VASCULAR PLANT INVENTORY AND PLANT COMMUNITY CLASSIFICATION FOR NINETY SIX NATIONAL HISTORIC SITE

Report for the Vertebrate and Vascular Plant Inventories:
Appalachian Highlands and Cumberland/Piedmont Network

Prepared by NatureServe for the National Park Service
Southeast Regional Office
November 2003

NatureServe is a non-profit organization providing the scientific knowledge that forms the basis for effective conservation action.

A NatureServe Technical Report
Prepared for the National Park Service under Cooperative Agreement H 5028 01 0435.

Citation:
White, Jr., Rickie D. and Tom Govus. 2003. *Vascular Plant Inventory and Plant Community Classification for Ninety Six National Historic Site.* Durham, North Carolina: NatureServe.

© 2003 NatureServe

NatureServe
6114 Fayetteville Road, Suite 109
Durham, NC 27713
919-484-7857

International Headquarters
1101 Wilson Boulevard, 15th Floor
Arlington, Virginia 22209
www.natureserve.org

National Park Service
Southeast Regional Office
Atlanta Federal Center
1924 Building
100 Alabama Street, S.W.
Atlanta, GA 30303

The view and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. Government. Mention of trade names or commercial products does not consitute their endorsement by the U.S. Government.

This report consists of the main report along with a series of appendices with information about the plants and plant communities found at the site. Electronic files have been provided to the National Park Service in addition to hard copies. Current information on all communities described here can be found on NatureServe Explorer at www.natureserve.org/explorer.

Cover photo: Rain lily (*Zephranthes atamasca*) blooming in April 2002 along Ninety Six Creek. Photo by Rickie White.

Acknowledgments

We wish to thank all park employees, co-workers, volunteers, and academics who helped with aspects of the preparation, field work, specimen identification, and report writing for this project.

Chief of Resource Management Eric Williams dispensed useful advice concerning the best places to find older trees and interesting geographic features in the park.

Dr. Michael Runyan, a professor at Lander University, joined us on multiple field trips into the park and updated us regularly on the new species he found within the park boundary.

This report was prepared for Ninety Six National Historic Site in cooperation with the Inventory and Monitoring Division of the Cumberland/Piedmont Network, National Park Service, Department of the Interior. Teresa Leibfreid of the network provided logistical help throughout the year while supporting the project in an encouraging, thoughtful manner. In addition, Sammi Jo Doyle expertly transferred our data into the correct format for the database NPSpecies.

Staff at the University of North Carolina – Chapel Hill Herbarium were especially helpful, patient, and considerate. Intern Erin Lunsford proofed our plant specimens for identification mistakes and mounted most of the specimens in the collection. Assistant Curator Carol Ann McCormick supplied all the necessary tools for identification (rulers, magnifying lenses, parking permits, coffee). Curator Alan Weakley contributed time in helping with the most challenging plant identification issues.

As part of this project, NatureServe worked with a team from the University of Georgia's Center for Remote Sensing and Mapping Science. Photointerpreters John Dolezal and Phyllis Jackson worked with us in the to come to ensure that our work on the ground would be compatible with the vegetation map that they would create.

Finally, we thank the entire NatureServe South team for their support throughout the project. Judy Teague used her invaluable ArcView skills to provide us with all plot locations and maps needed to complete the project. Mary Russo entered and managed the plot and species data quickly and efficiently. All members of the team contributed a great deal to the final product.

Table of Contents

Acknowledgments **iii**

Table of Contents **iv**

List of Figures **v**

List of Tables **vi**

List of Appendices **vii**

Summary **1**

Introduction **2**

Study Area 2
Land History 3
Methods **4**

Permanent plot establishment 4
Vegetation classification 5
Vascular plant inventory 5
Vegetation mapping 6
Results **7**

Discussion/Conclusions **9**

Species Inventory 9
Vegetation community analysis 10
Ecological Community Summary 21
Overview 22
Literature Cited **23**

List of Figures

Figure 1. Map of Ninety Six National Historic Site with all permanent points marked at their actual locations. 26

Figure 2. Species area curves for Ninety Six National Historic Site derived using data from a) just the 10 gridded plots in the park and b) all 15 plots. 27

List of Tables

Table 1. Plot numbers and locations for all permanent plots established at Ninety Six National Historic Site. 28

Table 2. List of all plants documented for park from current and historic inventories (ordered alphabetically by scientific name). 29

Table 3. List of vouchers that were collected at Ninety Six National Historic Site. 38

Table 4. Tables of vascular plant diversity measures and species total estimates 40

Table 5. Exotic plant species at Ninety Six National Historic Site 41

Table 6. Association numbers, plot numbers, and global ranks of all associations identified at Ninety Six National Historic Site. 44

Table 7. Plot photo names and photo descriptions for Ninety Six National Historic Site. 46

List of Appendices

Appendix I. Plot sheets used for permanent plots (formatted to fit in this report).....48
Appendix II. Descriptions of alliances and associations found at Ninety Six National Historic Site.....56
Appendix III. Photos of selected plots, plants, and people of Ninety Six National Historic Site..... 136
Appendix IV. Key to EcoGroups and Ecological Communities of Ninety Six National Historic Park..... 142

Summary

The first step in any effort to monitor the "vital signs" or ecological health of a tract of land is to develop a baseline from which to measure and gauge trends. We established a baseline for Ninety Six National Historic Site in three ways:

1) Ecologists from NatureServe established ten permanently marked one-hectare circular plots within the park in a grid system and another five circular plots in unique ecological areas that were not covered by the initial grid-based plot layout. The permanently marked plots are available to be used by researchers on studies ranging from bird point counts to individual plant monitoring.
2) Ecologists collected data on all unique vegetation communities within the park and identified seven natural and eleven human-modified or successional vegetation associations (unique ecological assemblages of plants) within the park boundary. Two ecological communities that either exist or may have existed prior to the establishment of the park within the park boundary may warrant special attention due to their relatively high global rank/rarity. The Floodplain Canebrake is a Coastal Plain and Piedmont community that is extremely rare due to suppression of fire and grazing and changes in land use within the range of cane. The Southern Piedmont Oak Bottomland Forest is an uncommon mature wetland forest that is well developed in the floodplain areas within the park boundary.
3) Ecologists collected and vouchered 30 new species to add to the list of species generated by Dr. Michael Runyan of Lander University. We now count 365 documented species, varieties, or subspecies of vascular plants in the park (364 species). We estimate that between 86% and 100% of the vascular flora of the park is now documented. Some species of note (because of their relative scarcity on the landscape) include Oglethorpe oak (*Quercus oglethorpensis*), American columbo (*Frasera caroliniensis*), eastern narrowleaf sedge (*Carex amphibola*), slender looseflower sedge (*Carex gracilescens*), Virginia snakeroot (*Aristolochia serpentaria*), squarestem spikerush (*Eleocharis quadrangulata*), bearded skeletongrass (*Gymnopogon ambiguus*), and Canadian licoriceroot (*Ligusticum canadense*). Oglethorpe oak, eastern narrowleaf sedge, and slender looseflower sedge are considered South Carolina state "of concern" species.

Introduction

Effective management of natural resources in our national parks relies upon ready access to comprehensive and scientifically credible information on species and habitats found within park boundaries. Currently, only a few units have compiled the baseline information needed to begin to assess the current state of natural resources at specific parks. Fewer still have begun to track and assess trends over time. With the passage of the National Parks Omnibus Management Act of 1998 by Congress, the National Park Service was given the mandate to "undertake a program of inventory and monitoring of National Park System resources to establish baseline information and to provide information on the long-term trends and the condition of National Park system resources." Funding for this initiative was appropriated in fiscal year 2000. In September 2001, NatureServe began work on the vascular plant inventory portion of the project at Ninety Six National Historic Site.

Although Ninety Six National Historic Site is better known for its historic importance in the Revolutionary War, the park contains significant natural resources, especially in its bottomland forests. The research emphasis here, however, has traditionally focused on the human history of the land. The only floristic study was begun in 2000 by Dr. Michael Runyan of Lander University and has been underway since that time. After assessing the past and current state of research in the park, we began to work on accomplishing three primary objectives:

1) Establish at least 15 permanent plots throughout the park for present and future monitoring purposes.
2) Document all ecological communities on the site as defined by the United States National Vegetation Classification (Grossman et al. 1998, Anderson et al. 1998).
3) Collect any species found in plots that were not already collected by Dr. Runyan.

NatureServe also worked with photointerpreters from the University of Georgia Center for Remote Sensing and Mapping Science (CRMS) to complete a vegetation map of all of the communities in the park (Welch and Madden 2003).

The ultimate goal of the project is to deliver the information described in this report to all interested parties in order to inform land management, conservation priorities, and future research at the park, and to ensure that future generations of visitors will visit a park that is both ecologically and historically intact.

Study Area

Ninety Six National Historic Site is located just south of the town of Ninety Six in Greenwood County, South Carolina. This park preserves the frontier village of Ninety Six and the earthworks associated with its role as a British outpost. According to legend, the town was named by traders after the distance between Charleston and the stopping off point on the path to the Cherokee town of Keowee (NPS 2000, Williams 2003). It was the scene of repeated confrontations between loyalists and patriots and the longest siege of the war conducted by the

Continental Army. Through the mid-18th century, Ninety Six was the economic and political center of the region.

The site is 400 ha (989 acres), composed primarily of mixed woods, riparian areas along Spring Branch, and some grassy areas, particularly around the earthworks. Star Fort Lake is an 11 ha impoundment within the park. Other water resources include 0.4 ha Little Pond and several springs in the Spring Branch area. Ninety Six Creek drains most of the park and is part of the Saluda River watershed (Nichols 2000). Elevation ranges from approximately 412 feet in the lowest part of the Niney Six Creek watershed up to approximately 520 feet in the northwestern corner of the park.

Ninety Six National Historic Site occurs in the Piedmont ecoregion (Bailey 1994). Ninety Six Creek, a tributary of the Saluda River, runs through the park and the wide floodplain has some South Atlantic Coastal Plain ecoregion attributes, due to the proximity of this area to the Coastal Plain and the low-lying topography near the creek.

The park has a diversity of soils ranging from loams to clays. The floodplain where bottomland oak and floodplain forests occur is dominated by Chewacla loams, whereas the side slopes of the creeks are mostly Hiwassee sandy loams, Enon sandy loams, and Pacolet sandy loams. The interior areas where much of the cultivated areas and successional forests occur include Coronaca sandy clay loams, Mecklenburg sandy loams, Pacolet sandy clay loams, Davidson sandy clay loams, and Wilkes fine sandy loams (Camp and Herren 1980).

Greenwood County's climate consists of mild winters and warm/hot summers. There is no climate station on site, but old records from other parts of the county show that the average minimum temperature is 10 degrees F whereas the mean yearly maximum temperature is 99 degrees F. The average rainfall is only 46 to 48 inches annually, the average length of freeze-free growing is about 224 days, and the snow cover averages only about 1.4 inches annually (Camp and Herren 1980).

Land History

Ninety Six National Historic Site was created by an act of Congress in 1976 to preserve the old frontier village and earthworks on the site (United States Congress 1976). The land upon which the park is located was settled prior to the Revolutionary War by traders who set up at the crossroads of a series of trading paths prior to 1750 (Bass 1978). As a consequence, most of the upland area was farmed or built upon over the past 250 years. Only the frequently flooded sections of the bottomlands were probably not farmed. The land of the park has been recovering from this human disturbance over the past 100 years, ever since both Ninety Six and the adjacent town of Cambridge ceased to function as populated towns. Since the establishment of the park, many former agricultural fields have grown up into successional forests.

Methods

The inventory and monitoring project covers four main areas: permanent plot establishment for future research in the park, a vegetation classification of all the vegetation associations within the park according to the National Vegetation Classification (Grossman et al. 1998), a vascular plant inventory within the park boundary that builds upon the existing plant list for the park, and a cooperative relationship with the mapping team from the University of Georgia to assure that the vegetation communities within the park are mapped in accordance with National Park Service standards.

Permanent plot establishment

In order to set up a gridded system of one-hectare circular plots within the park boundary as mandated by the *Study Plan for Vertebrate and Vascular Plant Inventories* (Nichols 2000), Judy Teague from NatureServe used GIS layers supplied by the National Park Service's Cumberland Piedmont Network. We manipulated the GIS layers supplied to us with the program ArcView (ArcView 1992). We chose a 56-meter buffer around the current park boundary since each point represents the center of a one-hectare circular plot and we did not wish to sample any private holdings outside of the park. With this buffer in place, we established an evenly spaced grid system (we chose the approximate grid size of 580 meters by 580 meters *a priori* based on observations made by a team of park service personnel in 2000 (Nichols 2000)). At each north-south and east-west line, we recorded the coordinates for one grid point (Figure 1 and Table 1).

Once we had fully laid out the grid using Arcview and recorded all of the GPS coordinates for use onsite, we identified areas of the park that were most likely to hold unique associations not represented by the gridded points. We added points in various places, including the north facing slopes of Ninety Six Creek and some unique forests just upstream from Star Lake. We flagged these areas for visits and established plots there and in other suitable habitat that was not represented by the gridded plots.

Once at the park, we met with park personnel and local researchers, described the project's goals, and asked for their collaboration in the project. Through this process, we identified priority areas of the park for additional plot establishment and species inventory, especially some areas with older trees in the bottomlands of Ninety Six Creek. In late summer of 2001 and the summer of 2002, we established ten plots on the grid system and an additional five plots off of the grid in habitats not covered by any of the grid points (Figure 1). Using the GPS units (Garmin Corp. 1999), we attempted to position ourselves within at least five meters of the "real" map location (the hypothetical location that we created in the lab prior to visiting the site). Once we were within five meters, we monumented each plot with a one foot piece of iron conduit and a small blue anodized aluminum tag with a distinctive number attached to an adjacent distinctive tree. General written directions to each permanent plot exist on the vegetation plot sheets filled out during the course of fieldwork and can also be found in the Access database archive of plot information held by the National Park Service. Due to variation in signal strength, accuracy may be more than five meters in some cases. In 2002, we recorded additional data at each point and worked in other locations as part of the vegetation mapping work.

Vegetation classification

After the establishment of each permanent one-hectare plot, we visually surveyed the area. We chose a representative and relatively homogenous 20 by 50-meter section of the hectare in which to place our standardized vegetation monitoring plot. Within the plot, we measured environmental characteristics and identified every vascular plant within the plot (see Appendix I for a blank version of the data sheets used). We assigned each species a cover value by strata and an overall cover value for the plot based on a modified Braun Blanquet cover class scale. In addition, we searched for and identified any species within the full hectare that were not represented in the 20 by 50-meter sample. Finally, we returned in the spring of 2002 to resample the plots to attempt to document any species that we had missed the previous summer.

We proofed the plot sheets, entered the data into the National Park Service PLOTS database, and assigned each plot to an association based on floristic composition and environmental factors using the National Vegetation Classification (Anderson et al. 1998, Grossman et al. 1998). We compared the plots with similar plots in other parks in the Piedmont and with written descriptions of each related classification unit. These comparisons, combined with a thorough review of all classification possibilities and a review of the literature for some of these association types, allowed us to produce the current park vegetation classification.

Vascular plant inventory

While gathering plot data, we discovered plant species within the plots that had not already been documented for Ninety Six National Historic Site. We collected any new specimens encountered within the plots and recorded the GPS coordinates using our Garmin III GPS unit. We pressed and thoroughly dried all specimens, identified any unknowns that could be identified, and then vouchered all new species according to National Park Service standards using the Integrated Taxonomic Information System (ITIS) as the naming standard.

To assess the success of past inventories, we used the program PC-ORD (McCune and Grace 2002, McCune and Mefford 1999) to create a species area curve using the data gathered at each one-hectare plot. In addition, we used a jackknife method within PC-ORD to estimate the total number of species found in the park (Palmer 1990). This method used the formula JACK1= SO + r1[n-1]/n where SO is the number of species observed in n quadrats, r1 is the number of species present in only one quadrat, and n is the number of plots sampled.

Vegetation mapping

In 2002 and early 2003, we returned to Ninety Six National Historic Site to follow-up on the first three goals and to cooperate with the University of Georgia Center for Remote Sensing and Mapping Science on their project to map all vegetation communities in the park. We supplied the University of Georgia team with all plot data already collected and a dichotomous key to the communities of the park and we walked throughout the park to help them identify unique mapping units. Since photointerpreters rely heavily on canopy species composition, understory species composition, and disturbance to classify polygons and ecologists rely just as heavily on the shrub and herb layer to classify types, the mapping units and the vegetation classification units do not always "crosswalk" (match up) perfectly. The last step of the project was to reconcile mapping units with vegetation associations to produce mapping units that match up well with the ecological units of the National Vegetation Classification. We continue to work with the University of Georgia team on the mapping; the vegetation map will be produced separately by the Center for Remote Sensing and Mapping Science and will include any crosswalk as specified in the cooperative agreement.

Results

During the species inventory work, we encountered and collected 33 specimens (Tables 2,3) of over 30 species that had not been confirmed previously from the park. We created 33 vouchers for the herbarium at Ninety Six National Historic Site (Table 3) from the plants we collected and photographed. These specimens are in addition to plants collected over the past three years by Dr. Michael Runyan at Lander University under a separate project.

In addition to collecting all new plants encountered within the plots, we estimated what percentage of the flora in the park is now documented. Eliminating all varieties, subspecies, and questionable identifications and including previously collected specimens, we believe that researchers have documented 364 species for the park. The estimates of the number of total species in the park that we generated using PC-ORD based on the plot data taken throughout the park were 360 using all 15 full plots and the first-order jackknife method, 420 using all plots and the second-order jackknife method, 302 using just the ten gridded plots and the first-order jackknife method, and 346 using just the ten gridded plots and the second-order jackknife method (Table 4). In addition, we calculated alpha (average species richness per plot), beta (measure of the heterogeneity of the data (alpha/gamma)), and gamma (total species overall plots) diversity values for the park based on information gathered from the plot data (Table 4). The alpha value for all plots combined was 47.7, the beta value was 5.3, and the gamma value was 254.

We also examined the species list for the park and determined which exotic plant species pose the biggest threats to the ecological health of the park (Table 5). Of the 364 species on our species list, 70 (19%) are considered to be exotic. Of these 70, 11 species found in the park are considered a severe threat to the ecological health in South Carolina or surrounding states (Miller 2000, Tennessee Exotic Pest Plants Council 2001) and six are considered to be significant but not severe threats to the health of ecological communities.

Using the information gathered in each plot, we discerned 18 distinct vegetation associations within eight distinct ecological systems, as defined by the United States National Vegetation Classification (Table 6). However, only seven of the communities identified are considered "natural" as opposed to "semi-natural" or exotic species dominated. The common names of all of the communities are as follows (* = natural community):

Successional Loblolly Pine – Sweetgum Forest
Piedmont Basic Mesic Mixed Hardwood Forest (*)
Successional Black Walnut Forest
Successional Sweetgum Forest
Successional Tuliptree-Hardwood Forest
Piedmont Dry-Mesic Oak-Hickory Forest (*)
Interior Southern Red Oak – White Oak Forest (*)
Successional Water Oak Forest
Southeastern Coastal Plain Flat Terrace Forest (*)
Southern Piedmont Oak Bottomland Forest (*)
Chinese Privet Shrubland
Golden Bamboo Shrubland

Floodplain Canebrake (*)
Blackberry – Greenbrier Successional Shrubland Thicket
Wisteria Vineland
Broomsedge Old Field
Cultivated Meadow
Southern Cattail Marsh (*)

While working in the park, we also captured digital images of plots and plants. These images are indexed (Table 7) and a selection of them can be seen in Appendix III.

Finally, we have included the key to associations (Appendix IV). This tool helps those with a basic understanding of vegetation to classify community types within the park quickly and easily.

Discussion/Conclusions

Species Inventory

The field work from this project added over 30 species to a list of over 330 species already present within the current boundary of the park (Table 2). One goal of the Inventory and Monitoring program of the National Park Service is to document at least 90% of the vascular flora of the park. Using various estimates and assumptions, the estimate for total number of species in the park ranged from 302 to 420. Excluding varieties, subspecies, and unidentifiable collections, researchers past and present have confirmed 364 species within the park. First-order jackknife estimates often underestimate number of species as evidenced by the lowest estimate in our first-order jackknife, whereas second-order jackknife estimates often overestimate the number of species (McCune and Grace 2002). Using all of the plot data (Figure 2), we found that between 86 and 100% of the species in the park have been documented. Based on our own knowledge of the park and our belief that we have supplemented well the work of Dr. Michael Runyan, we feel that 85-95% of the vascular flora of the park is documented. These numbers should only be used as an estimate, since tests of these indices have shown even the best ones to routinely underestimate the number of species in a park. Since we did sample systematically and without bias, we most likely have a more accurate number than if we had sampled only in areas that were of similar vegetation or only focused on particular parts of the park (Palmer 1990, McCune and Grace 2002).

Because of its history of human-induced disturbance, intact ecological communities at Ninety Six are only a fraction of the total acreage and are generally found in the bottomland forest and steep slopes along Ninety Six Creek. There are no occurrences of federal rare or endangered species. However, there are a number of species that are listed as of concern in the state of South Carolina. Oglethorpe oak is considered a species of concern and is found in only a handful of sites in South Carolina and has a spotty distribution throughout its range in Georgia, South Carolina, Mississippi, and Louisiana (NatureServe 2003). There is still very little known about its habitat requirements, having only been discovered and described in 1940 (Duncan 1940). In addition, the eastern narrowleaf sedge (Carex amphibola) and slender looseflower sedge (Carex gracilescens) are considered of state concern, even though their global rank is a secure G5 and G5?, respectively. American columbo (Frasera caroliniensis) is considered to be of concern regionally within this sector of the state of South Carolina.

Most of the remaining species on the species list are G5 (extremely secure). Other species that are worth mentioning here but that are still somewhat secure (G4 species) include: Virginia snakeroot (Aristolochia serpentaria), squarestem spikerush (Eleocharis quadrangulata), bearded skeletongrass (Gymnopogon ambiguous), and Canadian licoriceroot (Ligusticum canadense).

No single habitat type provides refuge for all of the sensitive species mentioned above. Oglethorpe oak is most common in the park in the Successional Water Oak forest but can also be found in the Southern Piedmont Oak Bottomland Forest and the Successional Loblolly Pine – Sweetgum Forest. This tree species seems to occur in the subcanopy and doesn't reach canopy size within the park. Many examples appear to be diseased, and it is rumored that this tree is affected by the chestnut blight (Patrick 1995). American columbo appears in the Piedmont Basic Mesic Mixed Hardwood Forest in clonal colonies.

Athough the park is rather large, the diversity of the upland flora is fairly low due to the successional nature of 90% of these forests and the lack of a diversity of ages in the upland flora. The bottomland flora is perhaps the most diverse, especially in areas not invaded yet by invasive exotics such as privet or Japanese stiltgrass and with a diverse sedge and spring ephemeral layer.

At least 70 of the plant species in the park (19%) are not native to the park (Table 5). Most of these species are historical relicts of plantings or introductions and are harmless present day components of the flora that found their way into natural areas from plantings or errant seed mixes. However, at least 17 of the 364 species found within the park are considered aggressive or potentially aggressive invasive species that are outcompeting and replacing native species in some parts of the Southern Piedmont ecoregion (Miller 2000). These species are probably the biggest single threat to the overall ecological health of the park at this point in time. Along wooded edges, kudzu (*Pueraria montana var. lobata*) and wisteria (*Wisteria floribunda* and *sinensis*) can establish and eventually overtake the canopy of stands, causing them to become monocultures of these invasive exotics and thereby seriously reducing biodiversity in the area. Bamboo (*Phyllostachys sp.*) has been planted in one area of the park and the stand expands yearly clonally, destroying habitat for all other plants as it expands. In the interior woods and forests, shrubs and vines such as thorny olive/ silverberry (*Elaeagnus umbellata* and *pungens*), Japanese honeysuckle (*Lonicera japonica*), and European privet (*Ligustrum vulgare*) all have begun to colonize areas of the understory. Much of the floodplain for the creeks that run through the park is heavily dominated by a combination of exotics, but especially Japanese stiltgrass (*Microstegium vimineum*) and privet. In fields and newly cleared areas, both wet and dry, mimosa (*Albizia julibrissin*) and Johnson grass (*Sorghum halepense*) have colonized areas and seem to be expanding in cover over time. Chinaberry (*Melia azedarach*) is present in the park and has proven to be a noxious weed in Tennessee. Other species may need monitoring and attention to ensure that they are not spreading, but the ones mentioned above seem to be the most likely candidates for control in the future. In areas where exotics have become a monoculture, removal should occur in conjunction with planting and seeding of natives to help prevent quick recolonization by the same or new invasive exotic species.

Vegetation community analysis

The unit of association is the finest level of the vegetation classification and is defined as “a plant community type of definite floristic composition, uniform habitat conditions, and uniform physiognomy” (Grossman et al. 1998). Ecological community information such as that gathered for this project and described in Appendix II can be very useful as a management and monitoring tool for the parks. Once identified to the association level, it is possible for land managers on a local scale to use the ecological community information gathered by researchers throughout the association’s range to make more informed decisions about how to manage locally. In addition to the information contained in Appendix II, we have included the “system” or broad ecological unit to which each association belongs, a global and local description for each association, specific information on the status of each association both globally and within the park, possible threats to the association in the park, plants of concern found in the park, and management concerns where they apply:

Successional Loblolly Pine – Sweetgum Forest (8462)

This community description encompasses all successional forests dominated by loblolly pine within the park boundary. It is a widespread successional forest type that exists throughout the southeastern United States on land left fallow after past agricultural activities. If left unmanaged or undisturbed, this can be a short-lived forest type, and is likely to succeed with greater age into various oak- and oak-pine-dominated forests.

Loblolly pine forests are found in upland areas that were heavily farmed and exhausted, then abandoned. The sites can be poorly drained, and examples close to bottomland areas may even have some standing water for some of the year. Within the park, the association is usually dominated by stands of loblolly pine (*Pinus taeda*), either planted and left untended or generated naturally after abandonment of farmland. Sweetgum (*Liquidambar styraciflua*) and occasionally planted slash pine (*Pinus elliottii*) may codominate in the canopy. Understory trees vary depending upon location and moisture, but range from thick stands of poison ivy (*Toxicodendron radicans*) and the exotic Japanese stiltgrass (*Microstegium* vimineum) in the most mesic examples to more sparse understories in the driest examples.

Successional pine forests are considered a human modified community and thus are of no conservation concern. Successional forests are very common due to the large scale abandonment of farmland over the last century in the Piedmont of South Carolina and this particular community is the most common association within the park.

This community is easily invaded by invasive exotic species such as Japanese honeysuckle and Japanese stiltgrass. Although this community is not of conservation concern, management of the invasive exotics may prevent the spread of these exotics into adjacent higher priority communities.

Piedmont Basic Mesic Mixed Hardwood Forest (*) (8466)

This association represents intermediate and basic, mesic, mixed hardwood forests of the Piedmont, ranging from Virginia south to Georgia.

This forest type is limited to the north-facing steep slopes along Ninety Six Creek. These slopes were most likely logged but not plowed. The examples of this community in the park are relatively young, so the beech (*Fagus grandifolia*) that is characteristic of this association is generally in the understory. Canopy species include tuliptree (*Liriodendron tulipifera*), white oak (*Quercus alba*), and northern red oak (*Quercus rubra*). The understory is dominated by elm (*Ulmus* spp.), beech, and southern sugar maple (*Acer barbatum*). The ground layer contains a fairly diverse but sparse herb layer including species associated with both acid and neutral soils. These can include Bosc's panicgrass (*Dichanthelium boscii*), American columbo, sharpscale sedge (*Carex oxylepis*), little brown jug (*Hexastylis arifolia*), spiderwort (*Callisia* spp.), and fragrant bedstraw (*Galium triflorum*). Redbud (*Cercis canadensis*), pawpaw (*Asimina triloba*), sweetshrub (*Calycanthus floridus*), and Eastern redcedar are also present. This community is restricted to the north facing slopes along Ninety Six Creek and occurs nowhere else within the current park boundary.

Although this community is fairly secure throughout its range, it represents a rare type within the park. This community only exists in narrow bands on steep north-facing slopes of Ninety Six Creek. Some examples contain breeding populations of American columbo, a species of regional concern in South Carolina.

Since these communities are on steep slopes, any type of soil disturbance should be avoided to prevent erosion. Most of these sites are not heavily invaded by invasive exotic species, but monitoring of some of these sites to determine if invasives are gaining a foothold would be prudent due to the high amount of exotic species in the park.

Successional Black Walnut Forest (7879)

This is a potentially widespread association, especially where old homesites with black walnut (*Juglans nigra*) trees have been abandoned and the trees have spread over time. Walnut is often the sole canopy tree.

At Ninety Six, this community exists near old homesites and other areas where soil has been altered to favor regeneration of walnuts that were probably planted throughout the yard prior to abandonment. At Ninety Six, this community is dominated by walnut and hackberry (*Celtis laevigata*) in the canopy and tends to have some understory species that are indicators of circumneutral soils such as redbud, Eastern redcedar, beautyberry (*Callicarpa americana*), and coralberry (*Symphoricarpos orbiculatus*).

This association is considered a human modified community and thus is of no conservation concern. It is an uncommon type in this area, only existing near old homesites. Within the park, it only occurs in small isolated patches.

This community is easily invaded by invasive exotic species such as Japanese honeysuckle and Japanese stiltgrass. Although this community is not of conservation concern, management of the invasive exotics within this community may prevent the spread of these exotics into adjacent higher priority communities.

Successional Sweetgum Forest (7216)

This forest is widespread throughout the Southeast and results from succession following human activities, such as logging and clearing. Stands are dominated by sweetgum, sometimes to the exclusion of other species.

Within the park, this community exists in both uplands and bottomlands where factors existed that promoted the growth of monotypic sweetgum rather than loblolly pine stands. These stands can often spring up as clonal stands in old fields or in bottomlands that may be inundated and too wet for pine species. The understory varies, but is generally either very poorly developed or invaded by exotics such as Japanese honeysuckle or Japanese stiltgrass. This community ranges throughout the park, both in upland and bottomland areas. It is most common on the very gentle south facing slope just north of the Ninety Six Creek bottomland.

This association is considered a human modified community and thus is of no conservation concern. It is a very common type in this area due to the large scale abandonment of farmland over the last century in the Piedmont of South Carolina.

This community is easily invaded by invasive exotic species such as Japanese honeysuckle and Japanese stiltgrass. Although this community is not of conservation concern, management of the invasive exotics within this community may prevent the spread of these exotics into adjacent higher priority communities.

Successional Tuliptree-Hardwood Forest (7221)

This forest is widespread throughout the Southeast and results from succession following human activities such as logging and clearing. Stands are dominated by tuliptree, sometimes to the exclusion of other species.

The community exists mostly in upland forest slopes but can also be found adjacent to bottomlands. The canopy of this semi-natural upland association is dominated by tuliptree. Red maple (*Acer* rubrum) is common in the understory along with oak species (*Quercus* spp.) and occasionally sweetgum. These early successional forests often follow cropping, clearcut logging, or other severe disturbance. Although this community type was not found in the park during this survey, it possibly occurs in small patches in unsearched areas of the park.

This association is considered a human modified community and thus is of no conservation concern. It is an uncommon type in this area, although it occurs much more frequently in other parts of the Piedmont of South Carolina.

As with other successional communities, this community is easily invaded by invasive exotic species such as Japanese honeysuckle and Japanese stiltgrass. Although this community is not of conservation concern, management of the invasive exotics within this community may prevent the spread of these exotics into adjacent higher priority communities.

Piedmont Dry-Mesic Oak-Hickory Forest (*) (8475)

This association is found in the Piedmont and northern Coastal Plain, as well as possibly in related areas of Maryland. In the Piedmont of South Carolina, this is a matrix type, probably the most common forest type remaining in the Piedmont.

Stands of this forest are closed to somewhat open, and are dominated by mixtures of oaks and hickories, with white oak being most prevalent, along with northern red oak (*Quercus rubra*), scarlet oak (*Quercus coccinea*), black oak (*Quercus velutina*), and hickory species. The hickory species are common in this type, but often most abundant in the understory. Understory species include maple species, flowering dogwood, sourwood (*Oxydendrum arboreum*), American holly (*Ilex opaca*), and blackgum (*Nyssa sylvatica*). Shrubs include deerberry (*Vaccinium stamineum*), blueridge blueberry (*Vaccinium pallidum*), mapleleaf viburnum (*Viburnum acerifolium*), and strawberry bush (*Euonymus americana*).

This community is common and secure throughout its range; however, it represents an uncommon type in the park. Within the park, this community exists on the steep north facing slopes of Ninety Six Creek and areas adjacent to these slopes.

For the most part, examples of this community are second growth stands. These sites are not heavily invaded by invasive exotic species, but monitoring of some of these sites to determine if invasives are gaining a foothold would be prudent due to the high amount of exotic species in the park.

Interior Southern Red Oak – White Oak Forest (*) (7244)

This southern red oak - white oak dry forest is found in the Piedmont of Georgia, South Carolina, North Carolina, and Virginia, and in the interior uplands and Cumberland Plateau of Kentucky and Tennessee. It has also been reported from the Upper East Gulf Coastal Plain of Mississippi and Georgia. It generally is a second-growth forest on low-fertility Ultisols. The vegetation is dominated by oaks and lesser amounts of hickories. The canopy is continuous, and several species of oak may be present or codominant. 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 red maple, tuliptree, sourwood, sweetgum, winged elm, flowering dogwood, blackgum, and Eastern redcedar. The tall-shrub stratum may contain farkleberry (*Vaccinium arboreum*). The low-shrub stratum can be sparse to moderate and may be dominated by various ericaceous shrubs. Cat greenbrier (*Smilax glauca*) and muscadine (*Vitis rotundifolia*) are common vines..

This community exists in some of the less disturbed uplands in the park where a second-growth forest has established. The soil fertility is low on these sites, but the community has aged so that there is a more diverse canopy of oaks rather than the pines seen in much of the rest of the uplands of the park. Within the park, the canopy varies quite a bit. Generally speaking, the trees are more than 50 years old and uneven-aged. Most are white oak, southern red oak, and northern red oak, but water oak and willow oak may comprise up to 25% of the canopy. This community type exists, for the most part, only in the northern third of the park.

For the most part, examples of this community are second growth stands. They may have been subject to occasional fire in the understory when fire was present on the landscape they appear to be stable communities within the park.

These sites are not heavily invaded by invasive exotic species, but monitoring of some of these sites to determine if invasives are gaining a foothold would be prudent due to the high amount of exotic species in the park.

Successional Water Oak Forest (4638)

This community is a result of disturbance and/or fire suppression of upland pinelands of the southeastern Coastal Plain and of pinelands and subsequent old fields in the adjacent Piedmont areas. This association occurs on mesic or dry-mesic sites, especially on loamy or other fine-textured soils.

This community occurs as a successional community on heavily eroded upland areas just to the north of Ninety Six Creek. The community most likely exists on areas of different soil than the successional pine communities of the park. Although there has been no research on this in the park, it appears that soils may have some role in determining which successional communities

established after farming (sandy vs. clay?). This community is dominated by water oak and can often be codominated by willow oak and sweetgum. The community often has a diverse understory which may include flowering dogwood, sweetgum, winged elm (*Ulmus alata*), and even Oglethorpe oak. The herbaceous layer is usually extremely sparse, and many of the examples of this community have established in areas that still show signs of heavy erosion from past farming practices. This community is most common on the gentle slope that leads from the center of the park south towards the Ninety Six Creek floodplain.

This association is considered a human modified community and thus is of little conservation concern. It is a very common type in this area due to the large scale abandonment of farmland over the last century in the Piedmont of South Carolina. The globally rare Oglethorpe oak seems to be fairly common in this community type.

This community is home to the largest populations of Oglethorpe oak in the immediate area. It may be important to monitor the rare oak population to look at its health and whether management needs to occur to maintain the populations within the park. If so, it will be important to study the habitat requirements of Oglethorpe oak across its range to determine ways to increase the health of the population at Ninety Six.

Southeastern Coastal Plain Flat Terrace Forest (*) (7730)

This forest association occurs on terraces of associated large creeks in the South Atlantic Coastal Plain and lower Piedmont. These are relatively more well-drained than the adjacent flats. The mostly closed canopy of this community is dominated by sycamore (*Platanus occidentalis*), hackberry (*Celtis laevigata*), and green ash (*Fraxinus pennsylvanica*). These species, along with boxelder (*Acer negundo*), are also important in the well-developed subcanopy.

In this park, the forest occurs on terraces adjacent to Ninety Six Creek and ranges well away from the creek along broad flat areas that are regularly flooded. The canopy composition varies widely and can be dominated by a combination of boxelder, green ash, eastern cottonwood (*Populus* deltoides), and black walnut. The shrub layer is sparse but diverse. The herb and short shrub layer is sparse to moderate and can be dominated by exotics like Japanese stiltgrass and privet and/or natives like fish-on-a-string (*Chasmanthium latifolium*) or giant cane (*Arundinaria gigantea ssp. gigantea*). This community is most common in the floodplain nearest to Ninety Six Creek.

This community is well developed within the park. Some examples of this forest seem to be older than that of the upland forests of the park. Residents probably used this land for grazing and timber harvesting, but probably never plowed the bottomland due to the frequent flooding that occurs in this bottoms area.

This community is very susceptible to understory and herbaceous invasion by invasive exotic species. These species include privet, Russian olive, Japanese stiltgrass, and Japanese honeysuckle. Privet species are particulary important in the shrub layer of large tracts of the forest. In some areas, thickets of these shrubs have prevented other species from germinating. As a consequence, as the forest matures and canopy trees die, the native trees may not be replaced, leading to a monoculture of privet shrubs. These shrubs should be aggressively controlled to allow for the maintenance of biodiversity in this community.

Southern Piedmont Oak Bottomland Forest (*) (8487)

This association covers bottomland forests of the southern Piedmont of Georgia and South Carolina, the Piedmont-Ridge and Valley transition region of Alabama, and the adjacent Upper East Gulf Coastal Plain of Georgia. Stands occur in broad flat floodplains of medium-sized rivers, or as smaller occurrences along creeks and their adjacent floodplains. The diverse canopy is primarily composed of bottomland terrace species, but may also contain some levee species that would normally sort out better along a hydrologic gradient in the larger floodplains of the Coastal Plain. Shrubs include river cane, northern spicebush (*Lindera benzoin*), possumhaw (*Ilex decidua*), beautyberry, and hazelnut (*Corylus americana*). Woody vines may be prominent in some stands. The herb stratum is fairly diverse.

Stands of this association within the park occur only within the broad floodplain of Ninety Six Creek and tend to occur in large patches away from the main channel. The canopy is dominated by a combination of swamp white oak (*Quercus michauxii*), shagbark hickory (*Carya* ovata), willow oak, bitternut hickory (*Carya cordiformis*), sweetgum, and green ash.. The understory contains these canopy species and red maple. The ground layer is sparsely covered but consists of rushes (*Juncus* spp.), sedge species (*Carex* spp.), bottlebrush grass (*Elymus* hystrix), as well as other bottomland species. In addition, in spring, large numbers of rain/Atamasco lilies (*Zephyranthes atamasca*) can be seen blooming throughout this community. This community is limited to the broad outer floodplain of Ninety Six Creek.

This is one of the more important communities in the park in terms of its rarity, its average age, and its biodiversity. Not only is it fairly rare (G3) but it contains large stands of large oak trees that probably haven't been heavily disturbed in the past 80-100 years. The herbaceous stratum can be fairly diverse and contains the showy spring ephemeral rain/Atamasco lily.

