



Terrestrial Vegetation Monitoring at Chattahoochee River National Recreation Area

2021 Data Summary

Natural Resource Data Series NPS/SECN/NRDS—2024/1407





ON THIS PAGE

Non-native, invasive plant species were frequently encountered in vegetation monitoring plots of Chattahoochee River National Recreation Area. In this plot, autumn olive (*Elaeagnus umbellata*)—with its showy round, red berries—dominates the shrub stratum along with Chinese privet (*Ligustrum sinense*; not pictured). The site is within the floodplain of the Chattahoochee River on the southern end of the Jones Bridge Unit, south of the Chattahoochee River Environmental Education Center.

NPS photo / M. Forbes Boyle (SECN Botanist).

ON THE COVER

Vegetation plots established during this monitoring effort were stratified into two types of broadly defined habitats of Chattahoochee River National Recreation Area—Piedmont Upland Forests (left) and Piedmont Alluvial Wetlands (right).

NPS photos / Elizabeth Rico.

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Cumberland Island National Seashore
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The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible and technically accurate.

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Contents

	Page
Figures	iv
Tables	v
Appendices	vi
Acknowledgments	vii
Executive Summary	viii
List of Terms	ix
Introduction	1
Overview	1
Monitoring Objectives	1
Methods	2
Study Area	2
Sampling Design	5
Nomenclature Standard, Growth Form Determination, and Conservation Status	5
Sampling Methodology	5
Results and Discussion	10
Piedmont Alluvial Wetland Vegetation	15
Species Diversity and Abundance	16
Woody Stem Metrics	17
Disturbance and Threats	21
Geomorphology and Soil	22
Piedmont Upland Forests	25
Species Diversity and Abundance	26
Trees	26
Woody Stem Metrics	27
Disturbance and Threats	27
Geomorphology and Soil	28
Fuel Load Estimates	30
North Unit	30
Middle Unit	30
South Unit	30
Literature Cited	33

Figures

	Page
Figure 1. Location of Chattahoochee River National Recreation Area in Georgia.	4
Figure 2. Southeast Coast Network terrestrial vegetation monitoring plot locations within the North and South land parcels of Chattahoochee River National Recreation Area	6
Figure 3. Southeast Coast Network terrestrial vegetation monitoring plot locations within the Middle land parcel of Chattahoochee River National Recreation Area.	7
Figure 4. The layout of the sampling plot for the Southeast Coast Network, which is a modified version of the standard Level 5 Carolina Vegetation Survey plot.	8
Figure 5. Georgia Exotic Pest Plant Council Category 1 invasive species count from 30 vegetation monitoring plots established within Chattahoochee River National Recreation Area in 2021	11
Figure 6. Thirteen Piedmont Alluvial Wetland Vegetation plots were established during this monitoring at Chattahoochee River National Recreation Area in June and July 2021.	16
Figure 7. Relative proportion of species groups across three woody stem strata—trees, saplings, and seedlings— within Piedmont Alluvial Wetland monitoring plots of Chattahoochee River National Recreation Area.	19
Figure 8. Health status of woody stems greater than or equal to 10 centimeters (3.9 in) DBH (“trees”) measured on Piedmont Alluvial Wetland monitoring plots of Chattahoochee River National Recreation Area.	20
Figure 9. Seventeen plots within Piedmont Upland Forest habitat of Chattahoochee River National Recreation Area were sampled during this monitoring event.	26
Figure 10. Relative proportion of species groups across three woody stem strata—trees, saplings, and seedlings— within Piedmont Upland Forest monitoring plots of Chattahoochee River National Recreation Area.	28
Figure 11. Health status of woody stems greater than or equal to 10 centimeters (3.9 in) DBH (“trees”) measured on Piedmont Upland Forest and Shrubland monitoring plots of Chattahoochee River National Recreation Area	29
Figure 12. Fuel load estimates from vegetation monitoring plots located on the North and South land parcels of Chattahoochee River National Recreation Area.	31
Figure 13. Fuel load estimates from vegetation monitoring plots located on the Middle land parcels of Chattahoochee River National Recreation Area.	32

Tables

	Page
Table 1. Vascular plant cover metrics of the Carolina Vegetation Survey (Peet et al. 1998) and used by the SECN terrestrial vegetation monitoring protocol (Boyle et al. 2019).	9
Table 2. Vascular plant species, subspecies, or varieties not reported from Zomlefer et al. (2012), Heath and Byrne (2014), or NPSpecies (NPS 2024) but found at Chattahoochee River National Recreation Area in 2021 through this current monitoring effort.	12
Table 3. Vascular plant species richness across multiple spatial scales on Southeast Coast Network vegetation plots located within Chattahoochee River National Recreation Area.	13
Table 4. Woody stem abundance and canopy metrics on Southeast Coast Network vegetation plots located in Chattahoochee River National Recreation Area.	18
Table 5. Disturbance observations and abundance (%cover) measured on vegetation monitoring plots of Chattahoochee River National Recreation Area.	21
Table 6. Local landform and hydrologic condition of vegetation monitoring plots at Chattahoochee River National Recreation Area.	22
Table 7. Soil nutrient status from vegetation monitoring plots at Chattahoochee River National Recreation Area.	23
Table A-1. Vascular plant species present in 30 vegetation monitoring plots within Chattahoochee River National Recreation Area, June-July 2021.	37
Table B-1. Constancy and average cover class for all vascular plant species observed in 30 Southeast Coast Network vegetation monitoring plots.	48
Table B-2. Basal area (BA, m ² /ha) and density (Den, count/ha) of woody vascular plant species observed in 30 Southeast Coast Network vegetation monitoring plots.	56

Appendices

Page

Appendix A. Vascular Plants Observed During the 2021 Southeast Coast Network Terrestrial Vegetation Monitoring Effort at Chattahoochee River National Recreation Area	36
Appendix B. Species Diversity, Abundance, and Woody Stem Metrics Summarized by Broadly Defined Habitats at Chattahoochee River National Recreation Area	48

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Top photo, from left, Matt Wood, Julieanne Montaquila, Wylie Paxton, Elizabeth Rico, Rob Klein, Forbes Boyle, and Tom Govus. NPS photo / SECN staff. Left photo, from left, Parker Smith, Tom Govus, Jack Dellapenna, and Allyson Read. NPS photo / Elizabeth Rico.

Executive Summary

The Southeast Coast Network (SECN) conducts long-term terrestrial vegetation monitoring as part of the NPS Inventory and Monitoring Program. The vegetation community vital sign is one of the primary-tier resources identified by SECN park managers, and monitoring is conducted at 15 network parks (DeVivo et al. 2008). Monitoring plants and their associated communities over time allows for targeted understanding of ecosystems within the SECN geography, which provides managers information about the degree of change within their parks' natural vegetation.

2021 marked the first year of conducting this monitoring effort at Chattahoochee River National Recreation Area (CHAT). Thirty vegetation plots were established throughout the park from June through July. Data collected in each plot included species richness across multiple spatial scales, species-specific cover and constancy, species-specific woody stem seedling/sapling counts and adult tree (greater than 10 centimeters [3.9 inches {in}]) diameter at breast height (DBH), overall tree health, landform, soil, observed disturbance, and woody biomass (i.e., fuel load) estimates.

This report summarizes the baseline (year 1) terrestrial vegetation data collected at Chattahoochee River National Recreation Area in 2021. Data were stratified across two dominant broadly defined habitats within the park, including Piedmont Upland Forests and Piedmont Alluvial Wetland Vegetation and three land parcels: North—from Bowman's Island to Abbotts Bridge, Middle—from Medlock Bridge to Gold Branch, and South—from Sope Creek to Palisades. Noteworthy findings include:

- 299 vascular plant taxa were observed across 30 vegetation plots, including 29 species not previously documented within the park.
- The most frequently encountered species in each broadly defined habitat included:
 - Piedmont Alluvial Wetland Vegetation: Chinese privet (*Ligustrum sinense*), sweetgum (*Liquidambar styraciflua*), eastern poison ivy (*Toxicodendron radicans* var. *radicans*), muscadine (*Muscadinia rotundifolia* var. *rotundifolia*), and smallspike false nettle (*Boehmeria cylindrica*).
 - Piedmont Upland Forests: tuliptree (*Liriodendron tulipifera* var. *tulipifera*), eastern poison ivy, Virginia creeper (*Parthenocissus quinquefolia*), cat greenbrier

(*Smilax glauca*), muscadine, mockernut hickory (*Carya tomentosa*), and black edge sedge (*Carex nigromarginta*).

- Sixteen non-native species categorized as invasive by the Georgia Exotic Pest Plant Council (GA-EPPC 2023) were encountered during this monitoring effort, including two not previously detected within the park—miniature beefsteak plant (*Mosla dianthera*) and Chinese holly (*Ilex cornuta*). Chinese privet and Japanese honeysuckle (*Lonicera japonica*) were the most frequently encountered and abundant invasive plant within the park.
- One species of special concern listed for Georgia (GADNR 2024) was observed during this monitoring effort—large-fruited sanicle (*Sanicula trifoliata*).
- Tuliptree, loblolly pine (*Pinus taeda*), boxelder (*Acer negundo* var. *negundo*), river birch (*Betula nigra*), and sweetgum were the most dominant species within the tree stratum of Piedmont Alluvial Wetlands of Chattahoochee River National Recreation Area; white oak (*Quercus alba*), loblolly pine, tuliptree, and mockernut hickory were the most dominant species of Piedmont Upland Forests.
- Chinese privet was the most abundant species within the sapling and seedling strata of Piedmont Alluvial Wetlands.
- The mortality rate of green ash (*Fraxinus pennsylvanica*) within Piedmont Alluvial Wetland plots was high, and it is likely these trees succumbed to impacts from emerald ash borer (*Agrilus planipennis*). The emerald ash borer is a wood-boring pest of ash (*Fraxinus* sp.) and is native to Asia. Since its discovery in the U. S. in the early 2000s, the insect has been responsible for the death of tens of millions of ash trees in the eastern and midwestern parts of the country. At this time, it is not certain whether the declining health of ash within Chattahoochee River National Recreation Area is due to emerald ash borer, edaphic factors that are responsible for natural mortality and decline, or other factors.
- Other threats to native vegetation within the park are: (1) the high prevalence of non-native, invasive plant species; (2) fire suppression within oak-hickory; and (3) impacts from heavy browse by white-tailed deer (*Odocoileus virginianus*).
- All plots monitored during this sampling effort are scheduled to be resampled in 2024.

List of Terms

Aspect: The compass direction that a slope faces.

Basal Area (BA): The cross-sectional area of woody stems at DBH; used to describe the amount of area occupied by a single or group of stems. BA is expressed in this report as m²/ha (square meters per hectare).

Coarse Woody Debris (CWD): Downed woody stems on the ground that are either lying prone on the ground, or at least one end of the broken bole of a dead tree is touching the ground at an angle of greater than 45° from vertical. Coarse woody debris includes pieces of wood greater than 8 centimeters (3.1 inch [in]) in diameter (approximately 1,000-hour fuel class).

Constancy: The percentage of plots in a given dataset in which a species occurs.

Cover: The vertical projection of vegetation from the ground as viewed from above, and in this protocol is estimated as a percentage of area that covers the ground above the ground surface (areal cover).

Density: The number of individual woody stems in a given area.

DBH: Diameter at breast height of an individual woody stem, or 1.37 meters (4.5 feet [ft]) above the ground surface.

Duff: An organic fuel layer that lies below the litter layer and above mineral soil. It is made up of litter material that has decomposed to the point where individual pieces are no longer identifiable. In general, the duff layer is darker than the litter layer.

Fine Woody Debris (FWD): Pieces of wood less than 8 centimeters (3.1 in) in diameter. They are either (1) not attached to the woody stem where they once grew and have fallen to the ground, (2) not attached to the stem where they once grew and are supported off the ground by live or dead material, or (3) attached to stems of woody material that are themselves considered “dead” and “down.” Fine woody debris is composed of the following fire size classes: 1-hour fuels (0–0.64 centimeters [0–0.2 in]), 10-hour fuels (0.64–2.54 centimeters [0.2–1 in]), and 100-hour fuels (2.54–8.1 centimeters [1–3.2 in]).

Global / State Status: Conservation status assessment ranks developed by NatureServe (2024) and individual state Natural Heritage Programs used to determine the extinction risk of species and ecosystems at the global and state scales. Global codes are as follows:

- G1: Critically imperiled-very high risk of extinction
- G2: Imperiled-high risk of extinction
- G3: Vulnerable-moderate risk of extinction
- G4: Apparently Secure-fairly low risk of extinction
- G5: Secure-very low risk of extinction

Growth Form: The shape and physical appearance of a species, reflecting site conditions and genetics. In this report, the following growth forms, following definitions set by USDA (2024), are used:

- Tree: a perennial, woody plant with a single stem (trunk), normally greater than 4–5 meters (13.1–16.4 ft) in height
- Shrub: a perennial, multi-stemmed woody plant that is usually less than 4–5 meters (13.1–16.4 ft) in height
- Vine: a twining or climbing plant with relatively long stems; can be woody or herbaceous
- Herb/Forb: a plant without significant woody tissue and lacking significant thickening by secondary woody growth
- Graminoid: a grass or grass-like plant; includes grasses (*Poaceae*), sedges (*Cyperaceae*), and rushes (*Juncaceae*).

Litter: An organic fuel layer made up of twigs, dead grasses, recently fallen leaves, and pine or other needles where the individual pieces are still identifiable and not altered by decomposition.

Sapling: Any live woody stem more than 1.37 meters (4.5 ft) in height but less than 10 centimeters (3.9 in) in diameter at breast height (DBH).

Seedling: Any live woody stem with at least two true leaves that are less than 1.37 meters (4.5 ft) tall.

Slope: The rise and fall of a land surface.

Species Richness: The overall number of species, or group of species, within a defined area.

Terrain Shape Index (TSI): A quantitative expression of the geometric shape (ranging from concave to convex) of the land surface. Negative TSI values indicate convex shape, positive values indicate concavity, and values around 0 indicate flat surfaces.

Tree: Any woody stem more than 1.37 meters (4.5 ft) in height and greater than or equal to 10 centimeters (3.9 in) in diameter at breast height (DBH). This term is also used to describe a specific growth form (see Growth Form above).

Introduction

Overview

Vegetation communities are the primary drivers of a range of ecological processes and are integral to the proper function of park ecosystems. Moreover, vegetation communities integrate the biological and physical environment—they serve as the foundation for food webs, provide wildlife habitat for many species, function as a carbon sink, produce oxygen, and cycle nutrients and energy through an ecosystem. Parks within the Southeast Coast Network (SECN) host a diverse assemblage of plants and terrestrial communities. Vegetation communities vary widely. Approximately 180 vegetation associations (i.e., fine-resolution floristic description), as defined by the National Vegetation and Classification Standard, Version 2.0 (FGDC 2008), occur in SECN park units. A diversity of vegetation resources can be found in these parks, including dry grassland dunes, maritime oak and pine dominated forests, pyrogenic pine flatwoods, black and brown water floodplain forests, and Piedmont upland forests.

Vegetation communities are dynamic entities whose species composition, abundance, distribution, and structure are influenced by environmental factors and the impacts over time by natural and anthropogenic disturbances. For communities to be considered “natural,” native species must be predominately distributed across the landscape as a consequence of disturbance factors (i.e., stressors) or site condition (i.e., environmental factors; e.g., soil nutrients, landform; Comer et al. 2003). The timing, type, and extent of a disturbance generally evoke a distinguishable response in vegetation across the landscape (Turner et al. 1990; Foster et al. 1998). Natural disturbance processes in SECN parks include those brought about by fire regimes and weather patterns (e.g., hurricanes and drought), while anthropogenic influences include landscape fragmentation, fire suppression, altered hydrology, shifts in seasonal weather patterns, and non-native species introduction.

Determining trends in vegetation communities over time and identifying plant stressors is vital to understanding the ecological health of terrestrial ecosystems within SECN parks. Collectively, this information can be used to guide management actions that sustain a park’s ecological integrity and support plant conservation across a diversity of spatial scales. The Southeast Coast Network collects long-term data on vegetation communities using a protocol largely based on the forest monitoring approaches used by the Cumberland Piedmont Network (White et al. 2011) and the Gulf Coast Network (Carlson et al. 2018).

This report provides a summary of data collected during summer 2021 within Chattahoochee River National Recreation Area (CHAT) as part of the SECN’s terrestrial vegetation monitoring effort. This report is intended to provide CHAT resource managers and partners with: (a) baseline information on the composition, abundance, and structure of vegetation across broad habitat types; (b) documentation of observable stressors to park vegetation resources; and (c) a summary of ancillary data associated with terrestrial ecosystems (e.g., soil nutrient status and fuel abundance).

Monitoring Objectives

The overall objective of this effort is to detect meaningful changes in species composition and vegetation structure within natural and semi-natural vegetation communities of SECN parks and determine whether these changes are correlated with trends in key stressors.

The data presented herein are from the first iteration of sampling activities in Chattahoochee River National Recreation Area utilizing the SECN terrestrial vegetation monitoring protocol (Boyle et al. 2019). For this “baseline” status report, 2021 data were synthesized to answer the following questions across broad habitat types within the park:

- How does species richness vary across terrestrial vegetation communities?
- What is the status of composition and abundance among native versus non-native, invasive species?
- What are the most common plants encountered during monitoring, and conversely, were there rare species detected?
- In forests, woodlands, and shrublands, what is the relative frequency of woody seedlings, saplings, and subcanopy or canopy species?
- Do observable stressors appear to impact vegetation communities?
- What is the current condition of soil nutrient chemistry and fuel volume?

