layer is often absent. When present, it contains spicebush (*Lindera benzoin*), species from the canopy and subcanopy. The short shrub layer is also variable and can cover 0 – 40% of the stand. Common short shrubs include Allegheny blackberry (*Rubus allegheniensis*), black raspberry (*Rubus occidentalis*), northern dewberry (*Rubus flagellaris*), and the invasive shrubs Japanese barberry (*Berberis thunbergii*) and multiflora rose (*Rosa multiflora*). The herbaceous layer is typically sparse (5–30% cover) and the species composition varies with hydrology, land use history, and available seed sources. Common species include: jewelweed (*Impatiens capensis*), broadleaf enchanter's nightshade (*Circaea lutetiana* ssp. *canadensis*), sweet vernalgrass (*Anthoxanthum odoratum*), white snakeroot (*Ageratina altissima* var. *altissima*), Jack in the pulpit (*Arisaema triphyllum*), and common gypsyweed (*Veronica officinalis*), Christmas fern (*Polystichum acrostichoides*), eastern hayscented fern (*Dennstaedtia punctilobula*), cleavers (*Galium aparine*), and common yellow oxalis (*Oxalis stricta*). The invasive species garlic mustard (*Alliaria petiolata*) and Japanese stilt grass (*Microstegium vimineum*) can be abundant in this forest type. Vines can be absent or common, with such species as eastern poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), and grape (*Vitis* spp.).

**Most Abundant Species:**

| <u>Stratum</u>      | <u>Lifeform</u>              | <u>Species</u>   |
|---------------------|------------------------------|--|
| Tree canopy         | Needle-leaved tree           | <i>Pinus strobus</i> , <i>Pinus resinosa</i> , <i>Picea abies</i>                |
| Tree subcanopy      | Needle-leaved tree           | <i>Juniperus virginiana</i>  |
| Short shrub/sapling | Broad-leaved deciduous shrub | <i>Berberis thunbergii</i> , <i>Rosa multiflora</i> ,<br><i>Rubus</i> spp.       |
| Herb (field)        | Graminoid                    | <i>Microstegium vimineum</i> , <i>Anthoxanthum odoratum</i>                      |
| Herb (field)        | Forb                         | <i>Impatiens capensis</i> , <i>Circaea lutetiana</i><br>ssp. <i>canadensis</i> , |
| Vine                | Vine                         | <i>Parthenocissus quinquefolia</i> , <i>Vitis</i> spp.                           |

**Characteristic Species:** *Pinus strobus*, *Juniperus virginiana*, *Microstegium vimineum*.

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

**Subnational Distribution with Crosswalk Data:**

| <u>State</u> | <u>State Rank</u> | <u>Confidence</u> | <u>State Name</u> | <u>Reference</u> |
|--------------|-------------------|-------------------|-------------------|------------------|
| PA           | NA                | NA                | no crosswalk      | Fike 1999        |

**Local Range:** This forest type occurs throughout the park in disturbed woodlots and forested areas.

**Classification Comments:** Despite the variation in species composition, this forest type is identifiable by the dominance of planted conifer species (typically *Pinus* spp. or *Picea* spp.) in the canopy.

**Other Comments:** Information not available.

**Local Description Authors:** S. Perles.

**Plots:** GETT.34.

**Gettysburg National Military Park and Eisenhower National Historic Site Inventory Notes:** Information not available.

**GLOBAL INFORMATION**

**NVC CLASSIFICATION**

|                            |   |
|----------------------------|---|
| Physiognomic Class         | Forest (I)  |
| Physiognomic Subclass      | Evergreen forest (I.A.)   |
| Physiognomic Group         | Temperate or subpolar needle-leaved evergreen forest (I.A.8.)                           |
| Physiognomic Subgroup      | Planted/Cultivated temperate or subpolar needle-leaved<br>evergreen forest (I.A.8.C.)   |
| Formation                  | Planted/cultivated temperate or subpolar needle-leaved evergreen<br>forest (I.A.8.C.x.) |
| Alliance                   | <i>Pinus strobus</i> Planted Forest Alliance (A.98)                                     |
| Alliance (English name)    | Eastern White Pine Planted Forest Alliance  |
| Association                | <i>Pinus</i> spp. Planted Forest  |
| Association (English name) | Pine species Planted Forest   |

**Ecological System(s):** Information not available.

## GLOBAL DESCRIPTION

**Concept Summary:** These plantations consist of mature *Pinus strobus* or *Pinus sylvestris*, with other conifers sometimes present in smaller amounts, planted in post-agricultural fields and pastures. Associated canopy conifers include *Pinus resinosa*, *Picea abies*, or *Larix decidua*. The understory varies widely in its degree of development and may be virtually absent. Northern hardwoods typically dominate the sapling and seedling layers, and cover is proportional to the degree of canopy break-up or opening that has occurred. Common hardwoods include *Prunus serotina*, *Acer rubrum*, and *Fraxinus americana*. A tall-shrub layer may be present; common species (aside from smaller individuals of the hardwood saplings) include *Crataegus* spp., *Hamamelis virginiana*, and *Lindera benzoin*. Common short shrubs include *Viburnum recognitum*, *Vaccinium pallidum*, *Rubus hispidus*, and *Rubus flagellaris*. The species composition and abundance of the herbaceous layer vary widely due to variation in canopy tree species composition, stand stocking, and soil drainage. Herbaceous species include *Ageratina altissima*, *Dryopteris intermedia*, *Dryopteris carthusiana*, *Oxalis stricta*, *Potentilla simplex*, *Mitchella repens*, *Galium aparine*, *Galium asprellum*, *Brachyelytrum erectum*, and *Lycopodium digitatum*. Graminoid and forb species associated with disturbed areas, such as *Agrostis stolonifera*, *Dichanthelium clandestinum*, *Dennstaedtia punctilobula*, and *Hypericum perforatum*, are often dominant in these communities. Vines such as *Toxicodendron radicans*, *Smilax glauca*, *Smilax rotundifolia*, *Vitis* spp., and *Parthenocissus quinquefolia* may be present, but not abundant, in these plantations. Disturbance from the silvicultural treatments and landscape fragmentation leave these communities prone to invasion by exotic species, including *Lonicera tatarica*, *Berberis vulgaris*, and *Rosa multiflora*, which are locally abundant in places.

**Environmental Description:** These mature plantations are planted in post-agricultural fields and pastures.

**Vegetation Description:** These plantations consist of mature *Pinus strobus* or *Pinus sylvestris*, with other conifers sometimes present in smaller amounts, planted in post-agricultural fields and pastures. Associated canopy conifers include *Pinus resinosa*, *Picea abies*, or *Larix decidua*. The understory varies widely in its degree of development and may be virtually absent. Northern hardwoods typically dominate the sapling and seedling layers, and cover is proportional to the degree of canopy break-up or opening that has occurred. Common hardwoods include *Prunus serotina*, *Acer rubrum*, and *Fraxinus americana*. A tall-shrub layer may be present; common species (aside from smaller individuals of the hardwood saplings) include *Crataegus* spp., *Hamamelis virginiana*, and *Lindera benzoin*. Common short shrubs include *Viburnum recognitum*, *Vaccinium pallidum*, *Rubus hispidus*, and *Rubus flagellaris*. The species composition and abundance of the herbaceous layer vary widely due to variation in canopy tree species composition, stand stocking, and soil drainage. Herbaceous species include *Ageratina altissima*, *Dryopteris intermedia*, *Dryopteris carthusiana*, *Oxalis stricta*, *Potentilla simplex*, *Mitchella repens*, *Galium aparine*, *Galium asprellum*, *Brachyelytrum erectum*, and *Lycopodium digitatum*. Graminoid and forb species associated with disturbed areas, such as *Agrostis stolonifera*, *Dichanthelium clandestinum*, *Dennstaedtia punctilobula*, and *Hypericum perforatum*, are often dominant in these communities. Vines such as *Toxicodendron radicans*, *Smilax glauca*, *Smilax rotundifolia*, *Vitis* spp., and *Parthenocissus quinquefolia* may be present, but not abundant, in these plantations. Disturbance from the silvicultural treatments and landscape fragmentation leave these communities prone to invasion by exotic species, including *Lonicera tatarica*, *Berberis vulgaris*, and *Rosa multiflora*, which are locally abundant in places.

**Most Abundant Species:**

| <u>Stratum</u> | <u>Lifeform</u>    | <u>Species</u>                                 |
|----------------|--------------------|--|
| Tree canopy    | Needle-leaved tree | <i>Pinus strobus</i> , <i>Pinus sylvestris</i> |

**Characteristic Species:** *Pinus strobus*, *Pinus sylvestris*.

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

**USFWS Wetland System:** Not applicable.

**DISTRIBUTION**

**Range:** Information not available.

**States/Provinces:** PA, VT.

**Federal Lands:** NPS (Allegheny Portage Railroad, Delaware Water Gap, Fort Necessity, Friendship Hill, Johnstown Flood, Marsh-Billings-Rockefeller).

**CONSERVATION STATUS**

**Rank:** GNA (modified/managed) (1-Dec-2004).

**Reasons:** Information not available.

**CLASSIFICATION INFORMATION**

**Status:** Standard.

**Confidence:** 3 – Weak.

**Comments:** This type is intended for plantations of mixed pines or pine mixed with other nonnative planted conifers.

**Similar Associations:**

- *Pinus strobus* Planted Forest (CEGL007178)--monotypic white pine.

**Related Concepts:** Information not available.

**SOURCES**

**Description Authors:** S. C. Gawler.

**References:** Eastern Ecology Working Group n.d., Perles et al. 2006a, Perles et al. 2006b, Perles et al. 2006.



Figure 16. Conifer Plantation in Gettysburg National Military Park (plot GETT.34). June 2004. NAD 1983 / UTM easting 308244, northing 4413695.



## Common Name (Park-specific): Virginia Pine Successional Forest

### SYNONYMS

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

### LOCAL INFORMATION

**Environmental Description:** This forest type occurs on upland silt loam soils in the Croton, Abbottstown and Mount Lucas series. These sites are typically flat and often surrounded by other disturbed or managed vegetation types.

**Vegetation Description:** The canopy is typically dominated by conifers such as Virginia pine (*Pinus virginiana*) often with eastern red-cedar (*Juniperus virginiana*) as an associate in the canopy and subcanopy. Other canopy and subcanopy associates include white ash (*Fraxinus americana*), black cherry (*Prunus serotina*), flowering dogwood (*Cornus florida*), red maple (*Acer rubrum*), and black oak (*Quercus velutina*). This association is variable both in vegetation structure and species composition. Land-use history as well as past and current management greatly affect the composition of each forest stand. The closed canopy extends 15–20 m in height, while subcanopy trees usually range from 5–15 m in height and cover 0–40% of the stand. Adventitious hardwoods such as white ash, pignut hickory (*Carya glabra*), black cherry, and several oak species (*Quercus velutina*, *Quercus rubra*, *Quercus alba*) can be found in the sparse tall-shrub layer. Seedlings of these trees make up the sparse short-shrub layer, along with Allegheny blackberry (*Rubus allegheniensis*), black raspberry (*Rubus occidentalis*), and northern dewberry (*Rubus flagellaris*). The herbaceous layer can be sparse or dense (15–80% cover) and contains jewelweed (*Impatiens capensis*), broadleaf enchanter's nightshade (*Circaea lutetiana* ssp. *canadensis*), sweet vernalgrass (*Anthoxanthum odoratum*), white snakeroot (*Ageratina altissima* var. *altissima*), Jack in the pulpit (*Arisaema triphyllum*), and common gypsyweed (*Veronica officinalis*). Invasive species are abundant in the tall-shrub, short-shrub and herbaceous layers of this forest type. The most common invasives include Japanese stilt grass (*Microstegium vimineum*), Japanese barberry (*Berberis thunbergii*), Japanese honeysuckle (*Lonicera japonica*), multiflora rose (*Rosa multiflora*), Morrow's honeysuckle (*Lonicera morrowii*), oriental ladythumb (*Polygonum caespitosum*), garlic mustard (*Alliaria petiolata*), and European privet (*Ligustrum vulgare*). Vines such as Virginia creeper (*Parthenocissus quinquefolia*), grape (*Vitis* spp.), and eastern poison ivy (*Toxicodendron radicans*) are common and often cover 10–20% of the stand.

### Most Abundant Species:

| <u>Stratum</u>      | <u>Lifeform</u>              | <u>Species</u>   |
|---------------------|------------------------------|--|
| Tree canopy         | Needle-leaved tree           | <i>Pinus virginiana</i>  |
| Tree subcanopy      | Needle-leaved tree           | <i>Juniperus virginiana</i>  |
| Short shrub/sapling | Broad-leaved deciduous shrub | <i>Berberis thunbergii</i> , <i>Rosa multiflora</i>                            |
| Herb (field)        | Vine/Liana                   | <i>Parthenocissus quinquefolia</i>   |
| Herb (field)        | Forb                         | <i>Circaea lutetiana</i> ssp. <i>canadensis</i> ,<br><i>Impatiens capensis</i> |
| Herb (field)        | Graminoid                    | <i>Anthoxanthum odoratum</i> , <i>Microstegium vimineum</i>                    |

**Characteristic Species:** *Juniperus virginiana*, *Pinus virginiana*.

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

**Subnational Distribution with Crosswalk Data:**

| <u>State</u> | <u>State Rank</u> | <u>Confidence</u> | <u>State Name</u>                     | <u>Reference</u> |
|--------------|-------------------|-------------------|---------------------------------------|------------------|
| PA           | S5                | 1                 | Virginia pine - mixed hardwood forest | Fike 1999        |

**Local Range:** This forest type occurs throughout the park in disturbed woodlots and forested areas.

**Classification Comments:** This forest type is identifiable by the dominance of *Pinus virginiana* in the canopy.

**Other Comments:** Information not available.

**Local Description Authors:** S. Perles.

**Plots:** GETT.24, GETT.70.

**Gettysburg National Military Park and Eisenhower National Historic Site Inventory Notes:** Information not available.

**GLOBAL INFORMATION**

**NVC CLASSIFICATION**

|                              |   |
|------------------------------|---|
| Physiognomic Class           | Forest (I)  |
| Physiognomic Subclass        | Evergreen forest (I.A.)   |
| Physiognomic Group           | Temperate or subpolar needle-leaved evergreen forest (I.A.8.)   |
| Physiognomic Subgroup        | Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)  |
| Formation                    | Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b.)   |
| Alliance                     | <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)<br>Northeastern Interior Dry-Mesic Oak Forest (CES202.592)<br>Southern Appalachian Low Mountain Pine Forest (CES202.332) |

**GLOBAL DESCRIPTION**

**Concept Summary:** This community occurs in areas where canopy removal has created dry, open conditions and bare mineral soil, allowing for the establishment of *Pinus virginiana*. These habitats include old fields, old pastures, clearcuts, and burned or eroded areas. This forest typically has a very dense canopy of *Pinus virginiana* and little understory vegetation. The dense canopy may also include admixtures of other *Pinus* species (e.g., *Pinus taeda*, *Pinus echinata*) or other early successional deciduous trees (e.g., *Acer rubrum*, *Liquidambar styraciflua*, *Liriodendron tulipifera*). 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*. 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* 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 Dystrachrepts). 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* and little understory vegetation. *Pinus taeda* or *Pinus echinata* may co-occur with *Pinus virginiana* in the canopy. The canopy can also have significant admixtures of early successional deciduous trees (e.g., *Acer rubrum*, *Liquidambar styraciflua*, *Liriodendron tulipifera*). Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species. Shrub and herb strata are absent to sparse in coverage. In eastern Tennessee the subcanopy may contain *Acer saccharum* and *Cornus florida*; other associated species may include *Cercis canadensis*, *Parthenocissus quinquefolia*, *Lonicera japonica*, and *Microstegium vimineum* (Andreu and Tukman 1995). In the Central Appalachians, associates include *Pinus taeda*, *Pinus echinata*, and *Pinus rigida*. The dense ericaceous shrub stratum contains *Vaccinium* spp., *Gaylussacia* spp., *Kalmia latifolia*, and *Rhododendron* spp.

**Most Abundant Species:**

| <u>Stratum</u>      | <u>Lifeform</u>              | <u>Species</u>   |
|---------------------|------------------------------|--|
| Tree canopy         | Needle-leaved tree           | <i>Pinus virginiana</i>  |
| Tree subcanopy      | Needle-leaved tree           | <i>Juniperus virginiana</i>  |
| Tree subcanopy      | Broad-leaved deciduous tree  | <i>Acer rubrum</i> , <i>Cornus florida</i> , <i>Nyssa sylvatica</i> , <i>Oxydendrum arboreum</i>                               |
| Tall shrub/sapling  | Broad-leaved deciduous tree  | <i>Cornus florida</i> , <i>Nyssa sylvatica</i> , <i>Oxydendrum arboreum</i>  |
| Tall shrub/sapling  | Broad-leaved evergreen tree  | <i>Vaccinium arboreum</i>  |
| Tall shrub/sapling  | Broad-leaved deciduous shrub | <i>Vaccinium stamineum</i>   |
| Short shrub/sapling | Broad-leaved deciduous tree  | <i>Cercis canadensis</i> , <i>Cornus florida</i> , <i>Oxydendrum arboreum</i> , <i>Quercus alba</i> , <i>Sassafras albidum</i> |
| Herb (field)        | Vine/Liana                   | <i>Lonicera japonica</i> , <i>Smilax glauca</i> , <i>Toxicodendron radicans</i>  |

**Characteristic Species:** *Pinus virginiana*.

**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 (Big South Fork, Blue Ridge Parkway?, Cumberland Gap, Gettysburg, Great Smoky Mountains, Kings Mountain, Lincoln Birthplace, Little River Canyon?, Mammoth

Cave, Natchez Trace, Obed, Shenandoah, Shiloh); TVA (Tellico); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Sumter, 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* 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:

- IA7c. Xeric Virginia Pine Ridge Forest (Allard 1990) B.
- Unclassified Old-Field Successional Forest (Fleming and Moorhead 2000) ?
- Virginia Pine - Oak: 78 (Eyre 1980) B.
- Virginia Pine, RV (Pyne 1994) B.
- Virginia Pine: 79 (Eyre 1980) B.
- Xeric Pine Forest (Ambrose 1990a) B.

#### SOURCES

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

**References:** Allard 1990, Ambrose 1990a, Andreu and Tukman 1995, Eyre 1980, Fike 1999, Fleming and Coulling 2001, Fleming and Moorhead 2000, Nelson 1986, Patterson et al. 1999, Pyne 1994, Schmalzer and DeSelm 1982, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data.





Figure 17. Virginia Pine Successional Forest in Gettysburg National Military Park (plot GETT.24). May 2004. NAD 1983 / UTM easting 307720, northing 4410586.



Figure 18. Virginia Pine Successional Forest in Gettysburg National Military Park (plot GETT.70). August 2004. NAD 1983 / UTM easting 310528, northing 4409622.

**Common Name (Park-specific): Sycamore – Mixed Hardwood Floodplain Forest**

**SYNONYMS**

- NVC English Name:** Sycamore - Box-elder - Black Walnut / Common Pawpaw / Virginia Bluebells Forest  
**NVC Scientific Name:** *Platanus occidentalis* - *Acer negundo* - *Juglans nigra* / *Asimina triloba* / *Mertensia virginica* Forest  
**NVC Identifier:** C EGL004073

**LOCAL INFORMATION**

**Environmental Description:** This forest type occurs on floodplain terraces and islands associated with the larger streams in the parks, such as Rock Creek and Marsh Creek. The association is found on poorly drained floodplain soils typical of the Hatboro and Bowmansville series. The ground story experiences scour from flood waters during high water events.

**Vegetation Description:** The canopy is typically dominated by sycamore (*Platanus occidentalis*), with associates black walnut (*Juglans nigra*), bitternut hickory (*Carya cordiformis*), silver maple (*Acer saccharinum*), shagbark hickory (*Carya ovata*), boxelder (*Acer negundo*), and shellbark hickory (*Carya laciniosa*). The subcanopy is composed of American elm (*Ulmus americana*), boxelder, silver maple, and green ash (*Fraxinus pennsylvanica*). The closed canopy extends 25–35 m in height, while subcanopy trees usually range from 5–15 m in height and cover 30–60% of the stand. The tall- and short-shrub layers are sparse, usually composed of saplings and seedlings of canopy and subcanopy trees, as well as other weedy hardwood species. The herbaceous layer is typically dense (about 90% cover) and contains false mermaidweed (*Floerkea proserpinacoides*), jewelweed (*Impatiens capensis*), broadleaf enchanter's nightshade (*Circaea lutetiana* ssp. *canadensis*), Canadian wild ginger (*Asarum canadense*), green dragon (*Arisaema dracontium*), spreading sedge (*Carex laxiculmis*), and smooth Solomon's seal (*Polygonatum biflorum*). Invasive species are abundant in the herbaceous layer, including garlic mustard (*Alliaria petiolata*), Japanese stilt grass (*Microstegium vimineum*), Japanese honeysuckle (*Lonicera japonica*), oriental ladythumb (*Polygonum caespitosum*), and Asiatic tearthumb (*Polygonum perfoliatum*). Vines such as eastern poison ivy (*Toxicodendron radicans*) and Virginia creeper (*Parthenocissus quinquefolia*) are typical and cover 5–20% of the stand.

**Most Abundant Species:**

| <u>Stratum</u> | <u>Lifeform</u>             | <u>Species</u>   |
|----------------|-----------------------------|--|
| Tree canopy    | Broad-leaved deciduous tree | <i>Acer negundo</i> , <i>Platanus occidentalis</i>                                       |
| Tree subcanopy | Broad-leaved deciduous tree | <i>Acer saccharinum</i> , <i>Ulmus americana</i>   |
| Herb (field)   | Vine/Liana                  | <i>Parthenocissus quinquefolia</i> ,<br><i>Toxicodendron radicans</i>                    |
| Herb (field)   | Forb                        | <i>Alliaria petiolata</i> , <i>Floerkea proserpinacoides</i> , <i>Impatiens capensis</i> |
| Herb (field)   | Graminoid                   | <i>Carex laxiculmis</i> , <i>Microstegium vimineum</i>                                   |

**Characteristic Species:** *Acer negundo*, *Acer saccharinum*, *Alliaria petiolata*, *Floerkea proserpinacoides*, *Microstegium vimineum*, *Platanus occidentalis*, *Ulmus americana*.

**Other Noteworthy Species:** *Carya laciniosa*.



**Subnational Distribution with Crosswalk Data:**

| <u>State</u> | <u>State Rank</u> | <u>Confidence</u> | <u>State Name</u>   | <u>Reference</u> |
|--------------|-------------------|-------------------|---|------------------|
| PA           | S3                | 3                 | Sycamore – (river birch) –<br>box-elder floodplain forest | Fike 1999        |

**Local Range:** This forest type occurs on floodplain terraces and islands associated with the larger streams in the park such as Rock Creek and Marsh Creek.

**Classification Comments:** Although plots used to describe this type contain some atypical species, the description is generally consistent with other Sycamore-Mixed Hardwood Floodplain Forest found in the state.

**Other Comments:** Information not available.

**Local Description Authors:** S. Perles.

**Plots:** GETT.6, GETT.64.

**Gettysburg National Military Park and Eisenhower National Historic Site Inventory Notes:**  
 Information not available.