To preserve this type it will be important to limit the spread of the invasive exotic privet. This shrub has colonized large chunks of the bottomland forest and threatens the remainder. It can form monotypic stands that shade out all other species. The privet invasion of this community is probably the single greatest threat to the ecological integrity of this park.

Chinese Privet Shrubland (3807)

Upland and wetland areas heavily infested with Chinese privet (*Ligustrum* sinense) and sometimes European privet (*Ligustrum vulgare*) to the exclusion of canopy trees. This community occurs in both uplands and palustrine systems where privet has become established as a virtual monoculture and is preventing regeneration of any natural community type.

Since this community is dominated by invasive exotics, it has no conservation value. As a matter of fact, it is important to find ways to control the spread of privet so that this community type does not expand in the landscape in the future.

Golden Bamboo Shrubland (8560)

This community represents uplands invaded and dominated by golden bamboo. It occurs in small to large patches where bamboo has escaped from plantings and established a monoculture.

Luckily, this community is limited in its extent at the present time. It occurs as a clonal patch of bamboo where this species was originally planted at Ninety Six.

This community is not of conservation value. As a matter of fact, this community is comprised of an invasive exotic and should be controlled to keep it from spreading and overtaking other natural communities.

Floodplain Canebrake (*) (3836)

This association is characterized by dense, often monospecific thickets of the giant cane (*Arundinaria gigantea*) occupying large areas referred to as canebrakes. The canebrake shrubland type was historically widespread, but is now rare throughout its former range and occupies very little of its former acreage. It was best developed in streamside flats and alluvial floodplains on ridges and terraces where it was protected from prolonged inundation. Historically, this community covered large areas of many floodplains and streamsides in the Coastal Plain from North Carolina to Texas, Mississippi River Alluvial Plain, Interior Highlands, Interior Low Plateau, Southern Blue Ridge and possibly the Central Appalachians of the southeastern United States. Stands occur on alluvial and loess soils and are often associated with bottomland hardwood forest vegetation. This association is successional and is thought to be maintained by periodic fires and/or heavy grazing. It may have originated following abandonment of aboriginal agricultural fields or other natural and anthropogenic disturbances such as blow-downs and catastrophic floods.

Within Ninety Six, the large patches that once dominated Ninety Six Creek are now found only in remnant patches underneath the canopy of the forested bottomlands. Due to suppression of fire and subsequent invasion by trees, this community is no longer occurs as a fully functioning ecological type within the landscape. The community historically occurred throughout this stretch of Ninety Six Creek in broad swaths, most likely in areas where the Southeastern Coastal Plain Flat Terrace Forest currently exists (Bass 1978). Stands of cane still exist, but are currently in areas of heavy forest and along openings created by the main channel of Ninety Six Creek. Although this community was much more common 200 or more years ago, it may still occur occasionally in areas within the floodplain where tip-ups have occurred and created a high light environment for the cane.

This community may no longer exist as a fully functioning ecological unit within the park boundary, but it was a substantial part of the landscape when the area was first settled (Bass 1978). At times, blowdowns in the floodplain area create small patches of cane that exist until trees replace the canopy gap. But this community type as described from intact examples of the community is effectively extinct from this area until appropriate management can be returned to a section of the floodplain to create the correct conditions for a shrubland community.

This community is of major conservation concern. It has disappeared from most of its former range over the past 200 years. Much of this disappearance can be attributed to the loss of fire on the landscape and the loss of large mammalian grazers in the ecosystem. This is the rarest community type potentially to be found within the boundary of the park and patches of cane with the other species common to canebrakes can be found in small patches scattered throughout the park.

Small populations of cane still exist in canopy gaps within the floodplain forests. To restore this community, it would probably be important to create openings and restore periodic fire to an area of the bottomland. This would encourage the growth of the cane and would help the cane better compete with faster growing but fire intolerant shrubs, trees, and herbs. However, it would be important to first consult with biologists who have had success restoring canebrake communities to determine a course of appropriate action.

Blackberry – Greenbrier Successional Shrubland Thicket (4732)

Stands of this successional community develop following disturbance (complete forest canopy removal). These stands are dominated by greenbrier species (*Smilax glauca*, *Smilax rotundifolia*) and blackberries/dewberries (*Rubus argutus*, *Rubus trivialis*). Many examples include a great variety of tree saplings and other woody species (oaks, sweetgum, red maple, persimmon (*Diospyros virginiana*), Eastern redcedar, winged sumac (*Rhus copallina*)), herbs (goldenrods, asters, sunflowers (*Helianthus* spp.), St. John's wort (*Hypericum* spp.), cinquefoil (*Potentilla* spp.)), and grasses (broomsedge (*Andropogon virginicus*), panicgrass (*Dichanthelium*), etc.). Examples that are surrounded by relatively intact ecosystems will tend to have more native species. Those surrounded by old fields or fragmented by development tend to have Japanese honeysuckle as a codominant vine overtopping much of the blackberry and greenbrier.

At Ninety Six, this community derives from successional old fields that have not been mowed for at least 3-5 years. This community is dominated by blackberry within the park, but may also be codominated by non-native shrubs such as privet, old field herbs, and Japanese honeysuckle. It occurs most commonly as an embedded feature within cultivated meadows of the park.

This association is considered a human modified community and thus is of no conservation concern. It is a very common type in this area due to the large scale abandonment of farmland over the last century in the Piedmont of South Carolina.

Although this community is not of conservation concern, management of the invasive exotics within this community may prevent the spread of these exotics into adjacent higher priority communities.

Wisteria Vineland (8568)

This vine-dominated vegetation is a monoculture of wisteria, a fast-growing vine native to Asia. The community is most commonly seen in fragmented landscapes near old homesteads and other highly impacted areas. The oldest colonies of this type may consist of Chinese wisteria (*Wisteria sinensis*) or Japanese wisteria (*Wisteria floribunda*) and little else since the wisteria slowly overtops and kills all other plants. It has the potential to occur in most southeastern states.

Within the park boundary. this community exists in upland and wetland areas adjacent to old homesites and areas where wisteria was introduced and has invaded. It is being controlled in the park, but is still present at the time of this report. The example is a monoculture of wisteria with some occasional small patches of trees. The patch occurs in only one location in the southern portion of the park near a boundary with a private landowner.

This community is not of conservation value. As a matter of fact, this community is comprised of an invasive exotic and should be controlled if possible to keep it from spreading and overtaking other natural communities.

Successional Broomsedge Vegetation (4044)

This association includes vegetation that occurs on old fields, pastures, and rocky sites dominated by broomsedge along with other native species typical of old fields. This is a very common and wide-ranging association. Additional components include typical pioneer species; these and other associated species will vary with geography and habitat. This association may develop temporarily following clear-cutting, and will persist indefinitely under a regular mowing regime, e.g., in powerline corridors. If undisturbed, these grasslands will rapidly succeed to shrubs, and eventually to tree species.

This association is considered a human modified community and thus is of little conservation concern. However, old fields dominated by native species can often add quite a lot to the overall biodiversity of a small park. It is a very common type in this area due to the large scale abandonment of farmland over the last century in the Piedmont of South Carolina.

This community is easily invaded by exotic species such as Japanese honeysuckle and privet. Although this community is of low conservation concern, management of the invasive exotics within this community may prevent the spread of these exotics into adjacent higher priority communities.

Cultivated Meadow (4048)

This association includes grassland pastures and hayfields, more-or-less cultural, though sometimes no longer actively maintained. The dominant species in this type are the European 'tall or meadow fescues'. These communities are sometimes nearly monospecific but can also be very diverse and contain many native species of grasses, sedges, and forbs. This vegetation is currently defined for the 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.

This community occurs throughout the park in all regularly mowed areas. It is most common in the northern 2/3 of the park.

This association is considered a human modified community and thus is of no conservation concern. It is a very common type in this area due to the large scale abandonment of farmland over the last century in the Piedmont of South Carolina.

This community is easily invaded by invasive exotic species such as Japanese honeysuckle and Japanese stiltgrass. Although this community is not of conservation concern, management of the invasive exotics within this community may prevent the spread of these exotics into adjacent higher priority communities.

Southern Cattail Marsh (*) (4150)

This association is a semi-natural type, consisting of cattails (*Typha latifolia*) as an essentially monospecific stand, especially in artificial wetlands, such as borrow pits or ponds. The water table is at or above the soil surface for at least part of the growing season. Cattails often form dense, almost monotypic stands. Sedges and bulrushes (*Schoenoplectus* spp.) are often found in this community, especially on the margins, along with other common wetland species.

Within the park, this community exists in shallow former farm ponds.

This association is considered a human modified community in this park since it is an old farm pond and thus is of little conservation concern. However, from an aquatics standpoint, it may be a significant community type in regards to upland salamander and frog diversity. It is a very common type in this area due to the large number of farms in this part of the state.

This community is susceptible to invasion by a number of aquatic weeds. Although this community is not of conservation concern, management of the invasive exotics within this community may prevent the spread of these exotics into adjacent higher priority communities.

Ecological Community Summary

Of the eighteen associations described above, only seven associations are considered natural or not successional. These seven association types occur in areas that have been free from heavy disturbance for more than 80 years or occur in bottomland areas that recover more quickly from stand initiating disturbance. All seven of the most natural associations combined account for only about one quarter to one third of the park's land area. These communities include the Piedmont Basic Mesic Mixed Hardwood Forest, Piedmont Dry-Mesic Oak-Hickory Forest, Interior Southern Red Oak – White Oak Forest, Southeastern Coastal Plain Flat Terrace Forest, Southern Piedmont Oak Bottomland Forest, Floodplain Canebrake, and Southern Cattail Marsh. When considering priorities for land management, exotic invasive control, preservation, etc., these communities should take higher priority than the successional and exotic-dominated communities.

Of all these communities, the Floodplain Canebrake community is considered the rarest; a G2? community. Ecological communities are generally ranked on a scale of 1 to 5, with 5 being extremely secure throughout its range, and 1 being very rare and not secure. Canebrakes occurred historically as a dominant landscape feature in southeastern United States floodplains at the time of European settlement (Platt 1997). They have rapidly disappeared due to lack of fire and anthropogenic disturbance. Unfortunately, very little is known of the canebrake community since it began disappearing rapidly shortly after European settlement. However, sources have documented that dense canebrakes provided cover for a variety of species now rare or extinct in the southeast, especially bison, swamp rabbits, black bear, passenger pigeons, six species of butterflies not known outside of canebrakes, and the possibly extinct Bachman's warbler (Platt 1997). Although this community is altered and no longer found within the park as a matrix community (only small degraded patches remain), it was documented in the park by the first European writers to visit the area (Bass 1978).

Areas that are similar to this community in the park are very patchy and only occur in small areas where trees have recently fallen down and allowed large amounts of sunlight to shine onto the floodplain floor. This floodplain floor is very impacted by invasive exotics such as privet and Japanese stiltgrass, so as these species become more common, the cane will probably continue to decline. In addition, the community needs a certain amount of disturbance to create ideal conditions, so the lack of fire, grazing, and/or wind disturbance has meant that much of the habitat has grown up into forest.

The Southern Piedmont Oak Bottomland Forest (G3?) is another uncommon and important natural community at Ninety Six. It generally occurs in the lowland areas further away from the main channel of the creek and contains a high diversity of bottomland oaks that are not found in the upland areas of the park (swamp white oak, Shumard's oak (*Quercus shumardii*), willow oak) and uncommon herbaceous species such as eastern narrowleaf sedge (*Carex* amphibola) and rain/Atamasco lily. The health of this community is mainly threatened by the invasive exotic privet shrub. Privet can form dense thickets in the understory of this community type, shading out herbs and seedlings of canopy trees. As a consequence, canopy trees may not be replaced in the future as older trees die, causing a conversion to privet shrubland as is seen in some storm damaged areas of the bottomland.

Although Ninety Six National Historic Site has been impacted heavily by past land use practices and settlement, it nevertheless serves as refuge for plant species and ecological communities that no longer exist in other parts of the region. In particular, the canebrake and oak bottomland communities are increasingly rare in this region and Ninety Six may serve as an important refuge for these communities outside of Sumter National Forest.

Overview

Some of the recommendations for the park found throughout this document are summarized below:

1) control invasive exotics in all communities, but especially those in and near the two priority natural communities. Privet and bamboo may be the most important species on which to focus, although the hard to control Japanese stiltgrass is probably having the most impact on the natural flora of the park.
2) Explore the possibility of restoring some of the canebrakes that historically occurred at the time of European settlement in areas where cane and other canebrake species still exist.
3) Focus management on the high quality examples of the seve natural communities within the park.
4) Study and monitor populations of Oglethorpe oak to understand better its habitat requirements to develop management techniques for this species.

Literature Cited

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

ArcView GIS 3.2. 1992. Environmental Systems Research Institute, Inc. Redlands, CA.

Bailey, R. G.; Avers, P. E.; King, T.; McNab, W. H., eds. 1994. Ecoregions and subregions of the United States (map). Washington, DC: USDA Forest Service. 1:7,500,000. With supplementary table of map unit descriptions, compiled and edited by W. H. McNab and R. G. Bailey.

Bass, Robert D. 1978. Ninety Six – the struggle for the South Carolina Backcountry. The Sandlapper Store. Lexington, S.C.

Camp, Wallace J. and Edward C. Herren. 1980. Soil survey of Greenwood and McCormick Counties, South Carolina. Dept. of Agriculture, Soil Conservation Service.

Critchfield, W.B. and E.L.Little, Jr. 1996. Geographic Distibution of the Pines of the World, USDA Forest Service Misc. Publication 991.

Duncan, W.H. 1940. A new species of white oak from Georgia. Amer. Midl. Naturalist 24: 755-756.

Garmin Corporation 1999. Garmin GPS III Plus Owner's Manual and Reference. Garmin International, Olathe, Kansas, USA.

Grossman, D.H., D. Faber-Langendoen, A.S. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. International classification of ecological communities: terrestrial vegetation of the United States. Volume 1. The National Vegetation Classification System: development, status, and applications. The Nature Conservancy, Arlington, Virginia, USA.

Heltshe, J.F., and N.E. Forrester. 1983. Estimating species richness using the jackknife procedure. Biometrics 39: 1-12.

Jones, S. M. 1988a. Old-growth forests within the Piedmont of South Carolina. Natural Areas Journal 8:31-37.

Jones, S. M. 1988b. Old-growth, steady state forests within the Piedmont of South Carolina. Ph.D. dissertation, Clemson University, Clemson, SC. 94 pp.

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

McCune, B., and J.B. Grace. 2002. Analysis of Ecological Communities. MjM Software Design, Gleneden Beach, Oregon.

McCune, B., and M.J. Mefford. 1999. PC-ORD, Multivariate analysis and ecological data, Version 4. MjM Software Design, Gleneden Beach, Oregon.

Miller, James H., Erwin B. Chambliss, and Charles T. Bargeron. 2000. Invasive Plants of the Thirteen Southern States. http://www.invasive.org/south/seweeds.cfm. (Accessed: October 20, 2003).

National Park Service. 2000. Ninety Six National Historic Site. Government Printing Office. 1 p.

Natural Resources Conservation Service (PLANTS database). 1991. PLOTS database. The Nature Conservancy/ National Park Service.

NatureServe. 2002. International Classification of Ecological Communities: Terrestrial Vegetation. Natural Heritage Central Databases. NatureServe, Arlington, VA.

NatureServe. 2003. NatureServe Explorer: An online encyclopedia of life [web application]. Version 1.8. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: October 20, 2003).

Nichols, Becky, M. Jenkins, J. Rock, K. Langdon, and T. Leibfreid. 2000. Study plan for vertebrate and vascular plant inventories. Appalachian Highlands Network and Cumberland Piedmont Network, National Park Service.

Palmer, M.W. 1990. The estimation of species richness by extrapolation. Ecol. 71.

Patrick, Thomas, Jim Allison, and Gregory Krakow. 1995. Protected Plants of Georgia. Georgia Department of Natural Resources.

Platt, S.G. and C.G. Brantley. 1997. Canebrakes: An ecological and historical perspective. Castanea 62: 8-21.

Radford, A.E., H.E. Ahles, and C. Ritchie Bell. 1968. Manual of the Vascular Flora of the Carolinas. The University of North Carolina Press. Chapel Hill. 1183 p.

Tennessee Exotic Pest Plants Council 2001. Invasive exotic pest plants in Tennessee. First revision (http://www.tneppc.org/invasive_plants).

United States Congress. 1976. Public Law 94-393 : 94th Congress, S. 2642, August 19, 1976 :

an act to provide for the establishment of the Ninety Six National Historic Site in the State of South Carolina, and for other purposes. Supt. of Docs., U.S. Govt. Print. Washington, D.C.

USDA, NRCS. 2004. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Weakley, A. 2000. Flora of the Carolinas and Virginia: Working Draft. UNC- Chapel Hill.

Welch, Roy and Marguerite Madden. 2003. Ninety Six National Historic Site preliminary mapping data provided by NPS with permission. University of Georgia Center for Remote Sensing and Mapping Science.

Williams, Eric. 2003. Personal communication.

Figure 1. Map of Ninety Six National Historic Site with all permanent points marked at their actual locations.

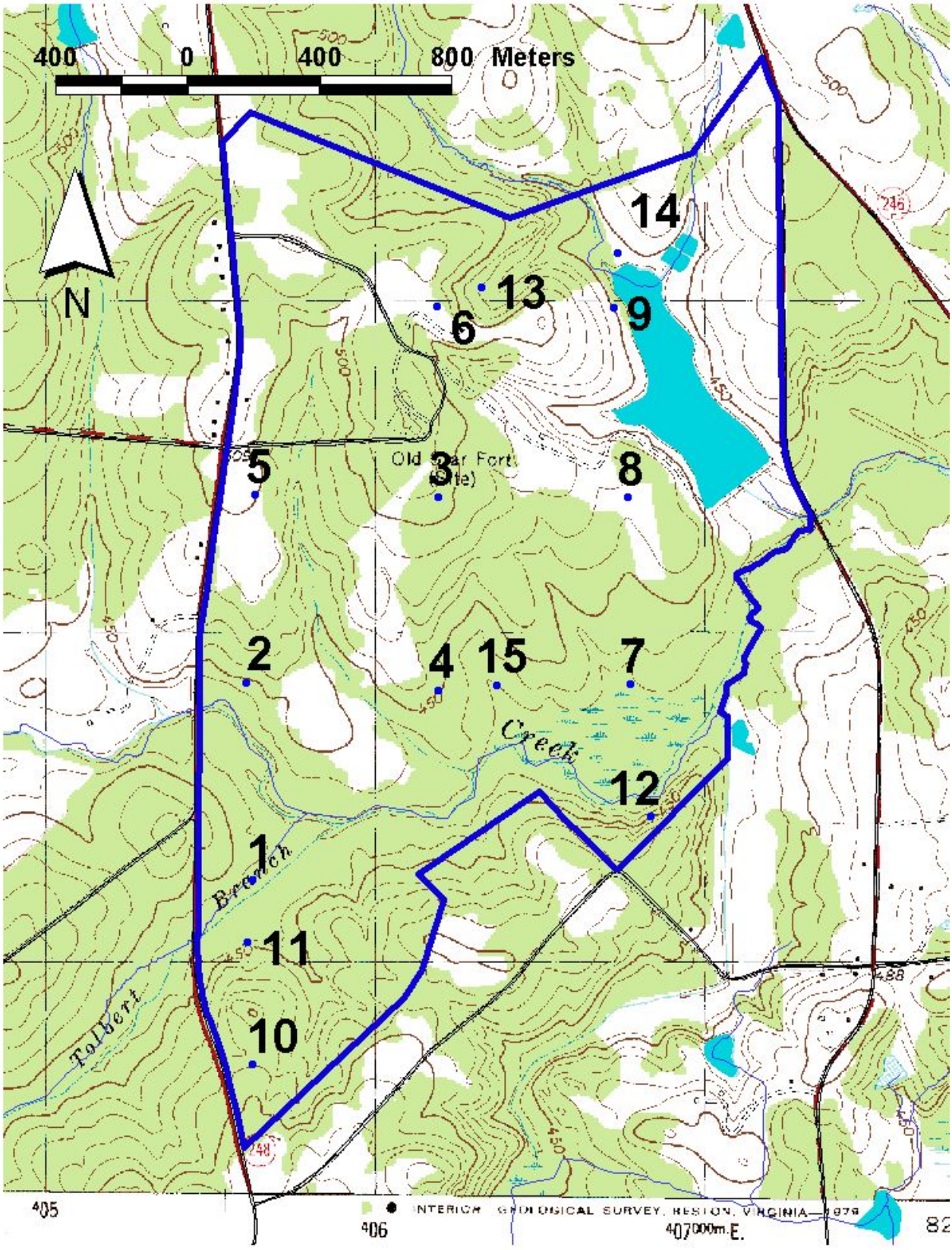
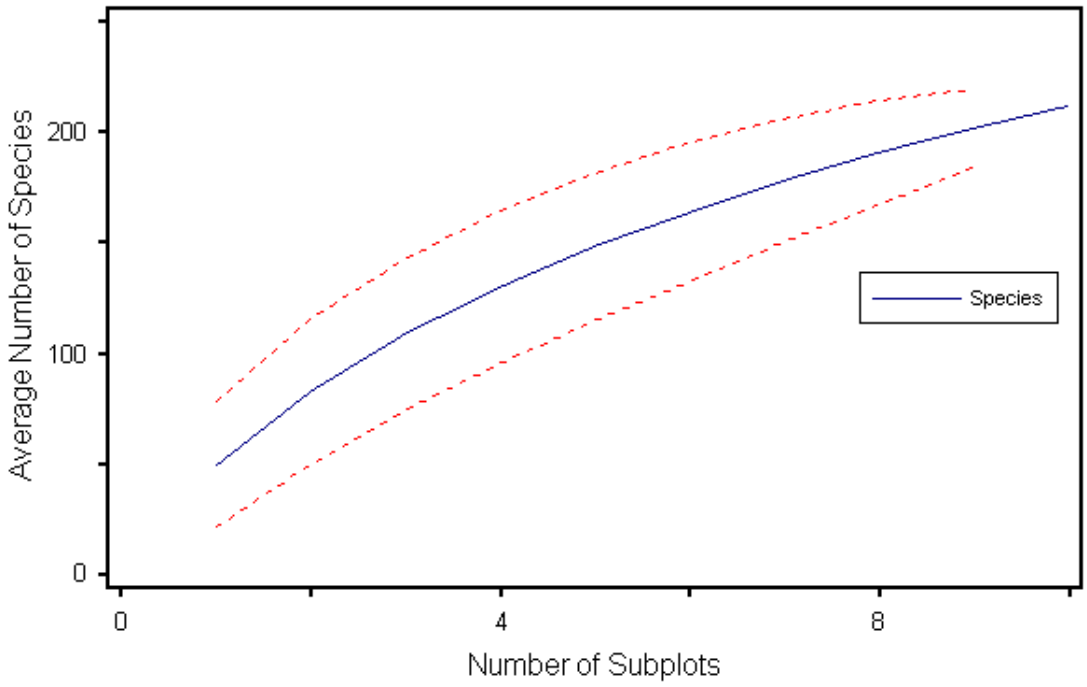


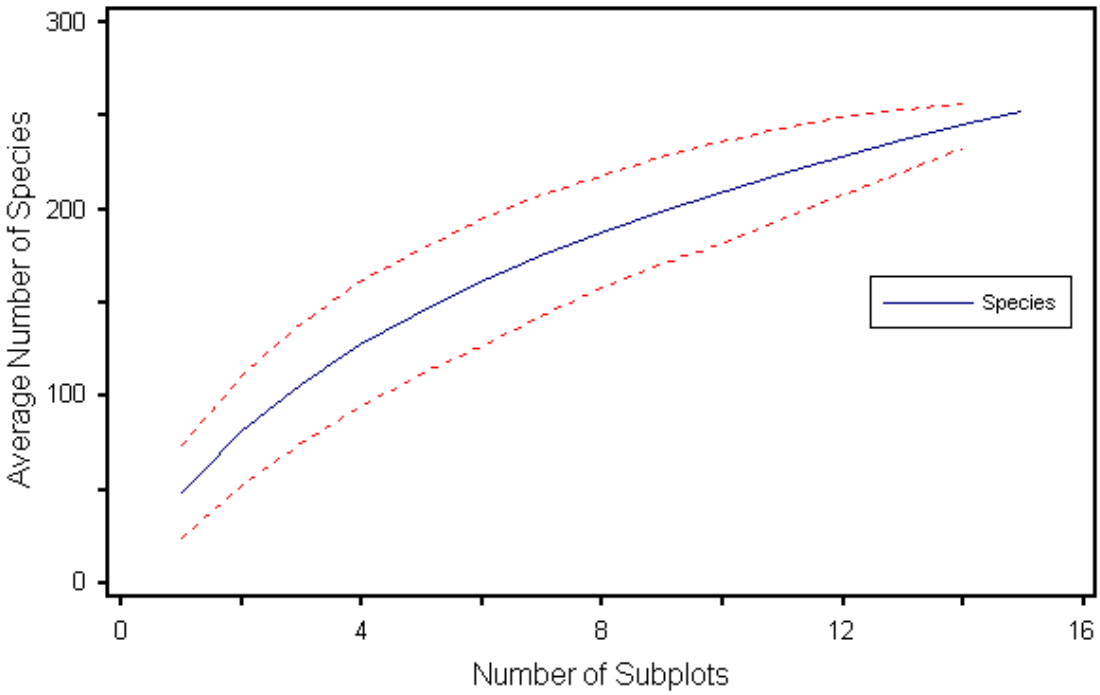
Figure 2. Species area curves for Ninety Six National Historic Site derived using data from a) just the 10 gridded plots in the park and b) all 15 plots.

a)



First-order jackknife estimate of number of species in park = 302.0
Second-order jackknife estimate of number of species in park = 344.3

b)



First-order jackknife estimate of number of species in park = 360.4
Second-order jackknife estimate of number of species in park = 419.8

Table 1. Plot numbers and locations for all permanent plots established at Ninety Six National Historic Site.

Plot Number	X Coordinate	Y Coordinate	Projection	Zone	Type of plot
1	405644.5	3777445.1	NAD83	17	FULL
2	405627.8	3778044.4	NAD83	17	FULL
3	405654.1	3778612.9	NAD83	17	FULL
4	406208.3	3778022.5	NAD83	17	FULL
5	406208.2	3778605.4	NAD83	17	FULL
6	406206.5	3779185.6	NAD83	17	FULL
7	406791.1	3778038.1	NAD83	17	FULL
8	406783.4	3778605.1	NAD83	17	FULL
9	406741.1	3779180.8	NAD83	17	FULL
10	405645.8	3776885.9	NAD83	17	FULL
11	405603.3	3777239.1	NAD83	17	FULL
12	406851.0	3777638.4	NAD83	17	FULL
13	406339.0	3779244.0	NAD83	17	FULL
14	406751.0	3779348.0	NAD83	17	FULL
15	406386.0	3778037.0	NAD83	17	FULL

Table 2. List of all plants documented for park from current and historic inventories (ordered alphabetically by scientific name).

Latin Name	Common Name	TSN	Grank
Acer barbatum	Florida maple	28759	G4G5Q
Acer leucoderme	chalk maple	28761	G5
Acer negundo	boxelder	28749	G5
Acer rubrum	red maple	28728	G5
Achillea millefolium	common yarrow	35423	G5
Acorus calamus	sweetflag	564989	GNR
Ageratina aromatica	lesser snakeroot	36467	G5
Agrimonia microcarpa	smallfruit agrimony	25097	G5
Agrimonia parviflora	harvestlice	25098	G5
Agrostis hyemalis	winter bentgrass	40394	G5
Aira elegans	annual silver hairgrass	41377	GNR
Albizia julibrissin	mimosa	26449	GNR
Allium canadense	meadow garlic	42635	G5
Allium vineale	wild garlic	42637	GNR
Ambrosia artemisiifolia	annual ragweed	36496	G5
Anagallis arvensis	pimpernel	24043	GNR
Andropogon glomeratus	bushy bluestem	40454	G5
Andropogon ternarius	splitbeard bluestem	40455	G5
Andropogon virginicus	broomsedge	40456	G5
Antennaria plantaginifolia	woman's tobacco	36717	G5
Apios americana	groundnut	25390	G5
Apocynum cannabinum	Indianhemp	30157	G5
Arabidopsis thaliana	mouseear cress	23041	GNR
Arisaema triphyllum	Jack in the pulpit	42525	G5
Aristolochia serpentaria	Virginia snakeroot	18342	G4
Arnoglossum atriplicifolium	pale Indian plantain	36583	G4G5
Arundinaria gigantea	giant cane	40477	G5
Asclepias tuberosa	butterfly milkweed	30313	G5?
Asclepias viridiflora	green milkweed	30322	G5
Asimina triloba	common pawpaw	18117	G5
Asparagus officinalis	asparagus	42784	G5?
Asplenium platyneuron	ebony spleenwort	17355	G5
Azolla caroliniana	Carolina mosquitofern	18008	G5
Barbarea verna	winter cress	22743	GNR
Belamcanda chinensis	blackberry lily	43280	GNR
Bidens tripartita	threelobe beggarticks	35709	G5
Bignonia capreolata	crossvine	34307	G5
Boehmeria cylindrica	smallspike false nettle	19121	G5
Botrychium virginianum	rattlesnake fern	17173	G5
Brachyelytrum erectum	bearded shorthusk	41527	G5
Briza minor	little quakinggrass	41531	GNR

Latin Name	Common Name	TSN	Grank
Bromus catharticus	rescuegrass	501066	GNR
Bromus commutatus	hairy brome	40497	GNR
Bromus japonicus	Japanese brome	40479	GNR
Bromus pubescens	hairy woodland brome	40514	G5
Bumelia lycioides	buckthorn bumelia	23806	G5
Callicarpa americana	American beautyberry	32144	G5
Callisia rosea	Piedmont roseling	501139	G5
Campsis radicans	trumpet creeper	34309	G5
Cardamine bulbosa	bulbous bittercress	22769	G5
Cardamine hirsuta	bittercress	22797	GNR
Carex albolutescens	greenwhite sedge	39371	G5
Carex amphibola	eastern narrowleaf sedge	39491	G5
Carex annectens	yellowfruit sedge	39373	G5
Carex blanda	woodland sedge	39379	G5?
Carex caroliniana	Carolina sedge	39382	G5
Carex cephalophora	oval-leaf sedge	39383	G5
Carex complanata	blue sedge	39551	G5
Carex corrugata	eastern narrowleaf sedge	39557	G5?
Carex crinita	fringed sedge	39385	G5
Carex flaccosperma	thinfruit sedge	39605	G5
Carex frankii	Frank's sedge	39393	G5
Carex gracilescens	slender looseflower sedge	39618	G5?
Carex grisea	eastern narrowleaf sedge	510206	G5?
Carex laevivaginata	wooly sedge	39410	G5
Carex leptalea	bristlystalked sedge	39669	G5
Carex lupulina	hop sedge	39413	G5
Carex lurida	shallow sedge	39414	G5
Carex oxylepis	sharpscale sedge	39424	G5?
Carex retroflexa	reflexed sedge	39782	G5
Carex rosea	rosy sedge	39429	G5
Carex scoparia	broom sedge	39432	G5
Carex squarrosa	squarrose sedge	39815	G4G5
Carex tribuloides	blunt broom sedge	39438	G5
Carex vulpinoidea	fox sedge	39442	G5
Carpinus caroliniana	american hornbean	19504	G5
Carya alba	mockernut hickory	501306	G5
Carya cordiformis	bitternut hickory	19227	G5
Carya glabra	pignut hickory	19231	G5
Carya illinoinensis	pecan	19234	G5
Carya ovata	shagbark hickory	19242	G5
Celtis laevigata	sugarberry	19042	G5
Centrosema virginianum	butterflypea	25778	G5
Cephalanthus occidentalis	buttonbush	34786	G5
Cercis canadensis	redbud	25782	G5

Latin Name	Common Name	TSN	Grank
Chaerophyllum tainturieri	hairyfruit chervil	29617	G5
Chamaecrista fasciculata var. fasciculata	partridge pea	566216	G5
Chasmanthium latifolium	Indian woodoats	41547	G5
Chasmanthium sessiliflorum	slender woodoats	41551	G5
Chimaphila maculata	striped prince's pine	23767	G5
Chrysogonum virginianum var. australe	green and gold	527359	G5TNR
Cicuta maculata	spotted water hemlock	29456	G5
Cirsium vulgare	bull thistle	36428	GNR
Claytonia virginica	spring beauty	20382	G5
Clitoria mariana	Atlantic pigeonwings	26542	G5
Cocculus carolinus	Carolina coralbead	18864	G5
Commelina virginica	Virginia dayflower	39128	G5
Conopholis americana	American squawroot	34274	G5
Cornus amomum	silky dogwood	27799	G5
Cornus florida	flowering dogwood	27806	G5
Crataegus uniflora	dwarf hawthorn	24608	G5
Cynodon dactylon	bermudagrass	41619	GNR
Cyperus echinatus	globe flatsedge	501920	G5
Cyperus erythrorhizos	redroot flatsedge	39887	G5
Cyperus odoratus	fragrant flatsedge	39894	G5
Dactylis glomerata	cocksfoot	193446	GNR
Danthonia sericea	downy oatgrass	41635	G5?
Danthonia spicata	poverty oatgrass	41642	G5
Daucus carota	Queen Anne's lace	29477	GNR
Desmodium canescens	hoary ticktrefoil	25792	G5
Desmodium paniculatum	Narrow-leaf ticktrefoil	25815	G5
Desmodium rotundifolium	prostrate ticktrefoil	502020	G5
Dichanthelium acuminatum var. fasciculatum	western panicgrass	527685	G5T5
Dichanthelium boscii	Bosc's panicgrass	41655	G5
Dichanthelium clandestinum	deertongue panicgrass	41656	G5?
Dichanthelium depauperatum	starved panicgrass	41658	G5
Dichanthelium dichotomum	cypress panicgrass	41659	G5
Dichanthelium dichotomum var. dichotomum	cypress panicgrass	527691	G5T5
Dichanthelium laxiflorum	openflower rosette grass	41661	G5
Dichanthelium oligosanthes	Heller's rosette grass	41667	G5
Dichanthelium ravenelii	Ravenel's rosette grass	41669	G5
Diospyros virginiana	persimmon	23855	G5
Duchesnea indica	Indian strawberry	25163	G5
Echinochloa crus-galli	Barnyard grass	502210	GNR
Elaeagnus pungens	thorny olive	502223	GNR

Latin Name	Common Name	TSN	Grank
Elaeagnus umbellata	silverberry	27776	GNR
Eleocharis obtusa	blunt spikesedge	40017	G5
Eleocharis quadrangulata	squarestem spikerush	40021	G4
Elephantopus carolinianus	Carolina elephantsfoot	37297	G5
Elephantopus tomentosus	devil's grandmother	37300	G5
Elymus hystrix var. hystrix	eastern bottlebrush grass	527866	G5T5
Elymus virginicus	Virginia wildrye	40681	G5
Epifagus virginiana	beechdrops	34276	G5
Eragrostis capillaris	lace grass	40774	G5
Erigeron strigosus	prairie fleabane	35951	G5
Euonymus americana	American strawberrybush	502577	G5
Eupatorium hyssopifolium	hyssopleaf thoroughwort	35979	G5
Euphorbia corollata	flowering spurge	28057	G5
Euphorbia pubentissima	false flowering spurge	28125	G5
Facelis retusa	annual trampweed	37367	GNR
Fagus grandifolia	American beech	19462	G5
Festuca arundinacea	tall fescue	40810	GNR
Festuca subverticillata	nodding fescue	502612	G5
Frasera caroliniensis	American columbo	502651	G5
Fraxinus pennsylvanica	green ash	32929	G5
Galium circaezans	licorice bedstraw	34800	G5
Galium obtusum	bluntleaf bedstraw	34802	G5
Galium obtusum ssp. filifolium	bluntleaf bedstraw	524096	G5T5
Galium uniflorum	oneflower bedstraw	34935	G4G5
Gamochaeta americana	American everlasting	37417	GNR
Gamochaeta falcata	narrowleaf purple everlasting	37419	GNR
Gelsemium sempervirens	evening trumpetflower	29932	G5
Geranium carolinianum	Carolina geranium	29105	G5
Geranium maculatum	spotted geranium	29107	G5
Geum canadense	white avens	24645	G5
Gleditsia triacanthos	honey locust	26714	G5
Glyceria striata	fowl mannagrass	40833	G5
Goodyera pubescens	downy rattlesnake plantain	43594	G5
Gymnopogon ambiguus	bearded skeletongrass	41749	G4
Helenium amarum	bitter sneezeweed	36007	G5
Hexastylis arifolia	little brown jug	502983	G5
Hibiscus syriacus	rose-of-sharon	21638	GNR
Hieracium venosum	rattlesnakeweed	37734	G5
Hordeum pusillum	little barley	40866	G5
Houstonia purpurea	purple bluets	35051	G5
Houstonia pusilla	tiny bluet	35052	G5
Hydrangea arborescens	wild hydrangea	24195	G5
Hydrocotyle umbellata	umbrella pennyroyal	29514	G5
Hypericum hypericoides	St. Andrew’s cross	503138	G5

Latin Name	Common Name	TSN	Grank
Hypericum mutilum	small flowered St. Johns-wort	21421	G5
Hypericum punctatum	spotted St. Johnswort	21422	G5
Ilex decidua	possumhaw	27998	G5
Ilex opaca	american holly	27982	G5
Ipomoea pandurata	man of the earth	30786	G5
Ipomoea purpurea	common morning glory	30789	GNR
Isoetes sp.	quillwort	17143	G?
Juglans nigra	black walnut	19254	G5
Juncus coriaceus	leathery rush	39230	G5
Juncus effusus	common rush	39232	G5
Juncus tenuis	poverty rush	39243	G5
Juniperus virginiana	eatern red-cedar	18048	G5
Krigia virginica	Virginia dwarfdandelion	37816	G5
Leersia virginica	white grass	40890	G5
Lemna minor	common duckweed	42590	G5
Lepidium ruderale	roadside pepperweed	22977	GNR
Lepidium virginicum	Virginia pepperweed	22955	G5
Lespedeza cuneata	Chinese lespedeza	25898	GNR
Lespedeza repens	creeping lespedeza	503402	G5
Leucanthemum vulgare	oxeyedaisy	37903	GNR
Ligusticum canadense	Canadian licoriceroot	29528	G4
Ligustrum vulgare	European privet	32980	GNR
Lindernia dubia	moistbank pimpernel	33221	G5
Liquidambar styraciflua	sweetgum	19027	G5
Liriodendron tulipifera	tulip poplar	18086	G5
Lolium perenne ssp. multiflorum	Italian ryegrass	524260	GNRTNR
Lonicera japonica	Japanese honeysuckle	35283	GNR
Lonicera sempervirens	trumpet honeysuckle	35303	G5
Ludwigia leptocarpa	anglestem waterprimrose	27349	G5
Luzula echinata	hedgehog woodrush	39342	G5
Lycopodium digitatum	fan clubmoss	17028	G5
Maclura pomifera	osage orange	19102	G4G5
Magnolia grandiflora	southern magnolia	18074	G5
Maianthemum racemosum ssp. racemosum	false Solomon’s seal	524297	G5
Malaxis unifolia	green addersmouth orchid	43647	G5
Manfreda virginica	false aloe	503687	G5
Matelea gonocarpos	angularfruit milkvine	503702	G5
Melia azedarach	chinaberry	29024	GNR
Melica mutica	twoflower melicgrass	41858	G5
Melothria pendula	Guadeloupe cucumber	22339	G5?
Menispermum canadense	common moonseed	18871	G5
Microstegium vimineum	Japanese stiltgrass	503829	GNR
Mikania scandens	climbing hempvine	36043	G5