Methods

Study Area

Chattahoochee River National Recreation Area (CHAT) occurs along a 77 kilometer (48 mile [mi]) stretch of the Chattahoochee River north of Atlanta, Georgia (Figure 1). The park is in four Georgia counties (Cobb, Forsyth, Fulton, and Gwinnett) and runs from Buford Dam (below Lake Sidney Lanier) south to approximately Vinings. It is broken into multiple distinct parcels and organized into 16 distinct management units that vary in size from 17 to 300 hectares (42 to 741 acres [ac]; Cotten et al. 2019). These units are often named after such features as bridges, mills, or streams. Chattahoochee River National Recreation Area is one of the largest urban parks within the U. S. (Getty et al. 2001) and the park is the largest single green space within metropolitan Atlanta (Kunkle and Vana-Miller 2000). Former President Jimmy Carter signed a congressional bill (16 United States Code 460ii) in 1978 which established the National Recreation Area, including parcels within the Palisades, Cochran Shoals, and Bowman's Island units. The original size of the park in 1978 was approximately 2,400 hectares (5,931 ac) while expansion in 1999 increased the overall size to 4,050 hectares (10,008 ac; Getty et al. 2001). Since 1999, there have been other acquisitions that have included land swaps (Cotten et al. 2019).

The land of the Chattahoochee River National Recreation has a long history of habitation and use by humans, including conversion of native forests to agriculture by Native Americans and early European settlers (Gerdes et al. 2007). In the mid to late 19th century, the river and its surroundings experienced impacts from significant industrial development—including the creation of grist mills, paper mills, and other manufacturing centers. The increased reliance of hydroelectric power in the 20th century resulted in the creation of two dams on the river—Morgan Falls Dam (which created Bull Sluice Reservoir) and Buford Dam (which created Lake Sidney Lanier).

A number of stressors and threats to vegetation resources are present within the park, many of which are related to large-scale land-use changes of the 19th and 20th centuries (described above) and current impacts from the population growth of Atlanta. Prior to the creation of the Buford Dam, large winter and early spring floods were common across the Chattahoochee River floodplain, with a frequency of occurrence between once and twice a decade (Collier et al. 1996). These extreme flood events are important for the creation of topographic variability across the floodplain (Opperman et al. 2010), thus creating heterogeneous habitat

for a diversity of plant species with unique moisture tolerance. Furthermore, dams accelerate bank erosion, create incised channels, and increase deposition in landforms that typically would not experience deposition (Hupp et al. 2009). Other threats to park vegetation resources include decades of fire suppression, visitor use impacts (e.g., “social” trails), competition from invasive non-native vegetation, and increases in point and non-point contaminants from outside park boundaries (DeVivo et al. 2008).

The distribution and composition of forested habitats within the park are largely determined by former land-use patterns, as well as by localized edaphic conditions. Like most of the vegetated uplands across the Southern Inner and Outer Piedmont ecoregion, the park's uplands are dominated by a mixture of early-to mid-successional pine (*Pinus* sp.), oak (*Quercus* sp.), and mixed hardwood forests, while alluvial habitats are dominated by a variety of hardwoods that can tolerate periodic flooding and soils that remain wet for most of the year (Cotten et al. 2019). There are also shrub- and graminoid-dominated wetlands along the Chattahoochee River and its tributaries (Cotten et al. 2019).

The most recent floristic survey within the Chattahoochee River National Recreation Area was conducted from 2006 to 2007 and reported 827 vascular plant species as vouchered for the park (Zomlefer et al. 2012), while NPSpecies lists 948 species as present within the park (NPS 2024). Of the 827 species listed in Zomlefer et al. (2012), 143 of these are non-native (19% of the flora) and 29 are cultivated exotics. Fifty of the non-native species are considered invasive by the Georgia Exotic Pest Plant Council (GA-EPPC 2023). Invasive species present on the park during the 2006–2007 survey that are ranked as either a Category 1 (a serious problem), Category 1-Alert (potential to be a serious problem), or Category 2 (a moderate problem) invasive plant in the updated GA-EPPC (2023) report include:

- Tree-of-heaven (*Ailanthus altissima*; Cat 1)
- Mimosa / Silk tree (*Albizia julibrissin*; Cat 1)
- Alligatorweed (*Alternanthera philoxeroides*; Cat 1)
- Small carpetgrass / Joint-head grass (*Arthraxon hispidus*; Cat 1-Alert)
- Round leaf bittersweet (*Celastrus orbiculatus*; Cat 1-Alert)
- Bermudagrass (*Cynodon dactylon*; Cat 2)

- Brazilian waterweed (*Egeria densa*; Cat 2)
- Silverthorn / thorny olive (*Elaeagnus pungens*; Cat 2)
- Autumn olive (*Elaeagnus umbellata*; Cat 1)
- English ivy (*Hedera helix* var. *helix*; Cat 1)
- Bicolor lespedeza / shrubby lespedeza (*Lespedeza bicolor*; Cat 1)
- Sericea lespedeza (*Lespedeza cuneata*; Cat 1)
- Oxeye daisy (*Leucanthemum vulgare*; Cat 2)
- Japanese privet (*Ligustrum japonicum*; Cat 2)
- Chinese privet (*Ligustrum sinense*; Cat 1)
- Japanese honeysuckle (*Lonicera japonica*; Cat 1)
- Amur honeysuckle (*Lonicera maackii*; Cat 2)
- Japanese climbing fern (*Lygodium japonicum*; Cat 1)
- Japanese stiltgrass / Nepalese browntop (*Microstegium vimineum*; Cat 1)
- Marsh dayflower (*Murdannia keisak*; Cat 1)
- Parrotfeather (*Myriophyllum aquaticum*; Cat 2)
- Sacred bamboo (*Nandina domestica*; Cat 2)

- Bahiagrass (*Paspalum notatum*; Cat 2)
- Princess tree (*Paulownia tomentosa*; Cat 1)
- Kudzu (*Pueraria montana* var. *lobata*; Cat 1)
- Bigleaf periwinkle (*Vinca major*; Cat 2)
- Common periwinkle (*Vinca minor*; Cat 2)
- Chinese wisteria (*Wisteria sinensis*; Cat 1)

There were no federally listed, endangered or threatened species vouchered for the park during the previous floristic survey, although at the time of the survey Georgia aster (*Symphyotrichum georgianum*) was a candidate for federal listing (Zomlefer et al. 2012). State protected species vouchered for the park included pink lady's slipper (*Cypripedium acaule*; status=unusual), large witch-alder (*Fothergilla major*; status=threatened), shoal's spiderlily (*Hymenocallis coronaria*; status=threatened), loose watermilfoil (*Myriophyllum* [*Melanthium*] *laxum*; status=rare), bay starvine (*Schisandra glabra*; status=threatened), and Ozark bunchflower (*Veratrum woodii*; status=rare); species of special concern for Georgia included American ginseng (*Panax quinquefolius*), woodland bulrush (*Scirpus expansus*), oval ladies'-tresses (*Spiranthes ovalis* var. *erostellata*), Epling's hedge-nettle (*Stachys eplingii*), and ash-leaf bush-pea (*Thermopsis fraxinifolia*; Zomlefer et al. 2012; GADNR 2024).

Chattahoochee River
National Recreation Area
Vegetation Sampling Units

Southeast Coast Network
National Park Service
U.S. Department of the Interior

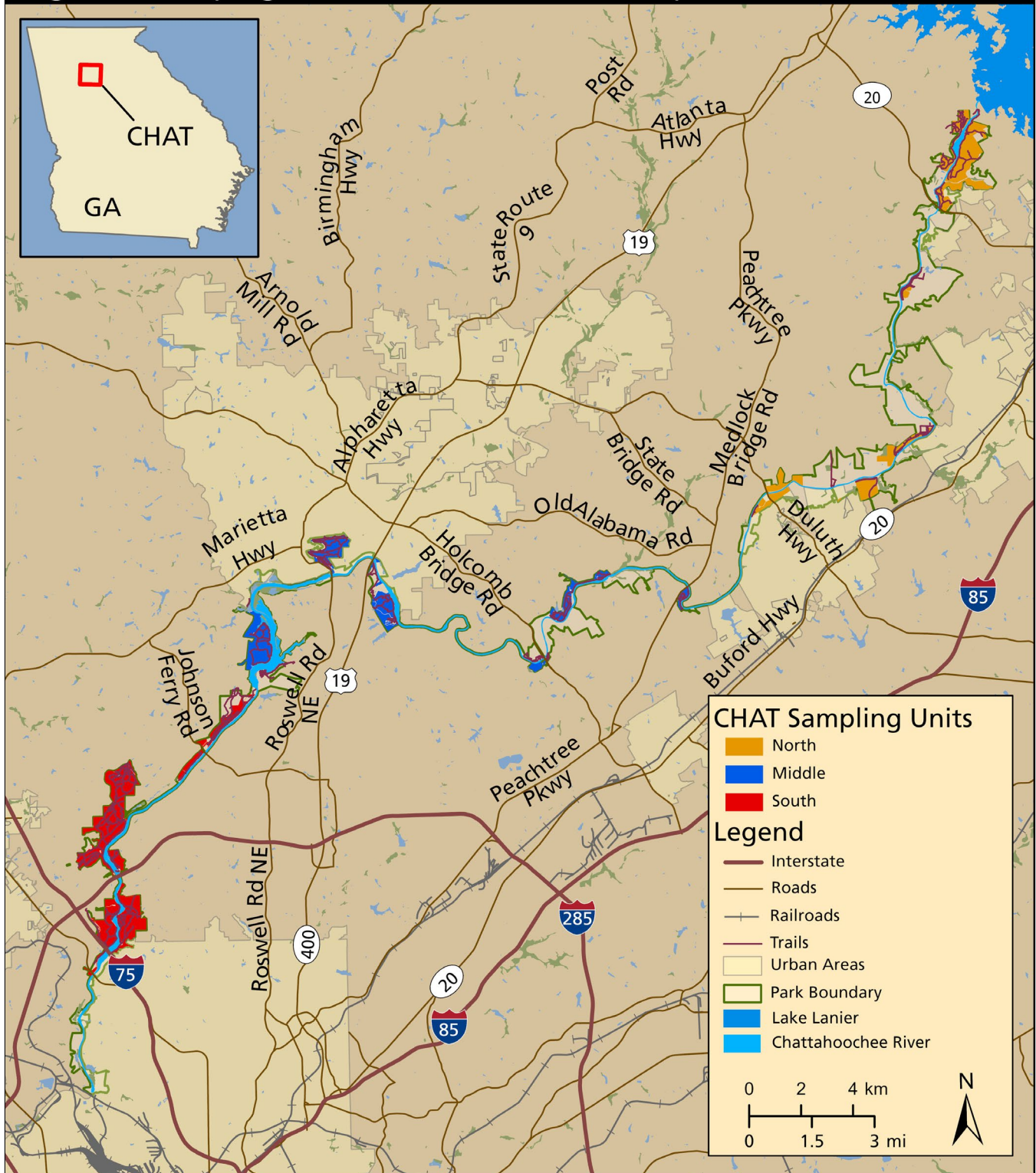


Figure 1. Location of Chattahoochee River National Recreation Area in Georgia. The map also shows the location of targeted land parcels (sampling units) within the park.

Sampling Design

The Southeast Coast Network monitors vegetation in long-term plots located in natural and semi-natural habitats of targeted parks, including Chattahoochee River National Recreation Area. Sample size (i.e., number of plots) is determined by a combination of factors, including: (1) priority plots are located in broadly defined habitats that cover more than 30% of the total area of park's natural and semi-natural vegetation (i.e., dominant and co-dominant habitat); (2) the number of priority plots is scaled according to the overall size of dominant/co-dominant mapped polygons, such that the distribution of plots is between 1 and 25 per 100 hectares (247 ac) of these habitat types; (3) the secondary sample target is any broadly defined habitat that covers between 1 and 30% of a park's natural and semi-natural vegetation; (4) each of the secondary sample target habitat types is allotted four plots.

Thirty vegetation plots were established and sampled within three land parcels: North—from Bowman's Island to Abbotts Bridge, Middle—from Medlock Bridge to Gold Branch, and South—from Sope Creek to Palisades of Chattahoochee River National Recreation Area from June through July 2022 (Figures 2 and 3). These plots were located in the following broadly defined habitats of the park: Piedmont Alluvial Wetland Vegetation (13 plots) and Piedmont Upland Forests (17 plots). Plot locations were determined using the generalized random-tessellation stratified (GRTS) sampling methodology, which creates a spatially-balanced array of sample points across an area of interest while maintaining flexibility in a project's sample size (Stevens and Olsen 2004).

Nomenclature Standard, Growth Form Determination, and Conservation Status

Species nomenclature for this report follows the Flora of the Southern and Mid-Atlantic States (Weakley 2020). Every attempt was made to identify all plants to species, variety, or subspecies; when this was not possible, the lowest level of

identifiable taxa (e.g., genera, family) was used. Occasionally, a taxonomic concept was created by “lumping” several species of the same genus of known occurrence within a park. For example, both southern red cedar (*Juniperus silicicola*) and eastern red cedar (*J. virginiana*) occur in the park; both species occur in abundance in the natural and semi-natural habitats targeted by this monitoring effort; the species can often be difficult to distinguish based on vegetative features; and, finally, no other species within the genus *Juniperus* are known to occur within the park. A taxonomic concept was created—*Juniperus* [*silicicola* + *virginiana*]*—*that combined the two species into a single concept. This “lumped” taxon is of finer scale taxonomic resolution than if these records had been identified as *Juniperus* sp. Once the final list was determined, each species was cross-referenced with the USDA Plants Database (USDA 2024) to determine growth form, native status, federal/state noxious status, and to provide a unique common name. When a single taxon linked to multiple growth forms, the lead author subjectively chose a single growth form to link with the taxa. The species list was also cross-referenced with the 782 rare plants in Georgia to determine the state and federal conservation status (e.g., Endangered, Threatened, Rarity) of each species (GADNR 2024) and the list of non-native invasive plants in Georgia to determine the degree of invasiveness (GA-EPPC 2023).

Sampling Methodology

The vegetation plot layout for this monitoring effort is based upon the plot design used by the Carolina Vegetation Survey (Peet et al. 1998; Lee et al. 2008) and the Cumberland Piedmont Network (White et al. 2011). The plot array consists of a 20 × 20 meters (65.6 × 65.6 ft) bounded square with multiple nested sampling frames ranging from 1 square meter (10.8 square feet [ft²]) to 400 square meters (4,305.5 ft²), three 25 meters (82.0 ft) fuel transects that cross both inside and outside the bounded square, and three soil sample frames located adjacent to the bounded square (Figure 4).

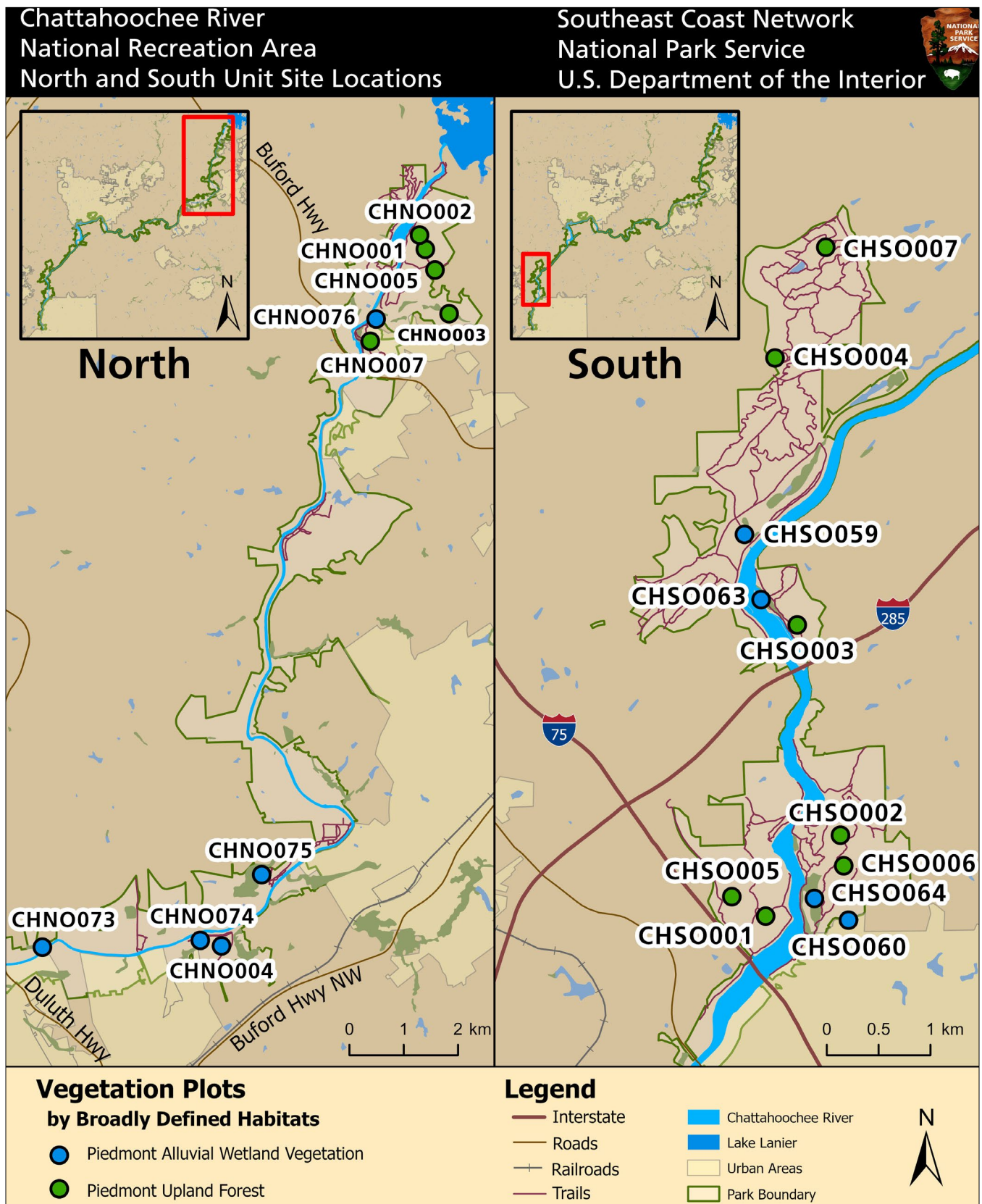


Figure 2. Southeast Coast Network terrestrial vegetation monitoring plot locations within the North and South land parcels of Chattahoochee River National Recreation Area

