



Vegetation Mapping at Horseshoe Bend National Military Park

Photointerpretation Key and Draft Vegetation Map

Natural Resource Report NPS/SECN/NRR—2014/862



ON THE COVER

'A Calm before the Storm'

Looking southwest across a freshly cut Bahiagrass field at Horseshoe Bend National Military Park

Photograph by: David Cotten, June 2014

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October 2014

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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Please cite this publication as:

Jordan, T. R., M. Madden, B. P. Adams, D. L. Cotten, and N. K. O'Hare. 2014. Vegetation mapping at Horseshoe Bend National Military Park: photointerpretation key and draft vegetation map. Natural Resource Report NPS/SECN/NRR—2014/862. National Park Service, Fort Collins, Colorado.

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Executive Summary

A map of vegetation communities was created for Horseshoe Bend National Military Park to the association level of the National Vegetation Classification System and in a 500 meter buffer zone around the park using the more general Anderson Level II classification. We were provided with the vegetation communities occurring in the park, as determined by NatureServe from ground plots. We overlaid the location of the NatureServe plots on leaf-on color infrared aerial photographs to determine the image signature of vegetation communities in terms of color, tone, texture, and topographic position. We also conducted our own field surveys to refine and verify photointerpretation.

The park encompasses 829 hectares (ha) while the buffer covers 712 ha. Within the park boundary, there were 23 vegetation communities, with pine and hardwood forest communities dominating (88%). While forested, the majority of the forests (66% of total area) are mid-successional forests 30 to 75 years of age, reflecting past anthropogenic influences. The most common vegetation class is Early-to Mid-Successional Loblolly Pine Forest (23%). Areas impacted by exotic invasives or pine bark beetles were minimal (<1%).

The buffer area (712 ha) was 81% forested. There is a small component of rangeland (12%), which depending upon location and actual use, may influence water quality. Less than 3% of the buffer zone is high intensity anthropogenic land-uses.

The deliverables produced include a photointerpretation key (Appendix 4), a draft vegetation map (Appendix 6), summary statistics of each vegetation class (Table 6 and Table 7), and a detailed geodatabase.

Acknowledgments

We would like to thank the Horseshoe Bend National Military Park staff for helping us with this project.

Superintendent Doyle Sapp kindly granted access to internal roads within the park, park staff, and discussed resource management issues.

Brian Anderson graciously and patiently escorted us around the park and supplemented our supply of bug spray.

Introduction

As part of the National Park Service (NPS) Vegetation Inventory Program (Schmoldt, Peterson and Silsbee 1994, Fancy, Gross and Carter 2009), The University of Georgia Center for Geospatial Research (CGR) in the Department of Geography was asked to produce vegetation maps of eight park units in the NPS-Southeast Coast Inventory and Monitoring Network (SECN) using mapping standards defined under the National Vegetation Characterization System (NVCS) (Jennings et al. 2009). Under Task Agreement # P13AC01319, CGR agreed to analyze existing leaf-on color infrared (CIR) aerial photography to develop photointerpretation keys, accuracy assessment study plans, final digital maps of vegetation, geodatabases and associated metadata in accordance with NPS vegetation mapping standards, and field verification surveys in accordance with standard mapping practices.

The mapping work is divided into two phases, in accordance to location, available funding, and NPS priorities. Study areas (with associate parks and time frames) included in the entire mapping effort are:

Phase 1 – Georgia/Alabama (December, 2013– July, 2014):

- Horseshoe Bend National Military Park (HOBE), Alabama
- Chattahoochee River National Recreation Area (CHAT), Georgia
- Ocmulgee National Monument (OCMU), Georgia

Phase 2 – Florida (August, 2014 to July 2015):

- Canaveral National Seashore (CANA)
- Timucuan Ecological and Historic Preserve / Fort Caroline National Monument (TIMU / FOCA)
- Castillo de San Marcos National Monument / Fort Matanzas National Monument (CASA / FOMA)

The contract for Phase 1 parks was signed on Nov 16, 2013. In compliance with the contract, the following tasks have been completed and delivered to Joe DeVivo, Program Manager for the SECN.

1. Draft over story maps were delivered on September 5, 2014 and final over story vegetation maps in digital ArcGIS geodatabase format are included with this report. Also included with this report are pdf files of cartographic products depicting color-coded and labeled over story vegetation, vegetation legend, Universal Transverse Mercator (UTM) grid and NPS banner/logo (Appendix 6). The associated spatial data includes vegetation community information according to NVCS standards, and also contains Federal Geographic Data Committee (FGDC) - compliant metadata.

2. A photointerpretation key is included as Appendix 3. The key contains a ground image and CIR image chip for each NCVS over story vegetation class occurring in HOBE and a description of the CIR signature based upon color, tone, texture, height, size, shape, location, and association.
3. This report provides written details on the photointerpretation and database/map generation procedures, and field work. It also includes summary statistics of area coverage and number polygons for each vegetation class (Table 6). Summary statistics were also developed for the general land use/land cover classes within the 500 meter buffer surrounding the park. (Table 7)
4. Summary statistics of area coverage and number of polygons for each vegetation class within HOBE were generated. This information was then used to develop the study design for the accuracy assessment (Table 9).

Separate reports for OCMU and CHAT also were submitted in September 2014, completing Phase I of the Task Agreement.

Work for Phase II of the project started in July 2014.

Location of Horseshoe Bend National Military Park

Horseshoe Bend National Military Park covers 829 hectares in northern Tallapoosa County, Alabama. The region is rural, with the closest town being Alexander City, population 15,000, located approximately 24 kilometers to the west. The Tallapoosa River is a significant physical and cultural feature of the park. The park name is derived from the horseshoe shaped meander of the Tallapoosa within the park. This meander of the Tallapoosa was thought to be a strategic military position and the associated battlefield is the impetus for the park. The park was established to preserve and commemorate cultural history, rather than any unusual flora or fauna.

The Battle of Horseshoe Bend took place in 1814 and was the final conflict in the Creek War (1813-1814). In the early 20th century, the land was owned by the Alabama Power Company. The company initially had plans to build a dam downstream from the site and inundate the area but an executive mindful of the land's cultural significance convinced the company to sell the land to the state and build a dam further downstream.

On July 25, 1956, President Eisenhower signed congressional legislation to establish Horseshoe Bend National Military (Martin 1960). The park boundaries have changed little since this original congressional act. The park opened officially to the public in March 1964 with dedication of a visitor center showcasing cultural artifacts and interpretive displays and currently offers visitors opportunities to engage in activities such as bicycling, fishing, boating, and hiking. Recently, during the ten year period ending in 2008, visitation increased seven percent. It is estimated that one million travelers pass through the park on Highway 49 each year.

The majority of the park is forested land that ranges from stands of relatively young pine trees to forests of older established hardwoods. There is one paved road, State Route 49, that passes through the park as well short section of paved road, Country Road 79, that intersects SR 49 near the northern border of the park. The boundary of the park is clearly demarcated by clear-cut path 5 meters wide to reduce unintentional hunting on park lands.

There are several resource management issues that may affect the vegetation within the park. Horseshoe Bend National Military Park is home to roughly 900 known plant species with very few exotic species. There is an active burn plan, exotic removal plan, and long leaf pine planting areas. While long leaf pine occurs naturally in the park there are very few pure stands of long leaf pine. To facilitate cultural interpretation and historical re-enactments, Superintendent Doyle Sapp is considering options to actively manage a portion of the forest so that forest structure more closely resembles that which occurred at the time of the Battle of Horseshoe Bend. At the time of the Battle, the forests had very little undergrowth thus allowing movement of troops and artillery.

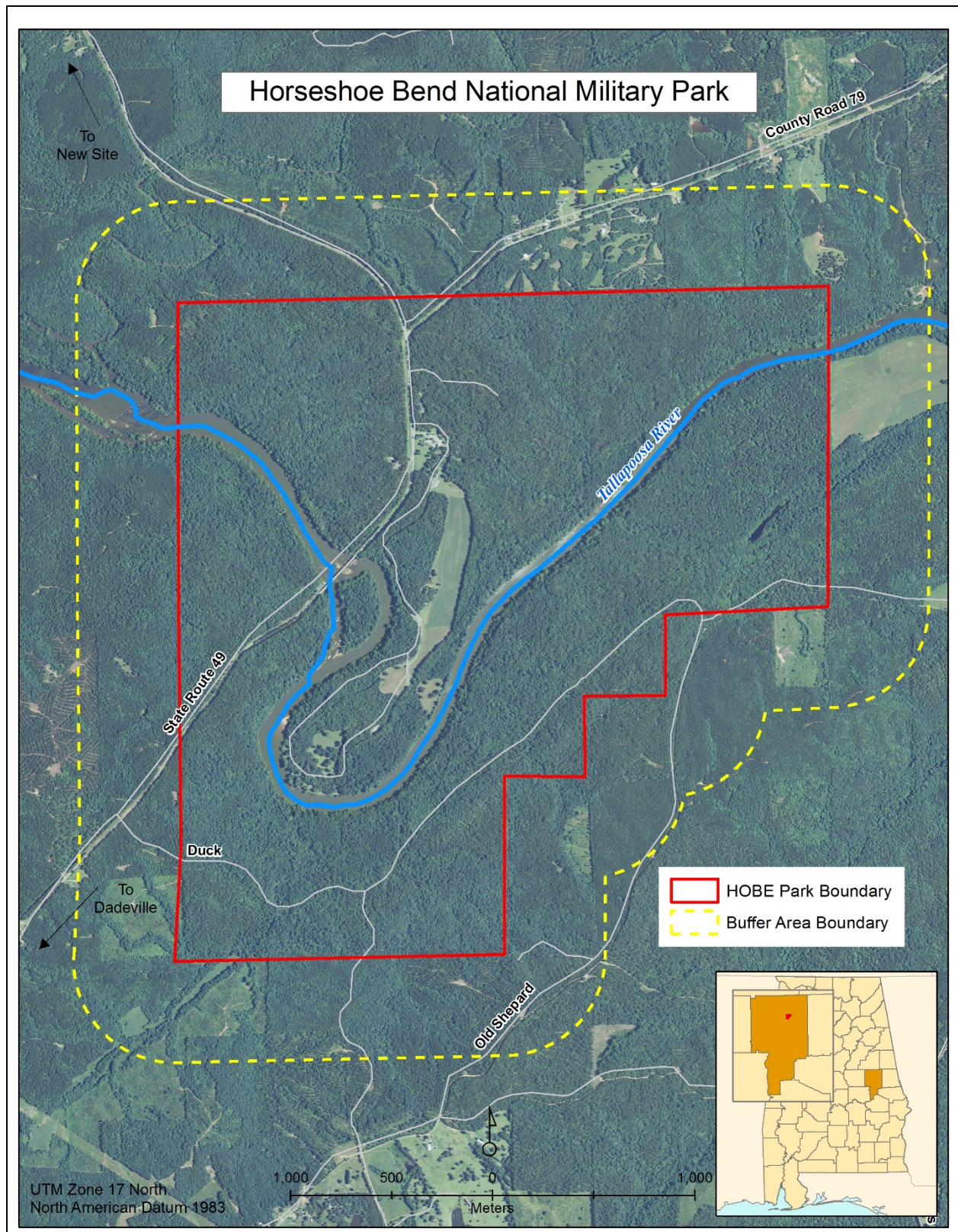


Figure 1. Horseshoe Bend National Military Park, Alabama, with buffer area boundary.

Vegetation Classification System

The task agreement for mapping required that the NVCS be used for areas inside each park. The NVCS was developed by the Nature Conservancy (Grossman et al. 1998, Anderson et al. 1998). It is primarily based upon vegetation rather than climatic or edaphic factors. It emphasizes the existing natural vegetation, and recognizes that vegetation communities form a continuum. The system has seven hierarchical levels so that vegetation can be described at multiple scales, depending upon the amount of information available. Higher levels can be broken down to lower levels as more information is available; conversely, lower levels can be aggregated to upper levels. The five upper levels (formation class, formation subclass, formation group, formation subgroup, and formation) describe vegetation physiognomy rather than actual species composition and is a modification of the UNESCO World Physiognomic Classification of Vegetation (UNESCO 1973). The two lowest levels (the alliance and association) are determined by floristic composition. The alliance level is determined by the species composition in the dominant or diagnostic species in the most prevalent stratum. A diagnostic species does not have to be dominant.

The association level is determined by diagnostic species in all strata (tree canopy, subcanopy, tall-shrub, short-shrub, herbaceous, non-vascular, vine/liana and epiphyte), recognizing that each of these strata may not occur in every association. The tallest stratum may not be the diagnostic/dominant stratum. The association level is assigned a unique community element global code (CEGL). The CEGL code for the vegetation association is the target vegetation classification specified in the task agreement.

The dominant species in the tallest stratum are always visible in leaf-on aerial photographs. If the tallest stratum is dense, with a closed canopy, the shorter subcanopy and understory layers are obstructed from the camera's view and are not visible. In vegetation communities where the tallest stratum is open, other strata will be visible in the aerial photograph. In some cases, a CEGL code can be determined solely by identifying its location (e.g., along a ridge or on the south slope) and viewing the uppermost stratum. In other cases, a lower stratum (or strata) not visible in the aerial photography must be used to determine CEGL code. In such cases, it is impossible to use only aerial photographs recorded during leaf-on conditions to accurately determine the NVCS code at the association level. If it was not possible to determine the association-level class due to similar over story characteristics and lack of information on subcanopy vegetation, a second vegetation was assigned as a supplement to the dominate vegetation code.

Prior to CGR's photointerpretation, NatureServe conducted field surveys in accordance with standard practices (Jennings et al. 2009) to create a list of NVCS CEGL codes for HOBE (NatureServe 2009). Their detailed report includes a dichotomous key for separating the CEGL codes described for the park. Many of the couplets in the dichotomous key relied upon differences in the dominant vegetation in the tallest stratum or the presence/absence of diagnostic species. However, some couplets relied upon lower strata which may not be evident in the aerial photographs and, or edaphic

factors¹ (e.g. soil pH) which would not be evident in leaf-on CIR photographs. Also included in the NatureServe report are comprehensive descriptions of diagnostic species for each CEGl and additional information on both the global and local expressions of the vegetation community type.

In general, the NVCS is best suited to natural or semi-natural vegetation communities that have been relatively undisturbed long enough for vegetation communities to develop in accordance with the environmental and climatic conditions of the site (Grossman et al. 1998, Anderson et al. 1998). Areas that are regularly or extensively disturbed by logging, fire, wind damage, exotic insects, exotic vegetation, and human activities are not easily classified with the NVCS. For this reason, CGR augmented the NVCS classes identified as occurring in the park by NatureServe to include additional disturbed, managed, successional, and modified classes, along with alphanumeric modifiers to provide detailed information to users of the vegetation databases and maps. Modifiers to the NVCS classes reflected variations of a particular NVCS class that are characteristic for the local site, but atypical of the global NVCS description.

The task agreement also required mapping a 500 meter buffer around each park. The buffer area contained extensive areas of human influence; consequently, the NVCS system was not applicable. Buffer areas were therefore mapped using guidelines derived from the Anderson Level II classification system which include human influences and water categories (Anderson 1976). Modifiers were also greatly utilized within the buffer to increase the knowledge base about what land use/ land cover categories surround the park, albeit, different modifiers tended to be used in buffer compared to the park.

In summary, the park was mapped to the association (CEGL) level of the NVCS while the buffer area was mapped using Anderson Level II guidelines. Modifiers to these classification systems were used when necessary in order to ensure a meaningful classification system for HOBE.

¹ Vegetation tends to reflect edaphic factors. Yet if the indicator vegetation is not visible in the aerial photograph, edaphic factors cannot be inferred.

Vegetation Mapping Workflow

The general workflow for this vegetation mapping was a series of steps, including

1. Define CEGL codes within the study area based upon plot-level ground data (completed by NatureServe)
2. Contact park staff to discuss their needs and concerns as applicable to the final vegetation map, obtain any existing background information on management activities to include in GIS database (see below), and arrange access.
3. Collect base data and construct a GIS foundation geodatabase
 - a. Collect and inventory the aerial photographs
 - b. If needed, scan and orthorectify the aerial photographs
 - c. Available GIS layers on exotic plant removal or prescribed burns that may affect vegetation communities
4. Create an initial photointerpretation key
 - a. Overlay NatureServe Vegetation Survey points on photos
 - b. Examine photos to understand signatures of vegetation communities as identified by ELCodes or CEGL number
5. Perform initial delineation of vegetation communities on CIR aerial photographs, supplemented by other leaf-off imagery (see Table 1) using photointerpretation from both stereo-pairs and 2D imagery by heads-up GIS methods
 - a. Identify spectral signatures dissimilar to the examples spectral signatures around the NatureServe ground plots so that vegetation can be evaluated in field visits
6. Field Visits
 - a. Schedule field trips to site to visit specific areas where questions exist
 - b. Verify vegetation communities present
 - c. Reconcile photo signature with NatureServe CEGL code
 - d. Refine classification as necessary with reference to field work and on-going communication with park staff regarding results
7. Refine and extend photointerpretation key and delineation of polygons
 - a. As needed, print photos and vegetation polygons for review and refinement

8. Prepare Final Deliverable Products

- a. Prepare final GIS files
 - i. Cleanup line work and attribute tables
- b. Compute statistics for vegetation polygons
- c. Prepare metadata for vegetation polygon files
- d. Finalize photointerpretation keys

What follows is a detailed description of the Vegetation Mapping Workflow. Steps 1 through 3 are self-explanatory. Steps 4 through 7 reflect an iterative, rather than a linear, process.

Base Data and GIS Geodatabase Construction

Relevant publically available GIS datasets that cover the study area were downloaded and archived on a local server in CGR. Datasets include roads, hydrology, boundary files (political and NPS), digital elevation models (DEMs), and additional aerial photographs. These data are available from sources such as the NPS Datastore, Georgia GIS Data Clearinghouse, the US Geological Survey National Map, and the NOAA Digital Coast websites. Also obtained were trail network and exotic plant removal datasets. These layers are not publicly available and were obtained through NPS contacts. The datasets used to populate the foundation GIS database were from different sources, compiled for different reasons, and may not be in the same map projection. The task agreement specified that the spatial data be projected to the UTM Coordinate System, North American Datum of 1983 (NAD83). Finally, a geodatabase in ArcGIS 10.2 format was created as a container to store and organize the data. Details of this database are presented in Figure 2 and Table 1.