Latin Name	Common Name	TSN	Grank
Mitchella repens	partridgeberry	35063	G5
Modiola caroliniana	Carolina bristlemallow	21851	G5
Morus rubra	red mulberry	19070	G5
Murdannia keisak	Asian spiderwort	39145	GNR
Myosotis macrosperma	largeseed forget-me-not	31695	G5
Nyssa sylvatica	blackgum	27821	G5
Oenothera biennis	common eveningprimrose	27368	G5
Ophioglossum engelmannii	adderstongue	504032	G5
Ophioglossum vulgatum	Southern adder’s-tongue	565333	G5
Ornithogalum umbellatum	Star-of-Bethlehem	42754	G2?
Osmunda cinnamomea	cinnamon fern	17219	G5
Oxalis stricta	Upright wood sorrel	29095	G5
Oxalis violacea	violet wood sorrel	29098	G5
Panicum anceps	beaked panicum	40904	G5
Panicum rigidulum var. combsii	Comb's panicgrass	529365	G5T5?
Parthenocissus quinquefolia	Virginia creeper	28602	G5
Paspalum dilatatum	Dallasgrass	40997	GNR
Paspalum distichum	knotgrass	41005	G5
Paspalum floridanum	Florida paspalum	40992	G5
Paspalum notatum var. saurae	bahiagrass	529414	GNRTNR
Passiflora incarnata	purple passionflower	504139	G5
Peltandra virginica	green arrow arum	42534	G5
Phoradendron tomentosum	mistletoe	27871	G5
Photinia serratifolia	Taiwanese photinia	507109	GNR
Phyllostachys sp.	bamboo	42022	GNR
Phytolacca americana	American pokeweed	19523	G5
Pinus echinata	yellow pine	183335	G5
Pinus elliottii	slash pine	18036	G5
Pinus taeda	loblolly pine	18037	G5
Piptochaetium avenaceum	blackseed needlegrass	504408	G5
Plantago lanceolata	narrowleaf plantain	32874	G5
Plantago major	broadleaf plantain	32887	G5
Plantago rugelii	blackseed plantain	504439	G5
Plantago virginica	Virginia plantain	32895	G5
Platanus occidentalis	sycamore	19020	G5
Pleopeltis polypodioides	resurrection fern	504451	G5
Poa annua	annual bluegrass	41107	GNR
Poa autumnalis	autumn bluegrass	41111	G5
Poa compressa	Canada bluegrass	41082	GNR
Podophyllum peltatum	mayapple	18850	G5
Polygonum caespitosum var. longisetum	oriental ladysthumb	566299	GNRTNR
Polygonum hydropiperoides	swamp smartweed	20857	G5
Polygonum setaceum	bog smartweed	20926	G5

Latin Name	Common Name	TSN	Grank
Polystichum acrostichoides	Christmas fern	17675	G5
Poncirus trifoliata	hardy orange	28989	GNR
Populus deltoides	plains cottonwood	22445	G5
Prenanthes sp.	rattlesnakeroot	38268	N/a
Proserpinaca palustris	marsh mermaidweed	27049	G5
Prunella vulgaris	heal all	32381	G5
Prunus angustifolia	Chickasaw plum	24768	G5
Prunus persica	peach	24765	G5
Prunus serotina	black cherry	24764	G5
Prunus umbellata	flatwood plum	24805	G4G5
Pseudognaphalium obtusifolium	rabbittobacco	507657	G5
Pueraria montana var. lobata	kudzu	529930	GNRTNR
Pyrus communis	pear	25295	G5
Quercus alba	white oak	19290	G5
Quercus coccinea	scarket oak	19288	G5
Quercus falcata	southern red oak	19277	G5
Quercus lyrata	overcup oak	19278	G5
Quercus marilandica	blackjack oak	19374	G5
Quercus michauxii	swamp chestnut oak	19279	G5
Quercus nigra	water oak	19280	G5
Quercus oglethorpensis	oglethorpe oak	19391	G3
Quercus pagoda	cherrybark oak	195195	G5
Quercus phellos	willow oak	19282	G5
Quercus rubra	northern red oak	19408	G5
Quercus shumardii	shumard oak	19417	G5
Quercus stellata	post oak	19422	G5
Quercus velutina	black oak	19447	G5
Ranunculus abortivus	littleleaf buttercup	18559	G5
Ranunculus pusillus	weak buttercup	18574	G5
Ranunculus recurvatus	blisterwort	18641	G5
Rhus copallina	dwarf sumac	28773	G5
Rhus glabra	smooth sumac	28782	G5
Rhynchosia sp.	snoutbean	500536	n/a
Rubus argutus	sawtooth blackberry	24877	G5
Rubus bifrons	Himalayan berry	24891	G5
Ruellia caroliniensis	Carolina wild petunia	34373	G5
Rumex crispus	curly dock	20937	GNR
Sabatia angularis	rosepink	30005	G5
Saccharum giganteum	sugarcane plumegrass	504933	G5
Salix nigra	black willow	22484	G5
Salvia lyrata	lyreleaf sage	32690	G5
Sambucus canadensis	american elder	35317	G5
Samolus valerandi ssp. parviflorus	water brookweed	524659	G5
Sanguinaria canadensis	bloodroot	18990	G5
Sanicula canadensis	Canadian blacksnakeroot	29850	G5

Latin Name	Common Name	TSN	Grank
Sassafras albidum	sassafras	18158	G5
Saururus cernuus	lizards tail	18221	G5
Scirpus cyperinus	bulrush	40228	G5
Scleria oligantha	littlehead nutrush	40314	G5
Scutellaria integrifolia var. integrifolia	Hyssop skullcap	-504538	G5
Senecio anonymus	Small's ragwort	36095	G5
Senna marilandica	wild senna	505160	G5
Setaria glaucum	yellow foxtail	565884	GNR
Setaria parviflora	marsh bristlegrass	505191	G5
Sherardia arvensis	field madder	35237	GNR
Sisyrinchium angustifolium	narrowleaf blueeyed grass	43240	G5
Sisyrinchium mucronatum	Blue-eyed grass	43239	G5
Smallanthus uvedalius	hairy leafcup	505252	G4G5
Smilax bona-nox	saw greenbrier	43341	G5
Smilax glauca	cat greenbrier	43342	G5
Smilax rotundifolia	roundleaf greenbrier	43346	G5
Smilax tamnoides	bristly greenbrier	43348	G5
Solanum carolinense	Carolina horsenettle	30413	G5
Sorghum halepense	Johnsongrass	42111	GNR
Sphenopholis nitida	shiny wedgescale	41281	G5
Sphenopholis obtusata	prairie wedgegrass	41279	G5
Spiranthes tuberosa	little ladies’-tresses	505346	G5
Spirodela polyrhiza	giant duckweed	42599	G5
Sporobolus indicus	smutgrass	42140	GNR
Symphyotrichum dumosum	rice button aster	522200	G5
Thalictrum revolutum	waxyleaf meadow-rue	18660	G5
Thalictrum thalictroides	rue anemone	18683	G5
Tillandsia usneoides	Spanish moss	42371	G5
Tipularia discolor	crippled cranefly	43703	G4G5
Toxicodendron radicans	poison ivy	28821	G5
Tragia urticifolia	nettleleaf noseburn	28437	G5
Tridens flavus	Purpletop	42227	G5
Trifolium arvense	hairy clover	26221	GNR
Trifolium campestre	field clover	26231	GNR
Trifolium pratense	red clover	26313	GNR
Triodanis perfoliata var. biflora	small Venus' looking glass	530742	G5T5
Triodanis perfoliata var. perfoliata	clasping Venus' looking glass	530743	G5T5
Typha latifolia	cattail	42326	G5
Ulmus alata	winged elm	19051	G5
Ulmus rubra	slippery elm	19050	G5
Utricularia gibba	humped bladderwort	34452	G5
Uvularia perfoliata	perfoliate bellwort	43110	G5
Vaccinium arboreum	farkleberry	23580	G5
Vaccinium elliottii	Elliott's blueberry	23592	G5Q

Latin Name	Common Name	TSN	Grank
Verbascum blattaria	moth mullein	33389	GNR
Verbena brasiliensis	Brazilian vervain	32086	GNR
Verbena rigida	tuberous vervain	32118	GNR
Verbesina alternifolia	wingstem	38597	G5
Verbesina occidentalis	yellow crownbeard	38610	G5
Verbesina virginica	white crownbeard	38613	G5?
Veronica arvensis	corn speedwell	33411	GNR
Viburnum prunifolium	blackhaw	35253	G5
Viburnum rufidulum	Rusty blackhaw	35274	G5
Vicia villosa ssp. varia	winter vetch	524812	GNR
Viola affinis	sand violet	22035	G5
Vitis aestivalis	summer grape	28607	G5
Vitis rotundifolia	muscadine	28609	G5
Vulpia myuros	rattail fescue	42263	G5
Vulpia sciurea	squirreltail fescue	42265	G5
Wisteria floribunda	Japanese wisteria	27020	GNR
Wisteria sinensis	Chinese wisteria	27023	GNR
Wolffia brasiliensis	Brazilian watermeal	505750	G5
Woodwardia areolata	netted chainfern	17749	G5
Youngia japonica	oriental false hawksbeard	38704	GNR
Yucca filamentosa	Adam's needle	43140	G5
Zephyranthes atamasca	Rain lily	505791	G4G5

Key to Global Ranking System (Granks):

G# = Numeric rank
G1 = Critically imperiled globally
G2 = Imperiled globally
G3 = Rare or uncommon
G4 = Widespread, abundant, and apparently secure, but with cause for long-term concern
G5 = Demonstrably widespread, abundant and secure
G#G# = Numeric range rank
G? = Unranked
GU = Unrankable
GH = Historical
GX = Extirpated
GC = Cultural (planted/cultivated)
GM=Modified
GW= Ruderal
GNR = Not ranked (usually because it is an exotic species)
GNRTNR = Not ranked (usually because it is an exotic species)
n/a = not ranked (usually because only genus was identified)

Qualifiers:

? = Inexact numeric rank
Q = Questionable taxonomy

Table 3. List of vouchers that were collected at Ninety Six National Historic Site.

Latin Name	Common Name	TSN #	Collector	Habitat
Asparagus officinalis	asparagus	42784	White, R., Govus, T.	Old field
Bromus catharticus	rescuegrass	501066	White, R., Govus, T.	Juglans nigra successional
Bromus japonicus	Japanese brome	40479	White, R., Govus, T.	Fraxinus pennsylvanica w/Acer negundo
Cardamine bulbosa	bulbous bittercress	22769	White, R., Govus, T.	Quercus shumardii - Quercus michauxii - Quercus nigra / Acer barbatum - Tilia americana var. heterophylla Forest
Carex annectens	yellowfruit sedge	39373	White, R., Govus, T.	Old field
Carex blanda	woodland sedge	39379	White, R., Govus, T.	Fraxinus pennsylvanica w/Acer negundo
Carex complanata	blue sedge	39551	White, R., Govus, T.	Old field
Carex corrugata	eastern narrowleaf sedge	39557	White, R., Govus, T.	Quercus nigra Forest
Carex frankii	Frank's sedge	39393	White, R., Govus, T.	Liquidambar - Acer rubrum successional bottom & slope
Carex gracilescens	slender looseflower sedge	39618	White, R., Govus, T.	Acer negundo - (Platanus occidentalis, Populus deltoides) Forest
Carex grisea	eastern narrowleaf sedge	510206	White, R., Govus, T.	Juglans nigra successional
Carex oxylepis	sharpscale sedge	39424	White, R., Govus, T.	Liriodendron - white oak bluff
Carex oxylepis	sharpscale sedge	39424	White, R., Govus, T.	Liquidambar - Acer rubrum successional bottom & slope
Carex retroflexa	reflexed sedge	39782	White, R., Govus, T.	Old field
Danthonia spicata	poverty danthonia	41642	White, R., Govus, T.	Liquidambar - Acer rubrum successional bottom & slope
Dichanthelium laxiflorum	openflower rosette grass	41661	Govus, T.	Successional Pinus taeda forest
Dichanthelium laxiflorum	openflower rosette grass	41661	White, R., Govus, T.	Liquidambar - Acer rubrum successional bottom & slope
Frasera caroliniensis (photo)	American columbo	502651	White, R.	Liriodendron - white oak bluff
Frasera caroliniensis (photo)	American columbo	502651	White, R.	Liriodendron - white oak bluff

Latin Name	Common Name	TSN #	Collector	Habitat
Galium obtusum ssp. filifolium	bluntleaf bedstraw	524096	White, R., Govus, T.	Quercus shumardii - Quercus michauxii - Quercus nigra / Acer barbatum - Tilia americana var. heterophylla Forest
Glyceria striata	fowl mannagrass	40833	White, R., Govus, T.	Acer negundo - (Platanus occidentalis, Populus deltoides) Forest
Glyceria striata	fowl mannagrass	40833	White, R., Govus, T.	Liquidambar - Acer rubrum successional bottom & slope
Leersia virginica	white grass	40890	White, R., Govus, T.	Quercus shumardii - Quercus michauxii - Quercus nigra / Acer barbatum - Tilia americana var. heterophylla Forest
Lolium arundinaceum	tall fescue	507979	White, R., Govus, T.	Old field
Maclura pomifera	osage orange	19102	White, R., Govus, T.	Pinus taeda - Liquidambar styraciflua Semi-natural Forest
Oxalis dillenii	Dillen's oxalis	29074	White, R., Govus, T.	Liquidambar - Acer rubrum successional bottom & slope
Poa autumnalis	autumn bluegrass	41111	White, R., Govus, T.	Acer negundo - (Platanus occidentalis, Populus deltoides) Forest
Poncirus trifoliata	hardy orange	28989	White, R., Govus, T.	Fraxinus pennsylvanica w/Acer negundo
Ranunculus abortivus	littleleaf buttercup	18559	White, R., Govus, T.	Acer negundo - (Platanus occidentalis, Populus deltoides) Forest
Ranunculus pusillus	weak buttercup	18574	White, R., Govus, T.	Quercus shumardii - Quercus michauxii - Quercus nigra / Acer barbatum - Tilia americana var. heterophylla Forest
Ranunculus recurvatus	blisterwort	18641	White, R., Govus, T.	Fraxinus pennsylvanica w/Acer negundo
Sanicula canadensis	Canadian blacksnakeroot	29850	White, R., Govus, T.	Fraxinus pennsylvanica w/Acer negundo
Veronica arvensis	corn speedwell	33411	White, R., Govus, T.	Old field
Youngia japonica	oriental false hawksbeard	38704	White, R., Govus, T.	Pinus taeda - Liquidambar styraciflua Semi-natural Forest
Zephyranthes atamasco (photo)	Atamasco lily / rain lily	505791	White, R.	Quercus shumardii - Quercus michauxii - Quercus nigra / Acer barbatum - Tilia americana var. heterophylla Forest

Table 4. Tables of vascular plant diversity measures and species total estimates

	Diversity Measures			
	N	alpha	beta	Gamma
Gridded plots only	10	48.7	4.3	211
Plots off grid only	5	45.8	2.9	135
All plots	15	47.7	5.3	254
Total for park				364

alpha = average species richness per plot
beta = measure of the heterogeneity of the data (gamma/alpha)
gamma = total species for all plots/park

	Estimate of # of species in park	If estimate is correct, % of species confirmed for park (based on 364 species confirmed)
First-order jackknife estimate (all plots)	360.4	99%
Second-order jackknife estimate (all plots)	419.8	86%
First-order jackknife estimate (gridded plots)	301.9	120%
Second-order jackknife estimate (gridded plots)	345.7	105%

Table 5. Exotic plant species at Ninety Six National Historic Site

Scientific Name	Common Name	Considered a Threat?	Source of information
Achillea millefolium	common yarrow	No	Radford et.al 1968
Acorus calamus	sweetflag	No	Radford et.al 1968, Weakley 2000
Aira elegans	annual silver hairgrass	No	Radford et.al 1968, Weakley 2000
Albizia julibrissin	mimosa	Severe Threat	Tennessee Exotic Pest Plants Council 2001, Miller 2000
Allium vineale	field garlic	Lesser Threat	Tennessee Exotic Pest Plants Council 2001
Anagallis arvensis	pimpernel	No	USDA, NRCS 2004
Arabidopsis thaliana	mouseear cress	No	USDA, NRCS 2004
Asaparagus officinalis	asparagus	No	USDA, NRCS 2004
Barbarea verna	winter cress	No	USDA, NRCS 2004
Belamcandra chinensis	blackberry lily	No	USDA, NRCS 2004
Briza minor	little quakinggrass	No	USDA, NRCS 2004
Bromus catharticus	rescuegrass	Lesser Threat	Tennessee Exotic Pest Plants Council 2001
Bromus commutatus	hairy brome	Significant Threat	Tennessee Exotic Pest Plants Council 2001
Bromus japonicus	Japanese brome	Significant Threat	Tennessee Exotic Pest Plants Council 2001
Cardamine hirsuta	bittercress	No	USDA, NRCS 2004
Cirsium vulgare	bull thistle	Significant Threat	Tennessee Exotic Pest Plants Council 2001
Cynodon dactylon	bermudagrass	No	USDA, NRCS 2004
Dactylis glomerata	cocksfoot	No	USDA, NRCS 2004
Daucus carota	Queen Anne's lace	Significant Threat	Tennessee Exotic Pest Plants Council 2001
Duchesnea indica	Indian strawberry	No	USDA, NRCS 2004
Echinocholoa crus-galli	barnyard grass	No	USDA, NRCS 2004
Elaeagnus pungens	thorny olive	Severe Threat	Tennessee Exotic Pest Plants Council 2001
Elaeagnus umbellata	silverberry	Severe Threat	Tennessee Exotic Pest Plants Council 2001
Festuca arundinacea	tall fescue	Significant Threat	Tennessee Exotic Pest Plants Council 2001
Gleditsia triacanthos	honey locust	No. Native to the U.S., but not to this ecoregion.	Weakley 2000
Hibiscus syriacus	rose-of-sharon	Watch List A	USDA, NRCS 2004
Ipomoea purpurea	common morning glory	No	USDA, NRCS 2004
Lepidium ruderale	roadside pepperweed	No	USDA, NRCS 2004

Scientific Name	Common Name	Considered a Threat?	Source of information
Lespedeza cuneata	Chinese lespedeza	No	Tennessee Exotic Pest Plants Council 2001
Leucanthemum vulgare	oxeyedaisy	No	USDA, NRCS 2004
Ligustrum vulgare	European privet	Severe Threat	Tennessee Exotic Pest Plants Council 2001; Miller 2000
Lolium perenne ssp. multiflorum	Italian ryegrass	No	USDA, NRCS 2004
Lonicera japonica	Japanese honeysuckle	Severe Threat	Tennessee Exotic Pest Plants Council 2001; Miller 2000
Maclura pomifera	osage orange	No. Native to U.S. but not to S.C.	Weakley 2000
Magnolia grandiflora	southern magnolia	Native to southern U.S., but probably not to this area.	Weakley 2000
Melia azedarach	chinaberry	Lesser Threat; Severe Threat	Miller 2000; Tennessee Exotic Pest Plants Council 2001
Microstegium vimineum	Japanese stiltgrass	Severe Threat	Tennessee Exotic Pest Plants Council 2001; Miller 2000
Ornithogalum umbellatum	Star-of-Bethlehem	Lesser Threat	Tennessee Exotic Pest Plants Council 2001
Paspalum dilatatum	Dallasgrass	No	USDA, NRCS 2004
Paspalum notatum var. saurae	bahiagrass	No	Weakley 2000
Photinia serratifolia	Taiwanese photinia	Potentialy significant, but not known yet	USDA, NRCS 2004
Phyllostachys spp.	exotic bamboo	Yes	USDA, NRCS 2004
Pinus elliottii	slash pine	No. Native to U.S. but planted in the park	Weakley 2000
Plantago lanceolata	narrowleaf plantain	No	USDA, NRCS 2004
Poa annua	annual bluegrass	No	USDA, NRCS 2004
Poa compressa	Canada bluegrass	No	USDA, NRCS 2004
Polygonum caespitosum var. longisetum	Oriental ladysthumb	Significant threat	Weakley 2000; Tennessee Exotic Pest Plants Council 2001
Poncirus trifoliata	hardy orange	No	USDA, NRCS 2004
Prunella vulgaris	heal all	No	USDA, NRCS 2004
Prunus persica	peach	No	USDA, NRCS 2004
Pyrus communis	pear	No	USDA, NRCS 2004
Rubus bifrons	Himalayan berry	No	USDA, NRCS 2004

Scientific Name	Common Name	Considered a Threat?	Source of information
Rumex crispus	curly dock	No	USDA, NRCS 2004
Setaria glaucum	yellow foxtail	No	USDA, NRCS 2004
Sherardia arvensis	field madder	No	USDA, NRCS 2004
Sorghum halepense	Johnsongrass	Severe Threat	Tennessee Exotic Pest Plants Council 2001
Sporobolus indicus	smutgrass	No	Weakley 2000
Trifolium arvense	hairy clover	No	USDA, NRCS 2004
Trivolium campestre	field clover	No	USDA, NRCS 2004
Trifolium pratense	red clover	No	USDA, NRCS 2004
Verbascum blattaria	moth mullein	No	USDA, NRCS 2004
Verbena brasiliensis	Brazilian vervain	No	USDA, NRCS 2004
Verbena rigida	tuberous vervain	No	USDA, NRCS 2004
Veronica arvensis	corn speedwell	No	USDA, NRCS 2004
Vicia villosa ssp. varia	winter vetch	No	USDA, NRCS 2004
Vulpia myuros	rattail fescue	No	USDA, NRCS 2004
Wisteria floribunda	Japanese wistera	Severe; Significant	Tennessee Exotic Pest Plants Council 2001; Miller 2000
Wisteria sinensis	Chinese wisteria	Severe; Significant	Tennessee Exotic Pest Plants Council 2001; Miller 2000
Wolffia brasiliensis	Brazilian watermeal	No	USDA, NRCS 2004
Youngia japonica	oriental false hawkweed	Relatively new; may be a threat	Weakley 2000; USDA, NRCS 2004

Table 6. Association numbers, plot numbers, and global ranks of all associations identified at Ninety Six National Historic Site.

CEGL #	Systems	Ecological Associations (Scientific name)	Ecological Associations (Name #2)	Ecological Associations (Name #3)	Plots	Global Rank
8462	Early Successional	Pinus taeda - Liquidambar styraciflua Semi-natural Forest	Loblolly Pine - Sweetgum Semi-natural Forest	Successional Loblolly Pine - Sweetgum Forest	5, 6, 8, 10	GM
8466	Southern Piedmont Mesic Forest	Fagus grandifolia - Quercus rubra / Ostrya virginiana - Acer (barbatum, leucoderme) / Actaea racemosa - Sanguinaria canadensis Forest	American Beech - Northern Red Oak / Eastern Hop-hornbeam - (Southern Sugar Maple, Chalk Maple) / Black Cohosh - Bloodroot Forest	Piedmont Basic Mesic Mixed Hardwood Forest	11, 12	G3G4
7879	Early Successional	Juglans nigra / Verbesina alternifolia Forest	Black Walnut / Common Wingstem Forest	Successional Black Walnut Forest	15	GD
7216	Early Successional	Liquidambar styraciflua Forest	Sweetgum Forest	Successional Sweetgum Forest	13	GM
7221	Successional	Liriodendron tulipifera - Acer rubrum - Quercus spp. Forest	Tuliptree-red maple-Oak Forest.	Successional Tuliptree – Hardwood Forest		GD
8475	Southern Piedmont Dry Oak-(Pine) Forest	Quercus alba - Quercus (rubra, coccinea) - Carya (alba, glabra) / Vaccinium pallidum Piedmont Dry-Mesic Forest	White oak – (red oak, scarlet oak) – (Hickory) / Deerberry Piedmont Dry-Mesic Forest.	Piedmont Dry-Mesic Oak - Hickory Forest		G5?
7244	Southern Piedmont Dry Oak-(Pine) Forest	Quercus falcata - Quercus alba - Carya alba / Oxydendrum arboreum / Vaccinium stamineum Forest	Southern Red Oak - White Oak - Mockernut Hickory / Sourwood / Deerberry Forest	Interior Southern Red Oak - White Oak Forest		G4G5
4638	Early Successional	Quercus nigra Forest	Water Oak Forest	Successional Water Oak Forest	2, 4	GM

CEGL #	Systems	Ecological Associations (Scientific name)	Ecological Associations (Name #2)	Ecological Associations (Name #3)	Plots	Global Rank
7730	Atlantic Coastal Plain Small Brownwater River Floodplain Forest	Platanus occidentalis - Celtis laevigata - Fraxinus pennsylvanica / Lindera benzoin - Ilex decidua / Carex retroflexa Forest	Sycamore - Sugarberry - Green Ash / Northern Spicebush - Possum-haw / Reflexed Sedge Forest	Southeastern Coastal Plain Flat Terrace Forest	1, 14	G4?
8487	Southern Piedmont Large Floodplain Forest	Quercus shumardii - Quercus michauxii - Quercus nigra / Acer barbatum - Tilia americana var. heterophylla Forest	Shumard Oak - Swamp Chestnut Oak - Water Oak / Southern Sugar Maple - Appalachian Basswood Forest	Southern Piedmont Oak Bottomland Forest	7	G3?
3807	Exotic Species Dominated	Ligustrum sinense Upland Shrubland	Chinese Privet Upland Shrubland	Privet Shrubland		GW
8560	Exotic Species Dominated	Phyllostachys aurea Shrubland	Golden Bamboo Shrubland	Golden Bamboo Shrubland		GW
3836	Southern Piedmont Small Floodplain and Riparian Forest	Arundinaria gigantea ssp. gigantea Shrubland	Giant Cane Shrubland	Floodplain Canebrake		G2?
4732	Early Successional	Rubus (argutus, trivialis) – Smilax (glauca, rotundifolia) Shrubland	(Southern Blackberry, Southern Dewberry) – (Whiteleaf Greenbrier, Common Greenbrier) Shurbland	Blackberry – Greenbrier Successional Shrubland Thicket		GC
8568	Exotic Species Dominated	Wisteria sinensis Vine-Shrubland	Chinese Wisteria Vine-Shrubland	Wisteria Vineland		GW
4044	Successional	Andropogon virginicus var. virginicus Herbaceous Veg	Broomsedge Herbaceous Vegetation	Broomsedge Old Field		GD
4048	Exotic Species Dominated	Lolium (arundinaceum, pratense) Herbaceous Vegetation	(Tall Fescue, Meadow Fescue) Herbaceous Vegetation	Cultivated meadow	3, 9	GW
4150	Pond	Typha latifolia Southern Herbaceous Vegetation	Southern Cattail Herbaceous Vegetation	Southern Cattail Marsh		G5

Table 7. Plot photo names and photo descriptions for Ninety Six National Historic Site.

Photo file name	Date taken	Description of photo
NISIplot01.jpg	10-2-01	Plot 1
NISIPlot02a.jpg	10-2-01	Plot 2
NISIPlot02b.jpg	10-2-01	Plot 2
NISIPlot03.jpg	10-1-01	Plot 3
NISIPlot04.jpg	10-2-01	Plot 4
NISIPlot05.jpg	10-1-01	Plot 5
NISIPlot06.jpg	10-11-01	Plot 6
NISIPlot07a.jpg	10-2-01	Plot 7
NISIPlot07b.jpg	10-2-01	Plot 7
NISIPlot08.jpg	10-1-01	Plot 8
NISIPlot09.jpg	10-1-01	Plot 9
NISIPlot10.jpg	10-11-01	Plot 10
NISIPlot12.jpg	10-11-01	Plot 12
NISIPlot13.jpg	4-18-02	Plot 13
NISIPlot14.jpg	4-18-02	Plot 14
NISIPlot15.jpg	4-18-02	Plot 15
Quercusoglethorpensis.jpg	10-1-01	Oglethorpe’s oak
Zephyranthes1.jpg	4-18-02	Rain lily (Zephyranthes atamasco)
Zephyranthes2.jpg	4-18-02	Rain lily (Zephyranthes atamasco)
Frasera1.jpg	4-18-02	American columbo (Frasera caroliniensis)
Frasera2.jpg	4-18-02	American columbo (Frasera caroliniensis)
PhyllisandJohn.jpg	4-18-02	Photointerpreters Phyllis Jackson and John Dolezal

Appendix I. Plot sheets used for permanent plots (formatted to fit in this report)

Ninety Six National Historic Site

Location name _____ *Jurisdiction (State):*____
Location organization (NPS, USFS, etc.) _____
Air photo # (if known) ____ Polygon code (if known)_____ Subplot? Y or N Subplot Parent Code _____

Provisional community name_____

Classified community name_____
Classifyer _____ Date_____

*TUSNVC Elcode*_____ *EONum-Suffix*_____

Sublocation (I.D.able feature on topo map)_____

USGS Quad name_____ *Quad code (if known)* _____

Survey date:_____ Surveyors:_____

Directions to permanent marker and to the plot (use reverse of sheet if necessary):

Vegetation Plot length (m)____ Plot width (m)____ Plot shape (rectangle?) _____ Permanent? Y or N

_Digital photos _Regular camera _No pictures taken Roll# or disc #_____ Frame #_____

Plot representativeness (is the matrix the same?)_____

_____

____ UTM ____ Lat/long (If lat/long, then values are _____ N _____ W

GPS Techniques/Equipment _____ GPS file name ___ ___ ___ ___ ___ ___ ___ ___

Field UTM X ___ ___ ___ ___ ___ ___ m E Corrected UTM X ___ ___ ___ ___ ___ ___ m E

Field UTM Y ___ ___ ___ ___ ___ ___ ___ m N Corrected UTM Y ___ ___ ___ ___ ___ ___ ___ m N

Coordinate accuracy _____ m / ft UTM Zone_____ GPS location with respect to permanent marker if not 0,0: x___ y___

_ *Estimated position marked on Topo. Sheet.* **Elevation** _____ **m / ft** topo map? altimeter? DEM? GPS?

ENVIRONMENTAL / SITE INFORMATION

Measured Slope _____

_ Flat 0 ° 0 %
_ Gentle 0-5 ° 1-9%
_ Mod 6-14 ° 10-25%
_ Somewhat steep 15-25 ° 26-49%
_ Steep27-45 ° 50-100%
_ Very steep 45-69 ° 101-275%
_ Abrupt 70-100 ° 276-300%
_ overhanging/sheltered >100 ° >300%

Measured Aspect __ ___ ° (N=0 °)

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

Compass: magnetic ? / corrected?

Topographic Postion

_ Interfluve (Ridge, summit or crest)
_ High Slope (upper slope, convex slope)
_ Midslope (middle slope)
_ Lowslope (lower slope, footslope)
_ Toeslope (alluvial toeslope)
_ Low level (terrace)
_ Channel bed

Cowardin System

_ Upland _ Palustrine
- Estuarine _ Lacustrine
_Riverine

Landform (check most applicable)

_ Alluvial flat
_ Alluvial terrace
_ Bank
_ Bar
_ Bench
_ Cliff
_ Colluvial Slope
_ Cove
_ Debris slide
_ Depression
_ Draw
_ Floodplain
_ Gap
_ Hanging valley
_ Knob
_ Midslope
_ Mima mound
_ Nose slope
_ Ravine
_ Ridge
_ Ridgetop bedrock outcrop
_ Saddle
_ Scour
_ Seep
_ Toe slope
_ Slope
_ Streambed
_ Slough
_ Streamhead
_
_

Geology

Igneous Rocks:

_ Granitic(Granite, Schyolite, Syenite, Trachyte)
_ Dioritic (Diorite, Dacite, Andesite)
_ Gabbroic (Gabbro, Basalt, Pyroxenite, Peridotite Diabase, Traprock)

Sedimentary Rocks:

_Conglomerates and Breccias
_Sandstone & conglomerate
_Siltstone (calcareous or noncalc)
_Shale (calcareous or noncalc)
_Limestone and Dolomite
_Gypsum
_Marl

Metamorphic Rocks:

_ Gneiss
_Schist
_Slate and Phyllite
_Marble
_ Serpentine (Ultramafic)

Y Other _____

Hydrologic Regime (check only for wetlands)

_ Intermittently flooded
_ Permanently flooded
_ Semipermanently flooded
_ Temporarily Flooded (e.g. floodplains)
_ Seasonally Flooded (e.g. seasonal ponds)
_ Saturated (e.g. bogs, perennial seeps)
_ Unknown
_ Not a wetland (Upland: XERIC : DRY - MESIC : MESIC)

_ Permanently flooded – Tidal
_ Tidally flooded
_ Irregularly flooded
_ Irregularly exposed

Salinity/Halinity Modifiers:

Upland (N/A)
Coastal Tidal: Saltwater- Tidal
Coastal Tidal – Brackish
Coastal Tidal – Freshwater
Inland Saltwater
Inland Brackish seeps)
Unknown

Hydrology Evidence (Describe the hydrological factors that caused you to assign the type to the hydrologic regime that you chose.):

Environmental comments:

_____

Landscape comments:

Soil Texture:

_ Sand
_ Sandy loam
_ Loam
_ Silt loam
_ Clay loam
_ Clay
_ Peat
_ Muck

Soil Taxon Description:

_____

_____

_____

Drainage:

_ Rapidly drained
_ Well drained
_ Moderately well drained
_ Somewhat poorly drained
_ Poorly drained
_ Very poorly drained

Soil depth (optional):_____

Ground cover

(adds to 100%)

_____% Bedrock
_____% Large rocks (cobbles, boulders >10cm)
_____% Small rocks (gravel, 0.2-10 cm)
_____% Sand (0.1-2 mm)
_____% Litter, duff
_____% Wood (> 1 cm)
_____% Water
_____% Bare soil
_____% Bryophyte/lichen
_____% Other

Leaf type:	**Leaf phenology** (dominant stratum)	**Physiognomic Class**
__Broad-leaved __Needle-leaved __Microphyllous __Graminoid __Broad-leaved herbaceous __Pteridophyte __Extremely xeromorphic	- Evergreen _ Cold-decidiuous _ Drought-deciduous _ Mixed evergreen-cold-deciduous _ Mixed evergreen drought deciduous _ Herb - Annual _ Herb - Perennial	_ Forest (closed tree canopy) _ Woodland (open tree canopy) _ Shrubland _ Dwarf Shrubland _ Herbaceous (less than 25% woody layers) _ Nonvascular _ Sparse Vegetation

DISTURBANCE

Natural and Anthropogenic Disturbance

_ logging _ fire _ Hydrologic
_ erosion _ trails/roads _ Agriculture
_ grazing _ wind/ice damage _ Old Growth
_ pine bk beetle _ exotic plants _ Fire Suppression
_ dogwood anthracnose _ adelgid
_ RCW _ ORV _ feral hogs

Disturbance in plot, of type and severity (0-5, 0=no disturbance, 5= extreme disturbance):

___*human:*_____

___*natural:*_____

___ *fire:when?*_____

___ *clear-cut: when?*_____

___
*animal*_____

Disturbance comments:

Current land use:

Former land use:

Qualitative Assessment (Write a brief word picture of community. Describe variation within occurrence in terms of veg structure and environment. Describe dominant and characteristic species and inclusion communities (if present). If community occurs as a mosaic describe spatial distribution and associated community types . Describe to what degree the example by the assigned classification unit Include landscape context information (adjacent communities):

QUANTITATIVE VEGETATION SAMPLE

STRATA	STRATA HEIGHT	COVER CLASS	DOMINANT/DIAGNOSTIC SPECIES	Height scale	Cover cls for strata
Emergent T1				**01** < .5m	**5%**
Tree Can-Opy T2				**02** .5-1m	**10%**
Under Story T3				**03** 1-2m	**20%**
Tall shrub S1				**04** 2-5m	**30%**
Short shrub S2				**05** 5-10m	**40%**
Herb-aceous				**06** 15-20m	**50%**
Non-vascular				**07** 15-20m	**60%**
Vine/liana				**08 20-35m**	**70%**
Other notable species (indicators of distinctive conditions, e.g. high pH soil, elevation, geographic region, other particularly abundant species):				**09 35-50m**	**80%**
				10 >50m	**90%**
					100%

T1: *Emergent * ***T2:*** *Tree Canopy * ***T3*** *Subcanopy * ***S1*** *Tall Shrub (>1m; to 5m) * ***S2*** *Short Shrub (< 1m) * ***H*** *Herbaceous * ***N*** *Nonvascular * ***V*** *Vines (lianas) * ***E*** *Epiphytes*

SPECIES COMP AND COVER CLASS BY STRATUM (enter cover values for each stratum AND for Total cover)

T1	T2	T3	S1	S2	H	N	V	E	Total Cover	Name (7 letter code or full name)	Collected? Spec #?	Diagnostic?

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

SPECIES COMPOSITION AND COVER/ABUNDANCE CLASS BY STRATUM

T 1	T 2	T3	S 1	S2	H	N	V	E	Total cover	Name (7 letter acronym or full name)	Collected? Spec #?	Diagn ostic?

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

T1: Emergent

T2: Tree Can

T3 Subcanopy

S1 Tall Shrub (>1m; to 5m)

S2 Short Shrub (< 1m)

H Herbaceous

N Nonvascular

V Vines (lianas)

E Epiphytes

Appendix II. Descriptions of alliances and associations found at Ninety Six National Historic Site.

INTERNATIONAL CLASSIFICATION OF ECOLOGICAL COMMUNITIES:

TERRESTRIAL VEGETATION OF THE UNITED STATES

Ninety Six National Historic Site

Report from
Biological Conservation Datasystem
September, 2003

by

NatureServe

1101 Wilson Blvd., 15th floor
Arlington, VA 22209

This subset of the International Classification of Ecological Communities (ICEC) covers vegetation alliances and associations attributed to Ninety Six National Historic Site**.** This community classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. A fully searchable and periodically updated on-line source for the ICEC is at http://www.natureserveexplorer.org. Comments and suggestions regarding the contents of this subset should be directed to rickie_white@mindspring.com and Rickie White.

Copyright © 2003 NatureServe, 1101 Wilson Blvd, 15th floor
Arlington, VA 22209, U.S.A. All Rights Reserved.

The following citation should be used in any published materials, which reference these data:
NatureServe. 2003. International Classification of Ecological Communities: Terrestrial Vegetation. Natural Heritage Central Databases. NatureServe, Arlington, VA.

Restrictions on Use: Permission to use, copy and distribute these data is hereby granted under the following conditions:
1. The above copyright notice must appear in all documents and reports;
2. Any use must be for informational purposes only and in no instance for commercial purposes;
3. Some data may be altered in format for analytical purposes, however the data should be referenced using the citation above.

Any rights not expressly granted herein are reserved by NatureServe. Except as expressly provided above, nothing contained herein shall be construed as conferring any license or right under any NatureServe copyright.

Information Warranty Disclaimer: All data are provided as is without warranty as to the currentness, completeness, or accuracy of any specific data. NatureServe hereby disclaims all warranties and conditions with regard to these data, including but not limited to all implied warranties and conditions of merchantability, fitness for a particular purpose, and non-infringement. In no event shall NatureServe be liable for any special, indirect, incidental, consequential damages, or for damages of any kind arising out of or in connection with the use of these data. Because the data in the Natural Heritage Central Databases are continually being updated, it is advisable to refresh data at least once a year after its receipt. The data provided are for planning, assessment, and informational purposes. Site specific projects or activities should be reviewed for potential environmental impacts with appropriate regulatory agencies.