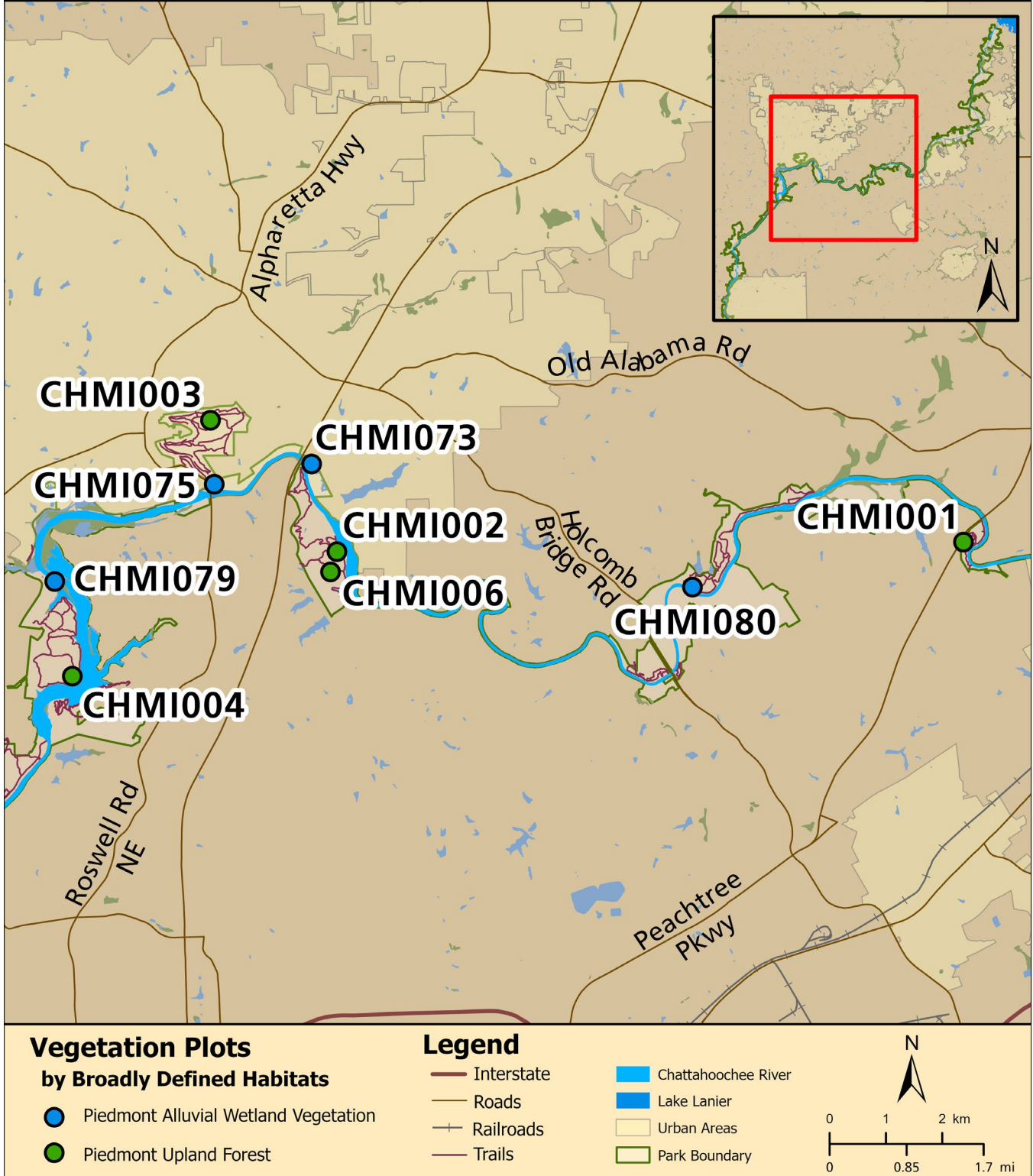


Figure 3. Southeast Coast Network terrestrial vegetation monitoring plot locations within the Middle land parcel of Chattahoochee River National Recreation Area.

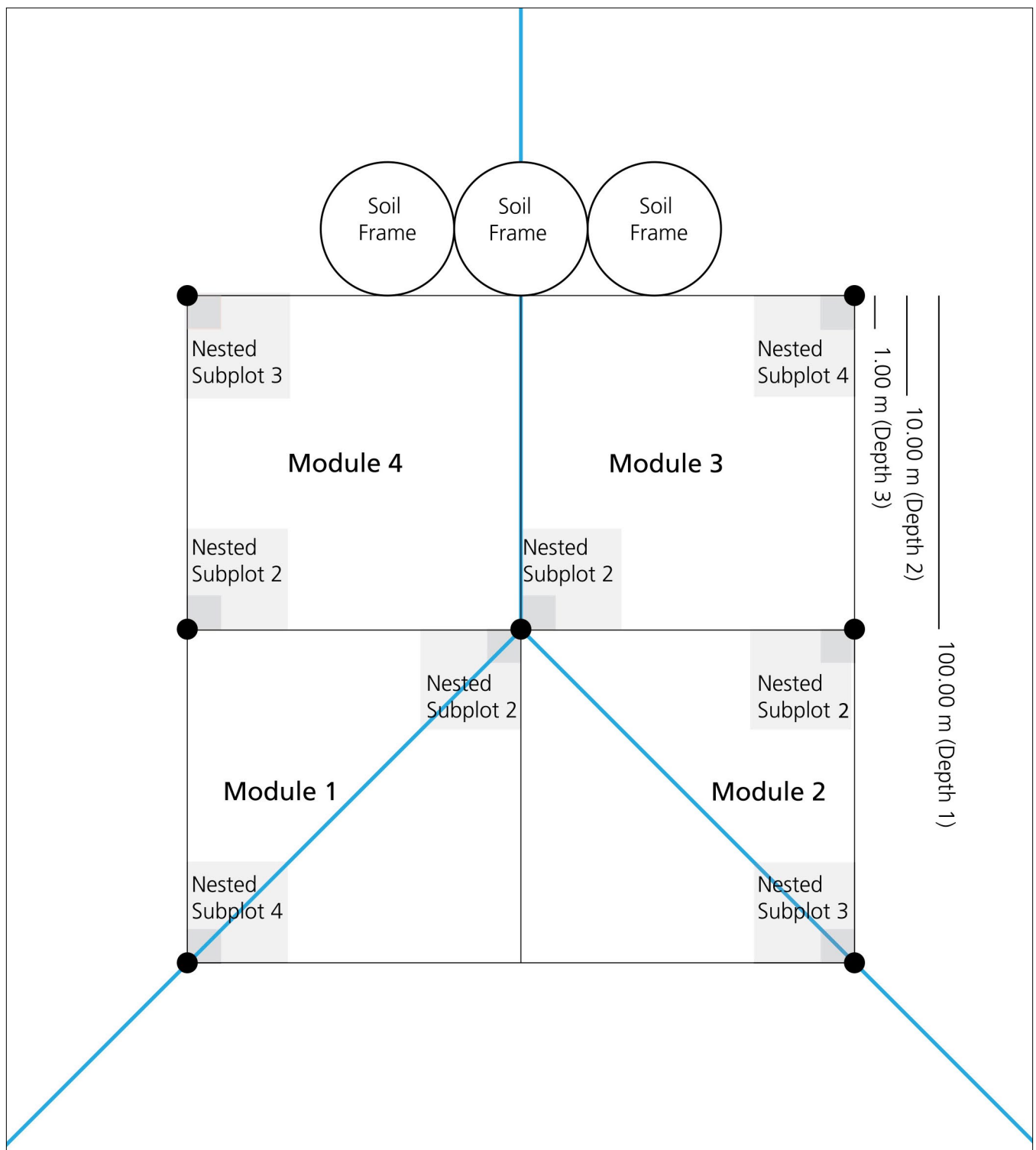


Figure 4. The layout of the sampling plot for the Southeast Coast Network, which is a modified version of the standard Level 5 Carolina Vegetation Survey plot. Ideal locations of rebar used as permanent structures to monument the plot are represented by black shaded circles. Blue lines represent locations of the three 25-meter (82-foot) fuel transects.

Vascular plant species presence was determined at three scales within each of the four 100 square meter (1,076.4 ft²) modules: the 1 square meter (10.8 ft²) nested depth, the 10 square meters (107.6 ft²) nested depth, and the full modular depth. The nested depth “quadrat” were in two of four corners within each module. For each species either rooted in or overhanging a module, an areal cover value was assigned using the cover class codes developed by the Carolina Vegetation Survey (Peet et al. 1998; Table 1).

Table 1. Vascular plant cover metrics of the Carolina Vegetation Survey (Peet et al. 1998) and used by the SECN terrestrial vegetation monitoring protocol (Boyle et al. 2019).

Cover Class	Cover Range (%)	Geometric Mean
1	0–0.1	0.03
2	0.1–1.0	0.32
3	1.0–2.0	1.41
4	2.0–5.0	3.16
5	5.0–10.0	7.07
6	10.0–25.0	15.81
7	25.0–50.0	35.36
8	50.0–75.0	61.24
9	75.0–95.0	84.41
10	95.0–100.0	97.47

Individual woody stem data were also calculated within each module. For each stem greater than or equal to 10 centimeters (3.9 inches [in]; tree) in diameter at 1.4 meters (4.5 ft) linear distance from the ground layer, its species, DBH, and health status was recorded. Within the two 10 square-meter (107.6 ft²) nested depth “quadrats” used for detecting overall species presence (see above), each woody stem that reached 1.4 meters (4.5 ft) in linear distance from the ground layer but was less than 10 centimeters (3.9 in) in diameter at this height (sapling) was identified to species and DBH was determined.

Finally, each woody stem less than 1.4 meters (4.5 ft) in linear distance from the ground layer (seedling) was identified to species and a height class was determined: 5–15 centimeters (2–5.9 in); 15–30 centimeters (5.9–11.8 in); 30–50 centimeters (11.8–19.7 in); or 50–137 centimeters (19.7–53.9 in) within the two 1 square meter (10.8 ft²) nested depth “quadrats” used for detecting overall species presence (see above).

Surface fuels were assessed at each Piedmont Upland Forest plot site using the planar transect method for the standard fuel size classes: 1-hour (0–0.6 cm), 10-hour (0.6–2.5 cm), 100-hour (2.5–7.6 cm), and 1000-hour (> 7.6 cm), and duff and litter depths (Brown 1974). Counts of each fuel size class were tallied across three fuel transects, with diameter and decay class recorded for each piece of 1000-hour fuel. These field data were incorporated into equations using constant multipliers defined by Brown (1974)—including quadratic mean diameter, nonhorizontal correction factor, specific gravity, and bulk density—to estimate fuel load weight (units = tons/acre) within each plot.

Additional site characteristics were also measured at each plot. Elements taken from the center of each plot included dominant slope, aspect, and terrain shape; basic hydrological condition; and presence and abundance of disturbance indicators. General canopy conditions were assessed, including canopy closure and average height. Closure was measured from the center of each module using a spherical densiometer, and height was taken from three representative trees within (or just outside) the plot. Soil samples were collected from the upper 10 centimeters (0.3 ft) of mineral soil in three sampling frames located adjacent to each vegetation plot. These samples were combined by plot upon return from the field and dried prior to shipping to a soil testing laboratory for standard nutrient analysis. Each plot was qualitatively assigned to one or two National Vegetation Classification (NVC) vegetation association types that best matched the sample site. Finally, two-dimensional photo points were taken with a point-and-shoot camera at the western and eastern center edge of each plot; a third photo point was made from the plot center using a 360-degree camera.

Results and Discussion

Two hundred and ninety-nine vascular plant taxa were detected during this monitoring effort within Chattahoochee River National Recreation Area (Appendix A), including 29 taxa not detected in previous lists documented in Zomlefer et al. (2012), Heath and Byrne (2014), or NPSpecies (NPS 2024) (Table 2). Twenty-one of these are also likely new records for the counties of observance. These include:

Cobb County

- Hill cane (*Arundinaria appalachiana*)
- Bigfruit hawthorn (*Crataegus macrosperma*)
- Bluntleaf bedstraw (*Galium obtusum* var. *filifolium*)
- Chinese holly (*Ilex cornuta*)
- Slimflower muhly (*Muhlenbergia tenuiflora*)
- Large-fruited sanicle (*Sanicula trifoliata*)
- Whip nutrush (*Scleria triglomerata*)
- Coral greenbrier (*Smilax walteri*)
- Tea viburnum (*Viburnum setigerum*)

Fulton County

- Hill cane
- Eastern woodland sedge (*Carex blanda*)
- Cumberland sedge (*Carex cumberlandensis*)
- Leavenworth's sedge (*Carex leavenworthii*)
- Greater straw sedge (*Carex normalis*)
- Bigfruit hawthorn
- Deertongue witchgrass (*Dichanthelium clandestinum*)
- Needle spikerush (*Eleocharis acicularis*)
- Bluntleaf bedstraw
- Oneflower bedstraw (*Galium uniflorum*)
- Chinese holly
- Miniature beefsteakplant (*Mosla dianthera*)
- Sweet cherry (*Prunus avium*)

- Whip nutrush
- West Indian nightshade (*Solanum emulans*)

Gwinnett County

- Bushy bluestem (*Andropogon glomeratus*)
- Leavenworth's sedge
- Greater straw sedge
- Bluntleaf bedstraw
- Oneflower bedstraw
- Chinese holly
- Whitegrass (*Leersia virginica*)
- Whip nutrush

Two of the species new to the park are listed as invasive by the Georgia Exotic Pest Plant Council (GA-EPPC 2023)—Chinese holly and Miniature beefsteakplant (Table 2).

Native richness ranged from 13 to 65 species per plot, and non-native species comprised between 0 and 22% of the total richness per plot (Table 3). Native species observed in these plots are common throughout the Piedmont of Georgia, and there were no federally listed nor state listed species observed during this monitoring effort. However, one species of special concern for Georgia was observed—large-fruited sanicle (GADNR 2024). Sixteen species listed by the GA-EPPC (2023) as invasive were observed in these monitoring plots, including 10 ranked as either Category 1 or Category 2 (Appendix A). The frequency of Category 1 and 2 invasive plants in these monitoring plots was very high. Category 1 and 2 species with high (> 25%) plot frequency included Chinese privet (21 of 30 plots; 70%) Japanese honeysuckle (18 of 30 plots; 60%), Japanese stiltgrass (13 of 30 plots, 43%), English ivy (8 of 30 plots, 27%), and Chinese holly (8 of 30 plots, 27%). Twenty-six of the 30 plots had at least one Category 1 invasive species present, and 14 had at least three (Figure 5).

Within the Georgia Piedmont, plant species composition and structure patterns within natural vegetation community types are determined by variations in soil and topography, as well as Native American use across the landscape (Edwards et al. 2013). What follows is a synopsis of vegetation and environmental data stratified by each of the broadly defined habitats sampled within the park.

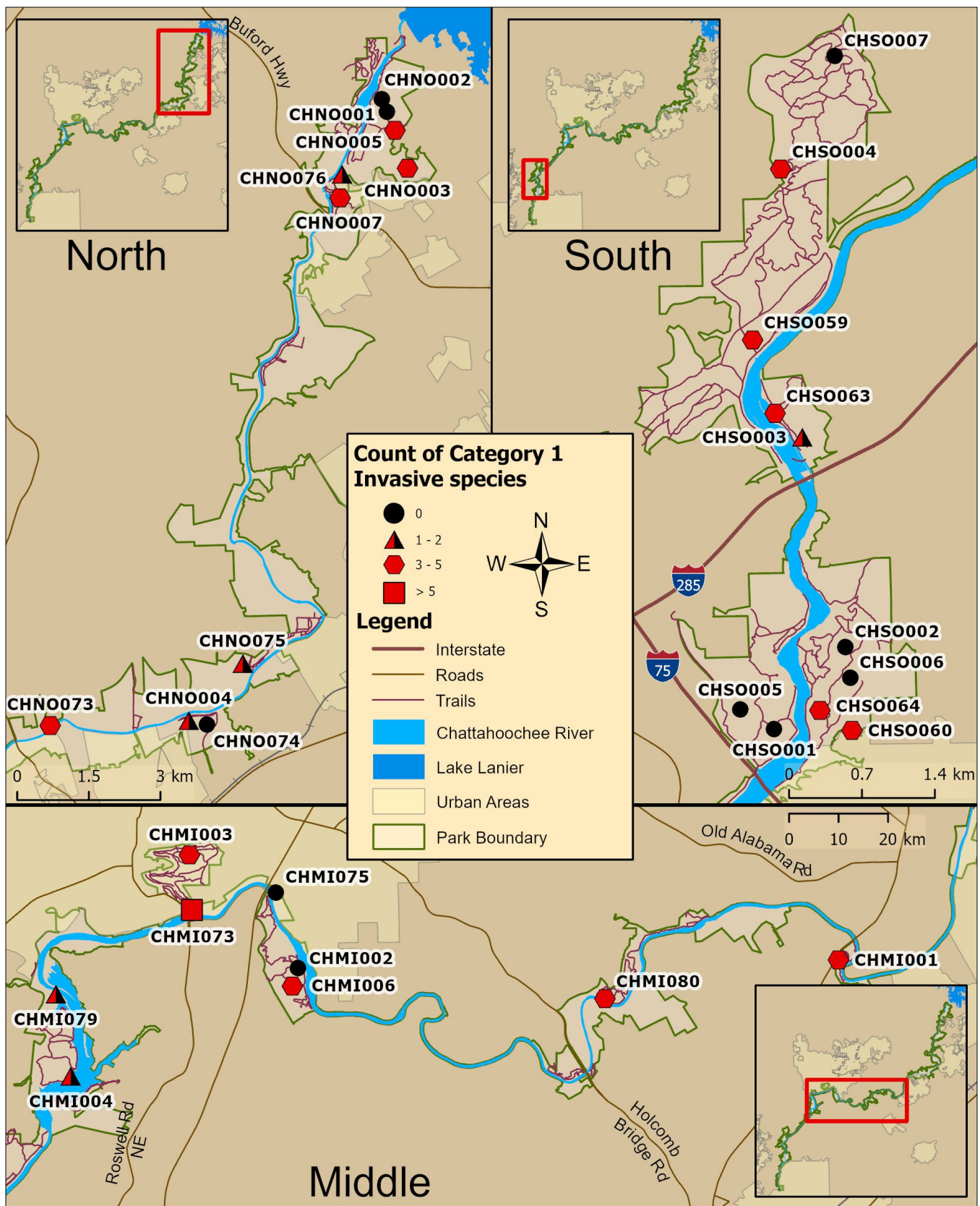


Figure 5. Georgia Exotic Pest Plant Council Category 1 invasive species count from 30 vegetation monitoring plots established within Chattahoochee River National Recreation Area in 2021

Table 2. Vascular plant species, subspecies, or varieties not reported from Zomlefer et al. (2012), Heath and Byrne (2014), or NPSpecies (NPS 2024) but found at Chattahoochee River National Recreation Area in 2021 through this current monitoring effort.