**GLOBAL INFORMATION**

**NVC CLASSIFICATION**

|                              |  |
|------------------------------|--|
| Physiognomic Class           | Forest (I)   |
| Physiognomic Subclass        | Deciduous forest (I.B.)  |
| Physiognomic Group           | Cold-deciduous forest (I.B.2.)   |
| Physiognomic Subgroup        | Natural/Semi-natural cold-deciduous forest (I.B.2.N.)  |
| Formation                    | Temporarily flooded cold-deciduous forest (I.B.2.N.d.)   |
| Alliance                     | Platanus occidentalis - (Fraxinus pennsylvanica, Celtis laevigata, Acer saccharinum) Temporarily Flooded Forest Alliance (A.288)       |
| Alliance (English name)      | Sycamore - (Green Ash, Sugarberry, Silver Maple) Temporarily Flooded Forest Alliance   |
| Association                  | <i>Platanus occidentalis</i> - <i>Acer negundo</i> - <i>Juglans nigra</i> / <i>Asimina triloba</i> / <i>Mertensia virginica</i> Forest |
| Association (English name)   | Sycamore - Box-elder - Black Walnut / Common Pawpaw / Virginia Bluebells Forest  |
| <b>Ecological System(s):</b> | Information not available.   |

**GLOBAL DESCRIPTION**

**Concept Summary:** This association occupies the higher elevations of floodplains, floodplain berms, and low terraces of major Mid-Atlantic rivers (e.g., Potomac, Shenandoah, Monocacy, James) and as main floodplain vegetation on medium-sized rivers draining areas of nutrient-rich substrates (e.g., Antietam Creek, Bull Run). Soil texture is variable, ranging from silty-clay loams to loams over much of the range, and samples collected from plots had very high base status. This vegetation type is a closed forest with mixed overstory dominance by *Platanus occidentalis*, *Juglans nigra*, *Carya cordiformis*, *Celtis occidentalis*, *Ulmus americana*, and, locally, *Fraxinus pennsylvanica*, *Liriodendron tulipifera*, and *Quercus shumardii*. *Acer saccharinum* is codominant in a minority of stands but absent or unimportant in many others. *Acer negundo* is strongly dominant in the subcanopy. *Asimina triloba* and/or *Lindera benzoin* dominate moderately dense to dense shrub layers. Herb layers are rich in spring ephemerals and other nutrient-demanding species, including *Mertensia virginica*, *Asarum canadense*,

*Chaerophyllum procumbens*, *Hydrophyllum canadense*, *Viola striata*, *Phlox divaricata*, *Podophyllum peltatum*, *Erythronium americanum*, *Dicentra canadensis*, *Sanicula odorata*, *Packera aurea*, *Claytonia virginica*, *Festuca subverticillata*, *Carex jamesii*, *Carex grisea*, *Floerkea proserpinacoides*, *Osmorhiza longistylis*, and *Ranunculus abortivus*. Invasive exotics, especially *Alliaria petiolata*, *Veronica hederifolia*, *Duchesnea indica*, *Urtica dioica* ssp. *dioica*, *Microstegium vimineum*, and *Glechoma hederacea*, are usually abundant. This type was defined to cover rich large-stream floodplain forests of the Mid-Atlantic Piedmont and Central Appalachians. It was split off from the more broadly defined *Platanus occidentalis* - *Acer saccharinum* - *Juglans nigra* - *Ulmus rubra* Forest (CEGL007334).

**Environmental Description:** This association occupies the higher elevations of floodplains, floodplain berms, and low terraces of major Mid-Atlantic rivers (Potomac, Shenandoah, Monocacy) and as main floodplain vegetation on medium-sized rivers draining areas of nutrient-rich substrates (e.g., Antietam Creek, Bull Run). In the Potomac Gorge, average flood-return interval was from about 3 to 15 years. Soil texture is variable, ranging from silty-clay loams to loams over much of the range, but it can be sandy loams or sands along high-gradient reaches. Soil samples collected from plots have a mean pH of 7.0, high calcium content (mean = 2800 ppm), and 100% total base saturation.

**Vegetation Description:** This vegetation type is a closed forest with mixed overstory dominance by *Platanus occidentalis*, *Juglans nigra*, *Carya cordiformis*, *Celtis occidentalis*, *Ulmus americana*, and, locally, *Fraxinus pennsylvanica*, *Liriodendron tulipifera*, and *Quercus shumardii*. *Acer saccharinum* is codominant in a minority of stands but absent or unimportant in many others. *Acer negundo* is strongly dominant in the subcanopy. *Asimina triloba* (usually on sites with coarser soil textures) and /or *Lindera benzoin* (on finer-textured substrates) dominate moderately dense to dense shrub layers. Vines are common, with *Parthenocissus quinquefolia*, *Vitis vulpina*, and *Toxicodendron radicans* most frequent. Herb layers are rich in spring ephemerals and other nutrient-demanding species, including *Mertensia virginica*, *Asarum canadense*, *Chaerophyllum procumbens*, *Hydrophyllum canadense*, *Viola striata*, *Phlox divaricata*, *Podophyllum peltatum*, *Erythronium americanum*, *Dicentra canadensis*, *Sanicula odorata*, *Packera aurea*, *Claytonia virginica*, *Festuca subverticillata*, *Carex jamesii*, *Carex grisea*, *Floerkea proserpinacoides*, *Osmorhiza longistylis*, and *Ranunculus abortivus*. Invasive exotics may be abundant and are represented by *Alliaria petiolata*, *Veronica hederifolia*, *Duchesnea indica*, *Urtica dioica* ssp. *dioica*, *Microstegium vimineum*, and *Glechoma hederacea*.

**Most Abundant Species:**

| <u>Stratum</u>     | <u>Lifeform</u>              | <u>Species</u>  |
|--------------------|------------------------------|---|
| Tree canopy        | Broad-leaved deciduous tree  | <i>Carya cordiformis</i> , <i>Platanus occidentalis</i> , <i>Ulmus americana</i>          |
| Tree subcanopy     | Broad-leaved deciduous tree  | <i>Acer negundo</i> , <i>Celtis occidentalis</i> , <i>Juglans nigra</i>                   |
| Tall shrub/sapling | Broad-leaved deciduous shrub | <i>Asimina triloba</i> , <i>Lindera benzoin</i>   |
| Herb (field)       | Vine/Liana                   | <i>Parthenocissus quinquefolia</i> , <i>Toxicodendron radicans</i> , <i>Vitis vulpina</i> |
| Herb (field)       | Forb                         | <i>Mertensia virginica</i>  |

**Characteristic Species:** *Acer negundo*, *Asimina triloba*, *Juglans nigra*, *Mertensia virginica*, *Platanus occidentalis*, *Ulmus americana*.

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

**USFWS Wetland System:** Not applicable.

#### DISTRIBUTION

**Range:** This community occurs on floodplains of large and medium-sized Mid-Atlantic rivers, including the Potomac, Shenandoah, James, Rappahannock, Monocacy, Clinch, and possibly others northward.

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

**Federal Lands:** NPS (Antietam, C&O Canal, Eisenhower, Friendship Hill, George Washington Parkway, Gettysburg, Harpers Ferry, Manassas, Monocacy, National Capital-East); USFS (George Washington).

#### CONSERVATION STATUS

**Rank:** G4 (25-Jan-2005).

**Reasons:** The type is not rare but has a restricted geographic range, is confined to larger rivers in the Mid-Atlantic region, and is subject to continuing degradation by invasive species.

#### CLASSIFICATION INFORMATION

**Status:** Standard.

**Confidence:** 2 – Moderate.

**Comments:** This type was defined through analysis of 36 plot samples from Virginia and Maryland and through consultation with ecologists from those states and West Virginia. It possibly extends into Pennsylvania but should be confirmed with ecologists in that state. It was decided to split this unit off from the more broadly defined USNVC unit *Platanus occidentalis* - *Acer saccharinum* - *Juglans nigra* - *Ulmus rubra* Forest (CEGL007334).

#### Similar Associations:

- *Acer saccharinum* - *Acer negundo* / *Ageratina altissima* - *Laportea canadensis* - (*Elymus virginicus*) Forest (CEGL006217).
- *Platanus occidentalis* - *Acer saccharinum* - *Juglans nigra* - *Ulmus rubra* Forest (CEGL007334)--covers rich floodplain forest west of the Appalachians.

#### Related Concepts:

- *Platanus occidentalis* - *Acer negundo* - *Juglans nigra* / *Asimina triloba* / *Mertensia virginica* Forest (Fleming et al. 2004) =
- *Platanus occidentalis* - *Acer negundo* / *Asarum canadense* Forest (Thomson et al. 1999) =
- *Platanus occidentalis* - *Acer negundo* / *Asimina triloba* - *Lindera benzoin* / *Mertensia virginica* - *Asarum canadense* Forest (Fleming and Coulling 2001) =
- *Platanus occidentalis* - *Acer negundo* / *Asimina triloba* / *Asarum canadense* Forest (Lea 2000) =
- *Platanus occidentalis* - *Acer negundo* / *Asimina triloba* / *Carex jamesii* Forest (Lea 2000) =
- *Platanus occidentalis* - *Acer negundo* / *Asimina triloba* / *Mertensia virginica* Forest (Lea 2000) =
- *Platanus occidentalis* - *Acer negundo* / *Hydrophyllum canadense* - *Laportea canadensis* Forest (Lea 2000) =
- *Platanus occidentalis* - *Fraxinus pennsylvanica* Floodplain Forest (Vanderhorst 2000b) =
- Piedmont / Central Appalachian Rich Floodplain Forest (Fleming et al. 2004) =

**SOURCES**

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

**References:** Eastern Ecology Working Group n.d., Fleming and Coulling 2001, Fleming et al. 2004, Harrison 2004, Lea 2000, Lea 2003, Thomson et al. 1999, VDNH 2003, Vanderhorst 2000b.



Figure 19. Sycamore – Mixed Hardwood Floodplain Forest in Gettysburg National Military Park (plot GETT.6). May 2004. NAD 1983 / UTM easting 310443, northing 4409188.





Figure 20. Sycamore – Mixed Hardwood Floodplain Forest in Eisenhower National Historic Site (plot GETT.64). June 2004. NAD 1983 / UTM easting 305245, northing 4407682.

## Common Name (Park-specific): Bottomland Mixed Hardwood Forest

### SYNONYMS

**NVC English Name:** Pin Oak - Red Maple / Gray's Sedge - Canada Avens Forest

**NVC Scientific Name:** *Quercus palustris* - *Acer rubrum* / *Carex grayi* - *Geum canadense* Forest

**NVC Identifier:** C EGL006185

### LOCAL INFORMATION

**Environmental Description:** This variable forest type is associated with low-lying areas surrounding small tributaries, creeks and drainages throughout the parks. This vegetation type typically occurs in small patches that follow the water courses and are often surrounded on either side by fields. These areas were probably previously used as pasture in many instances. The soil is saturated or holds standing water for at least part of the growing season. This association is found on moderately well-drained to poorly drained soils from the Bowmansville, Hatboro, Abbottstown, Croton, Watchung, and Mount Lucas series.

**Vegetation Description:** Due to the small fragmented nature of the stands and their disturbance history, the canopy composition can be extremely variable. The canopy can be dominated by one or more of the following species: green ash (*Fraxinus pennsylvanica*), pin oak (*Quercus palustris*), swamp white oak (*Quercus bicolor*), black walnut (*Juglans nigra*), or shagbark hickory (*Carya ovata*). A wide range of associates can be found in the canopy and subcanopy, such as: red maple (*Acer rubrum*), American elm (*Ulmus americana*), eastern redbud (*Cercis canadensis*), boxelder (*Acer negundo*), eastern red-cedar (*Juniperus virginiana*), Shumard oak (*Quercus shumardii*), black cherry (*Prunus serotina*), silver maple (*Acer saccharinum*), sweet cherry (*Prunus avium*), and tuliptree (*Liriodendron tulipifera*). The canopy varies from open woodland to closed canopy (25–80% cover) and extends 20–30 m in height. Subcanopy trees usually range from 10–15 m in height and cover 15–70% of the stand. Northern spicebush (*Lindera benzoin*), along with the invasive plants multiflora rose (*Rosa multiflora*), autumn olive (*Elaeagnus umbellata*), Morrow's honeysuckle (*Lonicera morrowii*), and European privet (*Ligustrum vulgare*) compose the tall-shrub layer that covers 20–60% of the stand. Common short shrubs are Japanese barberry (*Berberis thunbergii*), wine raspberry (*Rubus phoenicolasius*), black raspberry (*Rubus occidentalis*), northern dewberry (*Rubus flagellaris*), Allegheny blackberry (*Rubus allegheniensis*), and seedlings of the canopy and subcanopy species. The herbaceous layer is typically moderately dense to dense (50–99% cover) and contains jewelweed (*Impatiens capensis*), mannagrass (*Glyceria* sp.), spring avens (*Geum vernum*), Jack in the pulpit (*Arisaema triphyllum*), broadleaf enchanter's nightshade (*Circaea lutetiana* ssp. *canadensis*), eastern star sedge (*Carex radiata*), common yellow oxalis (*Oxalis stricta*), eastern narrowleaf sedge (*Carex amphibola*), rough bluegrass (*Poa trivialis*), Canadian wild ginger (*Asarum canadense*), wild garlic (*Allium vineale*), marsh blue violet (*Viola cucullata*), smallspike false nettle (*Boehmeria cylindrica*), and sensitive fern (*Onoclea sensibilis*). The invasive species Japanese stilt grass (*Microstegium vimineum*), Japanese honeysuckle (*Lonicera japonica*), creeping Jenny (*Lysimachia nummularia*), and garlic mustard (*Alliaria petiolata*) can be abundant in the herbaceous layer. Vines such as eastern poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), frost grape (*Vitis vulpina*), and common moonseed (*Menispermum canadense*) are typical and cover 10–60% of the stand.



**Most Abundant Species:**

| <u>Stratum</u>      | <u>Lifeform</u>              | <u>Species</u>  |
|---------------------|------------------------------|---|
| Tree canopy         | Broad-leaved deciduous tree  | <i>Acer rubrum</i> , <i>Carya ovata</i> , <i>Fraxinus pennsylvanica</i> , <i>Juglans nigra</i> , <i>Quercus bicolor</i> , <i>Quercus palustris</i>                  |
| Tree subcanopy      | Broad-leaved deciduous tree  | <i>Acer negundo</i> , <i>Acer rubrum</i> , <i>Juglans nigra</i> , <i>Ulmus americana</i>  |
| Tall shrub/sapling  | Needle-leaved tree           | <i>Juniperus virginiana</i>   |
| Tall shrub/sapling  | Broad-leaved deciduous shrub | <i>Lindera benzoin</i> , <i>Rosa multiflora</i>   |
| Short shrub/sapling | Broad-leaved deciduous shrub | <i>Rosa multiflora</i>  |
| Herb (field)        | Vine/Liana                   | <i>Lonicera japonica</i> , <i>Parthenocissus quinquefolia</i> , <i>Toxicodendron radicans</i>   |
| Herb (field)        | Forb                         | <i>Alliaria petiolata</i> , <i>Arisaema triphyllum</i> , <i>Circaea lutetiana</i> ssp. <i>canadensis</i> , <i>Impatiens capensis</i> , <i>Lysimachia nummularia</i> |
| Herb (field)        | Graminoid                    | <i>Microstegium vimineum</i>  |

**Characteristic Species:** *Acer rubrum*, *Boehmeria cylindrica*, *Fraxinus pennsylvanica*, *Lindera benzoin*, *Onoclea sensibilis*, *Poa trivialis*, *Quercus bicolor*, *Quercus palustris*, *Viola cucullata*.

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

**Subnational Distribution with Crosswalk Data:**

| <u>State</u> | <u>State Rank</u> | <u>Confidence</u> | <u>State Name</u> | <u>Reference</u> |
|--------------|-------------------|-------------------|-------------------|------------------|
| PA           | NA                | NA                | no crosswalk      | Fike 1999        |

**Local Range:** This forest type is found near small tributaries, creeks and drainages throughout the parks.

**Classification Comments:** In Gettysburg National Military Park and Eisenhower National Historic Site, patches of this broadly defined forest type can resemble other more specifically defined palustrine forest types, such as Green Ash Palustrine Forest and Bottomland Oak-Hardwood Palustrine Forest. However, canopy dominance is extremely patchy within the parks, even within small mapped polygons. As a result, it is not feasible to map or, in many instances, to classify this forest type any more specifically than the general Bottomland Mixed Hardwood Palustrine Forest.

**Other Comments:** Information not available.

**Local Description Authors:** S. Perles.

**Plots:** GETT.3, GETT.5, GETT.7, GETT.9, GETT.20, GETT.21, GETT.25, GETT.27, GETT.29, GETT.35, GETT.36, GETT.40, GETT.42, GETT.67, GETT.68.

**Gettysburg National Military Park and Eisenhower National Historic Site Inventory Notes:** Information not available.

**GLOBAL INFORMATION**

**NVC CLASSIFICATION**

|                       |  |
|-----------------------|--|
| Physiognomic Class    | Forest (I)   |
| Physiognomic Subclass | Deciduous forest (I.B.)                                |
| Physiognomic Group    | Cold-deciduous forest (I.B.2.)                         |
| Physiognomic Subgroup | Natural/Semi-natural cold-deciduous forest (I.B.2.N.)  |
| Formation             | Temporarily flooded cold-deciduous forest (I.B.2.N.d.) |

|                              |   |
|------------------------------|---|
| Alliance                     | Quercus palustris - Acer rubrum Temporarily Flooded Forest Alliance (A.301) |
| Alliance (English name)      | Pin Oak - Red Maple Temporarily Flooded Forest Alliance                     |
| Association                  | Quercus palustris - Acer rubrum / Carex grayi - Geum canadense Forest       |
| Association (English name)   | Pin Oak - Red Maple / Gray's Sedge - White Avens Forest                     |
| <b>Ecological System(s):</b> | Central Appalachian Floodplain (CES202.608)                                 |

**GLOBAL DESCRIPTION**

**Concept Summary:** This freely drained floodplain forest occurs along smaller rivers in southern New England. The canopy is comprised of *Quercus palustris*, *Fraxinus pennsylvanica*, *Acer rubrum*, *Ulmus americana*, and occasionally *Quercus bicolor* and *Platanus occidentalis*. The shrub layer includes *Lindera benzoin*, *Viburnum recognitum*, *Cornus amomum*, *Cornus obliqua*, or *Sambucus canadensis*. The herbaceous layer can have abundant sedges including *Carex lurida*, *Carex crinita*, *Carex intumescens*, *Carex lupulina*, or *Carex grayi* with additional species like *Cinna arundinacea*, *Geum canadense*, *Polygonum virginianum*, *Onoclea sensibilis*, *Athyrium filix-femina*, *Arisaema triphyllum*, *Iris versicolor*, *Viola sororia*, and *Toxicodendron radicans*.

**Environmental Description:** This forest occurs on alluvial deposits in the floodplain of small rivers. Flooding occurs during local events, especially during winter months.

**Vegetation Description:** This association comprises freely drained floodplain forests of smaller rivers in southern New England. The canopy is comprised of *Quercus palustris*, *Fraxinus pennsylvanica*, *Acer rubrum*, *Ulmus americana*, and occasionally *Quercus bicolor* and *Platanus occidentalis*. The shrub layer includes *Lindera benzoin*, *Viburnum recognitum*, *Cornus amomum*, *Cornus obliqua*, or *Sambucus canadensis*. The herbaceous layer can have abundant sedges, including *Carex lurida*, *Carex crinita*, *Carex intumescens*, *Carex lupulina*, or *Carex grayi*, with additional species such as *Cinna arundinacea*, *Geum canadense*, *Polygonum virginianum*, *Onoclea sensibilis*, *Athyrium filix-femina*, *Arisaema triphyllum*, *Iris versicolor*, *Viola sororia*, and *Toxicodendron radicans*.

**Most Abundant Species:**

| <u>Stratum</u>     | <u>Lifeform</u>              | <u>Species</u>   |
|--------------------|------------------------------|--|
| Tree canopy        | Broad-leaved deciduous tree  | <i>Acer rubrum</i> , <i>Fraxinus pennsylvanica</i> , <i>Quercus palustris</i> , <i>Ulmus americana</i> |
| Tree subcanopy     | Broad-leaved deciduous tree  | <i>Acer rubrum</i> , <i>Fraxinus pennsylvanica</i> , <i>Quercus palustris</i> , <i>Ulmus americana</i> |
| Tall shrub/sapling | Broad-leaved deciduous shrub | <i>Lindera benzoin</i>   |
| Herb (field)       | Graminoid                    | <i>Carex crinita</i> , <i>Carex intumescens</i> , <i>Carex lurida</i> , <i>Cinna arundinacea</i>       |
| Herb (field)       | Fern or fern ally            | <i>Onoclea sensibilis</i>  |

**Characteristic Species:** *Carex grayi*, *Fraxinus pennsylvanica*, *Geum canadense*, *Lindera benzoin*, *Quercus palustris*.

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

**USFWS Wetland System:** Palustrine.

**DISTRIBUTION**

**Range:** This association is currently known from Connecticut, Massachusetts, Rhode Island, New Jersey, and New York, but possibly extends to New Jersey and Pennsylvania.

**States/Provinces:** CT, MA, NJ, NY, PA, RI.

**Federal Lands:** NPS (Delaware Water Gap, Eisenhower, Gettysburg); USFWS (Great Swamp) Conservation Status.

**Rank:** GNR (1-Dec-1997).

**Reasons:** Information not available.

**CLASSIFICATION INFORMATION**

**Status:** Standard.

**Confidence:** 2 – Moderate.

**Comments:** This type is currently described from Connecticut. Silvics manual (Burns and Honkala 1990b) notes *Quercus palustris* as reaching into the eastern United States through Pennsylvania and northern New Jersey extending northward in the Hudson and Connecticut river valleys. It also occurs along the coast in Rhode Island.

**Similar Associations:**

- *Quercus palustris* - (*Quercus bicolor*) - *Acer rubrum* / *Osmunda cinnamomea* Forest (CEGL006240)--basin swamp with *Quercus palustris* and *Acer rubrum*.

**Related Concepts:**

- Southern New England floodplain forest (Rawinski 1984) ?

**SOURCES**

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

**References:** Barrett and Enser 1997, Breden et al. 2001, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Metzler and Barrett 2001, Rawinski 1984, Swain and Kearsley 2001.



Figure 21. Bottomland Mixed Hardwood Forest in Gettysburg National Military Park (plot GETT.3). May 2004. NAD 1983 / UTM easting 310424, northing 4410081.





Figure 22. Bottomland Mixed Hardwood Forest in Gettysburg National Military Park (plot GETT.9). May 2004. NAD 1983 / UTM easting 309759, northing 4408558.

## Common Name (Park-specific): Palustrine Shrub Thicket

### SYNONYMS

NVC Identifier: No Global Crosswalk

### LOCAL INFORMATION

**Environmental Description:** This shrub-dominated type is associated with low-lying areas surrounding small tributaries, creeks and drainages throughout the parks. These shrub thickets follow the water courses typically through pastures, agricultural fields or wet meadows. The soil is saturated or holds standing water for at least part of the growing season. This association is found on moderately well-drained to poorly drained soils from the Bowmansville, Hatboro, Abbottstown, Croton, Watchung, and Mount Lucas series.