Color infrared (CIR) aerial photographs of the park at 1:12,000 scale were acquired by Aero-Metric, Inc. on May 1, 2011. These photos were scanned and converted to digital orthophotographs at 0.3 meter (1 foot) resolution before being delivered to the NPS. Digital orthophotographs and hardcopy photographs in both film transparency and paper print formats were provided to UGA-CGR. A total of 12 photos in two flight lines were required to cover HOBE. Details about the flight lines and photo center locations can be found in Appendix 1 and Appendix 2.

The mapping area was split in two sections: park and buffer. The park was defined as the area within the prescribed park boundaries while the buffer pertained to the region within 500 meters outside of the park boundary. Detailed vegetation mapping using CEG codes was performed within the park whereas more general mapping using a revised Anderson Type II hierarchical classification scheme was used in the buffer area.

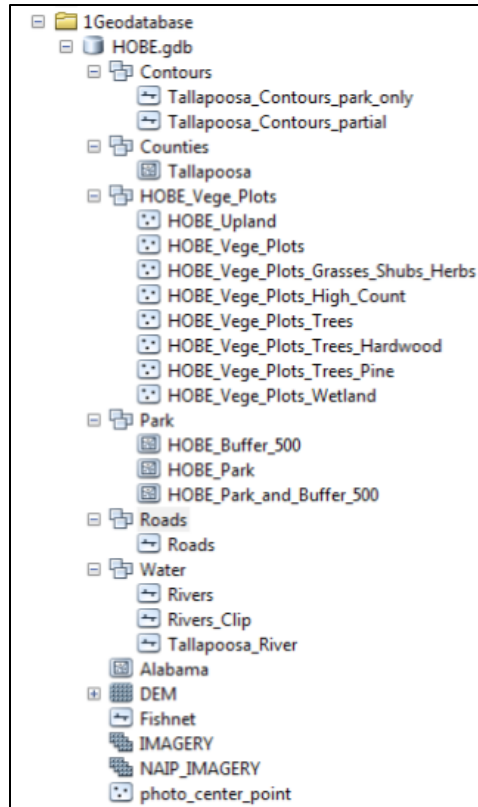


Figure 2. Foundation Geodatabase

Table 1. Datasets, descriptions, source, date, and scale imported into the Geodatabase.

Dataset	Description	Source	Date	Scale/Resolution
Contours	Statewide contours	ESRI	1996	1:100,000
Counties	County outline for Tallapoosa	US Census	2013	1:100,000
Park	Park and Buffer outlines	NPS Datastore and buffer analysis	2013	Unknown
Roads	Tiger Line Roads	US Census	2013	1:12,000
Hydrology	Rivers	National Hydrography Dataset (NHD)		1:24,000
DEM	USGS Digital Elevation Model	U.S. Geological Survey	2010	1/9 arc second
NAIP Imagery	Natural color orthoimagery in three bands	U.S. Geological Survey	2013	One meter

Initial Photointerpretation Key and Vegetation Delineation

Classifying the different vegetation communities within the park was aided by the use of a photointerpretation key. The initial photointerpretation key was based upon the NCVS vegetation classes at the association level. These associates were determined by NatureServe through independent plot-level vegetation surveys in accordance with standard NCVS field methods (Jennings et al. 2009). Plot sizes in HOBE ranged in size from 100 m² (10 m x 10 m) to 1,000 m² (50 m x 20 m). Plot-level species presence/abundance was used to assign a 4-digit CEGL number. The results of the survey are reported as a list of a point locations and CEGL codes, as well as descriptions and field notes (see Appendix 2, Appendix 3). The vegetation associations for HOBE were determined by NatureServe from 36 plots and included 22 associations. Researchers from CGR visited 213 points to interpret the CIR signatures of these vegetation associations to delineate vegetation. The future accuracy assessment of CGR's vegetation map will include 313 accuracy assessment points.

The NatureServe vegetation plot points were overlaid on the CIR aerial photographs and the photo signature was examined. Some vegetation classes were represented by multiple locations. As a result, multiple signatures exist for such codes. The NCVS recognizes that vegetation communities form a continuum both within and between CEGL codes; spectral signatures are also likely to reflect this natural variation.

The photointerpretation key was developed to assist in the extension of the signatures at the plot level to the remainder of the park (Appendix 4). The key noted color, tree crown shapes and sizes, texture, context, and any other characteristics that could help to differentiate one community from the others on the spectral signature of the leaf-on CIR aerial photography. The orthophotographs were examined on-screen in heads-up mode using the ArcGIS software. Where needed, the hardcopy photographs were viewed in stereo/3D using a light table and a mirror stereoscope. This method is excellent for using relative heights of the trees and terrain to assist in determining the vegetation community and to delineate the boundaries of the individual features.

The strength and intensity of the image were described using color (varying from green to pink to purple), tone (light to dark), and texture (fine to coarse). Other categories were based on canopy structure such as pattern (open to dense canopy) and height (short to tall). The remaining categories were used to express how the different codes are interrelated. These include shape (elongated to broad), size (based on total area, average size, and standard deviations of the polygons in a given class), location (relative to specific areas in the park), association (communities typically found near the specific class), and comments (to express any hints or issues that may arise). Also included are images taken from the field in order to provide a ground level perspective that can be compared to the sample image chips taken from the airborne CIR images. The NatureServe summary of the vegetation association and its distribution both globally and within the park are included for each class following the visual cue description.

The CEGL codes are listed in ascending numerical order in the key. While the NCVS itself is hierarchical, the numbering system for the codes is not hierarchical. Thus, it is impossible to

determine physiognomy, species composition or edaphic factors (e.g. soil saturation or inundation, soil pH, slope) from the CEGL code alone.

Using ArcGIS software, standard GIS methods, and a minimum mapping unit (MMU) of 0.5 hectares (ha), preliminary lines were drawn to delineate areas of uniform signature. Where the vegetation communities were clearly identifiable, polygons were tagged with the appropriate CEGL code. Where confusion existed, the polygons were tagged with an ‘unknown’ code until field visits could determine the appropriate CEGL.

Field Surveys and Ground Truth

In the course of developing the photointerpretation keys and delineating vegetation communities based upon their CIR signatures, a number of signatures were found that did not easily match the signatures from the NatureServe survey of 36 ground plots. These areas required field visits to clarify.

Field work and ground truthing for HOBE took place during May, June, and July 2014. Field visits were aimed at giving specific attention to representative habitats, rare and important communities, areas that have been managed, disturbed, or invaded, and plots previously surveyed by NatureServe to collect data on canopy species composition, diagnostic species for NVCS, and terrain, similar to NatureServe’s “Quick Plot” surveys.

Field crews carried paper field maps with the UTM grid coordinates, elevations, roads, rivers, initial vegetation polygons with CEGL codes, and points of interest superimposed on CIR photographs. They also used a Trimble Geo 6000 Xh Global Positioning System (GPS) handheld receiver loaded with similar GIS layers. On some trips, an Apple iPad with a geoPDF (Wuthrich 2006, Pardue 2008) replaced paper field maps. The geoPDF gave the user both a higher level of detail of the original CIR compared paper maps, along with the ability to determine location in real-time using the device’s internal GPS relative to the overlay of the line work.

The Trimble GPS was used to record location of each site sampled. The coordinates were later post-processed by differential correction using Trimble’s Pathfinder Office Software and base station data from sites in Atlanta. In some cases, base station data were only partially available, thereby necessitating use of multiple base stations in the Atlanta area for greater coverage. However, even when multiple base stations were used for a particular day, complete time coverage was not guaranteed. Some GPS locations could not be successfully differentially-corrected. Overall, post-processing produced a final accuracy of ± 1 to 5 m. Accuracy was higher in open areas than in closed-canopy forested areas.

At each sampling site, researchers recorded GPS position, species data, canopy cover, and topography (e.g. relative slope and aspect) inside an area between 250 and 1,000 m² based upon visual uniformity. Also noted were the presence of exotics, evidence of past or present human influence (e.g., agriculture, grazing, logging, mowing, exotic vegetation removal, old home sites), damage by insects, wild hogs, blow down, or fire. Prior to leaving a sampling location, researchers determined the primary association type, i.e. CEGL code (Anderson et al. 1998, (Grossman, Goodin

and Reuss 1994, Grossman et al. 1998). Some sites were located in a mixed area indicative of an ecotone or an area of successional recovery. In such cases, secondary associations were determined in addition to dominant associations. Often, tertiary modifiers were determined as well. In cases where researchers were unable to determine a clear match to an NVCS CEGL in the field, more detailed notes were taken in order to assign an appropriate CEGL or CGR-created class (e.g., a managed, damaged, human influence, or successional class) after further review of CIR signatures.

GPS points collected in the field were superimposed on CIR images in ArcMap. Field points were used in conjunction with the aerial photographs to refine vegetation delineation and assigned classification attributes (dominant CEGL, secondary CEGL, and modifiers, as appropriate). Additional field visits were conducted during the iterative interpretation process on an as-needed basis in order to refine interpretations, identify communities with unusual signatures, and resolve any questions. Maps were updated between field visits to reflect on-going process of photointerpretation of vegetation communities. And any areas visited that were already classified were checked for accuracy throughout the mapping process.

A total number of seven field visits/investigations and 213 discrete point locations were collected at HOBE (Table 2 and Appendix 5). The number of sites visited in a single day ranged from 13 to 53 and was often influenced by terrain, weather, and point of interest density. Usually, if more than two people were in the field, two independent field teams worked simultaneously to cover more area.

Table 2. Dates of field visits to Horseshoe Bend National Military Park.

Date(s) 2014	Team Member(s)	Number of Data Points
May 29 - 30	N. K. O'Hare, M. Madden, B. P. Adams	62
June 12 -13	N. K. O'Hare, D. L. Cotten, M. Madden, B. P. Adams	115
July 2-3	D. L. Cotten, B. P. Adams	36
Total		213

Photointerpretation and GIS Methods

The industry-standard GIS software, ArcGIS, offers a variety of methods and procedures to do most common mapping tasks. For the purposes of this project, photointerpretation was performed using heads-up digitizing methods in ArcGIS 10.2 using the CIR digital orthophotographs as the primary source material. Lines were drawn on-screen delineating the boundaries between different classes of vegetation. Where ecotones between features were broad, the line was drawn in the middle of the transition area. While the MMU for this project was 0.5 hectare, features that were smaller than this threshold that were distinct and could be easily mapped were delineated.

As vegetation areas were delineated with vector lines, points were digitized within each delineated area. These points were assigned attribute information such as the dominate vegetation (a CEGL value if located within the park or an Anderson type code for the buffer), secondary vegetation, a modifier, the interpreter's initials, the date, the confidence of the classification, as well as other relevant information.

After the line work was completed and points attributed, the lines were converted to polygons and the attributes assigned to each polygon by joining the tables of the point features and polygons based on spatial location. In this operation, the attributes of the point closest to the polygon were assigned to that polygon. A 'distance' field was also assigned which indicates the distance of the point location from the polygon. If the distance was 0, the point was inside the polygon. Any other value greater than "0" meant that the point used to populate the attribute fields was outside of the polygon. Consequently, the 'distance > 0' values were used as flags to select and examine polygons that were not properly attributed. Where necessary, additional points were added to the database to complete the map. The process was repeated until all polygons were properly attributed.

The initial draft maps were plotted at large scale on 'E-size' (34"x48") paper such that the hollow polygons with their respective CEGl labels were overlaid on the original aerial photographs. Each polygon was individually inspected by a person not directly involved in the original mapping to make sure that the line work followed the vegetation feature properly, and that the CEGl codes were consistent with spectral signature. Edits were marked on the hardcopy maps and then applied to the database within ArcGIS. This review process was repeated to ensure completeness.

Additional editing and refinement was performed as necessary using information collected during the field surveys.

Final Vegetation Mapping and Summary Statistics

A total of 23 distinct NVCS CEGL association-level vegetation communities were found in HOBE (Table 3). One CEGL code, Cultivated Meadow (4048), was not provided in the classification key for HOBE but was found at the park. Two non-CEGL codes, Water (9998) and Human Influence (9999), were also used.

In the buffer zone, there were 12 distinct Anderson Level II codes (Table 4). Both the park and buffer area were further classified through the use of modifiers (Table 5).

Table 3. Community Element Global (CEGL) codes and associated land cover classes found within Horseshoe Bend National Military Park.

Element Code	Description
3836	Floodplain Canebrake
4048	Open Grass
4290	Smartweed - Cutgrass Beaver Pond
4700	Bahia Grass Herbaceous Vegetation
4719	Highland Rim Pond (Woolgrass Bulrush - Threeway Sedge Type)
6011	Early- to Mid-Successional Loblolly Pine Forest
7201	Southern Mesic Beech - Tuliptree Slope
7213	Cumberland Plateau Mesic White Oak- Beech Forest
7216	Successional Sweetgum Forest
7217	Interior Mid- to Late-Successional Sweetgum - Oak Forest
7221	Successional Tuliptree Forest
7244	Southern Red Oak - White Oak Mixed Forest
7261	Lower Piedmont Chestnut Oak Forest
7312	River Birch Levee Forest
7330	Successional Sweetgum Floodplain Forest
7353	Sweetgum - Cherrybark Oak Floodplain Forest
7806	Southeastern Coastal Plain Green Ash - Elm Bottomland Forest
8437	Montane Mixed Longleaf Woodland
8462	Mid- to Late-Successional Loblolly Pine - Sweetgum Forest
8474	Southeastern Smooth Alder Swamp
8493	East Gulf Coastal Plain Shortleaf - Loblolly Pine Forest
8552	Upper East Gulf Coastal Plain Sweetbay - Blackgum Seepage Forest
8583	Overcup Oak - Sweetgum Forest

Table 4. Land use/ land cover classes found within the buffer area around Horseshoe Bend National Military Park.

Code	Description
11	Residential
14	Transportation, Communications, and Utilities
31	Herbaceous Rangeland
32	Shrub and Brush Rangeland
33	Mixed Rangeland
41	Deciduous Forest Land
42	Evergreen Forest Land
43	Mixed Forest Land
51	Streams and Canals
53	Reservoirs
61	Forested Wetland
76	Transitional Areas

Table 5. Modifiers used throughout the park and buffer.

Code	Description
CLt	Contains <i>Liriodendron tulipifera</i>
CQf	Contains <i>Quercus falcata</i>
Cul	Cultivated
DPs	Dominated by Pines (<i>Pinus</i> spp.)
DQn	Dominated by <i>Quercus nigra</i>
DQnFp	Dominated by <i>Quercus nigra</i> and <i>Fraxinus americana</i>
PBB	Pine Bark Beetle

The most common class found in HOBE is Early- to Mid-Successional Loblolly Pine Forest (6011) covering 23% of the park. This class combined with the second and third most common classes, Successional Sweetgum Floodplain Forest and Mid- to Late-Successional Loblolly Pine - Sweetgum Forest respectively, covers 57 percent of the park's 829 hectares. The smallest class in the park that is larger than 0.5 hectare is Highland Rim Pond (Wollgrass Bulrush – Threeway Sedge Type) (4719) which covers roughly one hectare. There are two classes, Smartweed-Cutgrass Beaver Pond (4290) and Floodplain Canebrake (3836), that occur in the park but the area they cover is less than the MMU. These areas were delineated and given their own polygons because they were identified by NatureServe vegetation plots.

Outside the park, the two most common classes are Evergreen Forest Land (42) and Deciduous Forest Land (41) which covers 35 percent and 31 percent of the buffer area respectively. These two classes cover two-thirds of the buffer area. Four classes, Transportation, Communications, and Utilities (14), Residential (11), Forested Wetland (61), Reservoirs (53) each cover less than one percent of the buffer area.

Modifiers were assigned to polygons in both the park and buffer regions in order to enhance the classification system. The modifier system was based on insect infestation, the presence of exotic plants, or other classification system. This other class can include vegetation, mixed forest, or impervious surface coverage based on a scaling system. The scaling system used is based on percent coverage of the specific modifier, 1 for less than 25%, 2 for greater than 25% but less than 75%, and 3 for coverage greater than 75% (Table 8). The final vegetation map can be found in Appendix 6.

Table 6. Community Element Global (CEGL) classes, frequency of occurrence (number of polygons), total area, mean area, and percent of total area within the park boundary.

Element Code	Frequency	Total Area (ha)	Mean Area (ha)	Percent of Park
3836	3	0.4	0.1	<0.1%
4048	4	7.2	1.8	0.9%
4290	1	0.2	0.2	<0.1%
4700	13	21.0	1.6	2.5%
4719	1	1.1	1.1	0.1%
6011	19	192.5	10.1	23.2%
7201	5	20.9	4.2	2.5%
7213	2	13.6	6.8	1.6%
7216	8	11.6	1.5	1.4%
7217	3	51.6	17.2	6.2%
7221	2	15.0	7.5	1.8%
7244	3	30.9	10.3	3.7%
7261	5	24.6	4.9	3.0%
7312	6	14.5	2.4	1.8%
7330	9	144.0	16.0	17.8%
7353	5	5.7	1.1	0.7%
7806	5	21.6	4.3	2.6%
8437	6	10.3	1.7	1.3%
8462	26	138.8	5.3	16.7%
8474	2	1.1	0.6	0.1%
8493	5	14.7	3.0	1.8%
8552	3	12.1	4.0	1.5%
8583	1	3.6	3.6	0.4%
9998	2	65.0	35.5	7.8%
9999	5	7.5	1.5	0.9%

Table 7. Land use / land cover class, frequency of occurrence (number of polygons), mean area, total area, and percent of total area within the buffer area.

Class	Frequency	Mean Area (ha)	Total Area (ha)	Percent of Total Area
Deciduous Forest Land	68	3.3	223.4	31.4%
Evergreen Forest Land	40	6.2	249.1	35.0%
Forested Wetland	1	0.5	0.5	<0.1%
Herbaceous Rangeland	32	1.8	58.6	8.2%
Mixed Forest Land	21	5.2	108.2	15.2%
Mixed Rangeland	3	3.0	8.9	1.2%
Reservoirs	1	0.1	0.1	<0.1%
Residential	4	1.2	5.0	0.7%
Shrub and Brush Rangeland	8	3.2	25.3	3.6%
Streams and Canals	2	8.8	17.7	2.5%
Transitional Areas	2	5.3	10.5	1.5%
Transportation, Communications, and Utilities	8	0.7	5.2	0.7%
Total	190	-	712.4	-

Table 8. Modifiers used throughout the park, including frequency of occurrence (number of polygons), mean area, and total area.