Scientific Name	Common Name ¹	Growth Form ¹	Native Status ¹	Georgia Invasive Status ²	Global Rank ³	State Rank ³ (Georgia)
<i>Andropogon glomeratus</i>	bushy bluestem	Graminoid	Native	–	G5	S5
<i>Arundinaria appalachiana</i>	hill cane	Graminoid, Shrub, Subshrub	Native	–	G4	SNR
<i>Carex blanda</i>	eastern woodland sedge	Graminoid	Native	–	G5	S5
<i>Carex cumberlandensis</i>	Cumberland sedge	Graminoid	Native	–	SNR	S4
<i>Carex leavenworthii</i>	Leavenworth's sedge	Graminoid	Native	–	G5	SNR
<i>Carex normalis</i>	greater straw sedge	Graminoid	Native	–	G5	SNR
<i>Carex radiata</i>	eastern star sedge	Graminoid	Native	–	G5	S3
<i>Crataegus macrocarpa</i>	bigfruit hawthorn	Tree, Shrub	Native	–	G5	SNR
<i>Crataegus spathulata</i>	littlehip hawthorn	Tree, Shrub	Native	–	G5	S5
<i>Danthonia sericea</i>	downy danthonia	Graminoid	Native	–	G5	S5
<i>Dichanthelium clandestinum</i>	deertongue	Graminoid	Native	–	G5	SNR
<i>Eleocharis acicularis</i>	needle spikerush	Graminoid	Native	–	G5	S4
<i>Festuca subverticillata</i>	nodding fescue	Graminoid	Native	–	G5	SNR
<i>Frangula caroliniana</i>	Carolina buckthorn	Shrub, Tree	Native	–	G5	SNR
<i>Galium obtusum</i> var. <i>filifolium</i>	bluntleaf bedstraw	Forb/herb	Native	–	G5	SNR
<i>Galium uniflorum</i>	oneflower bedstraw	Forb/herb	Native	–	G4	S4
<i>Ilex cornuta</i>	Chinese holly	Shrub, Tree	Non-native	Category 4	SNR	SNR
<i>Leersia virginica</i>	whitegrass	Graminoid	Native	–	G5	SNR
<i>Melica nitens</i>	threeflower melicgrass	Graminoid	Native	–	G5	SNR
<i>Mosla dianthera</i>	miniature beefsteakplant	Forb/herb	Non-native	Category 3	SNR	SNR
<i>Muhlenbergia tenuiflora</i>	slimflower muhly	Graminoid	Native	–	G5	SNR
<i>Nyssa biflora</i>	swamp tupelo	Tree	Native	–	G5	SNR
<i>Prunus angustifolia</i>	Chickasaw plum	Tree, Shrub	Native	–	G5	SNR
<i>Prunus avium</i>	sweet cherry	Tree	Non-native	–	SNR	SNR
<i>Sanicula trifoliata</i>	largefruit blacksnakeroot	Forb/herb	Native	–	G4	S1
<i>Scleria triglomerata</i>	whip nutrush	Graminoid	Native	–	G5	SNR
<i>Smilax walteri</i>	coral greenbrier	Shrub, Vine	Native	–	G5	SNR
<i>Solanum emulans</i>	West Indian nightshade	Forb/herb	Native	–	G5	SNR
<i>Viburnum setigerum</i>	tea viburnum	Shrub	Non-native	–	SNR	SNR

¹ Information obtained from the PLANTS database (USDA 2024)

² Information obtained from the Georgia Exotic Pest Plant Council (GA-EPPC 2023)

³ Conservation Status (G4, T4, or S4: Apparently Secure; G5, T5, or S5: Secure; SNR: Not Yet Accessed) obtained from NatureServe Explorer 2.0 (NatureServe 2024)

Table 3. Vascular plant species richness across multiple spatial scales on Southeast Coast Network vegetation plots located within Chattahoochee River National Recreation Area. The data are summarized by total number of native versus non-native species/plot, and by vegetative growth forms (T, tree; S, shrub; V, vine; H, herbs/forbs; G, graminoids). Growth form information was obtained from the USDA Plants Database (USDA 2024).

Broadly Defined Habitat	Plot	Native ¹	Non-native ¹	Unknown ¹	T ¹	S ¹	V ¹	H ¹	G ¹	T ²	S ²	V ²	H ²	G ²	T ³	S ³	V ³	H ³	G ³	T ⁴	S ⁴	V ⁴	H ⁴	G ⁴
Piedmont	CHMI073	42.0	10.0	3.0	14.0	2.0	10.0	15.0	14.0	9.5	1.3	6.8	11.8	8.0	6.6	0.4	4.4	6.3	3.4	4.1	0.1	2.8	2.5	0.8
Alluvial Wetland	CHMI075	21.0	2.0	1.0	10.0	0.0	3.0	10.0	1.0	7.0	0.0	2.3	5.8	0.5	2.8	0.0	1.3	3.1	0.1	0.6	0.0	0.0	2.3	0.0
Vegetation	CHMI079	42.0	4.0	0.0	19.0	3.0	10.0	12.0	2.0	10.3	1.0	7.3	5.0	0.5	3.5	0.3	4.1	2.1	0.0	1.4	0.1	1.9	0.9	0.0
	CHMI080	28.0	8.0	1.0	11.0	3.0	6.0	12.0	5.0	5.8	1.5	4.3	6.8	3.5	2.5	1.0	1.5	3.6	2.4	1.6	0.3	1.1	2.6	1.0
	CHNO004	28.0	2.0	0.0	15.0	0.0	6.0	7.0	2.0	10.0	0.0	4.0	2.8	1.3	5.0	0.0	2.3	0.4	0.9	2.4	0.0	1.0	0.0	0.5
	CHNO073	49.0	7.0	2.0	23.0	1.0	10.0	16.0	8.0	13.3	0.3	7.5	8.0	4.3	7.5	0.0	4.6	3.8	2.5	3.8	0.0	2.8	1.3	1.4
	CHNO074	18.0	0.0	1.0	6.0	0.0	1.0	4.0	8.0	3.5	0.0	0.3	2.3	5.3	1.5	0.0	0.1	1.4	3.5	0.6	0.0	0.1	1.0	2.9
	CHNO075	33.0	2.0	2.0	13.0	1.0	6.0	10.0	7.0	8.8	1.0	4.8	6.0	5.3	6.1	0.5	2.9	4.1	3.3	3.5	0.0	1.3	1.8	0.9
	CHNO076	13.0	3.0	0.0	4.0	0.0	3.0	5.0	4.0	2.8	0.0	1.5	2.3	1.8	1.5	0.0	0.6	1.0	1.3	0.6	0.3	0.0	0.5	1.0
	CHSO059	40.0	6.0	0.0	9.0	1.0	8.0	23.0	5.0	5.3	0.3	5.5	11.8	2.3	3.0	0.1	4.6	5.6	0.9	2.1	0.0	3.0	3.3	0.1
	CHSO060	28.0	5.0	0.0	17.0	0.0	7.0	7.0	2.0	9.8	0.0	5.0	3.3	0.8	3.6	0.0	2.4	1.0	0.5	2.8	0.0	1.3	0.5	0.0
	CHSO063	57.0	11.0	0.0	17.0	2.0	13.0	32.0	4.0	9.3	1.0	9.8	16.8	2.5	4.6	0.4	5.4	7.0	0.9	2.6	0.0	3.0	3.6	0.1
	CHSO064	30.0	4.0	0.0	16.0	0.0	10.0	7.0	1.0	8.0	0.0	5.5	2.3	0.3	2.3	0.0	2.5	0.5	0.1	1.4	0.1	0.8	0.1	0.0
	average	33.0	4.9	0.8	13.4	1.0	7.2	12.3	4.8	7.9	0.5	4.9	6.5	2.8	3.9	0.2	2.8	3.1	1.5	2.1	0.1	1.5	1.6	0.7
	standard deviation	12.6	3.3	1.0	5.3	1.2	3.5	7.9	3.7	3.0	0.6	2.6	4.5	2.4	2.0	0.3	1.7	2.2	1.3	1.2	0.1	1.1	1.2	0.8

¹ Total species richness at the full plot (400 square meters [4,305.6 ft²]) depth

² Mean species richness at the modular (100 square meters [1,076.3 ft²]) depth

³ Mean species richness at the nested 10 square meters (107.6 ft²) depth

⁴ Mean species richness at the nested 1 square meter (10.8 ft²) depth

Table 3 continued. Vascular plant species richness across multiple spatial scales on Southeast Coast Network vegetation plots located within Chattahoochee River National Recreation Area. The data are summarized by total number of native versus non-native species/plot, and by vegetative growth forms (T, tree; S, shrub; V, vine; H, herbs/forbs; G, graminoids). Growth form information was obtained from the USDA Plants Database (USDA 2024).

Broadly Defined Habitat	Plot	Native ¹	Non-native ¹	Unknown ¹	T ¹	S ¹	V ¹	H ¹	G ¹	T ²	S ²	V ²	H ²	G ²	T ³	S ³	V ³	H ³	G ³	T ⁴	S ⁴	V ⁴	H ⁴	G ⁴
Piedmont Upland Forests	CHMI001	45.0	3.0	1.0	23.0	3.0	10.0	7.0	6.0	17.8	1.0	6.8	3.3	3.3	7.9	0.3	5.0	1.3	1.0	2.8	0.1	2.5	0.3	0.3
	CHMI002	45.0	2.0	1.0	19.0	3.0	7.0	14.0	5.0	11.5	0.8	4.0	6.0	2.8	3.6	0.3	2.4	2.0	0.6	0.9	0.0	1.0	0.5	0.1
	CHMI003	42.0	3.0	0.0	28.0	2.0	6.0	7.0	2.0	18.8	1.8	4.8	3.0	1.3	8.9	0.4	3.4	1.0	0.4	3.1	0.1	2.0	0.3	0.1
	CHMI004	52.0	2.0	1.0	25.0	0.0	10.0	12.0	8.0	15.8	0.0	5.3	5.3	4.5	5.5	0.0	2.8	1.4	1.3	1.3	0.0	1.4	0.3	0.5
	CHMI006	50.0	3.0	4.0	21.0	3.0	9.0	17.0	7.0	13.5	1.3	6.5	8.5	4.5	6.1	0.0	3.6	2.4	1.0	2.4	0.0	1.8	0.6	0.1
	CHNO001	43.0	0.0	0.0	25.0	3.0	5.0	5.0	5.0	17.3	1.0	4.3	2.5	3.0	7.3	0.1	2.6	1.0	1.0	3.1	0.0	1.1	0.5	0.3
	CHNO002	37.0	2.0	0.0	16.0	0.0	5.0	14.0	4.0	9.8	0.0	3.3	7.0	1.8	5.1	0.0	2.3	2.8	0.8	2.0	0.0	0.8	0.9	0.0
	CHNO003	43.0	4.0	1.0	24.0	1.0	7.0	9.0	7.0	13.5	0.3	4.8	5.5	3.8	5.3	0.1	3.1	1.5	1.3	1.6	0.0	1.4	0.1	0.4
	CHNO005	48.0	4.0	0.0	20.0	0.0	10.0	12.0	10.0	11.5	0.0	6.3	5.5	5.0	5.9	0.0	3.9	2.8	2.1	3.1	0.0	1.9	1.5	1.5
	CHNO007	46.0	6.0	0.0	22.0	1.0	8.0	15.0	6.0	11.8	1.0	5.3	9.0	4.0	3.6	0.3	2.8	3.9	2.0	0.5	0.0	1.4	1.3	1.0
	CHSO001	44.0	1.0	0.0	22.0	2.0	6.0	8.0	7.0	12.8	1.3	4.8	4.8	4.8	4.8	1.0	3.0	1.9	1.5	1.1	0.0	1.5	0.3	0.3
	CHSO002	65.0	3.0	0.0	21.0	3.0	8.0	27.0	9.0	13.0	1.3	6.3	11.3	6.3	5.5	0.4	3.5	3.6	3.3	1.1	0.5	1.5	1.0	1.1
	CHSO003	47.0	3.0	0.0	33.0	1.0	7.0	7.0	2.0	18.8	0.3	5.3	3.0	1.0	7.4	0.0	3.1	0.9	0.3	1.8	0.1	2.3	0.0	0.0
	CHSO004	62.0	11.0	2.0	32.0	7.0	9.0	20.0	7.0	21.8	4.3	7.3	10.3	2.8	8.1	1.4	4.6	4.1	0.6	3.0	0.0	3.4	2.0	0.1
	CHSO005	33.0	0.0	0.0	21.0	2.0	4.0	2.0	4.0	11.3	0.8	1.8	1.0	2.0	4.0	0.4	0.9	0.4	0.5	1.9	0.5	0.0	0.1	0.4
	CHSO006	31.0	0.0	0.0	21.0	4.0	5.0	0.0	1.0	16.8	2.3	4.5	0.0	0.3	6.9	1.0	3.0	0.0	0.1	2.1	0.0	1.1	0.0	0.0
	CHSO007	54.0	1.0	2.0	23.0	3.0	8.0	18.0	5.0	16.0	1.0	5.0	8.3	3.3	6.3	0.3	3.3	2.5	0.8	1.9	0.5	1.5	0.6	0.0
	average	46.3	2.8	0.7	23.3	2.2	7.3	11.4	5.6	14.8	1.1	5.0	5.5	3.2	6.0	0.3	3.1	2.0	1.1	2.0	0.1	1.6	0.6	0.4
	standard deviation	8.8	2.7	1.1	4.4	1.8	1.9	6.9	2.5	3.4	1.0	1.4	3.2	1.6	1.6	0.4	0.9	1.2	0.8	0.8	0.2	0.7	0.6	0.4

¹ Total species richness at the full plot (400 square meters [4,305.6 ft²]) depth

² Mean species richness at the modular (100 square meters [1,076.3 ft²]) depth

³ Mean species richness at the nested 10 square meters (107.6 ft²) depth

⁴ Mean species richness at the nested 1 square meter (10.8 ft²) depth

Piedmont Alluvial Wetland Vegetation

Alluvial habitats of the southeastern Piedmont include forested and non-forested wetlands adjacent to rivers and streams that are often influenced by occasional or periodic flooding. The wet nature of floodplain soils protects these sites from fire and drought, and thus would have historically supported larger diameter, older-growth trees than surrounding uplands; early-successional zones of floodplains would have occurred specifically in small-scale windfall gaps or active flood zones (e.g. willow-bars; Sharitz and Mitsch 1993; Christensen 2000). In contrast to the Coastal Plain, whose well-developed, wide floodplains support numerous, complex geomorphologic features (e.g., point bars, sloughs, oxbow lakes, backswamps), Piedmont floodplains are narrow and often do not include complex geomorphologic features (Edwards et al. 2013). Most rivers within the southeastern Piedmont are constrained by geologic features, with lateral movement limited by the hard substrate (Edwards et al. 2013). Flooding is not as extensive within Piedmont floodplains and alluvial material is often limited to narrow bands along the river or stream channel.

Rivers and streams of the Piedmont have been modified by two centuries of intense anthropogenic land-use, including wide-spread clearing for agriculture. Farming practices which emphasized heavy rotations removed most of the nutrients from the soil and caused severe erosion. In some instances, sediments from erosion raised streambeds over 12 feet (3.7 meters [m]) and created unnatural bottomlands in lower slope (~mesic) uplands (Trimble 1974). Over time, streams have down cut rapidly through this higher sediment, causing steep terraces to form on either side of the streambank that prevent natural flooding (Edwards et al. 2013). Other threats and stressors to Piedmont alluvial wetlands include the high density of commercial, industrial, and residential land coupled with high density of impervious surfaces leading to increases in point- and non-point-sources of contamination; hydrologic pattern disruption from upstream dams; and increases in density of non-native, invasive plant species (e.g., Chinese privet; DeVivo et al. 2008; Edwards et al. 2013).