**Vegetation Description:** Most of these shrub thickets were planted by the park service in order to replicate the vegetation at the time of the battle. The thickets can contain some of the following shrub species: speckled alder (*Alnus incana* ssp. *rugosa*), hazel alder (*Alnus serrulata*), pawpaw (*Asimina triloba*), common buttonbush (*Cephalanthus occidentalis*), alternate-leaf dogwood (*Cornus alternifolia*), silky dogwood (*Cornus amomum*), gray dogwood (*Cornus racemosa*), red-osier dogwood (*Cornus sericea*), beaked hazelnut (*Corylus cornuta*), American hazelnut (*Corylus americana*), American witch-hazel (*Hamamelis virginiana*), northern spicebush (*Lindera benzoin*), eastern ninebark (*Physocarpus opulifolius*), choke cherry (*Prunus virginiana*), lanceleaf buckthorn (*Rhamnus lanceolata*), smooth sumac (*Rhus glabra*), Appalachian gooseberry (*Ribes rotundifolium*), Allegheny blackberry (*Rubus allegheniensis*), willows (*Salix* spp.), common elderberry (*Sambucus nigra* ssp. *canadensis*), white meadowsweet (*Spiraea alba*), American bladdernut (*Staphylea trifolia*), mapleleaf viburnum (*Viburnum acerifolium*), nannyberry (*Viburnum lentago*), southern arrowwood (*Viburnum dentatum* var. *lucidum*), and/or common prickly-ash (*Zanthoxylum americanum*). Grasses and forbs are typically sparsely distributed under the shrubs. Common species are typical of old fields, agricultural weeds, and wet meadows. Some common species are sedges (*Carex* spp.), rushes (*Juncus* spp.), reed canary grass (*Phalaris arundinacea*), rough bluegrass (*Poa trivialis*), rice cutgrass (*Leersia oryzoides*), bulrushes (*Scirpus* spp.), Indianhemp (*Apocynum cannabinum*), red fescue (*Festuca rubra*), meadow ryegrass (*Lolium pratense*), arrowleaf tearthumb (*Polygonum sagittatum*), harvestlice (*Agrimonia parviflora*), bluntleaf bedstraw (*Galium obtusum*), jewelweed (*Impatiens capensis*), fowl mannagrass (*Glyceria striata*), sweet vernalgrass (*Anthoxanthum odoratum*), early goldenrod (*Solidago juncea*), wrinkleleaf goldenrod (*Solidago rugosa*), narrowleaf mountainmint (*Pycnanthemum tenuifolium*), American burnweed (*Erechtites hieraciifolia*), common yellow oxalis (*Oxalis stricta*), St. John's wort (*Hypericum punctatum*, *Hypericum perforatum*), garden yellowrocket (*Barbarea vulgaris*), Queen Anne's lace (*Daucus carota*), wild garlic (*Allium vineale*), flat-top goldentop (*Euthamia graminifolia*), Virginia strawberry (*Fragaria virginiana*), and wild mint (*Mentha arvensis*).

### Most Abundant Species:

| <u>Stratum</u>      | <u>Lifeform</u>              | <u>Species</u>                       |
|---------------------|------------------------------|--------------------------------------|
| Tall shrub/sapling  | Broad-leaved deciduous shrub | numerous, see vegetation description |
| Short shrub/sapling | Broad-leaved deciduous shrub | numerous, see vegetation description |

**Characteristic Species:** Numerous, see vegetation description.

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

**Subnational Distribution with Crosswalk Data:**

| <u>State</u> | <u>State Rank</u> | <u>Confidence</u> | <u>State Name</u> | <u>Reference</u> |
|--------------|-------------------|-------------------|-------------------|------------------|
| PA           | NA                | NA                | no crosswalk      | Fike 1999        |

**Local Range:** This association is found throughout the parks.

**Classification Comments:** Palustrine Shrub Thickets are distinguished from other types by the abundance of numerous shrub species occurring along drainages in fields.

**Other Comments:** None.

**Local Description Authors:** S. Perles.

**Plots:** None. This type occurs only on private land that was inaccessible for sampling and in locations where the shrubs were planted by the park service after vegetation sampling was completed.

**Gettysburg National Military Park and Eisenhower National Historic Site Inventory Notes:**  
Information not available.



## Common Name (Park-specific): Successional Old Field

### SYNONYMS

**NVC English Name:** Orchard Grass - Sheep-sorrel Herbaceous Vegetation  
**NVC Scientific Name:** *Dactylis glomerata* - *Rumex acetosella* Herbaceous Vegetation  
**NVC Identifier:** C EGL006107

### LOCAL INFORMATION

**Environmental Description:** These fields occur on flat or sloping uplands and are generally associated with the Neshaminy, Lehigh, Penn, Abbottstown, Klinesville, and Reaville soil series. Some fields contain rocks and boulders. In general, these fields are no longer planted or plowed, allowing for a diverse mix of species to establish. These fields are also no longer mowed or are mowed infrequently, allowing woody plants to establish in the open fields. In some fields, herbicides are used to control invasive species and other woody plants.

**Vegetation Description:** These successional fields are typically dominated by a diverse mix of grasses and forbs with woody species establishing intermittently throughout the fields. Shrubs and saplings can be absent or cover up to 80% of the field. The most common tall shrub is eastern red-cedar (*Juniperus virginiana*), with sweet cherry (*Prunus avium*) and white ash (*Fraxinus americana*) as other common woody plants. Short shrubs can cover 5–40% of the field. Common short shrubs include Allegheny blackberry (*Rubus allegheniensis*), smooth sumac (*Rhus glabra*), eastern red-cedar, eastern redbud (*Cercis canadensis*), and northern dewberry (*Rubus flagellaris*). In areas of the field without dense shrubs, the herbaceous layer is typically dense (60–95% cover) and contains a diverse mix of grasses and forbs. The most common species include sweet vernalgrass (*Anthoxanthum odoratum*), red fescue (*Festuca rubra*), meadow ryegrass (*Lolium pratense*), early goldenrod (*Solidago juncea*), wrinkleleaf goldenrod (*Solidago rugosa*), narrowleaf mountainmint (*Pycnanthemum tenuifolium*), American burnweed (*Erechtites hieraciifolia*), common yellow oxalis (*Oxalis stricta*), fuzzy wuzzy sedge (*Carex hirsutella*), Indiangrass (*Sorghastrum nutans*), St. John's wort (*Hypericum punctatum*, *Hypericum perforatum*), garden yellowrocket (*Barbarea vulgaris*), Queen Anne's lace (*Daucus carota*), panicked-leaf tick-trefoil (*Desmodium paniculatum*), wild garlic (*Allium vineale*), flat-top goldentop (*Euthamia graminifolia*), Virginia strawberry (*Fragaria virginiana*), and wild mint (*Mentha arvensis*). Invasive species can be abundant in the tall-shrub, short-shrub and herbaceous layers, including Japanese honeysuckle (*Lonicera japonica*), Morrow's honeysuckle (*Lonicera morrowii*), multiflora rose (*Rosa multiflora*), and autumn olive (*Elaeagnus umbellata*). Vines such as eastern poison ivy (*Toxicodendron radicans*) and grape (*Vitis* spp.) are typical and can cover 0–40% of the stand.

#### Most Abundant Species:

| <u>Stratum</u>      | <u>Lifeform</u>              | <u>Species</u>  |
|---------------------|------------------------------|---|
| Tall shrub/sapling  | Needle-leaved tree           | <i>Juniperus virginiana</i>   |
| Short shrub/sapling | Broad-leaved deciduous shrub | <i>Rhus glabra</i> , <i>Rubus allegheniensis</i>  |
| Herb (field)        | Vine/Liana                   | <i>Lonicera japonica</i> , <i>Toxicodendron radicans</i>  |
| Herb (field)        | Forb                         | <i>Erechtites hieraciifolia</i> , <i>Pycnanthemum tenuifolium</i> , <i>Solidago juncea</i> , <i>Solidago rugosa</i> |

Herb (field)                      Graminoid                                      *Anthoxanthum odoratum*, *Festuca rubra*,  
*Lolium pratense*, *Sorghastrum nutans*

**Characteristic Species:** *Anthoxanthum odoratum*, *Festuca rubra*, *Juniperus virginiana*, *Lolium pratense*, *Rhus glabra*, *Rubus allegheniensis*, *Solidago juncea*, *Solidago rugosa*, *Sorghastrum nutans*.

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

**Subnational Distribution with Crosswalk Data:**

| <u>State</u> | <u>State Rank</u> | <u>Confidence</u> | <u>State Name</u> | <u>Reference</u> |
|--------------|-------------------|-------------------|-------------------|------------------|
| PA           | NA                | NA                | no crosswalk      | Fike 1999        |

**Local Range:** This association is found throughout the parks.

**Classification Comments:** Successional Old Fields are distinguished from other field types by the presence or dominance of woody plants, such as eastern red-cedar, blackberry and sumac, and by the diverse mix of goldenrods, warm-season grasses, and other common old-field species. Agricultural fields are typically near monocultures of one of the following species: timothy, fescue or wheat. The wet meadow vegetation type is dominated by a diverse mix of sedges and is saturated for at least part of the growing season. In Successional Old Fields, trees >5 m in height cover less than 50% of the field, in contrast to Modified Successional Forests in which trees >5 m in height cover greater than 50% of the area.

**Other Comments: Plots:** GETT.31, GETT.39, GETT.41, GETT.50, GETT.51, GETT.53, GETT.56, GETT.58, GETT.59, GETT.63.

**Local Description Authors:** S. Perles.

**Plots:** Information not available.

**Gettysburg National Military Park and Eisenhower National Historic Site Inventory Notes:** Information not available.

**GLOBAL INFORMATION**

**NVC CLASSIFICATION**

|                            |   |
|----------------------------|---|
| Physiognomic Class         | Herbaceous Vegetation (V)   |
| Physiognomic Subclass      | Perennial graminoid vegetation (V.A.)   |
| Physiognomic Group         | Temperate or subpolar grassland (V.A.5.)  |
| Physiognomic Subgroup      | Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)   |
| Formation                  | Medium-tall sod temperate or subpolar grassland (V.A.5.N.c.)  |
| Alliance                   | Dactylis glomerata - Rumex acetosella 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 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*, *Agrostis hyemalis*, *Elymus repens*, *Bromus inermis*, *Bromus tectorum*, *Lolium perenne*, *Poa pratensis*, *Poa compressa*, *Schizachyrium scoparium* (not in abundance), and *Anthoxanthum odoratum*. Forbs scattered among the grasses are varied but include *Hieracium* spp., *Oxalis stricta*, *Achillea millefolium*, *Asclepias syriaca*, *Solidago rugosa*, *Solidago nemoralis*, *Solidago juncea*, *Solidago canadensis*, *Solidago altissima*, *Euthamia graminifolia*, *Cerastium arvense*, *Oenothera biennis*, *Potentilla simplex*, *Symphyotrichum lateriflorum*, *Symphyotrichum novae-angliae*, *Symphyotrichum lanceolatum*, *Daucus carota*, *Ambrosia artemisiifolia*, *Vicia cracca*, *Trifolium* spp., and many others.

**Environmental Description:** This association occurs on pastures and land that has been tilled.

**Vegetation Description:** In addition to *Dactylis glomerata* and *Rumex acetosella* these grassy fields are characterized by *Symphyotrichum* spp. (including *Symphyotrichum lateriflorum* and *Symphyotrichum novae-angliae*), *Rudbeckia hirta*, *Pteridium aquilinum*, *Chenopodium album*, *Asclepias syriaca*, *Andropogon virginicus*, *Schizachyrium scoparium*, *Phytolacca americana*, *Phleum pratense*, *Poa pratensis*, *Poa compressa*, *Elymus repens*, *Bromus inermis*, *Solidago* spp. (including *Solidago rugosa*, *Solidago nemoralis*, *Solidago juncea*, *Solidago canadensis*, *Solidago altissima*), *Euthamia graminifolia*, *Oenothera biennis*, *Potentilla simplex*, *Daucus carota*, *Ambrosia artemisiifolia*, *Hieracium* spp., *Taraxacum officinale*, *Vicia cracca*, *Trifolium* spp., and many others.

**Most Abundant Species:**

| <u>Stratum</u> | <u>Lifeform</u> | <u>Species</u>            |
|----------------|-----------------|---------------------------|
| Herb (field)   | Forb            | <i>Rumex acetosella</i>   |
| Herb (field)   | Graminoid       | <i>Dactylis glomerata</i> |

**Characteristic Species:** *Dactylis glomerata*, *Rumex acetosella*.

**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, NH, NJ, NY, PA, RI, TN, VA, VT, WV.

**Federal Lands:** NPS (Allegheny Portage Railroad, Cape Cod, Delaware Water Gap, Fire Island, Fort Necessity, Friendship Hill, Gettysburg, Johnstown Flood, Marsh-Billings-Rockefeller, Minute Man, Morristown, Saint-Gaudens, Valley Forge, Weir Farm); USFWS (Assabet River, Great Meadows, Oxbow).

**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:** Information not available.

**Similar Associations:**

- *Lolium (arundinaceum, pratense)* Herbaceous Vegetation (CEGL004048)
- *Phleum pratense - Bromus pubescens - Helenium autumnale* Herbaceous Vegetation (CEGL004018).
- *Schizachyrium scoparium - Solidago* spp. Herbaceous Vegetation (CEGL006333).

**Related Concepts:** Information not available.

**SOURCES**

**Description Authors:** Eastern Ecology Group.

**References:** Clark 1986, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Keever 1979, Newbold et al. 1988, Perles et al. 2006, Perles et al. 2006a, Perles et al. 2006b, Perles et al. 2006c, Sneddon et al. 1995, TDNH unpubl. data.



Figure 23. Successional Old Field in Gettysburg National Military Park (plot GETT.53). June 2004. NAD 1983 / UTM easting 307730, northing 4413219.





Figure 24. Successional Old Field in Gettysburg National Military Park (plot GETT.59). June 2004. NAD 1983 / UTM easting 308033, northing 4407153.

## Common Name (Park-specific): Agricultural Field

### SYNONYMS

NVC Identifier: No Global Crosswalk

### LOCAL INFORMATION

**Environmental Description:** These fields occur on flat or sloping uplands and are generally associated with the Lehigh, Neshaminy, Abbottstown, Mount Lucas, and Brecknock soil series. These fields are plowed, planted and/or left fallow in multiple-year rotations. When planted with grasses, the fields may be harvested once a year for hay. Crops such as corn, soybeans and oats may also be planted in these fields.

**Vegetation Description:** When these fields are planted to grasses, they are often near monocultures of one of following species: timothy (*Phleum pratense*), meadow ryegrass (*Lolium pratense*), or common wheat (*Triticum aestivum*). Other common associates include wild garlic (*Allium vineale*), garden yellowrocket (*Barbarea vulgaris*), redtop (*Agrostis gigantea*), red clover (*Trifolium pratense*), white clover (*Trifolium repens*), quackgrass (*Elymus repens*), red fescue (*Festuca rubra*), orchard grass (*Dactylis glomerata*), Canada bluegrass (*Poa compressa*), common dandelion (*Taraxacum officinale*), sweet vernalgrass (*Anthoxanthum odoratum*), narrowleaf plantain (*Plantago lanceolata*), spreading dogbane (*Apocynum androsaemifolium*), and Kentucky bluegrass (*Poa pratensis*). Fallow fields usually contain a mixture of species that colonize bare soil, such as prairie fleabane (*Erigeron strigosus*), mouseear cress (*Arabidopsis thaliana*), common mouse-ear chickweed (*Cerastium fontanum*), bristlegass (*Setaria* spp.), and other annual weeds. The invasive species Canadian thistle (*Cirsium arvense*) can be abundant in the fallow fields and present in the planted fields. Woody plants and vines are generally absent from these fields. These fields may contain inclusions of wet meadow vegetation along the linear drainages and swales that run through the fields.

### Most Abundant Species:

| <u>Stratum</u> | <u>Lifeform</u> | <u>Species</u>  |
|----------------|-----------------|---|
| Herb (field)   | Graminoid       | <i>Phleum pratense</i> , <i>Lolium pratense</i> ,<br><i>Triticum aestivum</i> |

**Characteristic Species:** *Phleum pratense*, *Lolium pratense*, *Triticum aestivum*, *Allium vineale*, *Barbarea vulgaris*, *Agrostis gigantea*, *Trifolium* spp.

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

### Subnational Distribution with Crosswalk Data:

| <u>State</u> | <u>State Rank</u> | <u>Confidence</u> | <u>State Name</u> | <u>Reference</u> |
|--------------|-------------------|-------------------|-------------------|------------------|
| PA           | NA                | NA                | no crosswalk      | Fike 1999        |

**Local Range:** This common vegetation type is found throughout the parks.

**Classification Comments:** Agricultural Fields are typically near monocultures of one of the following species: timothy, fescue or wheat. In contrast, Successional Old Fields contain or are dominated by woody plants, such as eastern red-cedar, blackberry and sumac, and contain a diverse mix of goldenrods, warm-season grasses, and other common old-field species. The wet meadow vegetation type is dominated by a diverse mix of sedges and is saturated for at least part of the growing season.

**Other Comments:** None.

**Local Description Authors:** S. Perles.

**Plots:** GETT.48, GETT.54, GETT.57, GETT.60, GETT.62, GETT.69.



**Gettysburg National Military Park and Eisenhower National Historic Site Inventory Notes:**  
Information not available.



Figure 25. Agricultural Field in Gettysburg National Military Park (plot GETT.48). June 2004.  
NAD 1983 / UTM easting 307259, northing 4408121.



Figure 26. Agricultural Field in Gettysburg National Military Park (plot GETT.60). June 2004.  
NAD 1983 / UTM easting 307075, northing 4406225.

**Common Name (Park-specific): Pasture**

**SYNONYMS**

**NVC Identifier:** No Global Crosswalk

**LOCAL INFORMATION**

**Environmental Description:** These fields occur on flat or gently rolling uplands that are currently being actively used as pasture for livestock. These fields are associated with the Lehigh and Croton soil series, although the soil may be compacted in sections from heavy and frequent animal traffic. Hoof prints and manure are evident.

**Vegetation Description:** The vegetation in these fields is often heavily browsed. The species composition is variable, although most species are annual weeds or adapted to colonizing bare soil. Common species include meadow ryegrass (*Lolium pratense*), Kentucky bluegrass (*Poa pratensis*), timothy (*Phleum pratense*), white clover (*Trifolium repens*), red clover (*Trifolium pratense*), annual ragweed (*Ambrosia artemisiifolia*), sweet vernalgrass (*Anthoxanthum odoratum*), and poverty rush (*Juncus tenuis*). Other associates include prairie fleabane (*Erigeron strigosus*), Queen Anne's lace (*Daucus carota*), narrowleaf plantain (*Plantago lanceolata*), common dandelion (*Taraxacum officinale*), and orchard grass (*Dactylis glomerata*). Widely scattered trees may be present in the pastures or line the edges of the field. Possible species include eastern red-cedar (*Juniperus virginiana*), cherry (*Prunus* spp.), white ash (*Fraxinus americana*), black walnut (*Juglans nigra*), black locust (*Robinia pseudoacacia*), eastern redbud (*Cercis canadensis*), sassafras (*Sassafras albidum*), American elm (*Ulmus americana*), red maple (*Acer rubrum*), honeylocust (*Gleditsia triacanthos*), and oaks (*Quercus* spp.).

**Most Abundant Species:**

| <u>Stratum</u> | <u>Lifeform</u> | <u>Species</u>  |
|----------------|-----------------|---|
| Herb (field)   | Graminoid       | <i>Lolium pratense</i> , <i>Phleum pratense</i> ,<br><i>Juncus tenuis</i> |
| Herb (field)   | Forb            | <i>Trifolium repens</i> , <i>Trifolium pratense</i>                       |

**Characteristic Species:** *Lolium pratense*, *Phleum pratense*, *Juncus tenuis*, *Trifolium repens*, *Trifolium pratense*

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

**Subnational Distribution with Crosswalk Data:**

| <u>State</u> | <u>State Rank</u> | <u>Confidence</u> | <u>State Name</u> | <u>Reference</u> |
|--------------|-------------------|-------------------|-------------------|------------------|
| PA           | NA                | NA                | no crosswalk      | Fike 1999        |

**Local Range:** Pastures are found throughout the parks.

**Classification Comments:** Pastures are distinguished from Agricultural Fields by evidence of heavily browsed vegetation, compacted soil, hoof prints, and manure.

**Other Comments:** None.

**Local Description Authors:** S. Perles.

**Plots:** GETT.47, GETT.46.

**Gettysburg National Military Park and Eisenhower National Historic Site Inventory Notes:** Information not available.





Figure 27. Pasture in Eisenhower National Historic Site (plot GETT.46). June 2004. NAD 1983 / UTM easting 306354, northing 4407076.



Figure 28. Pasture in Eisenhower National Historic Site (plot GETT.47). June 2004. NAD 1983 / UTM easting 306433, northing 4407416.

**Common Name (Park-specific): Orchard**

**SYNONYMS**

**NVC Identifier:** No Global Crosswalk

**LOCAL INFORMATION**

**Environmental Description:** This type occurs on flat or gently rolling uplands that have been planted in fruit trees. These orchards may be frequently mowed.

**Vegetation Description:** This type is characterized by regularly spaced planted fruit trees such as apples (*Malus* spp.) and peach (*Prunus persica*). The ground story vegetation in these orchards is frequently mowed.

**Most Abundant Species:**

| <u>Stratum</u> | <u>Lifeform</u>             | <u>Species</u>                           |
|----------------|-----------------------------|--|
| Tree canopy    | Broad-leaved deciduous tree | <i>Malus</i> spp., <i>Prunus persica</i> |

**Characteristic Species:** *Malus* spp., *Prunus persica*.

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

**Subnational Distribution with Crosswalk Data:**

| <u>State</u> | <u>State Rank</u> | <u>Confidence</u> | <u>State Name</u> | <u>Reference</u> |
|--------------|-------------------|-------------------|-------------------|------------------|
| PA           | NA                | NA                | no crosswalk      | Fike 1999        |

**Local Range:** Orchards are found in three locations in Gettysburg National Military Park.

**Classification Comments:** Orchards are identified by regularly spaced planted fruit trees.

**Other Comments:** None.

**Local Description Authors:** S. Perles.

**Plots:** None. This is a planted cultural type.

**Gettysburg National Military Park and Eisenhower National Historic Site Inventory Notes:**  
Information not available.

**Common Name (Park-specific): Wet Meadow**

**SYNONYMS**

- NVC English Name:** Bluejoint - Bulrush species - Threeway Sedge Herbaceous Vegetation  
**NVC Scientific Name:** *Calamagrostis canadensis* - *Scirpus* spp. - *Dulichium arundinaceum* Herbaceous Vegetation  
**NVC Identifier:** C EGL006519

**LOCAL INFORMATION**

**Environmental Description:** This vegetation type is associated with low-lying areas surrounding drainages, often on Watchung, Bowmansville and Mount Lucas soils. The soil is saturated or under standing water for at least part of the growing season. This vegetation type can occur throughout a low-lying field or in linear strips along drainages in upland successional old fields or agricultural fields. The woody plants are suppressed in these open areas by periodic mowing or herbicide treatments.

**Vegetation Description:** This association is dominated by a diverse mix of hydrophilic graminoids, predominantly sedges (*Carex* spp.). Common sedges include broom sedge (*Carex scoparia*), fox sedge (*Carex vulpinoidea*), yellowfruit sedge (*Carex annectens*), Bush's sedge (*Carex bushii*), owlfruit sedge (*Carex stipata*), squarrose sedge (*Carex squarrosa*), shallow sedge (*Carex lurida*), blunt broom sedge (*Carex tribuloides*), tussock sedge (*Carex stricta*), and woolly sedge (*Carex pellita*). The graminoid and herbaceous vegetation is typically dense (>90% cover). Other common species are common rush (*Juncus effusus*), poverty rush (*Juncus tenuis*), reed canary grass (*Phalaris arundinacea*), rough bluegrass (*Poa trivialis*), rice cutgrass (*Leersia oryzoides*), green bulrush (*Scirpus atrovirens*), Indianhemp (*Apocynum cannabinum*), meadow ryegrass (*Lolium pratense*), red fescue (*Festuca rubra*), arrowleaf tearthumb (*Polygonum sagittatum*), harvestlice (*Agrimonia parviflora*), bluntnose bedstraw (*Galium obtusum*), woolgrass bulrush (*Scirpus cyperinus*), jewelweed (*Impatiens capensis*), fowl mannagrass (*Glyceria striata*), and many others. Short shrubs can be scattered throughout the wet meadow vegetation, including swamp rose (*Rosa palustris*), common elderberry (*Sambucus nigra* ssp. *canadensis*), willows (*Salix* spp.), and tree seedlings such as pin oak (*Quercus palustris*), swamp white oak (*Quercus bicolor*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), and American elm (*Ulmus americana*). The invasive species creeping Jenny (*Lysimachia nummularia*) and multiflora rose (*Rosa multiflora*) are frequent associates in this vegetation type.