NatureServe
1101 Wilson Blvd, 15th floor
Arlington, VA 22209

These data are extracted from:

NatureServe. 2003. International Classification of Ecological Communities: Terrestrial Vegetation. Natural Heritage Central Databases. NatureServe, Arlington, VA.

This document may be generally cited as follows:

NatureServe[1]. 2003. International classification of ecological communities: Terrestrial vegetation of the United States. NatureServe, Arlington, VA and Name and address of compiler's organization/program

[1] NatureServe (formerly called "Association for Biodiversity Information" ("ABI")) is an international organization including NatureServe regional offices, a NatureServe central office, U.S. State Natural Heritage Programs, and Conservation Data Centres (CDC) in Canada and Latin America and the Caribbean. Ecologists from the following organizations have contributed the development of the ICEC:

United States
Central NatureServe Office, Arlington, VA; Eastern Regional Office, Boston, MA; Midwestern Regional Office, Minneapolis, MN; Southeastern Regional Office, Durham, NC; Western Regional Office, Boulder, CO; Alabama Natural Heritage Program, Montgomery AL; Alaska Natural Heritage Program, Anchorage, AK; Arizona Heritage Data Management Center, Phoenix AZ; Arkansas Natural Heritage Commission Little Rock, AR; Blue Ridge Parkway, Asheville, NC; California Natural Heritage Program, Sacramento, CA; Colorado Natural Heritage Program, Fort Collins, CO; Connecticut Natural Diversity Database, Hartford, CT; Delaware Natural Heritage Program, Smyrna, DE; District of Columbia Natural Heritage Program/National Capital Region Conservation Data Center, Washington DC; Florida Natural Areas Inventory, Tallahassee, FL; Georgia Natural Heritage Program, Social Circle, GA; Great Smoky Mountains National Park, Gatlinburg, TN; Gulf Islands National Seashore, Gulf Breeze, FL; Hawaii Natural Heritage Program, Honolulu, Hawaii; Idaho Conservation Data Center, Boise, ID; Illinois Natural Heritage Division/Illinois Natural Heritage Database Program, Springfield, IL; Indiana Natural Heritage Data Center, Indianapolis, IN; Iowa Natural Areas Inventory, Des Moines, IA; Kansas Natural Heritage Inventory, Lawrence, KS; Kentucky Natural Heritage Program, Frankfort, KY; Louisiana Natural Heritage Program, Baton Rouge, LA; Maine Natural Areas Program, Augusta, ME; Mammoth Cave National Park, Mammoth Cave, KY; Maryland Wildlife & Heritage Division, Annapolis, MD; Massachusetts Natural Heritage & Endangered Species Program, Westborough, MA; Michigan Natural Features Inventory, Lansing, MI; Minnesota Natural Heritage & Nongame Research and Minnesota County Biological Survey, St. Paul, MN; Mississippi Natural Heritage Program, Jackson, MI; Missouri Natural Heritage Database, Jefferson City, MO; Montana Natural Heritage Program, Helena, MT; National Forest in North Carolina, Asheville, NC; National Forests in Florida, Tallahassee, FL; National Park Service, Southeastern Regional Office, Atlanta, GA; Navajo Natural Heritage Program, Window Rock, AZ; Nebraska Natural Heritage Program, Lincoln, NE; Nevada Natural Heritage Program, Carson City, NV; New Hampshire Natural Heritage Inventory, Concord, NH; New Jersey Natural Heritage Program, Trenton, NJ; New Mexico Natural Heritage Program, Albuquerque , NM; New York Natural Heritage Program, Latham, NY; North Carolina Natural Heritage Program, Raleigh, NC; North Dakota Natural Heritage Inventory, Bismarck, ND; Ohio Natural Heritage Database, Columbus, OH; Oklahoma Natural Heritage Inventory, Norman, OK; Oregon Natural Heritage Program, Portland, OR; Pennsylvania Natural Diversity Inventory, PA; Rhode Island Natural Heritage Program, Providence, RI; South Carolina Heritage Trust, Columbia, SC; South Dakota Natural Heritage Data Base, Pierre, SD; Tennessee Division of Natural Heritage, Nashville, TN; Tennessee Valley Authority Heritage Program, Norris, TN; Texas Conservation Data Center, San Antonio, TX; Utah Natural Heritage Program, Salt Lake City, UT; Vermont Nongame & Natural Heritage Program, Waterbury, VT; Virginia Division of Natural Heritage, Richmond, VA; Washington Natural Heritage Program, Olympia, WA; West Virginia Natural Heritage Program, Elkins, WV; Wisconsin Natural Heritage Program, Madison, WI; Wyoming Natural Diversity Database, Laramie, WY

Canada
Alberta Natural Heritage Information Centre, Edmonton, AB, Canada; Atlantic Canada Conservation Data Centre, Sackville, New Brunswick, Canada; British Columbia Conservation Data Centre, Victoria, BC, Canada; Manitoba Conservation Data Centre. Winnipeg, MB, Canada; Ontario Natural Heritage Information Centre, Peterborough, ON, Canada; Quebec Conservation Data Centre, Quebec, QC, Canada; Saskatchewan Conservation Data Centre, Regina, SK, Canada; Yukon Conservation Data Centre, Yukon, Canada

Latin American and Caribbean
Centro de Datos para la Conservacion de Bolivia, La Paz , Bolivia; Centro de Datos para la Conservacion de Colombia, Cali,Valle, Columbia; Centro de Datos para la Conservacion de Ecuador, Quito, Ecuador; Centro de Datos para la Conservacion de Guatemala, Ciudad de Guatemala , Guatemala; Centro de Datos para la Conservacion de Panama, Querry Heights , Panama; Centro de Datos para la Conservacion de Paraguay, San Lorenzo , Paraguay; Centro de Datos para la Conservacion de Peru, Lima, Peru; Centro de Datos para la Conservacion de Sonora, Hermosillo, Sonora , Mexico; Netherlands Antilles Natural Heritage Program, Curacao , Netherlands Antilles; Puerto Rico-Departmento De Recursos Naturales Y Ambientales, Puerto Rico; Virgin Islands Conservation Data Center, St. Thomas, Virgin Islands.

NatureServe also has partnered with many International and United States Federal and State organizations, which have also contributed significantly to the development of the International Classification. Partners include the following The Nature Conservancy; Provincial Forest Ecosystem Classification Groups in Canada; Canadian Forest Service; Parks Canada; United States Forest Service; National GAP Analysis Program; United States National Park Service; United States Fish and Wildlife Service; United States Geological Survey; United States Department of Defense; Ecological Society of America; Environmental Protection Agency; Natural Resource Conservation Services; United States Department of Energy; and the Tennessee Valley Authority. Many individual state organizations and people from academic institutions have also contributed to the development of this classification.

Table of Contents for Exhaustive Association Descriptions

Successional Loblolly Pine - Sweetgum Forest (CEGL008462) 65

Piedmont Basic Mesic Mixed Hardwood Forest (CEGL008466) 69

Successional Black Walnut Forest (CEGL007879) 72

Successional Sweetgum Forest (CEGL007216) 75

Successional Tuliptree - Hardwood Forest (CEGL007221) 79

Piedmont Dry-Mesic Oak - Hickory Forest (CEGL008475) 84

Interior Southern Red Oak - White Oak Forest (CEGL007244) 88

Successional Water Oak Forest (CEGL004638) 91

Southeastern Coastal Plain Flat Terrace Forest (CEGL007330) 95

Southern Piedmont Oak Bottomland Forest (CEGL008487) 99

Chinese Privet Upland Shrubland (CEGL003807) 103

Golden Bamboo Shrubland (CEGL008560) 105

Floodplain Canebrake (CEGL003836) 108

Wisteria Vineland ((CEGL008568) 112

Blackberry - Greenbrier Successional Shrubland Thicket (CEGL004732) 114

Successional Broomsedge Vegetation

(CEGL004044) 117

Cultivated Meadow (CEGL004048) 120

Southern Cattail Marsh (CEGL004150) 125

I. Forest
I.A.8.N.b. Rounded-crowned temperate or subpolar needle-leaved evergreen forest
I.A.8.N.b.16. PINUS TAEDA FOREST ALLIANCELoblolly Pine Forest Alliance

Alliance Concept

Summary: This alliance includes both successional forests, following cropping or site conversion, and natural forests in the Piedmont, Cumberlands and Ridge and Valley, and Coastal Plain of the southeastern United States. Other canopy and subcanopy species that may be present in successional stands are *Liriodendron tulipifera, Acer rubrum, Liquidambar styraciflua, Pinus virginiana, Juniperus virginiana var. virginiana, Quercus stellata, Quercus velutina, Ulmus rubra, Quercus alba, Nyssa sylvatica, Ulmus alata, Cornus florida, Prunus serotina var. serotina,* and *Carya* spp. *Vaccinium* spp., especially *Vaccinium stamineum*, are common in these forests. One association in this alliance occurs on barrier islands in the Mid-Atlantic Coastal Plain. Along with the dominant *Pinus taeda*, canopy associates often include *Quercus falcata, Acer rubrum, Prunus serotina var. serotina,* and *Sassafras albidum.* The tall-shrub layer is comprised of *Morella cerifera (= Myrica cerifera)* and *Vaccinium formosum.* Vines and lianas are always present in abundance; *Vitis rotundifolia* is most commonly present, but *Toxicodendron radicans, Smilax rotundifolia, Smilax glauca*, and *Parthenocissus quinquefolia* are usually present in abundance as well. The herbaceous layer may be sparse, particularly if shrubs and vines are dense, but *Chasmanthium laxum* may be fairly abundant in this community. Other herbs include *Panicum amarum var. amarulum, Eupatorium hyssopifolium*, and *Elephantopus nudatus*. In southern Virginia and North Carolina, *Quercus virginiana* and *Gelsemium sempervirens* may also be present, but *Quercus virginiana* is never abundant and when present is usually restricted to the understory. *Pinus taeda* may occur rarely in the Ouachita Mountains and Ozarks of Arkansas where the species is becoming naturalized, expanding from its native range in the Coastal Plain, where it naturally occurs in low, moist areas (e.g., deep, well-drained soils of floodplains). However, a natural *Pinus taeda* forest association is not recognized for the Ozark or Ouachita region.

Dynamics: The understory of the heavily disturbed examples of this alliance is often dominated by exotic species, to the exclusion of natives. Common invasives are *Lonicera japonica* and *Microstegium vimineum*. Due to the dominance of these species, stand dynamics often shift so that there are less seedlings and saplings in the understory.

Alliance Distribution

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

Nations: US

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

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

USFS Ecoregions: 221D:CC, 221Jb:CCC, 222Cb:CCC, 222Dc:CCC, 222Dd:CCC, 222Eb:CCC, 222Ec:CCC, 222Eg:CCC, 231Aa:CCC, 231Ab:CCC, 231Ac:CCC, 231Ad:CCC, 231Ae:CCC, 231Af:CCC, 231Ag:CCC, 231Ah:CCC, 231Ai:CCC, 231Aj:CCC, 231Ak:CCC, 231Al:CCC, 231Am:CCC, 231An:CCC, 231Ao:CCP, 231Ba:CCC, 231Bb:CCP, 231Bc:CCP, 231Bd:CCC, 231Be:CCP, 231Bf:CCP, 231Bg:CCP, 231Bh:CCP, 231Bi:CCP, 231Bj:CCP, 231Bk:CCP, 231Bl:CC?, 231Ca:CCP, 231Cb:CCP, 231Cc:CCP, 231Cd:CCC, 231Ce:CCC, 231Cf:CCC, 231Cg:CCP, 231Da:CCP, 231Dc:CCC, 231De:CC?, 231Ea:CCC, 231Eb:CC?, 231Ec:CC?, 231Ed:CC?, 231Ef:CC?, 231Eg:CCP, 231Eh:CCC, 231Ei:CC?, 231Ej:CC?, 231Ek:CCP, 231En:CC?, 231Fa:CPP, 231Fb:CP?, 232Ac:CCC, 232Ba:CCC, 232Bb:CC?, 232Bc:CC?, 232Bd:CC?, 232Be:CC?, 232Bg:CCC, 232Bh:CC?, 232Bi:CC?, 232Bj:CCC, 232Bk:CC?, 232Bl:CC?, 232Bm:CCC, 232Bn:CC?, 232Bo:CC?, 232Bp:CC?, 232Bq:CCC, 232Br:CCC, 232Bt:CC?, 232Bu:CC?, 232Bv:CC?, 232Bx:CC?, 232Bz:CCC, 232Ca:CCC, 232Cb:CCC, 232Cc:CC?, 232Ce:CCC, 232Cf:CC?, 232Cg:CC?, 232Ci:CC?, 232Da:CC?, 232Dc:CCC, 232Fa:CC?, 232Fb:CC?, 232Fe:CCC, 255Da:PPP, M221D:??

Federal Lands: DOD (Arnold, Fort Benning, Fort Gordon); NPS (Assateague Island, Cape Hatteras, Chickamauga-Chattanooga, Cowpens, Guilford Courthouse, Kennesaw Mountain, Kings Mountain, Ninety Six, Shiloh?); TVA (Tellico); USFS (Angelina, Apalachicola, Bankhead, Bienville, Chattahoochee, Conecuh, Croatan, Davy Crockett, De Soto, Francis Marion, Holly

Springs, Homochitto, Kisatchie, Land Between the Lakes, Oconee, Ouachita, Sabine NF, Sam Houston, Sumter, Talladega, Tombigbee, Tuskegee, Uwharrie); USFWS (Chincoteague)

Alliance Sources

Authors: D.J. ALLARD, RW, Southeast **Identifier:** A.130

References: Cain and Shelton 1994, Eyre 1980, FNAI 1992a, FNAI 1992b, Felix et al. 1983, Foti 1994b, Foti et al. 1994, Martin and Smith 1991, Martin and Smith 1993

Pinus taeda - Liquidambar styraciflua Semi-natural Forest
Loblolly Pine - Sweetgum Semi-natural Forest
Successional Loblolly Pine - Sweetgum Forest (CEGL008462)
Ecological Group (SCS;MCS): Semi-natural Wooded Uplands (900-40; 8.0.0.1)

Element Concept

GLOBAL SUMMARY: This community type is broadly defined to accommodate upland forests strongly codominated by *Pinus taeda* and *Liquidambar styraciflua*, resulting from past disturbance (such as agricultural or other land clearing) followed by forest succession. Understory composition differs based on edaphic site and on age and history. This broadly defined type occupies a variety of edaphic sites, ranging from mesic through dry-mesic sites on a wide variety of (generally acidic) soils. If left unmanaged or undisturbed, this can be a short-lived forest type, which is likely to succeed with greater age into various oak- and oak-pine-dominated forests.

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: This community is found in upland areas that were heavily farmed and exhausted, then left fallow. The sites tend to be poorly drained, and examples close to bottomland areas may even have some standing water for some of the year.

Global Environment: Stands of this community type are strongly codominated by *Pinus taeda* and *Liquidambar styraciflua*, resulting from past disturbance followed by forest succession. This community type is more influenced by past land-use history than by specific soil differences. However, this community type tends to occur on poorly drained and low-nutrient soils, especially in areas that were farmed heavily in the past.

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: Within the park, the association is usually dominated by stands of *Pinus taeda*, either planted and left untended or generated naturally after abandonment of farmland. *Liquidambar styraciflua* and occasionally planted *Pinus elliottii* may codominate in the canopy. Understory trees vary depending upon location and moisture, but range from thick stands of *Microstegium vimineum* and *Toxicodendron radicans* in the most mesic examples to more sparse and diverse understory in the driest examples.

Global Vegetation: Stands of this community type are strongly codominated by *Pinus taeda* and *Liquidambar styraciflua*. Some other species which may be present in stands of this association include *Quercus phellos, Quercus nigra, Ulmus alata,* and *Prunus serotina*, along with *Vitis rotundifolia, Toxicodendron radicans, Rubus argutus, Eupatorium capillifolium, Eupatorium hyssopifolium, Erigeron strigosus, Solidago gigantea, Ambrosia artemisiifolia,* and the exotics *Lespedeza cuneata* and *Ligustrum sinense*. Examples of this association in low-lying areas may also have a dense herbaceous layer of *Microstegium vimineum*.

Global Dynamics: This is a short-lived forest type, successional following cropping or other land clearing. It generally succeeds with greater age into various oak- and oak-pine-dominated forests.

MOST ABUNDANT SPECIES

Ninety Six National Historic Site

Stratum	Species
TREE CANOPY	*Pinus taeda*

Global

Stratum	Species
TREE CANOPY	*Liquidambar styraciflua, Pinus taeda*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- *Liriodendron tulipifera - Pinus taeda* Forest (CEGL007521)--with greater dominance by *Liriodendron*.
- *Pinus taeda / Saccharum alopecuroidum - (Andropogon* spp.) Forest (CEGL007109)--a related *Pinus taeda*-dominated type placed in evergreen.
- *Pinus taeda / Liquidambar styraciflua - Acer rubrum* var. *rubrum / Vaccinium stamineum* Forest (CEGL006011)--is very similar and may need to be merged with this concept

someday. For now, the main difference is that this community does not have *Liquidambar styraciflua* present in the canopy, but instead in the subcanopy/tall-shrub layer.

GRank & Reasons: GM (00-10-20). This forest represents early successional or silviculturally managed vegetation and is thus not of conservation concern and does not receive a conservation status rank.

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range: This community is the most common association within the park. It dominates much of the northern two-thirds of the park.

Global Range: This altered forest type is widespread in the lowland portions of the southeastern United States, particularly on the Coastal Plain, but also on adjacent inland provinces.

Nations: US
States/Provinces: AL:S?, AR:S?, GA:S?, LA:S4, MS:S?, NC:S?, OK:S?, SC:S?, TX:S?, VA:S?
TNC Ecoregions: 31:P, 39:C, 40:C, 41:C, 43:C, 52:C, 53:C, 56:C, 57:C
USFS Ecoregions: 231Aa:CCC, 231Ab:CCC, 231Ac:CCC, 231Ad:CCC, 231Ae:CCC, 231Af:CCC, 231Fa:CPP, 232Bm:CCC, 232F:CC, 255Da:PPP
Federal Lands: DOD (Fort Benning?); NPS (Guilford Courthouse, Kings Mountain, Ninety Six); USFS (Angelina, Davy Crockett, Kisatchie, Oconee, Ouachita, Sabine NF, Sam Houston, Talladega?, Tuskegee?, Uwharrie)

ELEMENT SOURCES

Authors: A.S. Weakley, mod. R. White, SCS **Confidence:** 1 **Identifier:** CEGL008462
REFERENCES (type in full citation below if reference is new): Allard 1990, Eyre 1980, Foti 1994b, Foti et al. 1994, Harcombe and Neaville 1977, Hoagland 2000, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. 2002, USFS 1988, Zanoni et al. 1979

I.B.2.N.a. Lowland or submontane cold-deciduous forest
I.B.2.N.a.17. FAGUS GRANDIFOLIA - QUERCUS RUBRA - QUERCUS ALBA FOREST ALLIANCE
American Beech - Northern Red Oak - White Oak Forest Alliance

ALLIANCE CONCEPT

Summary: Forests in this alliance occur in non-montane or low-elevation montane mesic situations and are dominated by *Fagus grandifolia* typically with some combination of *Quercus rubra* and/or *Quercus alba*. Associated canopy and subcanopy species can include *Liriodendron tulipifera, Acer saccharum, Magnolia tripetala, Magnolia acuminata* (Ozarks), *Tilia americana var. americana* (Ozarks), *Tilia americana var. heterophylla, Quercus muehlenbergii, Acer rubrum, Cornus florida, Ostrya virginiana, Aesculus sylvatica*, and *Ilex opaca*. Some of these forests, particularly in the Piedmont of South Carolina, the southern Ridge and Valley of Alabama, or in Arkansas, may contain *Acer barbatum* instead of *Acer saccharum*. Shrubs in this alliance include *Vaccinium stamineum, Viburnum rafinesquianum, Euonymus americana*, and, in some occurrences, *Kalmia latifolia*. The herb layer can be relatively lush with such species as *Polystichum acrostichoides, Galium circaezans, Hexastylis arifolia, Hexastylis minor, Desmodium nudiflorum, Erythronium umbilicatum ssp. umbilicatum, Hepatica nobilis var. obtusa, Epifagus virginiana, Tiarella cordifolia var. collina, Trillium* spp., *Heuchera americana, Stellaria pubera, Podophyllum peltatum, Botrychium virginianum*, and others present. These forests often occur on concave and sheltered landforms such as north-facing slopes, low slopes, high terraces along streams, and possibly other situations. The core concept of the range of this alliance includes areas inland from the Coastal Plain, as *Quercus rubra* is absent from large areas of the Coastal Plain (as in North Carolina). Forests in this alliance occur in the Cumberlands and Southern Ridge and Valley, Piedmont and Interior Low Plateau, and on protected slopes and ravines in the Ozarks, central Ouachita Mountains, and Arkansas Valley.

Dynamics:

ALLIANCE DISTRIBUTION

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

Nations: US

States/Provinces: AL AR CT DE GA IN? KY MA MD NC NJ NY OH OK PA RI SC TN VA WV

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

USFS Ecoregions: 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ae:CCP, 221Dc:CPP, 221Ea:CCC, 221Ef:CCP, 221Eg:CCP, 221Ha:CCC, 221Hc:CCP, 221Hd:CCP, 221He:CCC, 221Ja:CCP, 221Jb:CC?, 221Jc:CCP, 222Ab:CCC, 222Ag:CCC, 222An:CCC, 222Cb:CC?, 222Cc:CC?, 222Cd:CC?, 222Ce:CC?, 222Cf:CC?, 222Cg:CC?, 222Da:CCP, 222Db:CCP, 222Dc:CCP, 222Dd:CCP, 222De:CCP, 222Dg:CC?, 222Di:CC?, 222Dj:CC?, 222Ea:CCC, 222Eb:CCC, 222Ec:CC?, 222Ee:CCP, 222Ef:CCP, 222Eg:CCC, 222Eh:CCP, 222Ei:CCP, 222Ej:CCP, 222Ek:CCP, 222Em:CCP, 222En:CCP, 222Eo:CCP, 222F:CC, 231Aa:CCC, 231Ab:CCC, 231Ac:CCC, 231Ad:CCC, 231Ae:CCC, 231Af:CCC, 231Ag:CCC, 231Ah:CCC, 231Ai:CCC, 231Aj:CCC, 231Ak:CCP, 231Am:CCP, 231An:CCC, 231Ao:CCC, 231Ba:C??, 231Bb:C??, 231Be:C??, 231Bg:C??, 231Bh:C??, 231Bi:C??, 231Bk:C??, 231Ca:CCP, 231Cb:CCP, 231Cc:CCP, 231Cd:CCC, 231Ce:CCP, 231Cf:CCP, 231Cg:CCP, 231Da:CCC, 231Db:CCC, 231Dc:CCC, 231Dd:CCC, 231Gb:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CCC, 232Br:CCC, 232Bt:CCC, 232Bx:CCP, 232Bz:CCC, 232C:CC, 234Ab:PPP, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC

Federal Lands: COE (Falls Lake, Jordan Lake, Kerr Reservoir); DOD (Fort Benning); NPS (Buffalo, Guilford Courthouse, Mammoth Cave, Ninety Six, Rock Creek, Shiloh, Thomas Stone); TVA (Tellico); USFS (Bankhead, Chattahoochee, Cherokee?, Conecuh, Daniel Boone,

Homochitto, Jefferson?, Land Between the Lakes, Ouachita, Ozark, Sumter, Talladega, Tuskegee, Uwharrie)

ALLIANCE SOURCES

Authors: D.J. ALLARD, MOD. A.S. WE, RW, Southeast **Identifier:** A.229

References: Allard 1990, Ambrose 1990a, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Foti 1994b, Foti et al. 1994, Golden 1979, Jones 1988a, Jones 1988b, Martin and Smith 1991, Pyne 1994, Schafale and Weakley 1990, Swain and Kearsley 2001, USFS 1990

Fagus grandifolia - Quercus rubra / Ostrya virginiana - Acer (barbatum, leucoderme) / Actaea racemosa - Sanguinaria canadensis ForestAmerican Beech - Northern Red Oak / Eastern Hop-hornbeam - (Southern Sugar Maple, Chalk Maple) / Black Cohosh - Bloodroot Forest

Piedmont Basic Mesic Mixed Hardwood Forest (CEGL008466)

Ecological Group (SCS;MCS):

Appalachian Highlands Mesic Circumneutral Hardwood Forests (420-15; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association represents intermediate and basic, mesic, mixed hardwood forests of the Piedmont, ranging from Virginia south to Georgia. Stands of this association are closed-canopy forests dominated by *Fagus grandifolia* and *Quercus rubra* with *Liriodendron tulipifera, Quercus alba, Carya ovata, Fraxinus americana,* and, locally in Virginia stands, *Quercus muehlenbergii*. In addition, *Acer barbatum* or *Acer leucoderme* may be present within their ranges. Prominent understory species include *Aesculus sylvatica, Ostrya virginiana,* and *Asimina triloba*. Herbs which appear to be abundant or characteristic include *Polystichum acrostichoides, Asarum canadense, Actaea racemosa (= Cimicifuga racemosa), Sanguinaria canadensis, Tiarella cordifolia var. collina, Carex laxiflora var. laxiflora, Carex grisea, Desmodium pauciflorum, Uvularia sessilifolia, Maianthemum racemosum, Polygonatum biflorum, Tipularia discolor, Dicentra canadensis, Podophyllum peltatum, Cardamine concatenata, Erythronium americanum,* and *Erythronium umbilicatum ssp. umbilicatum*.

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: This community is limited to the north-facing steep slopes along Ninety Six Creek. These slopes were most likely logged but not plowed.

Global Environment: This association represents intermediate and basic mesic mixed hardwood forests of the Piedmont, ranging from Virginia south to Georgia.

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: The examples of this community in the park are relatively young, so the *Fagus grandifolia* that is characteristic of this association is generally in the understory. Canopy species include *Liriodendron tulipifera, Quercus alba,* and *Quercus rubra*. The understory is dominated by *Ulmus* spp., *Fagus grandifolia,* and *Acer barbatum*. The ground layer contains a fairly diverse but sparse herb layer including both acid-loving and basic-loving species. These can include *Dichanthelium boscii, Frasera caroliniensis, Carex oxylepis, Hexastylis arifolia, Tradescantia* sp., and *Galium triflorum*. *Cercis canadensis, Asimina triloba, Calycanthus floridus*, and *Juniperus virginiana* are also present.

Global Vegetation: Nelson (1986) cites as components of the Basic Forest of the Piedmont *Quercus alba, Quercus shumardii, Quercus velutina,* other oaks, *Carya alba, Carya glabra, Aesculus pavia, Liriodendron tulipifera, Fagus grandifolia, Acer rubrum, Acer saccharum* (sic) (in fact *Acer barbatum, Acer leucoderme*). He also cites *Nyssa sylvatica, Cornus florida, Euonymus americana, Symplocos tinctoria, Viburnum* spp., *Vaccinium* spp., *Rhododendron* spp., *Luzula* spp., *Juncus* spp., *Stellaria pubera, Podophyllum peltatum, Anemone virginiana, Anemone quinquefolia var. quinquefolia, Anemone lancifolia, Trillium cuneatum, Trillium catesbaei, Trillium cernuum, Sanguinaria canadensis, Hepatica nobilis var. obtusa, Cynoglossum virginianum, Uvularia perfoliata, Hybanthus concolor*, and *Iris cristata*.

Global Dynamics:

MOST ABUNDANT SPECIES

Ninety Six National Historic Site

Stratum	Species
TREE CANOPY	*Quercus alba, Quercus rubra*

Global

Stratum	Species
TREE CANOPY	*Fagus grandifolia*

CHARACTERISTIC SPECIES

Ninety Six National Historic Site

Stratum	Species
SUB-CAN	*Fagus grandifolia*
SHRUB	*Asimina triloba, Cercis canadensis*

OTHER NOTEWORTHY SPECIES

Ninety Six National Historic Site

Stratum	Species
FORB	*Frasera caroliniensis*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- *Fagus grandifolia - Quercus rubra / Cornus florida / Polystichum acrostichoides - Hexastylis virginica* Forest (CEGL008465)--the more acidic Piedmont equivalent.

GRank & Reasons: G3G4 (02-08-29). This association is naturally restricted to intermediate and basic, mesic environmental settings in the Piedmont. The degree of uncertainty in the rank reflects the need for further inventory of this community. Threats include timber harvest (in particular the removal of commercially valuable timber species), erosion, fragmentation, and the conversion of adjacent areas to planted pine stands. Some examples receive some protection on public lands (e.g., national forests, military lands, Corps of Engineers property).

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range: This community is restricted to the north-facing slopes along Ninety Six Creek and occurs nowhere else within the current park boundary.

Global Range: This association is found in the Piedmont and localized areas of adjacent ecoregions of the southeastern United States.

Nations: US
States/Provinces: GA:S?, NC:S2, SC:S?, VA:S?
TNC Ecoregions: 52:C
USFS Ecoregions: 231A:CC, 232B:CC
Federal Lands: COE (Falls Lake, Jordan Lake, Kerr Reservoir); DOD (Fort Benning); NPS (Ninety Six); USFS (Uwharrie)

ELEMENT SOURCES

Authors: M.P. Schafale, SCS **Confidence:** 2 **Identifier:** CEGL008466
REFERENCES (type in full citation below if reference is new): Fleming et al. 2001, Fleming pers. comm., NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Peet et al. 2002, Schafale and Weakley 1990, Schafale pers. comm.

I.B.2.N.a.107. JUGLANS NIGRA FOREST ALLIANCE
Black Walnut Forest Alliance
I.B. Deciduous forest

ALLIANCE CONCEPT

Summary: Successional forests usually dominated or codominated by *Juglans nigra*, often associated with former homesites or other disturbance on fertile alluvial deposits. Originally described from the Great Smoky Mountains National Park, Tennessee, but may be widespread and range into adjacent states.

Dynamics: The alliance seems to occur on heavily impacted old homesites

ALLIANCE DISTRIBUTION

Range: This alliance is currently defined for the mountains of Tennessee and North Carolina and from one occurrence in the Piedmont of South Carolina, but may range into adjacent states.

Nations: US

States/Provinces: NC SC TN

TNC Ecoregions: 51:C, 52:P

USFS Ecoregions: 231Aa:PPP, M221Dd:CCC

Federal Lands: NPS (Great Smoky Mountains, Ninety Six)

ALLIANCE SOURCES

Authors: K.D. PATTERSON, RW, Southeast **Identifier:** A.1932

References: NatureServe Ecology - Southeastern U.S. unpubl. data

Juglans nigra / Verbesina alternifolia Forest
Black Walnut / Common Wingstem Forest
Successional Black Walnut Forest (CEGL007879)
Ecological Group (SCS;MCS): Semi-natural Wooded Uplands (900-40; 8.0.0.1)

ELEMENT CONCEPT

GLOBAL SUMMARY: This is a potentially widespread association. This community was sampled on former homesites along streams, possibly in association with circumneutral soils, at 1500-2000 feet elevation in the Smokies. In addition, the association was sampled from the Piedmont of South Carolina in a low-lying poor drainage area approximately 550 feet in elevation. It was originally defined from former homesites in Great Smoky Mountains National Park, where this association is an open, successional forest. *Juglans nigra* is often the sole canopy tree, though *Liriodendron tulipifera, Juglans cinerea,* and *Aesculus flava* are dominants or codominants in some examples. The herb stratum is dominated by *Verbesina alternifolia*. Other herbs include *Amphicarpaea bracteata* and *Ambrosia trifida*. The exotics *Rosa multiflora* and *Microstegium vimineum* can be common in this community.

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: At Ninety Six, this community exists near old homesites and other areas where soil has been altered to favor regeneration of the *Juglans nigra* that were probably planted throughout the yard.

Global Environment: This community often occurs on former homesites along streams, possibly in association with circumneutral soils. It was originally defined from former homesites in Great Smoky Mountains National Park, where this association is an open, successional forest.

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: This community is dominated by *Juglans nigra* and *Celtis laevigata* in the canopy and tends to have some understory species that are indicators of circumneutral soils such as *Cercis canadensis, Juniperus virginiana, Callicarpa americana,* and *Symphoricarpos orbiculatus*.

Global Vegetation: *Juglans nigra* is often the sole canopy tree, though *Liriodendron tulipifera, Juglans cinerea, Celtis laevigata,* and *Aesculus flava* are dominant or codominant in some examples. The herb stratum is dominated by *Verbesina alternifolia* or *Microstegium vimineum*. Other herbs include *Amphicarpaea bracteata* and *Ambrosia trifida*. The exotic *Rosa multiflora* can be common in this community.

Global Dynamics: Since this community was the product of an anthropogenic catastrophic disturbance, the canopy is likely to change drastically as new species of trees colonize gaps left by senescent walnuts.

MOST ABUNDANT SPECIES

Ninety Six National Historic Site

Stratum	Species
TREE CANOPY	*Celtis laevigata, Juglans nigra*
GRAMINOID	*Microstegium vimineum*

Global

Stratum	Species
TREE CANOPY	*Juglans nigra*
FORB	*Verbesina alternifolia*

CHARACTERISTIC SPECIES

Ninety Six National Historic Site

Stratum	**Species**
SHRUB	*Callicarpa americana, Juniperus virginiana, Symphoricarpos orbiculatus*

Global

Stratum	**Species**
TREE CANOPY	*Juglans nigra*
SHRUB	*Rosa multiflora*
FORB	*Verbesina alternifolia*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

SYNONYMY [OtherName (short citation) relationship. Note]:

- (NatureServe Ecology - Southeastern U.S. unpubl. data) UNDNAT01ICEC
- (NatureServe Ecology - Southeastern U.S. unpubl. data) UNDABI01ICEC
- (Peet et al. 2002) U02PEE01ICEC

GRank & Reasons: GD (01-04-02). This vegetation represents vegetation created by anthropogenic disturbance and is thus not a conservation priority. Grank changed from GW to GD 2001-04-02 MP.

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range:

Global Range: This potentially widespread association is currently defined only for Tennessee but likely ranges into adjacent states.

Nations: US
States/Provinces: NC:S?, SC:S?, TN:S?
TNC Ecoregions: 51:C, 52:P
USFS Ecoregions: 231Aa:PPP, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains, Ninety Six)

ELEMENT SOURCES

Authors: SCS **Confidence:** 3 **Identifier:** CEGL007879
REFERENCES (type in full citation below if reference is new): NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. 2002

I.B.2.N.a.22. LIQUIDAMBAR STYRACIFLUA FOREST ALLIANCE
Sweetgum Forest Alliance

ALLIANCE CONCEPT

Summary: This alliance includes a variety of natural and disturbance-related forests dominated by *Liquidambar styraciflua* and other hardwoods, including *Quercus* spp. and *Carya* spp. Included are upland forests dominated by *Liquidambar styraciflua* that follow logging, agricultural cropping, or natural disturbance in uplands of the Coastal Plain, Piedmont, and other ecoregions. Some associations may have *Quercus* spp. and *Carya* spp., especially *Quercus alba, Quercus falcata, Quercus nigra, Quercus phellos, Quercus velutina,* and *Carya alba*. In addition, *Pinus taeda* may be present. Piedmont cove forests (of Alabama and likely other states) codominated by *Liquidambar styraciflua* and *Liriodendron tulipifera* are included within this alliance as well (although no association specifically accommodates them). These forests have *Nyssa sylvatica, Quercus nigra,* and *Acer rubrum var. rubrum* as associated canopy species, with *Vitis rotundifolia, Toxicodendron radicans,* and *Smilax rotundifolia* commonly present.

Dynamics:

ALLIANCE DISTRIBUTION

Range: This alliance is distributed throughout the southeastern United States in most physiographic provinces. It is found in Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia, and elsewhere, but not in Florida.

Nations: US

States/Provinces: AL AR GA KY LA MS NC OK SC TN VA

TNC Ecoregions: 31:P, 32:P, 38:C, 39:C, 40:P, 41:C, 42:P, 43:C, 44:?, 50:P, 51:P, 52:C, 53:P, 56:P, 57:C, 58:P

USFS Ecoregions: 222A:CC, 222C:CC, 222D:CC, 222Eb:CCC, 222Fa:CCP, 222Fb:CCC, 222Fe:CCP, 231Aa:CCP, 231Ae:CCP, 231Af:CCP, 231Ag:CCP, 231Ah:CCP, 231Ai:CCP, 231Aj:CCP, 231Ak:CCP, 231Al:CCP, 231Am:CCP, 231An:CCP, 231Ao:CCP, 231Ap:CCP, 231Ba:CCP, 231Bb:CCP, 231Bc:CCC, 231Be:CCP, 231Bh:CCP, 231Bi:CCP, 231Bj:CCP, 231Bk:CCC, 231Ca:CCP, 231Cb:CCP, 231Cc:CCP, 231Cd:CCP, 231Ce:CCP, 231Cf:CC?, 231Cg:CC?, 231Da:C??, 231Db:C??, 231Dc:C??, 231Dd:C??, 231De:C??, 231Eb:CC?, 231Ec:CC?, 231Ed:CC?, 231Ga:CC?, 231Gb:CC?, 231Gc:CC?, 232Ba:CCP, 232Bb:CCP, 232Bc:CCP, 232Bd:CC?, 232Bj:CCC, 232Bk:CC?, 232Bl:CC?, 232Bm:CC?, 232Bn:CC?, 232Bo:CC?, 232Bp:CCP, 232Bq:CCC, 232Br:CCC, 232Bs:CCC, 232Ca:CCC, 232Cb:CCC, 232Cc:CCP, 232Cf:CCP, 232Cg:CCP, 232Ch:CC?, 234Aa:CCP, 234Ab:CCC, 234Ac:CCC, 234Ad:CCP, 234Ae:CCP, 234Af:CCP, 234Ag:CCP, 234Ah:CCP, 234Ai:CCP, 234Aj:CCP, 234Ak:CCP, 234Al:CCP, 234Am:CCP, 234An:CCP, M221Dc:CC?, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CC?, M231Ab:CC?, M231Ac:CC?, M231Ad:CC?

Federal Lands: DOD (Arnold, Fort Benning); NPS (Congaree Swamp, Guilford Courthouse, Kings Mountain, Ninety Six, Shiloh); TVA (Tellico); USFS (Bienville, Cherokee, Conecuh, Croatan?, Delta?, De Soto, Francis Marion?, Holly Springs, Homochitto, Oconee?, Ouachita, Ozark, St. Francis, Talladega, Tombigbee, Tuskegee); USFWS (Eufaula)

ALLIANCE SOURCES

Authors: D.J. ALLARD, MP, Southeast **Identifier:** A.234

References: Foti et al. 1994, Gallyoun et al. 1996, Monk et al. 1989

Liquidambar styraciflua ForestSweetgum Forest
Successional Sweetgum Forest (CEGL007216)
Ecological Group (SCS;MCS): Semi-natural Wooded Uplands (900-40; 8.0.0.1)

ELEMENT CONCEPT

GLOBAL SUMMARY: This forest results from succession following human activities, such as logging and clearing. Stands are dominated by *Liquidambar styraciflua*, sometimes to the exclusion of other species. This community may intergrade with *Liquidambar styraciflua / Lindera benzoin / Arisaema triphyllum ssp. triphyllum* Forest (CEGL004418) in bottomlands.

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: This community exists in both uplands and bottomlands where factors existed that promoted the growth of monotypic *Liquidambar styraciflua* rather than *Pinus taeda* stands. These stands can often spring up as clonal stands in old fields or in bottomlands that may be inundated and too wet for *Pinus* spp.

Global Environment: Uplands and bottomlands that have been heavily impacted by agriculture and are recovering.