Code	Description	Frequency of Occurrence	Mean Area (ha)	Total Area (ha)
CLt	Contains <i>Liriodendron tulipifera</i>	3	11.9	35.8
CQf	Contains <i>Quercus falcata</i>	1	2.1	2.1
Cul	Cultivated	1	0.8	0.8
DPs	Dominated by <i>Pinus</i> spp	1	12.5	12.5
DQn	Dominated by <i>Quercus nigra</i>	2	1.3	2.6
DQnFp	Dominated by <i>Quercus nigra</i> and <i>Fraxinus americana</i>	1	7.9	7.9
PBB	Pine Bark Beetle	3	1.5	4.6
Total		12	5.5	66.3

Mapping Difficulties

It is difficult to distinguish between evergreen species such as loblolly pine, shortleaf pine, and longleaf pine in CIR imagery. As a result, associations that include these species as dominant canopy species were difficult to classify from imagery alone.

During field visits, bioindicators such as *Aesculus* spp (buckeye) in basic soil and *Vaccinium* spp (blueberry) in acidic soil helped researchers distinguish between vegetation associations. Frequently, vegetation species reflecting soil pH were understory species which are not visible on CIR and therefore were only useful in locations where field visits were made.

Accuracy Assessment Point Selection

As a part of the total mapping effort, a separate accuracy analysis (AA) of the thematic contents of the vegetation maps is required. Only classes with CEG codes assigned and only polygons that fall within the prescribed park boundary are evaluated. To accomplish this, a set of points is selected to represent the distribution and rarity of the mapped vegetation classes. The number of AA sample points per class depends on the total area (in ha) of the particular vegetation class within the map area, according to the rule set established by the NPS for this purpose:

- Classes with < 8.33 ha 5 points per class
- Classes with ≥ 8.33 AND < 50 ha number of points is $0.6 \times$ the area in ha
- Classes with ≥ 50 ha 30 points per class

The task agreement requires determination of the number of accuracy assessment points. With the actual distribution of the sample points will be determined under a separate task agreement, by another contractor. Protocol dictates that the points are randomly distributed and stratified by class. For example, if 30 points are required for a particular class, those 30 points should be randomly distributed within all of the polygons of that particular class. The distribution of classes, the number of polygons and the areas of each class is given in Table 9.

Table 9. Community Element Global (CEGL) classes, number of NVCS vegetation plots, frequency of occurrence (number of polygons), mean area, total area, and number of accuracy assessment points.

Element Code	NatureServe Points	Frequency of Occurrence	Mean Area (ha)	Total Area (ha)	Accuracy Assessment Points
3836	1	3	0.1	0.4	5
4048	-	4	1.8	7.2	5
4290	1	1	0.2	0.2	5
4700	1	13	1.6	21.0	13
4719	1	1	1.1	1.1	5
6011	3	19	10.1	192.5	30
7201	1	5	4.2	20.9	13
7213	1	2	6.8	13.6	8
7216	1	8	1.5	11.6	7
7217	1	3	17.2	51.6	30
7221	1	2	7.5	15.0	9
7244	1	3	10.3	30.9	19
7261	1	5	4.9	24.6	15
7312	2	6	2.4	14.5	9
7330	3	9	16.0	144.0	30
7353	2	5	1.1	5.7	5
7806	1	5	4.3	21.6	13
8437	2	6	1.7	10.3	6
8462	7	26	5.3	138.8	30
8474	1	2	0.6	1.1	5
8493	1	5	3.0	14.7	9
8552	2	3	4.0	12.1	7
8583	1	1	3.6	3.6	5
9998	-	2	35.5	65.0	-
9999	-	5	1.5	7.5	-
Total	36	145	-	829.4	313

Conclusion

The majority (88%) of HOBE is forested; much of the area (66% of total area) is successional forest classes. The Tallapoosa River is 8% of park area. The most common NVCS vegetation association within the park boundary is Early-to Mid-Successional Loblolly Pine Forest (6011) which covers 23% of the park. There is no vegetation association dominated by exotic species, and it was rarely necessary to use a modifier necessary to denote the presence of exotics. While pine associations were dominant, there was little evidence of pine bark beetle at this time. The use of controlled burns and maintaining the easement surrounding the park boundary has helped maintain the biological integrity of native plant communities.

In the 500 meter buffer zone surrounding the park, 81% is forested, with Evergreen Forest Land being the most common land cover (35%). There is a small component of rangeland (12%), which depending upon location and actual use, may influence water quality. Less than 3% of the buffer zone is high intensity anthropogenic land-uses.

Producing an accurate vegetation map based on color infrared imagery is a lengthy process and can take three to seven years to complete. During this time, disturbances may change some areas significantly. As a result, conclusions made from ground observations that were conducted during the middle or end of the overall process may be different from conclusions made from interpreting aerial photographs that were collected at the onset of the project.

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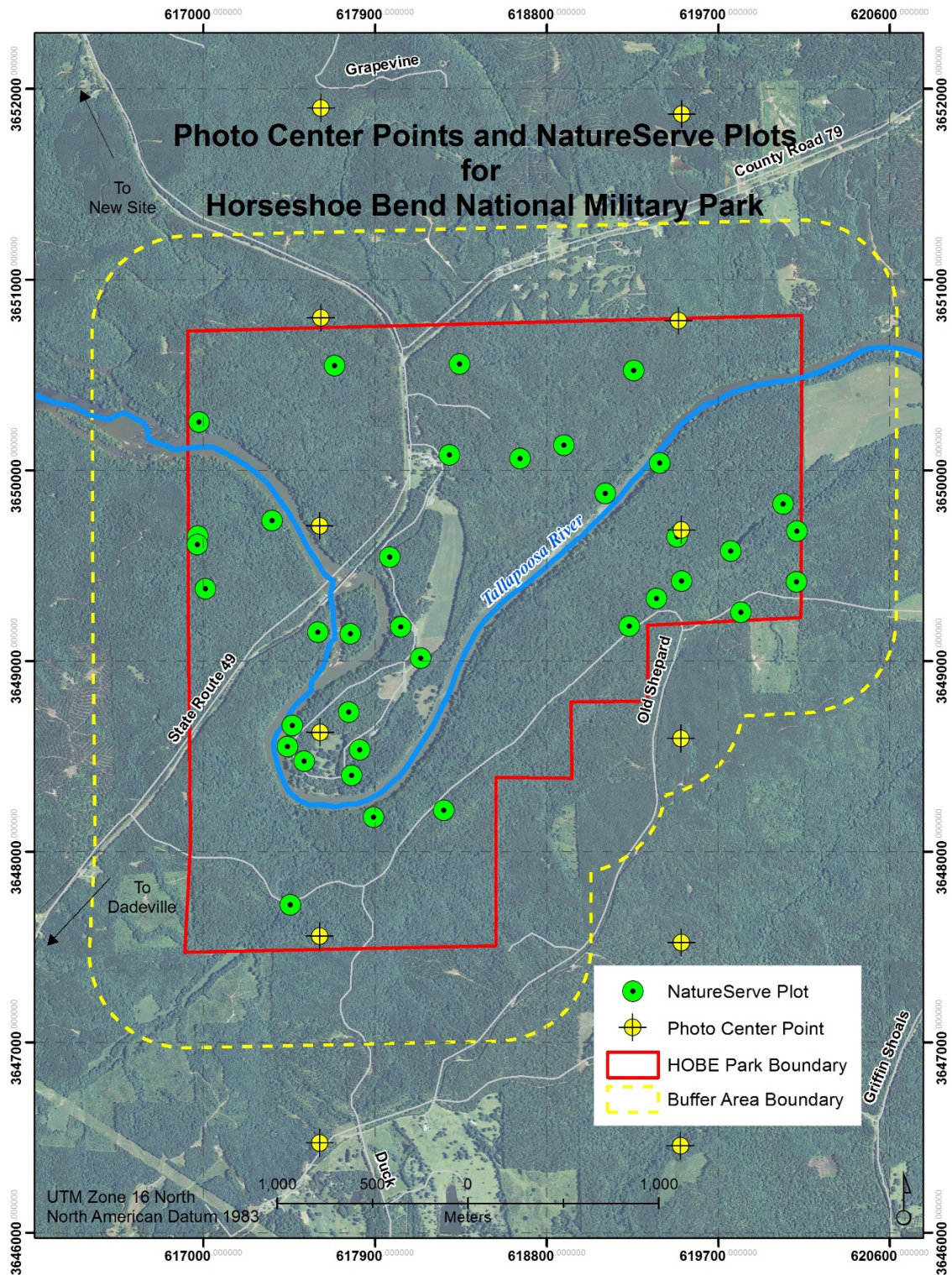
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Appendix A. Flight Lines for Aerial Photography.

Table A-1. Flight line and photo numbers and photo center coordinates (UTM Zone 16, NAD83) used for photointerpretation. Photos were acquired by Aero-Metric at 1:12,000 scale on May 1, 2011.

Flight Line	Photo	Easting	Northing
1	1	617610.9	3646471.6
1	2	617611.6	3647557.7
1	3	617613.6	3648625.4
1	4	617610.8	3649707.7
1	5	617617.0	3650800.4
1	6	617616.5	3651900.0
2	1	619503.8	3646456.4
2	2	619508.4	3647523.0
2	3	619505.1	3648593.0
2	4	619507.3	3649688.1
2	5	619493.2	3650785.7
2	6	619509.7	3651869.9

Appendix B. Photo Center Point and NatureServe Plot Locations.



Appendix C. NatureServe Plot Location Field Notes

Table C-1. NatureServe vegetation plot locations and notes. Field data acquired by L. Echols, L. Kruse and G. Burke in May, July, August, September and October of 2007 and August and September of 2008.

Plot Code	Field X	Field Y	Provisional	Element Code	Environment	Leaf Type	Leaf Phenology	Physiological Class
HOBE01	32.97900	-85.74819	bottomland hardwood forest	7806		Broad-leaved	Cold-deciduous	Forest
HOBE02	32.97860	-85.74822	upland oak-hickory forest	7217		Broad-leaved	Cold-deciduous	Forest
HOBE03	32.97650	-85.74780	loblolly pine-hardwood forest	6011		Needle-leaved	Evergreen	Forest
HOBE04	32.96760	-85.73972	bottomland hardwood forest	7330		Broad-leaved	Cold-deciduous	Forest
HOBE05	32.97310	-85.73577	maintained field	4700		Graminoid	Perennial herb	Herbaceous vegetation
HOBE06	32.97060	-85.73983	loblolly pine-hardwood forest	8462		Needle-leaved	Mixed evergreen - cold-deciduous	Forest
HOBE07	32.98270	-85.73402	loblolly pine-hardwood forest	6011		Needle-leaved	Mixed evergreen - cold-deciduous	Forest
HOBE08	32.98440	-85.74805	pine-hardwood forest	8493		Broad-leaved	Cold-deciduous	Forest
HOBE09	32.98700	-85.74041	montane longleaf pine forest	8437		Broad-leaved	Mixed evergreen - cold-deciduous	Forest
HOBE10	32.97450	-85.72405	mid-successional sweetgum forest	7216		Broad-leaved	Cold-deciduous	Forest
HOBE11	32.96150	-85.74325	alder swamp	8474	site appears to be the bed of a former beaver impoundment; gradually reverting to woodland	Broad-leaved	Cold-deciduous	Shrubland
HOBE12	32.96590	-85.73458	upland oak-hickory forest	7244		Broad-leaved	Cold-deciduous	Forest
HOBE13	32.96560	-85.73852	bottomland loblolly pine-hardwood forest	8462		Needle-leaved	Mixed evergreen - cold-deciduous	Forest
HOBE14	32.97460	-85.73686	upland hardwood	7221		Broad-leaved	Cold-deciduous	Forest

Table A-1. (Continued).

Plot Code	Field X	Field Y	Provisional	Element Code	Environment	Leaf Type	Leaf Phenology	Physiological Class
			forest					
HOBE15	32.96900	-85.74330	riverine herbaceous vegetation	3836	densely vegetated	Broad-leaved herbaceous	Perennial herb	Herbaceous vegetation
HOBE16	32.97000	-85.74302	herbaceous mudflat	4290		Graminoid	Perennial herb	Herbaceous vegetation
HOBE17	32.96830	-85.74238	maintained hardwood forest	8462		Broad-leaved	Cold-deciduous	Forest
HOBE18	32.97790	-85.73744	small stream ravine forest	7213		Broad-leaved	Cold-deciduous	Forest
HOBE19	32.96880	-85.73925	early-successional sweetgum forest	7330		Broad-leaved	Cold-deciduous	Forest
HOBE20	32.97580	-85.72250	loblolly pine-hardwood forest	8462		Needle-leaved	Evergreen	Forest
HOBE21	32.97660	-85.72108	small stream ravine forest	7330		Broad-leaved	Cold-deciduous	Forest
HOBE22	32.97870	-85.72130	bottomland loblolly pine-hardwood forest	8462		Broad-leaved	Cold-deciduous	Forest
HOBE23	32.98220	-85.72222	riverine hardwood forest	7312		Broad-leaved	Cold-deciduous	Forest
HOBE24	32.97430	-85.73969	riverine hardwood forest	7353		Broad-leaved	Cold-deciduous	Forest
HOBE25	32.97440	-85.74152	beech forest	7201		Broad-leaved	Cold-deciduous	Forest
HOBE26	32.97800	-85.71830	herbaceous depression	4719		Graminoid	Perennial herb	Herbaceous vegetation
HOBE27	32.98020	-85.71533	oak slough	8583		Broad-leaved	Cold-deciduous	Forest
HOBE28	32.97890	-85.71458	hardwood slope	7261		Broad-leaved	Cold-deciduous	Forest
HOBE29	32.97650	-85.71463	sweetbay streamside forest	8552		Broad-leaved	Cold-deciduous	Forest
HOBE30	32.97510	-85.71777	loblolly pine - hardwood forest	8462		Needle-leaved	Evergreen	Forest
HOBE31	32.98080	-85.72530	riverine forest	7312		Broad-leaved	Cold-deciduous	Forest
HOBE32	32.98660	-85.72361	loblolly pine -	8462		Needle-	Evergreen	Forest

Table A-1. (Continued).

Plot Code	Field X	Field Y	Provisional	Element Code	Environment	Leaf Type	Leaf Phenology	Physiological Class
			hardwood forest			leaved		
HOBE33	32.98310	-85.72758	sweetbay streamside forest	8552		Broad-leaved	Cold-deciduous	Forest
HOBE34	32.98250	-85.73005	early-successional loblolly pine forest	6011		Needle-leaved	Evergreen	Forest
HOBE35	32.98700	-85.73338	montane longleaf pine forest	8437		Needle-leaved	Evergreen	Forest
HOBE36	32.97970	-85.74402	bottomland hardwood forest	7353		Broad-leaved	Cold-deciduous	Forest

Appendix D. Photointerpretation Key For Horseshoe Bend National Military Park

The photointerpretation key describes the attributes of the color infrared (CIR) images used to delineate the vegetation association [Community Element Global (CEGL) codes] found within the park. For each CEGL, a CIR image chip from within the park is included. For most CEGL codes, there is also a ground based digital photo of the vegetation, taken within the park. The standard visual cues to interpret and distinguish vegetation are described, including color, tone, texture, and pattern. When applicable, comments on location within the park or topographic position. If there were other vegetation associations within the park that appeared similar on the CIR photographs, traits used to distinguish between similar vegetation associations are described.

The Vegetation Description for the CEGL within the park was copied directly from NatureServe (2009) to provide plot-level information on species composition, dominance, characteristic species, and percent estimate of vegetation cover in understory, midstory, and/or canopy. It also includes the Global Description and geographic distribution. A separate literature cited section of the references from NatureServe (2009) text that was directly copied into the photointerpretation key is included at the end of this appendix.

Mid- to Late-Successional Loblolly Pine Sweetgum Forest (8462)



Characteristic	Value
Color	Pink to Red
Tone	Medium to Dark
Texture	Coarse
Pattern	Moderate to Dense
Height	Tall
Shape	Expansive broad areas
Size	Common class. Third largest in area
Location	Pine dominated forest found on slopes or ridge tops that are never flooded
Association	7330, 7261, and 7213
Comments	Easily distinguishable from deciduous classes

Horseshoe Bend National Military Park Vegetation: The moderate to dense (40-80% cover) tree canopy, 20-35 m tall, is dominated by *Liquidambar styraciflua* (sweetgum) and *Pinus taeda* (loblolly pine); additional canopy species may include *Quercus falcata* (southern red oak) and more commonly *Quercus nigra* (water oak). The sparse to moderately dense (30-70%) subcanopy (10- 20 m) is dominated by *Liquidambar styraciflua* (sweetgum) and may include other canopy species as well as *Acer rubrum* (red maple), *Prunus serotina* (black cherry), and *Quercus stellata* (post oak). The sparse to moderately dense (30-70%) tall-shrub layer (2-10 m) is also dominated by *Liquidambar styraciflua* (sweetgum) along with *Cornus florida* (flowering dogwood) and saplings of the above-mentioned tree species along with other hardwood species. The sparse (30-40%) short-shrub layer (1-5 m) includes species from the upper layers and may include *Asimina parviflora* (smallflower pawpaw), *Callicarpa americana* (American beautyberry), *Diospyros virginiana* (common persimmon), *Fagus grandifolia* (American beech), *Ostrya virginiana* (hophornbeam), *Vaccinium arboreum* (farkleberry), and *Vaccinium elliotii* (Elliott's blueberry). The very sparse to moderately dense (10-70%) herbaceous layer includes *Carex debilis* (white edge sedge), *Centrosema virginianum* (spurred butterfly pea), *Chasmanthium sessiliflorum* (longleaf woodoats), *Clitoria*

mariana (Atlantic pigeonwings), *Dichanthelium commutatum* (variable panicgrass), and *Polystichum acrostichoides* (Christmas fern), among others. Common vines (20-50%) include *Gelsemium sempervirens* (evening trumpetflower), *Smilax glauca* (cat greenbrier), *Toxicodendron radicans* (eastern poison ivy), *Vitis rotundifolia* (muscadine), and *Lonicera japonica* (Japanese honeysuckle) (exotic).