At Chattahoochee River National Recreation Area, alluvial wetlands in the form of swamp or bottomland hardwood forests are found along the floodplain of the Chattahoochee River and its major tributaries (Heiman 2002). These alluvial forests are the most common type along the river corridor and its tributaries. Open, graminoid-dominated marshes also are present along the floodplain and its tributaries (Heiman 2002). Several vegetation associations corresponding with this broadly defined habitat type were sampled within the park during this monitoring effort (Figure 5), including

(descriptions from Cotten et al. 2019 and NatureServe 2024):

- Common Rush Marsh (CEGL004112; 1 plot): Seasonally flooded marsh vegetation typically dominated by common rush (*Juncus effusus* ssp. *solutus*), along with other wetland forbs and graminoids. A short canopy of woody species may also occasionally be present, and include green ash (*Fraxinus pennsylvanica*), sweetgum (*Liquidambar styraciflua*), and black willow (*Salix nigra*). (Global Status: G5—Secure; State (GA) Status: No Status Rank)
- Upper Southeast Sweetgum - Tuliptree Small Stream Forest (CEGL004418; 1 plot): This wide-ranging forest of the Piedmont, Coastal Plain, Cumberland Plateau, and Ridge and Valley occurs along small streams on relatively acidic soil. The canopy is always dominated or co-dominated by sweetgum and tuliptree (*Liriodendron tulipifera* var. *tulipifera*). The herbaceous layer can be species rich and include good sedge development. (Global Status: G4—Apparently Secure; State (GA) Status: No Status Rank)
- Ruderal Tuliptree Forest (Typic Type) (CEGL007221; 1 plot): This early successional, ruderal forest occurs on uplands or well-drained floodplains following clearcut logging or cropping. The canopy is often dominated by a combination of tuliptree, loblolly pine (*Pinus taeda*), and oaks (*Quercus* spp). This community type is widespread across the southeastern U.S. (Global Status: No Status Rank; State (GA) Status: No Status Rank)
- River Birch Levee Forest (CEGL007312; 2 plots): Forests dominated by river birch (*Betula nigra*) and American sycamore (*Platanus occidentalis*) and occurring primarily on levees adjacent to small rivers and streams in the Piedmont and Coastal Plain of the Southeastern U.S. Flooding on these sites is typically seasonal or occasional but rarely prolonged. (Global Status: G4—Apparently Secure; State (GA) Status: No Status Rank)
- Ruderal Loblolly Pine – Tuliptree Wet Forest (CEGL007546; 1 plot): This broadly defined alluvial forest of the Piedmont, Coastal Plain, Cumberland Plateau, and Ridge and Valley provinces is dominated by a combination of loblolly pine and tuliptree, along with lesser amounts of water oak (*Quercus nigra*); northern spicebush (*Lindera benzoin*) is a typical shrub. This successional forest develops along floodplain alluvial terraces following windfall events, logging, or agriculture. (Global Status: No Status Rank; State (GA) Status: No Status Rank)

- **Piedmont Loblolly Pine - Mixed Oak Floodplain Forest** (CEGL007551; 1 plot): Floodplain forests with a canopy dominated by loblolly pine and subcanopy co-dominated by tuliptree, sweetgum, and water oak. It is unclear if this association type is representative of older forests that formed on abandoned agriculture or timber plantation land or if its origin is of more dynamic, natural processes. (Global Status: No Status Rank; State (GA) Status: No Status Rank)
- **American Sycamore - Sugarberry - Green Ash Floodplain Forest** (CEGL007730; 6 plots): This riparian forest typically occurs on terraces of Atlantic Coast and Piedmont rivers and large creeks; soils tend to be more well-drained than adjacent alluvial flats. Canopy and subcanopy dominant species can include American sycamore, sugarberry (*Celtis laevigata*), green ash, and boxelder (*Acer negundo* var. *negundo*). (Global Status: G4—Apparently Secure; State (GA) Status: No Status Rank)



Figure 6. Thirteen Piedmont Alluvial Wetland Vegetation plots were established during this monitoring at Chattahoochee River National Recreation Area in June and July 2021. Vegetation types included early successional, ruderal areas dominated by graminoids (left) and hardwood-dominated floodplain forests (right). NPS photo / SECN staff.

Species Diversity and Abundance

Native species richness ranged from 13 to 57 (mean = 33.0) within vegetation plots of this broadly defined habitat type in Chattahoochee River National Recreation Area (Table 3). Trees represented the most diverse growth forms across all spatial scales within plots of this habitat (Table 3). Non-native species were frequent, with one or more species observed in all but one alluvial wetland plot (Table 3). Fourteen of the 16 invasive plants found within the park during this monitoring effort were encountered in these Piedmont Alluvial Wetlands. Invasive species that occurred in 50% or more of these plots included Chinese privet, Japanese honeysuckle, and Japanese stiltgrass (Appendix B, Table B-1). Native vascular plants observed in these plots are fairly common across the southeastern Piedmont. One hundred eighty-two vascular plant species were found collectively within these 13 plots and 90 of these were only found in this broadly defined habitat (Appendix B, Table B-1). A complete species list, along with constancy and average

cover per species, is located in Appendix B, Table B-1. Species with high constancy in this habitat are listed below, by growth form (constancy values in parentheses):

Trees

- Sweetgum (92%)
- Chinese privet (92%)
- Black cherry (*Prunus serotina* var. *serotina*; 77%)
- Green ash (77%)
- Boxelder (77%)
- Water oak (69%)
- Tuliptree (69%)
- Red maple (*Acer rubrum*; 69%)

Vines

- Eastern poison ivy (*Toxicodendron radicans* var. *radicans*; 92%)
- Muscadine (*Muscadinia rotundifolia* var. *rotundifolia*; 85%)
- Virginia creeper (*Parthenocissus quinquefolia*; 77%)
- Trumpet creeper (*Campsis radicans*; 69%)

Herbs/Forbs/Graminoids

- Blackseed false nettle (*Boehmeria cylindrica*; 85%)

Woody Stem Metrics

Total basal area (BA) of trees ranged from 13.7 to 47.3 m²/ha with an overall average of 26.8 m²/ha; density of canopy stems ranged from nine to 29 per plot, with an average of 19.2 (Table 4). Canopy height ranged from 14 to 42 meters (average 30.0), and canopy cover ranged from 30 to 85% (average=71.7%; Table 4). The most dominant canopy species included tuliptree (mean BA = 8.45 m²/ha, mean density = 88/ha), loblolly pine (mean BA = 4.75 m²/ha, mean density = 44/ha), boxelder (mean BA = 3.39 m²/ha, mean density = 104/ha), river birch (mean BA = 2.47 m²/ha, mean density = 19/ha), and sweetgum (mean BA 1.81 m²/ha, mean density = 46/ha; Appendix B, Table B-2). Sapling density at the 80-meter square scale ranged from 2 to 131 stems, with an average of 28.6, while seedling density at the 8-meter square scale ranged from 6 to 257 stems, with an average of 88.7 across all plots (Table 4). Chinese privet dominated the sapling and seedling strata in these sites (Appendix B, Table B-2).

Based on stem count (density), maples (mostly boxelder), tuliptree, sweetgum, and loblolly pine comprised over 70% of the relative abundance among species within the tree stratum (Figure 7). The sapling and seedling strata were dominated by Chinese privet (Figure 7).

Most of the measured trees in these monitoring plots were living (92%) and over 50% were categorized with healthy vigor (Figure 8). Of the 19 trees that were dead within these plots, 11 were green ash. Emerald ash borer (*Agrilus planipennis*), a non-native insect pest, was observed in one of the living ash trees measured on these sites and has been detected in Cobb County since 2014 and Fulton County since 2013 (USDA 2023). The emerald ash borer is a wood-boring pest of ash (*Fraxinus* sp.) and is native to Asia. Since its discovery in the U.S. in the early 2000s, the insect has been responsible for the death of tens of millions of ash trees in the eastern and midwestern parts of the country. At this time, it is not certain whether the declining health of ash within Chattahoochee River National Recreation Area is due to emerald ash borer, edaphic factors that are responsible for natural mortality and decline, or other factors.

Forests within this broad habitat of the park were characterized by an uneven-age structure, with multiple size-classes of woody stems present across the canopy and subcanopy. Almost one-third of the trees measured in these plots were directly below the canopy (~intermediate crown class), while 28% of the trees made up the forest canopy (~co-dominant crown class), and 41% were completely overtopped (Figure 8).

Table 4. Woody stem abundance and canopy metrics on Southeast Coast Network vegetation plots located in Chattahoochee River National Recreation Area [m—meters; ha—hectares].

Broadly Defined Habitat	Plot	Tree Basal Area (m ² /ha)	Tree Density (400 m ²)	Sapling Basal Area (m ² /ha)	Sapling Density (80 m ²)	Seedling Density (8 m ²)	Mean Canopy Cover (%)	Mean Height (m)
Piedmont Alluvial Wetland Vegetation	CHMI073	30.10	26.00	95.00	53.38	257.00	72.75	34.33
	CHMI075	11.20	18.00	37.00	26.63	19.00	67.94	29.33
	CHMI079	24.48	27.00	67.00	31.00	165.00	73.31	32.33
	CHMI080	16.31	18.00	59.00	11.06	100.00	68.50	30.33
	CHNO004	25.22	15.00	7.00	7.37	61.00	77.50	25.33
	CHNO073	13.74	9.00	31.00	36.74	145.00	84.44	28.00
	CHNO074	16.33	17.00	7.00	1.66	6.00	29.94	14.33
	CHNO075	41.01	30.00	10.00	19.90	64.00	84.56	30.00
	CHNO076	25.68	11.00	2.00	5.52	26.00	73.88	30.67
	CHSO059	24.80	29.00	48.00	20.28	79.00	73.44	36.33
	CHSO060	32.62	10.00	25.00	8.62	67.00	73.88	41.67
	CHSO063	39.25	16.00	64.00	19.43	100.00	74.69	28.33
	CHSO064	47.34	24.00	223.00	130.83	64.00	77.06	29.67
	average	26.78	19.23	51.92	28.65	88.69	71.68	30.05
	standard deviation	11.07	7.27	58.62	33.89	68.16	13.49	6.29
Piedmont Upland Forests	CHMI001	25.64	11.00	45.00	35.75	124.00	70.19	29.33
	CHMI002	27.30	17.00	11.00	24.82	34.00	81.75	34.67
	CHMI003	24.14	22.00	27.00	20.67	98.00	77.06	29.67
	CHMI004	3.56	6.00	23.00	32.24	31.00	74.44	27.33
	CHMI006	9.30	11.00	15.00	30.82	47.00	73.06	38.00
	CHNO001	22.54	20.00	40.00	70.74	109.00	76.19	26.00
	CHNO002	35.50	18.00	17.00	16.52	29.00	73.25	36.67
	CHNO003	16.93	10.00	10.00	23.43	29.00	73.50	37.67
	CHNO005	24.43	17.00	17.00	18.97	78.00	75.88	33.00
	CHNO007	23.57	17.00	20.00	15.04	50.00	77.94	37.67
	CHSO001	28.15	20.00	14.00	18.49	60.00	88.94	31.33
	CHSO002	34.25	20.00	20.00	12.85	38.00	78.13	30.00
	CHSO003	17.44	13.00	11.00	21.73	93.00	76.94	44.33
	CHSO004	45.71	20.00	18.00	19.05	153.00	91.13	31.00
	CHSO005	62.89	23.00	9.00	20.60	15.00	71.63	27.33
	CHSO006	26.67	18.00	14.00	29.92	41.00	76.38	42.67
	CHSO007	11.29	11.00	24.00	18.85	43.00	76.06	30.00
	average	25.84	16.12	19.71	25.32	63.06	77.20	33.33
	standard deviation	13.90	4.87	10.00	13.32	39.30	5.55	5.40

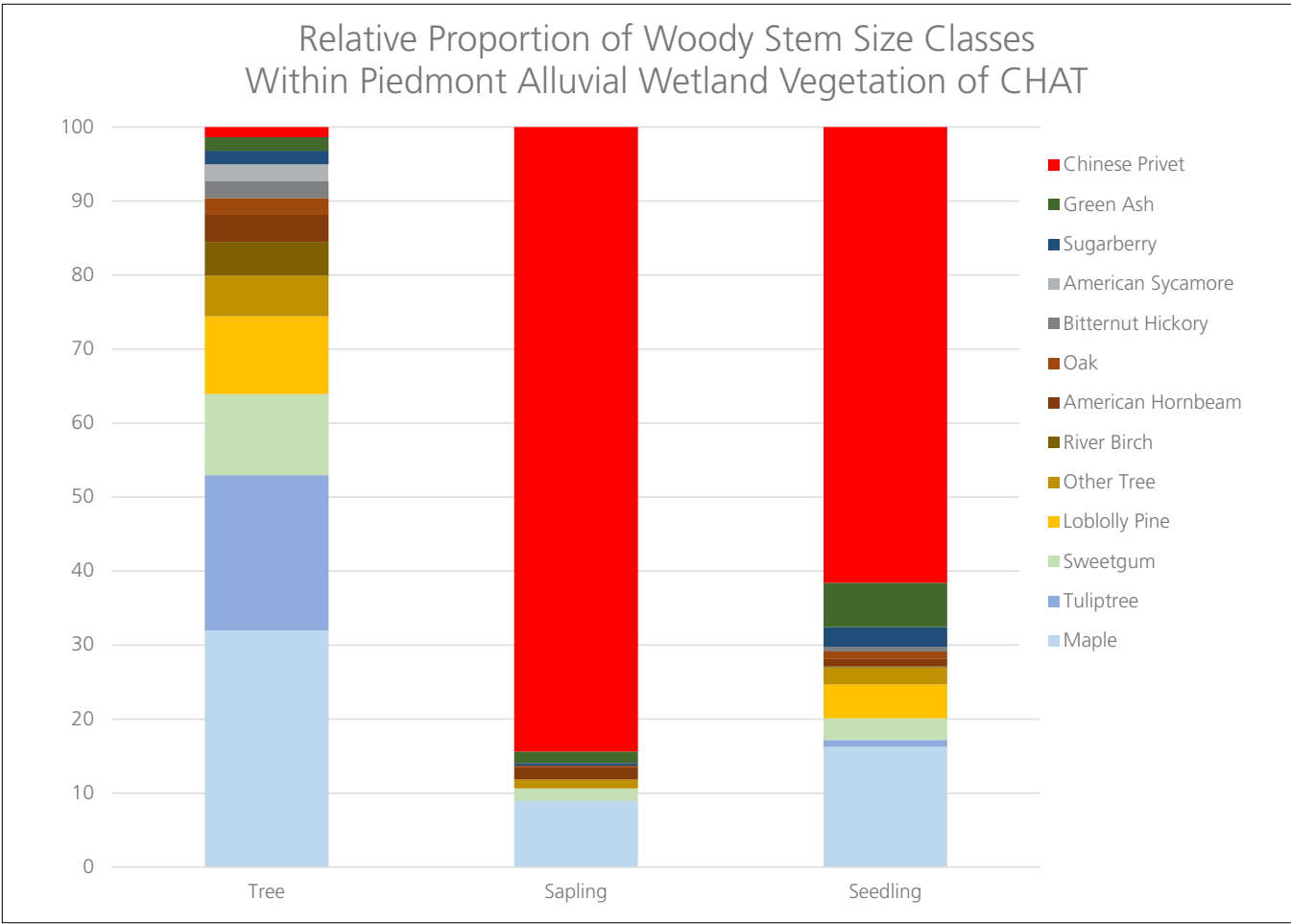


Figure 7. Relative proportion of species groups across three woody stem strata—trees, saplings, and seedlings— within Piedmont Alluvial Wetland monitoring plots of Chattahoochee River National Recreation Area.

Health Condition of Trees Within Piedmont Alluvial Wetland Vegetation Plots of CHAT

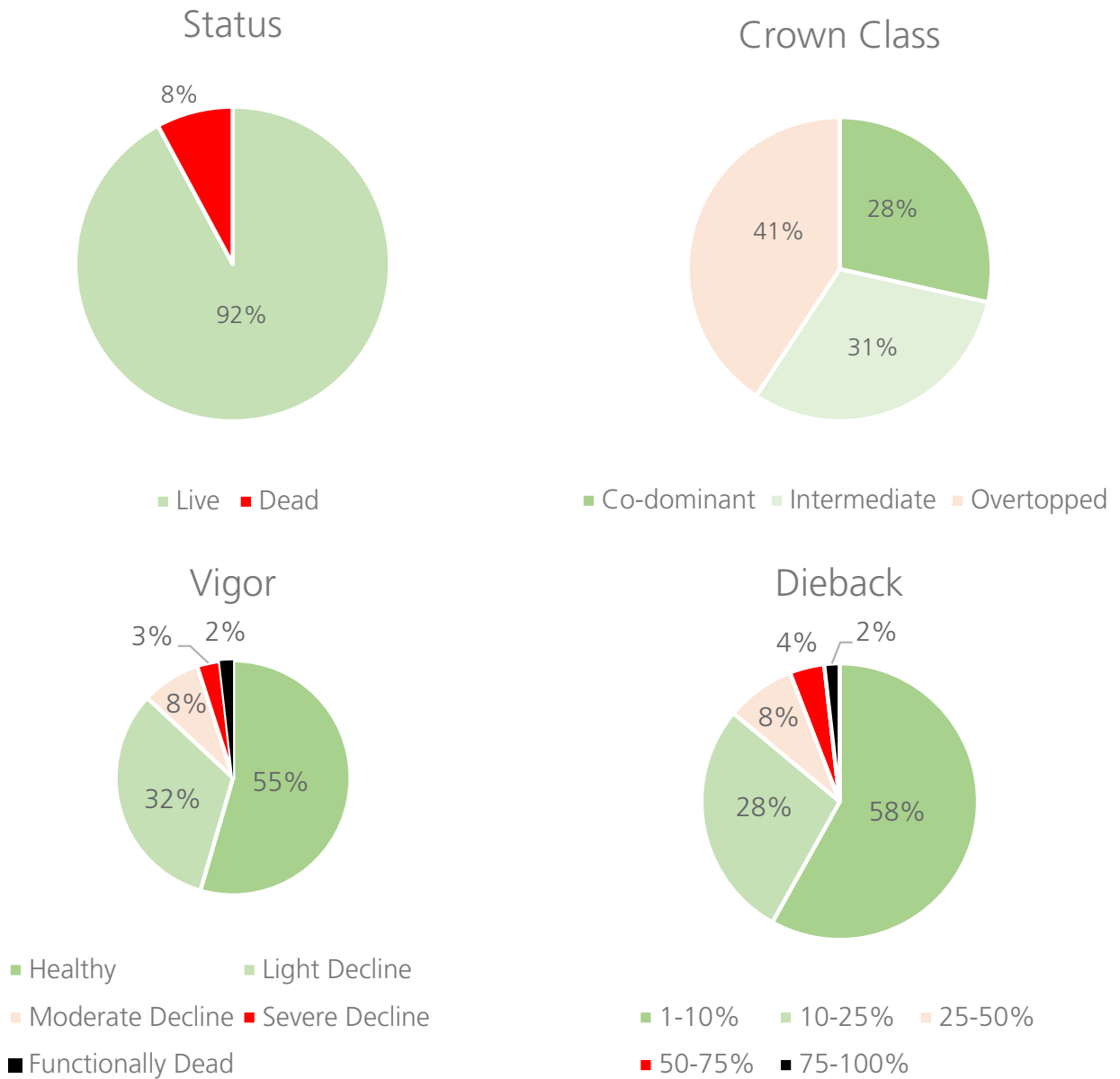


Figure 8. Health status of woody stems greater than or equal to 10 centimeters (3.9 in) DBH ("trees") measured on Piedmont Alluvial Wetland monitoring plots of Chattahoochee River National Recreation Area.