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: Always a monotypic stand of *Liquidambar styraciflua*. The understory varies, but is generally either very poorly developed or invaded by exotics such as *Lonicera japonica* or *Microstegium vimineum*.

Global Vegetation: Dominated by *Liquidambar styraciflua*.

Global Dynamics: These communities represent successional stands of upland and wetland *Liquidambar styraciflua*. As the stands mature, they begin to assume the characteristics of more natural community types. For example, small stream bottomland sweetgum stands in the Piedmont may recover quickly from disturbance and begin to approximate the characters of *Liquidambar styraciflua / Lindera benzoin / Arisaema triphyllum ssp. triphyllum* Forest (CEGL004418) 50 years or more after a stand-initiating disturbance.

MOST ABUNDANT SPECIES

Ninety Six National Historic Site

Stratum	Species
TREE CANOPY	*Liquidambar styraciflua*
SHRUB	*Liquidambar styraciflua*

Global

Stratum	Species
TREE CANOPY	*Liquidambar styraciflua*
SHRUB	*Liquidambar styraciflua*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- *Liquidambar styraciflua - Quercus (alba, falcata)* Forest (CEGL007217)--of interior provinces.
- *Liquidambar styraciflua - Quercus (nigra, phellos) - Pinus taeda / Vaccinium elliottii - Morella cerifera* Forest (CEGL007726)--a more diverse successional forest of the Coastal Plain.
- *Liquidambar styraciflua / Lindera benzoin / Arisaema triphyllum ssp. triphyllum* Forest (CEGL004418) - a more natural community of Piedmont bottomland streams that is distinguished by higher herbaceous diversity and older trees (at least 50 years old or more).

GRank & Reasons: GM (99-08-11). This is a successional vegetation type composed of native species. Its conservation value is limited, but it may provide buffer for communities of greater conservation value.

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range: This community ranges throughout the park, both in upland and bottomland areas. It is most common on the very gentle south -acing slope just north of the Ninety Six Creek bottomland.

Global Range: Throughout the southeastern United States.

Nations: US
States/Provinces: AL:S?, GA:S?, KY:S?, LA:S?, MS:S?, NC:S?, OK:S?, SC:S?, TN:S?, VA:S?
TNC Ecoregions: 31:P, 32:P, 40:P, 41:C, 42:P, 50:P, 51:P, 52:P, 53:P, 56:P, 57:P
USFS Ecoregions: 222Fa:CCP, 222Fb:CCC, 222Fe:CCP, 231Aa:PPP, M221Dc:???, M221Dd:???
Federal Lands: NPS (Guilford Courthouse, Ninety Six); USFS (Oconee?, St. Francis?)

ELEMENT SOURCES

Authors: R. White, SCS **Confidence:** 3 **Identifier:** CEGL007216
REFERENCES (type in full citation below if reference is new): NatureServe Ecology - Southeastern U.S. unpubl. Data

I.B.2.N.a.24. LIRIODENDRON TULIPIFERA FOREST ALLIANCE
Tuliptree Forest Alliance
I.B. Deciduous forest

ALLIANCE CONCEPT

Summary: This alliance includes deciduous forests dominated by *Liriodendron tulipifera*, primarily in areas which were once clearcut, old fields, or cleared by fire or other natural disturbances. These non-wetland forests are also found along mesic stream terraces and on upland mountain benches. Forests in this alliance are abundant in the central and southern Appalachians, below 3000 feet (900 m) elevation, usually associated with disturbance and on the most productive sites, but also occur in the Coastal Plain, Piedmont, Ridge and Valley, and Cumberland Plateau. This alliance includes pure, often even-aged stands of *Liriodendron tulipifera* as well as forests with *Liriodendron tulipifera* associated with other species favored by canopy openings. Associated species vary with geographic location. Throughout most of the range of this alliance, *Acer rubrum, Robinia pseudoacacia, Betula lenta, Acer saccharum*, and *Acer negundo* are common components. In the Piedmont and Coastal Plain, *Liquidambar styraciflua* is a common associate. In the Appalachians, *Halesia tetraptera, Tsuga canadensis, Tilia americana var. heterophylla (= Tilia heterophylla), Prunus serotina var. serotina*, and *Magnolia fraseri* can be additional components. In the Ridge and Valley and Cumberland Plateau, additional species include *Quercus rubra, Magnolia acuminata, Carya alba, Carya glabra, Pinus virginiana, Sassafras albidum, Pinus strobus, Carpinus caroliniana, Asimina triloba*, and *Staphylea trifolia*. Herbaceous strata are not diverse and, in the southern Appalachians, this feature distinguishes these forests from rich cove forests in I.B.2.N.a *Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235). Vines can be abundant including *Vitis* spp., *Smilax* spp., *Aristolochia macrophylla*, and *Parthenocissus quinquefolia*. Forests in this alliance occur on middle to lower slopes, sheltered coves and gentle concave slopes, and river terraces over various soils and geologies. Vegetation of this alliance is uncommon in Louisiana.

Environment: Forests in this alliance are primarily found in areas which were once clearcut, old fields, or cleared by fire or other natural disturbances. These forests are also found along streams in flat bottoms and on upland mountain benches. Forests in this alliance are abundant in the central and southern Appalachians, below 900 m (3000 feet) elevation, usually associated with disturbance and on the most productive sites. They also occur in the Coastal Plain, Piedmont, Ridge and Valley, and Cumberland Plateau.

Vegetation: This alliance includes pure, often even-aged stands of *Liriodendron tulipifera* as well as forests with *Liriodendron tulipifera* associated with other species favored by canopy openings. Associated species vary with geographic location. Throughout most of the range of this alliance, *Acer rubrum, Robinia pseudoacacia, Betula lenta, Acer saccharum*, and *Acer negundo* are common components. In the Piedmont and Coastal Plain, *Liquidambar styraciflua* is a common associate. In the Appalachians, *Halesia tetraptera, Tsuga canadensis, Tilia americana var. heterophylla (= Tilia heterophylla), Prunus serotina var. serotina*, and *Magnolia fraseri* can be additional components. In the Ridge and Valley and Cumberland Plateau, additional species include *Quercus rubra, Magnolia acuminata, Carya alba, Carya glabra, Pinus virginiana, Sassafras albidum, Pinus strobus, Carpinus caroliniana, Asimina triloba*, and *Staphylea trifolia*. Herbaceous strata are not diverse and, in the southern Appalachians, this feature distinguishes these forests from rich cove forests in *Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235). Vines can be abundant including *Vitis* spp., *Smilax* spp., *Aristolochia macrophylla*, and *Parthenocissus quinquefolia*.

Dynamics:

Similar Alliances:

- LIQUIDAMBAR STYRACIFLUA - (LIRIODENDRON TULIPIFERA, ACER RUBRUM) TEMPORARILY FLOODED FOREST ALLIANCE (A.287)
- PINUS TAEDA - LIRIODENDRON TULIPIFERA TEMPORARILY FLOODED FOREST ALLIANCE (A.434)

Similar Alliance Comments: For temporarily flooded forests dominated or codominated by *Liriodendron tulipifera* see I.B.2.N.d *Liquidambar styraciflua - (Liriodendron tulipifera, Acer rubrum)* Temporarily Flooded Forest Alliance (A.287) and I.C.3.N.b *Pinus taeda - Liriodendron tulipifera* Temporarily Flooded Forest Alliance (A.434).

Synonymy:

- Yellow-Poplar: 57, in part (Eyre 1980)

Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is found in Alabama, Georgia, Kentucky, Louisiana, Mississippi (?), North Carolina, South Carolina, Tennessee, Maryland, Pennsylvania, Virginia, and West Virginia. Forests in this alliance are abundant in the central and southern Appalachians, below 3000 feet (900 m) elevation, but also occur in the Coastal Plain, Piedmont, Ridge and Valley, and Cumberland Plateau.

Nations: US

States/Provinces: AL GA KY MD NC PA SC TN VA WV

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

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

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

ALLIANCE SOURCES

Authors: D.J. ALLARD, RW, Southeast **Identifier:** A.236

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

Liriodendron tulipifera - Acer rubrum - Quercus spp. Forest
Tuliptree - Red Maple - Oak species Forest
Successional Tuliptree - Hardwood Forest (CEGL007221)
Ecological Group (SCS;MCS): Semi-natural Wooded Uplands (900-40; 8.0.0.1)

ELEMENT CONCEPT

GLOBAL SUMMARY: The canopy of this semi-natural upland association is dominated by *Liriodendron tulipifera*. *Acer rubrum* is common in the understory along with *Quercus* spp. and occasionally *Liquidambar styraciflua*. These early successional forests often follow cropping, clearcut logging, or other severe disturbance, and are successional to mixed *Quercus - Carya* forests. They are potentially widespread. The oak in these stands will frequently be multi-stemmed, resulting from coppicing. Lesser amounts of *Pinus virginiana* and *Pinus echinata* may be present in severely disturbed sites.

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: Same as global description.

Global Environment: These semi-natural upland deciduous forests are found primarily in areas which were once clearcuts, old fields, or were cleared by fire or other natural disturbances. These non-wetland forests are also found along mesic stream terraces.

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: Same as global description.

Global Vegetation: The canopy of this semi-natural upland association is dominated by *Liriodendron tulipifera*. *Acer rubrum* is common in the understory along with *Quercus* spp. (e.g., *Quercus falcata, Quercus nigra, Quercus velutina*), as well as other early successional hardwoods including *Nyssa sylvatica*. Lesser amounts of *Pinus virginiana* and *Pinus echinata* may be present in severely disturbed sites.

Global Dynamics: This community is widespread in areas that had stand-initiating disturbance such as heavy logging or plowing in the recent past. In areas that have been protected for more than 80 years, this community is uncommon.

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- *Liriodendron tulipifera - Acer rubrum - Robinia pseudoacacia* Forest (CEGL007219)--resulting from more severe disturbance.
- *Liriodendron tulipifera - Acer (negundo, rubrum) / Asimina triloba* Forest (CEGL007184)

GRank & Reasons: GD (00-08-08). This forest represents early successional vegetation and is thus not of conservation concern. This is a successional vegetation type composed of native species. Its conservation value is limited, but mature examples could provide buffer for communities of greater conservation value.

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range: If it exists in the park, this community is fairly uncommon.

Global Range: This association is known from the southern Cumberland Plateau and Piedmont of the southeastern U.S. and may also occur in the Upper East Gulf Coastal Plain and Interior Low Plateau. It is known from Alabama, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, and possibly Virginia.

Nations: US
States/Provinces: AL:S?, GA:S?, KY:S?, NC:S?, SC:S?, TN:S?, VA?
TNC Ecoregions: 43:P, 44:P, 50:C, 52:C
USFS Ecoregions: 221Hc:CCC, 222C:CC, 222D:CC, 222Eb:CCC, 222En:CCC, 222Eo:CCC, 231Aa:CCP, 231Ae:CCC, 231Bc:CCC, 231Cd:CCP, 231Dc:CCC

Federal Lands: DOD (Fort Benning); NPS (Cowpens, Guilford Courthouse, Kennesaw Mountain, Kings Mountain, Ninety Six?, Shiloh); USFS (Bankhead, Daniel Boone, Oconee?, Talladega)

ELEMENT SOURCES

Authors: SCS **Confidence:** 3 **Identifier:** CEGL007221

References: Gallyoun et al. 1996, NatureServe Ecology - Southeastern U.S. unpubl. data

I.B.2.N.a.27. QUERCUS ALBA - (QUERCUS RUBRA, CARYA SPP.) FOREST ALLIANCE

White Oak - (Northern Red Oak, Hickory species) Forest Alliance

I.B. Deciduous forest

ALLIANCE CONCEPT

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

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

Environment: Stands are found on gentle to moderately steep slopes on uplands and on steep valley sides. The soils are moderately deep to deep and vary from silts to clays and loams. The parent material ranges from glaciated till to limestone, shale, sandstone and other bedrock types. In the Midwest, many stands are succeeding to types dominated by *Acer saccharum, Tilia americana, Acer rubrum*, and other mesic tree associates. This succession may be delayed by fire and grazing. In the East and Southeast, *Liriodendron tulipifera, Fraxinus americana*, and other mesic associates often increase after disturbances, such as clearcutting or windstorms, especially in the absence of fire (Eyre 1980).

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

Dynamics:

Similar Alliances:

- QUERCUS VELUTINA - QUERCUS ALBA - (QUERCUS COCCINEA) FOREST ALLIANCE (A.1911)
- QUERCUS ALBA MONTANE FOREST ALLIANCE (A.271)
- QUERCUS RUBRA MONTANE FOREST ALLIANCE (A.272)
- QUERCUS RUBRA - (ACER SACCHARUM) FOREST ALLIANCE (A.251)

Similar Alliance Comments: See the I.B.2.N.a *Quercus velutina - Quercus alba - (Quercus coccinea)* Forest Alliance (A.1911) for floristically and structurally similar stands. Forest dominated by *Quercus alba* or *Quercus rubra* in extreme montane landscapes are classified in A.271 and A.272. Other similar forests may be found in *Quercus rubra - (Acer saccharum)* Forest Alliance (A.251).

Comments:

ALLIANCE DISTRIBUTION

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

Nations: CA US

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

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

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

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

ALLIANCE SOURCES

Authors: D.J. ALLARD/D. FABER-LANG, RW, Midwest **Identifier:** A.239

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

Quercus alba - Quercus (rubra, coccinea) - Carya (alba, glabra) / Vaccinium pallidum Piedmont Dry-Mesic Forest
White Oak - (Northern Red Oak, Scarlet Oak) - (Mockernut Hickory, Pignut Hickory) / Hillside Blueberry Piedmont Dry-Mesic Forest
Piedmont Dry-Mesic Oak - Hickory Forest (CEGL008475)
Ecological Group (SCS;MCS): Appalachian Highlands Dry-mesic Oak Forests and Woodlands (401-13; 2.5.3.2)

ELEMENT CONCEPT

GLOBAL SUMMARY: This forest is found on submesic to dry-mesic to subxeric upland sites of mid- to upper-slope position with northerly or easterly aspects, or mid to lower slopes with more southerly aspects. In drier landscapes, this type could occupy habitats considered relatively mesic (e.g., concave slopes, lower slopes, shallow ravines). These sites are described as dry to intermediate in soil moisture. The soils are acidic and nutrient-poor, being weathered from felsic metamorphic and sedimentary rocks, or composed of unconsolidated sediments. Stands of this forest are closed to somewhat open, and are dominated by mixtures of oaks and hickories, with *Quercus alba* being most prevalent, along with *Quercus rubra, Quercus coccinea, Quercus velutina, Carya alba, Carya ovalis*, and *Carya glabra*. The *Carya* spp. are common in this type, but often most abundant in the understory. In Virginia examples, *Quercus prinus* is inconstant but sometimes important. In addition, *Pinus* spp., *Liriodendron tulipifera, Liquidambar styraciflua*, and *Acer rubrum* may be common. Understory species include *Acer rubrum, Cornus florida, Oxydendrum arboreum, Ilex opaca*, and *Nyssa sylvatica*. Shrubs include *Vaccinium stamineum, Vaccinium pallidum, Viburnum acerifolium, Viburnum rafinesquianum*, and *Euonymus americana*. In Virginia, *Vaccinium pallidum* is the principal ericad of patchy low-shrub layers, and stands may contain *Calycanthus floridus* (G. Fleming pers. comm. 2001). The woody vines *Vitis rotundifolia* and *Toxicodendron radicans* often are present. Herbs are fairly sparse, with *Hexastylis* spp., *Goodyera pubescens, Chimaphila maculata, Desmodium nudiflorum, Maianthemum racemosum, Polygonatum biflorum, Viola hastata, Tipularia discolor*, and *Hieracium venosum* as some common components (Schafale and Weakley 1990). This association is less nutrient-rich than *Quercus rubra - Quercus alba - Carya glabra / Geranium maculatum* Forest (CEGL007237).

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: This community exists in upland areas just above the north-facing slopes of Ninety Six Creek. This community may intergrade into CEGL008466, but CEGL008466 has a more mesic and basic species component.

Global Environment: The sites on which this vegetation is found are described as `intermediate' in soil moisture (Jones 1988a, 1988b). This association is less nutrient-rich than *Quercus rubra - Quercus alba - Carya glabra / Geranium maculatum* Forest (CEGL007237). Virginia stands occur on submesic to subxeric uplands with acidic, nutrient-poor soils weathered from felsic metamorphic and sedimentary rocks, and unconsolidated sediments. This type frequently occupies somewhat mesic habitats (e.g., concave slopes, lower slopes, shallow ravines) in dry landscapes where Mixed Oak/Heath types are prevalent. It is probably a large-patch or matrix type in some regions (G. Fleming pers. comm. 2001). In North Carolina, this is a matrix type, probably the most common forest type remaining in the Piedmont.

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: Same as global description.

Global Vegetation: Stands of this forest are closed to somewhat open, and are dominated by mixtures of oaks and hickories, with *Quercus alba* being most prevalent, along with *Quercus rubra, Quercus coccinea, Quercus velutina, Carya alba, Carya ovalis*, and *Carya glabra*. The *Carya* spp. are common in this type, but often most abundant in the understory. In Virginia examples, *Quercus prinus* is inconstant but sometimes important. In addition, *Pinus* spp., *Liriodendron tulipifera, Liquidambar styraciflua*, and *Acer rubrum* may be common. Understory species include *Acer rubrum, Cornus florida, Oxydendrum arboreum, Ilex opaca*, and *Nyssa*

sylvatica. Shrubs include *Vaccinium stamineum, Vaccinium pallidum, Viburnum acerifolium, Viburnum rafinesquianum*, and *Euonymus americana*. In Virginia, *Vaccinium pallidum* is the principal ericad of patchy low-shrub layers, and stands may contain *Calycanthus floridus* (G. Fleming pers. comm. 2001). The woody vines *Vitis rotundifolia* and *Toxicodendron radicans* often are present. Herbs are fairly sparse, with *Hexastylis* spp., *Goodyera pubescens, Chimaphila maculata, Desmodium nudiflorum, Maianthemum racemosum, Polygonatum biflorum, Viola hastata, Tipularia discolor*, and *Hieracium venosum* as some common components (Schafale and Weakley 1990).

Global Dynamics: Disturbed areas have increased amounts of pines and weedy hardwoods such as *Acer rubrum, Liriodendron tulipifera*, and *Liquidambar styraciflua*, with the amounts depending on the degree of canopy opening. Areas that were cultivated are generally dominated by even-aged pine stands which are replaced by the climax oaks and hickories only as the pines die. Logged areas may have a mixture of hardwoods and pines (Schafale and Weakley 1990). Under natural conditions these forests are uneven-aged, with old trees present. Reproduction occurs primarily in canopy gaps. Rare, severe natural disturbances such as wind storms may allow pulses of increased regeneration and allow the less shade-tolerant species to remain in the community. However, Skeen, Carter, and Ragsdale (1980) argued that even the shade-intolerant *Liriodendron* could reproduce enough in gaps to persist in the climax Piedmont forests.
The natural fire regime of the Piedmont is not known, but fires certainly occurred periodically. Most of the component trees are able to tolerate light surface fires with little effect. However, *Acer rubrum* is fairly intolerant of fire and often appears to be out-competing the regeneration of oaks in long-unburned stands. Regular fire may have created a more open forest, with gaps persisting longer than at present and perhaps forming more frequently (Schafale and Weakley 1990).

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- *Quercus rubra - Quercus alba - Carya glabra / Geranium maculatum* Forest (CEGL007237)--a related more mesic type.
- *Quercus alba - Carya alba / Euonymus americana / Hexastylis arifolia* Forest (CEGL006227)--similar with a more southerly range.
- *Quercus alba - Carya alba / Vaccinium elliottii* Forest [Provisional] (CEGL007224)--of the Coastal Plain.
- *Quercus alba - Carya glabra* / Mixed Herbs Coastal Plain Forest (CEGL007226)--of the Coastal Plain.
- *Quercus alba - Quercus nigra - Quercus falcata / Ilex opaca / Clethra alnifolia - Arundinaria gigantea* ssp. *tecta* Forest (CEGL007862)--of the Coastal Plain.

GRank & Reasons: G5? (01-02-06).

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range: This community only occurs in the southern portion of the park just south of the Ninety Six Creek north-facing slope.

Global Range: This association is found in the Piedmont and northern Coastal Plain (Chesapeake Bay Lowlands Ecoregion) of Virginia, as well as south in the Piedmont to the Carolinas and possibly Georgia, as well as possibly in related areas of Maryland.

Nations: US
States/Provinces: GA?, MD?, NC:S5, SC:S?, VA:S?
TNC Ecoregions: 52:C, 58:C, 61:?
USFS Ecoregions: 221Db:CCC, 231Aa:CCC, 231Ae:CCC, 232Ad:CCC, 232Bt:CC?, 232Bx:CCC
Federal Lands: NPS (Guilford Courthouse, Ninety Six)

ELEMENT SOURCES

Authors: M.P. Schafale/G.P. Fleming, SCS **Confidence:** 1 **Identifier:** CEGL008475
References: Allard 1990, Ambrose 1990a, Fleming et al. 2001, Fleming pers. comm., Jones 1988a, Jones 1988b, Nelson 1986, Patterson pers. comm., Schafale and Weakley 1990, Skeen et al. 1980

I.B.2.N.a.29. QUERCUS ALBA - QUERCUS (FALCATA, STELLATA) FOREST ALLIANCE

White Oak - (Southern Red Oak, Post Oak) Forest Alliance

I.B. Deciduous forest

ALLIANCE CONCEPT

Summary: This alliance contains vegetation that can be described as dry oak and oak-hickory forests. These are usually dominated by a mixture of *Quercus alba* and *Quercus falcata*; *Quercus stellata* may be dominant or codominant. In addition, *Quercus coccinea, Quercus velutina, Quercus marilandica, Carya alba, Carya glabra, Carya pallida, Carya carolinae-septentrionalis, Carya ovata*, and *Fraxinus americana* often are present. Common subcanopy and shrub species include *Oxydendrum arboreum, Acer rubrum, Ulmus alata, Juniperus virginiana var. virginiana, Vaccinium arboreum, Cornus florida, Sassafras albidum, Gaylussacia frondosa (= var. frondosa), Gaylussacia baccata, Vaccinium pallidum*, and *Vaccinium stamineum*. Herbaceous species that may be present include *Chimaphila maculata, Polystichum acrostichoides, Asplenium platyneuron, Hexastylis arifolia, Coreopsis major, Tephrosia virginiana, Sanicula canadensis, Desmodium nudiflorum, Desmodium nuttallii, Symphyotrichum urophyllum*? (= *Aster sagittifolius*?), *Symphyotrichum patens (= Aster patens), Solidago ulmifolia*, and *Hieracium venosum*. These often are successional forests following logging and/or agricultural cropping (and possibly also chestnut blight in the southern Appalachians). Some examples occur in upland flats and have been called xerohydric because they occasionally will have standing water in the winter due to a perched water table, but are droughty by the end of the growing season. Other occurrences are found on well-drained sandy loam or clay loam soils that are often, although not always, shallow. Karst topography can be found in areas where this alliance occurs. Soils are most often a well-drained sandy loam, although clay loams are not uncommon. Forests of this alliance may occupy narrow bands of dry-mesic habitat transitional between lower and midslope mesic communities and xeric ridgetops. This alliance is found in the Upper East Gulf Coastal Plain, Piedmont, low mountains (including Cumberlands, Ridge and Valley, and low parts of the Southern Blue Ridge), and Interior Low Plateau. Distribution in the Atlantic Coastal Plain, East Gulf Coastal Plain, and Upper West Gulf Coastal Plain needs assessment. In the Shawnee Hills, Knobs, Coastal Plain, and Appalachian Plateau regions of Kentucky, these forests form a common matrix vegetation over acid sandstone and shales. These Kentucky forests are dominated by *Quercus alba* with little or no *Quercus falcata* and occupy middle to upper slope positions. In the southern Illinois portion of the range, examples occur on south- to west-facing slopes where increased temperatures favor *Quercus falcata* over *Quercus rubra*.

Dynamics:

ALLIANCE DISTRIBUTION

Range: This alliance is found in southern Illinois, Indiana (?), Kentucky, Tennessee, Arkansas, Louisiana (?), Oklahoma (?), Texas (?), Mississippi, Alabama, Georgia, South Carolina, North Carolina, Virginia, Delaware, Maryland, and New Jersey. This alliance is found in the Upper East Gulf Coastal Plain, Piedmont, low mountains, and Interior Low Plateau. Distribution in the Atlantic Coastal Plain, East Gulf Coastal Plain, and Upper West Gulf Coastal Plain needs assessment. In the Shawnee Hills, Knobs, Coastal Plain, and Appalachian Plateau regions of Kentucky, these forests form a common matrix vegetation over acid sandstone and shales.

Nations: US

States/Provinces: AL AR CT DE GA IL IN? KY LA? MA MD MS NC NJ NY OK? SC TN TX? VA

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

USFS Ecoregions: 221Ad:CPP, 221Dc:C??, 221Ha:CCP, 221Hc:CCC, 221Hd:CCP, 221He:CCP, 221Jb:CCC, 222Ca:CCP, 222Cb:CCC, 222Cc:CCP, 222Cd:CCP, 222Ce:CCP, 222Cf:CC?, 222Cg:CC?, 222Ch:CC?, 222Da:CCC, 222Dc:CCP, 222Dd:CCP, 222De:CCC, 222Df:CCP, 222Dg:CCC, 222Dh:CCC, 222Di:CCP, 222Dj:CCC, 222Ea:CCC, 222Eb:CCC, 222Ec:CCP, 222Ee:CCC, 222Ef:CCC, 222Eg:CCC, 222Eh:CCC, 222Ei:CCC, 222Ej:CCC, 222El:CCC, 222En:CCC, 231Aa:CCC, 231Ab:CCP, 231Ac:CCP, 231Ad:CCP, 231Ae:CCC, 231Af:CCC, 231Ag:CCC, 231Ah:CCP, 231Ai:CCC, 231Aj:CCP, 231Ak:CCC, 231Al:CCC, 231Am:CCC, 231An:CCC, 231Ao:CCC, 231Ap:CCC, 231Ba:CPP, 231Bc:CPP, 231Bd:CPP, 231Be:CP?, 231Ca:CCP, 231Cb:CCP, 231Cc:CCP, 231Cd:CCC, 231Ce:CCP, 231Cg:CCP,

231Da:CCC, 231Dc:CCC, 231De:CCC, 231Ea:CC?, 231Eb:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CCP, 232Bl:CCP, 232Bm:CCP, 232Bn:CCP, 232Bq:CCC, 232Br:CCC, 232Bt:CCC, 232Bv:CCP, 232Bx:CCP, 232Bz:CCP, 232Ca:CP?, 232Ch:CP?, 232Fa:CP?, 234Aa:CC?, 234Ab:CCC, 234Ac:CCP, 234Ae:CCC, 234Ag:CC?, 234Ah:CCP, M221Aa:CC?, M221Ab:CCC, M221Da:CCC, M221Dd:CCC

Federal Lands: DOD (Arnold, Fort Benning, Fort Gordon); DOE (Oak Ridge); NPS (Big South Fork, Chickamauga-Chattanooga, Cowpens, Fire Island, Great Smoky Mountains, Guilford Courthouse, Kennesaw Mountain, Kings Mountain, Ninety Six, Shiloh); TVA (Tellico); USFS (Bankhead, Chattahoochee?, Cherokee, Daniel Boone, Holly Springs?, Kisatchie?, Land Between the Lakes?, Oconee, Sabine NF?, St. Francis, Shawnee, Sumter, Talladega, Tombigbee?, Tuskegee?, Uwharrie); USFWS (Eufaula)

ALLIANCE SOURCES

Authors: M. PYNE/A.S. WEAKLEY 6-94, RW, Southeast **Identifier:** A.241

References: Allard 1990, Andreu and Tukman 1995, Braun 1950, Diamond 1993, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Fike 1999, Foti 1994b, Foti et al. 1994, Fralish et al. 1991, Golden 1979, Oosting 1942, Peet and Christensen 1980, Pyne 1994, Robertson and Heikens 1994, Schafale and Weakley 1990, Smith 1991, Sneddon et al. 1996, Swain and Kearsley 2001, Voigt and Mohlenbrock 1964

Quercus falcata - Quercus alba - Carya alba / Oxydendrum arboreum / Vaccinium stamineum Forest
Southern Red Oak - White Oak - Mockernut Hickory / Sourwood / Deerberry Forest
Interior Southern Red Oak - White Oak Forest (CEGL007244)
Ecological Group (SCS;MCS): Appalachian Highlands Dry-mesic Oak Forests and Woodlands (401-13; 2.5.3.2)

ELEMENT CONCEPT

GLOBAL SUMMARY: This southern red oak - white oak dry forest is found in the Piedmont of Georgia, South Carolina, North Carolina, and Virginia, and in the interior uplands and Cumberland Plateau of Kentucky and Tennessee. It has also been reported from the Upper East Gulf Coastal Plain of Mississippi and Georgia. It generally is a second-growth forest on low-fertility Ultisols. The vegetation is dominated by *Quercus* spp. and lesser amounts of *Carya* spp. The canopy is continuous, and several species of *Quercus* may be present or codominant (e.g., *Quercus falcata, Quercus alba, Quercus velutina, Quercus coccinea*, and *Quercus stellata*). 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, Liriodendron tulipifera, Oxydendrum arboreum, Liquidambar styraciflua, Ulmus alata, Cornus florida, Nyssa sylvatica, Juniperus virginiana var. virginiana*, and *Vaccinium arboreum*. The tall-shrub stratum may contain *Rhododendron canescens* and *Vaccinium arboreum*. The low-shrub stratum can be sparse to moderate and may be dominated by various ericaceous shrubs such as *Vaccinium pallidum, Vaccinium stamineum, Vaccinium fuscatum*, and *Gaylussacia baccata*. *Smilax glauca* and *Vitis rotundifolia* are common vines. Herbaceous species that may be present include *Aristolochia serpentaria, Symphyotrichum dumosum (= Aster dumosus), Clitoria mariana, Desmodium nudiflorum, Euphorbia corollata, Galium circaezans, Chimaphila maculata, Polystichum acrostichoides, Asplenium platyneuron, Hexastylis arifolia, Coreopsis major, Solidago odora, Tephrosia virginiana, Potentilla simplex, Porteranthus stipulatus, Pteridium aquilinum, Lespedeza* spp., *Dichanthelium* spp., and *Hieracium venosum*.

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: This community exists in some of the less disturbed uplands in the park where a second-growth forest has established. The soil fertility is low on these sites, but the community has aged so that there is a more diverse canopy of oaks rather than the pines seen in much of the rest of the uplands of the park.

Global Environment: Stands are typically found on low fertility Ultisols in the Piedmont, the interior uplands, and the Cumberland Plateau. This community occurs on soils of relatively low fertility; suborders on which this community occurs include Hapludults and Paleudults. Stands are uneven-aged and tree replacement occurs in gaps; severe fires most likely destroy community occurrences although light fires probably are tolerated.

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: Within the park, the canopy varies quite a bit. Generally speaking, the trees are more than 50 years old and uneven-aged. Most are *Quercus alba, Quercus falcata*, and *Quercus rubra*, but *Quercus nigra* and *Quercus phellos* may comprise up to 25% of the canopy.

Global Vegetation: The vegetation is dominated by *Quercus* spp. and lesser amounts of *Carya* spp. The canopy is continuous, and several species of *Quercus* may be present (e.g., *Quercus falcata, Quercus alba, Quercus velutina, Quercus coccinea*, and *Quercus stellata*). 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, Liriodendron tulipifera, Oxydendrum arboreum, Liquidambar styraciflua, Ulmus alata, Cornus florida, Nyssa sylvatica, Juniperus virginiana var. virginiana*, and *Vaccinium arboreum*. The tall-shrub stratum may contain *Rhododendron canescens* and *Vaccinium arboreum*. The low-shrub stratum is dominated by various ericaceous shrubs such as *Vaccinium pallidum, Vaccinium*

stamineum, Vaccinium fuscatum, and *Gaylussacia baccata*. *Smilax glauca* and *Vitis rotundifolia* are common vines. Herbaceous species that may be present include *Aristolochia serpentaria, Symphyotrichum dumosum (= Aster dumosus), Clitoria mariana, Desmodium nudiflorum, Euphorbia corollata, Galium circaezans, Chimaphila maculata, Polystichum acrostichoides, Asplenium platyneuron, Hexastylis arifolia, Coreopsis major, Solidago odora, Tephrosia virginiana, Potentilla simplex, Porteranthus stipulatus, Pteridium aquilinum, Lespedeza* spp., *Dichanthelium* spp., and *Hieracium venosum*.

Global Dynamics: There is no known natural disturbance regime responsible for development or maintenance of this community type. Tree replacement occurs most frequently in single tree-sized gaps. Occasional catastrophic windstorms and fires occur.

MOST ABUNDANT SPECIES

Global Stratum	Species
TREE CANOPY	*Carya alba, Quercus alba, Quercus coccinea, Quercus falcata, Quercus velutina*
TREE SUB-CAN	*Cornus florida, Oxydendrum arboreum*
SHORT SHRUB	*Vaccinium pallidum, Vaccinium stamineum*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- *Quercus falcata - Quercus alba - Quercus stellata - Quercus velutina* Forest (CEGL005018)
- *Quercus alba - Carya alba / Euonymus americana / Hexastylis arifolia* Forest (CEGL006227)--a more mesic type with range overlap in the southern Piedmont.
- *Pinus echinata - Quercus alba / Vaccinium pallidum / Hexastylis arifolia - Chimaphila maculata* Forest (CEGL008427)--a related mixed type.

GRank & Reasons: G4G5 (99-02-16). This is not a rare forest type, although most examples have been impacted by removal of the more valuable timber species (e.g., *Quercus alba*), and remaining ones on private land are highly vulnerable to canopy removal and conversion to other forest types or other land uses.

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range: This community types exists, for the most part, only in the northern third of the park.

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

Nations: US
States/Provinces: AL:S?, GA:S?, KY:S5, MS:S?, NC:S4, SC:S?, TN:S?, VA?
TNC Ecoregions: 43:C, 44:C, 50:C, 52:C, 53:?
USFS Ecoregions: 221Hc:CCC, 222Eb:CCC, 231Ae:CCC
Federal Lands: DOD (Arnold, Fort Benning, Fort Gordon?); DOE (Oak Ridge); NPS (Cowpens, Guilford Courthouse, Kings Mountain, Ninety Six, Shiloh); USFS (Daniel Boone, Holly Springs?, Oconee, Sumter, Talladega, Uwharrie); USFWS (Eufaula)

ELEMENT SOURCES

Authors: S. Landaal, SCS **Confidence:** 2 **Identifier:** CEGL007244
REFERENCES (type in full citation below if reference is new): ALNHP 2002, Allard 1990, Ambrose 1990a, Evans 1991, Eyre 1980, Golden 1979, NatureServe Ecology - Southeastern U.S. unpubl. data, Oberholster 1993, Oosting 1942, Peet and Christensen 1980, Peet et al. 2002, Pyne 1994, Rawinski 1992, Schafale and Weakley 1990

I.B.2.N.a.35. QUERCUS NIGRA FOREST ALLIANCE
Water Oak Forest Alliance
I.B. Deciduous forest

ALLIANCE CONCEPT

Summary: Upland forests dominated or codominated by *Quercus nigra*, in some cases as a result of disturbance and/or fire suppression of more diverse canopied forests. Forests in this alliance occur on mesic or dry-mesic sites, especially on loamy or other fine-textured soils (in contrast to the *Quercus hemisphaerica* Forest Alliance (A.53), which occurs primarily on coarse-textured sands in drier situations). One association is found along small streams. Stands of this alliance typically contain other *Quercus* spp. (e.g., *Quercus falcata*), *Liquidambar styraciflua*, and *Pinus taeda*. In the Upper Gulf Coastal Plain of Georgia, some examples may contain *Fagus grandifolia, Liriodendron tulipifera, Carya alba*, and *Cornus florida* in the subcanopy. In Texas, *Quercus nigra* dominates the canopy, with scattered *Quercus virginiana*. The subcanopy/shrub stratum is dense (without fire) and contains *Ilex vomitoria*, *Vaccinium stamineum*, and *Vitis rotundifolia*. In small stream forests of the Gulf Coast Prairies and Marshes Ecoregion and possibly adjacent areas, other shrubs and small trees include *Callicarpa americana* and *Prunus caroliniana*. Woody vines include *Berchemia scandens, Parthenocissus quinquefolia, Toxicodendron radicans*, and *Ampelopsis arborea*. *Chasmanthium sessiliflorum* is the dominant herb. Other herbs are *Oplismenus hirtellus ssp. setarius (= Oplismenus setarius), Carex cherokeensis, Verbesina virginica, Ageratina aromatica, Asplenium platyneuron var. platyneuron, Geum canadense*, and *Polygonum virginianum. Tillandsia usneoides* and *Pleopeltis polypodioides ssp. michauxiana* are common epiphytes. This alliance appears to be more abundantly represented (or more 'natural') towards the western end of the Coastal Plain.

Dynamics:

ALLIANCE DISTRIBUTION

Range: This alliance is found in Alabama, Florida (?), Georgia, Louisiana, Mississippi, South Carolina (?), and Texas. This alliance appears to be more abundantly represented (or more 'natural') towards the western end of the Coastal Plain.

Nations: US

States/Provinces: AL FL? GA LA MS SC TX

TNC Ecoregions: 31:C, 40:?, 41:P, 42:?, 43:C, 52:C, 53:C, 55:?, 56:C

USFS Ecoregions: 221Aa:CCC, 231A:CC, 231Bd:CCC, 231Ea:CPP, 231Ef:CPP, 231Eh:CPP, 231Ei:CPP, 231Fa:CPP, 232Ba:CCP, 232Bb:CCP, 232Bg:CC?, 232Bh:CCP, 232Bi:CCP, 232Bj:CC?, 232Bk:CCP, 232Bl:CCP, 232Bm:CCC, 232Bn:CCP, 232Bo:CCP, 232Bp:CCP, 232Bq:CCC, 232Br:CCC, 232Bs:CCC, 232Bu:CC?, 232Bv:CC?, 232Ca:CCC, 232Cb:CC?, 232Dc:CPP, 232Ea:CPP, 232Fa:CPP, 232Fb:CPP, 232Fe:CPP, 234Aa:???, 234Ab:???, 234Ac:???, 234Ag:???, 234Ah:???, 234Ak:???, 234Al:???, 234Am:???, 234An:???, 255Db:CCC

Federal Lands: DOD (Fort Benning, Fort Gordon, Fort Stewart); NPS (Ninety Six); USFS (Talladega?, Tuskegee?); USFWS (San Bernard)

ALLIANCE SOURCES

Authors: A.S. WEAKLEY, MP, Southeast **Identifier:** A.247

References:

Quercus nigra Forest
Water Oak Forest
Successional Water Oak Forest (CEGL004638)
Ecological Group (SCS;MCS): Semi-natural Wooded Uplands (900-40; 8.0.0.1)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community is a result of disturbance and/or fire suppression of upland pinelands of the southeastern Coastal Plain and of pinelands and subsequent old fields in the adjacent Piedmont areas. This association occurs on mesic or dry-mesic sites, especially on loamy or other fine-textured soils (in contrast to the *Quercus hemisphaerica* Forest Alliance (A.53), which occurs primarily on coarse-textured sands in drier situations). Other oaks (e.g., *Quercus falcata, Quercus phellos, Quercus hemisphaerica*) may be intermixed, as well as *Liquidambar styraciflua*, remnant *Pinus palustris*, weedy *Pinus elliottii var. elliottii, Carya* spp., or *Pinus taeda*. In the Upper Gulf Coastal Plain of Georgia, some examples may contain *Fagus grandifolia, Liriodendron tulipifera, Carya alba*, and *Cornus florida* in the subcanopy.