Global Vegetation: Stands of this community type are strongly codominated by *Pinus taeda* (loblolly pine) and *Liquidambar styraciflua* (sweetgum). Some other species which may be present in stands of this association include *Quercus phellos* (willow oak), *Quercus nigra* (water oak), *Ulmus alata* (winged elm), *Acer rubrum* (red maple), *Quercus michauxii* (swamp chestnut oak), *Nyssa sylvatica* (blackgum), and *Prunus serotina* (black cherry), along with *Vitis rotundifolia* (muscadine), *Toxicodendron radicans* (eastern poison ivy), *Rubus argutus* (sawtooth blackberry), *Smilax rotundifolia* (roundleaf greenbrier), *Eupatorium capillifolium* (dogfennel), *Eupatorium hyssopifolium* (hyssopleaf thoroughwort), *Erigeron strigosus* (prairie fleabane), *Solidago gigantea* (giant goldenrod), *Ambrosia artemisiifolia* (annual ragweed), *Juncus effusus* (common rush), *Juncus subcaudatus* (woodland rush), and the exotics *Lespedeza cuneata* (Chinese lespedeza) and *Ligustrum sinense* (Chinese privet). Examples of this association in low-lying areas may also have a dense herbaceous layer of *Microstegium vimineum* (Nepalese browntop).

Early- to Mid-Successional Loblolly Pine Forest (6011)



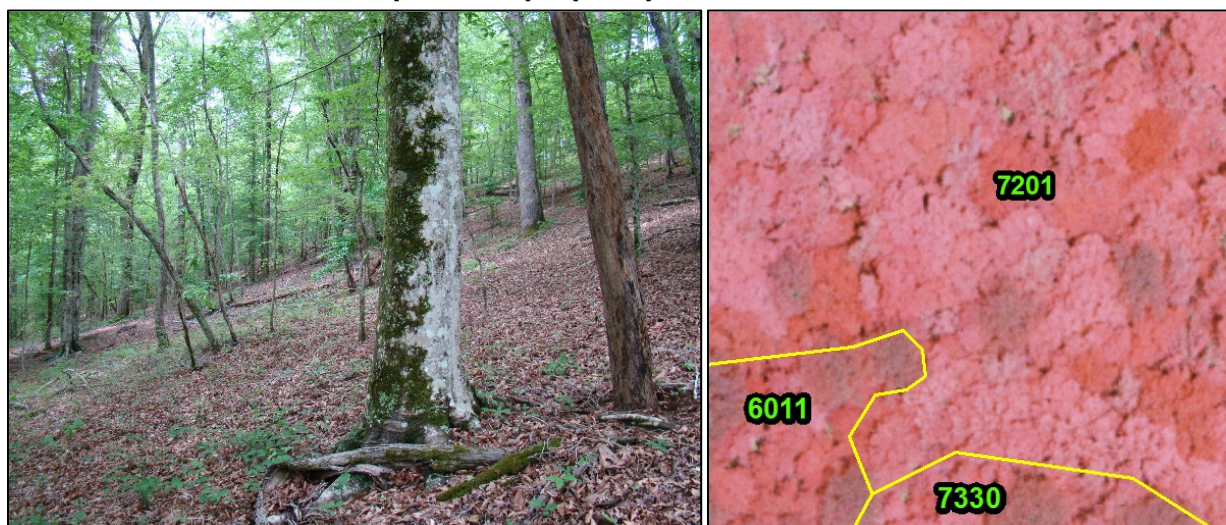
Characteristic	Value
Color	Pink to Red
Tone	Dark
Texture	Coarse
Pattern	Moderate to dense
Height	Tall
Shape	Expansive broad areas
Size	Largest class. Represents roughly 23% of the park
Location	Gently to moderate, south and north facing slopes
Association	7201, 8552, 8437, 7217, and 7806
Comments	Easily distinguishable from deciduous classes

Horseshoe Bend National Military Park Vegetation: The moderate (40-60% cover) tree canopy, 20-35 m tall, is dominated by *Pinus taeda* (loblolly pine). The moderate to dense (40-80%) subcanopy (5-15 m) may include *Cornus florida* (flowering dogwood), *Fagus grandifolia* (American beech), *Liquidambar styraciflua* (sweetgum), *Oxydendrum arboreum* (sourwood), and *Pinus taeda* (loblolly pine), among others. The moderately sparse (30-40%) tall-shrub layer (2-10 m) is made up of saplings of trees from the upper layers, as is the sparse (20-30%) short-shrub layer (0.5-2 m) which likely also includes *Vaccinium arboreum* (farkleberry). The very sparse (10-20%) herbaceous layer includes *Chasmanthium sessiliflorum* (longleaf woodoats), *Elephantopus tomentosus* (devil's grandmother), and *Saccharum brevibarbe* var. *contortum* (shortbeard plumegrass), among others. The most common vine (10-20%) is *Vitis rotundifolia* (muscadine).

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

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

Southern Mesic Beech-Tuliptree Slope (7201)

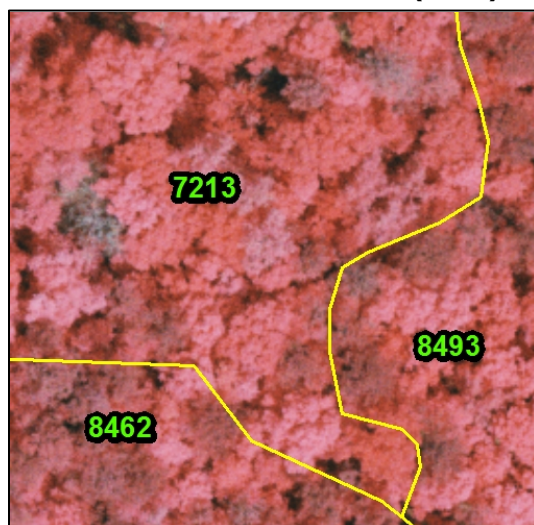


Characteristic	Value
Color	Pink to Light Red
Tone	Light to Medium
Texture	Coarse
Pattern	Dense
Height	Tall
Shape	Irregular
Size	Represents between two and eight percent of park
Location	Typically along a drainage networks and on north side of slopes
Association	6011 and 8462

Horseshoe Bend National Military Park Vegetation: The moderate (60% cover) tree canopy, 20-35 m tall, is dominated by *Fagus grandifolia* (American beech) along with *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Quercus rubra* (northern red oak), and *Ulmus alata* (winged elm). The moderate (50%) subcanopy (10-15 m) includes *Fagus grandifolia* (American beech) and *Oxydendrum arboreum* (sourwood). The moderate (50%) tall-shrub layer (2-5 m) is also dominated by *Fagus grandifolia* (American beech) along with lesser amounts of *Carpinus caroliniana* (American hornbeam), *Hamamelis virginiana* (American witchhazel), *Liquidambar styraciflua* (sweetgum), and *Rhododendron canescens* (mountain azalea). The moderate (50%) short-shrub layer (1-2 m) is dominated by *Acer barbatum* (southern sugar maple) and includes *Asimina parviflora* (smallflower pawpaw), *Callicarpa americana* (American beautyberry), and *Vaccinium elliotii* (Elliott's blueberry). The sparse (20%) herbaceous layer includes *Chasmanthium sessiliflorum* (longleaf woodoats), *Epifagus virginiana* (beechdrops), *Hexastylis arifolia* var. *arifolia* (littlebrownjug), *Mitchella repens* (partridgeberry), *Polystichum acrostichoides* (Christmas fern), and *Scleria oligantha* (littlehead nutrush). Vines (40%) include *Decumaria barbara* (woodvamp), *Smilax rotundifolia* (roundleaf greenbrier), and *Vitis rotundifolia* (muscadine).

Global Vegetation: These mesic slope forests are dominated by *Fagus grandifolia* (American beech) and *Liriodendron tulipifera* (tuliptree). According to Golden (1979), other important canopy/subcanopy species include *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), *Fraxinus americana* (white ash), *Quercus rubra* (northern red oak), *Carpinus caroliniana* (American hornbeam), *Magnolia virginiana* (sweetbay), *Nyssa sylvatica* (blackgum), *Diospyros virginiana* (common persimmon), *Oxydendrum arboreum* (sourwood), and *Cornus florida* (flowering dogwood). Shrubs and woody vines include *Decumaria barbara* (woodvamp), *Euonymus americanus* (strawberry bush), *Rhododendron canescens* (mountain azalea), *Toxicodendron radicans* (eastern poison ivy), *Vitis rotundifolia* (muscadine), *Smilax glauca* (cat greenbrier), and the exotic *Lonicera japonica* (Japanese honeysuckle). Important herbs include *Athyrium filix-femina* ssp. *asplenioides* (asplenium ladyfern), *Polystichum acrostichoides* (Christmas fern), *Woodwardia areolata* (netted chainfern), *Osmunda cinnamomea* (cinnamon fern), *Mitchella repens* (partridgeberry), and *Hexastylis arifolia* (littlebrownjug).

Cumberland Plateau Mesic White Oak-Beech Forest (7213)

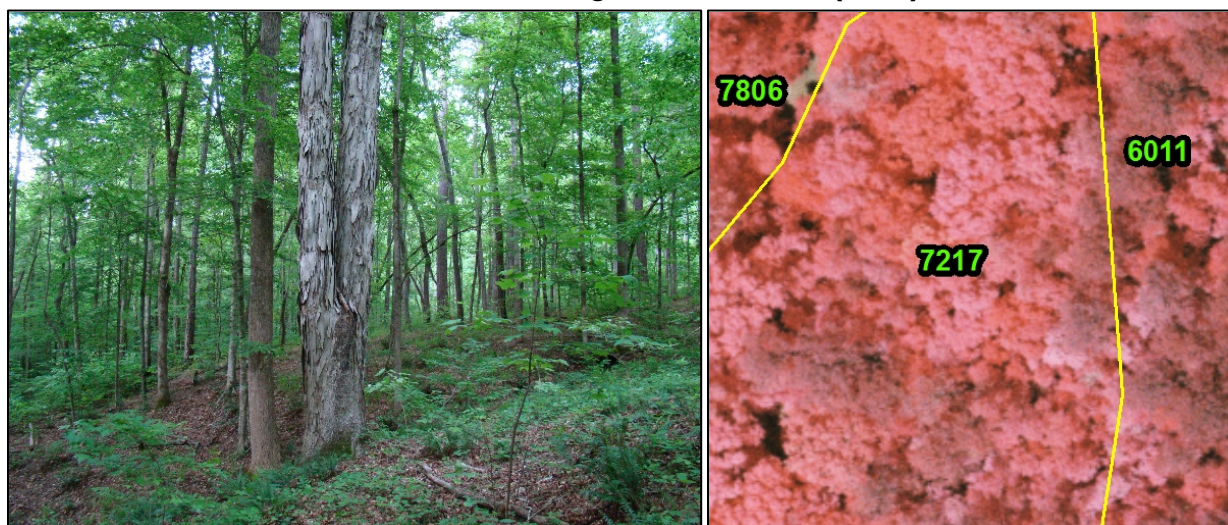


Characteristic	Value
Color	Pink to Red
Tone	Light
Texture	Coarse
Pattern	Dense
Height	Tall
Shape	Irregular
Size	Represents less than two percent of the park
Location	
Association	6011, 8462, and 7261

Horseshoe Bend National Military Park Vegetation: The moderate (50% cover) tree canopy, 20-35 m tall, is dominated by *Quercus alba* (white oak) along with *Fagus grandifolia* (American beech), *Liquidambar styraciflua* (sweetgum), *Quercus nigra* (water oak), and *Quercus rubra* (northern red oak). The moderately sparse (40%) subcanopy (15-20 m) includes *Carya glabra* (pignut hickory), *Halesia diptera* (two-wing silverbell), and *Liriodendron tulipifera* (tuliptree), among others. The moderate (60%) tall-shrub layer (5-10 m) is dominated by *Halesia diptera* (two-wing silverbell) and includes *Carpinus caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), *Liquidambar styraciflua* (sweetgum), and *Nyssa sylvatica* (blackgum). The moderately sparse (40%) short-shrub layer (1-2 m) includes *Acer barbatum* (southern sugar maple), *Callicarpa americana* (American beautyberry), *Carpinus caroliniana* (American hornbeam), *Fagus grandifolia* (American beech), *Halesia diptera* (two-wing silverbell), and *Vaccinium elliottii* (Elliott's blueberry), among others. The sparse (20%) herbaceous layer includes *Carex digitalis* (slender woodland sedge), *Chasmanthium latifolium* (Indian woodoats), *Chasmanthium sessiliflorum* (longleaf woodoats), *Dichanthelium boscii* (Bosc's panicgrass), and *Polystichum acrostichoides* (Christmas fern). Vines (30%) include *Bignonia capreolata* (crossvine), *Decumaria barbara* (woodvamp), *Toxicodendron radicans* (eastern poison ivy), and *Vitis rotundifolia* (muscadine).

Global Vegetation: This is a deciduous forest with a well-developed canopy and subcanopy, a variable shrub layer, and an open to sparse herbaceous layer. The canopy is always dominated by *Quercus alba* (white oak) with codominance by *Fagus grandifolia* (American beech) and/or *Liriodendron tulipifera* (tuliptree). Some examples may have large individuals of *Pinus taeda* (loblolly pine) blending in from forests on adjacent, higher slopes, or as an artifact of past disturbance. Other common canopy trees include *Tilia americana* var. *heterophylla* (American basswood), *Magnolia acuminata* (cucumber-tree), *Liquidambar styraciflua* (sweetgum), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak), and *Carya alba* (mockernut hickory). Species most typically abundant in the subcanopy include *Ostrya virginiana* (hophornbeam), *Acer barbatum* (southern sugar maple), *Magnolia macrophylla* (bigleaf magnolia), and *Ilex opaca* (American holly). Other subcanopy species include *Acer rubrum* (red maple), *Carpinus caroliniana* (American hornbeam), *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Carya cordiformis* (bitternut hickory), *Cornus florida* (flowering dogwood), and *Ulmus rubra* (slippery elm). The most typically abundant shrubs are *Hydrangea quercifolia* (oakleaf hydrangea), *Euonymus americanus* (strawberry bush), and *Viburnum acerifolium* (mapleleaf viburnum). Other shrubs are *Asimina triloba* (pawpaw), *Asimina parviflora* (smallflower pawpaw), *Lindera benzoin* (northern spicebush), *Styrax grandifolius* (bigleaf snowbell), *Ilex opaca* (American holly), *Arundinaria gigantea* (giant cane), *Kalmia latifolia* (mountain laurel), and *Rhododendron canadense* (rhodora). Common vines are *Decumaria barbara* (woodvamp), *Smilax rotundifolia* (roundleaf greenbrier), and *Toxicodendron radicans* (eastern poison ivy). Herbaceous composition varies from site to site. The most abundant and constant species are *Carex picta* (Boott's sedge), *Polystichum acrostichoides* (Christmas fern), *Solidago caesia* (wreath goldenrod), and *Brachyelytrum erectum* (bearded shorthusk). Other typical species include *Chasmanthium sessiliflorum* (longleaf woodoats), *Chimaphila maculata* (striped prince's pine), *Dioscorea quaternata* (fourleaf yam), *Goodyera pubescens* (downy rattlesnake plantain), *Hexastylis arifolia* (littlebrownjug), *Epifagus virginiana* (beechdrops), *Campanula divaricata* (small bonny bellflower), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dioscorea quaternata* (fourleaf yam), *Maianthemum racemosum* (feathery false lily of the valley), *Mitchella repens* (partridgeberry), *Thelypteris noveboracensis* (New York fern), and *Tiarella cordifolia* (heartleaf foamflower). In addition, *Hybanthus concolor* (eastern greenviolet) may be present. A plot attributed here from the Talladega National Forest, Oakmulgee Ranger District has abundant *Illicium floridanum* (Florida anisetree) (NatureServe Ecology unpubl. data). This sample is atypical and presumably at the southern range limit of the type.

Interior Mid- to Late-Successional Sweetgum-Oak Forest (7217)



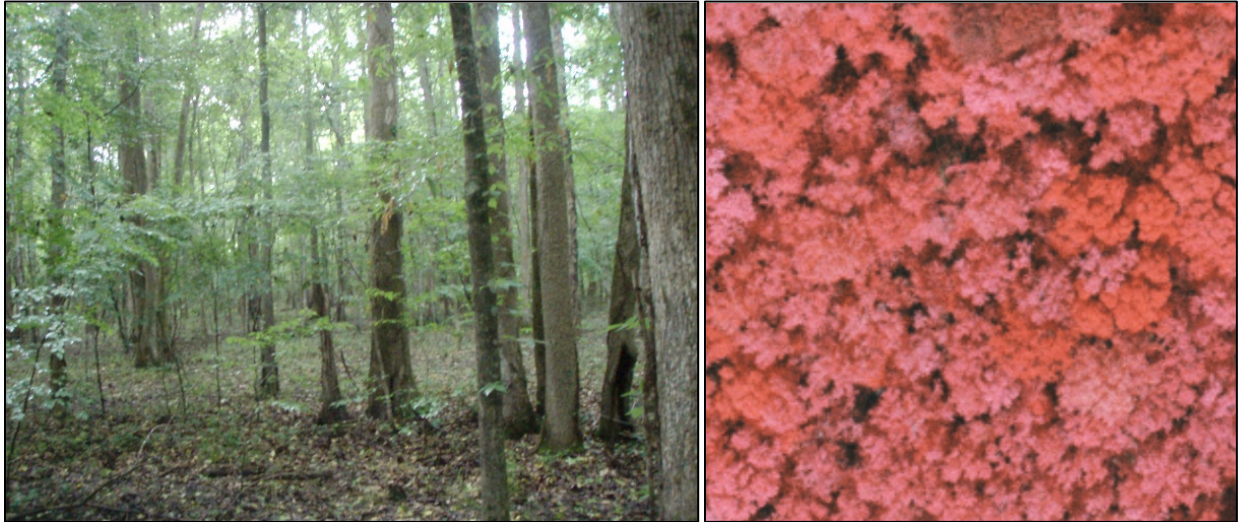
Characteristic	Value
Color	Pink to Dark Red
Tone	Light to Medium
Texture	Coarse
Pattern	Moderate to Dense
Height	Medium to Tall
Shape	Irregular
Size	Represents between two and eight percent of park
Location	
Association	6011, 8437, and 8493

Horseshoe Bend National Military Park Vegetation: The moderate (50% cover) tree canopy, 15-20 m tall, is dominated by *Quercus alba* (white oak) along with *Liquidambar styraciflua* (sweetgum) and *Liriodendron tulipifera* (tuliptree). The moderate (50%) subcanopy (10-15 m) includes *Fagus grandifolia* (American beech), *Liquidambar styraciflua* (sweetgum), and *Oxydendrum arboreum* (sourwood). The moderate (40%) tall-shrub layer (2-5 m) includes *Cornus florida* (flowering dogwood) and *Liquidambar styraciflua* (sweetgum), as does the sparse (30%) short-shrub layer (1-2 m) which also includes *Asimina triloba* (pawpaw), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Halesia diptera* (two-wing silverbell), and *Oxydendrum arboreum* (sourwood). The sparse (20%) herbaceous layer includes *Chasmanthium sessiliflorum* (longleaf woodoats) and *Polystichum acrostichoides* (Christmas fern). Vines (20%) include *Decumaria barbara* (woodvamp), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (cat greenbrier), *Toxicodendron radicans* (eastern poison ivy), and *Vitis rotundifolia* (muscadine).