Disturbance and Threats

The browse by white-tailed deer (*Odocoileus virginianus*) was observed in three of the 13 Piedmont Alluvial Wetland Vegetation plots (Table 5). Increases in white-tailed deer populations in the eastern United States, due to removal and loss of natural predators and land use changes, have had major impacts on the understory vegetation within eastern forested ecosystems. Research has documented the reduction of tree regeneration (e.g., seedlings, saplings) in forest stands of areas with high deer density (Boerner and Brinkman 1996; Rossell et al. 2007). Long-term forest monitoring plots established by other National Park Service Inventory and Monitoring Networks in the eastern United States have also documented the impact of abundant white-tailed deer populations on tree

regeneration patterns and ground cover condition (Miller and McGill 2019; Schmit et al. 2020). The population density estimates of white-tailed deer from Cobb, Forsyth, Fulton, and Gwinnett Counties, Georgia from 2001 to 2005 by the Quality Deer Management Association (QDMA) was between 30 to 40 deer per square mile (11.5 to 15.5 per square kilometer [km²]) (Walters et al. 2016), which is higher than the threshold (> 8.5 km²) proposed by Russell et al. (2001) for significant reduction in tree regeneration. Long-term monitoring of vegetation structure and composition within Chattahoochee River National Recreation Area can be used to determine forest regeneration patterns as they relate to changes in browsing pressure.

Table 5. Disturbance observations and abundance (%cover) measured on vegetation monitoring plots of Chattahoochee River National Recreation Area.

Broadly Defined Habitat	Plot	Browse- Beaver	Browse- Deer	Heavy Erosion	Heavy Windthrow	Historical Homesite	Historical Logging	Historical Agriculture
Piedmont Alluvial Wetland Vegetation	CHMI073	10	—	—	—	—	—	—
	CHMI075	—	—	—	—	—	—	—
	CHMI079	10	—	—	—	—	—	10
	CHMI080	—	—	—	—	100	—	—
	CHNO004	—	—	—	—	—	100	—
	CHNO073	—	—	—	—	—	—	—
	CHNO074	—	—	—	—	—	—	—
	CHNO075	—	—	—	—	—	—	—
	CHNO076	—	100	—	—	—	—	—
	CHSO059	—	—	—	—	—	100	—
	CHSO060	—	30	—	—	—	—	—
	CHSO063	—	80	—	—	—	—	—
	CHSO064	—	—	—	100	—	—	—
Piedmont Upland Forests	CHMI001	—	—	50	—	—	—	—
	CHMI002	—	—	—	—	—	—	—
	CHMI003	—	—	—	—	—	30	—
	CHMI004	—	20	—	—	—	—	—
	CHMI006	—	—	—	—	—	—	—
	CHNO001	—	—	—	—	—	—	30
	CHNO002	—	—	—	—	—	—	—
	CHNO003	—	—	—	—	—	—	100
	CHNO005	—	—	—	—	—	—	—
	CHNO007	—	—	—	—	—	—	—
	CHSO001	—	—	—	—	—	—	—
	CHSO002	—	30	—	20	—	—	—
	CHSO003	—	—	—	—	—	100	—
	CHSO004	—	100	10	—	—	—	100
	CHSO005	—	100	—	—	—	—	—
	CHSO006	—	—	—	—	—	—	—
	CHSO007	—	—	—	—	—	—	—

Geomorphology and Soil

Plots of Piedmont Alluvial Wetlands within Chattahoochee River National Recreation Area were located on flat topographies, with little to no slope (Table 6). Nutrient analysis of soil samples collected from these plots indicated pH ranges

from 3.9 to 6.0 (strongly to slightly acidic) (Table 7). Alluvial floodplains of the Piedmont are typically fairly fertile, as these data suggest, owing to the periodic input of nutrients from flood events, which can lead to rapid tree growth

Table 6. Local landform and hydrologic condition of vegetation monitoring plots at Chattahoochee River National Recreation Area.

Broadly Defined Habitat	Plot	Slope (°)	Aspect (°)	TSI ¹ (°)	Landform Type	Water Source	Submerged (%)
Piedmont Alluvial Wetland Vegetation	CHMI073	0.0	n/a	0.000	alluvial plain	Flood zones	0
	CHMI075	0.0	n/a	0.000	alluvial plain	Flood zones	50
	CHMI079	0.0	n/a	0.000	alluvial plain	Flood zones	0
	CHMI080	0.0	n/a	0.000	alluvial plain	Flood zones	0
	CHNO004	0.0	n/a	0.000	alluvial plain	Flood zones	0
	CHNO073	0.0	n/a	0.000	alluvial plain	Flood zones	0
	CHNO074	0.0	n/a	0.000	alluvial plain	Flood zones	0
	CHNO075	0.0	n/a	0.000	alluvial plain	Flood zones	0
	CHNO076	1.0	n/a	0.125	alluvial plain	Flood zones	0
	CHSO059	0.0	n/a	0.000	alluvial plain	Flood zones	0
	CHSO060	0.0	n/a	0.000	alluvial plain	Flood zones	0
	CHSO063	0.0	n/a	0.000	alluvial plain	Flood zones	0
	CHSO064	0.0	n/a	0.000	alluvial plain	Flood zones	0
Piedmont Upland Forests	CHMI001	5.0	225	1.250	side slope	None	0
	CHMI002	20.0	135	-0.125	side slope	None	0
	CHMI003	10.0	45	-0.625	side slope	None	0
	CHMI004	20.5	135	-1.250	side slope	None	0
	CHMI006	10.0	135	-1.375	side slope	None	0
	CHNO001	11.0	135	-0.250	side slope	None	0
	CHNO002	16.0	225	0.000	side slope	None	0
	CHNO003	12.0	315	-1.500	side slope	None	0
	CHNO005	19.0	225	4.625	side slope	None	0
	CHNO007	20.0	315	-0.500	side slope	None	0
	CHSO001	16.0	310	-1.000	side slope	None	0
	CHSO002	25.0	225	-4.250	side slope	None	0
	CHSO003	7.0	225	-1.750	side slope	None	0
	CHSO004	11.0	87	-1.500	side slope	None	0
	CHSO005	14.0	315	-4.625	side slope	None	0
	CHSO006	22.5	315	-0.250	side slope	None	0
	CHSO007	20.0	114	-8.500	interfluv	None	0

¹ Terrain Shape Index: the larger the value, the higher degree of microsite concavity; the lower the value, the higher degree of microsite convexity; "0" values indicate a completely flat shape.

Table 7. Soil nutrient status from vegetation monitoring plots at Chattahoochee River National Recreation Area. The Mehlich III method was used to obtain volume of exchangeable cations and extractable minor elements within soil samples. Methods to obtain other soil chemistry metrics (e.g., total exchange capacity [TEC], pH, and organic matter content [OM]) can be found at [Brookside Laboratories, Inc](#) (BL 2023).

Broadly Defined Habitat	Plot	TEC (ME/100g)	pH H ² O 1:1	OM (%)	P ¹	Ca ¹	Mg ¹	K ¹	Na ¹	B ¹	Fe ¹	Mn ¹	Cu ¹	Zn ¹	Al ¹
Piedmont Alluvial Wetland Vegetation	CHNO004	10.85	4.90	5.96	16.00	792.00	85.00	89.00	7.00	0.10	152.00	39.00	4.23	1.67	1060.00
	CHNO073	12.96	6.00	6.40	21.00	1818.00	125.00	59.00	8.00	0.48	103.00	76.00	1.18	3.36	503.00
	CHNO074	13.66	3.90	7.00	25.00	594.00	28.00	25.00	15.00	0.22	371.00	44.00	4.23	1.74	1271.00
	CHNO075	7.25	4.30	5.16	13.00	320.00	71.00	41.00	9.00	0.10	176.00	62.00	2.34	0.89	1106.00
	CHNO076	11.87	5.60	6.83	20.00	1290.00	138.00	109.00	11.00	0.53	109.00	89.00	1.80	1.81	647.00
	CHMI073	15.36	4.90	7.45	17.00	1152.00	116.00	77.00	11.00	0.34	331.00	138.00	1.89	16.21	283.00
	CHMI075	11.08	4.70	6.79	22.00	709.00	92.00	69.00	12.00	0.38	253.00	155.00	4.02	4.24	1044.00
	CHMI079	6.46	4.90	3.19	9.00	444.00	72.00	29.00	9.00	0.21	233.00	84.00	1.24	5.51	507.00
	CHMI080	7.28	4.10	5.91	35.00	303.00	43.00	47.00	7.00	0.10	152.00	110.00	1.59	1.82	947.00
	CHSO059	7.60	5.30	3.88	34.00	732.00	71.00	26.00	7.00	0.39	124.00	42.00	0.97	1.40	474.00
	CHSO060	10.59	4.80	4.01	22.00	743.00	85.00	46.00	8.00	0.49	127.00	107.00	1.35	4.24	435.00
	CHSO063	13.18	4.80	7.55	16.00	924.00	105.00	63.00	9.00	0.47	223.00	172.00	3.17	9.35	630.00
	CHSO064	5.54	4.00	3.69	14.00	171.00	54.00	27.00	10.00	0.42	201.00	90.00	1.00	2.23	768.00
	average	10.28	4.78	5.68	20.31	768.62	83.46	54.38	9.46	0.33	196.54	92.92	2.23	4.19	744.23
	standard deviation	3.15	0.62	1.53	7.64	452.89	32.05	26.41	2.33	0.16	83.99	42.69	1.25	4.28	310.64

¹Anions (P: Phosphorous); Exchangeable Cations (Ca: Calcium, Mg: Magnesium, K: Potassium, Na: Sodium); Extractable Minors (B: Boron, Fe: Iron, Mn: Manganese, Cu: Copper, Zn: Zinc, Al: Aluminum). Data reported in parts per million (ppm).

Table 7 (continued). Soil nutrient status from vegetation monitoring plots at Chattahoochee River National Recreation Area. The Mehlich III method was used to obtain volume of exchangeable cations and extractable minor elements within soil samples. Methods to obtain other soil chemistry metrics (e.g., total exchange capacity [TEC], pH, and organic matter content [OM]) can be found at [Brookside Laboratories, Inc](#) (BL 2023).

Broadly Defined Habitat	Plot	TEC (ME/100g)	pH H ² O 1:1	OM (%)	P ¹	Ca ¹	Mg ¹	K ¹	Na ¹	B ¹	Fe ¹	Mn ¹	Cu ¹	Zn ¹	Al ¹
Piedmont Upland Forests	CHNO001	2.08	4.20	3.69	5.00	63.00	22.00	40.00	5.00	0.10	144.00	12.00	0.26	0.64	826.00
	CHNO002	9.61	4.60	7.00	16.00	458.00	141.00	83.00	12.00	0.27	123.00	108.00	0.94	1.73	1183.00
	CHNO003	6.11	5.50	6.18	19.00	535.00	111.00	100.00	7.00	0.22	85.00	80.00	0.61	2.35	794.00
	CHNO005	9.41	4.60	7.44	20.00	519.00	106.00	56.00	7.00	0.21	126.00	38.00	0.51	1.92	715.00
	CHNO007	6.08	4.80	4.84	11.00	269.00	114.00	115.00	8.00	0.10	85.00	82.00	1.33	3.55	927.00
	CHMI001	6.12	4.10	2.35	10.00	228.00	58.00	20.00	6.00	0.10	219.00	20.00	0.10	1.48	713.00
	CHMI002	5.04	5.10	5.41	11.00	332.00	86.00	59.00	7.00	0.25	81.00	86.00	0.83	3.83	881.00
	CHMI003	5.05	5.00	5.67	13.00	309.00	78.00	66.00	9.00	0.25	110.00	91.00	0.48	2.31	745.00
	CHMI004	8.61	4.60	9.87	32.00	398.00	121.00	120.00	8.00	0.23	138.00	56.00	0.96	3.40	942.00
	CHMI006	5.63	4.80	6.34	13.00	350.00	62.00	53.00	7.00	0.28	111.00	107.00	0.72	2.33	973.00
	CHSO001	7.31	4.70	7.36	27.00	337.00	108.00	138.00	13.00	0.25	69.00	128.00	0.61	4.30	923.00
	CHSO002	5.05	4.50	11.87	22.00	231.00	57.00	71.00	8.00	0.10	131.00	110.00	0.67	4.08	1070.00
	CHSO003	5.72	4.60	5.13	13.00	281.00	74.00	62.00	9.00	0.27	137.00	38.00	1.02	2.05	1020.00
	CHSO004	9.65	4.10	7.25	23.00	316.00	97.00	103.00	7.00	0.29	168.00	41.00	0.97	3.68	658.00
	CHSO005	2.03	4.20	4.07	6.00	62.00	22.00	35.00	6.00	0.23	311.00	6.00	0.87	1.59	894.00
	CHSO006	3.71	4.20	6.75	11.00	145.00	30.00	42.00	7.00	0.30	287.00	6.00	0.63	1.53	1044.00
	CHSO007	6.72	4.60	11.18	34.00	327.00	80.00	102.00	10.00	0.29	182.00	103.00	1.04	3.19	1140.00
	average	6.11	4.60	6.61	16.82	303.53	80.41	74.41	8.00	0.22	147.47	65.41	0.74	2.59	908.71
	standard deviation	2.32	0.38	2.53	8.51	135.00	35.27	33.63	2.09	0.07	68.74	40.77	0.31	1.08	153.64

¹Anions (P: Phosphorous); Exchangeable Cations (Ca: Calcium, Mg: Magnesium, K: Potassium, Na: Sodium); Extractable Minors (B: Boron, Fe: Iron, Mn: Manganese, Cu: Copper, Zn: Zinc, Al: Aluminum). Data reported in parts per million (ppm).

Piedmont Upland Forests

Piedmont Upland Forests of Chattahoochee River National Recreation Area include early-to mid-successional mixed hardwood and pine forests located on dry slopes or ridge tops and more mesic forests located on lower slopes adjacent to alluvial habitats (Cotten et al. 2019; Figure 9). The canopy and subcanopy of these forests within the park are dominated by loblolly pine, tuliptree, oaks, and hickories (*Carya* sp.) (Cotten et al. 2019). Species composition and structure within these forests can be highly variable, and are largely dependent on soil moisture, available soil nutrients, and former land use. Mesophytic forests typically develop along lower slope positions, flatter topography, northeastern aspects, and where soil depths are higher. These forests are dominated by a diversity of hardwood species. Xeric forests are found on upper slopes and ridgetops where sunlight exposure and edaphic factors contribute to drier, often droughty, conditions. The canopy of these forests is often dominated by dry-site oaks (e.g., chestnut oak [*Quercus montana*] and, when fire is frequent, shortleaf pine (*Pinus echinata*). The most commonly occurring natural upland Piedmont forest of Georgia are oak-hickory forests that occur on intermediate, submesic, or subxeric soils; these are the matrix forests that occur between the driest ridgetops and most mesic lower slopes (Edwards et al. 2013).

The Piedmont Upland Forest and Shrubland habitat type is the most dominant habitat within Chattahoochee River National Recreation Area, occupying about 72% of the coverage of all natural and semi-natural vegetation types within the park (Cotten et al. 2019). Vegetation associations sampled within the park that belong to this habitat type include (descriptions from NatureServe 2024):

- Piedmont Loblolly Pine – Oak Forest (CEGL004232; 3 plots): Semi-natural forests dominated by a mixture of loblolly pine and various oaks and other hardwoods; these forests develop on former timberland where loblolly pine was planted on abandoned agriculture fields and are abundant across the southern Piedmont and adjacent interior Coastal Plain of the United States. (Global Status: No Status Rank; State (GA) Status: No Status Rank)
- Piedmont Rocky Mesic Mafic Forest (CEGL004542; 1 plot): Piedmont forests occurring on lower slopes or adjacent to alluvial terraces with a significant amount of rock in the upper substrate and basic soil; the canopy is composed of a mixture of hardwood species, including white oak, mockernut hickory (*Carya tomentosa*),

American basswood (*Tilia americana*), northern red oak, and white ash (*Fraxinus americana*); American beech (*Fagus grandifolia* var. *caroliniana*) is typically absent from these sites. (Global Status: No Status Rank; State (GA) Status: No Status Rank)

- Ruderal Tuliptree Forest (Rich Type; CEGL007220; 1 plot): Early successional or ruderal forests that develop on disturbed mesic sites with rich soils; the canopy is often dominated by tuliptree with a variety of other hardwoods that share canopy and subcanopy codominance; eastern redbud (*Cercis canadensis*) and northern spicebush (*Lindera benzoin*) are typically found in the understory; these young mesic forests are differentiated from other forests occupying similar topographic position by the presence of circumneutral indicator species. (Global Status: No Status Rank; State (GA) Status: No Status Rank)
- Piedmont Dry-Mesic Basic Oak – Hickory Forest (CEGL007232; 4 plots): Dry-mesic forests that develop on base-rich, well-drained soils of the Piedmont and typically associated with amphibolite and other mafic rocks; the canopy is often dominated by white oak (*Quercus alba*), often in a combination with other oaks and hickories; chalk maple (*Acer leucoderme*) is often an important understory component, and overall species diversity can be high when sites are not overgrazed by deer. (Global Status: G3—Vulnerable; State (GA) Status: No Status Rank)
- Interior Southern Red Oak – White Oak Forest (CEGL007244; 2 plots): Forests of subxeric high slopes and ridges of the Cumberland Plateau, southern Ridge and Valley, Southern Blue Ridge, and Piedmont of the southeastern U.S.; the canopy of these forests is often dominated by southern red oak (*Quercus falcata*), with white oak (*Quercus alba*), tulip tree, and hickories additionally present. (Global Status: n/a; State (GA) Status: n/a)
- Piedmont Acidic Mesic Mixed Hardwood Forest (CEGL008465; 4 plots): Forests located on sheltered slopes adjacent to creeks or rivers and characterized by a canopy of mesophytic hardwoods like American beech, northern red oak (*Quercus rubra* var. *rubra*), red maple, and tuliptree; the herbaceous layer within these forests are often dense, and diverse. (Global Status: G3—Vulnerable; State (GA) Status: No Status Rank)

- Piedmont Dry-Mesic Acidic Oak – Hickory Forest (CEGL008475; 2 plots): Forests located on submesic to subxeric uplands with acidic, fairly nutrient poor soils and located throughout the Piedmont of the Southeastern U.S.; the canopies can be closed to somewhat open, and are dominated by a mixture of oaks and hickories; in

disturbed stands, these forests can also be co-dominated by pines (e.g., loblolly pine), tuliptree, sweetgum, and red maple; these forests can be species rich, particularly in areas where deer populations are effectively controlled. (Global Status: G4—Apparently Secure; State (GA) Status: No Status Rank)



Figure 9. Seventeen plots within Piedmont Upland Forest habitat of Chattahoochee River National Recreation Area were sampled during this monitoring event. Plots were often co-dominated by a canopy of loblolly pine (*Pinus taeda*) (left) or a mixture of oaks (*Quercus* sp.) and hickories (*Carya* sp.) (right). NPS photo / SECN staff.