**Most Abundant Species:**

| <u>Stratum</u>      | <u>Lifeform</u>              | <u>Species</u>   |
|---------------------|------------------------------|--|
| Short shrub/sapling | Broad-leaved deciduous shrub | <i>Rosa palustris</i>                                    |
| Herb (field)        | Forb                         | <i>Apocynum cannabinum</i> , <i>Polygonum sagittatum</i> |
| Herb (field)        | Graminoid                    | <i>Leersia oryzoides</i> , <i>Poa trivialis</i>          |

**Characteristic Species:** *Apocynum cannabinum*, *Galium obtusum*, *Glyceria striata*, *Leersia oryzoides*, *Poa trivialis*, *Scirpus atrovirens*, *Scirpus cyperinus*.

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



**Subnational Distribution with Crosswalk Data:**

| <u>State</u> | <u>State Rank</u> | <u>Confidence</u> | <u>State Name</u> | <u>Reference</u> |
|--------------|-------------------|-------------------|-------------------|------------------|
| PA           | S5                | 2                 | Wet Meadow        | Fike 1999        |

**Local Range:** This vegetation type is found in low-lying areas and near drainages throughout the parks.

**Classification Comments:** Wet Meadow is distinguished from other graminoid-dominated vegetation types by the diverse mix of sedges and other hydrophilic graminoids such as *Juncus* spp., *Scirpus* spp., and *Eleocharis* spp. Reed Canary Grass Riverine Grassland can be distinguished from Wet Meadow by the clear dominance of reed canary grass (>50% cover) in the former.

**Other Comments:** Information not available.

**Local Description Authors:** S. Perles.

**Plots:** GETT.43, GETT.44, GETT.45, GETT.49, GETT.52, GETT.61, GETT.65.

**Gettysburg National Military Park and Eisenhower National Historic Site Inventory Notes:** Information not available.

**GLOBAL INFORMATION**

**NVC CLASSIFICATION**

|                              |   |
|------------------------------|---|
| Physiognomic Class           | Herbaceous Vegetation (V)   |
| Physiognomic Subclass        | Perennial graminoid vegetation (V.A.)   |
| Physiognomic Group           | Temperate or subpolar grassland (V.A.5.)  |
| Physiognomic Subgroup        | Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)   |
| Formation                    | Seasonally flooded temperate or subpolar grassland (V.A.5.N.k.)   |
| Alliance                     | Calamagrostis canadensis Seasonally Flooded Herbaceous Alliance (A.1400)                                    |
| Alliance (English name)      | Bluejoint Seasonally Flooded Herbaceous Alliance  |
| Association                  | <i>Calamagrostis canadensis</i> - <i>Scirpus</i> spp. - <i>Dulichium arundinaceum</i> Herbaceous Vegetation |
| Association (English name)   | Bluejoint - Bulrush species - Threeway Sedge Herbaceous Vegetation  |
| <b>Ecological System(s):</b> | Laurentian-Acadian Floodplain Forest (CES201.587)<br>Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582) |

**GLOBAL DESCRIPTION**

**Concept Summary:** These are seasonally flooded, mixed-composition wetland meadows of the northeastern United States. They occur on flats, floodplains of small streams, beaver meadows, and lakeshores. The substrate is muck or well-decomposed peat overlying mineral soil, usually slightly acidic (pH 5.0–6.0). After spring flooding, many sites will dry to exposed soil during the summer; others remain well saturated. The vegetation is dominated by robust graminoids or graminoids mixed with shrubs. Shrub cover can range up to 50%, but graminoid cover typically exceeds woody cover, and in some cases, shrubs are absent. The herbaceous layer is well-developed, often over 40% cover and up to nearly 100% cover. Bryophyte cover is usually little to none but may occasionally be extensive. The herbaceous layer is often dominated by some combination of *Calamagrostis canadensis*, *Scirpus* spp. (including *Scirpus cyperinus*, *Scirpus expansus*, and *Scirpus atrovirens*), and *Dulichium arundinaceum*. Other locally common species may include *Acorus calamus*, *Agrostis gigantea*, *Carex lacustris*, *Carex lupulina*, *Carex*

*lupuliformis*, *Carex lurida*, *Carex stricta*, *Carex utriculata*, *Glyceria canadensis*, *Glyceria grandis*, *Iris versicolor*, *Hypericum ellipticum*, *Juncus canadensis*, *Leersia oryzoides*, *Leersia virginica*, *Lysimachia terrestris*, *Onoclea sensibilis*, *Osmunda regalis*, *Phalaris arundinacea*, *Poa palustris*, and *Triadenum fraseri*. *Typha latifolia* may occasionally be present, but these wetlands are usually slightly higher (relative to the water table) than typical cattail marsh. *Lythrum salicaria* may be locally invasive. Shrub species typically include *Spiraea alba* and *Salix* spp. Other shrub constituents vary from site to site and may include *Alnus incana*, *Alnus serrulata*, *Cephalanthus occidentalis*, *Cornus sericea*, *Ilex verticillata*, *Myrica gale*, *Salix pedicellaris*, *Spiraea tomentosa*, *Vaccinium corymbosum*, or *Viburnum dentatum*. This association is related to other regional wet meadow types but differs in not being almost monotypically dominated by *Carex stricta*, *Calamagrostis canadensis*, or *Phalaris arundinacea*.

**Environmental Description:** These are seasonally flooded, mixed-composition wetland meadows of the northeastern United States. They occur on flats, floodplains of small streams, beaver meadows, and lakeshores. The substrate is muck or well-decomposed peat overlying mineral soil, usually slightly acidic (pH 5.0–6.0). After spring flooding, many sites will dry to exposed soil during the summer.

**Vegetation Description:** The vegetation is dominated by robust graminoids or graminoids mixed with shrubs. Shrub cover can range up to 50%, but graminoid cover typically exceeds woody cover, and in some cases, shrubs are absent. The herbaceous layer is well-developed, often over 40% cover and up to nearly 100% cover. Bryophyte cover is usually little to none but may occasionally be extensive. The herbaceous layer is often dominated by some combination of *Calamagrostis canadensis*, *Scirpus* spp. (including *Scirpus cyperinus*, *Scirpus expansus*, and *Scirpus atrovirens*), and *Dulichium arundinaceum*. Other locally common species may include *Acorus calamus*, *Agrostis gigantea*, *Carex lacustris*, *Carex lupulina*, *Carex lupuliformis*, *Carex lurida*, *Carex stricta*, *Carex utriculata*, *Glyceria canadensis*, *Glyceria grandis*, *Iris versicolor*, *Hypericum ellipticum*, *Juncus canadensis*, *Leersia oryzoides*, *Leersia virginica*, *Lysimachia terrestris*, *Onoclea sensibilis*, *Osmunda regalis*, *Phalaris arundinacea*, *Poa palustris*, and *Triadenum fraseri*. *Typha latifolia* may occasionally be present, but these wetlands are usually slightly higher (relative to the water table) than typical cattail marsh. *Lythrum salicaria* may be locally invasive. Shrub species typically include *Spiraea alba* and *Salix* spp. Other shrub constituents vary from site to site, and may include *Alnus incana*, *Alnus serrulata*, *Cephalanthus occidentalis*, *Cornus sericea*, *Ilex verticillata*, *Myrica gale*, *Salix pedicellaris*, *Spiraea tomentosa*, *Vaccinium corymbosum*, or *Viburnum dentatum*.

**Most Abundant Species:**

| <u>Stratum</u> | <u>Lifeform</u> | <u>Species</u>  |
|----------------|-----------------|---|
| Herb (field)   | Graminoid       | <i>Calamagrostis canadensis</i> , <i>Dulichium arundinaceum</i> , <i>Scirpus atrovirens</i> ,<br><i>Scirpus cyperinus</i> , <i>Scirpus expansus</i> |

**Characteristic Species:** *Calamagrostis canadensis*, *Dulichium arundinaceum*, *Scirpus atrovirens*, *Scirpus cyperinus*, *Scirpus expansus*.

**Other Noteworthy Species:** *Scirpus ancistrochaetus*.

**USFWS Wetland System:** Palustrine.

**DISTRIBUTION**

**Range:** Information not available.

**States/Provinces:** DE, MA, ME, NH, NY, PA, VT.

**Federal Lands:** NPS (Acadia, Eisenhower, Gettysburg, Saint-Gaudens); USFWS (Assabet River, Great Meadows, Oxbow).

**CONSERVATION STATUS**

**Rank:** GNR (6-Jul-1999).

**Reasons:** Information not available.

**CLASSIFICATION INFORMATION**

**Status:** Standard.

**Confidence:** 2 – Moderate.

**Comments:** Information not available.

**Similar Associations:**

- *Calamagrostis canadensis* - *Phalaris arundinacea* Herbaceous Vegetation (CEGL005174).
- *Carex stricta* - *Carex vesicaria* Herbaceous Vegetation (CEGL006412).
- *Scirpus cyperinus* Seasonally Flooded Herbaceous Vegetation (CEGL006349).

**Related Concepts:** Information not available.

**SOURCES**

**Description Authors:** S. C. Gawler.

**References:** Calhoun et al. 1994, Eastern Ecology Working Group n.d., Gawler 2002, Northern Appalachian Ecology Working Group 2000, Sperduto 2000b, Sperduto and Nichols 2004, Thompson and Sorenson 2000.



Figure 29. Wet Meadow in Gettysburg National Military Park (plot GETT.44). June 2004. NAD 1983 / UTM easting 308506, northing 4407513.



Figure 30. Wet Meadow in Gettysburg National Military Park (plot GETT.49). June 2004.  
NAD 1983 / UTM easting 307109, northing 4408282.

**Common Name (Park-specific): Reed Canary Grass Riverine Grassland**

**SYNONYMS**

**NVC English Name:** Reed Canary Grass Eastern Herbaceous Vegetation  
**NVC Scientific Name:** *Phalaris arundinacea* Eastern Herbaceous Vegetation  
**NVC Identifier:** CEGL006044

**LOCAL INFORMATION**

**Environmental Description:** This vegetation type is associated with low-lying areas surrounding drainages and streams such as Willoughby Run. This association typically occurs on Bowmansville soils. The soil is saturated or under standing water for at least part of the growing season, especially during periods of high water.

**Vegetation Description:** This association is dominated by reed canary grass (*Phalaris arundinacea*) covering more than 50% of the area. Despite dense graminoid and herbaceous vegetation, this association contains significantly less botanical diversity than Wet Meadow. Common associates to the reed canary grass include common rush (*Juncus effusus*), blunt spikerush (*Eleocharis obtusa*), broom sedge (*Carex scoparia*), arrowleaf tearthumb (*Polygonum sagittatum*), marshpepper knotweed (*Polygonum hydropiper*), purpleleaf willowherb (*Epilobium coloratum*), fowl mannagrass (*Glyceria striata*), marsh seedbox (*Ludwigia palustris*), and others. Short shrubs can be scattered throughout, including silky dogwood (*Cornus amomum*).

**Most Abundant Species:**

| <u>Stratum</u>      | <u>Lifeform</u>              | <u>Species</u>              |
|---------------------|------------------------------|-----------------------------|
| Short shrub/sapling | Broad-leaved deciduous shrub | <i>Cornus amomum</i>        |
| Herb (field)        | Graminoid                    | <i>Phalaris arundinacea</i> |

**Characteristic Species:** *Epilobium coloratum*, *Glyceria striata*, *Phalaris arundinacea*.

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

**Subnational Distribution with Crosswalk Data:**

| <u>State</u> | <u>State Rank</u> | <u>Confidence</u> | <u>State Name</u>                   | <u>Reference</u> |
|--------------|-------------------|-------------------|-------------------------------------|------------------|
| PA           | S5                | 2                 | Bluejoint - reed canary grass marsh | Fike 1999        |

**Local Range:** This vegetation type is occasionally found in low-lying areas throughout the parks.

**Classification Comments:** Reed Canary Grass Riverine Grassland can be distinguished from Wet Meadow and other graminoid-dominated vegetation types by the clear dominance of reed canary grass (>50% cover). This vegetation type contains significantly less botanical diversity than Wet Meadow.

**Other Comments:** Information not available.

**Local Description Authors:** S. Perles.

**Plots:** GETT.66.

**Gettysburg National Military Park and Eisenhower National Historic Site Inventory Notes:** Information not available.

**GLOBAL INFORMATION**

**NVC CLASSIFICATION**

Physiognomic Class            Herbaceous Vegetation (V)  
 Physiognomic Subclass       Perennial graminoid vegetation (V.A.)



|                              |   |
|------------------------------|---|
| Physiognomic Group           | Temperate or subpolar grassland (V.A.5.)  |
| Physiognomic Subgroup        | Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)   |
| Formation                    | Seasonally flooded temperate or subpolar grassland (V.A.5.N.k.)   |
| Alliance                     | <i>Phalaris arundinacea</i> Seasonally Flooded Herbaceous Alliance<br>(A.1381)  |
| Alliance (English name)      | Reed Canary Grass Seasonally Flooded Herbaceous Alliance  |
| Association                  | <i>Phalaris arundinacea</i> Eastern Herbaceous Vegetation   |
| Association (English name)   | Reed Canary Grass Eastern Herbaceous Vegetation   |
| <b>Ecological System(s):</b> | Central Interior Highlands and Appalachian Sinkhole and<br>Depression Pond (CES202.018)<br>North-Central Interior Floodplain (CES202.694)<br>Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582) |

**GLOBAL DESCRIPTION**

**Concept Summary:** This association is found throughout the northeastern United States and Canada, but its distribution as a natural type is complicated elsewhere. It is native to the United States and Canada, but is now more widely distributed and abundant because of local introductions from both local and European populations. The introduced strains may be a more aggressive ecotype than native strains. Stands are found in both minerotrophic basin wetlands as well as river shores. It has been widely used as a forage and hay crop, especially in marshes and floodplains, and is used for wildlife food, for shoreline and ditch stabilization. Stands are dominated by *Phalaris arundinacea*, a 0.5–2-m tall perennial grass, which tends to occur in monocultures or associated with *Calamagrostis canadensis*. Other associates in the northeast include *Viburnum nudum*, *Alnus incana* or *Alnus serrulata*, *Viburnum dentatum*, and *Agrostis gigantea*. Midwest associates include species characteristic of wet meadows. *Phalaris arundinacea* can displace native species over time. Further work is required to resolve the natural versus introduced nature of this type in the southeast before a description can be completed.

**Environmental Description:** Stands are found in both minerotrophic basin wetlands as well as river shores. It has been widely used as a forage and hay crop, especially in marshes and floodplains, and is used for wildlife food, for shoreline and ditch stabilization (Barnes 1999).

**Vegetation Description:** Stands are dominated by *Phalaris arundinacea*, a 0.5–2 m tall perennial grass that is native to the United States and Canada, but which has also been introduced from European strains. The introduced strains may be a more aggressive ecotype than native strains (Barnes 1999). It tends to occur in monocultures or associated with *Calamagrostis canadensis*. Other associates in the Northeast include *Viburnum nudum*, *Alnus incana* or *Alnus serrulata*, *Viburnum dentatum*, and *Agrostis gigantea*. Midwest associates include species characteristic of wet meadows. *Phalaris arundinacea* can displace native species over time (Apfelbaum and Sams 1987, Barnes 1999, and references therein). Further work is required to resolve the natural versus introduced nature of this type in the Southeast before a description can be completed.

**Most Abundant Species:**

| <u>Stratum</u> | <u>Lifeform</u> | <u>Species</u>              |
|----------------|-----------------|-----------------------------|
| Herb (field)   | Graminoid       | <i>Phalaris arundinacea</i> |

**Characteristic Species:** *Phalaris arundinacea*.

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

**USFWS Wetland System:** Palustrine.

#### DISTRIBUTION

**Range:** This association is found throughout the northeastern United States and Canada, but its distribution as a natural type is complicated elsewhere. It currently ranges from Virginia north to Vermont, east to Minnesota and south to Tennessee.

**States/Provinces:** CT, DE, IA, MA, MD, ME, MN, NH, NJ, NY, OH, ON, PA, RI, TN, VA, VT, WV.

**Federal Lands:** NPS (Allegheny Portage Railroad, Delaware Water Gap, Effigy Mounds, Eisenhower, Gettysburg); USFWS (Assabet River, Great Meadows, Oxbow).

#### CONSERVATION STATUS

**Rank:** GNA (invasive) (1-Dec-1997).

**Reasons:** Information not available.

#### CLASSIFICATION INFORMATION

**Status:** Standard.

**Confidence:** 2 – Moderate.

**Comments:** Type has a broad distribution; in fact, it is widespread throughout temperate areas of the northern hemisphere. It is native to the United States and Canada, but is now more widely distributed and abundant because of local introductions from both local and European populations (Apfelbaum and Sams 1987). It can invade a variety of habitats, suggesting that little unites these stands apart from the dominance of *Phalaris arundinacea*. However, that may be the only reasonable way to describe this type. This vegetation is documented from Shady Valley TNC Preserve, Johnson County, Tennessee, where it occupies channelized streams, impoundments, and fen restoration sites. In these examples, characteristic associates include *Juncus effusus*, *Carex lurida*, *Carex gynandra*, and *Alnus serrulata*.

#### Similar Associations:

- Calamagrostis canadensis - Phalaris arundinacea Herbaceous Vegetation (CEGL005174).
- *Phalaris arundinacea* Western Herbaceous Vegetation (CEGL001474).

#### Related Concepts:

- Palustrine Persistent Emergent Wetland (PEM1) (Cowardin et al. 1979) ?
- Reed canary grass riverine grassland (Perles et al. 2004) ?
- SNE low-energy riverbank community (Rawinski 1984) ?
- Shallow Emergent Marsh (Thompson 1996) ?
- Southern New England nutrient-poor streamside/lakeside marsh (Rawinski 1984) ?
- Southern New England nutrient-rich streamside/lakeside marsh (Rawinski 1984) ?

#### SOURCES

**Description Authors:** D. Faber-Langendoen.

**References:** Apfelbaum and Sams 1987, Barnes 1999, Cowardin et al. 1979, Edinger et al. 2002, Fike 1999, Metzler and Barrett 2001, Midwestern Ecology Working Group n.d., Perles et al. 2004, Perles et al. 2006, Rawinski 1984, Sperduto 2000a, Swain and Kearsley 2001, TDNH unpubl. data, TNC and WPC 2004, Thompson 1996, Thompson and Sorenson 2000.



Figure 31. Reed Canary Grass Riverine Grassland in Eisenhower National Historic Site (plot GETT.66). June 2004. NAD 1983 / UTM easting 305636, northing 4407629.

## Vegetation Map Production

In order to produce an association-level vegetation map, the formation-level vegetation map was edited and refined onscreen in ArcView 3.2. Based on the vegetation data analysis, each polygon was attributed with the name of a vegetation association. The vegetation associations were assigned using information from plot data, field observations, classification analyses, aerial photography signatures, and topographic maps. Polygon boundaries were also revised based on these five information sources. Several polygons were labeled as mosaics of the Wet Meadow associations and one of the following vegetation types: Agricultural Field, Pasture, or Successional Old Field. These polygons were labeled as mosaics because both types were present in the polygons and clear boundaries between the two associations could not be delineated.

Within the Dry Oak – Mixed Hardwood Forest association, numerous stands were significantly disturbed by weedy native plant species (i.e. *Juniperus virginiana*, *Liriodendron tulipifera*) and nonnative invasive plants (i.e. *Berberis thunbergii*, *Rosa multiflora*, *Lonicera japonica*, *Alliaria petiolata*, *Microstegium vimineum*, *Polygonum caespitosum*). Since Dry Oak – Mixed Hardwood Forest is the most abundant forest type in the parks, it is important for the proper management of this forest type to distinguished between high quality stands and disturbed stands. Therefore, the qualifier Dry Oak – Mixed Hardwood Forest (disturbed) was developed to identify these disturbed stands in the association map. Dry Oak – Mixed Hardwood Forest (disturbed) is not a unique vegetation association and therefore does not have a unique association description. Descriptions of the disturbed stands are included in the Dry Oak – Mixed Hardwood Forest association description. However, mapped polygons that represent disturbed stands were identified with the Dry Oak – Mixed Hardwood Forest (disturbed) label.

Polygons that were attributed with modified Anderson level II categories retained their attributes. The category of Cleared Land was added as an Anderson level II category (modified) for polygons that had recently undergone woodlot removal as part of the battlefield rehabilitation. An aerial photograph interpretation key for the vegetation associations and Anderson level II categories (modified) is located in Appendix A.

The thematic accuracy of this vegetation association map was then assessed. Based on the accuracy assessment sampling data, the association-level map was revised again to correct errors and create more accurate vegetation association polygon boundaries. In this final revision, accuracy assessment data, plot data, field observations, classification analyses, aerial photography signatures, and topographic maps were used to revise polygon boundaries and attributes.

One important change in vegetation classification resulted from the thematic accuracy assessment. The thematic accuracy assessment data indicated that the two palustrine forest associations, Bottomland Oak – Hardwood Palustrine Forest and Green Ash Palustrine Forest, frequently intergraded and co-occurred even in very small polygons. The two types could not be reliably distinguished from each other in the field and could not be reliably mapped separately (see thematic accuracy assessment results section below for more quantitative details). The insignificant and ambiguous results of the TWINSpan and NMS analyses of the palustrine forest data subset confirm that these two types cannot be reliably classified and should be

retained as a single association. Therefore, these two types were lumped into one generic association, Bottomland Mixed Hardwood Forest, for the final classification and association map.

Thus, to create the final association map, polygons were attributed with 15 vegetation associations: Chestnut Oak Forest, Dry Oak – Mixed Hardwood Forest, Tuliptree Forest, Modified Successional Forest, Conifer Plantation, Virginia Pine Successional Forest, Sycamore – Mixed Hardwood Floodplain Forest, Bottomland Mixed Hardwood Forest, Palustrine Shrub Thicket, Successional Old Field, Agricultural Field, Pasture, Orchard, Wet Meadow, and Reed Canary Grass Riverine Grassland. The resulting final vegetation association map is shown in Figure 32 and a summary of the vegetation association distribution and abundance is provided in Table 6. The number of total mapped hectares listed in Table 6 is larger than the number of hectares in the park because the mapped polygons extend beyond the park boundary.

#### Accuracy Assessment

##### Positional Accuracy

The final horizontal positional accuracies of the GETT/EISE and GETT/ECF mosaics are 1.18 meters and 0.93 meters, respectively, both of which meet Class 1 National Map Accuracy Standards (FGDC 1998b). The spreadsheets, containing the x and y coordinates for each ground control point and the accuracy calculation formula, are included in the air photo archive.

##### Thematic Accuracy

For the thematic accuracy assessment analysis, eight of the 227 sampling points were excluded from the analysis. Two points were excluded because the vegetation at the sampling points had been removed as part of the battlefield rehabilitation. No new vegetation had been established in these areas at the time of sampling; therefore, the points could not be assigned to any particular vegetation type. Also, since the vegetation map reflects the vegetation at the time the aerial photography was taken, these points cannot be included in the analysis. The other six excluded points fell in Pasture areas that were inactive. Because the vegetation was not browsed, the vegetation at the sampling points resembled that of an Agricultural Field at the time of thematic accuracy assessment. However, at the request of the park resource managers, these fields will retain their Pasture label. Since the type assigned to these fields is influenced more by their cultural and management designation than the vegetation, these points were excluded from the analysis.