Global Vegetation: The overstory of stands of this association are usually dominated by *Liquidambar styraciflua* (sweetgum), but may also support other species such as *Quercus alba* (white oak), *Liriodendron tulipifera* (tuliptree), and *Quercus falcata* (southernred oak). Other woody species encountered in plots attributed to this type include *Fraxinus americana* (white ash), *Cornus florida*

(flowering dogwood), *Diospyros virginiana* (common persimmon), *Quercus velutina* (black oak), *Quercus rubra* (northern red oak), and *Carya* (hickory) spp. (NatureServe Ecology unpubl. data).

Successional Sweetgum Forest (7216)



Characteristic	Value
Color	Pink to Red
Tone	Light to Medium
Texture	Coarse
Pattern	Sparse to Dense
Height	Short to Tall
Shape	Small patches
Size	Represents less than two percent of total area
Location	Typically found in lowlands
Association	8462 and 6011

Horseshoe Bend National Military Park Vegetation: The dense (80% cover) tree canopy, 20-35 m tall, is dominated almost exclusively by *Liquidambar styraciflua* (sweetgum). The sparse (30%) subcanopy (15-20 m) includes *Acer rubrum* (red maple), *Fraxinus pennsylvanica* (green ash), *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), and *Quercus nigra* (water oak). The moderate (50%) tall-shrub layer (5-10 m) is also dominated by *Liquidambar styraciflua* (sweetgum) and includes *Cornus florida* (flowering dogwood) and *Nyssa sylvatica* (blackgum). The very sparse (10%) short-shrub layer (1-2 m) includes *Callicarpa americana* (American beautyberry). The moderate (50%) herbaceous layer is dominated by the invasive exotic *Microstegium vimineum* (Nepalese browntop). Vines (20%) include *Smilax rotundifolia* (roundleaf greenbrier) and *Vitis rotundifolia* (muscadine).

Global Vegetation: Stands are dominated by *Liquidambar styraciflua* (sweetgum), sometimes to the exclusion of other species.

Successional Tuliptree Forest (7221)



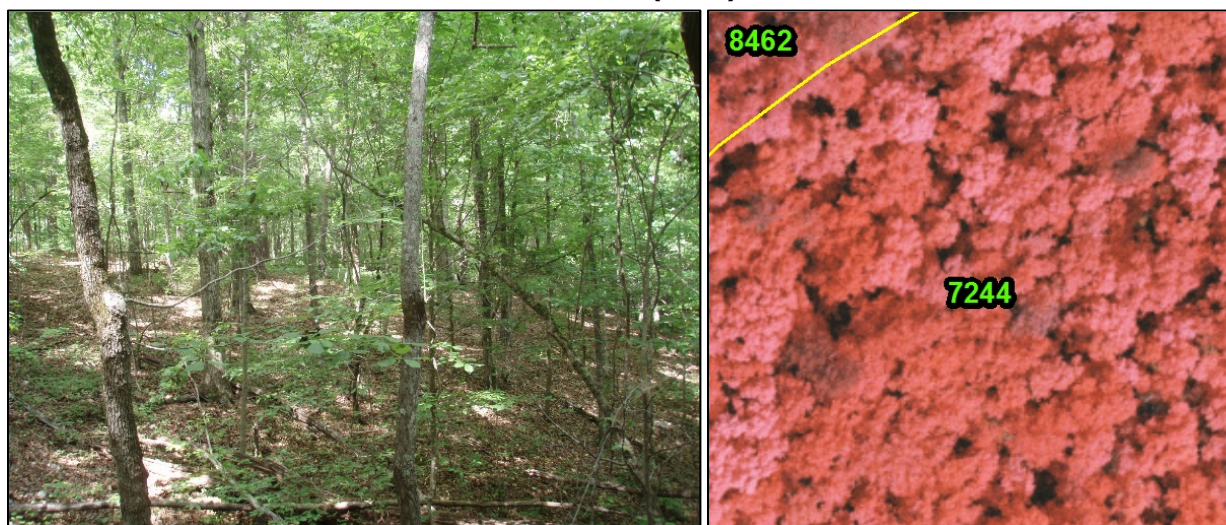
Characteristic	Value
Color	Pink to Red
Tone	Light to Medium
Texture	Medium to Rough
Pattern	Open to Dense
Height	Medium to Tall
Shape	Irregular
Size	Represents less than two percent of total area
Location	Along river
Association	8462, 4700, 8493

Horseshoe Bend National Military Park Vegetation: The moderately dense (70% cover) tree canopy, 20-35 m tall, is codominated by *Acer barbatum* (southern sugar maple), *Liriodendron tulipifera* (tuliptree), *Quercus nigra* (water oak), and *Quercus stellata* (post oak). The moderate (50%) subcanopy (15-20 m) is dominated by *Liquidambar styraciflua* (sweetgum) and includes *Acer rubrum* (red maple), *Carya alba* (mockernut hickory), *Prunus serotina* (black cherry), and *Quercus alba* (white oak). The moderate (50%) tall-shrub layer (5-10 m) is codominated by *Carpinus caroliniana* (American hornbeam), *Halesia diptera* (two-wing silverbell), and *Liquidambar styraciflua* (sweetgum), as is the moderately sparse (40%) short-shrub layer (1-2 m). The sparse (30%) herbaceous layer includes *Chasmanthium sessiliflorum* (longleaf woodoats) and *Polystichum acrostichoides* (Christmas fern). Vines (20%) include *Bignonia capreolata* (crossvine), *Toxicodendron radicans* (eastern poison ivy), and *Vitis rotundifolia* (muscadine).

Global Vegetation: The canopy of this semi-natural upland association is dominated by *Liriodendron tulipifera* (tuliptree). *Quercus* (oak) species (*Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus falcata* (southern red oak), *Quercus nigra* (water oak), *Quercus velutina* (black oak)) are often present; additional associates may include *Acer barbatum* (southern sugar maple), *Acer rubrum* (red maple), *Carya* (hickory) spp., *Fagus grandifolia* (American beech), *Nyssa*

sylvatica (blackgum), *Cornus florida* (flowering dogwood), and *Robinia pseudoacacia* (black locust). *Betula lenta* (sweet birch) is a common associate at the northern range limit. Shrub layers may include saplings of the canopy species and *Acer pensylvanicum* (striped maple), *Amelanchier arborea* (common serviceberry), *Hamamelis virginiana* (American witchhazel), *Lindera benzoin* (northern spicebush) (in small amounts), and *Vaccinium pallidum* (Blue Ridge blueberry). Herbs vary across the range but may include *Actaea racemosa* (black bugbane), *Dichanthelium clandestinum* (deertongue), *Dioscorea quaternata* (fourleaf yam), *Galium circaezans* (licorice bedstraw), *Geranium maculatum* (spotted geranium), *Goodyera pubescens* (downy rattlesnake plantain), *Medeola virginiana* (Indian cucumber), *Potentilla simplex* (common cinquefoil), *Scutellaria serrata* (showy skullcap), *Thelypteris noveboracensis* (New York fern), and *Uvularia perfoliata* (perfoliate bellwort). *Lycopodium digitatum* (fan clubmoss) may be abundant in some stands.

Southern Red Oak - White Oak Mixed Forest (7244)



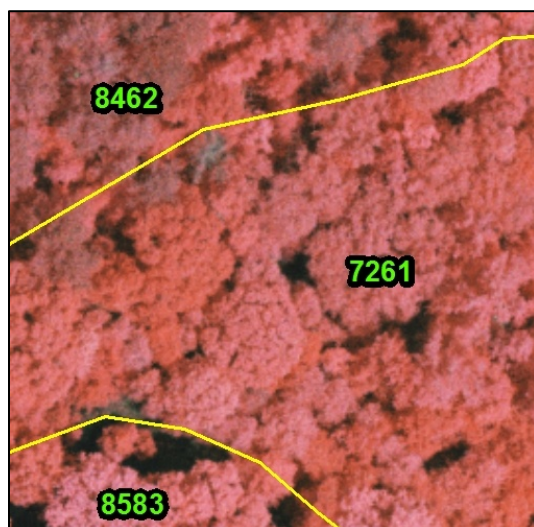
Characteristic	Value
Color	Pink to Red
Tone	Light to Medium
Texture	Coarse
Pattern	Sparse to Dense
Height	Medium to Tall
Shape	Irregular
Size	Represents approximately four percent of total area
Location	Wetland and Upland areas
Association	6011 and 8437

Horseshoe Bend National Military Park Vegetation: The moderately dense (70% cover) tree canopy, 20-35 m tall, is comprised of *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), and *Quercus falcata* (southern red oak). The moderate (50%) subcanopy (15-20 m) includes canopy species as well as *Carya alba* (mockernut hickory), *Fagus grandifolia* (American beech), *Oxydendrum arboreum* (sourwood), and *Quercus prinus* (chestnut oak). The moderately sparse (40%) tall-shrub layer (5-10 m) and sparse (30%) short-shrub layer (1-2 m) include *Acer rubrum* (red maple), *Cornus florida* (flowering dogwood), and *Oxydendrum arboreum* (sourwood). The very sparse (<5%) herbaceous layer includes trace amounts of *Aristolochia serpentaria* (Virginia snakeroot), *Danthonia sericea* (downy danthonia), *Euphorbia mercurialina* (mercury spurge), *Iris verna* var. *smalliana* (dwarf violet iris), *Pleopeltis polypodioides* (resurrection fern), and *Trillium catesbaei* (bashful wakerobin), among others.

Global Vegetation: The vegetation is dominated by *Quercus* (oak) spp. and lesser amounts of *Carya* (hickory) spp. The canopy is continuous, and several species of *Quercus* (oak) may be present (e.g., *Quercus falcata* (southern red oak), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Quercus coccinea* (scarlet oak), and *Quercus stellata* (post oak)). The subcanopy closure is variable, ranging from less than 25% to more than 40% cover, and the shrub and herb layers generally are

sparse. Subcanopy species include canopy species and *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Oxydendrum arboreum* (sourwood), *Liquidambar styraciflua* (sweetgum), *Ulmus alata* (winged elm), *Cornus florida* (flowering dogwood), *Nyssa sylvatica* (blackgum), *Juniperus virginiana* var. *virginiana* (eastern redcedar), and *Vaccinium arboreum* (farkleberry). The tall-shrub stratum may contain *Rhododendron canescens* (mountain azalea) and *Vaccinium arboreum* (farkleberry). The low-shrub stratum is dominated by various ericaceous shrubs such as *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Vaccinium fuscum* (black highbush blueberry), and *Gaylussacia baccata* (black huckleberry). *Smilax glauca* (cat greenbrier) and *Vitis rotundifolia* (muscadine) are common vines. Herbaceous species that may be present include *Aristolochia serpentaria* (Virginia snakeroot), *Symphotrichum dumosum* (rice button aster), *Clitoria mariana* (Atlantic pigeonwings), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Euphorbia corollata* (flowering spurge), *Galium circaezans* (licorice bedstraw), *Chimaphila maculata* (striped prince's pine), *Polystichum acrostichoides* (Christmas fern), *Asplenium platyneuron* (ebony spleenwort), *Hexastylis arifolia* (littlebrownjug), *Coreopsis major* (greater tickseed), *Solidago odora* (anisescented goldenrod), *Tephrosia virginiana* (Virginia tephrosia), *Potentilla simplex* (common cinquefoil), *Porteranthus stipulatus* (Indian physic), *Pteridium aquilinum* (western brackenfern), *Lespedeza* (lespedeza) spp., *Dichanthelium* (rosette grass) spp., and *Hieracium venosum* (rattlesnakeweed).

Lower Piedmont Chestnut Oak Forest (7261)



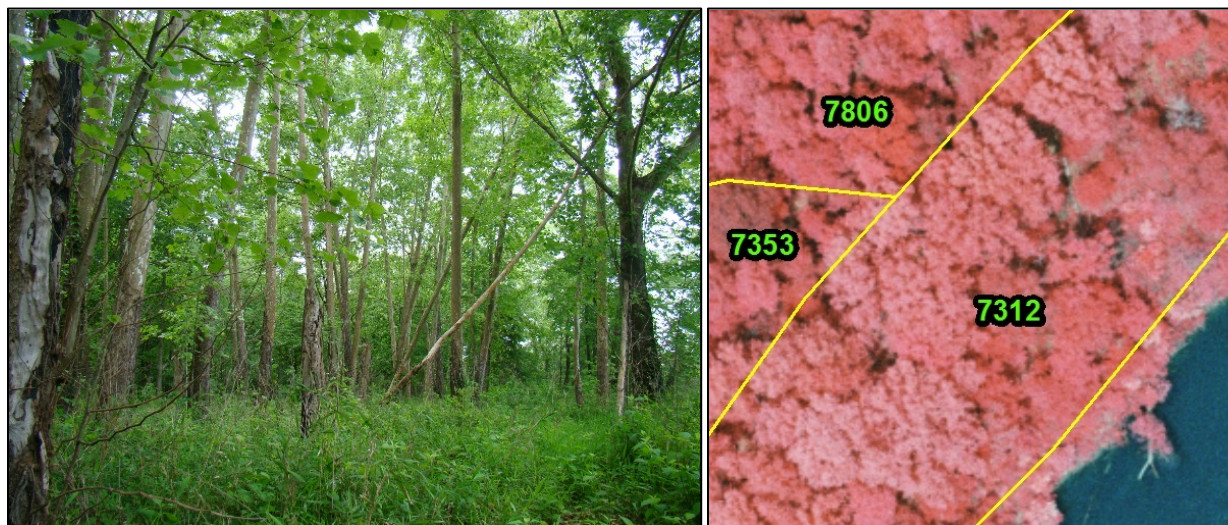
Characteristic	Value
Color	Pink to Red
Tone	Light to Medium
Texture	Coarse
Pattern	Moderate to Dense
Height	Medium to Tall
Shape	Finger like
Size	Represents approximately three percent of total area
Location	Typically in upland areas
Association	7330

Horseshoe Bend National Military Park Vegetation: The moderately dense (70% cover) tree canopy, 20-35 m tall, is codominated by *Carya glabra* (pignut hickory) and *Quercus prinus* (chestnut oak). The moderate (60%) subcanopy (15-20 m) is made up of *Liriodendron tulipifera* (tuliptree), *Oxydendrum arboreum* (sourwood), and *Tilia americana* var. *caroliniana* (Carolina basswood). The moderately dense (70%) tall-shrub layer (5-10 m) is codominated by *Acer rubrum* (red maple), *Fagus grandifolia* (American beech), *Liquidambar styraciflua* (sweetgum), and *Oxydendrum arboreum* (sourwood), as is the moderate (50%) short-shrub layer (1-2 m) which also includes *Halesia diptera* (two-wing silverbell), *Hydrangea quercifolia* (oakleaf hydrangea), *Magnolia tripetala* (umbrella-tree), and *Vaccinium elliotii* (Elliott's blueberry), among others. The moderate (50%) herbaceous layer is dominated by *Polystichum acrostichoides* (Christmas fern). Vines (20%) include *Smilax glauca* (cat greenbrier), *Toxicodendron radicans* (eastern poison ivy), and *Vitis rotundifolia* (muscadine). In addition, this community supports globally and state-vulnerable *Aesculus parviflora* (bottlebrush buckeye).

Global Vegetation: The canopy of stands of this association is strongly dominated by *Quercus prinus* (chestnut oak), *Carya alba* (mockernut hickory), and *Quercus velutina* (black oak). Other tree species present include *Quercus falcata* (southern red oak), *Quercus alba* (white oak), *Quercus*

stellata (post oak), *Carya glabra* (pignut hickory), and *Pinus echinata* (shortleaf pine). Understory woody species include *Cornus florida* (flowering dogwood), *Nyssa sylvatica* (blackgum), and *Oxydendrum arboreum* (sourwood). Shrubs and woody vines include *Aesculus pavia* (red buckeye), *Asimina parviflora* (smallflower pawpaw), *Ceanothus americanus* (New Jersey tea), *Epigaea repens* (trailing arbutus), *Euonymus americanus* (strawberry bush), *Gaylussacia dumosa* (dwarf huckleberry), *Hydrangea quercifolia* (oakleaf hydrangea), *Parthenocissus quinquefolia* (Virginia creeper), *Rhododendron canescens* (mountain azalea), *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Symplocos tinctoria* (common sweetleaf), *Toxicodendron pubescens* (Atlantic poison oak), *Toxicodendron radicans* (eastern poison ivy), *Vaccinium arboreum* (huckleberry), *Vaccinium elliotii* (Elliott's blueberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), and *Vitis rotundifolia* (muscadine) (Golden 1979). Herbs and herbaceous vines present include *Coreopsis major* (greater tickseed), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dioscorea villosa* (wild yam), *Elephantopus tomentosus* (devil's grandmother), *Hexastylis arifolia* (littlebrownjug), *Iris verna* var. *smalliana* (dwarf violet iris), *Maianthemum racemosum* (feathery false lily of the valley), *Mimosa microphylla* (littleleaf sensitive-briar), *Mitchella repens* (partridgeberry), *Silphium compositum* (kidneyleaf rosinweed), *Tephrosia virginiana* (Virginia tephrosia), and *Uvularia perfoliata* (perfoliate bellwort). Ferns include *Polystichum acrostichoides* (Christmas fern) and *Pteridium aquilinum* (western brackenfern). In addition, Beckett and Golden (1982) include *Carya pallida* (sand hickory), *Quercus coccinea* (scarlet oak), *Quercus velutina* (black oak), *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Carya ovalis* (red hickory), *Acer rubrum* (red maple), *Pinus taeda* (loblolly pine), and *Magnolia macrophylla* (bigleaf magnolia) as components of this type (in decreasing order of frequency).