Species Diversity and Abundance

Native species richness ranged from 31 to 65 (mean = 46.3) within vegetation plots of this broadly defined habitat type, and most plots had at least one non-native species present (Table 3). Tree species exhibited the highest richness across all spatial scales within these plots, while vine richness was high in smaller nested depths (e.g., 10 m² and 1 m²; Table 3). Overall species richness was highest in CHSO002—classified as a Piedmont Dry-Mesic Basic Oak – Hickory Forest association and CHSO004—classified as a Piedmont Acidic Mesic Mixed Hardwood Forest (Table 3). Twelve of the 16 invasive plants found within the park during this monitoring effort were encountered in the Piedmont Upland Forest habitat type, although not all species were observed in all 17 plots. Category 1 invasive plants that had high frequency of occurrence included Japanese honeysuckle (59% of the plots), Chinese privet (53%), and Japanese stiltgrass (35%) (Appendix B, Table B-1). Native vascular plants observed in these plots are fairly common across the Southeastern Coastal Plain. Large-fruited sanicle--the one species of special concern for Georgia that was observed during this monitoring effort--was located in a plot of this broadly defined habitat. Two hundred and nine vascular plant species were found collectively within these 17 plots, and 117 of these were only found in this broadly defined habitat (Appendix B, Table B-1). A complete species list, along

with constancy and average cover per species, is located in Appendix B, Table B-1. Species with high constancy in this habitat are listed below, by growth form (constancy values in parentheses):

Trees

- Tuliptree (100%)
- Mockernut hickory (94%)
- Black cherry (88%)
- American beech (88%)
- Loblolly pine (82%)
- Sweetgum (82%)

Shrubs

- Smallflower pawpaw (*Asimina parviflora*; 88%)

Vines

- Cat greenbrier (*Smilax glauca*; 100%)
- Virginia creeper (100%)
- Eastern poison ivy (100%)

- Muscadine (94%)
- Roundleaf greenbrier (*Smilax rotundifolia*; 82%)

Herbs/Forbs/Graminoids

- Black edge sedge (*Carex nigromarginta*; 94%)
- Variable panicgrass (*Dichanthelium commutatum*; 76%)

Woody Stem Metrics

Total basal area (BA) of trees was highly variable in these plots, and ranged from 3.6 to 62.9 m²/ha with an overall average of 25.8 m²/ha; density of larger diameter stems (i.e., greater than or equal to 10 centimeters [3.9 inches] ranged from six to 23 per plot, with an average of 16.1 (Table 4). Canopy height ranged from 26 to 44 meters (average = 33.3), and canopy cover ranged from 70 to 91% (average = 77.2%; Table 4). The most dominant canopy species included white oak (mean BA = 4.07 m²/ha, mean density = 46/ha), loblolly pine (mean BA = 3.72 m²/ha, mean density = 34/ha), tuliptree (mean BA = 3.12 m²/ha, mean density = 38/ha), and mockernut hickory (mean BA = 2.31 m²/ha, mean density = 44/ha; Appendix B, Table B-2). Sapling density at the 80-meter square scale ranged from 12 to 71 stems, with an average of 25.3, while seedling density at the 8-meter square scale ranged from 15 to 153 stems, with an average of 63.1 across all plots (Table 4). The most dominant sapling species within these plots included American beech, sweetgum, hophornbeam (*Ostrya virginiana*); dominant seedlings included several species of woody vines (muscadine, eastern poison ivy, and Japanese honeysuckle) as well as sweetgum and loblolly pine (Appendix B, Table B-2).

Based on stem count (density), oaks comprised about 25% of the relative abundance among species within the tree stratum (Figure 10). Dominant oaks included white, black (*Quercus velutina*), and southern red. The sapling stratum was heavily dominated by a variety of hardwoods, including small trees typical of Piedmont oak-hickory forests such as hophornbeam, eastern redbud, and American hornbeam (*Carpinus caroliniana*; Figure 10). Sweetgum and loblolly pine dominated the seedling stratum within these plots (Figure 10).

Most of the measured trees in these monitoring plots were living (96%) and the majority were categorized with healthy vigor and minimal dieback (Figure 11). Of the 315 trees that were measured within these 17 plots, only 13 were dead. Forests within this broad habitat of the park were characterized by an uneven-age structure, with multiple size-classes of woody stems present across the canopy and subcanopy. About one-fourth of the trees measured in these plots made up the forest canopy (dominant or co-dominant),

while 29% were of intermediate height class, and 47% were completely overtopped (Figure 11).

Disturbance and Threats

The most frequently encountered observable disturbance within these upland forests was related to impacts from heavy browse by white-tailed deer (*Odocoileus virginianus*), with four of the 17 plots experiencing severe impact (Table 5). See discussion above in the Piedmont Alluvial Wetland Vegetation section about deer overabundance and tree recruitment.

Long-term monitoring will provide a clearer picture of how non-native vegetation are impacting forest regeneration and the stability of native ground cover. The impacts of invasive species on native ecosystems and biodiversity are well-documented, and increased rates of habitat alteration and climate change are providing more opportunities for invasion (Vitousek et al. 1996; Chornesky and Randall 2003). Factors that facilitate pathways for invasion, such as increased density of roadways, land clearings, and urbanization (Christen and Matlack 2006; McNab and Loftis 2002) are a present and increasing reality for the landscape surrounding the Chattahoochee River. The historical legacy from agriculture can also be a factor that leads to the establishment and spread of invasive plants (Kuhman et al. 2011). Management efforts that target reduction of certain non-native species can lead to increased abundances of undesirable native species, other non-native species, or the targeted non-native species (see Royo and Carson 2006), which may have consequences on forest regeneration and ground cover diversity. It is difficult to predict how species will respond to both local-scale management efforts and landscape-scale changes (e.g., climate change). However, data from vegetation monitoring plots which track trends over time of non-native and native species abundance and forest regeneration patterns with regards to specific non-native control efforts can provide keen insight to park managers on the condition of their forest vegetation resources.

Another threat to upland vegetation communities within the Piedmont of Georgia is related to the exclusion of fire—a natural ecosystem-shaping disturbance event. In the Piedmont, fire has been critical in the creation of montane longleaf pine woodlands, xeric pine and pine-oak woodlands, and Piedmont prairies; furthermore, fire promoted oaks and pines on sites of intermediate moisture regime (Edwards et al. 2013). Prior to European settlement, the Piedmont of Georgia was dominated by tree species that either required fire for regeneration or were tolerant of fire (Cowell 1995). Although natural fire compartments were likely smaller in the Piedmont than in the neighboring Coastal Plain where there were large distances

between natural fire breaks (e.g. floodplains), fires ignited both naturally (~lightning) and by Native Americans still impacted the landscape, creating a mosaic patchwork of forested systems composed of fire-adapted and fire-intolerant (i.e., mesophytic) species. Fire exclusion over the past century has resulted in the decline in quality and extent of pine-oak woodlands and oak-hickory forests within Georgia’s Piedmont (Edwards et al. 2013). Use of fire as a tool to restore these sites is often challenging due to the proximity of roads, houses, shopping centers, and other urban features. Fire events raise public concern about air quality, reduced visibility on highways (e.g., smoke management), and structure damage. These challenges are very apparent at Chattahoochee River National Recreation Area. Historically, the park’s drier ridgetops and gentle slopes

undoubtedly supported fire-adapted ecosystems. Without fire, or other fire surrogate treatments, these forests likely will become dominated by a higher frequency of mesophytic, fire-intolerant hardwoods (e.g., red maple, tuliptree, sweetgum).

Geomorphology and Soil

Plots located within Piedmont Upland Forests of Chattahoochee River National Recreation Area occurred across a wide range of slopes, aspects, and terrain shapes (Table 6). The soils collected from these plots were acidic (average pH = 4.6) and had low cation content (Total Exchange Capacity [TEC] = 6.11) and relatively low available nutrients (Table 7).

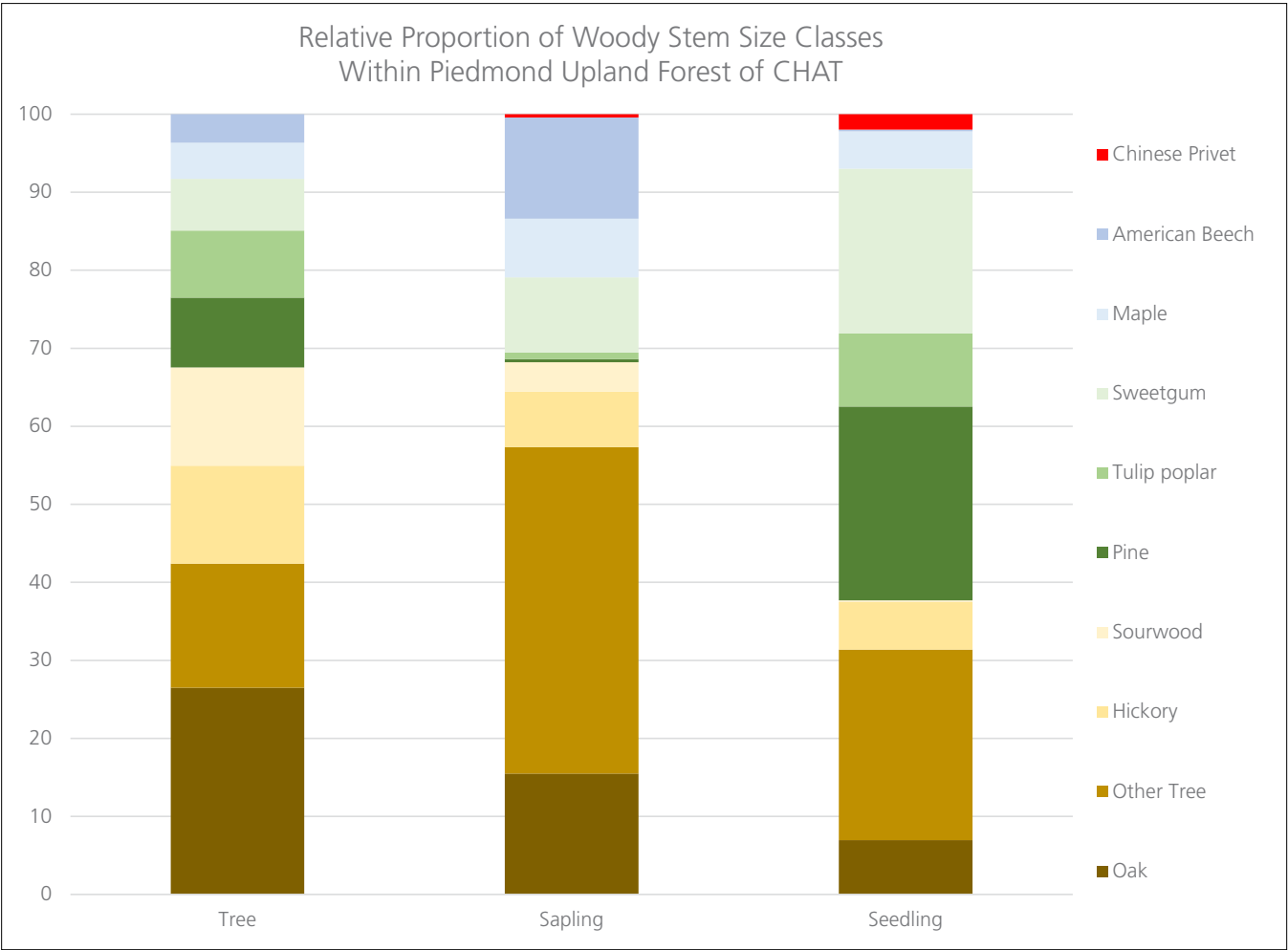
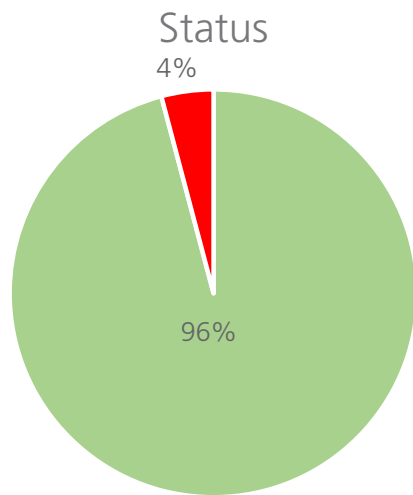
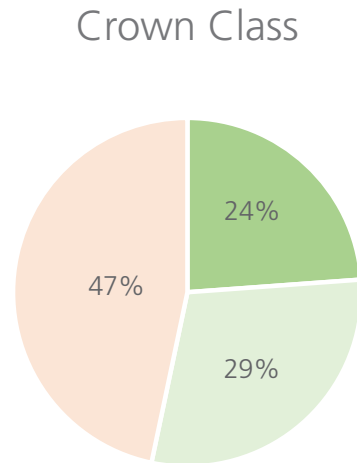


Figure 10. Relative proportion of species groups across three woody stem strata—trees, saplings, and seedlings—within Piedmont Upland Forest monitoring plots of Chattahoochee River National Recreation Area. The Other Tree category includes a variety of hardwood species such as hophornbeam, blackgum (*Nyssa sylvatica*), eastern redbud, American hornbeam, flowering dogwood (*Benthamidia florida*), and winged elm (*Ulmus alata*).

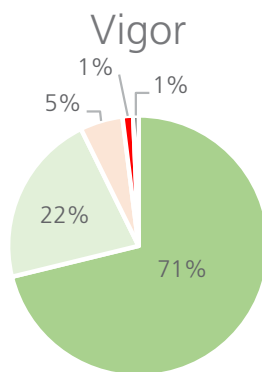
Health Condition of Trees Within Piedmont Upland Forest Plots of CHAT



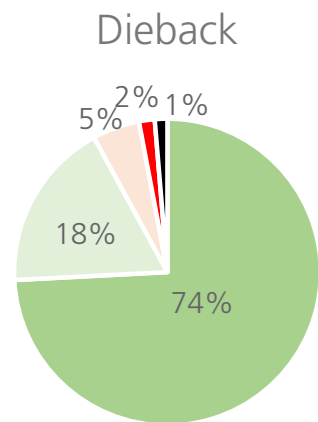
■ Live ■ Dead



■ Co-dominant ■ Intermediate ■ Overtopped



■ Healthy ■ Light Decline
 ■ Moderate Decline ■ Severe Decline
 ■ Functionally Dead



■ 1-10% ■ 10-25% ■ 25-50%
 ■ 50-75% ■ 75-100%

Figure 11. Health status of woody stems greater than or equal to 10 centimeters (3.9 in) DBH ("trees") measured on Piedmont Upland Forest and Shrubland monitoring plots of Chattahoochee River National Recreation Area

Fuel Load Estimates

Results are summarized below for each land parcel within Chattahoochee River National Recreation Area. It should be noted that there was high variability between fuel loads among vegetation plots in the park, even within similar land parcels and broadly defined habitat types. Variation in fuel loads is typical and related to differences in vegetation structure (e.g., abundance and height) and disturbance history between sites.

North Unit

Fuel loads ranged from 6.3 to 17.3 tons/acre (1.4 to 3.9 kg/m²) within the northern section of Chattahoochee River National Recreation Area (Figure 12). The two plots with the highest fuel loads had deeper duff and litter depths than the other plots. Average total fuel loads were lowest in this land parcel of the park.

Middle Unit

Fuel loads ranged from 8.2 to 36.4 tons/acre (1.8 to 8.2 kg/m²) within the middle section of Chattahoochee River National Recreation Area (Figure 13). The high volume of coarse woody debris (CWD; 1000-hour fuels) contributed to the elevated fuel loads of CHMI001 and CHMI004. However, it should be noted that presence of CWD can be indicator of good forest health, as it provides critical habitat for dead-wood dependent species (e.g. fungi, bryophytes, epiphytic plants, and invertebrates) (Grove 2002).

South Unit

Fuel loads were highest in the south unit parcel of the park and ranged from 10.8 to 25.9 tons/acre (2.4 to 5.8 kg/m²; Figure 12). Duff and litter volume contributed the most to fuel loads within these plots.