The thematic accuracy assessment data also informed one important change in vegetation classification, the lumping of Bottomland Oak – Hardwood Palustrine Forest and Green Ash Palustrine Forest into one generic palustrine forest association, Bottomland Mixed Hardwood Forest. The errors of commission and omission were originally calculated for Bottomland Oak – Hardwood Palustrine Forest and Green Ash Palustrine Forest as two distinctive types. For Bottomland Oak – Hardwood Palustrine Forest, the error of omission was 66.67% and the error of commission was 75.00%. For Green Ash Palustrine Forest, the error of omission was 40.00% and the error of commission was 22.22%. None of these calculated errors meet the protocol requirements and the calculated errors for Green Ash Palustrine Forest are dismally low. These



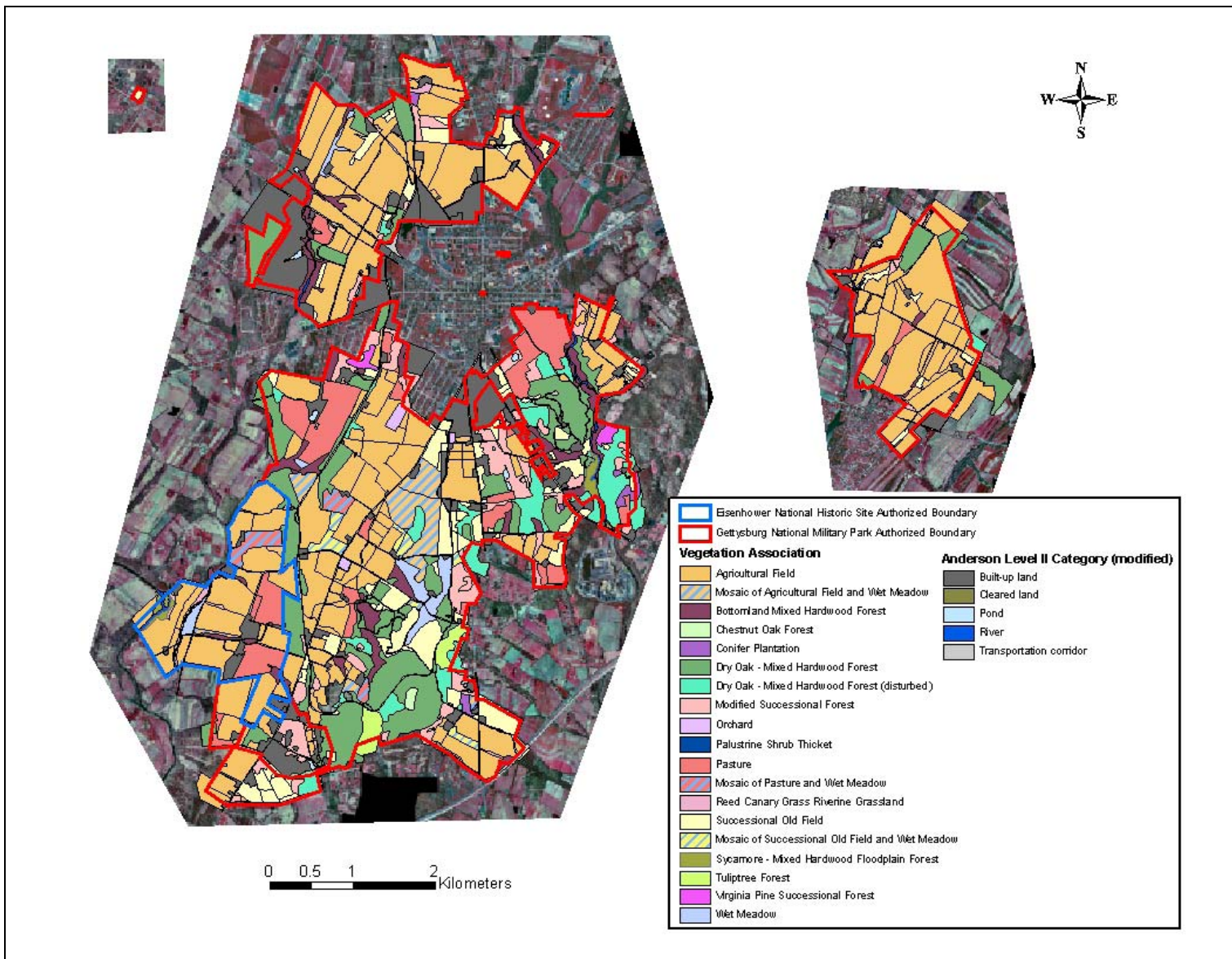


Figure 32. Vegetation associations of Gettysburg National Military Park and Eisenhower National Historic Site.

**USGS – NPS Vegetation Mapping Program**  
**Gettysburg National Military Park and Eisenhower National Historic Site**

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Table 6. Number of polygons, total mapped hectares, and mapped hectares within the park boundary for vegetation associations and Anderson level II categories (modified) at Gettysburg National Military Park and Eisenhower National Historic Site.

| Vegetation Association                                       | Number of Polygons | Total Mapped Hectares | Mapped Hectares within Park Boundary |
|--|--------------------|-----------------------|--------------------------------------|
| Agricultural Field   | 189                | 1,204.96              | 1,169.72                             |
| Mosaic of Agricultural Field and Wet Meadow <sup>1</sup>     | 7                  | 64.11                 | 64.11                                |
| Bottomland Mixed Hardwood Forest                             | 47                 | 127.06                | 112.42                               |
| Chestnut Oak Forest  | 1                  | 3.12                  | 3.12                                 |
| Conifer Plantation   | 6                  | 11.17                 | 11.06                                |
| Dry Oak - Mixed Hardwood Forest                              | 64                 | 381.70                | 341.86                               |
| Dry Oak - Mixed Hardwood Forest (disturbed) <sup>2</sup>     | 24                 | 132.26                | 109.39                               |
| Modified Successional Forest                                 | 68                 | 159.31                | 131.09                               |
| Orchard  | 3                  | 6.96                  | 6.96                                 |
| Palustrine Shrub Thicket                                     | 1                  | 0.58                  | 0.58                                 |
| Pasture  | 25                 | 186.96                | 186.03                               |
| Mosaic of Pasture and Wet Meadow <sup>1</sup>                | 3                  | 24.51                 | 24.51                                |
| Reed Canary Grass Riverine Grassland                         | 5                  | 5.86                  | 5.83                                 |
| Successional Old Field                                       | 98                 | 195.73                | 191.02                               |
| Mosaic of Successional Old Field and Wet Meadow <sup>1</sup> | 9                  | 22.97                 | 22.96                                |
| Sycamore - Mixed Hardwood Floodplain Forest                  | 5                  | 10.60                 | 9.96                                 |
| Tuliptree Forest   | 2                  | 22.68                 | 16.20                                |
| Virginia Pine Successional Forest                            | 2                  | 9.36                  | 9.19                                 |
| Wet Meadow   | 6                  | 33.82                 | 33.82                                |
| Anderson Level II Category (modified)                        |                    |                       |                                      |
| Built-up land  | 153                | 353.60                | 219.58                               |
| Cleared land   | 4                  | 7.86                  | 7.86                                 |
| Pond   | 18                 | 7.06                  | 6.05                                 |
| River  | 7                  | 14.82                 | 11.69                                |
| Transportation corridor                                      | 11                 | 73.78                 | 60.66                                |
| <b>Total</b>   | <b>758</b>         | <b>3,060.84</b>       | <b>2,755.68</b>                      |

<sup>1</sup> These polygons were labeled as mosaics because both vegetation associations were present in the polygons and clear boundaries between the two associations could not be delineated.

<sup>2</sup> Same association as Dry Oak – Mixed Hardwood Forest.

results, combined with field observations that these two types frequently intergrade and co-occur even in very small polygons, provided the justification for creating the Bottomland Hardwood Palustrine Forest that is described and mapped in the final products.

Based on the contingency matrix (Table 7), the Kappa index for the vegetation association map was  $86.1\% \pm 4.1\%$ , with the overall percent accuracy calculated as 87.6%. This meets the USGS/NPS vegetation mapping protocol requirement of 80%. The errors of commission for 13 of the 15 vegetation types exceeded the USGS/NPS Vegetation Mapping Protocol requirement of 80% (Table 7). The exceptions were Modified Successional Forest (71.4%) and Dry Oak – Mixed Hardwood Forest (disturbed) (73.3%) which fell below the protocol requirement. The errors of omission for 13 of the 15 vegetation types also exceeded the USGS/NPS vegetation mapping protocol requirement of 80%. Dry Oak – Mixed Hardwood Forest (disturbed) (68.8%) and Sycamore – Mixed Hardwood Floodplain Forest (75.0%) did not meet the protocol requirements. The low errors of commission and omission calculated for Dry Oak – Mixed Hardwood Forest (disturbed) verify the difficulty of accurately assessing the quality of vegetation associations through aerial photography interpretation. These map errors were corrected after the accuracy assessment. Therefore, despite the low calculated errors, the (disturbed) label will provide valuable information about the condition of the forest stands. The low error of commission calculated for Modified Successional Forest can be attributed to the difficulty in distinguishing between Modified Successional Forest and Bottomland Oak Forest and Successional Old Fields on the aerial photography. Because many of the Bottomland Oak Forest stands are fragmented into very small polygons and often disturbed, it is difficult to distinguish between that type and Modified Successional Forest on the aerial photography. Likewise, Successional Old Fields that contain young trees or tall shrubs are difficult to distinguish from Modified Successional Forest on the aerial photography. The low error of omission calculated for Sycamore – Mixed Hardwood Floodplain Forest can be attributed to the incorrect label on one polygon.

### Project Deliverables

Final products of the vegetation mapping project are shown in Table 8. All products have been delivered to the National Park Service by the Pennsylvania Science Office of The Nature Conservancy with this report.

Table 7. Contingency matrix and calculated errors for the thematic accuracy assessment of the vegetation association map of Gettysburg National Military Park and Eisenhower National Historic Site.

| Accuracy Assessment Observation                | Mapped Vegetation Association |                                       |                    |                     |                                 |   |                              |         |         |                                      |                        |   |                  |                                   |  | Total | Error of Commission (% correct) |
|--|-------------------------------|---------------------------------------|--------------------|---------------------|---------------------------------|---|------------------------------|---------|---------|--------------------------------------|------------------------|---|------------------|-----------------------------------|--|-------|---------------------------------|
|  | Agricultural Field            | Bottomland Hardwood Palustrine Forest | Conifer Plantation | Chestnut Oak Forest | Dry Oak - Mixed Hardwood Forest | Dry Oak - Mixed Hardwood Forest (disturbed) | Modified Successional Forest | Orchard | Pasture | Reed Canary Grass Riverine Grassland | Successional Old Field | Sycamore - Mixed Hardwood Floodplain Forest | Tuliptree Forest | Virginia Pine Successional Forest | Wet Meadow and Wet Meadow Mosaics <sup>1</sup> |       |                                 |
| Agricultural Field                             | 29                            |                                       |                    |                     |                                 |   |                              |         |         |                                      | 2                      |   |                  |                                   | 2  | 33    | 87.88%                          |
| Bottomland Hardwood Palustrine Forest          |                               | 27                                    |                    |                     | 2                               | 1   | 2                            |         |         |                                      |                        | 1   |                  |                                   |  | 33    | 81.82%                          |
| Conifer Plantation                             |                               |                                       | 1                  |                     |                                 |   |                              |         |         |                                      |                        |   |                  |                                   |  | 1     | 100.00%                         |
| Chestnut Oak Forest                            |                               |                                       |                    | 1                   |                                 |   |                              |         |         |                                      |                        |   |                  |                                   |  | 1     | 100.00%                         |
| Dry Oak -Mixed Hardwood Forest                 |                               |                                       |                    |                     | 27                              | 1   |                              |         |         |                                      |                        |   |                  |                                   |  | 28    | 96.43%                          |
| Dry Oak - Mixed Hardwood Forest (disturbed)    |                               |                                       |                    |                     | 1                               | 11  | 3                            |         |         |                                      |                        |   |                  |                                   |  | 15    | 73.33%                          |
| Modified Successional Forest                   |                               | 5                                     |                    |                     |                                 | 3   | 25                           |         |         |                                      | 2                      |   |                  |                                   |  | 35    | 71.43%                          |
| Orchard  |                               |                                       |                    |                     |                                 |   |                              | 3       |         |                                      |                        |   |                  |                                   |  | 3     | 100.00%                         |
| Pasture  |                               |                                       |                    |                     |                                 |   |                              |         | 14      |                                      |                        |   |                  |                                   |  | 14    | 100.00%                         |
| Reed Canary Grass Riverine Grassland           |                               |                                       |                    |                     |                                 |   |                              |         |         | 5                                    |                        |   |                  |                                   | 1  | 6     | 83.33%                          |
| Successional Old Field                         | 1                             |                                       |                    |                     |                                 |   |                              |         |         |                                      | 26                     |   |                  |                                   |  | 27    | 96.30%                          |
| Sycamore - Mixed Hardwood Floodplain Forest    |                               |                                       |                    |                     |                                 |   |                              |         |         |                                      |                        | 3   |                  |                                   |  | 3     | 100.00%                         |
| Tuliptree Forest                               |                               |                                       |                    |                     |                                 |   |                              |         |         |                                      |                        |   | 2                |                                   |  | 2     | 100.00%                         |
| Virginia Pine Successional Forest              |                               |                                       |                    |                     |                                 |   |                              |         |         |                                      |                        |   |                  | 2                                 |  | 2     | 100.00%                         |
| Wet Meadow and Wet Meadow Mosaics <sup>1</sup> |                               |                                       |                    |                     |                                 |   |                              |         |         |                                      |                        |   |                  |                                   | 16   | 16    | 100.00%                         |
| Total  | 30                            | 32                                    | 1                  | 1                   | 30                              | 16  | 30                           | 3       | 14      | 5                                    | 30                     | 4   | 2                | 2                                 | 19   | 219   |                                 |
| Error of Omission (% correct)                  | 96.67%                        | 84.38%                                | 100.00%            | 100.00%             | 90.00%                          | 68.75%                                      | 83.33%                       | 100.00% | 100.00% | 100.00%                              | 86.67%                 | 75.00%                                      | 100.00%          | 100.00%                           | 84.21%   |       |                                 |

Total Points Correct 192

Overall Accuracy 87.60%

Kappa Index 86.10%

90% Confidence Interval 4.10%

<sup>1</sup> Includes mosaics of Wet Meadow with Agricultural Field, Pasture, or Successional Old Field

Table 8. Summary of products resulting from the Gettysburg National Military Park and Eisenhower National Historic Site vegetation classification and mapping project.

| Product  | FGCD-complaint spatial metadata |
|--|---------------------------------|
| Aerial photos, including flight line map and photoindex                                | Yes                             |
| Photomosaic as paper copy and in digital format  | Yes                             |
| Annotated field forms with vegetation plot sampling data                               | Not applicable                  |
| Vegetation plot sampling data in the PLOTS 2.0 database                                | Not applicable                  |
| Differentially corrected GPS locations of vegetation plots                             | Yes                             |
| Annotated field forms with thematic accuracy assessment data                           | Not applicable                  |
| Thematic accuracy assessment data in the PLOTS 2.0 database                            | Not applicable                  |
| Differentially corrected GPS locations of thematic accuracy assessment sampling points | Yes                             |
| Digital photos representative of all vegetation types                                  | Not applicable                  |
| Final map of vegetation associations as paper copy and in digital format               | Yes                             |
| Final report as paper copy and in digital format                                       | Not applicable                  |

## Discussion

### Vegetation Classification and Characterization

This study at Gettysburg National Military Park and Eisenhower National Historic Site identified 15 vegetation associations: Chestnut Oak Forest, Dry Oak – Mixed Hardwood Forest, Tuliptree Forest, Modified Successional Forest, Conifer Plantation, Virginia Pine Successional Forest, Sycamore – Mixed Hardwood Floodplain Forest, Bottomland Mixed Hardwood Forest, Palustrine Shrub Thicket, Successional Old Field, Agricultural Field, Pasture, Orchard, Wet Meadow, and Reed Canary Grass Riverine Grassland. These vegetation types are strongly influenced by the varied environmental settings of the parks and the mandate to preserve the topographic, landscape, and cultural features as they were in 1863 such that visitors and historians can fully understand and appreciate the Battle of Gettysburg.

One of the most influential environmental factors on the parks’ vegetation is the Gettysburg Sill, the large diabase intrusion that runs southwest to northeast through Gettysburg National Military Park. The sill forms topographically high areas that are resistant to weathering and support very stony soils. These areas are mostly forested because the stony hills are inhospitable to row crop agriculture. Dry Oak – Mixed Hardwood Forest is the most abundant forest association in the park that primarily occurs on the forested sill areas of Big Round Top, Little Round Top, Powers Hill, and Culp’s Hill. Due to the mineral-rich soils weathered from the diabase, several plant



species of special concern are associated with Dry Oak – Mixed Hardwood Forest. These species include: Adam and Eve (*Aplectrum hyemale*), Short's sedge (*Carex shortiana*), hoary puccoon (*Lithospermum canescens*), greater yellow lady's slipper (*Cypripedium pubescens* var. *pubescens*), downy phlox (*Phlox pilosa*), cankerweed (*Prenanthes serpentina*), eastern smooth beardtongue (*Penstemon laevigatus*), Shumard's oak (*Quercus shumardii*), and Missouri gooseberry (*Ribes missouriense*) (J. Kunsman, unpublished data). The Dry Oak – Mixed Hardwood Forest also occurs in the historic woodlots scattered throughout the rest of Gettysburg National Military Park. Missouri gooseberry and cankerweed also occur in Dry Oak – Mixed Hardwood Forest woodlots that do not occur over diabase.

The Chestnut Oak Forest, the rarest forest type in the park, covering just 3.1 ha (7.7 ac), also occurs over the Gettysburg Sill. This association is rare within the parks because it is restricted to rocky soil and upper elevations that are found only on the upper slopes and summit of Big Round Top. Another occasional forest association found on the sill is Tuliptree Forest, occurring on rocky upland slopes dominated by tuliptree (*Liriodendron tulipifera*).

Another environmental setting in which forested areas persist are the low areas surrounding drainages and creeks. Sycamore – Mixed Hardwood Floodplain Forest is typical of the low terrace floodplains of the larger tributaries such as Marsh Creek and Rock Creek. Bottomland Mixed Hardwood Forest can occur on the floodplain of these larger tributaries as well as on the topographically low areas surrounding smaller drainages. Forest stands adjacent the smaller drainages are usually surrounded by agricultural land and are therefore very fragmented and disturbed. Canopy species composition of these bottomland forests is variable and the understory is often dominated by invasive exotic species and weedy native species.

The fragmentation and disturbance of forest stands also influence the Modified Successional Forest association, a common forest type in the parks. These stands are dominated by early successional weedy tree species in the canopy and subcanopy, and by nonnative invasive plants in the shrub and herbaceous layers. These stands should be targeted for invasive species control and restoration to a native forest association. A few Conifer Plantation stands remain in areas where coniferous trees were planted, primarily on privately held lands. Virginia Pine Successional Forest occurs in two locations in Gettysburg National Military Park in which Virginia pine (*Pinus virginiana*) has become established.

In Gettysburg National Military Park and Eisenhower National Historic Site, the ongoing management to maintain the historic and cultural landscape has equal if not greater influence on the vegetation than the environmental setting. Agricultural Field is the most common vegetation type in the parks, covering 1,170 ha (2,889 ac), over 40% of the parks' area. Other maintained cultural vegetation types include Pasture (186 ha; 459 ac) and Orchard (7 ha; 17 ac).

The rotation of grasses in the Agricultural Field areas, as well as many of the Successional Old Field, inactive Pasture, Wet Meadow, and Reed Canary Grass Riverine Grassland areas, contribute to the abundance of grassland in the parks. Large expanses of grassland like those found in Gettysburg National Military Park and Eisenhower National Historic Site are increasingly rare in Pennsylvania due to land conversion for development and reforestation. These grasslands provide critical habitat for several species of birds and mammals. According to the Pennsylvania Audubon Society the parks are an important component of the Freedom

Township Grasslands Important Bird Area. The grasslands provide critical habitat for bobolink (*Dolichonyx oryzivorus*), grasshopper sparrow (*Ammodramus savannarum*), eastern meadowlark (*Sturnella magna*), loggerhead shrike (*Lanius ludovicianus*), short-eared owl (*Asio flammeus*), upland sandpiper (*Bartramia longicauda*), northern harrier (*Circus cyaneus*), and barn owl (*Tyto alba*). All of these species are found in at least one of the two parks and, with exception of the Bobolink, are considered species of special concern by federal agencies, state agencies, or the Audubon Society (Crossley 1999; Yahner et al. 2001b). One state endangered mammal, the least shrew (*Cryptotis parva*), has also been documented in the Gettysburg National Military Park grasslands (J. Hart, unpublished data). Battlefield rehabilitation will convert some of the large Agricultural Field areas to smaller contiguous patches of native grasses that will provide additional grassland habitat.

The Wet Meadow and the Successional Old Field associations also provide habitat for several plant species of special concern. The Wet Meadow sites in Gettysburg National Military Park and Eisenhower National Historic Site are particularly diverse, dominated by an interesting mix of hydrophilic graminoids, including the following species of special concern: rigid sedge (*Carex tetanica*), bog rush (*Juncus biflorus*), whiteroot rush (*Juncus brachycarpus*), Buxbaum's sedge (*Carex buxbaumii*), low spearwort (*Ranunculus pusillus*), and orange coneflower (*Rudbeckia fulgida*). In the Successional Old Field sites, hoary frostweed (*Helianthemum bicknellii*), Heller's rosette grass (*Dichantheium oligosanthos* var. *oligosanthos*), eastern smooth beardtongue (*Penstemon laevigatus*), sidebeak pencilflower (*Stylosanthes biflora*), and orange coneflower (*Rudbeckia fulgida*) are the species of special concern that have been documented (J. Kunsman, unpublished data). Many of these species occur in the parks only in areas influenced by the diabase Gettysburg Sill.

The Wet Meadow and the Palustrine Shrub Thicket associations are palustrine vegetation types that can be crosswalked to the Cowardin classification system that was used for the National Wetland Inventory mapping efforts (Cowardin et al. 1979). Using the Cowardin classification system, Wet Meadow is best classified as Palustrine, Emergent, Persistent (PEM1). The Palustrine Shrub Thicket is best classified as Palustrine, Scrub-Shrub, Broad-leaved Deciduous (PSS1).

Invasive exotic plant species are an important threat to the native vegetation at Gettysburg National Military Park and Eisenhower National Historic Site. Species such as multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thunbergii*), tree of heaven (*Ailanthus altissima*), Asiatic tearthumb (*Polygonum perfoliatum*), Japanese stilt grass (*Microstegium vimineum*), Japanese honeysuckle (*Lonicera japonica*), Amur honeysuckle (*Lonicera maackii*), and Morrow's honeysuckle (*Lonicera morrowii*) were documented in the parks during this study. Park staff and the Mid-Atlantic Exotic Plant Management Team have been using chemical and mechanical controls on some of these invasive species. This management should continue in order to protect the native vegetation associations.

### Vegetation Map Production

The final vegetation map for Gettysburg National Military Park and Eisenhower National Historic Site includes 15 vegetation associations and five modified Anderson level II categories. It is important to note that the vegetation formations listed in the attribute table of the final

vegetation-association shapefile were determined by the hierarchical nature of the NVCS. Based on the NVCS, each polygon was attributed with the appropriate formation for the polygon's NVCS association. The original formation-level map created during this study was developed solely to guide vegetation sampling and was not intended to identify specific NVCS formations for specific polygons. The information on each polygon's vegetation structure, leaf phenology, and hydrologic regime that was contained in the original formation-level vegetation map has been retained in the "Veg\_Strc" field of the final vegetation association shapefile.