River Birch Levee Forest (7312)



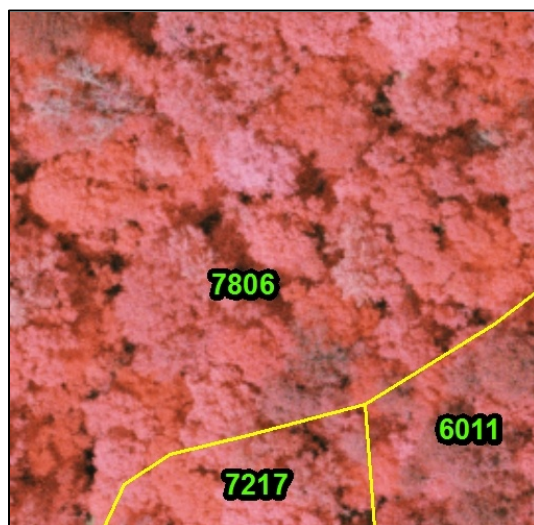
Characteristic	Value
Color	Pink
Tone	Light
Texture	Coarse
Pattern	Moderate to Dense
Height	Medium to Tall
Shape	Long and narrow
Size	Represents approximately two percent of total area inside the park
Location	Along river bank
Association	7217 and 7330

Horseshoe Bend National Military Park Vegetation: The dense (70-80% cover) tree canopy, 20-35 m tall, is codominated by *Betula nigra* (river birch), *Fraxinus pennsylvanica* (green ash), and *Platanus occidentalis* (American sycamore) and may include a substantial amount of *Juglans nigra* (black walnut). The moderately dense (50-70%) subcanopy (15-20 m) is dominated by *Acer negundo* (boxelder) and may include *Carya cordiformis* (bitternut hickory), *Celtis laevigata* (sugarberry), *Fraxinus pennsylvanica* (green ash), *Ostrya virginiana* (hophornbeam), and *Platanus occidentalis* (American sycamore). The moderate (50-60%) tall-shrub layer (5-10 m) is dominated in several areas by the invasive exotic *Ligustrum sinense* (Chinese privet) and may include *Acer negundo* (boxelder), *Halesia diptera* (two-wing silverbell), and *Quercus nigra* (water oak). The moderate (40-50%) short-shrub layer (1-2 m) has the same composition as the tall-shrub layer along with *Styrax grandifolius* (bigleaf snowbell). The moderately dense (70%) herbaceous layer is dominated by *Arundinaria gigantea* ssp. *gigantea* (giant cane); additional species include *Chasmanthium latifolium* (Indian woodoats), *Verbesina alternifolia* (wingstem), *Verbesina occidentalis* (yellow crownbeard), and the invasive exotic *Microstegium vimineum* (Nepalese browntop) which can also dominate. Vines (30%) include *Campsis radicans* (trumpet creeper), *Smilax bona-nox* (saw greenbrier), *Smilax*

rotundifolia (roundleaf greenbrier), *Smilax tamnoides* (bristly greenbrier), and *Vitis rotundifolia* (muscadine).

Global Vegetation: *Betula nigra* (river birch) contributes at least 50%, and often more, of the tree density of stands of this community. *Platanus occidentalis* (American sycamore) may be codominant, or at least prominent, with large individuals overtopping the *Betula* (birch), which tends to have a greater number of stems, but *Platanus occidentalis* (American sycamore) may be more conspicuous because of its larger size. Other canopy associates include *Liriodendron tulipifera* (tuliptree), *Liquidambar styraciflua* (sweetgum), *Acer rubrum* (red maple), *Acer negundo* (boxelder), *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Celtis* (hackberry) spp., and *Quercus* (oak) spp. *Pinus echinata* (shortleaf pine), *Pinus strobus* (eastern white pine), or *Pinus virginiana* (Virginia pine) may be found in some montane or submontane examples. The subcanopy or tall-shrub strata may include *Cornus florida* (flowering dogwood) and *Carpinus caroliniana* (American hornbeam), along with *Acer rubrum* (red maple), *Ilex opaca* (American holly), *Ulmus alata* (winged elm), *Prunus serotina* (black cherry), and *Carya* (hickory) spp. Shrubs and woody vines may include *Alnus serrulata* (hazel alder), *Euonymus americanus* (strawberry bush), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy), and *Vitis rotundifolia* (muscadine). Herbs may include *Boehmeria cylindrica* (smallspike false nettle), *Polygonum virginianum* (jumpseed), *Rudbeckia laciniata* (cutleaf coneflower), *Sanicula* (sanicle) sp., *Symphyotrichum lateriflorum* (calico aster), *Thalictrum dioicum* (early meadow-rue), *Viola sororia* (common blue violet), *Polystichum acrostichoides* (Christmas fern), *Woodwardia areolata* (netted chainfern), *Botrychium dissectum* (cutleaf grapefern), *Botrychium virginianum* (rattlesnake fern), and *Impatiens capensis* (jewelweed). The exotics *Ligustrum sinense* (Chinese privet), *Lonicera japonica* (Japanese honeysuckle), *Microstegium vimineum* (Nepalese browntop), and *Rosa multiflora* (multiflora rose) may spread into disturbed examples of this community. No effort has been made to subdivide this type into northern and southern, or Coastal Plain and Interior variants, although there are undoubtedly some floristic differences between these extremes, at least in the lower strata.

Southeastern Coastal Plain Green Ash - Elm Bottomland Forest (7806)



Characteristic	Value
Color	Pink to Red
Tone	Light to Medium
Texture	Smooth to Coarse
Pattern	Moderate to Dense
Height	Short to Tall
Shape	Long and narrow
Size	Represents roughly three percent of park
Location	Along river bank
Association	6011 and 7312

Horseshoe Bend National Military Park Vegetation: The moderately sparse (40% cover) tree canopy, 20-35 m tall, is made up of *Fraxinus pennsylvanica* (green ash) and *Liquidambar styraciflua* (sweetgum). The moderate (60%) subcanopy (10-20 m) includes *Acer negundo* (boxelder), *Carpinus caroliniana* (American hornbeam), *Morus rubra* (red mulberry), and *Ulmus americana* (American elm). The moderately sparse (40%) tall-shrub layer (5-10 m) contains *Acer rubrum* (red maple), *Carpinus caroliniana* (American hornbeam), and *Halesia diptera* (two-wing silverbell), among others. The sparse (20%) short-shrub layer (1-2 m) is made up of species from the upper layers. The moderately sparse (20%) herbaceous layer is dominated by the invasive exotic *Microstegium vimineum* (Nepalese browntop) and native fern *Polystichum acrostichoides* (Christmas fern).

Global Vegetation: This community typically has an uneven-aged canopy dominated by *Fraxinus pennsylvanica* (green ash), *Ulmus americana* (American elm), and *Celtis laevigata* (sugarberry). Other typical canopy species include *Acer negundo* (boxelder), *Liquidambar styraciflua* (sweetgum), *Acer rubrum* (red maple), *Acer saccharinum* (silver maple), *Morus rubra* (red mulberry), *Platanus occidentalis* (American sycamore), *Ulmus alata* (winged elm), and others. The understory stratum includes *Carpinus caroliniana* (American hornbeam), *Cornus foemina* (stiff dogwood), *Ilex decidua* (possumhaw), *Morus rubra* (red mulberry), and *Crataegus* (hawthorn) spp. The herbaceous and vine

strata are sparse to abundant. Composition may vary somewhat with flooding regime and geographic location. Common species are *Boehmeria cylindrica* (smallspike false nettle), *Carex lupulina* (hop sedge), *Carex retroflexa* (reflexed sedge), *Carex grayi* (Gray's sedge), *Carex abscondita* (thicket sedge), *Pilea pumila* (Canadian clearweed), *Carex louisianica* (Louisiana sedge), *Arisaema dracontium* (green dragon), *Saururus cernuus* (lizard's tail), *Matelea carolinensis* (maroon Carolina milkvine), *Leersia lenticularis* (catchfly grass), *Chasmanthium latifolium* (Indian woodoats), *Justicia ovata* (looseflower water-willow), *Carex intumescens* (greater bladder sedge), and others. Common vine species in this community are *Vitis rotundifolia* (muscadine), *Campsis radicans* (trumpet creeper), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy), *Bignonia capreolata* (crossvine), *Cocculus carolinus* (Carolina coralbead), and others. Some earlier successional stands may contain *Betula nigra* (river birch).

Successional Sweetgum Floodplain Forest (7330)



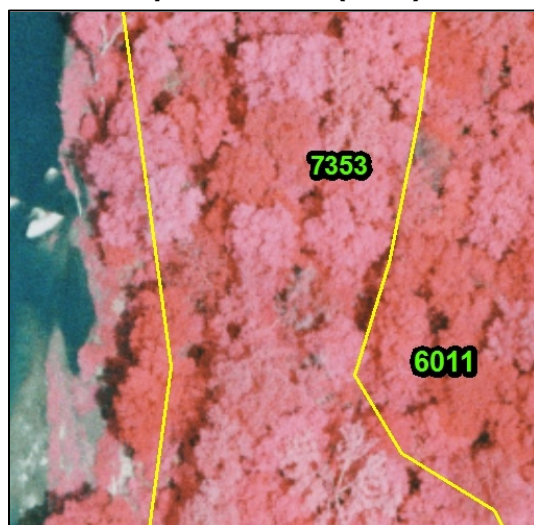
Characteristic	Value
Color	Pink to Red
Tone	Light to Medium
Texture	Medium to Coarse
Pattern	Moderate to Dense
Height	Medium to Tall
Shape	Irregular
Size	Second largest vegetation class in park
Location	Lowland
Association	6011 and 8462

Horseshoe Bend National Military Park Vegetation: The structures (particularly the height of the canopy) of the sampled stands are quite variable, likely due to differences in age. The moderately dense (60-70% cover) tree canopy, 15-35 m tall, is dominated by *Liquidambar styraciflua* (sweetgum) and *Liriodendron tulipifera* (tuliptree) and may include *Carya glabra* (pignut hickory), *Fagus grandifolia* (American beech), *Magnolia virginiana* (sweetbay), *Pinus taeda* (loblolly pine), and *Quercus nigra* (water oak). The moderate (40-60%) subcanopy (15-20 m) includes the canopy species as well as *Acer rubrum* (red maple), *Carpinus caroliniana* (American hornbeam), *Quercus alba* (white oak), and *Ulmus alata* (winged elm). The moderate (30-50%) tall-shrub layer (5-10 m) is made up of saplings of the canopy layers as well as *Carpinus caroliniana* (American hornbeam) and *Halesia diptera* (two-wing silverbell) as is the moderate (40-50%) short-shrub layer (1-2 m) along with *Vaccinium elliotii* (Elliott's blueberry). The herbaceous layer may be lacking or very dense (90%) and is dominated by *Arundinaria gigantea* ssp. *gigantea* (giant cane), when present (up to 90% cover); additional species may include *Carex debilis* (white edge sedge), *Carex digitalis* (slender woodland sedge), *Chasmanthium sessiliflorum* (longleaf woodoats), *Polystichum acrostichoides* (Christmas fern), and *Verbesina occidentalis* (yellow crownbeard), among others. Vines (20-30%) are diverse (9 species recorded in 3 plots) and may include *Berchemia scandens*

(Alabama supplejack), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax rotundifolia* (roundleaf greenbrier), and *Vitis rotundifolia* (muscadine).

Global Vegetation: The canopy of this association is dominated by *Liquidambar styraciflua* (sweetgum) but can be dominated by *Liriodendron tulipifera* (tuliptree) in some cases. *Acer rubrum* (red maple) may be a major component of the canopy and subcanopy and may even partially dominate in some instances (TNC 1998a). In more mature examples, other canopy/subcanopy species which may occur to a lesser extent and often as scattered emergents are *Quercus alba* (white oak), *Quercus phellos* (willow oak), *Quercus nigra* (water oak), *Fraxinus americana* (white ash), *Carya* (hickory) spp., *Nyssa sylvatica* (blackgum), and *Cornus florida* (flowering dogwood). Stands in the Inner Coastal Plain of South Carolina typically contain *Persea palustris* (swamp bay) and *Magnolia virginiana* (sweetbay) (Jones et al. 1981b). The shrub layer contains *Carpinus caroliniana* (American hornbeam), *Itea virginica* (Virginia sweetspire), *Vitis rotundifolia* (muscadine), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax rotundifolia* (roundleaf greenbrier), and *Rubus* (blackberry) sp., in addition to canopy/subcanopy species. *Lonicera japonica* (Japanese honeysuckle) is often abundant in the understory. On disturbed sites, the shrub layer is often dominated by *Ligustrum sinense* (Chinese privet), and the ground layer is typically solid *Microstegium vimineum* (Nepalese browntop) or a tangle of *Smilax rotundifolia* (roundleaf greenbrier) and *Rubus* (blackberry) sp. The herbaceous layer may include *Chasmanthium laxum* (slender woodoats), *Carex* (sedge) spp., *Boehmeria cylindrica* (smallspike false nettle), and *Botrychium biternatum* (sparselobe grapefern), sometimes growing on hummocks in standing water. Various *Carex* (sedge) species may be present.

Sweetgum - Cherrybark Oak Floodplain Forest (7353)

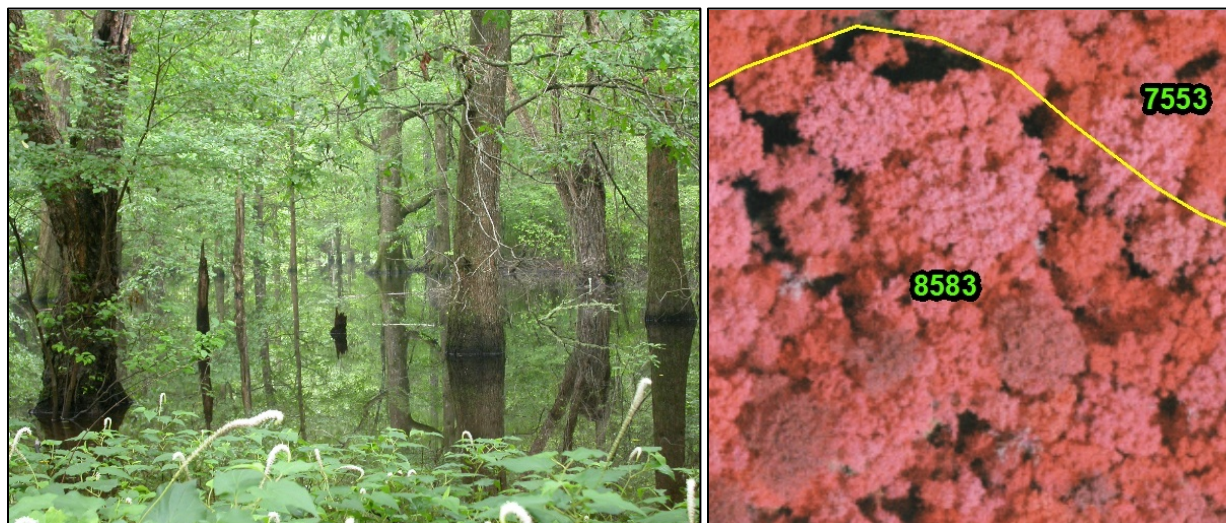


Characteristic	Value
Color	Pink to Red
Tone	Light to Medium
Texture	Medium to Coarse
Pattern	Moderate to Dense
Height	Tall
Shape	Typically elongated
Size	Less than one percent of total park area
Location	Usually follows outline of adjacent water bodies
Association	7330

Horseshoe Bend National Military Park Vegetation: The moderately dense (70% cover) tree canopy, 20-35 m tall, is codominated by *Carya cordiformis* (bitternut hickory) and *Quercus nigra* (water oak) and may include *Juglans nigra* (black walnut), *Liriodendron tulipifera* (tuliptree), and *Platanus occidentalis* (American sycamore). The moderate (60%) subcanopy (15-20 m) includes *Acer negundo* (boxelder), *Carya cordiformis* (bitternut hickory), *Liquidambar styraciflua* (sweetgum), *Quercus nigra* (water oak), and *Ulmus americana* (American elm), among others. The moderate (60%) tall-shrub layer (5-10 m) is may be dominated by *Asimina triloba* (pawpaw), *Carpinus caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), *Halesia diptera* (two-wing silverbell), *Liquidambar styraciflua* (sweetgum), and/or *Ulmus alata* (winged elm). The moderate (50-60%) short-shrub layer (1-2 m) includes *Asimina triloba* (pawpaw), *Carpinus caroliniana* (American hornbeam), *Halesia diptera* (two-wing silverbell), and *Ostrya virginiana* (hophornbeam). The moderately dense (60-70%) herbaceous layer is dominated by *Arundinaria gigantea* ssp. *Gigantea* (giant cane) and may include *Carex digitalis* (slender woodland sedge), *Chasmanthium sessiliflorum* (longleaf woodoats), *Dichanthelium boscii* (Bosc's panicgrass), and *Verbesina occidentalis* (yellow crownbeard). Vines (20-40%) include *Smilax rotundifolia* (roundleaf greenbrier) and *Vitis rotundifolia* (muscadine), among others.

Global Vegetation: The canopy of stands of this bottomland hardwood forest is dominated by *Liquidambar styraciflua* (sweetgum), *Quercus pagoda* (cherrybark oak), and *Carya* (hickory) spp. (including *Carya cordiformis* (bitternut hickory), *Carya ovata* (shagbark hickory), *Carya laciniata* (shellbark hickory), *Carya ovalis* (red hickory)). The understory may contain *Carpinus caroliniana* (American hornbeam), *Fraxinus pennsylvanica* (green ash), *Ulmus americana* (American elm), *Carya alba* (mockernut hickory), *Carya ovalis* (red hickory), and *Quercus nigra* (water oak). Portions of the stand may exhibit canopy dominance by *Liquidambar styraciflua* (sweetgum), *Platanus occidentalis* (American sycamore), and *Carya* (hickory) spp, with lower coverage by oaks. Shrubs include *Asimina triloba* (pawpaw), *Arundinaria gigantea* (giant cane) and *Ilex decidua* (possumhaw), along with smaller individuals of successional tree species such as *Acer negundo* (boxelder) and *Celtis laevigata* (sugarberry). Woody and herbaceous vines found here include *Bignonia capreolata* (crossvine), *Vitis rotundifolia* (muscadine), *Parthenocissus quinquefolia* (Virginia creeper), *Dioscorea villosa* (wild yam), *Smilax bona-nox* (saw greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Menispermum canadense* (common moonseed), *Toxicodendron radicans* (eastern poison ivy), *Amphicarpaea bracteata* (American hogpeanut), and *Passiflora lutea* (yellow passionflower). Herbs include *Arisaema dracontium* (green dragon), *Arisaema triphyllum* (Jack in the pulpit), *Aristolochia serpentaria* (Virginia snakeroot), *Hymenocallis caroliniana* (Carolina spiderlily), *Ruellia* (wild petunia) sp., *Leersia* (cutgrass) sp., *Boehmeria cylindrica* (smallspike false nettle), *Laportea canadensis* (Canadian woodnettle), *Polygonum virginianum* (jumpseed), *Spigelia marilandica* (woodland pinkroot), *Carex debilis* (white edge sedge), *Carex grayi* (Gray's sedge), *Carex squarrosa* (squarrose sedge), *Carex tribuloides* (blunt broom sedge), *Chasmanthium latifolium* (Indian woodoats), *Viola* (violet) spp., and *Commelina virginica* (Virginia dayflower). The exotics *Ligustrum sinense* (Chinese privet), *Alliaria petiolata* (garlic mustard), and *Microstegium vimineum* (Nepalese browntop) may be present in examples of this association.