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: This community occurs as a successional community on upland areas just to the north of Ninety Six Creek. The community most likely exists on areas of different soil than the successional pine communities of the park. Although there has been no research on this in the park, it appears that soils may have some role in determining which successional communities established after farming (sandy vs. clay?).

Global Environment: This community is a result of disturbance and/or fire suppression of upland pinelands of the southeastern Coastal Plain and adjacent Piedmont areas. This association occurs especially on mesic or dry-mesic sites, especially on loamy or other fine-textured soils. In the Piedmont transition of South Carolina, it may have grown out of areas that had been heavily farmed or cut over in the past, but which did not grow up into *Pinus taeda* forests.

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: This community is dominated by *Quercus nigra* and can often be codominated by *Quercus phellos* and *Liquidambar styraciflua*. The community often has a diverse understory which may include *Cornus florida, Liquidambar styraciflua, Ulmus alata*, and even *Quercus oglethorpensis*. The herbaceous layer is usually extremely sparse, and many of the examples of this community have established in areas that still show signs of heavy erosion from past farming practices.

Global Vegetation: The canopy of this association is dominated by *Quercus nigra*. Other oaks may be intermixed, especially *Quercus phellos*, as well as *Liquidambar styraciflua*, remnant *Pinus palustris*, weedy *Pinus elliottii var. elliottii, Carya* spp., or *Pinus taeda*. In the Upper Gulf Coastal Plain of Georgia, some examples may contain *Fagus grandifolia, Liriodendron tulipifera, Carya alba*, and *Cornus florida* in the subcanopy.

Global Dynamics: This community occurs as a successional community following either degradation of pinelands or recovery from old fields in fairly sandy soils.

MOST ABUNDANT SPECIES

Ninety Six National Historic Site

Stratum	Species
TREE CANOPY	*Quercus nigra*

Global

Stratum	Species
TREE CANOPY	*Quercus nigra*

CHARACTERISTIC SPECIES

Ninety Six National Historic Site

Stratum	Species
TREE SUB-CAN	*Quercus oglethorpensis*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

GRank & Reasons: GM (97-06-25). This vegetation is presumed to be either a result of disturbance of more diverse-canopied hardwood forests, and/or a result of lack of fire on sites which would be dominated by *Pinus palustris*. In the Piedmont area of South Carolina, it may occur on areas formerly codominated by *Quercus oglethorpensis*. In these areas, the *Quercus oglethorpensis* still survives, making this modified community of more conservation value in those areas.

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range: This community is most common on the gentle slope that leads from the center of the park south towards the Ninety Six Creek floodplain.

Global Range: This community is distributed throughout the traditional range of longleaf pine communities, mainly in the Coastal Plain from Texas up through at least South Carolina. In some parts of its range in South Carolina and Georgia, the community may be found in the Piedmont within 50 miles of the fall-line and may share dominance with other successional pine-dominated communities more common in the Piedmont.

Nations: US
States/Provinces: AL:S?, FL?, GA:S?, LA:S?, MS:S?, SC:S?, TX?
TNC Ecoregions: 41:P, 42:?, 43:C, 52:C, 53:C, 55:?, 56:C
USFS Ecoregions: 221Aa:CCC, 231A:CC, 231Bd:CCC, 232Bm:CCC, 232Bq:CCC, 232Br:CCC, 232Ca:CCC, 234Aa:???, 234Ab:???, 234Ac:???, 234Ag:???, 234Ah:???, 234Ak:???, 234Al:???, 234Am:???, 234An:???
Federal Lands: DOD (Fort Benning, Fort Gordon, Fort Stewart); NPS (Ninety Six); USFS (Talladega?, Tuskegee?)

ELEMENT SOURCES

Authors: SCS **Confidence:** 3 **Identifier:** CEGL004638
REFERENCES (type in full citation below if reference is new): NatureServe Ecology - Southeastern U.S. unpubl. data

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

I.B.2.N.d.13. PLATANUS OCCIDENTALIS - (FRAXINUS PENNSYLVANICA, CELTIS LAEVIGATA, ACER SACCHARINUM) TEMPORARILY FLOODED FOREST ALLIANCE

Sycamore - (Green Ash, Sugarberry, Silver Maple) Temporarily Flooded Forest Alliance

ALLIANCE CONCEPT

Summary: Forests in this alliance occur on the fronts, terraces, and levees of small, medium and large rivers of the Atlantic Coastal Plain, Southern Ridge and Valley, Interior Low Plateau, Ozark Highlands, Ouachita Mountains, Arkansas Valley, East and West Gulf coastal plains, Mississippi River Alluvial Plain, Cumberland Plateau, Southern Blue Ridge, and lower Piedmont. These forests are dominated by *Platanus occidentalis* or a mixture of it with *Fraxinus pennsylvanica, Celtis laevigata*, and *Acer saccharinum*, as well as *Acer negundo, Ulmus americana, Liquidambar styraciflua, Ulmus alata, Planera aquatica, Juglans nigra, Celtis occidentalis, Carya illinoinensis, Quercus nigra, Salix nigra, Carya cordiformis, Quercus pagoda*, and *Carya aquatica*. The understory may be dense and typically contains *Asimina triloba, Crataegus viridis, Crataegus spathulata*, and *Lindera benzoin*. Herbaceous species that may be present include *Elymus virginicus, Carex grayi, Carex lupulina, Carex abscondita, Chasmanthium latifolium, Boehmeria cylindrica, Polygonum virginianum, Elymus virginicus, Pilea pumila, Leersia lenticularis*, and others. Vines may be abundant and species include *Bignonia capreolata, Toxicodendron radicans*, and *Smilax tamnoides (= Smilax hispida)*. This alliance does not include typical alluvial forests of the upper Piedmont and Blue Ridge, but forests in this alliance may occur in these areas in restricted calcareous situations. In Arkansas, these forests occur during point bar succession as intermediates between forests dominated by *Salix* and *Populus*, and those dominated by *Carya illinoinensis*. In Kentucky and Arkansas, *Fraxinus americana, Fraxinus pennsylvanica, Ulmus rubra*, and *Ulmus americana* are common in these forests. According to K. Ribbeck (pers. comm.) 'Sycamore - River Birch - Silver Maple' forests of the Pearl River in Louisiana are included here.

Dynamics:

ALLIANCE DISTRIBUTION

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

Nations: US

States/Provinces: AL AR CT GA IN KY LA MA MD MO MS NC NH NY OH? PA RI SC TN TX VA VT? WV

TNC Ecoregions: 24:C, 29:C, 31:C, 32:?, 37:C, 38:C, 39:P, 40:P, 41:C, 42:C, 43:C, 44:C, 45:C, 49:C, 50:C, 51:C, 52:C, 53:P, 56:P, 57:C, 58:P, 59:C, 60:C, 61:C, 63:C

USFS Ecoregions: 212E:C?, 212Fb:CCP, 212Fc:CCC, 221A:CC, 221Bd:CCC, 221D:CC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCP, 221Eg:CCC, 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 222Ab:CCC, 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Ah:CCC, 222Aj:CCC, 222Ak:CCC, 222Am:CCC, 222An:CCC, 222Cb:CCP, 222Cd:CCP, 222Ce:CCP, 222Cg:CCC, 222De:CCP, 222Eb:CCC, 222Ec:CCC, 222Ed:CCP, 222Eh:CCP, 222Em:CCP, 222En:CCC, 222Eo:CCC, 222Fa:CCC, 222Fb:CCC, 222Fc:CCC, 222Fd:CCC, 222Hb:CCC, 222Hf:CCC, 222I:C?, 222O:C?, 231Aa:CCC, 231Ae:CCC, 231Af:CCC, 231Ak:CCP, 231Al:CCC, 231Ap:CCC, 231Ba:CCP, 231Bc:CCP, 231Bd:CCP, 231Be:CCC, 231Bg:CCP, 231Bj:CCP, 231Bk:CCP, 231Bl:CCP, 231Cd:CCC, 231Da:CCP, 231Dc:CCC, 231Ef:CCC, 231Eg:CCP, 231Eh:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Ad:CCC, 232Bj:CCC, 232Bk:CCP, 232Bl:CCP, 232Bq:CCP, 232Br:CCP, 232Bs:CCC, 232Bu:CCP, 232Bv:CCP, 232Ca:CPP, 232Fa:CCP, 232Fb:CCP, 232Fc:CCP, 232Fd:CCP, 234Aa:CCP, 234Ab:CC?, 234Ac:CCC, 234Ae:CCP, 234Ag:CCC, 234Ah:CC?, 234Am:CCC, 234An:CCC, 251Cd:CPP, 251Eb:CCC, 255Da:CCP, 255Db:CCC, 315:C, M212B:??, M221Aa:CCC,

M221Ab:CCC, M221Cd:CCC, M221Da:CCC, M221Db:CCP, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231:P

Federal Lands: DOD (Arnold, Fort Benning); NPS (Congaree Swamp, Great Smoky Mountains, Harpers Ferry, Kennesaw Mountain, Ninety Six, Rock Creek, Shiloh); USFS (Angelina, Bankhead, Bienville, Chattahoochee, Daniel Boone, Davy Crockett, De Soto, Delta?, Holly Springs?, Homochitto, Jefferson, Kisatchie, Oconee, Ozark, Pisgah?, Sabine NF, St. Francis?, Sam Houston, Tombigbee?, Tuskegee); USFWS (San Bernard?)

ALLIANCE SOURCES

Authors: D.J. ALLARD, MOD., MP, Southeast **Identifier:** A.288

References: Allard 1990, Diamond 1993, Evans 1991, Eyre 1980, Foti pers. comm., Ribbeck pers. comm.

Platanus occidentalis - Celtis laevigata - Fraxinus pennsylvanica / Lindera benzoin - Ilex decidua / Carex retroflexa Forest
Sycamore - Sugarberry - Green Ash / Northern Spicebush - Possum-haw / Reflexed Sedge Forest
Southeastern Coastal Plain Flat Terrace Forest (CEGL007330)
Ecological Group (SCS;MCS): Southeastern Coastal Plain Riverfront and Levee Forests and Shrublands (385-30; 1.6.4.4)

ELEMENT CONCEPT

GLOBAL SUMMARY: This forest association occurs on terraces of associated rivers and large creeks in the Mid-Atlantic Coastal Plain, lower Piedmont, and possibly in adjacent regions. These are relatively more well-drained than the adjacent flats. The mostly closed canopy of this community is dominated by *Platanus occidentalis, Celtis laevigata,* and *Fraxinus pennsylvanica*. These species, along with *Acer negundo,* are important in the well-developed subcanopy also. Other tree species are possible in these strata; these include *Crataegus viridis, Juglans nigra, Acer saccharinum, Morus rubra, Ilex decidua, Ulmus americana, Planera aquatica, Quercus laurifolia, Quercus nigra, Liquidambar styraciflua, Populus deltoides, Carya aquatica*, and others. The shrub layer generally is sparse and is dominated by *Lindera benzoin, Ilex decidua, Asimina triloba,* and likely other species as well. Some examples of this community also have patches of *Arundinaria gigantea* in spots. The herbaceous layer is typically sparse to moderate and constant species are *Boehmeria cylindrica, Carex grayi, Carex retroflexa,* and *Viola* spp. Other typical species include *Botrychium dissectum, Carex frankii, Carex lupulina, Chasmanthium latifolium, Onoclea sensibilis, Pilea pumila, Polygonum hydropiperoides, Polygonum virginianum*, and others. The vine stratum is moderate and many species are possible. Among these are *Bignonia capreolata, Parthenocissus quinquefolia, Smilax tamnoides, Vitis rotundifolia, Ampelopsis arborea, Berchemia scandens, Gelsemium sempervirens,* and *Toxicodendron radicans*. Exotic species such as *Ligustrum sinense, Lonicera japonica,* and *Microstegium vimineum* may invade stands of this association, and increase following disturbance. This forest type is documented in the Mid-Atlantic Coastal Plain (and lower Piedmont) but is possible in adjacent regions; global distribution needs assessment.

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: This forest occurs on terraces adjacent to Ninety Six Creek and ranges well away from the creek along broad flat areas that are regularly flooded by the creek.

Global Environment: This forest occurs on terraces of associated rivers and on well-drained bottoms of creeks in the Mid-Atlantic Coastal Plain, lower Piedmont, and possibly in adjacent regions. These terraces are relatively more well-drained than the adjacent flats.

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: The canopy can vary quite a bit and can be dominated by a combination of *Acer negundo, Fraxinus pennsylvanica, Populus deltoides*, and *Juglans nigra*. The subcanopy is usually not well-developed, but may contain *Acer negundo* and some other representatives of the canopy. The shrub layer is sparse but diverse. The herb layer is sparse to moderate and can be dominated by exotics like *Microstegium vimineum* etc., natives like *Chasmanthium latifolium* etc., or cane (*Arundinaria gigantea ssp. gigantea*). This community seems to be fairly secure, but may benefit from invasive exotic removal of *Ligustrum sinense* in the places where it has colonized. *Microstegium vimineum* seems to be reducing diversity but may be impractical to control for so large an area.

Global Vegetation: The mostly closed canopy of this community is dominated by *Platanus occidentalis, Celtis laevigata,* and *Fraxinus pennsylvanica*. These species, along with *Acer negundo,* are important in the well-developed subcanopy also. Other tree species are possible in these strata; these include *Crataegus viridis, Juglans nigra, Acer saccharinum, Morus rubra, Ilex decidua, Ulmus americana, Planera aquatica, Quercus laurifolia, Liquidambar styraciflua, Carya aquatica*, and others. The shrub layer generally is sparse and is dominated by *Lindera benzoin,*

Ilex decidua, *Asimina triloba*, and likely other species as well. Some examples of this community also have patches of *Arundinaria gigantea* in spots. The herbaceous layer is typically sparse and constant species are *Boehmeria cylindrica*, *Carex grayi*, *Carex retroflexa*, and *Viola* spp. Other typical species include *Botrychium dissectum*, *Carex lupulina*, *Chasmanthium latifolium*, *Onoclea sensibilis*, *Pilea pumila*, *Polygonum hydropiperoides*, *Polygonum virginianum*, and others. The vine stratum is moderate and many species are possible. Among these are *Bignonia capreolata*, *Parthenocissus quinquefolia*, *Smilax tamnoides*, *Vitis rotundifolia*, and *Toxicodendron radicans*. Exotic species such as *Ligustrum sinense*, *Lonicera japonica*, and *Microstegium vimineum* may invade stands of this association, and increase following disturbance.

Global Dynamics:

MOST ABUNDANT SPECIES

Ninety Six National Historic Site

Stratum	Species
TREE CANOPY	*Acer negundo*, *Celtis laevigata*, *Fraxinus pennsylvanica*
GRAMINOID	*Chasmanthium latifolium*, *Microstegium vimineum*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

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

GRank & Reasons: G4? (01-10-09). This community type is globally relatively secure (TNC 1998b). This community, and other types of floodplain forests, are threatened by alteration of the hydroperiod by artificial impoundments or river diversion projects, or the disruption of the floodplain communities by forestry or agriculture. Exotic species such as *Ligustrum sinense*, *Lonicera japonica*, and *Microstegium vimineum* may invade stands of this association, and increase following disturbance.

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range: This community is most common in the floodplain nearest to Ninety Six Creek.

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

Nations: US
States/Provinces: GA?, NC?, SC:S?, VA?
TNC Ecoregions: 52:C, 53:P, 56:P, 57:C
USFS Ecoregions: 231Aa:CCC, 232Bs:CCC
Federal Lands: NPS (Congaree Swamp, Ninety Six); USFS (Oconee)

ELEMENT SOURCES

Authors: SCS **Confidence:** 2 **Identifier:** CEGL007730
REFERENCES (type in full citation below if reference is new): NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. 2002, TNC 1998b

I.B.2.N.d.16. QUERCUS (MICHAUXII, PAGODA, SHUMARDII) - LIQUIDAMBAR STYRACIFLUA TEMPORARILY FLOODED FOREST ALLIANCE

(Swamp Chestnut Oak, Cherrybark Oak, Shumard Oak) - Sweetgum Temporarily Flooded Forest Alliance

I.B. Deciduous forest

ALLIANCE CONCEPT

Summary: Stands of this alliance are typically dominated by some combination of *Quercus michauxii, Quercus pagoda,* and *Quercus shumardii,* with *Liquidambar styraciflua* typically as a significant component. All three of these primary oaks are possible in combination in the coastal plains, *Quercus pagoda* being the most restricted in range. *Quercus michauxii* will be absent from much of the Ozarks, Ouachitas, and Interior Low Plateau (except along the larger unimpounded rivers). *Quercus shumardii* is apparently absent from much of the Mississippi River Alluvial Plain. In addition, *Quercus phellos, Quercus laurifolia, Quercus similis, Quercus oglethorpensis, Quercus sinuata var. sinuata,* and/or *Quercus nigra* may also be present, but in combination with the other primary oaks. Other associated species include *Carya glabra, Carya ovata, Fraxinus americana, Fraxinus pennsylvanica, Carya alba, Carya cordiformis, Carya myristiciformis, Nyssa biflora, Liriodendron tulipifera, Pinus taeda, Pinus glabra,* with *Carya laciniosa* in the northern part of the range of the alliance. Associated subcanopy and shrub species include *Asimina triloba, Ilex opaca var. opaca, Aesculus sylvatica, Carpinus caroliniana, Ilex decidua, Cornus foemina, Cornus florida, Halesia diptera,* and *Styrax americanus. Arundinaria gigantea* is common in forests in this alliance. Other herbaceous and vine species that may be present include *Phlox carolina, Chasmanthium laxum, Chasmanthium sessiliflorum, Tillandsia usneoides, Campsis radicans, Toxicodendron radicans,* and *Parthenocissus quinquefolia*. Within the Mississippi River Alluvial Plain, high presence of *Liquidambar* and *Quercus nigra* indicate past farming at least on the associated upland. This alliance occurs primarily in brownwater situations, and often occurs on terraces in second bottoms. This alliance is distributed throughout the Atlantic and Gulf coastal plains, the Piedmont, the Cumberland Plateau, the Interior Low Plateau, and in the Mississippi River Alluvial Plain northwards to southern Illinois.

Dynamics:

ALLIANCE DISTRIBUTION

Range: This alliance occurs primarily in brownwater situations, and often occurs on terraces in second bottoms. This alliance is distributed throughout the Atlantic and Gulf coastal plains, the Piedmont, the southern Ridge and Valley, the Cumberland Plateau, the Interior Low Plateau, and in the Mississippi River Alluvial Plain northwards to southern Illinois. This alliance is found in southern Illinois, southern Indiana, southeastern Missouri, Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia, and possibly Florida (?), and Oklahoma (?).

Nations: US

States/Provinces: AL AR FL? GA IL IN KY LA MO MS NC OK? SC TN TX VA

TNC Ecoregions: 38:C, 39:?, 40:C, 41:C, 42:C, 43:C, 44:C, 50:C, 52:C, 53:C, 56:C, 57:C, 58:C

USFS Ecoregions: 221He:CCC, 222Al:CCC, 222Ao:CCP, 222Ca:CCC, 222Cb:CCC, 222Cc:CCC, 222Ce:CCP, 222Cf:CCP, 222Cg:CCC, 222Ch:CCC, 222Db:CCC, 222Dc:CCC, 222Di:CCC, 222Eb:CCC, 222Ee:CCP, 222Ef:CCP, 222Eg:CCP, 222Ff:CCC, 222Gc:CCC, 231Aa:CCC, 231Ac:CCC, 231Ae:CCC, 231Af:CCC, 231Ai:CCP, 231Aj:CCC, 231Ao:CCC, 231Ba:CCP, 231Bb:CCP, 231Bc:CCC, 231Bd:CCC, 231Be:CCP, 231Bg:CCP, 231Bh:CCC, 231Bj:CCC, 231Bk:CCP, 231Cd:CCC, 231Db:CCC, 231Dd:CCP, 231Ea:CCC, 231Eb:CCC, 231Ec:CC?, 231Ed:CC?, 231Ee:CC?, 231Ef:CC?, 231Eg:CC?, 231Eh:CCC, 231Ei:CC?, 231Ej:CCC, 231Ek:CC?, 231El:CCC, 231Em:CC?, 231En:CC?, 232Ad:CCC, 232Ba:CCP, 232Bb:CCC, 232Bc:CCP, 232Bd:CCP, 232Bi:CCP, 232Bj:CCC, 232Bk:CCP, 232Bl:CCP, 232Bm:CCP, 232Bn:CCC, 232Bo:CCP, 232Bp:CCP, 232Bq:CCC, 232Br:CCC, 232Bs:CCC, 232Bv:CCC, 232Ca:CCC, 232Cb:CCC, 232Cg:CCC, 232Ch:CCP, 232Fa:CCC, 232Fb:CCP, 232Fc:CCC, 232Fd:CCC, 234Aa:CCP, 234Ab:CCP, 234Ac:CCC, 234Ae:CCC, 234Ag:CCP, 234Ah:CCP, 234Ak:CC?, 234Al:CC?, 234Am:CCP, 234An:CCC, M221Cd:CCC

Federal Lands: COE (Claiborne Lake, Jordan Lake); DOD (Arnold, Fort Benning, Pine Bluff Arsenal); DOE (Savannah River Site); NPS (Chickasaw NRA, Congaree Swamp, Ninety Six,

Shiloh); USFS (Angelina, Apalachicola?, Bankhead, Bienville, Conecuh, Croatan?, Daniel Boone, Davy Crockett, Delta, De Soto, Francis Marion, Holly Springs, Homochitto, Kisatchie, Oconee, Osceola?, Ouachita, Sabine NF, St. Francis, Sam Houston, Talladega, Tombigbee, Tuskegee); USFWS (Chickasaw NWR?, Eufaula, Felsenthal?, Hatchie, Overflow, Pond Creek, Reelfoot)

ALLIANCE SOURCES

Authors: D.J. ALLARD 5-94, MOD., MP, Southeast **Identifier:** A.291

References: Allard 1990, Aulbach-Smith pers. comm., Burns and Honkala 1990b, Campbell pers. comm., Diamond 1993, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Foti 1994b, Foti et al. 1994, Foti pers. comm., Jackson 1979, Klimas 1988b, Pell and Rettig 1983, Schafale and Weakley 1990, Tassin pers. comm., Voigt and Mohlenbrock 1964, Wharton et al. 1982, Wieland pers. comm., Zollner pers. comm.

Quercus shumardii - Quercus michauxii - Quercus nigra / Acer barbatum - Tilia americana var. heterophylla Forest
Shumard Oak - Swamp Chestnut Oak - Water Oak / Southern Sugar Maple - Appalachian Basswood Forest
Southern Piedmont Oak Bottomland Forest (CEGL008487)
Ecological Group (SCS;MCS): Appalachian Highlands Large River Floodplain Forests (422-20; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association covers bottomland forests of the southern Piedmont of Georgia and South Carolina, the Piedmont-Ridge and Valley transition region of Alabama, and the adjacent Upper East Gulf Coastal Plain of Georgia. Stands occur in broad flat floodplains of medium-sized rivers, or as smaller occurrences along creeks and their adjacent floodplains. The diverse canopy is primarily composed of bottomland terrace species, but may also contain some levee species which would normally sort out better along a hydrologic gradient in the larger floodplains of the Coastal Plain. The canopy of stands is typically dominated by *Quercus shumardii* and *Quercus michauxii* with *Liquidambar styraciflua* and *Quercus nigra*. This type is found either in the outer edges of the Piedmont, in the transition area to the Ridge and Valley, or just barely coastward of the Fall-line, so *Quercus pagoda* is either not present at all, or if present it is at very low frequency. Other canopy and/or subcanopy species may include *Acer barbatum, Liriodendron tulipifera, Tilia americana var. heterophylla, Carya cordiformis* (which may have high cover), *Carya carolinae-septentrionalis, Juglans nigra, Quercus phellos*, and *Pinus taeda*. Occasionally, *Celtis laevigata, Platanus occidentalis* or *Betula nigra* may be present at low values, but they are not characteristic and may signal the start of a different bottomland community type when noted in large quantities. The rare tree *Quercus oglethorpensis* may be present within its limited range in the driest versions of this community (e.g., in Elbert and Wilkes counties of Piedmont Georgia and Greenwood and McCormick counties of Piedmont South Carolina). Shrubs include *Arundinaria gigantea* (which may be dominant in some stands), *Lindera benzoin, Ilex decidua, Callicarpa americana,* and *Corylus americana*. Woody vines may be prominent in stands. The herb stratum is fairly diverse.

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: Stands of this association occur only within the broad floodplain of Ninety Six Creek and tend to occur in large patches away from the main channel.

Global Environment: Stands of this association occur in broad flat floodplains of medium-sized rivers, or as smaller occurrences along creeks and adjacent floodplains.

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: The canopy is dominated by a combination of *Quercus michauxii, Carya ovata, Quercus phellos, Carya cordiformis, Liquidambar styraciflua,* and *Fraxinus pennsylvanica*. The understory contains these canopy species and *Acer rubrum*. The ground layer is sparsely covered but consists of *Juncus* spp., *Carex* spp., *Elymus hystrix (= Hystrix patula),* as well as other bottomland species. In addition, in spring, large numbers of *Zephyranthes atamasca* can be seen blooming throughout this community. This community is particularly threatened by the invasive shrub *Ligustrum sinense*. Control at the park has opened up a number of these stands, but many more are still choked by this shrub, and regeneration of the current forest type may not continue in stands dominated by the shrub.

Global Vegetation: The canopy of stands is typically dominated by *Quercus shumardii* and *Quercus michauxii* with *Liquidambar styraciflua* and *Quercus nigra*. This type is found either in the Piedmont, in the transition area to the Ridge and Valley, or just barely coastward of the Fall-line, so *Quercus pagoda* is either not present at all, or if present it is at very low frequency. Other canopy and/or subcanopy species may include *Acer barbatum, Liriodendron tulipifera, Tilia americana var. heterophylla, Carya cordiformis* (which may have high cover), *Carya carolinae-septentrionalis, Juglans nigra, Quercus phellos,* and *Pinus taeda*. Occasionally, *Celtis laevigata,*

Platanus occidentalis or *Betula nigra* may be present at low values, but they are not characteristic. The rare tree *Quercus oglethorpensis* may be present within its limited range (e.g., in Elbert and Wilkes counties of Piedmont Georgia). Some additional subcanopy and tall shrub components are *Fagus grandifolia, Fraxinus pennsylvanica, Fraxinus americana, Carpinus caroliniana, Ulmus alata, Acer barbatum, Acer leucoderme, Halesia tetraptera, Carya alba, Carya ovalis, Cornus florida, Morus rubra, Prunus serotina, Ilex decidua, Cercis canadensis, Aesculus pavia, Aesculus sylvatica*, and *Asimina triloba*. Shrubs include *Arundinaria gigantea* (which may be dominant in some stands), *Lindera benzoin, Ilex decidua, Callicarpa americana*, and *Corylus americana*. Woody vines may be prominent in stands. They include *Toxicodendron radicans, Vitis rotundifolia, Parthenocissus quinquefolia, Bignonia capreolata, Smilax bona-nox, Berchemia scandens, Campsis radicans, Clematis virginiana, Decumaria barbara*, and *Smilax rotundifolia*. The herb stratum includes *Chasmanthium latifolium, Dichanthelium boscii (= Panicum boscii), Ageratina altissima (= Eupatorium rugosum), Solidago caesia, Carex abscondita, Vernonia gigantea, Boehmeria cylindrica, Polystichum acrostichoides, Mitchella repens, Bromus pubescens, Dioscorea quaternata, Symphyotrichum lateriflorum (= Aster lateriflorus), Commelina virginica, Carex crinita, Carex intumescens, Carex laxiflora, Carex picta, Carex rosea, Carex typhina, Carex venusta, Matelea carolinensis*, and others. There is some concern about the identity of the *Tilia americana* in stands of this association. In some examples, it could be *Tilia americana var. caroliniana*. The exotic species *Lonicera japonica, Ligustrum sinense*, and *Microstegium vimineum* may invade stands of this association. Both of the nominal oaks may be of lesser frequency north of about the latitude of Atlanta and Athens, Georgia (Burns and Honkala 1990a), so the northern extent of this type may not extend beyond this area.

Global Dynamics:

MOST ABUNDANT SPECIES

Ninety Six National Historic Site

Stratum	Species
TREE CANOPY	*Carya ovata, Quercus michauxii, Quercus phellos*
GRAMINOID	*Elymus hystrix*

OTHER NOTEWORTHY SPECIES

Ninety Six National Historic Site

Stratum	Species
FORB	*Zephyranthes atamasca*

Carex spp. are dominant graminoids.

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- *Carya (glabra, alba) - Fraxinus americana - Juniperus virginiana* var. *virginiana* Woodland (CEGL003752)--of the Triassic Piedmont, with *Quercus pagoda*.

GRank & Reasons: G3 (02-10-24). This association is restricted in range. Some examples are afforded some protection at Fort Benning (Georgia/Alabama), in the Oconee National Forest (Georgia), at Ninety Six National Historic Park (South Carolina), and in the Talladega National Forest (Alabama). Many examples have been lost to flooding from impoundments, timber removal, and conversion to agriculture or other commercial forest types. Threats include fragmentation from powerline corridors and sewerline easements, siltation from land disturbance and development upstream, and anthropogenic flooding from wildlife subimpoundments and other hydrologic enhancements. The exotic species *Lonicera japonica, Ligustrum sinense*, and *Microstegium vimineum* may invade stands of this association, especially those altered from nearby fragmentation or from siltation from land disturbance upstream. Stands on impounded rivers may suffer from altered hydrologies. This community's rank was changed from G3G4 to G3 due to its relative scarcity, the restriction of its range to small parts of 3 ecoregions, and the fact that few high-quality examples of this community are left. These communities are declining as invasive exotic plants continue to invade areas and as large-scale manipulation of the floodplain areas of South Carolina continues to occur.

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range: This community is limited to the broad outer floodplain of Ninety Six Creek.

Global Range: This bottomland forest is found in the southern Piedmont of Georgia and South Carolina, as well as the Piedmont-Ridge and Valley transition region of Alabama and possibly the adjacent Upper East Gulf Coastal Plain of Georgia and Alabama. Its range could include portions of the middle Chattahoochee River, the Savannah River and their tributaries, and the upper Saluda River, as well as the upper portions of the Flint, the Yellow River, the Oconee and Little Oconee, the Ogeechee, and their tributaries. In Alabama, in the Piedmont-Ridge and Valley transition region, this would include the Coosa and Tallapoosa and their tributaries as well.

Nations: US
States/Provinces: AL:S?, GA:S?, SC:S?
TNC Ecoregions: 43:C, 50:C, 52:C
USFS Ecoregions: 231Aa:CCC, 231Ac:CCC, 231Ae:CCP, 231Ai:CCP, 231Aj:CCP, 231Bd:CCC, 231Db:CCC, 231Dd:CCP
Federal Lands: DOD (Fort Benning); NPS (Ninety Six); USFS (Oconee, Talladega)

ELEMENT SOURCES

Authors: M. Pyne, SCS **Confidence:** 2 **Identifier:** CEGL008487
REFERENCES (type in full citation below if reference is new): Ambrose 1990a, Burns and Honkala 1990a, NatureServe Ecology - Southeastern U.S. unpubl. data, Wharton 1978

III. Shrubland
III.A.2.N.a. Temperate broad-leaved evergreen shrubland
III.A.2.N.a.1. LIGUSTRUM SINENSE SHRUBLAND ALLIANCE
Chinese Privet Shrubland Alliance

ALLIANCE CONCEPT

Summary: This alliance mostly consists of moist upland areas which are dominated by the exotic *Ligustrum sinense*, with little or no canopy. The density of the shrub layer may be such that there is no development of the herbaceous stratum. *Ligustrum sinense* is a serious weedy species in the southeastern United States. It generally occurs as a shrub-layer dominant under tree canopies, especially in floodplains. Such sites are considered degraded occurrences of the equivalent natural forest community.

Dynamics:

ALLIANCE DISTRIBUTION

Range: This alliance is found in Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee (?), Virginia, and probably others.

Nations: US

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

TNC Ecoregions: 39:C, 41:C, 52:C

USFS Ecoregions: 221:C, 222:C, 231Aa:CCC, 231Ga:CCC, 231Gc:CCC, 232:C, 234Ah:CC?, 234Ak:CC?, 234An:CCC, M231:C

Federal Lands: DOD (Fort Benning); NPS (Ninety Six)

ALLIANCE SOURCES

Authors: A.S. WEAKLEY, MP, Southeast **Identifier:** A.738

References:

Ligustrum sinense Upland Shrubland

Chinese Privet Upland Shrubland (CEGL003807)

Ecological Group (SCS;MCS): Exotic Species-Dominated Southeastern Wooded Uplands (900-30; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: Upland and wetland areas heavily infested with *Ligustrum sinense* to the exclusion of canopy trees.

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: This community occurs in both uplands and palustrine systems where *Ligustrum sinense* has become established as a virtual monoculture and is preventing regeneration of any natural community type.

Global Environment: This community exists in disturbed bottomlands and uplands, usually highly fragmented, where they can establish and exclude almost all native species.

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: This community is usually a monoculture of *Ligustrum sinense*.

Global Vegetation: This community is usually a monoculture of *Ligustrum sinense*.

Global Dynamics:

MOST ABUNDANT SPECIES

Ninety Six National Historic Site

Stratum	Species
SHRUB	*Ligustrum sinense*

Global

Stratum	Species
SHRUB	*Ligustrum sinense*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

GRank & Reasons: GW (97-12-01).

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range: This community occurs both in upland and bottomland areas where *Ligustrum sinense* has established and outcompeted all other species.

Global Range:

Nations: US
States/Provinces: AL:S?, AR:S?, FL:S?, GA:S?, LA:S?, MS:S?, NC?, SC:S?, TN?, VA:S?
TNC Ecoregions: 39:C, 41:C, 52:C
USFS Ecoregions: 221:C, 222:C, 231Aa:CCC, 231Ga:CCC, 231Gc:CCC, 232:C, 234A:CC, M231:C
Federal Lands: DOD (Fort Benning); NPS (Ninety Six)

ELEMENT SOURCES

Authors: SCS **Confidence:** 3 **Identifier:** CEGL003807
REFERENCES (type in full citation below if reference is new):

III.A.2.N.f. Temperate broad-leaved evergreen shrubland with a sparse cold-deciduous tree layer

III.A.2.N.f.100. PHYLLOSTACHYS AUREA SHRUBLAND ALLIANCE

Golden Bamboo Shrubland Alliance

III. Shrubland

ALLIANCE CONCEPT

Summary: This alliance includes stands of *Phyllostachys aurea* which have either been planted or naturalized. These stands occur in upland settings on a variety of soil types.

Dynamics:

ALLIANCE DISTRIBUTION

Range: This alliance may occur throughout the southeastern United States where this species has become naturalized.

Nations: US

States/Provinces: AL? AR? FL GA LA? MS? NC? SC TN TX VA?

TNC Ecoregions: 31:P, 32:P, 38:?, 39:?, 40:C, 41:C, 42:?, 43:P, 44:?, 50:C, 51:?, 52:?, 53:C, 56:?, 57:?

USFS Ecoregions: 231Ae:CCC, 231F:CP, 232B:CC, 232D:CC, 232E:CP, 255D:PP

Federal Lands: NPS (Cowpens, Kings Mountain, Ninety Six)

ALLIANCE SOURCES

Authors: R.E. EVANS, MP, Southeast **Identifier:** A.2010

References:

Phyllostachys aurea Shrubland
Golden Bamboo Shrubland
Golden Bamboo Shrubland (CEGL008560)
Ecological Group (SCS;MCS): Exotic Species-Dominated Southeastern Wooded Uplands (900-30; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: Uplands dominated by *Phyllostachys aurea*.

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: This community occurs in small patches where *Phyllostachys aurea* has escaped from plantings and established a monoculture.

Global Environment: Disturbed lands, often near creeks and other mesic areas.

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: A monoculture of *Phyllostachys aurea*.

Global Vegetation: Usually a monoculture of *Phyllostachys aurea* with no light or resources reaching the understory.

Global Dynamics:

MOST ABUNDANT SPECIES

Global Stratum	Species
TALL SHRUB	*Phyllostachys aurea*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

SYNONYMY [OtherName (short citation) relationship. Note]:

- (NatureServe Ecology - Southeastern U.S. unpubl. data) UNDNAT01ICEC

GRank & Reasons: GW (01-10-03). This shrubland represents vegetation dominated by an invasive exotic and thus does not receive a conservation. status rank.

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range: This community is very rare, occurring as a clonal patch of bamboo where this species was originally planted.

Global Range: This vegetation is possible throughout the southeastern United States.

Nations: US
States/Provinces: AL?, AR?, FL:S?, GA:S?, LA?, MS?, NC?, SC:S?, TN:S?, TX:S?, VA?
TNC Ecoregions: 31:P, 32:P, 38:?, 39:?, 40:C, 41:C, 42:?, 43:P, 44:?, 50:C, 51:?, 52:?, 53:C, 56:?, 57:?
USFS Ecoregions: 231Ae:CCC, 231F:CP, 232B:CC, 232E:CP, 255D:PP
Federal Lands: NPS (Cowpens, Kings Mountain, Ninety Six)

ELEMENT SOURCES

Authors: R. White, SCS **Confidence:** 1 **Identifier:** CEGL008560
REFERENCES (type in full citation below if reference is new): NatureServe Ecology - Southeastern U.S. unpubl. data

III.A.2.N.g. Temporarily flooded temperate broad-leaved evergreen shrubland
III.A.2.N.g.1. ARUNDINARIA GIGANTEA TEMPORARILY FLOODED SHRUBLAND ALLIANCE
Giant Cane Temporarily Flooded Shrubland Alliance
III. Shrubland

ALLIANCE CONCEPT

Summary: This alliance encompasses various temporarily flooded wetlands, including alluvial or loess substrates (streamside flats, bottomlands), dominated by *Arundinaria*, without an overstory, or with widely scattered trees. Evidence suggests that this alliance was widespread historically, covering large areas of many floodplains and streamsides in the Coastal Plain from North Carolina to Texas, the Mississippi River Alluvial Plain north to Illinois and Missouri, Interior Highlands, Interior Low Plateau, Southern Blue Ridge and possibly the Central Appalachians of the southeastern United States. It now occupies very little of its former acreage. Canebrakes are successional communities and may have originated following abandonment of aboriginal agricultural fields or catastrophic disturbances such as windstorms. They are thought to have been maintained in part by fires set by Native Americans. This alliance may be found along larger rivers (Buffalo, White, Norfork) in the Ozarks, as well as in the Wabash and Ohio drainage systems, at least historically. It was also reported historically along the Red and Mississippi rivers in Louisiana, Coastal Prairie rivers in Texas, and the Black, Washita, Arkansas, Pearl, Tombigbee, Yazoo, Savannah, and St. Mary's rivers. Large, extant canebrakes still exist and have been documented from the Ocmulgee Basin, south of Macon, Georgia. In the Central Appalachians various wetlands, including those on alluvial or loess substrates (streamside flats, bottomlands), were dominated by *Arundinaria*, without an overstory, or with widely scattered trees.
Dynamics: Vegetation classed within this alliance is successional and is thought to be maintained by periodic fires and may have originated following abandonment of aboriginal agricultural fields or catastrophic disturbances such as windstorms.