#### Recommendations for Future Projects

The final vegetation map is based on the aerial photography that was flown in April 2003. Since that time the vegetation in the park continues to change. In most national parks ongoing management of invasive species and woody plants and continued natural succession alters and influences the mapped vegetation. However, in Gettysburg National Military Park, the battlefield rehabilitation has also significantly altered the vegetation in many sections of the park, so much so that the vegetation map will be significantly out of date even before this report is published. Therefore, once the battlefield rehabilitation is completed, a new map of the vegetation associations should be completed. The vegetation classification work will not need to be redone since the associations reported here adequately describe the parks' vegetation types and already incorporate many of the changes recommended by the rehabilitation plan. A description may need to be developed for the constructed wetlands that will be created as part of the rehabilitation. The classification will, for the vast majority of the parks, still adequately represent the vegetation on the ground. However, a significant percentage of the mapped polygons will have to be redelineated or reattributed once the battlefield rehabilitation is completed. Thus, new aerial photography should be flown and the association-level map redrawn based on the map and data presented here, the battlefield rehabilitation, and additional field reconnaissance.

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Appendix A. Aerial photograph interpretation keys to formation- and association-level vegetation types and Anderson level II categories (modified) at Gettysburg National Military Park and Eisenhower Hill National Historic Site.

**AERIAL PHOTOGRAPH INTERPRETATION KEY TO FORMATION-LEVEL  
VEGETATION TYPES AND ANDERSON LEVEL II CATEGORIES (MODIFIED) AT  
GETTYSBURG NATIONAL MILITARY PARK AND  
EISENHOWER NATIONAL HISTORIC SITE  
for April 2003 Color Infrared Aerial Photography**

1. Individual tree crowns visible as gray, black, or pink signatures of varying architecture. Trees cover greater than 25% of area. (If buildings, structures, parking lots, and roads are present see couplet 11 below).
2. Signatures of at least 25% of the trees are pink and conical, indicating evergreen trees.
3. Signatures of greater than 75% of the trees are pink and conical, creating a near continuous pink canopy or an open canopy of conical crowns.
4. Tree crowns cover 25–60% of the area, such that individual trees or clumps of trees are visible in a matrix of white to light gray herbaceous vegetation. Gray shrubs may also be present.

**Conical-crowned temperate evergreen woodland**

4. Tree crowns cover greater than 60% of the area, creating a near continuous canopy.

**Conical-crowned temperate evergreen forest**

3. Signatures of 25–75% of the trees are pink and conical. The canopy contains interspersed light to dark gray deciduous tree crowns and pink, conical evergreen tree crowns.
5. Tree crowns cover 25–60% of the area, such that individual trees or clumps of trees are visible in a matrix of white to light gray herbaceous vegetation. Gray shrubs may also be present.

**Mixed needle-leaved evergreen - cold-deciduous woodland**

5. Tree crowns cover greater than 60% of the area, creating a near continuous canopy.
6. Forest occurs in a swale, depression, or low topographic position. Polygon typically surrounds or includes curvilinear drainage features.  
**Temporarily flooded mixed needle-leaved evergreen - cold-deciduous forest**

6. Forest occurs in a terrestrial setting with no evidence curvilinear drainage features or other hydrologic indicators.

**Mixed needle-leaved evergreen - cold-deciduous forest**

2. Signatures of trees are light to dark gray or black, indicating cold-deciduous trees. Less than 25% of the trees are pink and conical.
7. Tree crowns cover 60% or less of the area, such that individual trees or clumps of trees are visible in a matrix of white to light gray herbaceous vegetation. Gray shrubs may also be present.
8. Trees are regularly spaced, planted in rows, and have open-grown, full, round canopies. Vegetation under the trees is bright pink, light pink or white.

**Orchard**

8. Trees are not regularly spaced or planted in rows.
9. Individual gray or black tree crowns form an open canopy over bright to light pink herbaceous vegetation. Dark curvilinear drainage features are present.

**Temporarily flooded cold-deciduous woodland**

9. Individual gray or black tree crowns form an open canopy over light pink, gray, or white herbaceous vegetation. Rounded gray clumps of shrubs may also be present. Dark curvilinear drainage features are not present

**Cold-deciduous woodland**

7. Tree crowns cover greater than 60% of the area, creating a near continuous canopy.
10. Forest occurs immediately adjacent to the dark blue gray signature of a creek or drainageway. Shading of forest floor tends to be more dark gray than white.
10. Forest does not occur immediately adjacent to the dark blue gray signature of a creek or drainageway. Shading of forest floor tends to be more light gray or white than dark gray.

**Temporarily flooded cold-deciduous forest**

**Lowland or submontane cold-deciduous forest**

1. Individual tree crowns cover less than 25% of the area.
11. Signature is primarily white, gray, or pink ranging from uniform to mottled. Buildings, structures, parking lots, and roads are absent. Signature is not uniform dark blue gray with occasional white speckles, indicating open water.
12. Shrubs cover greater than 25% of the area, appearing as round gray circles, or short, thin, pink cones. Shrubs are scattered or in clumps within a matrix of white, light gray, or pink herbaceous vegetation. Areas of dense deciduous shrub cover will have a bumpy gray signature.

13. At least 25% of the shrubs occur as short, thin, pink cones, with the remaining shrubs appear as round gray circles.

**Mixed evergreen - cold-deciduous shrubland**

13. Less than 25% of the shrubs occur as short, thin, pink cones. The vast majority of the shrubs appear as round gray circles.

14. Shrubs occur in a matrix that is in parts bright dappled white, indicating hummocks herbaceous vegetation in saturated soil. Dark gray curvilinear drainage features are present.

**Temporarily-flooded cold-deciduous shrubland**

14. Shrubs occur in a matrix that is mottled white, light pink, or bright pink. Dark gray curvilinear drainage features are absent.

**Temperate cold-deciduous shrubland**

12. Shrubs cover 25% or less of the area. Signature is almost entirely white, light gray, and/or light to bright pink herbaceous vegetation, ranging from uniform to mottled.

15. Signature is bright white and dappled, indicating saturated soil and hummocky herbaceous vegetation. Dark gray linear drainage features are present.

**Saturated temperate perennial forb vegetation**

15. Signature tends to be bright to light pink, white, and/or light to dark gray, often in wide linear bands of color. Parallel mow lines are often prominent. Polygons tend to have linear edges and regular shapes.

**Agricultural Land**

11. Either, buildings, structures, parking lots and roads are present, often surrounded by frequently mowed turf grass that has a light to bright pink signature. Or, signature is uniform dark blue gray with occasional white speckles, indicating open water.

16. Buildings, structures, parking lots and roads are present, often surrounded by frequently mowed turf grass that has a light to bright pink signature.

17. Buildings, structures, and parking lots, often surrounded by frequently mowed turf grass that has a light, bright pink signature.

**Built-up land**

17. Roads and highways have a linear uniform light gray to blue-gray signature often with visible lane lines and automobiles.

**Transportation corridor**

16. Signature is dark blue gray with occasional white speckles, indicating open water.

18. Feature is curvilinear dark blue gray with occasional white speckles.

**River**

18. Feature is small, somewhat circular dark blue gray features isolated within other vegetation types.

**Pond**

**AERIAL PHOTOGRAPH INTERPRETATION KEY TO VEGETATION  
ASSOCIATIONS AND ANDERSON LEVEL II CATEGORIES (MODIFIED) AT  
GETTYSBURG NATIONAL MILITARY PARK AND  
EISENHOWER NATIONAL HISTORIC SITE  
for April 2003 Color Infrared Aerial Photography**

1. Individual tree crowns visible as gray, black, or pink signatures of varying architecture. Trees cover greater than 25% of area. (If buildings, structures, parking lots, and roads are present see couplet 12 below).

2. Signatures of at least 25% of the trees are pink and conical, indicating evergreen trees.

3. Tree crowns are medium height, somewhat rounded, and a medium shade of pink, indicating Virginia pine (*Pinus virginiana*).

**Virginia Pine Successional Forest**

3. Tree crowns are either: a) light pink, sharply star shaped, and tall, indicating eastern white pine (*Pinus strobus*), or b) dark pink, tear-drop shaped, and short, indicating eastern red-cedar (*Juniperus virginiana*).

4. Tree crowns are light pink, sharply star shaped, and tall, indicating eastern white pine (*Pinus strobus*). Canopy can be predominantly coniferous, or mixed with light to dark gray or black cold-deciduous trees.

**Conifer Plantation**

4. Tree crowns are dark pink, tear-drop shaped, and short, indicating eastern red-cedar (*Juniperus virginiana*). Canopy can be predominantly coniferous, or mixed with light to dark gray or black cold-deciduous trees.

**Modified Successional Forest**

2. Signatures of trees are light to dark gray or black, indicating cold-deciduous trees. Less than 25% of the trees are pink and conical.

5. Trees are regularly spaced, planted in rows, and have open-grown, full, round canopies. Vegetation under the trees is bright pink, light pink or white.

**Orchard**

5. Trees are not regularly spaced or planted in rows.

6. Forest occurs immediately adjacent to the dark blue gray signature of a creek or occurs around dark gray curvilinear drainage features in topographically low areas.



7. Bright white trunk and branches of sycamores (*Platanus occidentalis*) are prominent in the canopy.

**Sycamore – Mixed Hardwood Floodplain Forest**

7. Bright white trunk and branches of sycamores (*Platanus occidentalis*) are rare or absent. Tree crowns are light to dark gray with varying architecture.

**Bottomland Mixed Hardwood Forest**

6. Forest does not occur immediately adjacent to the dark blue gray signature of a creek or drainageway. Forest occurs in mid-level to upper slopes topographically.

8. Canopy trees are varied, light to dark gray or black cold-deciduous trees, often with dark pink, tear-drop shaped, and short eastern red-cedar (*Juniperus virginiana*) trees as associates. Canopy trees are typically young in stature often with prominent open canopy gaps. Groundstory is dappled bright pink, blue gray, and white.

**Modified Successional Forest**

8. Tree crowns are either: a) predominantly light gray to light brown, symmetrical, fine-branched, and tall, or b) predominantly dark gray with open asymmetrical canopies and coarse craggy branches.

9. Tree crowns are predominantly light gray to light brown, symmetrical, fine-branched, and tall. Often emergent crowns are visible above a varied subcanopy.

**Tuliptree Forest**

9. Tree crowns are predominantly dark gray with open asymmetrical canopies and coarse craggy branches

10. Forest occurs on the very top of Big Round Top. The canopy is fairly open over a bright white groundstory.

**Chestnut Oak Forest**

10. Forest occurs on mid to upper slopes throughout the parks, frequently with a closed canopy and light gray to white groundstory.

11. Closed canopy is somewhat uniform and dominated by dark gray, open asymmetrical crowns with coarse craggy branches. Groundstory is somewhat uniform, light gray or white. This is the most common forest type in the parks.

**Dry Oak – Mixed Hardwood Forest**

11. Canopy is dominated by dark gray, open asymmetrical crowns with coarse craggy branches. However, canopy can contain gaps, as well as scattered dark pink, tear-drop shaped, and short eastern red-cedar (*Juniperus virginiana*) trees as associates. At least some of the groundstory is dappled bright pink, blue gray, and white.

**Dry Oak – Mixed Hardwood Forest (disturbed)**

1. Individual tree crowns cover less than 25% of the area.
12. Signature is predominantly white, light gray or pink herbaceous vegetation, ranging from uniform to mottled. Shrubs, appearing as round gray circles, may be present or absent, scattered or in clumps within the white to light gray matrix of herbaceous vegetation. Buildings, structures, parking lots, roads, and open water are absent.
13. Signature is white, light gray, or light to bright pink, indicating herbaceous vegetation. Individual tree crowns and shrubs are widely scattered or absent.
14. Signature is bright white, with gray or pink dapples or mottles, indicating temporarily-flooded to saturated herbaceous vegetation. Polygon is adjacent to or contains dark gray curvilinear features of creeks or drainages.
15. Signature is bright white and dappled with gray to black speckled or textured areas that indicate saturated soil and hummocky vegetation. Dark gray linear drainage features are prominent or common.

**Wet Meadow**

15. Signature is bright white, mottled with pink. Polygon occurs adjacent to large dark gray curvilinear feature of creek.

**Reed Canary Grass Riverine Grassland**

14. Signature tends to be bright to light pink, white, and/or light to dark gray, with no indication of drainage features or saturated soils. Boulders, downed trees, parallel mow lines, and fences may be present.
16. Signature tends to be bright to light pink, white, and/or light gray, often scattered white boulders or downed trees present among the vegetation. Parallel mow lines and fences are absent.
17. Signature tends to be light gray, with downed trees scattered throughout or arranged neatly. Vehicle tracks may be visible.

**Cleared land**

17. Signature tends to be bright to light pink, white, and/or light gray, often scattered white boulders present among the vegetation. No downed trees are visible. Statues may occasionally be present.

**Successional Old Field**

16. Signature tends to be bright to light pink, white, and/or light to dark gray, often in wide linear bands of color. Parallel mow lines, fences, or animal paths are often prominent. Polygons tend to have linear edges and regular shapes.

18. Signature tends to be bright to light pink, white, and/or light to dark gray, often in wide linear bands of color. Parallel mow lines are often prominent.

**Agricultural Land**

18. Signature tends to be bright pink, surrounded by fences, and often contains visible animals, or the worn gray paths the animals create. Trees may be scattered throughout.

**Pasture**

13. Shrubs, appearing as round gray circles, are present, scattered or in clumps within the white to light gray matrix of herbaceous vegetation. Areas of dense shrub cover will have a bumpy gray signature.

19. Dense shrub cover appears as a bumpy gray signature surrounding a dark curvilinear drainage feature.

**Palustrine Shrub Thicket**

19. Shrubs, appearing as round gray circles or pink cones, are present, scattered or in clumps within the white to light gray matrix of herbaceous vegetation. Scattered tree crowns or white boulders may also be visible. Dark curvilinear drainage features are absent.

**Successional Old Field**

12. Either, buildings, structures, parking lots and roads are present, often surrounded by frequently mowed turf grass that has a light to bright pink signature. Or, signature is uniform dark blue gray with occasional white speckles, indicating open water.

20. Buildings, structures, parking lots and roads are present, often surrounded by frequently mowed turf grass that has a light to bright pink signature.

21. Buildings, structures, and parking lots, often surrounded by frequently mowed turf grass that has a light, bright pink signature.

**Built-up land**

21. Roads and highways have a linear uniform light gray to blue-gray signature often with visible lane lines and automobiles.

**Transportation corridor**

20. Signature is dark blue gray with occasional white speckles, indicating open water.

22. Feature is curvilinear dark blue gray with occasional white speckles.

**River**

22. Feature is small, somewhat circular dark blue gray features isolated within other vegetation types.

**Pond**

Appendix B. Vegetation plot sampling form.

Form 3: Quantitative Community Characterization  
 Draft: Summer 2003 NPS 6 Parks Vegetation Mapping Project

**A. General Information**

|                    |                   |
|--------------------|-------------------|
| Plot Number: _____ | Park Name: _____  |
| Survey date: _____ | Surveyors: _____  |
| Easting: _____     | E Northing: _____ |
| N EPE/APE: _____   | DOP: _____        |
| Map datum: _____   | Zone: _____       |

**B. Environmental Description**

| Representative sketch of stand and landscape position<br><br><br><br><br><br><br><br><br><br>Picture No.: _____  |  | Slope: _____<br>Aspect: _____<br>Elevation: _____<br><br>Stoniness:<br>___ Stone free <0.1%<br>___ Moderately stony 0.1-1%<br>___ Stony 3-15%<br>___ Very stony 15-50%<br>___ Exceedingly stony 50-90%<br>___ Stone piles >90%       |         |       |          |       |    |          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|--|--|--|---------|-------|----------|-------|----|----------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| <b>Topographic position:</b><br>___ Interfluve (ridgetop)    ___ Low slope<br>___ High Slope                ___ Toe slope<br>___ High level                 ___ Low level<br>___ Midslope                  ___ Channel wall<br>___ Back slope                 ___ Channel bed<br>___ Step in slope              ___ Basin floor<br>___ Other _____ | <b>Hydrologic regime:</b><br>___ Permanently flooded<br>___ Semi-permanently flooded<br>___ Seasonally flooded<br>___ Intermittently flooded<br>___ Temporarily flooded<br>___ Artificially flooded<br>___ Saturated (wet, but never flooded)  | <b>Average soil texture:</b><br>___ sand                        ___ clay loam<br>___ sandy loam                ___ clay<br>___ loam                         ___ peat<br>___ silt loam                  ___ muck<br>___ other : _____ |         |       |          |       |    |          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Soil drainage:</b><br>___ Rapidly drained<br>___ Well drained<br>___ Moderately well drained<br>___ Somewhat poorly drained<br>___ Poorly drained<br>___ Very poorly drained  | Soil profile description: note depth, texture, and color of each horizon. Note significant changes such as depth to mottling, depth to water table, root penetration depth<br><table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 10%;">Horizon</th> <th style="width: 10%;">Depth</th> <th style="width: 20%;">Texture</th> <th style="width: 15%;">Color</th> <th style="width: 10%;">pH</th> <th style="width: 35%;">Comments</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table> |  | Horizon | Depth | Texture  | Color | pH | Comments |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Horizon  | Depth  | Texture  | Color   | pH    | Comments |       |    |          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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Appendix C. Plants observed in Gettysburg National Military Park and Eisenhower National Historic Site during vegetation plot and thematic accuracy assessment sampling.

**Plants Observed in Gettysburg National Military Park and Eisenhower National Historic Site During Vegetation Plot and Thematic Accuracy Assessment Sampling**

Nomenclature follows the *PLANTS Database, Version 3.5*, developed by the Natural Resource Conservation Service in cooperation with the Biota of North America Program (United States Department of Agriculture, National Resources Conservation Service 2006). For this report, some common names listed in the *PLANTS Database* were changed to reflect the common names typically used by ecologists and resource managers in this region.

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| Family           | Scientific Name                                  | Common Name               |
|------------------|--|---------------------------|
| Aceraceae        | <i>Acer negundo</i>                              | Boxelder                  |
|                  | <i>Acer platanoides</i>                          | Norway maple              |
|                  | <i>Acer rubrum</i>                               | red maple                 |
|                  | <i>Acer saccharinum</i>                          | silver maple              |
| Alismataceae     | <i>Alisma subcordatum</i>                        | American water plantain   |
|                  | <i>Sagittaria</i> sp.                            | arrowhead                 |
| Amaranthaceae    | <i>Amaranthus albus</i>                          | prostrate pigweed         |
| Anacardiaceae    | <i>Rhus copallinum</i>                           | flameleaf sumac           |
|                  | <i>Rhus glabra</i>                               | smooth sumac              |
|                  | <i>Toxicodendron radicans</i>                    | eastern poison ivy        |
| Apiaceae         | <i>Cicuta maculata</i>                           | spotted water hemlock     |
|                  | <i>Daucus carota</i>                             | Queen Anne's lace         |
|                  | <i>Osmorhiza longistylis</i>                     | longstyle sweetroot       |
|                  | <i>Sanicula canadensis</i>                       | Canadian blacksnakeroot   |
|                  | <i>Sanicula odorata</i>                          | clustered blacksnakeroot  |
|                  | <i>Sanicula trifoliata</i>                       | largefruit blacksnakeroot |
| Apocynaceae      | <i>Apocynum androsaemifolium</i>                 | spreading dogbane         |
|                  | <i>Apocynum cannabinum</i>                       | Indianhemp                |
|                  | <i>Vinca minor</i>                               | common periwinkle         |
| Araceae          | <i>Arisaema dracontium</i>                       | green dragon              |
|                  | <i>Arisaema triphyllum</i>                       | Jack in the pulpit        |
|                  | <i>Symplocarpus foetidus</i>                     | skunk cabbage             |
| Araliaceae       | <i>Panax trifolius</i>                           | dwarf ginseng             |
| Aristolochiaceae | <i>Asarum canadense</i>                          | Canadian wild ginger      |
| Asclepiadaceae   | <i>Asclepias incarnata</i>                       | swamp milkweed            |
|                  | <i>Asclepias quadrifolia</i>                     | fourleaf milkweed         |
|                  | <i>Asclepias syriaca</i>                         | common milkweed           |
|                  | <i>Asclepias viridiflora</i>                     | green comet milkweed      |
| Aspleniaceae     | <i>Asplenium platyneuron</i>                     | ebony spleenwort          |
| Asteraceae       | <i>Achillea millefolium</i>                      | common yarrow             |
|                  | <i>Ageratina altissima</i> var. <i>altissima</i> | white snakeroot           |
|                  | <i>Ambrosia artemisiifolia</i>                   | annual ragweed            |
|                  | <i>Ambrosia trifida</i>                          | great ragweed             |
|                  | <i>Antennaria parlinii</i>                       | Parlin's pussytoes        |
|                  | <i>Antennaria plantaginifolia</i>                | woman's tobacco           |
|                  | <i>Arctium minus</i>                             | lesser burdock            |
|                  | <i>Bidens frondosa</i>                           | devil's beggartick        |
|                  | <i>Cichorium intybus</i>                         | chicory                   |

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| Family                         | Scientific Name   | Common Name            |
|--------------------------------|---|------------------------|
| Asteraceae (cont.)             | <i>Cirsium arvense</i>                                      | Canada thistle         |
|                                | <i>Cirsium discolor</i>                                     | field thistle          |
|                                | <i>Cirsium muticum</i>                                      | swamp thistle          |
|                                | <i>Cirsium vulgare</i>                                      | bull thistle           |
|                                | <i>Conyza canadensis</i>                                    | Canadian horseweed     |
|                                | <i>Erechtites hieracifolia</i>                              | American burnweed      |
|                                | <i>Erigeron annuus</i>                                      | eastern daisy fleabane |
|                                | <i>Erigeron philadelphicus</i>                              | Philadelphia fleabane  |
|                                | <i>Erigeron strigosus</i>                                   | prairie fleabane       |
|                                | <i>Eupatorium perfoliatum</i>                               | common boneset         |
|                                | <i>Eurybia macrophylla</i>                                  | bigleaf aster          |
|                                | <i>Euthamia graminifolia</i>                                | flat-top goldentop     |
|                                | <i>Helianthus divaricatus</i>                               | woodland sunflower     |
|                                | <i>Hieracium caespitosum</i>                                | meadow hawkweed        |
|                                | <i>Hieracium venosum</i>                                    | rattlesnakeweed        |
|                                | <i>Lactuca biennis</i>                                      | tall blue lettuce      |
|                                | <i>Lactuca canadensis</i>                                   | Canada lettuce         |
|                                | <i>Lactuca serriola</i>                                     | prickly lettuce        |
|                                | <i>Leucanthemum vulgare</i>                                 | oxeye daisy            |
|                                | <i>Packera aurea</i>  | golden ragwort         |
|                                | <i>Packera paupercula</i>                                   | balsam groundsel       |
|                                | <i>Rudbeckia hirta</i>                                      | blackeyed Susan        |
|                                | <i>Solidago caesia</i>                                      | wreath goldenrod       |
|                                | <i>Solidago canadensis</i>                                  | Canada goldenrod       |
|                                | <i>Solidago canadensis</i> var. <i>scabra</i>               | Canada goldenrod       |
|                                | <i>Solidago gigantea</i>                                    | giant goldenrod        |
|                                | <i>Solidago juncea</i>                                      | early goldenrod        |
|                                | <i>Solidago nemoralis</i>                                   | gray goldenrod         |
|                                | <i>Solidago rugosa</i>                                      | wrinkleleaf goldenrod  |
|                                | <i>Sonchus arvensis</i>                                     | field sowthistle       |
|                                | <i>Sonchus oleraceus</i>                                    | common sowthistle      |
|                                | <i>Symphyotrichum lateriflorum</i> var. <i>lateriflorum</i> | calico aster           |
|                                | <i>Symphyotrichum novae-angliae</i>                         | New England aster      |
|                                | <i>Symphyotrichum undulatum</i>                             | waxy leaf aster        |
| <i>Taraxacum officinale</i>    | common dandelion  |                        |
| <i>Verbesina alternifolia</i>  | wingstem  |                        |
| <i>Vernonia noveboracensis</i> | New York ironweed   |                        |
| Balsaminaceae                  | <i>Impatiens capensis</i>                                   | jewelweed              |
|                                | <i>Impatiens pallida</i>                                    | pale touch-me-not      |
| Berberidaceae                  | <i>Berberis thunbergii</i>                                  | Japanese barberry      |
|                                | <i>Podophyllum peltatum</i>                                 | mayapple               |
| Betulaceae                     | <i>Carpinus caroliniana</i>                                 | American hornbeam      |
|                                | <i>Ostrya virginiana</i>                                    | hophornbeam            |
| Bignoniaceae                   | <i>Catalpa speciosa</i>                                     | northern catalpa       |
| Boraginaceae                   | <i>Cynoglossum officinale</i>                               | gypsyflower            |
|                                | <i>Cynoglossum virginianum</i>                              | wild comfrey           |
|                                | <i>Echium vulgare</i>                                       | common viperbugloss    |