Overcup Oak - Sweetgum Forest (8583)



Characteristic	Value
Color	Pink to Red
Tone	Light to Dark
Texture	Coarse
Pattern	Moderate to Dense
Height	Medium to Tall
Shape	Rectangular
Size	Represent less than one percent of total park area
Location	Wetland
Association	4719, 7353, and 7261

Horseshoe Bend National Military Park Vegetation: The moderately dense (70% cover) tree canopy, 20-35 m tall, is dominated exclusively by *Quercus lyrata* (overcup oak). The moderate (50%) subcanopy (15-20 m) includes *Acer rubrum* (red maple), *Quercus lyrata* (overcup oak), and *Quercus phellos* (willow oak). The moderate (50%) tall-shrub layer (5-10 m) is dominated by *Acer rubrum* (red maple) and the sparse (20%) short-shrub layer (1-2 m) by *Itea virginica* (Virginia sweetspire). The very sparse (<5%) herbaceous layer includes *Panicum rigidulum* (redtop panicgrass) and *Pluchea camphorata* (camphor pluchea).

Global Vegetation: Stands are dominated by a variable combination of *Quercus lyrata* (overcup oak), *Liquidambar styraciflua* (sweetgum), and *Quercus phellos* (willow oak). The use of *Liquidambar styraciflua* (sweetgum) as a nominal indicates a shorter hydroperiod than *Quercus lyrata* (overcup oak) by itself. Occasional examples have a canopy dominated by *Quercus phellos* (willow oak) almost exclusively. One example on the Chattahoochee floodplain in Alabama on Fort Benning is dominated by *Fraxinus pennsylvanica* (green ash) with lesser amounts of *Quercus phellos* (willow oak). These are small-scale seasonally flooded depressions in a temporarily flooded bottomland that appear to flood more often as the result of rainfall accumulation rather than stream or

river overflow. *Quercus lyrata* (overcup oak) dominates the center of the depressions (the wettest areas) with *Quercus phellos* (willow oak) and *Liquidambar styraciflua* (sweetgum) fringing the depressions. The open subcanopy is well-developed and contains *Carpinus caroliniana* (American hornbeam), *Acer rubrum* (red maple), and *Ulmus alata* (winged elm) in addition to canopy species regeneration. Shrubs are sparse and include *Ilex decidua* (possumhaw) and *Rubus* (blackberry) spp. Herbaceous vegetation is also sparse (<5% cover) and includes *Carex* (sedge) spp. and *Zephyranthes atamasca* (Atamasco lily) on small rises in the soil surface. The vast majority of the ground surface (95% or more) is covered by a combination of leaf detritus in various stages of decomposition, and exposed mud.

Upper East Gulf Coastal Plain Sweetbay - Blackgum Seepage Forest (8552)



Characteristic	Value
Color	Pink to Red
Tone	Light to Medium
Texture	Coarse
Pattern	Moderate to Dense
Height	Medium
Shape	Long and narrow
Size	Less than two percent of total area
Location	Typically along drainage networks
Association	6011, 8462, 7201, 7330

Horseshoe Bend National Military Park Vegetation: The moderately dense (60-70% cover) tree canopy, 15-35 m tall, is dominated by *Magnolia virginiana* (sweetbay) and *Liquidambar styraciflua* (sweetgum) and may include substantial amounts of *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Quercus nigra* (water oak), and/or *Quercus phellos* (willow oak). The moderately dense (60-70%) subcanopy (10-20 m) is dominated by *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), and *Magnolia virginiana* (sweetbay) and may include *Cornus florida* (flowering dogwood), *Fagus grandifolia* (American beech), and *Juniperus virginiana* var. *virginiana* (eastern redcedar). The moderate (50%) tall-shrub layer (5-10 m) is made up of saplings of the tree species as well as *Carpinus caroliniana* (American hornbeam). The moderately sparse (40%) short-shrub layer (1-2 m) includes *Callicarpa americana* (American beautyberry), *Ilex opaca* (American holly), *Magnolia virginiana* (sweetbay), and *Vaccinium elliotii* (Elliott's blueberry). The sparse to moderate (30-60%) herbaceous layer may include *Arundinaria gigantea* ssp. *gigantea* (giant cane), *Chasmanthium sessiliflorum* (longleaf woodoats), *Dichanthelium dichotomum* (cypress panicgrass), *Juncus coriaceous* (leathery rush), *Polystichum acrostichoides* (Christmas fern), and *Woodwardia areolata* (netted chainfern). Vines (30-40%) include *Gelsemium sempervirens* (evening

trumpetflower), *Smilax rotundifolia* (roundleaf greenbrier), and *Vitis rotundifolia* (muscadine), among others. This community also supports state-vulnerable *Gentiana saponaria* (harvestbells).

Global Vegetation: The canopy is dominated by the nominal species, *Magnolia virginiana* (sweetbay) and *Nyssa biflora* (swamp tupelo); *Acer rubrum* var. *trilobum* (red maple), *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Pinus taeda* (loblolly pine), and *Quercus nigra* (water oak) can also be important. The subcanopy typically contains the canopy species and additionally *Oxydendrum arboreum* (sourwood). These species may also occur in the shrub stratum, along with *Photinia pyrifolia* (red chokeberry), *Alnus serrulata* (hazel alder), *Arundinaria gigantea* ssp. *tecta* (switchcane), *Illicium floridanum* (Florida anisetree), *Itea virginica* (Virginia sweetspire), *Leucothoe racemosa* (swamp doghobble), *Morella caroliniensis* (southern bayberry), *Rhododendron* (rhododendron) sp. (deciduous), *Vaccinium fuscatum* (black highbush blueberry), and *Viburnum nudum* var. *nudum* (possumhaw). Lianas include *Decumaria barbara* (woodvamp), *Smilax laurifolia* (laurel greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy), and *Vitis rotundifolia* (muscadine). Herbs are sparse, consisting primarily of *Mitchella repens* (partridgeberry), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* var. *spectabilis* (royal fern), and *Woodwardia areolata* (netted chainfern). *Sphagnum* (sphagnum) spp. are usually abundant.

East Gulf Coastal Plain Shortleaf - Loblolly Pine Forest (8493)



Characteristic	Value
Color	Red to Dark Red
Tone	Dark
Texture	Coarse
Pattern	Moderate to Dense
Height	Medium to Tall
Shape	Irregular
Size	Less than two percent of total area
Location	
Association	6011, 8462, 8437, and 7221

Horseshoe Bend National Military Park Vegetation: The moderate (60% cover) tree canopy, 20-35 m tall, is dominated by *Pinus taeda* (loblolly pine) and includes *Carya glabra* (pignut hickory), *Liriodendron tulipifera* (tuliptree), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Quercus falcata* (southern red oak), and a small amount of *Pinus echinata* (shortleaf pine). The sparse (30%) subcanopy (10-15 m) includes canopy species along with *Oxydendrum arboreum* (sourwood) and *Nyssa sylvatica* (blackgum). The moderate (40%) tall-shrub layer (5-10 m) is dominated by *Cornus florida* (flowering dogwood). The sparse (30%) short-shrub layer (1-2 m) is dominated by *Vaccinium pallidum* (Blue Ridge blueberry) and includes saplings of *Acer rubrum* (red maple), *Carya glabra* (pignut hickory), *Liquidambar styraciflua* (sweetgum), *Nyssa sylvatica* (blackgum), and *Ostrya virginiana* (hophornbeam), among others. The very sparse (<5%) herbaceous layer includes trace amounts of *Dioscorea villosa* (wild yam), *Lilium michauxii* (Carolina lily), *Pteridium aquilinum* var. *pseudocaudatum* (western brackenfern), and *Trillium catesbaei* (bashful wakerobin), among others. The dominant vine (40%) is *Vitis rotundifolia* (muscadine).

Global Vegetation: The open canopy is characterized by *Pinus echinata* (shortleaf pine) and a mixture of mesic hardwoods, including *Quercus alba* (white oak), *Quercus stellata* (post oak), *Carya*

alba (mockernut hickory), *Carya glabra* (pignut hickory), *Quercus falcata* (southern red oak), and *Quercus velutina* (black oak). In addition to overstory species, the subcanopy includes *Cornus florida* (flowering dogwood), *Oxydendrum arboreum* (sourwood), *Nyssa sylvatica* (blackgum), and *Liquidambar styraciflua* (sweetgum). The patchy shrub layer includes *Vaccinium elliotii* (Elliott's blueberry), *Asimina parviflora* (smallflower pawpaw), *Aesculus pavia* (red buckeye), *Hamamelis virginiana* (American witchhazel), and *Arundinaria gigantea* (giant cane). This community has a sparse herbaceous layer including *Piptochaetium avenaceum* (blackseed speargrass), *Chasmanthium sessiliflorum* (longleaf woodoats), *Elephantopus tomentosus* (devil's grandmother), *Hexastylis arifolia* (littlebrownjug), *Iris verna* (dwarf violet iris), *Rudbeckia fulgida* (orange coneflower), *Solidago juncea* (early goldenrod), *Euphorbia pubentissima* (false flowering spurge), and *Mitchella repens* (partridgeberry).

Montane Mixed Longleaf Woodland (8437)



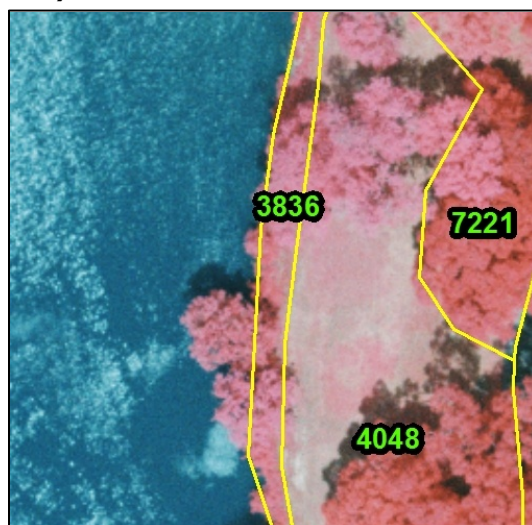
Characteristic	Value
Color	Red
Tone	Medium to Dark
Texture	Coarse
Pattern	Sparse to Moderate
Height	Tall
Shape	Small patches
Size	Less than two percent of total park area
Location	Typically upland areas
Association	6011, 8493, and 7217

Horseshoe Bend National Military Park Vegetation: The moderate (50-70% cover) tree canopy, 20-35 m tall, is dominated by *Pinus palustris* (longleaf pine); additional canopy species may include lesser amounts of *Liquidambar styraciflua* (sweetgum), *Pinus echinata* (shortleaf pine), *Quercus alba* (white oak), and *Quercus falcata* (southern red oak). The moderate (60%) subcanopy (15-20 m) may include *Pinus palustris* (longleaf pine) and *Pinus taeda* (loblolly pine) along with *Liriodendron tulipifera* (tuliptree) and *Quercus falcata* (southern red oak), among others. The moderate (60%) tall-shrub layer (5-15 m) is dominated by *Cornus florida* (flowering dogwood) and may include *Fagus grandifolia* (American beech), *Liquidambar styraciflua* (sweetgum), *Nyssa sylvatica* (blackgum), *Oxydendrum arboreum* (sourwood), and sapling canopy species. The moderately sparse (40%) short-shrub layer (1-5 m) includes *Acer rubrum* (red maple), *Cornus florida* (flowering dogwood), and *Vaccinium arboreum* (farkleberry). The very sparse (<5-20%) herbaceous layer includes *Chasmanthium sessiliflorum* (longleaf woodoats) and *Polystichum acrostichoides* (Christmas fern). Vines (10-50%) are dominated by *Vitis rotundifolia* (muscadine) and include *Gelsemium sempervirens* (evening trumpetflower) and *Smilax rotundifolia* (roundleaf greenbrier).

Global Vegetation: Vegetation structure is variable and depends on frequency and recency of fire. The canopy is open to closed. In addition to *Pinus palustris* (longleaf pine), the canopy may include

Pinus echinata (shortleaf pine), *Pinus taeda* (loblolly pine), and *Pinus virginiana* (Virginia pine). Subcanopy species present include *Quercus marilandica* (blackjack oak), *Quercus stellata* (post oak), *Quercus prinus* (chestnut oak), *Quercus coccinea* (scarlet oak), *Quercus velutina* (black oak), *Quercus falcata* (southern red oak), and *Quercus alba* (white oak). Other characteristic subcanopy trees are *Nyssa sylvatica* (blackgum), *Oxydendrum arboreum* (sourwood), *Acer rubrum* var. *rubrum* (red maple), *Sassafras albidum* (sassafras), *Carya pallida* (sand hickory), *Carya alba* (mockernut hickory), and sometimes *Cornus florida* (flowering dogwood). At Sprewell Bluff State Park (Pine Mountain, Georgia), stands of this type include some oak associates more typical of sandhill longleaf pine communities such as *Quercus laevis* (turkey oak) and *Quercus margarettiae* (runner oak). It is believed that in the historically more frequently burned landscape, pines, and especially *Pinus palustris* (longleaf pine) and *Pinus echinata* (shortleaf pine) would have predominated in the canopy, with some oaks as well. Following fire exclusion, the oaks and less fire-tolerant pines (*Pinus virginiana* (Virginia pine) and *Pinus taeda* (loblolly pine)) increase their importance. The shrub stratum is of variable density; characteristic species include *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium arboreum* (farkleberry), *Vaccinium stamineum* (deerberry), *Symplocos tinctoria* (common sweetleaf), and (in some portions of the range) *Gaylussacia frondosa* (blue huckleberry) and *Vaccinium tenellum* (small black blueberry). Woody vines include *Smilax glauca* (cat greenbrier) and *Vitis rotundifolia* (muscadine). The herb layer may be highly suppressed following fire exclusion and canopy closure, but can be dense and grassy with fire. Characteristic species are *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), *Andropogon ternarius* (splitbeard bluestem), *Danthonia sericea* (downy danthonia), *Danthonia spicata* (poverty oatgrass), *Iris verna* (dwarf violet iris), *Pteridium aquilinum* var. *pseudocaudatum* (western brackenfern), *Solidago odora* var. *odora* (anisescented goldenrod), *Tephrosia virginiana* (Virginia tephrosia), *Clitoria mariana* (Atlantic pigeonwings), *Lespedeza* (lespedeza) spp., *Desmodium* (ticktrefoil) spp., *Pityopsis graminifolia* var. *latifolia* (narrowleaf silkgrass), *Dichanthelium commutatum* (variable panicgrass), *Coreopsis major* (greater tickseed), *Silphium compositum* (kidneyleaf rosinweed), *Parthenium integrifolium* var. *integrifolium* (wild quinine), *Scleria triglomerata* (whip nutrush), *Liatris* (blazing star) sp., and *Solidago* (goldenrod) sp.

Floodplain Canebrake (3836)



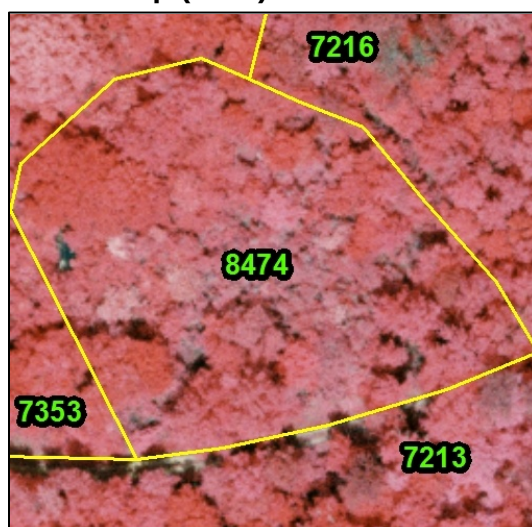
Characteristic	Value
Color	Pink
Tone	Light
Texture	Smooth to Medium
Pattern	Open
Height	Short
Shape	Long and narrow
Size	Second smallest class in park.
Location	Along bank of Tallapoosa River
Association	4048

Horseshoe Bend National Military Park Vegetation: The sparse (20%) short-shrub layer (1-2 m) includes *Cornus amomum* (silky dogwood) and *Sambucus canadensis* (common elderberry). The moderate (50%) herbaceous layer is dominated by *Arundinaria gigantea ssp. gigantea* (giant cane) and includes *Chasmanthium latifolium* (Indian woodoats), *Dichanthelium clandestinum* (deertongue), *Eupatorium serotinum* (lateflowering thoroughwort), *Rubus argutus* (sawtooth blackberry), *Verbesina alternifolia* (wingstem), and *Verbesina occidentalis* (yellow crownbeard). Vines (30%) include *Smilax bona-nox* (saw greenbrier) and *Vitis rotundifolia* (muscadine).

Global Vegetation: The vegetation is dominated by *Arundinaria gigantea* (giant cane). Little else is known about its vegetational characteristics. However, information on its historic patterns of distribution provides some clues as to its ecology. General Land Office surveys and other historical accounts indicate that canebrakes were present in southern Illinois, southern Indiana, Kentucky, Missouri, Arkansas, eastern Texas, Louisiana, Tennessee, Mississippi, Alabama, Georgia, and South Carolina. Historical accounts refer to both "pure" stands of cane without an overstory of trees (cane shrublands) and areas with variable overstory closure (woodlands or forests) but with a dense understory dominated by cane as "canebrakes." As currently described, this association refers only to the former, cane shrublands. Cane was abundant along the Wabash and Ohio drainage systems (B.