ALLIANCE DISTRIBUTION

Range: This alliance was widespread historically but now occupies very little acreage. It may be found along rivers and streamsides in Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and possibly Virginia (?).
Nations: US
States/Provinces: AL AR FL? GA IL IN KY LA MO MS NC OK SC TN TX VA?
TNC Ecoregions: 31:P, 32:P, 38:C, 39:C, 40:C, 41:P, 42:C, 43:P, 44:C, 50:C, 51:C, 52:P, 53:P, 56:C, 57:P, 59:C
USFS Ecoregions: 221Ha:CC?, 221Hc:CCP, 221Hd:CCP, 221He:CC?, 221Ja:CCC, 221Jb:CCP, 221Jc:CCP, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Ca:CCP, 222Cb:CCP, 222Cc:CCP, 222Cd:CCP, 222Ce:CCP, 222Cf:CCP, 222Cg:CCP, 222Ch:CCP, 222Da:CCP, 222Db:CCP, 222Dc:CCP, 222Dd:CCP, 222De:CCP, 222Dg:CCP, 222Di:CCP, 222Dj:CCP, 222Ea:CCC, 222Eb:CCC, 222Ec:CCC, 222Ed:CCC, 222Ef:CCP, 222Eg:CCP, 222Eh:CCC, 222Ei:CCP, 222Ej:CC?, 222Ek:CCP, 222El:CCP, 222Em:CCP, 222En:CC?, 222Eo:CC?, 222Fa:CCC, 222Fb:CCC, 222Fc:CCC, 222Fd:CCC, 222Ff:CC?, 231Aa:CCP, 231Ab:CC?, 231Ac:CCP, 231Ad:CCP, 231Ae:CCP, 231Af:CCP, 231Ag:CC?, 231Ah:CC?, 231Ai:CCP, 231Am:CC?, 231An:CC?, 231Ao:CCP, 231Ba:CCP, 231Bb:CCP, 231Bc:CCP, 231Bd:CCP, 231Be:CCP, 231Bf:CCP, 231Bg:CCP, 231Bh:CCP, 231Bi:CCP, 231Bj:CCP, 231Bk:CCP, 231Bl:CCP, 231Ca:CCP, 231Cb:CCP, 231Cc:CCP, 231Cd:CCP, 231Ce:CCP, 231Cf:CCP, 231Cg:CCP, 231Da:CCP, 231Db:CCP, 231Dc:CCP, 231Dd:CCP, 231De:CCP, 231Ea:CCP, 231Eb:CCP, 231Ec:CCC, 231Ed:CCC, 231Ee:CCP, 231Ej:CCP, 231Ek:CCP, 231Em:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 234Aa:CCC, 234Ab:CC?, 234Ac:CCP, 234Ad:CCP, 234Ae:CCC, 234Af:CCP, 234Ag:CCC, 234Ah:CC?, 234Ai:CCC, 234Aj:CC?, 234Ak:CC?, 234Al:CCP, 234Am:CCC, 234An:CCC, 255Da:PPP, 255Db:PPP, M221Dc:CCC, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC
Federal Lands: DOD (Fort Benning); NPS (Buffalo, Great Smoky Mountains, Ninety Six); USFS (Cherokee?, Mark Twain, Ouachita?, Ozark, St. Francis); USFWS (Little River, San Bernard?)

ALLIANCE SOURCES

Authors: A.S. WEAKLEY, MO. J. TEAG, MP, Southeast **Identifier:** A.795

References: Campbell 1980, Campbell 1989b, Davidson 1950, Flores 1984, Foti et al. 1994, Heineke 1987, Hoagland 1998a, Hughes 1966, McInteer 1952, Meanley 1972, Mohr 1901, Platt and Brantley 1992, Platt and Brantley 1997, West 1934

Arundinaria gigantea ssp. gigantea Shrubland
Giant Cane Shrubland
Floodplain Canebrake (CEGL003836)
Ecological Group (SCS;MCS): Interior Highlands Riverfront and Levee Forests and Shrublands (426-45; 1.6.3.6)
Southeastern Coastal Plain Floodplain Shrublands (385-25; 1.6.4.5)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association is characterized by dense, often monospecific thickets of the bamboo shrub *Arundinaria gigantea* occupying large areas referred to as canebrakes. The canebrake shrubland type was historically widespread, but is now rare and occupies very little of its former acreage. It was best developed in streamside flats and alluvial floodplains on ridges and terraces where it was protected from prolonged inundation. Historically, this community covered large areas of many floodplains and streamsides in the Coastal Plain from North Carolina to Texas, Mississippi River Alluvial Plain, Interior Highlands, Interior Low Plateau, Southern Blue Ridge and possibly the Central Appalachians of the southeastern United States. Stands occur on alluvial and loess soils and are often associated with bottomland hardwood forest vegetation. This association is successional and is thought to be maintained by periodic fires. It may have originated following abandonment of aboriginal agricultural fields or other natural and anthropogenic disturbances such as blow-downs and catastrophic floods. Historical accounts report cane as abundant along the Wabash and Ohio drainage systems, as well as common along larger rivers (Buffalo, White, Norfork) in the Ozarks and Ouachitas. It was also reported as common along the Red and Mississippi rivers in Louisiana, Coastal Prairie rivers in Texas, and the Black, Washita, Arkansas, Sabine, Pearl, Tombigbee, Yazoo, Savannah, and St. Mary's rivers. Large, extant canebrakes still exist and have been documented from the Ocmulgee Basin, south of Macon, Georgia. In the Central Appalachians various wetlands, including those on alluvial or loess substrates (streamside flats, bottomlands), were dominated by *Arundinaria*, without an overstory, or with widely scattered trees.

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: Within Ninety Six, this community is historic and no longer occurs as an intact stand-alone community type due to suppression of fire and subsequent invasion by trees. The community occurred along Ninety Six Creek in broad swaths, most likely in areas where *Platanus occidentalis - Celtis laevigata - Fraxinus pennsylvanica / Lindera benzoin - Ilex decidua / Carex retroflexa* Forest (CEGL007730) currently exists. Stands of cane still exist, but are currently in areas of heavy forest and along openings created by the main channel of Ninety Six Creek. Restoration would require the careful selection of a site that still contained cane but was not of value as a forest, and the careful introduction of fire to reduce competition from other species and invasive exotics such as *Ligustrum sinense*.

Global Environment: Stands of this association occur on alluvial and loess soils often affiliated with bottomland hardwood forest vegetation. Historically, it was best developed in streamside flats and alluvial floodplains on ridges and terraces where it was protected from prolonged inundation.

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: See global description.

Global Vegetation: The vegetation is dominated by *Arundinaria gigantea*. 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*, 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.

Global Dynamics: A canebrake is an early successional community. It is suggested that Native Americans maintained canebrakes with the use of periodic fire, to provide a ready source of cane for a myriad of uses. Canebrakes may have expanded greatly in cover following the abandonment of aboriginal agricultural lands after the collapse of Native American populations due to exotic diseases (Platt and Brantley 1997).

MOST ABUNDANT SPECIES

Global Stratum	Species
TALL SHRUB	*Arundinaria gigantea*

CHARACTERISTIC SPECIES

Global Stratum	Species
TALL SHRUB	*Arundinaria gigantea*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

GRank & Reasons: G2? (99-02-15). Stands of this vegetation type were historically widespread, but now are rare or occupy very little acreage. It is thought to be maintained by frequent fire and may have historically resulted from aboriginal agriculture and burning. Dense, monospecific stands of *Arundinaria gigantea ssp. gigantea* were historically found in bottomland sites throughout the southeastern United States. Today, this vegetation exists as small remnants, and high-quality examples are extremely rare.

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range: Although this community was much more common 200 or more years ago, it may still occur occasionally in areas within the floodplain where tip-ups have occurred and created a high light environment for the cane.

Global Range: This association was widespread historically but now occupies very little acreage. It may be found along rivers and streamsides in Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and possibly Virginia (?).

Nations: US
States/Provinces: AL:S?, AR:S?, FL?, GA:S?, IL:S?, IN:S?, KY:S?, LA:S?, MO:S?, MS:S?, NC:S?, OK:S?, SC:S?, TN:S?, TX:S?, VA?
TNC Ecoregions: 31:P, 32:P, 38:C, 39:C, 40:C, 41:P, 42:C, 43:P, 44:C, 50:C, 51:C, 52:P, 53:P, 56:C, 57:P, 59:C
USFS Ecoregions: 221Ha:CC?, 221Hc:CCP, 221Hd:CCP, 221He:CC?, 221Ja:CCC, 221Jb:CCP, 221Jc:CCP, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Ca:CCP, 222Cb:CCP, 222Cc:CCP, 222Cd:CCP, 222Ce:CCP, 222Cf:CCP, 222Cg:CCP, 222Ch:CCP, 222Da:CCP, 222Db:CCP, 222Dc:CCP, 222Dd:CCP, 222De:CCP, 222Dg:CCP, 222Di:CCP, 222Dj:CCP, 222Ea:CCC, 222Eb:CCC, 222Ec:CCC, 222Ed:CCC, 222Ef:CCP, 222Eg:CCP, 222Eh:CCC, 222Ei:CCP, 222Ej:CC?, 222Ek:CCP, 222El:CCP, 222Em:CCP, 222En:CC?, 222Eo:CC?, 222Fa:CCC, 222Fb:CCC, 222Fc:CCC, 222Fd:CCC, 222Ff:CC?, 231Aa:CCP, 231Ab:CC?, 231Ac:CCP, 231Ad:CCP, 231Ae:CCP, 231Af:CCP, 231Ag:CC?, 231Ah:CC?, 231Ai:CCP, 231Am:CC?, 231An:CC?, 231Ao:CCP, 231Ba:CCP, 231Bb:CCP, 231Bc:CCP, 231Bd:CCP, 231Be:CCP, 231Bf:CCP, 231Bg:CCP, 231Bh:CCP, 231Bi:CCP, 231Bj:CCP, 231Bk:CCP,

231Bl:CCP, 231Ca:CCP, 231Cb:CCP, 231Cc:CCP, 231Cd:CCP, 231Ce:CCP, 231Cf:CCP, 231Cg:CCP, 231Da:CCP, 231Db:CCP, 231Dc:CCP, 231Dd:CCP, 231De:CCP, 231Ea:CCP, 231Eb:CCP, 231Ec:CCC, 231Ed:CCC, 231Ee:CCP, 231Ej:CCP, 231Ek:CCP, 231Em:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 234Aa:CCC, 234Ab:CC?, 234Ac:CCP, 234Ad:CCP, 234Ae:CCC, 234Af:CCP, 234Ag:CCC, 234Ah:CC?, 234Ai:CCC, 234Aj:CC?, 234Ak:CC?, 234Al:CCP, 234Am:CCC, 234An:CCC, 255Da:PPP, 255Db:PPP, M221Dc:CCC, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC
Federal Lands: NPS (Buffalo, Great Smoky Mountains, Ninety Six); USFS (Cherokee?, Mark Twain, Ouachita?, Ozark, St. Francis); USFWS (Little River, San Bernard?)

ELEMENT SOURCES

Authors: K.D. Patterson, mod. D. Faber-Langendoen, mod. J. Teague, SCS **Confidence:** 2
Identifier: CEGL003836
REFERENCES (type in full citation below if reference is new): Barden 1997, Blair 1938, Campbell 1980, Campbell 1989b, Davidson 1950, Flores 1984, Foti et al. 1994, Heineke 1987, Hoagland 1997, Hoagland 1998c, Hoagland 2000, Hughes 1966, McClain pers. comm., McInteer 1952, Meanley 1972, Mohr 1901, Nigh pers. comm., Nuttall 1821, Peet et al. 2002, Platt and Brantley 1992, Platt and Brantley 1997, Schafale 1998b, Smeins et al. 1992, West 1934

III.B.2.N.a. Temperate cold-deciduous shrubland
III.B.2.N.a.102. WISTERIA (SINENSIS, FLORIBUNDA) VINE-SHRUBLAND ALLIANCE
(Chinese Wisteria, Japanese Wisteria) Vine-Shrubland Alliance

ALLIANCE CONCEPT

Summary: This alliance, dominated either by the invasive exotic Asian vine *Wisteria sinensis* or *Wisteria floribunda*, is most commonly seen in fragmented landscapes near old homesteads and other areas. The oldest colonies of this type may consist of *Wisteria sinensis* or *Wisteria floribunda* and little else since the wisteria slowly overtops and kills all other plants nearby.
Dynamics:

ALLIANCE DISTRIBUTION

Range: *Wisteria sinensis* and *Wisteria floribunda* are considered invasive exotics throughout the southeastern U.S. and Eastern Seaboard. The alliance was created from data in North Carolina, but it is suspected that it occurs at least in Virginia, North Carolina, South Carolina, Tennessee, Georgia, Florida, Mississippi, Alabama, Louisiana, and Arkansas.
Nations: US
States/Provinces: AL? AR? FL? GA? LA? MS? NC SC TN? VA?
TNC Ecoregions: 52:C
USFS Ecoregions: 231Ae:CCC
Federal Lands: NPS (Guilford Courthouse, Ninety Six)

ALLIANCE SOURCES

Authors: R. WHITE, RW, Southeast **Identifier:** A.2013
References:

Wisteria sinensis Vine-Shrubland
Chinese Wisteria Vine-Shrubland
Wisteria Vineland ((CEGL008568)
Ecological Group (SCS;MCS): Exotic Species-Dominated Southeastern Wooded Uplands (900-30; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This vine-dominated vegetation is dominated by *Wisteria sinensis*, a fast-growing vine native to China. The community is most commonly seen in fragmented landscapes near old homesteads and other areas. The oldest colonies of this type may consist of *Wisteria sinensis* or *Wisteria floribunda* and little else since the wisteria slowly overtops and kills all other plants It has the potential to occur in most southeastern states.

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: This community exists in upland and wetland areas adjacent to old homesites and areas where *Wisteria sinensis* was introduced and has invaded. It is being controlled in the park, but is still present at the time of this report.

Global Environment: This association occurs in a wide variety of habitats, but tends to occur in areas that were formerly second-growth pine or tuliptree woodlands. Since this species invades by overtopping trees, this community tends to occur in highly fragmented areas that are near old homesteads or other past human habitations where wisteria persists. This community is rare across the landscape at this point, but there is the potential for it to occupy more land as fragmentation continues to occur.

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: The community is a monoculture of *Wisteria sinensis* with some occasional small patches of trees.

Global Vegetation: The vegetation is dominated by *Wisteria sinensis*, an exotic vine native to Asia. Wisteria was introduced as an ornamental vine in the South in the 19th century. It is not nearly as invasive as *Pueraria*, but in forests that have been disturbed by windstorm or other severe disturbances, it can colonize the canopy and spread to adjacent trees. In areas like this, where control has not taken place, this species can colonize more than 1 hectare. All existing vegetation is eventually choked out, leaving mounds of dying or dead trees overtopped by layers of *Wisteria sinensis*.

Global Dynamics: This association chokes out existing vegetation.

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- *Pueraria montana* var. *lobata* Vine-Shrubland (CEGL003882)

GRank & Reasons: GW (02-05-15). This vegetation is dominated by an exotic species, is of anthropogenic origin, and is thus not a conservation priority.

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range: The patch occurs in only one location in the southern portion of the park near a boundary with a private landowner.

Global Range: This vegetation is known to occur in North Carolina, but most likely occurs throughout the southeastern U.S.

Nations: US
States/Provinces: AL?, AR?, FL?, GA?, LA?, MS?, NC:S?, SC:S?, TN?, VA?
TNC Ecoregions: 52:C
USFS Ecoregions: 231Ae:CCC
Federal Lands: NPS (Guilford Courthouse, Ninety Six)

ELEMENT SOURCES

Authors: R. White, SCS **Confidence:** 2 **Identifier:** CEGL008568
REFERENCES (type in full citation below if reference is new):

III.B.2.N.a.15. RUBUS (ARGUTUS, TRIVIALIS) SHRUBLAND ALLIANCE

(Southern Blackberry, Southern Dewberry) Shrubland Alliance
III. Shrubland

ALLIANCE CONCEPT

Summary: This alliance includes successional vegetation which develops following disturbance (complete forest canopy removal) dominated by *Rubus argutus* and/or *Rubus trivialis*. Many examples also contain *Smilax* spp. and a great variety of tree saplings and other woody species. In central Tennessee, these may include *Quercus* spp., *Liquidambar styraciflua, Acer rubrum,* and *Rhus copallinum*. Herbs in central Tennessee examples may include *Solidago* spp., Asteraceae spp., *Helianthus* spp., *Hypericum* spp., *Potentilla simplex*; grasses may include *Andropogon* spp., *Dichanthelium* spp., *Panicum* spp., *Schizachyrium scoparium*, and *Sorghastrum nutans*.
Dynamics: Stands of this alliance are successional and develop following disturbance (complete forest canopy removal).

ALLIANCE DISTRIBUTION

Range: This alliance is found from Tennessee and the Carolinas south into Mississippi, Alabama, and Georgia. Its full distribution has not been documented.
Nations: US
States/Provinces: AL? GA MS? NC SC TN
TNC Ecoregions: 43:C, 44:C, 50:C, 52:C
USFS Ecoregions: 221Ae:CCC, 222Eb:CCC, 231Aa:CCC, 231Ae:CCC
Federal Lands: DOD (Arnold); NPS (Cowpens, Ninety Six); USFS (Ouachita, Ozark, Talladega, Tuskegee?)

ALLIANCE SOURCES

Authors: M.J. RUSSO 2-97, MOD. M., RW, Southeast **Identifier:** A.908
References:

Rubus (argutus, trivialis) - Smilax (glauca, rotundifolia) Shrubland (Southern Blackberry, Southern Dewberry) - (Whiteleaf Greenbrier, Common Greenbrier) Shrubland

Blackberry - Greenbrier Successional Shrubland Thicket (CEGL004732)

Ecological Group (SCS;MCS): Semi-natural Wooded Uplands (900-40; 8.0.0.1)

ELEMENT CONCEPT

GLOBAL SUMMARY: Stands of this successional community develop following disturbance (complete forest canopy removal). These stands are dominated by greenbrier species (*Smilax glauca, Smilax rotundifolia*) and blackberries/dewberries (*Rubus argutus, Rubus trivialis*). Many examples include a great variety of tree saplings and other woody species (*Quercus* spp., *Liquidambar styraciflua, Acer rubrum, Diospyros virginiana, Juniperus virginiana var. virginiana, Rhus copallinum*), herbs (*Solidago* spp., Asteraceae spp., *Helianthus* spp., *Hypericum* spp., *Potentilla simplex*), and grasses (*Andropogon* spp., *Dichanthelium* spp., *Panicum* spp., *Schizachyrium scoparium, Lolium* spp., and *Sorghastrum nutans*). Communities that are surrounded by relatively intact ecosystems will tend to have more native species. Those surrounded by old fields or fragmented by development tend to have *Lonicera japonica* as a codominant vine overtopping much of the blackberry and greenbrier.

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: This community derives from successional old fields that have not been mowed for at least 3-5 years.

Global Environment: This community can exist in both lowlands and uplands that have been cleared but have not been further disturbed by continued mowing or plowing for 3-5 years.

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: This community is dominated by *Rubus* spp. within the park, but may also be codominated by non-native shrubs such as *Ligustrum sinense*, old field herbs, and *Lonicera japonica*.

Global Vegetation: Stands of this association are dominated by greenbrier species (*Smilax glauca, Smilax rotundifolia*) and blackberries/dewberries (*Rubus argutus, Rubus trivialis*). They also contain a great variety of tree saplings and other woody species (e.g., *Quercus* spp., *Liquidambar styraciflua, Acer rubrum, Rhus copallinum*). Some herbs in central Tennessee examples may include *Solidago* spp., Asteraceae spp., *Helianthus* spp., *Hypericum* spp., *Potentilla simplex*; grasses may include *Andropogon* spp., *Dichanthelium* spp., *Panicum* spp., *Schizachyrium scoparium, Lolium* spp., and *Sorghastrum nutans*. Communities that are surrounded by relatively intact ecosystems will tend to have more native species. Those surrounded by old fields or fragmented by development tend to have *Lonicera japonica* as a codominant vine overtopping much of the blackberry and greenbrier.

Global Dynamics: Stands of this successional community develop following disturbance (complete forest canopy removal) followed by a period of no disturbance of 3-5 years.

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

GRank & Reasons: GD (01-10-03). This type represents ruderal successional vegetation dominated by species native to North America. GRank changed from GW to GD to reflect this composition.

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range: This community occurs most commonly as an embedded feature within cultivated meadows of the park.

Global Range: This ruderal successional vegetation could be found throughout the upper southern United States.

Nations: US
States/Provinces: AL?, GA:S?, MS?, NC:S?, SC:S?, TN:S?
TNC Ecoregions: 43:C, 44:C, 50:C, 52:C

USFS Ecoregions: 222Eb:CCC, 231Aa:CCC, 231Ae:CCC
Federal Lands: DOD (Arnold); NPS (Cowpens, Ninety Six); USFS (Talladega?, Tuskegee?)

ELEMENT SOURCES

Authors: M.J. Russo, mod. R. White, SCS **Confidence:** 2 **Identifier:** CEGL004732
REFERENCES (type in full citation below if reference is new): NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. 2002, TNC 1998a

V. Herbaceous Vegetation
V.A.5.N.c. Medium-tall sod temperate or subpolar grassland
A.1208—ANDROPOGON VIRGINICUS HERBACEOUS ALLIANCE (V.A.5.N.c.3)
Common Broomsedge Herbaceous Alliance

NatureServe Regions: **Southeast**,**ECS,MCS,SCS! SHARED ALLIANCE !**
LeadResp: Southeast

ALLIANCE CONCEPT

Summary: This alliance includes vegetation dominated by *Andropogon virginicus var. virginicus* that occurs on old fields, pastures, and rocky sites. Associated species vary with geography and habitat and include typical pioneer species. This is a very wide-ranging alliance. There is no known natural vegetation in this alliance.
Environment: Stands of this alliance occur on old fields, pastures, and rocky sites.
Physiognomy:
Vegetation: Stands of this alliance are dominated by *Andropogon virginicus var. virginicus*. Associated species vary with geography and habitat and include typical pioneer species.
Dynamics:
Similar Alliances:
Similar Alliance Comments:
Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is found in Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and Missouri, and possibly Illinois (?), Indiana (?), and elsewhere.
Nations: US
States: AL AR GA IL IN? KY LA MO? MS NC OK SC TN TX VA
TNC Ecoregions: 31:C, 32:C, 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:C, 50:C, 51:P, 52:P, 53:C, 56:C, 57:C, 59:C
USFS Ecoregions: 221C:CP, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Cg:CCC, 231Aa:CCC, 231Ae:CCC, 231Fa:CCP, 231Fb:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232B:CC, 232F:CC, 255Da:CCC, 255Dc:CCC, M221Aa:CCC, M221Ab:CCC, M221Ba:C??, M221Bd:C??, M221Ca:CPP, M221Cb:CPP, M221Cc:CPP, M221Ce:CPP, M221Da:CCC, M221Db:CCC, M221Dc:CCP, M221Dd:CCP, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC
Federal Lands: DOD (Arnold, Fort Benning, Fort Gordon); NPS (Cowpens, Ninety Six, Shiloh); USFS (Cherokee, George Washington, Jefferson, Oconee?, Ouachita?, Ozark?, Talladega?, Tuskegee?); USFWS (Anahuac, Big Boggy?, Brazoria)

ALLIANCE INTERNAL TRACKING

Internal Comments: *MP 8-02: Shiloh added.
TNC Ecoregion Notes:
Predecessors:
Obsolete Names or Formations:

ALLIANCE SOURCES

Authors: A.S. WEAKLEY **SCS Master:** RW
Origin: 1997-11-26 **Edition:** 94-11-01
References: Hoagland 1998a

Andropogon virginicus var. virginicus Herbaceous Vegetation
Common Broomsedge Herbaceous Vegetation
Successional Broomsedge Vegetation (CEGL004044)
Ecological Group (SCS;MCS): Semi-natural Upland Herbaceous Vegetation (900-50; 8.0.0.3)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes vegetation that occurs on old fields, pastures, and rocky sites which is dominated by *Andropogon virginicus var. virginicus*. This is a very common and wide-ranging association. Additional components include typical pioneer species; these and other associated species will vary with geography and habitat.
Environment: This vegetation typically occurs on old fields, pastures, and rocky sites. It will persist indefinitely under a regular mowing regime, e.g., in powerline corridors.

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: Same as global description.

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

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: Same as global description.

Global Vegetation: Stands of this alliance are dominated by *Andropogon virginicus var. virginicus*. Associated species vary with geography and habitat and include typical pioneer species. Other species with high cover values in plot samples attributed to this type include *Tridens flavus, Setaria parviflora (= Setaria geniculata), Eragrostis spectabilis,* and *Panicum anceps* (NatureServe unpubl. data). On the eastern Highland Rim of Tennessee (Arnold Air Force Base), associated species include *Andropogon virginicus, Diodia teres, Aristida dichotoma, Aristida oligantha, Packera anonyma (= Senecio anonymus), Paspalum laeve, Lespedeza virginica,* and *Plantago virginica*. *Rubus argutus* and *Smilax* spp. may be locally abundant but are not dominant. In clearcuts, *Schizachyrium scoparium, Danthonia spicata*, and *Dichanthelium* spp. are also common, as are occasional *Quercus* spp. and *Rubus argutus*.

Global Dynamics: This association may develop temporarily following clear-cutting, and will persist indefinitely under a regular mowing regime, e.g., in powerline corridors. If undisturbed, these grasslands will rapidly succeed to shrubs, and eventually to tree species.

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

GRank & Reasons: GD (00-08-08). This is a ruderal community and represents vegetation resulting from succession following anthropogenic disturbance of an area. It is not a conservation priority for its own sake and does not receive a conservation rank.

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range:

Global Range: This community is possibly found throughout the southeastern United States.

Nations: US
States/Provinces: AL:S?, AR:S?, GA:S?, IL:S?, IN?, KY:S?, LA:S?, MO?, MS:S?, NC:S?, OK:S?, SC:S?, TN:S?, TX:S?, VA:S?
TNC Ecoregions: 31:C, 32:C, 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:C, 50:C, 51:P, 52:P, 53:C, 56:C, 57:C, 59:C
USFS Ecoregions: 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Cg:CCC, 231Aa:CCC, 231Fa:CCP, 231Fb:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232B:CC, 232F:CC, 255Da:CCC, 255Dc:CCC, M221Aa:CCC, M221Ab:CCC, M221Ba:C??, M221Bd:C??, M221Ca:CPP, M221Cb:CPP, M221Cc:CPP, M221Ce:CPP, M221Da:CCC, M221Db:CCC, M221Dc:CCP, M221Dd:CCP, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: DOD (Arnold, Fort Benning, Fort Gordon); NPS (Cowpens, Ninety Six, Shiloh); USFS (Cherokee, George Washington, Jefferson, Oconee?, Ouachita?, Ozark?, Talladega?, Tuskegee?); USFWS (Anahuac, Big Boggy?, Brazoria)

ELEMENT SOURCES

Authors: SCS **Confidence:** 1 **Identifier:** CEGL004044

References: Fleming and Coulling 2001, Hoagland 2000, NatureServe Ecology - Southeastern U.S. unpubl. data, Penfound 1953, TNC 1998a, Tarr et al. 1980

V.A.5.N.c.8. LOLIUM (ARUNDINACEUM, PRATENSE) HERBACEOUS ALLIANCE

(Tall Fescue, Meadow Fescue) Herbaceous Alliance

V.A. Perennial graminoid vegetation

ALLIANCE CONCEPT

Summary: This alliance includes pastures, hayfields, and old pastures, more-or-less cultural, though sometimes no longer actively maintained. The dominant species in this alliance are the European 'tall or meadow fescues,' of uncertain and controversial generic placement. Although at one time treated as *Festuca elatior* and *Festuca arundinacea*, these two closely related species are now treated as *Lolium pratense* and *Lolium arundinaceum*, respectively. These communities are sometimes nearly monospecific, but can also be very diverse and contain many native species of grasses, sedges, and forbs.

Dynamics:

ALLIANCE DISTRIBUTION

Range: This alliance is currently defined for the 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. It is found in Arkansas, Georgia, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia, Missouri, and elsewhere.

Nations: CA US

States/Provinces: AR GA MO MS NB? NC NS? OK ON? QC? SC TN VA

TNC Ecoregions: 38:C, 39:C, 40:P, 43:C, 50:C, 51:C, 52:C, 57:C, 59:C

USFS Ecoregions: 221:C, 222:C, 231Ae:CCC, M221Dc:CCC, M221Dd:CCC, M222Ab:CCC, M231Aa:CCP, M231Ab:CCP, M231Ac:CCP, M231Ad:CCP

Federal Lands: NPS (Blue Ridge Parkway, Buffalo, Carl Sandburg Home, Cowpens, Great Smoky Mountains, Guilford Courthouse, Kings Mountain, Ninety Six, Shenandoah); USFS (Cherokee, Ouachita, Ozark)

ALLIANCE SOURCES

Authors: A.S. WEAKLEY 95-05, MOD., RW, Southeast **Identifier:** A.1213

References: Kartesz 1999

Lolium (arundinaceum, pratense) Herbaceous Vegetation
(Tall Fescue, Meadow Fescue) Herbaceous Vegetation
Cultivated Meadow (CEGL004048)
Ecological Group (SCS;MCS): Exotic Species-Dominated Herbaceous Upland Vegetation (900-60; 8.0.0.4)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes grassland pastures and hayfields, more-or-less cultural, though sometimes no longer actively maintained. The dominant species in this type are the European 'tall or meadow fescues,' of uncertain and controversial generic placement. These communities are sometimes nearly monospecific but can also be very diverse and contain many native species of grasses, sedges, and forbs. This vegetation is currently defined for the 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.

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: Same as global description.

Global Environment: This association includes grassland pastures and hayfields, more-or-less cultural, though sometimes no longer actively maintained.

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: Same as global description.

Global Vegetation: The dominant species in this alliance are the European 'tall or meadow fescues,' of uncertain and controversial generic placement. Although traditionally treated as *Festuca pratensis (= Festuca elatior)* and *Festuca arundinacea*, these two closely related species are now usually treated as either *Lolium pratense* and *Lolium arundinaceum* (Kartesz 1999), or as *Schedonorus pratensis* and *Schedonorus arundinaceus*. These communities are sometimes nearly monospecific but can also be very diverse and contain many native species of grasses, sedges, and forbs.

Global Dynamics: This association varies greatly depending upon the past land-use history and the recent history of the site. Some examples that have been recently farmed may be monocultures of *Lolium*, whereas other fields that were traditionally lightly grazed may have much higher diversity.

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

GRank & Reasons: GW (00-01-05). This vegetation is dominated by an exotic species, is of anthropogenic origin, and is thus not a conservation priority.

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range: This community occurs throughout the park in all regularly mowed areas. It is most common in the northern two-thirds of the park.

Global Range: This association is possible throughout much of the eastern United States and southern Canada.

Nations: CA? US

States/Provinces: AR:S?, GA:S?, MO:S?, MS:S?, NB?, NC:S?, NS?, OK:S?, ON?, QC?, SC:S?, TN:S?, VA:S?
TNC Ecoregions: 38:C, 39:C, 40:P, 43:C, 50:C, 51:C, 52:C, 57:C, 59:C
USFS Ecoregions: 221:C, 222:C, 231Ae:CCC, M221Dc:CCC, M221Dd:CCC, M222Ab:CCC, M231A:CC
Federal Lands: NPS (Blue Ridge Parkway, Buffalo, Carl Sandburg Home, Cowpens, Great Smoky Mountains, Guilford Courthouse, Kings Mountain, Ninety Six, Shenandoah); USFS (Cherokee, Ouachita, Ozark)

ELEMENT SOURCES

Authors: SCS **Confidence:** 2 **Identifier:** CEGL004048

REFERENCES (type in full citation below if reference is new): Heath et al. 1973, Hoagland 2000, Kartesz 1999, NatureServe Ecology - Southeastern U.S. unpubl. Data

V.A.5.N.l. Semipermanently flooded temperate or subpolar grassland
V.A.5.N.l.9. TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (Narrowleaf Cattail, Broadleaf Cattail) - (Clubrush species) Semipermanently Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance, found in virtually every state in the United States and probably most Canadian provinces, contains stands dominated by *Typha angustifolia* and/or *Typha latifolia*, either alone or in combination with other tall emergent marsh species. Associated species vary widely; in the Midwest they include many sedges such as *Carex aquatilis, Carex rostrata, Carex pellita (= Carex lanuginosa)*, bulrushes such as *Schoenoplectus americanus (= Scirpus americanus), Schoenoplectus acutus (= Scirpus acutus)*, and *Schoenoplectus heterochaetus (= Scirpus heterochaetus)*, and broad-leaved herbs such as *Thelypteris palustris, Asclepias incarnata, Impatiens capensis, Sagittaria latifolia, Scutellaria lateriflora, Sparganium eurycarpum, Hibiscus moscheutos*, and *Verbena hastata*. Floating aquatics such as *Lemna minor* may predominate in deeper zones.

This alliance is found most commonly along lake margins and in shallow basins, and occasionally in river backwaters. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots grow suspended in a buoyant peaty mat. *Typha angustifolia* can grow in deeper water compared to *Typha latifolia*, although both species reach maximum growth at a water depth of 50 cm. *Typha* often occurs in pure stands, and can colonize areas recently exposed by either natural or human causes. *Lythrum salicaria*, an exotic species from Europe, has become a common associate of many eastern *Typha* marshes. In the Southeast, this alliance is widespread and currently representative of a wide variety of mixed marshes with no clear dominants. Vegetation in this alliance may be natural or semi-natural and includes mixed stands of the nominal species, as well as essentially monospecific stands of *Typha latifolia*. These monospecific stands occur especially in artificial wetlands, such as borrow pits or ponds. This alliance occurs on hydric soils in wetlands, ditches, ponds, lakes, and rivers, as well as on shorelines and streambanks. Inundation is commonly 3-6 dm (1-2 feet) in depth. These marshes have hydric soils and are flooded with water levels ranging from several centimeters to more than 1 m for a significant part of the growing season. Occurrences may display areas of open water, but emergent vegetation dominates (80% cover). Seasonal flooding during winter and spring or flooding during heavy rains help maintain these marshes by causing water exchange which replenishes freshwater and circulates nutrients and organic debris. Soils which support this community can be mineral or organic but are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. Vegetative diversity and density is highly variable in response to water depth, water chemistry, and natural forces.

Environment: This alliance is found most commonly along lake or pond margins, slow-moving ditches, in shallow basins, adjacent to stream or river channels in wet mud, oxbows, and occasionally in river backwaters. Elevations range from near sea level to around 2000 m in Colorado. Sites where this alliance occurs are typically semipermanently flooded, inundated with 30-100 cm of water throughout the year. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots grow suspended in a buoyant peaty mat. *Typha angustifolia* can grow in deeper water compared to *Typha latifolia*, although both species reach maximum growth at a water depth of 50 cm (Grace and Wetzel 1981). Soils are characterized by accumulations of organic matter over deposits of fine silt and clay (Hansen et al. 1995), or loams, sandy loams, or coarse sand (Jones and Walford 1995, Bundy et al. 1996). *Typha* often occurs in pure stands, and can colonize areas recently exposed by either natural or human causes.

Adjacent herbaceous wetland vegetation types can be dominated by species of *Scirpus* and/or *Schoenoplectus, Carex*, or *Eleocharis*. Riparian shrublands or forests include those dominated by species of *Salix, Fraxinus*, or *Populus*.

Vegetation: This alliance, is found at low to moderate elevations in virtually every state in the United States and probably most Canadian provinces. It contains stands dominated by *Typha angustifolia* and/or *Typha latifolia*, either alone or in combination with other tall emergent marsh

species. Associated species vary widely; in the central and western United States, they include many sedges such as *Carex aquatilis, Carex rostrata, Carex pellita (= Carex lanuginosa),* and bulrushes such as *Schoenoplectus americanus (= Scirpus americanus), Schoenoplectus acutus (= Scirpus acutus), Schoenoplectus tabernaemontani (= Scirpus tabernaemontani),* and *Schoenoplectus heterochaetus (= Scirpus heterochaetus).* Other graminoids can include *Juncus* spp., *Eleocharis* spp., or *Glyceria* spp. In the central and eastern parts of its range, broad-leaved herbs such as *Thelypteris palustris, Asclepias incarnata, Impatiens capensis, Sagittaria latifolia, Scutellaria lateriflora, Sparganium eurycarpum, Hibiscus moscheutos,* and *Verbena hastata*, may be present. In the west, forbs may include *Mentha arvensis, Polygonum amphibium, Epilobium ciliatum* and many others. Floating aquatics such as *Lemna minor* may predominate in deeper zones (Anderson 1982, MNNHP 1993, Hansen et al. 1995).

Dynamics: *Typha angustifolia* occupies inundated and disturbed grounds and can tolerate deeper water and higher alkalinity levels than *Typha latifolia* (Great Plains Flora Association 1986). *Typha* species are prolific seed producers, spreading rapidly to become the early colonizers of wet mineral soil and will persist under wet conditions (Hansen et al. 1995). Roots and lower stems are well-adapted to prolonged submergence, but periods of draw-down are required for seed germination to occur (Hansen et al. 1995). These are important wetland communities for many species of birds and waterfowl. Hansen et al. (1995) report that in Montana heavy livestock use may convert stands to *Carex nebrascensis*-dominated communities.

Similar Alliances:

- TYPHA SPP. - (SCHOENOPLECTUS SPP., JUNCUS SPP.) SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1394)
- CAREX SPP. - TYPHA SPP. SATURATED HERBACEOUS ALLIANCE (A.1465)
- TYPHA DOMINGENSIS SEASONALLY FLOODED TEMPERATE HERBACEOUS ALLIANCE (A.1392)
- PHRAGMITES AUSTRALIS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1431)
- SCHOENOPLECTUS ACUTUS - (SCHOENOPLECTUS TABERNAEMONTANI) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1443)
- SCHOENOPLECTUS AMERICANUS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1432)
- ZIZANIA (AQUATICA, PALUSTRIS) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1441)

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is found in virtually every state in the United States and is likely to be found in most Canadian provinces. In the southeastern United States, it is found in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia.