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| Family                      | Scientific Name                                      | Common Name                   |
|-----------------------------|--|-------------------------------|
| Boraginaceae (cont.)        | <i>Hackelia virginiana</i>                           | beggarslice                   |
| Brassicaceae                | <i>Alliaria petiolata</i>                            | garlic mustard                |
|                             | <i>Arabidopsis thaliana</i>                          | mouseear cress                |
|                             | <i>Armoracia rusticana</i>                           | horseradish                   |
|                             | <i>Barbarea vulgaris</i>                             | garden yellowrocket           |
|                             | <i>Cardamine bulbosa</i>                             | bulbous bittercress           |
|                             | <i>Cardamine concatenata</i>                         | cutleaf toothwort             |
|                             | <i>Cardamine pensylvanica</i>                        | Pennsylvania bittercress      |
|                             | <i>Hesperis matronalis</i>                           | dames rocket                  |
|                             | <i>Rorippa nasturtium-aquaticum</i>                  | watercress                    |
|                             | <i>Sisymbrium altissimum</i>                         | tall tumbledustard            |
|                             | <i>Thlaspi arvense</i>                               | field pennycress              |
|                             | Campanulaceae  | <i>Lobelia cardinalis</i>     |
| <i>Lobelia inflata</i>      |  | Indian-tobacco                |
| <i>Triodanis perfoliata</i> |  | clasping Venus' looking-glass |
| Caprifoliaceae              | <i>Lonicera japonica</i>                             | Japanese honeysuckle          |
|                             | <i>Lonicera maackii</i>                              | Amur honeysuckle              |
|                             | <i>Lonicera morrowii</i>                             | Morrow's honeysuckle          |
|                             | <i>Sambucus nigra</i> ssp. <i>canadensis</i>         | common elderberry             |
|                             | <i>Viburnum acerifolium</i>                          | mapleleaf viburnum            |
|                             | <i>Viburnum dentatum</i> var. <i>lucidum</i>         | southern arrowwood            |
|                             | <i>Viburnum prunifolium</i>                          | blackhaw                      |
| Caryophyllaceae             | <i>Cerastium fontanum</i>                            | common mouse-ear chickweed    |
|                             | <i>Cerastium fontanum</i> ssp. <i>vulgare</i>        | big chickweed                 |
|                             | <i>Dianthus armeria</i>                              | Deptford pink                 |
|                             | <i>Saponaria officinalis</i>                         | bouncingbet                   |
|                             | <i>Stellaria graminea</i>                            | grasslike starwort            |
|                             | <i>Stellaria media</i>                               | common chickweed              |
| Celastraceae                | <i>Celastrus orbiculatus</i>                         | oriental bittersweet          |
|                             | <i>Euonymus alata</i>                                | winged burning bush           |
| Chenopodiaceae              | <i>Chenopodium album</i>                             | lambsquarters                 |
|                             | <i>Chenopodium simplex</i>                           | mapleleaf goosefoot           |
| Cistaceae                   | <i>Lechea</i> sp.                                    | pinweed                       |
| Cladoniaceae                | <i>Cladina</i> sp.                                   | reindeer lichen               |
| Climaciaceae                | <i>Climacium americanum</i>                          | American climacium moss       |
| Clusiaceae                  | <i>Hypericum ascyron</i>                             | great St. John's wort         |
|                             | <i>Hypericum mutilum</i>                             | dwarf St. John's wort         |
|                             | <i>Hypericum perforatum</i>                          | common St. John's wort        |
|                             | <i>Hypericum punctatum</i>                           | spotted St. John's wort       |
| Convolvulaceae              | <i>Ipomoea</i> sp.                                   | morning-glory                 |
| Cornaceae                   | <i>Cornus amomum</i>                                 | silky dogwood                 |
|                             | <i>Cornus florida</i>                                | flowering dogwood             |
|                             | <i>Cornus racemosa</i>                               | gray dogwood                  |
| Crassulaceae                | <i>Hylotelephium telephium</i> ssp. <i>telephium</i> | witch's moneybags             |
|                             | <i>Penthorum sedoides</i>                            | ditch stonecrop               |
| Cupressaceae                | <i>Juniperus virginiana</i>                          | eastern red-cedar             |
| Cuscutaceae                 | <i>Cuscuta gronovii</i>                              | scaldweed                     |

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| Family                          | Scientific Name                                 | Common Name              |
|---------------------------------|---|--------------------------|
| Cyperaceae                      | <i>Carex albicans</i>                           | whitening sedge          |
|                                 | <i>Carex amphibola</i>                          | eastern narrowleaf sedge |
|                                 | <i>Carex annectens</i>                          | yellowfruit sedge        |
|                                 | <i>Carex blanda</i>                             | eastern woodland sedge   |
|                                 | <i>Carex bushii</i>                             | Bush's sedge             |
|                                 | <i>Carex cephalophora</i>                       | oval-leaf sedge          |
|                                 | <i>Carex davisii</i>                            | Davis' sedge             |
|                                 | <i>Carex digitalis</i>                          | slender woodland sedge   |
|                                 | <i>Carex festucacea</i>                         | fescue sedge             |
|                                 | <i>Carex folliculata</i>                        | northern long sedge      |
|                                 | <i>Carex glaucoidea</i>                         | blue sedge               |
|                                 | <i>Carex granularis</i>                         | limestone meadow sedge   |
|                                 | <i>Carex grayi</i>                              | Gray's sedge             |
|                                 | <i>Carex hirsutella</i>                         | fuzzy wuzzy sedge        |
|                                 | <i>Carex hystericina</i>                        | bottlebrush sedge        |
|                                 | <i>Carex intumescens</i>                        | greater bladder sedge    |
|                                 | <i>Carex laxiculmis</i>                         | spreading sedge          |
|                                 | <i>Carex leavenworthii</i>                      | Leavenworth's sedge      |
|                                 | <i>Carex lurida</i>                             | shallow sedge            |
|                                 | <i>Carex molesta</i>                            | troublesome sedge        |
|                                 | <i>Carex normalis</i>                           | greater straw sedge      |
|                                 | <i>Carex pellita</i>                            | woolly sedge             |
|                                 | <i>Carex pennsylvanica</i>                      | Pennsylvania sedge       |
|                                 | <i>Carex radiata</i>                            | eastern star sedge       |
|                                 | <i>Carex retroflexa</i>                         | reflexed sedge           |
|                                 | <i>Carex scoparia</i>                           | broom sedge              |
|                                 | <i>Carex squarrosa</i>                          | squarrose sedge          |
|                                 | <i>Carex stipata</i>                            | owlfruit sedge           |
|                                 | <i>Carex stricta</i>                            | tussock sedge            |
|                                 | <i>Carex swanii</i>                             | Swan's sedge             |
|                                 | <i>Carex tribuloides</i>                        | blunt broom sedge        |
|                                 | <i>Carex vulpinoidea</i>                        | fox sedge                |
|                                 | <i>Carex willdenowii</i>                        | Willdenow's sedge        |
|                                 | <i>Eleocharis elliptica</i>                     | elliptic spikerush       |
|                                 | <i>Eleocharis erythropoda</i>                   | bald spikerush           |
|                                 | <i>Eleocharis obtusa</i>                        | blunt spikerush          |
|                                 | <i>Eleocharis tenuis</i>                        | slender spikerush        |
|                                 | <i>Scirpus atrovirens</i>                       | green bulrush            |
|                                 | <i>Scirpus cyperinus</i>                        | woolgrass                |
|                                 | <i>Scirpus microcarpus</i>                      | panicked bulrush         |
| <i>Scirpus pendulus</i>         | rufous bulrush                                  |                          |
| <i>Trichophorum planifolium</i> | bashful bulrush                                 |                          |
| Dennstaedtiaceae                | <i>Dennstaedtia punctilobula</i>                | eastern hayscented fern  |
| Dioscoreaceae                   | <i>Dioscorea quaternata</i>                     | fourleaf yam             |
|                                 | <i>Dioscorea villosa</i>                        | wild yam                 |
| Dipsacaceae                     | <i>Dipsacus fullonum</i> ssp. <i>sylvestris</i> | Fuller's teasel          |
| Dryopteridaceae                 | <i>Dryopteris carthusiana</i>                   | spinulose woodfern       |



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|---------------------------|-----------------------------------|--------------------------------|
| Dryopteridaceae (cont.)   | <i>Dryopteris marginalis</i>      | marginal woodfern              |
|                           | <i>Onoclea sensibilis</i>         | sensitive fern                 |
|                           | <i>Polystichum acrostichoides</i> | Christmas fern                 |
| Elaeagnaceae              | <i>Elaeagnus umbellata</i>        | autumn olive                   |
| Ericaceae                 | <i>Vaccinium corymbosum</i>       | highbush blueberry             |
|                           | <i>Vaccinium pallidum</i>         | Blue Ridge blueberry           |
|                           | <i>Vaccinium stamineum</i>        | deerberry                      |
| Euphorbiaceae             | <i>Acalypha rhomboidea</i>        | Virginia threeseed mercury     |
|                           | <i>Euphorbia corollata</i>        | flowering spurge               |
|                           | <i>Euphorbia cyparissias</i>      | cypress spurge                 |
| Fabaceae                  | <i>Amphicarpaea bracteata</i>     | American hogpeanut             |
|                           | <i>Cercis canadensis</i>          | eastern redbud                 |
|                           | <i>Chamaecrista fasciculata</i>   | sleeping plant                 |
|                           | <i>Coronilla varia</i>            | purple crownvetch              |
|                           | <i>Desmodium marilandicum</i>     | smooth small-leaf tick-trefoil |
|                           | <i>Desmodium nudiflorum</i>       | naked-flower tick-trefoil      |
|                           | <i>Desmodium paniculatum</i>      | panicked-leaf tick-trefoil     |
|                           | <i>Gleditsia triacanthos</i>      | honeylocust                    |
|                           | <i>Glycine max</i>                | soybean                        |
|                           | <i>Lespedeza procumbens</i>       | trailing lespedeza             |
|                           | <i>Lespedeza repens</i>           | creeping lespedeza             |
|                           | <i>Lespedeza virgata</i>          | wand lespedeza                 |
|                           | <i>Lespedeza virginica</i>        | slender lespedeza              |
|                           | <i>Medicago lupulina</i>          | black medick                   |
|                           | <i>Melilotus officinalis</i>      | yellow sweetclover             |
|                           | <i>Robinia pseudoacacia</i>       | black locust                   |
|                           | <i>Stylosanthes biflora</i>       | sidebeak pencilflower          |
|                           | <i>Trifolium arvense</i>          | rabbitfoot clover              |
|                           | <i>Trifolium aureum</i>           | golden clover                  |
|                           | <i>Trifolium campestre</i>        | field clover                   |
| <i>Trifolium pratense</i> | red clover                        |                                |
| <i>Trifolium repens</i>   | white clover                      |                                |
| Fagaceae                  | <i>Quercus alba</i>               | white oak                      |
|                           | <i>Quercus bicolor</i>            | swamp white oak                |
|                           | <i>Quercus palustris</i>          | pin oak                        |
|                           | <i>Quercus prinus</i>             | chestnut oak                   |
|                           | <i>Quercus rubra</i>              | northern red oak               |
|                           | <i>Quercus velutina</i>           | black oak                      |
| Fumariaceae               | <i>Corydalis flavula</i>          | yellow fumewort                |
| Gentianaceae              | <i>Gentiana</i> sp.               | gentian                        |
| Geraniaceae               | <i>Geranium maculatum</i>         | spotted geranium               |
|                           | <i>Geranium pusillum</i>          | small geranium                 |
| Grossulariaceae           | <i>Ribes missouriense</i>         | Missouri gooseberry            |
| Hamamelidaceae            | <i>Hamamelis virginiana</i>       | American witch-hazel           |
| Hydrophyllaceae           | <i>Hydrophyllum virginianum</i>   | Shawnee salad                  |
| Iridaceae                 | <i>Iris</i> sp.                   | iris                           |
|                           | <i>Sisyrinchium angustifolium</i> | narrowleaf blue-eyed grass     |

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| Family            | Scientific Name                                    | Common Name                       |
|-------------------|--|-----------------------------------|
| Iridaceae (cont.) | <i>Sisyrinchium mucronatum</i>                     | needletip blue-eyed grass         |
| Juglandaceae      | <i>Carya alba</i>                                  | mockernut hickory                 |
|                   | <i>Carya cordiformis</i>                           | bitternut hickory                 |
|                   | <i>Carya glabra</i>                                | pignut hickory                    |
|                   | <i>Carya laciniosa</i>                             | shellbark hickory                 |
|                   | <i>Carya ovalis</i>                                | red hickory                       |
|                   | <i>Carya ovata</i>                                 | shagbark hickory                  |
|                   | <i>Juglans nigra</i>                               | black walnut                      |
| Juncaceae         | <i>Juncus acuminatus</i>                           | tapertip rush                     |
|                   | <i>Juncus brachycarpus</i>                         | whiteroot rush                    |
|                   | <i>Juncus canadensis</i>                           | Canadian rush                     |
|                   | <i>Juncus effusus</i>                              | common rush                       |
|                   | <i>Juncus secundus</i>                             | lopsided rush                     |
|                   | <i>Juncus tenuis</i>                               | poverty rush                      |
| Lamiaceae         | <i>Glechoma hederacea</i>                          | ground ivy                        |
|                   | <i>Lycopus americanus</i>                          | American water horehound          |
|                   | <i>Lycopus uniflorus</i>                           | northern bugleweed                |
|                   | <i>Lycopus virginicus</i>                          | Virginia water horehound          |
|                   | <i>Mentha arvensis</i>                             | wild mint                         |
|                   | <i>Monarda clinopodia</i>                          | white bergamot                    |
|                   | <i>Prunella vulgaris</i>                           | common selfheal                   |
|                   | <i>Pycnanthemum incanum</i>                        | hoary mountainmint                |
|                   | <i>Pycnanthemum tenuifolium</i>                    | narrowleaf mountainmint           |
|                   | <i>Pycnanthemum virginianum</i>                    | Virginia mountainmint             |
|                   | <i>Scutellaria incana</i>                          | hoary skullcap                    |
|                   | <i>Scutellaria integrifolia</i>                    | helmet flower                     |
| Lauraceae         | <i>Lindera benzoin</i>                             | northern spicebush                |
|                   | <i>Sassafras albidum</i>                           | sassafras                         |
| Liliaceae         | <i>Allium vineale</i>                              | wild garlic                       |
|                   | <i>Asparagus officinalis</i>                       | garden asparagus                  |
|                   | <i>Erythronium americanum</i>                      | yellow trout-lily                 |
|                   | <i>Hemerocallis fulva</i>                          | orange daylily                    |
|                   | <i>Maianthemum canadense</i>                       | Canada mayflower                  |
|                   | <i>Maianthemum racemosum</i> ssp. <i>racemosum</i> | feathery false lily of the valley |
|                   | <i>Polygonatum biflorum</i>                        | smooth Solomon's seal             |
|                   | <i>Uvularia perfoliata</i>                         | perfoliate bellwort               |
|                   | <i>Uvularia sessilifolia</i>                       | sessileleaf bellwort              |
| Limnanthaceae     | <i>Floerkea proserpinacoides</i>                   | false mermaidweed                 |
| Linaceae          | <i>Linum virginianum</i>                           | woodland flax                     |
| Lythraceae        | <i>Cuphea viscosissima</i>                         | blue waxweed                      |
| Magnoliaceae      | <i>Liriodendron tulipifera</i>                     | tuliptree                         |
| Malvaceae         | <i>Hibiscus trionum</i>                            | flower of an hour                 |
| Menispermaceae    | <i>Menispermum canadense</i>                       | common moonseed                   |
| Mniaceae          | <i>Mnium</i> sp.                                   | mnium calcareous moss             |
| Molluginaceae     | <i>Mollugo verticillata</i>                        | green carpetweed                  |

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| Family                | Scientific Name  | Common Name                         |                       |
|-----------------------|--|-------------------------------------|-----------------------|
| Moraceae              | <i>Maclura pomifera</i>                                | osage orange                        |                       |
|                       | <i>Morus alba</i>                                      | white mulberry                      |                       |
|                       | <i>Morus rubra</i>                                     | red mulberry                        |                       |
| Nyssaceae             | <i>Nyssa sylvatica</i>                                 | blackgum                            |                       |
| Oleaceae              | <i>Fraxinus americana</i>                              | white ash                           |                       |
|                       | <i>Fraxinus pennsylvanica</i>                          | green ash                           |                       |
|                       | <i>Ligustrum vulgare</i>                               | European privet                     |                       |
| Onagraceae            | <i>Circaea lutetiana</i>                               | broadleaf enchanter's<br>nightshade |                       |
|                       | <i>Circaea lutetiana</i> ssp. <i>canadensis</i>        | broadleaf enchanter's<br>nightshade |                       |
|                       | <i>Epilobium coloratum</i>                             | purpleleaf willowherb               |                       |
|                       | <i>Ludwigia palustris</i>                              | marsh seedbox                       |                       |
|                       | <i>Oenothera biennis</i>                               | common evening-primrose             |                       |
|                       | <i>Oenothera fruticosa</i>                             | narrowleaf evening-primrose         |                       |
|                       | <i>Oenothera perennis</i>                              | little evening-primrose             |                       |
|                       | Ophioglossaceae  | <i>Botrychium virginianum</i>       | rattlesnake fern      |
|                       |  | <i>Ophioglossum vulgatum</i>        | southern adderstongue |
|                       | Orchidaceae  | <i>Platanthera lacera</i>           | green fringed orchid  |
| Oxalidaceae           | <i>Oxalis stricta</i>                                  | common yellow oxalis                |                       |
| Papaveraceae          | <i>Sanguinaria canadensis</i>                          | bloodroot                           |                       |
| Parmeliaceae          | <i>Flavoparmelia</i> sp.                               | flavoparmelia                       |                       |
| Phytolaccaceae        | <i>Phytolacca americana</i>                            | American pokeweed                   |                       |
| Pinaceae              | <i>Picea abies</i>                                     | Norway spruce                       |                       |
|                       | <i>Pinus resinosa</i>                                  | red pine                            |                       |
|                       | <i>Pinus rigida</i>                                    | pitch pine                          |                       |
|                       | <i>Pinus strobus</i>                                   | eastern white pine                  |                       |
|                       | <i>Pinus virginiana</i>                                | Virginia pine                       |                       |
|                       | <i>Tsuga canadensis</i>                                | eastern hemlock                     |                       |
|                       | Plantaginaceae   | <i>Plantago lanceolata</i>          | narrowleaf plantain   |
| <i>Plantago major</i> |  | common plantain                     |                       |
| Platanaceae           | <i>Platanus occidentalis</i>                           | sycamore                            |                       |
| Poaceae               | <i>Agrostis gigantea</i>                               | redtop                              |                       |
|                       | <i>Agrostis stolonifera</i>                            | creeping bentgrass                  |                       |
|                       | <i>Andropogon gerardii</i>                             | big bluestem                        |                       |
|                       | <i>Andropogon virginicus</i>                           | broomsedge bluestem                 |                       |
|                       | <i>Anthoxanthum odoratum</i>                           | sweet vernal grass                  |                       |
|                       | <i>Brachyelytrum erectum</i>                           | bearded shorthusk                   |                       |
|                       | <i>Bromus commutatus</i>                               | meadow brome                        |                       |
|                       | <i>Bromus inermis</i>                                  | smooth brome                        |                       |
|                       | <i>Bromus japonicus</i>                                | Japanese brome                      |                       |
|                       | <i>Bromus pubescens</i>                                | hairy woodland brome                |                       |
|                       | <i>Cinna latifolia</i>                                 | drooping woodreed                   |                       |
|                       | <i>Dactylis glomerata</i>                              | orchard grass                       |                       |
|                       | <i>Danthonia spicata</i>                               | poverty oatgrass                    |                       |
|                       | <i>Deschampsia flexuosa</i>                            | wavy hairgrass                      |                       |
|                       | <i>Dichanthelium acuminatum</i> var. <i>acuminatum</i> | tapered rosette grass               |                       |

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| Family          | Scientific Name   | Common Name               |
|-----------------|---|---------------------------|
| Poaceae (cont.) | <i>Dichanthelium clandestinum</i>                           | deertongue                |
|                 | <i>Dichanthelium depauperatum</i>                           | starved panicgrass        |
|                 | <i>Dichanthelium dichotomum</i> var. <i>dichotomum</i>      | cypress pancigrass        |
|                 | <i>Dichanthelium oligosanthes</i> var. <i>oligosanthes</i>  | Heller's rosette grass    |
|                 | <i>Dichanthelium oligosanthes</i> var. <i>scribnerianum</i> | Scribner's rosette grass  |
|                 | <i>Digitaria ischaemum</i>                                  | smooth crabgrass          |
|                 | <i>Echinochloa crus-galli</i>                               | barnyardgrass             |
|                 | <i>Elymus hystrix</i>                                       | eastern bottlebrush grass |
|                 | <i>Elymus repens</i>  | quackgrass                |
|                 | <i>Elymus villosus</i>                                      | hairy wildrye             |
|                 | <i>Eragrostis spectabilis</i>                               | purple lovegrass          |
|                 | <i>Festuca rubra</i>  | red fescue                |
|                 | <i>Festuca subverticillata</i>                              | noddling fescue           |
|                 | <i>Glyceria striata</i>                                     | fowl minnagrass           |
|                 | <i>Leersia oryzoides</i>                                    | rice cutgrass             |
|                 | <i>Leersia virginica</i>                                    | whitegrass                |
|                 | <i>Lolium pratense</i>                                      | meadow ryegrass           |
|                 | <i>Microstegium vimineum</i>                                | Japanese silt grass       |
|                 | <i>Muhlenbergia</i> sp.                                     | muhly                     |
|                 | <i>Panicum</i> sp.  | panicgrass                |
|                 | <i>Paspalum</i> sp.   | crowgrass                 |
|                 | <i>Phalaris arundinacea</i>                                 | reed canary grass         |
|                 | <i>Phleum pratense</i>                                      | timothy                   |
|                 | <i>Poa compressa</i>  | Canada bluegrass          |
|                 | <i>Poa nemoralis</i>  | wood bluegrass            |
|                 | <i>Poa pratensis</i>  | Kentucky bluegrass        |
|                 | <i>Poa trivialis</i>  | rough blugrass            |
|                 | <i>Schizachyrium scoparium</i>                              | little bluestem           |
|                 | <i>Setaria faberi</i>                                       | Japanese bristlegrass     |
|                 | <i>Sorghastrum nutans</i>                                   | Indiangrass               |
|                 | <i>Sphenopholis intermedia</i>                              | slender wedgescale        |
|                 | <i>Tridens flavus</i>                                       | purpletop tridens         |
|                 | <i>Triticum aestivum</i>                                    | common wheat              |
|                 | <i>Zea mays</i>   | corn                      |
| Polygalaceae    | <i>Polygala verticillata</i>                                | whorled milkwort          |
| Polygonaceae    | <i>Polygonum amphibium</i>                                  | water knotweed            |
|                 | <i>Polygonum caespitosum</i>                                | oriental ladysthumb       |
|                 | <i>Polygonum hydropiper</i>                                 | marshpepper knotweed      |
|                 | <i>Polygonum hydropiperoides</i>                            | swamp smartweed           |
|                 | <i>Polygonum pennsylvanicum</i>                             | Pennsylvania smartweed    |
|                 | <i>Polygonum perfoliatum</i>                                | Asiatic tearthumb         |
|                 | <i>Polygonum persicaria</i>                                 | spotted ladysthumb        |
|                 | <i>Polygonum sagittatum</i>                                 | arrowleaf tearthumb       |
|                 | <i>Polygonum scandens</i>                                   | climbing false buckwheat  |
|                 | <i>Polygonum virginianum</i>                                | jumpseed                  |
|                 | <i>Rumex acetosella</i>                                     | common sheep sorrel       |
|                 | <i>Rumex crispus</i>  | curly dock                |