McClain pers. comm. 2000). In Missouri, these canebrakes were also thought to be common in the Ozark Highlands, particularly in southward draining rivers and streams with finer-textured, more developed soils on upper floodplain terraces (T. Nigh pers. comm. 2000). Stands may be found along larger rivers (Buffalo, White, Norfork) in the Arkansas Ozarks in addition to the Ouachitas. In the Central Appalachians various wetlands, including those on alluvial or loess substrates (streamside flats, bottomlands), were dominated by *Arundinaria* (cane), without an overstory, or with widely scattered trees (Central Appalachian Forest Ecoregional Team pers. comm. 1998). Historic accounts describe large expanses (one area was described as 75 miles long by 1-3 miles wide) of an "ocean of cane" in bottomlands of the Coastal Prairie of Texas (Smeins et al. 1992). No extant occurrences of this vegetation are known from this area today.

Southeastern Smooth Alder Swamp (8474)



Characteristic	Value
Color	Pink to Red
Tone	Light to Medium
Texture	Smooth to Medium
Pattern	Open to Moderate
Height	Short to Medium
Shape	Small patches
Size	Less than one percent of the total park area
Location	Wetland
Association	8462, 7312, 7213, 7330, and 7216

Horseshoe Bend National Military Park Vegetation: The moderately dense (70%) tall-shrub layer (5-10 m) is dominated by *Alnus serrulata* (hazel alder); additional species include sapling *Acer rubrum* (red maple), *Magnolia virginiana* (sweetbay), and *Quercus michauxii* (swamp chestnut oak). *Alnus serrulata* (hazel alder) also dominates the moderately sparse (40%) short-shrub layer (1-2 m) which includes *Acer rubrum* (red maple), *Cornus amomum* (silky dogwood), and *Ilex verticillata* (common winterberry). The very dense (100%) herbaceous layer is dominated by the invasive exotic *Microstegium vimineum* (Nepalese browntop) to the near exclusion of any other species. Native species at trace amounts include *Boehmeria cylindrica* (smallspike false nettle), *Commelina virginica* (Virginia dayflower), *Geum canadense* (white avens), *Juncus effusus* (common rush), *Onoclea sensibilis* (sensitive fern), *Rubus argutus* (sawtooth blackberry), *Solidago rugosa* (wrinkleleaf goldenrod), *Symphytotrichum lateriflorum* (calico aster), *Triadenum walteri* (greater marsh St. Johnswort), and others.

Global Vegetation: Stands of this vegetation are dominated by tall shrubs and are characterized by some combination of *Alnus serrulata* (hazel alder), *Viburnum* (viburnum) spp., *Cornus* (dogwood) spp., and *Salix* (willow) spp. In addition, saplings of *Acer rubrum* (red maple) are typical. Other shrubs present may include *Cephalanthus occidentalis* (common buttonbush), *Decodon verticillatus*

(swamp loosestrife), and *Ilex verticillata* (common winterberry). Herbaceous associates include *Osmunda regalis* (royal fern), *Thelypteris palustris* (eastern marsh fern), *Boehmeria cylindrica* (smallspike false nettle), *Polygonum sagittatum* (arrowleaf tearthumb), *Commelina virginica* (Virginia dayflower), *Galium* (bedstraw) spp., *Lycopus* (waterhorehound) spp., *Typha latifolia* (broadleaf cattail), *Peltandra virginica* (green arrow arum), *Mikania scandens* (climbing hempvine), and *Carex* (sedge) spp. (e.g., *Carex crinita* (fringed sedge), *Carex atlantica* (prickly bog sedge)). Tree species such as *Acer rubrum* (red maple) and *Juglans nigra* (black walnut) may exist on the fringes of such an association, occasionally overshadowing parts of it. The exotic *Murdannia keisak* (wartremoving herb) may also be present.

Bahia Grass Herbaceous Vegetation (4700)

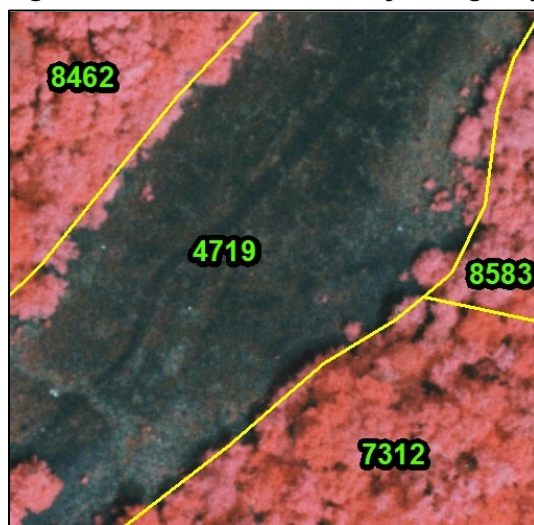


Characteristic	Value
Color	Pink
Tone	Light
Texture	Smooth
Pattern	Open
Height	Short
Shape	Irregular
Size	Represents three percent of park
Location	Wetland, Low areas
Association	7330, 8462, 8493, 6011, and 7221

Horseshoe Bend National Military Park Vegetation: The dense (80%) herbaceous layer is dominated by *Paspalum notatum* (bahia grass) and includes lesser amounts of *Cynodon dactylon* (Bermudagrass), *Paspalum dilatatum* (dallisgrass), *Paspalum urvillei* (Vasey's grass), and *Solanum carolinense* (Carolina horsenettle).

Global Vegetation: These improved pastures, roadsides and lawns are dominated by *Paspalum notatum* (bahia grass), with varying degrees of native composition remaining. Various remnant native species occur to varying degrees and are sometimes codominant.

Highland Rim Pond (Woolgrass Bulrush - Threeway Sedge Type) (4719)



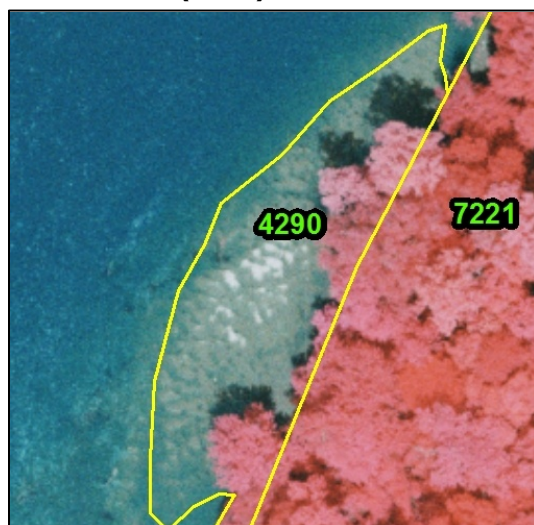
Characteristic	Value
Color	Dark gray to black
Tone	Dark
Texture	Smooth
Pattern	Open
Height	Short
Shape	Long and narrow
Size	
Location	Lowland areas
Association	8583, 8462, 7312

Horseshoe Bend National Military Park Vegetation: The dense (80%) herbaceous layer is dominated almost exclusively by *Panicum rigidulum* (redtop panicgrass) but does include small amounts of *Pluchea camphorata* (camphor pluchea) and *Polygonum hydropiperoides* (swamp smartweed).

Global Vegetation: The vegetation is typically dominated by patches or zones of *Scirpus cyperinus* (woolgrass), possibly with thick mats of *Dulichium* (dulichium). In addition to these, various *Carex* (sedge) spp., *Juncus coriaceus* (leathery rush), *Juncus effusus* (common rush), *Osmunda regalis* var. *spectabilis* (royal fern), *Panicum rigidulum* (redtop panicgrass), *Rhynchospora* (beaksedge) spp., and scattered *Itea virginica* (Virginia sweetspire) and *Cephalanthus occidentalis* (common buttonbush) are often found. Floristics and gradient expression vary with context and management. Some examples (Interior Low Plateau of Tennessee) may have additional small trees and shrubs, such as *Hibiscus moscheutos* (crimson-eyed rosemallow), *Liquidambar styraciflua* (sweetgum), *Quercus phellos* (willow oak), and *Rosa palustris* (swamp rose) scattered within. The Upper East Gulf Coastal Plain (Alabama) example has *Nyssa biflora* (swamp tupelo), *Alnus serrulata* (hazel alder), *Itea virginica* (Virginia sweetspire), *Liquidambar styraciflua* (sweetgum), *Pinus taeda* (loblolly pine) and *Acer rubrum* var. *trilobum* (red maple) as scattered woody plants. *Scirpus cyperinus* (woolgrass) may

share dominance with *Panicum rigidulum* var. *elongatum* (redtop panicgrass) and *Rhynchospora corniculata* (shortbristle horned beaksedge) on drier ground surrounding the pond center, or scattered about on hummocks. Zones or areas of deeper water may support floating aquatics, including *Nymphaea odorata* (American white waterlily) and *Utricularia gibba* (humped bladderwort). In more open examples (Tennessee), some other species present may include *Xyris laxifolia* var. *iridifolia* (irisleaf yelloweyed grass), *Carex bullata* (button sedge), *Carex gigantea* (giant sedge), *Carex lurida* (shallow sedge), *Calamagrostis coarctata* (arctic reedgrass), *Leersia hexandra* (southern cutgrass), *Rhynchospora corniculata* (shortbristle horned beaksedge), *Rhynchospora glomerata* (clustered beaksedge), *Rhynchospora perplexa* (pineland beaksedge), *Andropogon virginicus* (broomsedge bluestem), *Dichanthelium scoparium* (velvet panicum), *Dichanthelium dichotomum* var. *ramulosum*, *Dichanthelium longiligulatum* (coastalplain panicgrass), *Saccharum baldwinii* (narrow plumegrass), and *Proserpinaca pectinata* (combleaf mermaidweed). Some additional herbaceous species seen in the Alabama occurrence include *Eleocharis* (spikerush) sp., *Ludwigia alternifolia* (seedbox), *Ludwigia leptocarpa* (anglestem primrose-willow), *Ludwigia palustris* (marsh seedbox), *Lycopus* (waterhorehound) sp., *Rhexia mariana* (Maryland meadowbeauty), *Rhynchospora chalarocephala* (loosehead beaksedge), *Triadenum virginicum* (Virginia marsh St. Johnswort), and *Xyris smalliana* (Small's yelloweyed grass). The vegetation may consist of monospecific clumps of the component species, which are present around the pond margin, or scattered clumps in examples with less clear zonation.

Smartweed - Cutgrass Beaver Pond (4290)



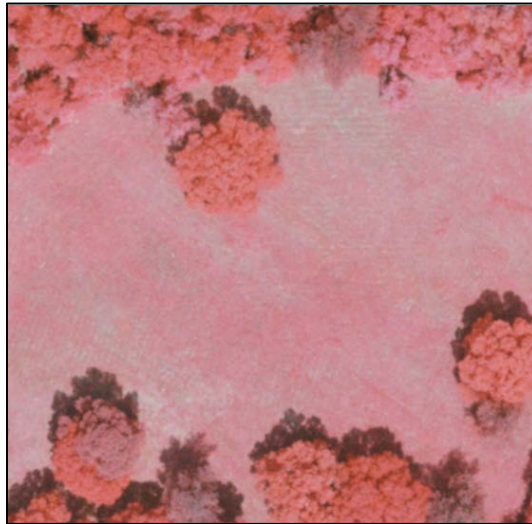
Characteristic	Value
Color	White to Pink
Tone	Light
Texture	Smooth
Pattern	Open
Height	n/a
Shape	Long and narrow
Size	Smallest class inside park
Location	Along Tallapoosa River
Association	7221

Horseshoe Bend National Military Park Vegetation: The moderately dense (70%) herbaceous layer is dominated by *Leersia oryzoides* (rice cutgrass) and includes *Agrostis stolonifera* (creeping bentgrass), *Eupatorium serotinum* (lateflowering thoroughwort), *Pluchea camphorata* (camphor pluchea), *Polygonum punctatum* (dotted smartweed), *Polygonum sagittatum* (arrowleaf tearthumb), and others.

Global Vegetation: Stands of this vegetation are dominated by some combination of *Polygonum punctatum* (dotted smartweed), *Polygonum hydropiperoides* (swamp smartweed), *Leersia lenticularis* (catchfly grass), *Leersia oryzoides* (rice cutgrass), and/or *Leersia virginica* (whitegrass). Other herbaceous species which may be present include *Polygonum densiflorum* (denseflower knotweed), *Saururus cernuus* (lizard's tail), *Proserpinaca* (mermaidweed) sp., *Sparganium americanum* (American bur-reed), *Typha latifolia* (broadleaf cattail), *Scirpus cyperinus* (woolgrass), *Lobelia cardinalis* (cardinalflower), *Onoclea sensibilis* (sensitive fern), *Penthorum sedoides* (ditch stonecrop), *Boehmeria cylindrica* (smallspike false nettle), *Sambucus canadensis* (common elderberry), *Bidens aristosa* (bearded beggarticks), and *Xanthium strumarium* (rough cocklebur). Scattered individuals of *Cephalanthus occidentalis* (common buttonbush) and *Acer saccharinum* (silver maple) or other woody plants may be present. Examples which have become dried-out

(through drought and/or beaver dam failure) may exhibit greater dominance by *Leersia* (cutgrass) rather than *Polygonum* (knotweed). The combination of *Polygonum punctatum* - *Leersia virginica* was first noted, but the combination of *Polygonum hydropiperoides* (swamp smartweed) and *Leersia lenticularis* (catchfly grass) has also been observed in the Oconee National Forest.

Open Grass (4048)



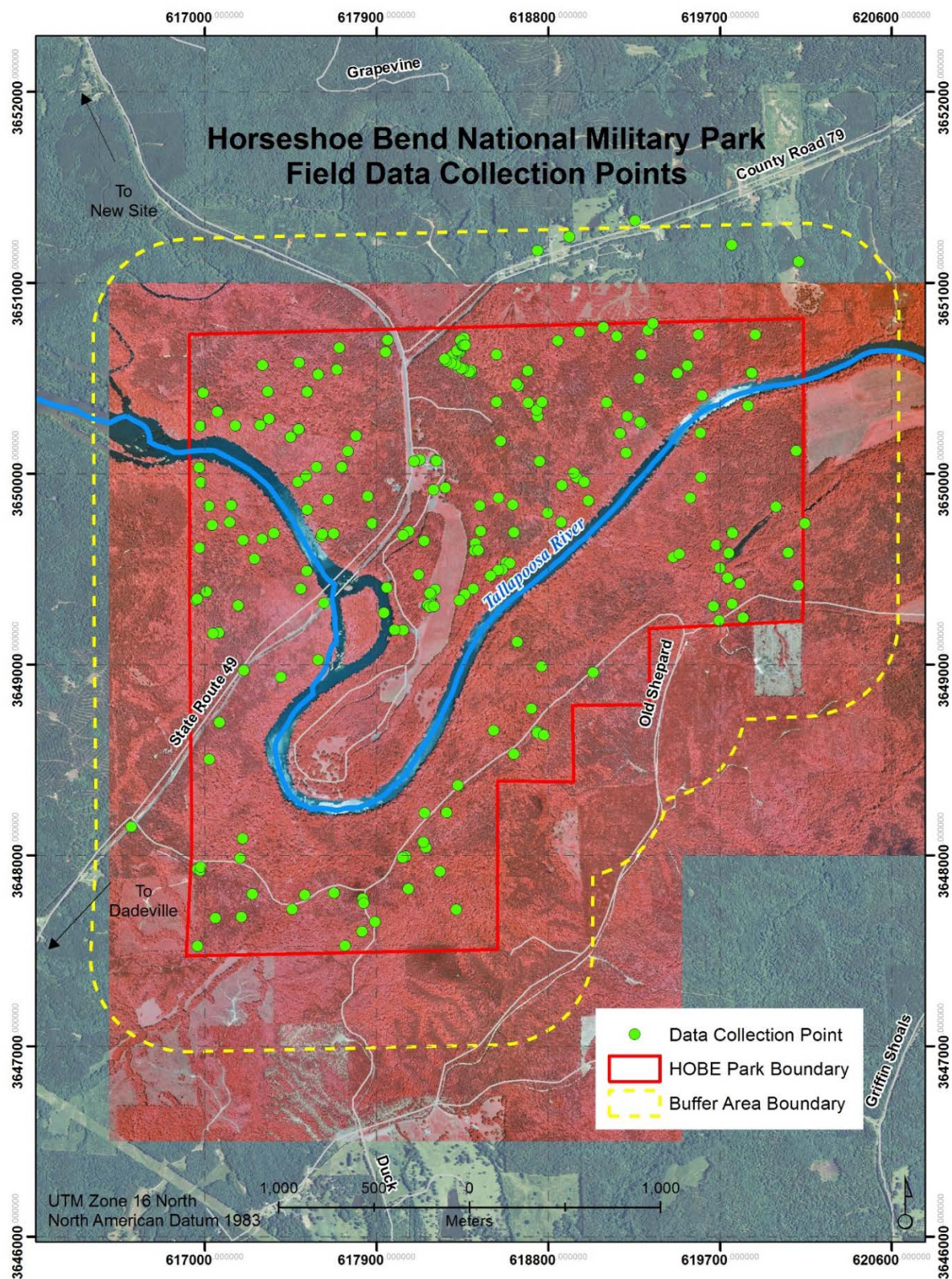
Characteristic	Value
Color	Pink
Tone	Light
Texture	Smooth
Pattern	Open
Height	Short
Shape	Irregular
Size	3%
Location	Wetland, Low areas
Association	8462, 7330

Summary: This association includes grassland pastures and hayfields, more-or-less cultural, though sometimes no longer actively maintained. It is currently defined for the Central and Southern Appalachians, Ozarks, Ouachita Mountains, and parts of the Piedmont and Interior Low Plateau, but it is possible throughout much of the eastern United States and southern Canada. The dominant species in this type are the European "tall or meadow fescues" of uncertain and controversial generic placement. Several other exotic grasses (*Agrostis gigantea*, *Dactylis glomerata*, *Holcus lanatus*, *Phleum pratense*, and *Poa pratensis*, for example) are common associates. These communities are sometimes nearly monospecific but can also be very diverse and contain many native as well as exotic species of grasses, sedges, and forbs. Exotic forbs include the legumes *Lespedeza cuneata*, *Trifolium campestre*, *Trifolium hybridum*, *Trifolium pratense*, and *Trifolium repens*, as well as *Achillea millefolium*, *Calystegia sepium*, *Daucus carota*, *Leucanthemum vulgare*, *Oxalis stricta*, and *Plantago lanceolata*. Common native herbs include *Apocynum cannabinum*, *Desmodium canescens*, *Dichanthelium clandestinum*, *Erigeron annuus*, *Fragaria virginiana*, *Potentilla simplex*, *Solanum carolinense*, *Solidago canadensis*, and *Verbesina occidentalis*.

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Appendix E. Field Verification Sampling Locations.



Appendix F. Draft Vegetation Map for Horseshoe Bend National Military Park

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 407/126819, October 2014

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