Nations: CA US

States/Provinces: AL AR AZ BC CA CO CT DE FL? GA IA ID IL IN KS KY LA MA MB MD ME MI MN MO MS MT NC ND NE NH NJ NM NV NY OH OK ON OR PA QC RI SC SD TN TX UT VA VT WA WI WV WY

TNC Ecoregions: 10:C, 11:C, 12:C, 17:C, 19:C, 20:C, 25:C, 26:C, 27:C, 2:C, 31:C, 32:C, 33:C, 34:C, 35:C, 36:C, 37:C, 38:C, 39:C, 40:C, 41:C, 42:P, 43:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:P, 51:P, 52:C, 53:C, 56:C, 57:C, 58:C, 59:C, 60:C, 61:C, 62:C, 63:C, 64:C, 6:C

USFS Ecoregions: 212Aa:C??, 212Ab:C??, 212Ba:C??, 212Bb:C??, 212Ca:CC?, 212Cb:CCC, 212Da:CCC, 212Db:CCC, 212Dc:CC?, 212Ea:CCC, 212Ec:CCP, 212Ed:CCP, 212Ee:CCP, 212Fa:CCC, 212Fb:CCC, 212Fc:CCC, 212Fd:CCC, 212Ga:CCC, 212Gb:CCC, 212Ha:CCP, 212Hb:CCP, 212He:CCC, 212Hh:CCP, 212Hi:CCP, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCP, 212Hn:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCC, 212Hu:CCC, 212Hv:CCC, 212Hw:CCC, 212Hx:CCC, 212Hy:CCP, 212Ia:CCC, 212Ib:CCP, 212Ja:CCC, 212Jb:CCP, 212Jc:CCP, 212Jf:CCP, 212Jj:CCP, 212Jk:CCP, 212Jl:CCP, 212Jm:CCP, 212Jn:CCC, 212Jo:CCP, 212Jr:CCC, 212Ka:CCP, 212Kb:CCC, 212La:CPP, 212Lb:CPP, 212Lc:CPP, 212Ld:CPP, 212Ma:CPP, 212Mb:CPP, 212Na:CCP, 212Nb:CCP, 212Nc:CCC, 212Nd:CCP, 212Oa:CCC, 212Ob:CCC, 212Pa:CCC, 212Pb:CCC, 221Aa:CC?, 221Ab:CC?, 221Ac:CC?, 221Ad:CC?, 221Ae:CCP, 221Af:CC?, 221Ag:CC?, 221Ah:CC?,

221Ai:CC?, 221Aj:CC?, 221Ak:CC?, 221Al:CCC, 221Am:CC?, 221Ba:CCP, 221Bb:CCC, 221Bc:CCP, 221Bd:CCC, 221Da:C??, 221Db:C??, 221Dc:C??, 221Ea:CC?, 221Eb:CC?, 221Ec:CCC, 221Eg:CCC, 221Fa:C??, 221Fb:C??, 221H:CC, 221Ja:CC?, 221Jc:CC?, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222Am:CCC, 222An:CCC, 222Cf:CCP, 222Cg:CCP, 222D:CC, 222Eb:CCC, 222Eg:CCP, 222Eh:CCP, 222F:CC, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Ia:CCC, 222Ib:CCP, 222Ic:CC?, 222Id:CC?, 222Ie:CCP, 222If:CCC, 222Ja:CCC, 222Jc:CCC, 222Je:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kd:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kj:CCC, 222Lc:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 222Na:CCC, 222Q:CC, 231Aa:C??, 231Ae:C??, 231Af:C??, 231Ak:C??, 231Al:C??, 231Am:C??, 231An:C??, 231Ao:C??, 231Ap:C??, 231C:CC, 231E:CC, 231Fb:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Aa:C??, 232Ac:C??, 232Ad:C??, 232Bc:C??, 232Bd:C??, 232Br:C??, 232Ce:CCC, 232Ch:CC?, 232Cj:CC?, 234Ac:PP?, 242A:CC, 251Aa:CCC, 251Ab:CCC, 251Ba:CCC, 251Bb:CCC, 251Bd:CCC, 251Be:CCC, 251Cb:CCC, 251Cc:CCC, 251Cd:CC?, 251Cf:CCC, 251Cg:CCC, 251Ch:CCC, 251Cm:CCC, 251Cp:CCC, 251Dc:CCC, 251Dg:CCC, 251Ea:CCC, 251Eb:CCC, 251Ed:CCC, 251F:CC, 255Aa:CCC, 255C:CC, 255Da:CCC, 255Dc:CCC, 261A:CC, 262A:CC, 263A:CC, 311A:CC, 331C:CC, 331F:CP, 331H:CC, 331I:CC, 332A:CP, 332B:C?, 332C:CC, 332D:CP, 332E:CC, 341C:CC, 342:C, M212Aa:CP?, M212Ab:CP?, M212Ac:CP?, M212Ad:CP?, M212Ba:CP?, M212Bb:CP?, M212Ca:CP?, M212Cb:CPP, M212Cc:CP?, M212Cd:CP?, M212Da:CC?, M212Db:CC?, M212Dc:CC?, M212Ea:CCC, M212Eb:CCC, M212Fa:C??, M212Fb:C??, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Bd:CCC, M221Be:CCC, M221Bf:CCC, M221Ca:C??, M221Cb:C??, M221Cc:C??, M221Cd:C??, M221Da:CCC, M221Db:CCP, M221Dc:CCP, M221Dd:CCP, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC, M261E:CC, M331F:CC, M331I:CC, M333C:CC, M334A:CC

Federal Lands: DOD (Arnold, Fort Benning); NPS (Acadia, Badlands, Fort Laramie, Isle Royale, Ninety Six, Scotts Bluff, Theodore Roosevelt, Voyageurs, Wind Cave, Yosemite); USFS (Black Hills, Daniel Boone, Kisatchie, Oconee?, Ouachita, Ozark, Pisgah, Talladega?, Tuskegee?); USFWS (Anahuac, Brazoria, Lacreek, Little River, Ouray, San Bernard)

ALLIANCE SOURCES

Authors: MCS, MOD. M.S. REID, MP, Midwest **Identifier:** A.1436

References: Anderson 1982, Apfelbaum 1985, Bundy et al. 1996, Bunin 1985, Christy 1973, Eggers and Reed 1987, Faber-Langendoen et al. 1996, Fike 1999, Foti 1994b, Foti et al. 1994, Grace and Wetzel 1981, Great Plains Flora Association 1986, Hansen et al. 1991, Hansen et al. 1995, Hoagland 1998a, Hoagland 2000, Jones and Walford 1995, Kittel et al. 1996, Kittel et al. 1999a, Komarkova 1976, Komarkova 1986, Kovalchik 1993, Lindauer 1978, Lindauer and Christy 1972, MNNHP 1993, Masek 1979, McEachern 1979, Mitsch and Gosselink 1993, Mohlenbrock 1959, Muldavin et al. 1993b, Muldavin et al. 2000a, Padgett et al. 1989, Sawyer and Keeler-Wolf 1995, Segadas-Vianna 1951, Simkins 1931, Smith 1991, TNC 1995b, Tolstead 1942, Wharton 1978, Youngblood et al. 1985a

Typha latifolia Southern Herbaceous Vegetation
Broadleaf Cattail Southern Herbaceous Vegetation
Southern Cattail Marsh (CEGL004150)
Ecological Group (SCS;MCS): Eastern Emergent Marshes (480-20; 1.4.1.2)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association is a semi-natural type, consisting of *Typha latifolia* as an essentially monospecific stand, especially in artificial wetlands, such as borrow pits or ponds. The water table is at or above the soil surface for at least part of the growing season. The dominant species, *Typha latifolia*, often forms dense, almost monotypic stands. *Carex* spp. and *Schoenoplectus* spp. (= *Scirpus* spp.) are often found in this community, especially on the margins. Other co-occurring species of this association are not fully understood. It is a widespread type. In the Interior Low Plateau of Tennessee, *Typha latifolia* is commonly found with *Scirpus cyperinus* in roadside ditches and on the margins of ponds and reservoirs.
Environment: This type is found especially in artificial wetlands, such as borrow pits or ponds. The water table is at or above the soil surface for at least part of the growing season.

ENVIRONMENTAL DESCRIPTION

Ninety Six National Historic Site Environment: Within the park, this community exists in shallow former farm ponds.

Global Environment: This type is found especially in artificial wetlands, such as borrow pits or ponds. The water table is at or above the soil surface for at least part of the growing season.

VEGETATION DESCRIPTION

Ninety Six National Historic Site Vegetation: Same as global description.

Global Vegetation: Stands of this association consist of *Typha latifolia* as an essentially monospecific stand. *Carex* spp. and *Schoenoplectus* spp. (= *Scirpus* spp.) are often found in this community, especially on the margins. Other co-occurring species of this association are not fully understood. In the Interior Low Plateau of Tennessee, *Typha latifolia* is commonly found with *Scirpus cyperinus*. In addition, *Juncus effusus* and an occasional *Alnus serrulata* are also present.

Global Dynamics:

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

GRank & Reasons: G5 (01-06-14). This is a wide-ranging type that includes naturally occurring and artificial wetlands.

CLASSIFICATION COMMENTS

Ninety Six National Historic Site :

Global Classif Comments: This community is a common element found in many Southeastern wetland systems, but little work has been done to determine its diagnostic features and component species. The variability of this association across its range and its relation to adjacent types in this and related alliances are not fully understood. At Arnold Air Force Base, Coffee and Franklin counties, Tennessee, this vegetation is found scattered along the border of Woods Reservoir. It appears to be a component of a mosaic of communities which form bands from the edge of the reservoir to the surrounding forest. The band found at the reservoir's edge is dominated by *Typha latifolia* and *Scirpus cyperinus*. *Juncus* sp., grasses, and an occasional *Alnus serrulata* are also present. The *Typha latifolia* grows patchily, being concentrated in dense clumps throughout the outer band.

ELEMENT DISTRIBUTION

Ninety Six National Historic Site Range: This community is known to occur in one farm pond in the central portion of the park.

Global Range: This vegetation is possible throughout the southeastern United States.

Nations: US

States/Provinces: AL:S?, AR:S1S2, FL?, GA:S?, KY:S?, LA:S?, MS:S?, NC:S?, OK:S?, SC:S?, TN:S?, TX:S?, VA:S?, WV:S?
TNC Ecoregions: 31:C, 38:C, 39:C, 41:C, 42:P, 43:C, 44:C, 50:P, 52:?, 53:P, 56:P, 57:P, 59:C
USFS Ecoregions: 221:C, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Cf:CCP, 222Cg:CCP, 222Eb:CCC, 222Eg:CCP, 222Eh:CCP, 231A:C?, 231Fb:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232:C, 251:P, 255Da:CCC, 255Dc:CCC, M221:C, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC
Federal Lands: DOD (Arnold, Fort Benning); NPS (Ninety Six); USFS (Kisatchie, Oconee?, Ouachita, Ozark, Talladega?, Tuskegee?); USFWS (Anahuac, Brazoria, San Bernard)

ELEMENT SOURCES

Authors: SCS **Confidence:** 2 **Identifier:** CEGL004150
References: Allard 1990, Blair and Hubbell 1938, Foti 1994b, Foti et al. 1994, Grace and Wetzel 1981, Hoagland 2000, McCoy 1958, TNC 1998a

References for Appendix II

Allard, D. J. 1990. Southeastern United States ecological community classification. Interim report, Version 1.2. The Nature Conservancy, Southeast Regional Office, Chapel Hill, NC. 96 pp.

ALNHP [Alabama Natural Heritage Program]. 2002. Eufaula National Wildlife Refuge: Natural community and rare plant survey. Alabama Natural Heritage Program, The Nature Conservancy, Montgomery.

Ambrose, J. 1990a. Georgia's natural communities--A preliminary list. Unpublished document. Georgia Natural Heritage Inventory. 5 pp.

Anderson, D. M. 1982. Plant communities of Ohio: A preliminary classification and description. Division of Natural Areas and Preserves, Ohio Department of Natural Resources, Columbus, OH. 182 pp.

Andreu, M. G., and M. L. Tukman. 1995. Forest communities of the Tellico Lake Area, East Tennessee. M.F. project report, Duke University, School of the Environment. Durham, NC. 66 pp. plus appendices.

Apfelbaum, S. I. 1985. Cattail (*Typha* spp.) management. Natural Areas Journal 5(3):9-17.

Aulbach-Smith, C. Personal communication. Botanical Services of SC.

Barden, L. S. 1997. Historic prairies in the Piedmont of North and South Carolina, USA. Natural Areas Journal 17 (2):149-152.

Blair, W. F. 1938. Ecological relationships of the mammals of the Bird Creek region, northeastern Oklahoma. The American Midland Naturalist 20:473-526.

Blair, W. F., and T. H. Hubbell. 1938. The biotic districts of Oklahoma. The American Midland Naturalist 20:425-454.

Braun, E. L. 1950. Deciduous forests of eastern North America. Hafner Press, New York. 596 pp.

Bundy, R. M., J. V. Baumgartner, M. S. Reid, P. S. Bourgeron, H. C. Humphries, and B. L. Donohue. 1996. Ecological classification of wetland plant associations in the Lahontan Valley, Nevada. Prepared for Stillwater National Wildlife Refuge and USDI Fish & Wildlife Service. 53 pp. not including inventories, tables and graphs.

Bunin, J. E. 1985. Vegetation of the City of Boulder, Colorado open space lands. Report prepared for the City of Boulder, Real Estate/Open Space, Boulder, CO. 114 pp.

Burns, R. M., and B. H. Honkala, technical coordinators. 1990a. Silvics of North America: Volume 1. Conifers. USDA Forest Service. Agriculture Handbook 654. Washington, DC. 675 pp.

Burns, R. M., and B. H. Honkala, technical coordinators. 1990b. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. USDA Forest Service, Washington, DC. 877 pp.

Cain, M. D., and M. G. Shelton. 1994. Indigenous vegetation in a southern Arkansas pine-hardwood forest after a half century without catastrophic disturbances. Natural Areas Journal 14:165-174.

Campbell, J. J. N. 1980. Present and presettlement forest conditions in the Inner Bluegrass region of Kentucky. Ph.D. dissertation, University of Kentucky, Lexington. 109 pp. [Excerpts only]

Campbell, J. J. N. 1989b. Historical evidence of forest composition in the Bluegrass Region of Kentucky. Pages 231-246 in: Proceedings of the Seventh Central Hardwood Forest Conference, Southern Illinois University, Carbondale.

Campbell, Julian J. N. Personal communication. Kentucky Field Office, The Nature Conservancy.

Christy, S. 1973. An analysis of the woody vegetation on the South Platte River flood plain in northeastern Colorado. Unpublished thesis, University of Northern Colorado, Greeley. 82 pp.

Davidson, U. M. 1950. The original vegetation of Lexington, Kentucky and vicinity. M.S. thesis, University of Kentucky, Lexington. 45 pp.

Diamond, D. D. 1993. Classification of the plant communities of Texas (series level). Unpublished document. Texas Natural Heritage Program, Austin. 25 pp.

Eggers, S. D., and D. M. Reed. 1987. Wetland plants and plant communities of Minnesota and Wisconsin. U.S. Army Corps of Engineers, St. Paul District, St. Paul, MN. 201 pp.

Evans, M. 1991. Kentucky ecological communities. Draft report to the Kentucky Nature Preserves Commission. 19 pp.

Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.

Faber-Langendoen, D., and Midwest State Natural Heritage Program Ecologists. 1996. Terrestrial vegetation of the midwest United States. International classification of ecological communities: Terrestrial vegetation of the United States. The Nature Conservancy, Arlington, VA.

Felix, A. C., III, T. L. Sharik, B. S. McGinnes, and W. C. Johnson. 1983. Succession in loblolly pine plantations converted from second growth forest in the central Piedmont of Virginia. The American Midland Naturalist 110:365-380.

Fike, J. 1999. Terrestrial and palustrine plant communities of Pennsylvania. Pennsylvania Natural Diversity Inventory. Pennsylvania Department of Conservation and Recreation. Bureau of Forestry. Harrisburg, PA. 86 pp.

Fleming, G. P., and P. P. Coulling. 2001. Ecological communities of the George Washington and Jefferson national forests, Virginia. Preliminary classification and description of vegetation types. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. 317 pp.

Fleming, G. P., P. P. Coulling, D. P. Walton, K. M. McCoy, and M. R. Parrish. 2001. The natural communities of Virginia: Classification of ecological community groups. First approximation. Natural Heritage Technical Report 01-1. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. Unpublished report. January 2001. 76 pp.

Fleming, Gary P. Personal communication. Ecologist, Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA.

Flores, D. L. 1984. Jefferson and southwestern exploration. The Freeman and Curtis accounts of the Red River Expedition of 1806. University of Oklahoma Press.

FNAI [Florida Natural Areas Inventory]. 1992a. Natural communities. Unpublished document. The Nature Conservancy, Florida Natural Areas Inventory, Tallahassee. 6 pp.

FNAI [Florida Natural Areas Inventory]. 1992b. Natural community classification. Unpublished document. The Nature Conservancy, Florida Natural Areas Inventory, Tallahassee. 16 pp.

Foti, T., compiler. 1994b. Natural vegetation classification system of Arkansas, draft five. Unpublished document. Arkansas Natural Heritage Commission, Little Rock. 8 pp.

Foti, T., M. Blaney, X. Li, and K. G. Smith. 1994. A classification system for the natural vegetation of Arkansas. Proceedings of the Arkansas Academy of Science 48:50-53.

Foti, Tom. Personal communication. Ecologist. Arkansas Natural Heritage Commission, Little Rock.

Fountain, M. S., and J. M. Sweeney. 1985. Ecological assessment of the Roaring Branch Research Natural Area. USDA Forest Service, Southern Forest Experiment Station. Research Paper SO-213. New Orleans, LA. 15 pp.

Fralish, J. S. 1988b. Predicting potential stand composition from site characteristics in the Shawnee Hills Forest of Illinois. The American Midland Naturalist 120(1):79-101.

Fralish, J. S., F. B. Crooks, J. L. Chambers, and F. M. Harty. 1991. Comparison of presettlement, second-growth and old-growth forest on six site types in the Illinois Shawnee Hills. The American Midland Naturalist 125:294-309.

Gallyoun, M., G. Meyer, A. Andreu, and W. Slocumb. 1996. Mapping vegetation communities with The Nature Conservancy's vegetation classification system on five small national parks in the southeastern USA. Unpublished report. The Nature Conservancy, Southeast Regional Office, Conservation Science Department, Chapel Hill, NC.

Golden, M. S. 1974. Forest vegetation and site relationships in the central portion of the Great Smoky Mountains National Park. Ph.D. dissertation, University of Tennessee, Knoxville. 275 pp.

Golden, M. S. 1979. Forest vegetation of the lower Alabama Piedmont. Ecology 60:770-782.

Grace, J. B., and R. G. Wetzel. 1981. Habitat partitioning and competitive displacement in cattail (*Typha*): Experimental field studies. The American Midland Naturalist 118:463-474.

Great Plains Flora Association. 1986. Flora of the Great Plains. University Press of Kansas, Lawrence. 1402 pp.

Hansen, P. L., R. D. Pfister, K. Boggs, B. J. Cook, J. Joy, and D. K. Hinckley. 1995. Classification and management of Montana's riparian and wetland sites. Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Miscellaneous Publication No. 54. 646 pp. + posters.

Hansen, P., K. Boggs, and R. Pfister. 1991. Classification and management of riparian and wetland sites in Montana. Unpublished draft version prepared for Montana Riparian Association, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula. 478 pp.

Harcombe, P. A., and J. E. Neaville. 1977. Vegetation types of Chambers County, Texas. The Texas Journal of Science 29:209-234.

Heath, M. E., D. S. Metcalfe, and R. E. Barnes. 1973. Forages: the science of grassland agriculture. Iowa State University Press, Ames.

Heineke, T. E. 1987. The flora and plant communities of the middle Mississippi River Valley. Ph.D. dissertation, Southern Illinois University, Carbondale. 653 pp.

Hoagland, B. 2000. The vegetation of Oklahoma: A classification for landscape mapping and conservation planning. The Southwestern Naturalist 45(4):385-420.

Hoagland, B. W. 1997. Preliminary plant community classification for Oklahoma. Unpublished draft document, version 35629. University of Oklahoma, Oklahoma Natural Heritage Inventory, Norman. 47 pp.

Hoagland, B. W. 1998a. Classification of Oklahoma vegetation types. Working draft. University of Oklahoma, Oklahoma Natural Heritage Inventory, Norman. 43 pp.

Hoagland, B. W. 1998c. Oklahoma riparian vegetation. In: A. Fallon and M. Smolen, editors. Riparian area management handbook. Publication number E-952. Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater.

Horn, J. C. 1980. Short-term changes in vegetation after clearcutting in the southern Appalachians. Castanea 45:88-96.

Hughes, R. H. 1966. Fire ecology of canebrakes. Proceedings of the Tall Timbers Fire Ecology Conference 5:149-158.

Jackson, M. T. 1979. A classification of Indiana plant communities. Proceedings of the Indiana Academy of Science 89:159-171.

Jones, G. P., and G. M. Walford. 1995. Major riparian vegetation types of eastern Wyoming. Submitted to Wyoming Department of Environmental Quality, Water Quality Division. Wyoming Natural Diversity Database, Laramie, WY. 245 pp.

Jones, S. M. 1988a. Old-growth forests within the Piedmont of South Carolina. Natural Areas Journal 8:31-37.

Jones, S. M. 1988b. Old-growth, steady state forests within the Piedmont of South Carolina. Ph.D. dissertation, Clemson University, Clemson, SC. 94 pp.

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

Kittel, G., E. Van Wie, M. Damm, R. Rondeau, S. Kettler, and J. Sanderson. 1999a. A classification of the riparian plant associations of the Rio Grande and Closed Basin watersheds, Colorado. Unpublished report prepared by the Colorado Natural Heritage Program, Colorado State University, Fort Collins.

Kittel, G., R. Rondeau, and A. McMullen. 1996. A classification of the riparian vegetation of the Lower South Platte and parts of the Upper Arkansas River basins, Colorado. Submitted to Colorado Department of Natural Resources and the Environmental Protection Agency, Region VIII. Prepared by Colorado Natural Heritage Program, Fort Collins. 243 pp.

Klimas, C. V. 1988b. Forest vegetation of the leveed floodplain of the lower Mississippi River. U.S. Army Corps of Engineers, Waterways Experimental Station, Lower Mississippi River Environmental Program. Report No. 11. Vicksburg, MS. 281 pp.

Komarkova, V. 1976. Alpine vegetation of the Indian Peaks Area, Front Range, Colorado Rocky Mountains. Unpublished dissertation, University of Colorado, Boulder. 655 pp.

Komarkova, V. 1986. Habitat types on selected parts of the Gunnison and Uncompahgre national forests. Unpublished final report prepared for USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO. 270 pp. plus appendices.

Kovalchik, B. L. 1993. Riparian plant associations on the national forests of eastern Washington - Draft version 1. USDA Forest Service, Colville National Forest, Colville, WA. 203 pp.

Lindauer, I. E. 1978. A comparison of the vegetative communities of the South Platte and Arkansas River drainages in eastern Colorado. Pages 56-72 in: W. D. Graul and S. J. Bissel, editors. Lowland River and Stream Habitat in Colorado: A Symposium, 4-5 October 1978. Colorado Chapter of Wildlife Society and Audubon Council.

Lindauer, I. E., and S. J. Christy. 1972. An analysis of the woody vegetation on the South Platte River floodplain in northeastern Colorado. Unpublished report to the U.S. Bureau of Reclamation, Denver, CO, by the University of Northern Colorado, Biology Department, Greeley.

Martin, D. L., and L. M. Smith. 1991. A survey and description of the natural plant communities of the Kisatchie National Forest, Winn and Kisatchie districts. Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA. 372 pp.

Martin, D. L., and L. M. Smith. 1993. A survey and description of the natural plant communities of the Kisatchie National Forest, Evangeline and Catahoula districts. Louisiana Department of Wildlife and Fisheries, Baton Rouge. 274 pp.

Masek, J. 1979. Vegetation community descriptions for the South Platte River in Colorado and Nebraska. Unpublished report prepared for the Water and Power Resources Service, Denver, CO. 23 pp.

McClain, W. E. Personal communication. Ecologist, Illinois Department of Natural Heritage.

McCoy, D. A. 1958. Vascular plants of Pontotoc County, Oklahoma. American Midland Naturalist 59:371-396.

McEachern, K. 1979. Population biology of *Populus sargentii* in northeastern Colorado. Unpublished thesis, University of Northern Colorado, Greeley. 41 pp.

McGee, C. E., and R. M. Hooper. 1970. Regeneration after clearcutting in the southern Appalachians. USDA Forest Service. Research Paper SE-70. 12 pp.

McInteer, B. B. 1952. Original vegetation in the Bluegrass Region of Kentucky. Castanea 17:153-164.

McLeod, D. E. 1988. Vegetation patterns, floristics, and environmental relationships in the Black and Craggy mountains of North Carolina. Ph.D. dissertation, University of North Carolina, Chapel Hill. 222 pp.

Meanley, B. 1972. Swamps, river bottoms and canebrakes. Barre Publishing, Barre, MA. 142 pp.

Mitsch, W. J., and J. G. Gosselink. 1993. Wetlands. Second edition. Van Nostrand Reinhold Company, New York. 722 pp.

MNNHP [Minnesota Natural Heritage Program]. 1993. Minnesota's native vegetation: A key to natural communities. Version 1.5. Minnesota Department of Natural Resources, Natural Heritage Program, St. Paul, MN. 110 pp.

Mohlenbrock, R. H. 1959. A floristic study of a southern Illinois swampy area. Ohio Journal of Science 59:89-100.

Mohr, C. T. 1901. Plant life of Alabama. Contrib. U.S. National Herbarium No. 6. Washington, DC. 921 pp.

Monk, C. D., D. W. Imm, and R. L. Potter. 1990. Oak forests of eastern North America. Castanea 55(2):77-96.

Monk, C. D., D. W. Imm, R. L. Potter, and G. G. Parker. 1989. A classification of the deciduous forest of eastern North America. Vegetatio 80:167-181.

Muldavin, E., B. Sims, and L. Johnson. 1993b. Pecos Wild and Scenic River in stream flow report. Final Report prepared for the USDA National Forest Service, Santa Fe National Forest, Santa Fe, NM.

Muldavin, E., P. Durkin, M. Bradley, M. Stuever, and P. Mehlhop. 2000a. Handbook of wetland vegetation communities of New Mexico: Classification and community descriptions (volume 1). Final report to the New Mexico Environment Department and the Environmental Protection Agency prepared by the New Mexico Natural Heritage Program, University of New Mexico, Albuquerque, NM.

NatureServe Ecology - Southeastern United States. No date. Unpublished data. NatureServe, Durham, NC.

Nelson, J. B. 1986. The natural communities of South Carolina: Initial classification and description. South Carolina Wildlife and Marine Resources Department, Division of Wildlife and Freshwater Fisheries, Columbia, SC. 55 pp.

Nigh, Tim A. Personal communication. Ecologist, Missouri Conservation Commission, Jefferson City.

Nuttall, T. 1821. A journal of travels into the Arkansas territory during the year 1819. T. H. Palmer, Philadelphia. (Re-published 1980. University of Oklahoma Press, Norman.)

Oakley, S. C., H. E. LeGrand, Jr., and M. P. Schafale. 1995. An inventory of mafic natural areas in the North Carolina Piedmont. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program, Raleigh. 252 pp.

Oberholster, C. 1993. Preliminary list of natural communities of Alabama. Unpublished document. Alabama Department Conservation and Natural Resources, Natural Heritage Section, Montgomery, AL. 6 pp.

Oosting, H. J. 1942. An ecological analysis of the plant communities of Piedmont, North Carolina. The American Midland Naturalist 28:1-127.

Padgett, W. G., A. P. Youngblood, and A. H. Winward. 1989. Riparian community type classification of Utah and southeastern Idaho. USDA Forest Service, Intermountain Region. Report R4-ECOL-89-01. Ogden, UT. 191 pp.

Patterson, Karen D. Personal communication. Ecologist, Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA.

Peet, R. K., and N. L. Christensen. 1980. Hardwood forest vegetation of the North Carolina Piedmont. Veroeff. Geobot. Inst. Eidg. Tech. Hochsch., Stift. Ruebel Zuer. 69:14-39.

Peet, R. K., T. R. Wentworth, M. P. Schafale, and A.S. Weakley. 2002. Unpublished data of the North Carolina Vegetation Survey. University of North Carolina, Chapel Hill.

Pell, W. F., and J. H. Rettig, compiler. 1983. Arkansas natural community abstracts. Arkansas Natural Heritage Commission, Little Rock. 37 pp.

Penfound, W. T. 1953. Plant communities of Oklahoma lakes. Ecology 34:561-583.

Phillips, D. L., and D. J. Shure. 1990. Patch-size effects on early succession in southern Appalachian forests. Ecology 71:204-212.

Platt, S. G., and C. G. Brantley. 1992. The management and restoration of switchcane (Louisiana). Restoration Management Notes 10:84-85.

Platt, S. G., and C. G. Brantley. 1997. Canebrakes: An ecological and historical perspective. Castanea 62:8-21.

Pyne, M. 1994. Tennessee natural communities. Unpublished document. Tennessee Department of Conservation, Ecology Service Division, Nashville. 7 pp.

Rawinski, T. J. 1992. A classification of Virginia's indigenous biotic communities: Vegetated terrestrial, palustrine, and estuarine community classes. Unpublished document. Virginia Department of Conservation and Recreation, Division of Natural Heritage. Natural Heritage Technical Report No. 92-21. Richmond, VA. 25 pp.

Ribbeck, K. Personal communication. Louisiana Department of Forestry.

Robertson, P. A., and A. L. Heikens. 1994. Fire frequency in oak-hickory forests of southern Illinois. Castanea 59(3):286-291.

Robertson, P. A., M. D. MacKenzie, and L. F. Elliott. 1984. Gradient analysis and classification of the woody vegetation for four sites in southern Illinois and adjacent Missouri. Vegetatio 58:87-104.

Sawyer, J. O., and T. Keeler-Wolf. 1995. A manual of California vegetation. California Native Plant Society, Sacramento. 471 pp.

Schafale, M. 1998b. Fourth approximation guide. High mountain communities. March 1998 draft. North Carolina Natural Heritage Program, Raleigh.

Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina. Third approximation. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program, Raleigh. 325 pp.

Schafale, Mike P. Personal communication. Ecologist, North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program, Raleigh.

Schmalzer, P. A. 1978. Classification and analysis of forest communities in several coves of the Cumberland Plateau in Tennessee. M.S. thesis, University of Tennessee, Knoxville. 24 pp.

Segadas-Vianna, F. 1951. A phytosociological and ecological study of cattail stands in Oakland County, Michigan. Journal of Ecology 39:316-329.

Simkins, E. C. 1931. The alpine flora of Mt. Niwot, Colorado. Unpublished thesis, University of Colorado, Boulder. 68 pp.

Skeen, J. N., M. E. B. Carter, and H. L. Ragsdale. 1980. Yellow-poplar: The Piedmont case. Bulletin of the Torrey Botanical Club 107:1-6.

Smeins, F. E., D. D. Diamond, and C. W. Hanselka. 1992. Coastal Prairie. Pages 269-290 in: R. T. Coupland, editor. Natural Grasslands. Elsevier, New York.

Smith, T. L. 1991. Natural ecological communities of Pennsylvania. First revision. Unpublished report. Pennsylvania Science Office of The Nature Conservancy, Middletown, PA. 111 pp.

Sneddon, L., M. Anderson, and K. Metzler. 1996. Community alliances and elements of the Eastern Region. Unpublished report. The Nature Conservancy, Eastern Heritage Task Force, Boston, MA. 235 pp.

Swain, P. C., and J. B. Kearsley. 2001. Classification of natural communities of Massachusetts. September 2001 draft. Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife. Westborough, MA.

Tarr, J., G. Botkin, E. L. Rice, E. Carpenter, and M. Hart. 1980. A broad analysis of fifteen sites in the tall-grass prairie of Oklahoma. Proceedings of the Oklahoma Academy of Science 60:39-42.

Tassin, K. Personal communication. Ecologist, The Nature Conservancy, Georgia Field Office, Atlanta, GA.

Thomas, R. D. 1966. The vegetation and flora of Chilhowee Mountain. Ph.D. dissertation, University of Tennessee, Knoxville. 355 pp.

TNC [The Nature Conservancy]. [1998]b. Classification of the vegetation of Congaree Swamp National Monument. Report to BRD-NPS Vegetation Mapping Program. The Nature Conservancy, Southern Conservation Science, Chapel Hill, NC. 67 pp.

TNC [The Nature Conservancy]. 1995b. Element Stewardship Abstract for North American cattails. The Nature Conservancy, Arlington, VA. 16 pp.

TNC [The Nature Conservancy]. 1998a. An investigation and assessment of the vegetation of Arnold Air Force Base. Coffee and Franklin counties, Tennessee. The Nature Conservancy, Tennessee Field Office, Nashville. 37 pp. plus appendices.

Tolstead, W. L. 1942. Vegetation of the northern part of Cherry County, Nebraska. Ecological Monographs 12(3):257-292.

USFS [U.S. Forest Service]. 1988. Silvicultural examination and prescription field book. USDA Forest Service, Southern Region. Atlanta, GA. 35 pp.

USFS [U.S. Forest Service]. 1990. Establishment record for Dismal Hollow Research Natural Area within Ozark National Forest, Newton County, Arkansas. Unpublished document. USDA Forest Service, Ozark National Forest, Russellville, AR. 20 pp. plus map.

Voigt, J. W., and R. H. Mohlenbrock. 1964. Plant communities of southern Illinois. Southern Illinois University Press, Carbondale. 202 pp.

West, E. M. 1934. Canebrakes of the southeastern United States. Ph.D. dissertation, Ohio State University, Columbus.

Wharton, C. H. 1978. The natural environments of Georgia. Georgia Department of Natural Resources, Atlanta. 227 pp.

Wharton, C. H., W. M. Kitchens, E. C. Pendleton, and T. W. Sipe. 1982. The ecology of bottomland hardwood swamps of the Southeast: A community profile. U.S. Fish and Wildlife Service, Office of Biological Services. FWS/OBS-81/37. Washington, DC.

Wieland, Ron G. Personal communication. Ecologist, Mississippi Department of Wildlife, Fisheries, and Parks, Museum of Natural Science, Natural Heritage Program, Jackson, MS.

Youngblood, A. P., W. G. Padgett, and A. H. Winward. 1985a. Riparian community type classification of eastern Idaho-western Wyoming. USDA Forest Service, Intermountain Region. R4-Ecol-85-01. Ogden, UT. 78 pp.

Zanoni, T. A., P. G. Risser, and I. H. Butler. 1979. Natural areas for Oklahoma. Oklahoma Natural Heritage Program, Norman. 72 pp.

Zollner, Douglas. Personal communication. Ecologist, The Nature Conservancy, Arkansas Field Office, Little Rock.

Appendix III. Photos of selected plots, plants, and people of Ninety Six National Historic Site.

Plot 1 at Ninety Six National Historic Site.

Plot 2 at Ninety Six National Historic Site.

Plot 3 at Ninety Six National Historic Site.

Plot 4 at Ninety Six National Historic Site.


Plot 5 at Ninety Six National Historic Site.


Plot 6 at Ninety Six National Historic Site.


Plot 7 at Ninety Six National Historic Site.


Plot 8 at Ninety Six National Historic Site.


Plot 9 at Ninety Six National Historic Site.


Plot 10 at Ninety Six National Historic Site.


Plot 12


Plot 13


Plot 14 at Ninety Six National Historic Site.


Plot 15 at Ninety Six National Historic Site.


Atamasco lily (Zephyranthes atamasco)


American columbo (Frasera caroliniensis)

Appendix IV. Key to EcoGroups and Ecological Communities of Ninety Six National Historic Park.

This key was developed for Ninety Six National Historic Park and is intended to allow field workers and naturalists to quickly identify community types while in the field. Due to the small size of the park and the limited habitat types available within the park boundary, this key does not cover all of the ecosystems of the adjacent region. However, within the boundary, we believe this key represents the range of variation of existing vegetation.

The document is structured like a dichotomous key. The user must make a series of choices based on the structure, composition, and environment of the vegetation to arrive at the correct association. If the key leads to a choice that is not reasonable, consider returning to the beginning of the key and reviewing your decisions to confirm that you are confident in all your choices. It may be useful to walk around the area in question to get a feel for the composition of the area. This exercise may help you arrive at the correct place in the key since small-scale variations within a matrix community may be misleading. In addition, ecotones between ecological communities may have traits of both communities and so may need to be classified as both communities.

Where appropriate, the name of the NatureServe System appears in **BOLD AND CAPITAL LETTERS**. The system is a broader concept than the association level, so similar communities may fall out in one system. The code (e.g. CEGL002591) appears alongside an italicized title of the type. The CEGL code may be used to refer back to the document or to look association names and information up in other references that use the National Vegetation Classification.

Key to Ecological Communities of Ninety Six National Historic Park

A.Early successional or exotic species dominated forests, shrublands, and fields (<50 years since last major disturbance). These communities are generally dominated by one or two species in the dominant strata (for instance, all loblolly pine) and are generally not very species diverse. Most of the trees or shrubs in the stands are even aged, evidence that they all were generated from one stand-destroying event in the past, such as plowing and agriculture or clear cutting.

1.Dominated by exotic species in dominant strata

EXOTIC SPECIES DOMINATED SYSTEM

a.Community dominated by herbaceous vegetation

Cultivated meadow – 4048

b.Shrubland or vineland

1.Community dominated by an exotic species of vine (wisteria), with some areas approaching a shrubland where vines have toppled canopy trees and created large gaps

Wisteria Vineland - 8568

2.Community dominated by shrub or bamboo.

a.Nearly 100% dominated by golden bamboo

Golden Bamboo Shrubland - 8560

b.Nearly 100% dominated by privet with <10% overtopping canopy trees

Chinese Privet Upland Shrubland - 3807

2.Dominated by native species in dominant strata
EARLY SUCCESSIONAL SYSTEM
a.Not forested
1.Community dominated by herbaceous vegetation with mostly native old field species, especially broomsedge
Successional Broomsedge Vegetation - 4044

2.Community dominated by shrubs – mainly blackberry and greenbrier
Blackberry – Greenbrier Successional Shrubland Thicket - 4732

b.Forested
1.Forest located in flat area near creek or wet flat area near ponds or upland nutrient rich old homesites.
a.Canopy dominated by black walnut (at least 50%) often with hackberry
Successional black walnut forest – 7879

b.Canopy dominated by sweetgum (at least 50%) and red maple
Sweetgum Forest – 7216

2.Forest located in uplands or on slopes along creek
a.Canopy dominated by conifers, specifically loblolly pine (at least 50% of canopy)
Successional Loblolly Pine – Sweetgum Forest – 8462

b.Canopy dominated by hardwoods
1.Canopy dominated by water oak (usually at least 50% of canopy) as well as willow oak and sweetgum
Water Oak Forest - 4638

2.Canopy dominated by tulip poplar (at least 50%) with red maple and oak species
Successional Tuliptree – Hardwood Forest - 7221

B.Later successional forest and/or wetland not dominated by exotic species in the dominant stratum. These communities are generally more species diverse than early successional communities. In addition, their structure is generally more complex (not even-aged) and they don't have obvious signs of recent human disturbance.
1.Wetlands and communities within floodplains of creeks
a.Standing water for most of year
POND SYSTEM
Southern Cattail Marsh – 4150

b.Temporarily flooded
1.Shrubland

SOUTHERN PIEDMONT SMALL FLOODPLAIN AND RIPARIAN FOREST
Floodplain Canebrake – 3836 – only exists in small isolated patches under new tree blowdowns in floodplain

2.Forested

a.Community dominated by various oaks (at least 50% of canopy)
SOUTHERN PIEDMONT LARGE FLOODPLAIN FOREST
Southern Piedmont Oak Bottomland Forest - 8487

b.Community not dominated by oaks (< 50% oak dominance) Canopy dominated by a combination of ash (25-75%), boxelder (10-50%), and often sycamore, walnut, and cottonwood.
ATLANTIC COASTAL PLAIN SMALL BROWNWATER RIVER FLOODPLAIN FOREST
Southeastern Coastal Plain Flat Terrace Forest - 7730

2.Upland communities – including those of slopes adjacent to creeks

a.Community restricted to north facing slopes along creek banks; this community type is mesic with basic soil tendencies, beech and maple in understory.
SOUTHERN PIEDMONT MESIC FOREST
Piedmont Basic Mesic Mixed Hardwood Forest - 8466

b.Community, for the most part, on upland areas except for steep north facing slopes along creek banks. Acidic and low diversity, with sourwood and dogwood in understory.
SOUTHERN PIEDMONT DRY OAK – (PINE) FOREST

1.Dominated by a combination of white oak, northern red oak, and hickory – usually just upslope from 8466
Piedmont Dry – Mesic Oak – Hickory Forest - 8475

2.Dominated by a combination of southern red oak, black oak, and white oak – drier than 8475
Interior Southern Red Oak – White Oak Forest - 7244