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| Family                       | Scientific Name                                | Common Name                  |                     |
|------------------------------|--|------------------------------|---------------------|
| Polygonaceae (cont)          | <i>Rumex obtusifolius</i>                      | bitter dock                  |                     |
|                              | <i>Rumex orbiculatus</i>                       | greater water dock           |                     |
| Polypodiaceae                | <i>Polypodium virginianum</i>                  | rock polypody                |                     |
| Portulacaceae                | <i>Claytonia virginica</i>                     | Virginia springbeauty        |                     |
| Primulaceae                  | <i>Anagallis arvensis</i>                      | scarlet pimpernel            |                     |
|                              | <i>Lysimachia ciliata</i>                      | fringed loosestrife          |                     |
|                              | <i>Lysimachia nummularia</i>                   | creeping Jenny               |                     |
| Pyrolaceae                   | <i>Chimaphila maculata</i>                     | striped prince's pine        |                     |
| Ranunculaceae                | <i>Actaea</i> sp.                              | baneberry                    |                     |
|                              | <i>Anemone canadensis</i>                      | Canadian anemone             |                     |
|                              | <i>Anemone virginiana</i>                      | tall thimbleweed             |                     |
|                              | <i>Aquilegia vulgaris</i>                      | European columbine           |                     |
|                              | <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         |                     |
|                              | <i>Ranunculus hispidus</i>                     | bristly buttercup            |                     |
|                              | <i>Ranunculus hispidus</i> var. <i>nitidus</i> | bristly buttercup            |                     |
|                              | <i>Thalictrum pubescens</i>                    | king of the meadow           |                     |
|                              | <i>Thalictrum revolutum</i>                    | waxyleaf meadow-rue          |                     |
|                              | <i>Thalictrum thalictroides</i>                | rue anemone                  |                     |
|                              | Rosaceae                                       | <i>Agrimonia gryposepala</i> | tall hairy agrimony |
|                              |  | <i>Agrimonia parviflora</i>  | harvestlice         |
|                              |  | <i>Agrimonia striata</i>     | roadside agrimony   |
|                              |  | <i>Amelanchier arborea</i>   | common serviceberry |
|                              |  | <i>Crataegus uniflora</i>    | dwarf hawthorn      |
|                              |  | <i>Duchesnea indica</i>      | Indian strawberry   |
|                              |  | <i>Fragaria vesca</i>        | woodland strawberry |
| <i>Fragaria virginiana</i>   |  | Virginia strawberry          |                     |
| <i>Geum canadense</i>        |  | white avens                  |                     |
| <i>Geum laciniatum</i>       |  | rough avens                  |                     |
| <i>Geum vernum</i>           |  | spring avens                 |                     |
| <i>Malus</i> sp.             |  | apple                        |                     |
| <i>Potentilla canadensis</i> |  | dwarf cinquefoil             |                     |
| <i>Potentilla norvegica</i>  |  | Norwegian cinquefoil         |                     |
| <i>Potentilla recta</i>      |  | sulphur cinquefoil           |                     |
| <i>Potentilla simplex</i>    |  | common cinquefoil            |                     |
| <i>Prunus avium</i>          |  | sweet cherry                 |                     |
| <i>Prunus persica</i>        |  | peach                        |                     |
| <i>Prunus serotina</i>       |  | black cherry                 |                     |
| <i>Prunus virginiana</i>     |  | choke cherry                 |                     |
| <i>Rosa blanda</i>           | smooth rose                                    |                              |                     |
| <i>Rosa carolina</i>         | Carolina rose                                  |                              |                     |
| <i>Rosa multiflora</i>       | multiflora rose                                |                              |                     |
| <i>Rosa palustris</i>        | swamp rose                                     |                              |                     |
| <i>Rubus allegheniensis</i>  | Allegheny blackberry                           |                              |                     |
| <i>Rubus flagellaris</i>     | northern dewberry                              |                              |                     |

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| Family           | Scientific Name                 | Common Name                   |
|------------------|---------------------------------|-------------------------------|
| Rosaceae (cont.) | <i>Rubus idaeus</i>             | American red raspberry        |
|                  | <i>Rubus occidentalis</i>       | black raspberry               |
|                  | <i>Rubus phoenicolasius</i>     | wine raspberry                |
|                  | <i>Waldsteinia fragarioides</i> | Appalachian barren strawberry |
| Rubiaceae        | <i>Galium aparine</i>           | cleavers                      |
|                  | <i>Galium asprellum</i>         | rough bedstraw                |
|                  | <i>Galium circaezans</i>        | licorice bedstraw             |
|                  | <i>Galium concinnum</i>         | shining bedstraw              |
|                  | <i>Galium mollugo</i>           | false baby's breath           |
|                  | <i>Galium obtusum</i>           | bluntleaf bedstraw            |
|                  | <i>Galium palustre</i>          | common marsh bedstraw         |
|                  | <i>Galium pilosum</i>           | hairy bedstraw                |
|                  | <i>Galium triflorum</i>         | fragrant bedstraw             |
|                  | <i>Houstonia caerulea</i>       | azure bluet                   |
|                  | <i>Mitchella repens</i>         | partridgeberry                |
| Rutaceae         | <i>Zanthoxylum americanum</i>   | common prickly-ash            |
| Salicaceae       | <i>Salix alba</i>               | white willow                  |
| Saxifragaceae    | <i>Tiarella cordifolia</i>      | heartleaf foamflower          |
| Scrophulariaceae | <i>Chelone glabra</i>           | white turtlehead              |
|                  | <i>Linaria vulgaris</i>         | butter and eggs               |
|                  | <i>Mimulus ringens</i>          | Allegheny monkeyflower        |
|                  | <i>Penstemon digitalis</i>      | talus slope penstemon         |
|                  | <i>Penstemon hirsutus</i>       | hairy beardtongue             |
|                  | <i>Scrophularia lanceolata</i>  | lanceleaf figwort             |
|                  | <i>Verbascum blattaria</i>      | moth mullein                  |
|                  | <i>Verbascum thapsus</i>        | common mullein                |
|                  | <i>Veronica arvensis</i>        | corn speedwell                |
|                  | <i>Veronica officinalis</i>     | common gypsyweed              |
|                  | <i>Veronica peregrina</i>       | neckweed                      |
|                  | <i>Veronica serpyllifolia</i>   | thymeleaf speedwell           |
|                  | Simaroubaceae                   | <i>Ailanthus altissima</i>    |
| Smilacaceae      | <i>Smilax herbacea</i>          | smooth carrionflower          |
|                  | <i>Smilax rotundifolia</i>      | roundleaf greenbrier          |
| Solanaceae       | <i>Physalis heterophylla</i>    | clammy groundcherry           |
|                  | <i>Solanum carolinense</i>      | Carolina horsenettle          |
|                  | <i>Solanum dulcamara</i>        | climbing nightshade           |
|                  | <i>Solanum nigrum</i>           | black nightshade              |
| Sphagnaceae      | <i>Sphagnum sp.</i>             | sphagnum                      |
| Tiliaceae        | <i>Tilia americana</i>          | basswood                      |
| Ulmaceae         | <i>Celtis occidentalis</i>      | common hackberry              |
|                  | <i>Ulmus americana</i>          | American elm                  |
|                  | <i>Ulmus rubra</i>              | slippery elm                  |
| Urticaceae       | <i>Boehmeria cylindrica</i>     | smallspike false nettle       |
|                  | <i>Laportea canadensis</i>      | Canadian woodnettle           |
|                  | <i>Pilea pumila</i>             | Canadian clearweed            |
| Verbenaceae      | <i>Phryma leptostachya</i>      | American lopseed              |
|                  | <i>Verbena hastata</i>          | swamp verbena                 |



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| Family             | Scientific Name                              | Common Name               |
|--------------------|--|---------------------------|
| Verbenaceae (cont) | <i>Verbena urticifolia</i>                   | white vervain             |
| Violaceae          | <i>Viola cucullata</i>                       | marsh blue violet         |
|                    | <i>Viola hastata</i>                         | halberdleaf yellow violet |
|                    | <i>Viola palmata</i>                         | early blue violet         |
|                    | <i>Viola pubescens</i>                       | downy yellow violet       |
|                    | <i>Viola pubescens</i> var. <i>pubescens</i> | downy yellow violet       |
|                    | <i>Viola sagittata</i>                       | arrowleaf violet          |
|                    | <i>Viola sororia</i>                         | common blue violet        |
| Vitaceae           | <i>Parthenocissus quinquefolia</i>           | Virginia creeper          |
|                    | <i>Vitis aestivalis</i>                      | summer grape              |
|                    | <i>Vitis riparia</i>                         | riverbank grape           |
|                    | <i>Vitis vulpina</i>                         | frost grape               |

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Appendix D. Dichotomous field key to the vegetation associations of Gettysburg National Military Park and Eisenhower National Historic Site.

**KEY TO VEGETATION TYPES AT  
GETTYSBURG NATIONAL MILITARY PARK  
AND EISENHOWER NATIONAL HISTORIC  
SITE**

1. HERBACEOUS VEGETATION: TREES AND SHRUBS COVER LESS THAN 25%.
  2. Vegetation is associated with a stream or drainage. Soil is saturated or under standing water for at least part of the growing season. Sedges (*Carex* spp.) or reed canary grass (*Phalaris arundinacea*) are dominant.
    3. Vegetation is dominated by a diverse mix of hydrophilic graminoids, predominantly sedges (*Carex* spp.), rushes (*Juncus* spp.), bulrushes (*Scirpus* spp.), and herbs such as Indianhemp (*Apocynum cannabinum*) and arrowleaf tearthumb (*Polygonum sagittatum*).

**Wet Meadow**
    3. Vegetation is dominated by reed canary grass (*Phalaris arundinacea*) that covers more than 50% of the area. The dense graminoid and herbaceous vegetation is usually dominated by a few species and contains significantly less botanical diversity than the Wet Meadow type above.

**Reed Canary Grass Riverine Grassland**
  2. Vegetation is primarily terrestrial with hydrophilic sedges (*Carex* spp.) or reed canary grass (*Phalaris arundinacea*) absent or as rare associates.
    4. Field is surrounded by a fence and contains heavily browsed vegetation, often with compacted soil, hoof prints, and manure. Large boulders and scattered trees may be common. Common species include meadow ryegrass (*Lolium pratense*), red fescue (*Festuca rubra*), Kentucky bluegrass (*Poa pratensis*), timothy (*Phleum pratensis*), clover (*Trifolium* spp.), annual ragweed (*Ambrosia artemisiifolia*), sweet vernalgrass (*Anthoxanthum odoratum*), and poverty rush (*Juncus tenuis*).

**Pasture**
    4. Field does not contain heavily browsed vegetation, with compacted soil, hoof prints, and manure. Field may contain a near monoculture of timothy (*Phleum pratensis*), meadow ryegrass (*Lolium pratense*), common wheat (*Triticum aestivum*), row crops, or a diverse mix of weedy annuals, goldenrods, or grasses.
      5. Field is planted as a near monoculture of timothy (*Phleum pratensis*), meadow ryegrass (*Lolium pratense*), common wheat (*Triticum aestivum*), corn (*Zea mays*), soybeans (*Glycine max*), or oats (*Avena* sp.).

**Agricultural Field**

5. Field contains a diverse mix of weedy annuals, goldenrods, or grasses
6. Field is fallow and contains a mixture of species that colonize bare soil, such as prairie fleabane (*Erigeron strigosus*), mouseear cress (*Arabidopsis thaliana*), common mouse-ear chickweed (*Cerastium fontanum*), Canadian thistle (*Cirsium arvense*), bristlegass (*Setaria* spp.), and other annual weeds.

**Agricultural Field**

6. Field is no longer planted or plowed and contains a diverse mix of goldenrods and grasses. Large boulders and scattered trees or shrubs are common. Typical species include sweet vernalgrass (*Anthoxanthum odoratum*), meadow ryegrass (*Lolium pratense*), red fescue (*Festuca rubra*), goldenrods (*Solidago juncea*, *Solidago rugosa*), flat-top goldentop (*Euthamia graminifolia*), narrowleaf mountainmint (*Pycnanthemum tenuifolium*), Indiangrass (*Sorghastrum nutans*), St. John's wort (*Hypericum punctatum*, *Hypericum perforatum*), tick-trefoils (*Desmodium* spp.), and lespedezas (*Lespedeza* spp.)

**Successional Old Field**

1. FOREST, WOODLAND, OR SHRUBLAND: TREES OR SHRUBS COVER AT LEAST 25%.

7. Trees are planted in straight rows. Common tree species include apples (*Malus* spp.) and peach (*Prunus persicaria*). Ground layer vegetation is consistently mowed.

**Orchard**

7. Vegetation is not as above.

8. Shrubs (woody plants  $\leq 5$  meters in height) cover 30 – 80% of the area, while trees (woody plants  $> 5$  meters in height) cover  $\leq 50\%$  of the area.
9. Common shrub species include alder (*Alnus* spp.), pawpaw (*Asimina triloba*), common buttonbush (*Cephalanthus occidentalis*), dogwoods (*Cornus* spp.), hazels (*Corylus* spp.), American witch-hazel (*Hamamelis virginiana*), northern spicebush (*Lindera benzoin*), ninebark (*Physocarpus opulifolius*), choke cherry (*Prunus virginiana*), lanceleaf buckthorn (*Rhamnus lanceolata*), smooth sumac (*Rhus glabra*), Appalachian gooseberry (*Ribes rotundifolium*), Allegheny blackberry (*Rubus allegheniensis*), willows (*Salix* spp.), common elderberry (*Sambucus nigra* spp. *canadensis*), white meadowsweet (*Spiraea alba*), American bladdernut (*Staphylea trifolia*), viburnums (*Viburnum* spp.) and/or common prickly-ash (*Zanthoxylum americanum*). Shrubs occur immediately adjacent to a stream or drainage.

**Palustrine Shrub Thicket**

9. Common shrub species include eastern red-cedar (*Juniperus virginiana*), sweet cherry (*Prunus avium*), white ash (*Fraxinus americana*), smooth sumac (*Rhus glabra*), eastern red bud (*Cercis canadensis*), and Allegheny blackberry (*Rubus*

*allegheniensis*). Large boulders and scattered trees are common. A diverse mix of goldenrods and grasses occurs in between and under the shrubs.

#### **Successional Old Field**

8. Trees (woody plants >5 meters in height) are the dominant strata, covering greater than 50% of the area in the canopy or subcanopy.
10. Forest is associated with a creek, stream, or drainageway. The soil is saturated, holds standing water for at least part of the growing season, or experiences flooding during high water events. Ground story contains mesic or hydrophilic plants.
11. Forest is dominated by one or more of the following: sycamore (*Platanus occidentalis*), green ash (*Fraxinus pennsylvanica*), red maple (*Acer rubrum*), pin oak (*Quercus palustris*), swamp white oak (*Quercus bicolor*), black walnut (*Juglans nigra*), and shagbark hickory (*Carya ovata*).
12. Forest is dominated by sycamore (*Platanus occidentalis*) with associates black walnut (*Juglans nigra*), bitternut hickory (*Carya cordiformis*), silver maple (*Acer saccharinum*), shagbark hickory (*Carya ovata*), boxelder (*Acer negundo*), and American elm (*Ulmus americana*). Forest occurs on floodplains of Marsh Creek and Rock Creek.

#### **Sycamore – Mixed Hardwood Floodplain Forest**

12. Forest is dominated by one or more of the following: green ash (*Fraxinus pennsylvanica*), red maple (*Acer rubrum*), pin oak (*Quercus palustris*), swamp white oak (*Quercus bicolor*), black walnut (*Juglans nigra*), and shagbark hickory (*Carya ovata*). Canopy composition can be extremely variable, often with patchy species dominance. These small patches of forest follow drainageways and are often surrounded on either side by fields.

#### **Bottomland Mixed Hardwood Forest**

11. Forest is dominated by dry or mesic oaks (*Quercus alba*, *Quercus velutina*, *Quercus rubra*), hickories (*Carya glabra*, *Carya alba*), tuliptree (*Liriodendron tulipifera*), and/or eastern white pine (*Pinus strobus*). The presence of a small drainageway has little to no effect on the composition of the canopy which is similar to the canopy in the surrounding terrestrial forest. See terrestrial forest in couplet 10 below.
10. Forest is terrestrial, not associated with a creek, stream, or drainageway.
13. Canopy is dominated by conifers such as Virginia pine (*Pinus virginiana*) and/or eastern white pine (*Pinus strobus*), often with eastern red-cedar (*Juniperus virginiana*) as an associate in the canopy and subcanopy. Hardwood associates such as white ash (*Fraxinus americana*), black cherry (*Prunus serotina*), flowering dogwood (*Cornus florida*), red maple (*Acer*

*rubrum*), and oaks (*Quercus* spp.) may be present or co-dominant depending on the past management of the stand.

14. Canopy is dominated by eastern white pine (*Pinus strobus*), or other planted pine species such as red pine (*Pinus resinosa*), Norway spruce (*Picea abies*), Scotch pine (*Pinus sylvestris*), or blue spruce (*Picea pungens*).

#### **Conifer Plantation**

14. Canopy is dominated by Virginia pine (*Pinus virginiana*), often with eastern red-cedar (*Juniperus virginiana*) as an associate in the canopy and subcanopy.

#### **Virginia Pine Successional Forest**

13. Canopy is dominated by hardwood species, or contains a mixture of hardwoods and eastern red-cedar (*Juniperus virginiana*).
15. Canopy contains early successional, weedy species such as white ash (*Fraxinus americana*), black cherry (*Prunus serotina*), black walnut (*Juglans nigra*), black locust (*Robinia pseudoacacia*), sassafras (*Sassafras albidum*), red maple (*Acer rubrum*), honeylocust (*Gleditsia triacanthos*), eastern white pine (*Pinus strobus*), quaking aspen (*Populus tremuloides*), and northern catalpa (*Catalpa speciosa*). Often there is no clear canopy dominant. The canopy may contain scattered patches of oaks (*Quercus* spp.) and hickories (*Carya* spp.), but these species are not consistent or dominant. Invasive species and vines can be abundant.

#### **Modified Successional Forest**

15. Canopy is consistently dominated by oaks (*Quercus* spp.), hickories (*Carya* spp.) or tuliptree (*Liriodendron tulipifera*).
16. Tuliptree (*Liriodendron tulipifera*) is dominant in the canopy and subcanopy, covering greater than 50% of the forest canopy.

#### **Tuliptree Forest**

16. Tuliptree (*Liriodendron tulipifera*) covers less than 50% of the forest canopy. Oaks (*Quercus alba*, *Quercus rubra*, *Quercus prinus*) and hickories (*Carya alba*, *Carya glabra*, *Carya ovalis*) are the canopy dominants.
17. Canopy is dominated by chestnut oak (*Quercus prinus*) with oak and hickory associates (*Quercus velutina*, *Quercus coccinea*, *Quercus alba*, *Carya alba*, *Carya glabra*, *Carya ovalis*). A short shrub layer containing mostly ericaceous species such as Blue Ridge blueberry (*Vaccinium pallidum*), mountain laurel (*Kalmia*

*latifolia*), lowbush blueberry (*Vaccinium angustifolium*), and black huckleberry (*Gaylussacia baccata*) is characteristic. Forest occurs above 200 m in elevation on the summit of Big Round Top on xeric, shallow, rocky soil.

#### **Chestnut Oak Forest**

17. Canopy is dominated by white oak (*Quercus alba*) and/or northern red oak (*Quercus rubra*) in a variety of upland settings.
18. Forest occurs on upland slopes often with large boulders and rock outcrops. The canopy is dominated by white oak (*Quercus alba*) and/or northern red oak (*Quercus rubra*), with associates pignut hickory (*Carya glabra*), black oak (*Quercus velutina*), white ash (*Fraxinus americana*), mockernut hickory (*Carya alba*), and eastern white pine (*Pinus strobus*). The herbaceous layer is generally sparse and includes broadleaf enchanter's nightshade (*Circaea lutetiana* ssp. *canadensis*), jewelweed (*Impatiens capensis*), licorice bedstraw (*Galium circaezans*), and rue anemone (*Thalictrum thalictroides*).

#### **Dry Oak – Mixed Hardwood Forest**

18. The canopy is dominated by white oak (*Quercus alba*), northern red oak (*Quercus rubra*), or black oak (*Quercus velutina*), often with tuliptree (*Liriodendron tulipifera*) or early successional, weedy species as prominent associates. Dead or declining eastern red-cedar (*Juniperus virginiana*) can be common in the subcanopy. The invasive species multiflora rose (*Rosa multiflora*) and Japanese barberry (*Berberis thunbergii*) can also be abundant. The herbaceous layer often includes Japanese honeysuckle (*Lonicera japonica*), garlic mustard (*Alliaria petiolata*), Japanese stilt grass (*Microstegium vimineum*), and oriental ladythumb (*Polygonum caespitosum*).

#### **Dry Oak – Mixed Hardwood Forest (disturbed)**

**USGS – NPS Vegetation Mapping Program**  
**Gettysburg National Military Park and Eisenhower National Historic Site**

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Appendix E. Accuracy assessment data form.  
Accuracy Assessment Form for USGS-NPS Vegetation Mapping Program

Plot Number \_\_\_\_\_ Park \_\_\_\_\_ Date \_\_\_\_\_ Observers \_\_\_\_\_  
Easting: \_\_\_\_\_ E Northing \_\_\_\_\_ N EPE/APE: \_\_\_\_\_ DOP: \_\_\_\_\_ Map datum: \_\_\_\_\_ Zone: \_\_\_\_\_  
Topographic Description: \_\_\_\_\_ Elevation: \_\_\_\_\_ Aspect: \_\_\_\_\_ Canopy Closure: \_\_\_\_\_  
Vegetation Association at Point: \_\_\_\_\_  
Veg Assoc 1 w/in 50 m of point: \_\_\_\_\_  
Veg Assoc 2 w/in 50 m of point: \_\_\_\_\_  
Major Species by Strata: \_\_\_\_\_

Rationale for Classification:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Comments:

\_\_\_\_\_

\_\_\_\_\_

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Plot Number \_\_\_\_\_ Park \_\_\_\_\_ Date \_\_\_\_\_ Observers \_\_\_\_\_  
Easting: \_\_\_\_\_ E Northing \_\_\_\_\_ N EPE/APE: \_\_\_\_\_ DOP: \_\_\_\_\_ Map datum: \_\_\_\_\_ Zone: \_\_\_\_\_  
Topographic Description: \_\_\_\_\_ Elevation: \_\_\_\_\_ Aspect: \_\_\_\_\_ Canopy Closure: \_\_\_\_\_  
Vegetation Association at Point: \_\_\_\_\_  
Veg Assoc 1 w/in 50 m of point: \_\_\_\_\_  
Veg Assoc 2 w/in 50 m of point: \_\_\_\_\_  
Major Species by Strata: \_\_\_\_\_

Rationale for Classification:

\_\_\_\_\_

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Comments:

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Appendix F. Index of representative photographs of vegetation classification sampling plots in Gettysburg National Military Park and Eisenhower National Historic Site.

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Appendix G. Bibliography for global vegetation descriptions from the National Vegetation Classification System.

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**USGS – NPS Vegetation Mapping Program**  
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