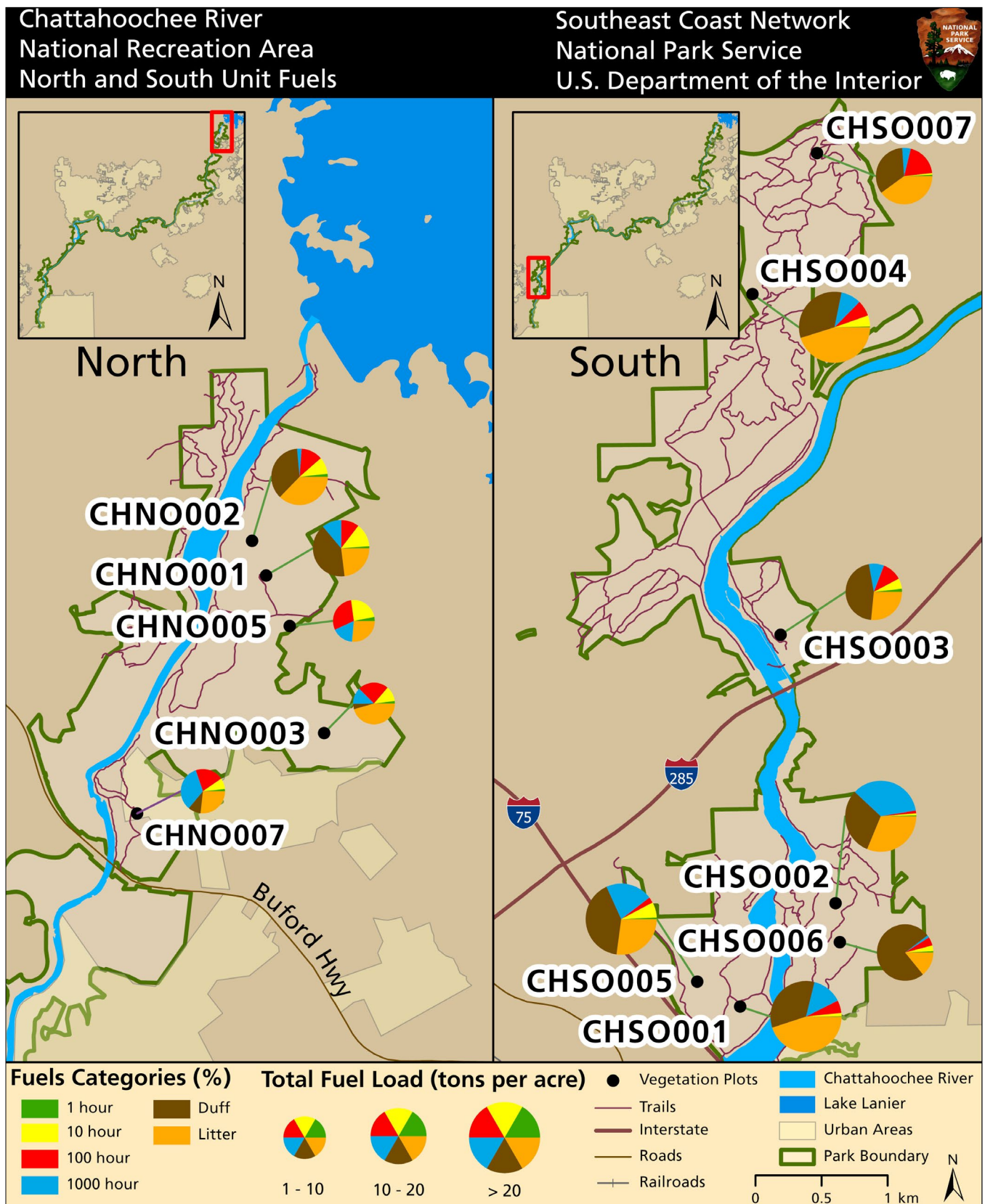


Figure 12. Fuel load estimates from vegetation monitoring plots located on the North and South land parcels of Chattahoochee River National Recreation Area.

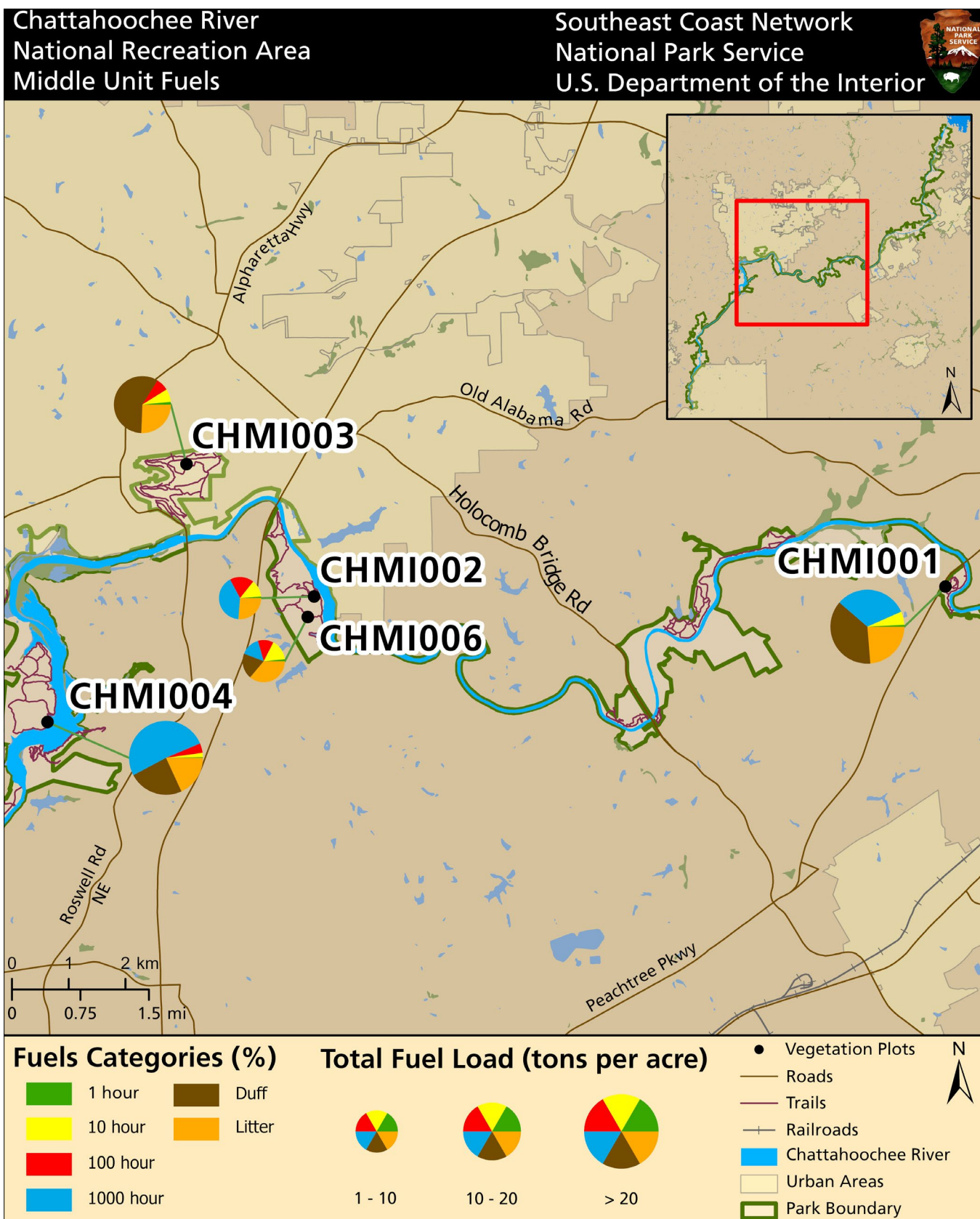


Figure 13. Fuel load estimates from vegetation monitoring plots located on the Middle land parcels of Chattahoochee River National Recreation Area.

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Appendix A. Vascular Plants Observed During the 2021 Southeast Coast Network Terrestrial Vegetation Monitoring Effort at Chattahoochee River National Recreation Area

Table A-1. Vascular plant species present in 30 vegetation monitoring plots within Chattahoochee River National Recreation Area, June-July 2021.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	Georgia Invasive Status ²	Georgia Rare-Protected Status ³
Euphorbiales	Euphorbiaceae	<i>Acalypha rhomboidea</i>	common threeseed mercury	Native	Forb/herb	–	–
Sapindales	Aceraceae	<i>Acer floridanum</i>	southern sugar maple	Native	Tree	–	–
Sapindales	Aceraceae	<i>Acer leucoderme</i>	chalk maple	Native	Tree, Shrub	–	–
Sapindales	Aceraceae	<i>Acer negundo</i> var. <i>negundo</i>	boxelder	Native	Tree	–	–
Sapindales	Aceraceae	<i>Acer rubrum</i>	red maple	Native	Tree	–	–
Ranunculales	Ranunculaceae	<i>Actaea pachypoda</i>	white baneberry	Native	Forb/herb	–	–
Ranunculales	Ranunculaceae	<i>Actaea racemosa</i>	black baneberry	Native	Forb/herb	–	–
Sapindales	Hippocastanaceae	<i>Aesculus sylvatica</i>	painted buckeye	Native	Tree, Shrub	–	–
Asterales	Asteraceae	<i>Ageratina altissima</i>	white snakeroot	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Ageratina aromatica</i>	lesser snakeroot	Native	Forb/herb	–	–
Rosales	Rosaceae	<i>Agrimonia pubescens</i>	soft agrimony	Native	Forb/herb	–	–
Fabales	Fabaceae	<i>Albizia julibrissin</i>	mimosa / silktree	Non-native	Shrub, Tree	Category 1	–
Liliales	Liliaceae	<i>Allium</i>	onion	Unknown	Forb/herb	–	–
Asterales	Asteraceae	<i>Ambrosia artemisiifolia</i>	annual ragweed	Native	Forb/herb	–	–
Rosales	Rosaceae	<i>Amelanchier arborea</i>	common serviceberry	Native	Tree, Shrub	–	–
Fabales	Fabaceae	<i>Amphicarpaea bracteata</i>	American hogpeanut	Native	Vine, Forb/herb	–	–
Lamiales	Boraginaceae	<i>Andersonglossum virginianum</i>	wild confrey	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Andropogon glomeratus</i>	bushy bluestem	Native	Graminoid	–	–
Ranunculales	Ranunculaceae	<i>Andropogon virginicus</i> var. <i>virginicus</i>	broomsedge bluestem	Native	Graminoid	–	–
Asterales	Asteraceae	<i>Antennaria plantaginifolia</i>	woman's tobacco	Native	Forb/herb	–	–
Gentianales	Apocynaceae	<i>Apocynum cannabinum</i>	Indianhemp	Native	Forb/herb	–	–
Apiales	Araliaceae	<i>Aralia spinosa</i>	devil's walkingstick	Native	Tree, Shrub	–	–
Arales	Araceae	<i>Arisaema dracontium</i>	green dragon	Native	Forb/herb	–	–
Arales	Araceae	<i>Arisaema triphyllum</i>	Jack in the pulpit	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Arthraxon hispidus</i>	small carpetgrass	Non-native	Graminoid	Category 1 - Alert	–
Cyperales	Poaceae	<i>Arundinaria appalachiana</i>	hill cane	Native	Graminoid, Shrub, Subshrub	–	–

¹ Information obtained from the PLANTS database (USDA 2024)² Information obtained from the Georgia Exotic Pest Plant Council (GA-EPPC 2023)³ Information obtained from the Georgia Department of Natural Resources (GADNR 2024)

Table A-1 (continued). Vascular plant species present in 30 vegetation monitoring plots within Chattahoochee River National Recreation Area, June-July 2021.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	Georgia Invasive Status ²	Georgia Rare-Protected Status ³
Cyperales	Poaceae	<i>Arundinaria gigantea</i>	giant cane	Native	Subshrub, Shrub, Graminoid	–	–
Cyperales	Poaceae	<i>Arundinaria tecta</i>	switchcane	Native	Graminoid, Shrub, Subshrub	–	–
Gentianales	Asclepiadaceae	<i>Asclepias variegata</i>	redring milkweed	Native	Forb/herb	–	–
Magnoliales	Annonaceae	<i>Asimina parviflora</i>	smallflower pawpaw	Native	Tree, Shrub	–	–
Magnoliales	Annonaceae	<i>Asimina triloba</i>	pawpaw	Native	Tree, Shrub	–	–
Polypodiales	Aspleniaceae	<i>Asplenium platyneuron</i>	ebony spleenwort	Native	Forb/herb	–	–
Polypodiales	Dryopteridaceae	<i>Athyrium asplenoides</i>	common ladyfern	Native	Forb/herb	–	–
Cornales	Cornaceae	<i>Benthamidia florida</i>	flowering dogwood	Native	Tree, Shrub	–	–
Fagales	Betulaceae	<i>Betula nigra</i>	river birch	Native	Tree	–	–
Scrophulariales	Bignoniaceae	<i>Bignonia capreolata</i>	crossvine	Native	Vine	–	–
Urticales	Urticaceae	<i>Boehmeria cylindrica</i>	smallspike false nettle	Native	Forb/herb	–	–
Laurales	Calycanthaceae	<i>Calycanthus floridus</i>	eastern sweetshrub	Native	Shrub	–	–
Scrophulariales	Bignoniaceae	<i>Campsis radicans</i>	trumpet creeper	Native	Vine	–	–
Cyperales	Cyperaceae	<i>Carex</i>	sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex amphibola</i>	eastern narrowleaf sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex blanda</i>	eastern woodland sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex cumberlandensis</i>	Cumberland sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex digitalis</i> var. <i>digitalis</i>	slender woodland sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex festucacea</i>	fescue sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex frankii</i>	Frank's sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex laxiculmis</i>	spreading sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex laxiflora</i>	broad looseflower sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex leavenworthii</i>	Leavenworth's sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex lupulina</i>	hop sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex nigromarginata</i>	black edge sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex normalis</i>	greater straw sedge	Native	Graminoid	–	–

¹ Information obtained from the PLANTS database (USDA 2024)² Information obtained from the Georgia Exotic Pest Plant Council (GA-EPPC 2023)³ Information obtained from the Georgia Department of Natural Resources (GADNR 2024)

Table A-1 (continued). Vascular plant species present in 30 vegetation monitoring plots within Chattahoochee River National Recreation Area, June-July 2021.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	Georgia Invasive Status ²	Georgia Rare-Protected Status ³
Cyperales	Cyperaceae	<i>Carex picta</i>	Boott's sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex radiata</i>	eastern star sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex scoparia</i>	broom sedge	Native	Graminoid	–	–
Fagales	Betulaceae	<i>Carpinus caroliniana</i>	American hornbeam	Native	Shrub, Tree	–	–
Juglandales	Juglandaceae	<i>Carya</i>	hybrid hickory	Native	Tree	–	–
Juglandales	Juglandaceae	<i>Carya cordiformis</i>	bitternut hickory	Native	Tree	–	–
Juglandales	Juglandaceae	<i>Carya glabra</i>	pignut hickory	Native	Tree	–	–
Juglandales	Juglandaceae	<i>Carya pallida</i>	sand hickory	Native	Tree	–	–
Juglandales	Juglandaceae	<i>Carya tomentosa</i>	mockernut hickory	Native	Tree	–	–
Urticales	Ulmaceae	<i>Celtis laevigata</i>	sugarberry	Native	Tree, Shrub	–	–
Rubiales	Rubiaceae	<i>Cephalanthus occidentalis</i>	common buttonbush	Native	Shrub, Tree	–	–
Fabales	Fabaceae	<i>Cercis canadensis</i>	eastern redbud	Native	Tree, Shrub	–	–
Cyperales	Poaceae	<i>Chasmanthium latifolium</i>	Indian woodoats	Native	Graminoid	–	–
Ericales	Pyrolaceae	<i>Chimaphila maculata</i>	striped prince's pine	Native	Subshrub	–	–
Scrophulariales	Oleaceae	<i>Chionanthus virginicus</i>	white fringetree	Native	Tree, Shrub	–	–
Ranunculales	Ranunculaceae	<i>Clematis terniflora</i>	sweet autumn virginsbower	Non-native	Vine	Category 3	–
Ranunculales	Ranunculaceae	<i>Clematis virginiana</i>	devil's darning needles	Native	Vine	–	–
Ranunculales	Menispermaceae	<i>Cocculus carolinus</i>	Carolina coralbead	Native	Vine	–	–
Commelinales	Commelinaceae	<i>Commelina virginica</i>	Virginia dayflower	Native	Forb/herb	–	–
Rosales	Rosaceae	<i>Crataegus</i>	hawthorn	Native	Tree, Shrub	–	–
Rosales	Rosaceae	<i>Crataegus macrosperma</i>	bigfruit hawthorn	Native	Tree, Shrub	–	–
Rosales	Rosaceae	<i>Crataegus spathulata</i>	littlehip hawthorn	Native	Tree, Shrub	–	–
Rosales	Rosaceae	<i>Crataegus uniflora</i>	dwarf hawthorn	Native	Tree, Shrub	–	–
Cyperales	Poaceae	<i>Danthonia sericea</i>	downy danthonia	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Danthonia spicata</i>	poverty oatgrass	Native	Graminoid	–	–
Fabales	Fabaceae	<i>Desmodium rotundifolium</i>	prostrate ticktrefoil	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Dichanthelium boscii</i>	Bosc's panicgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium clandestinum</i>	deertongue	Native	Graminoid	–	–

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Table A-1 (continued). Vascular plant species present in 30 vegetation monitoring plots within Chattahoochee River National Recreation Area, June-July 2021.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	Georgia Invasive Status ²	Georgia Rare-Protected Status ³
Cyperales	Poaceae	<i>Dichanthelium commutatum</i>	variable panicgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium depauperatum</i>	starved panicgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium dichotomum</i> var. <i>dichotomum</i>	cypress panicgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium laxiflorum</i>	openflower rosette grass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium scoparium</i>	velvet panicum	Native	Graminoid	–	–
Liliales	Dioscoreaceae	<i>Dioscorea villosa</i>	wild yam	Native	Forb/herb, Vine	–	–
Ebenales	Ebenaceae	<i>Diospyros virginiana</i>	common persimmon	Native	Tree	–	–
Rhamnales	Elaeagnaceae	<i>Elaeagnus pungens</i>	thorny olive	Non-native	Shrub	Category 2	–
Rhamnales	Elaeagnaceae	<i>Elaeagnus umbellata</i>	autumn olive	Non-native	Shrub	Category 1	–
Cyperales	Cyperaceae	<i>Eleocharis acicularis</i>	needle spikerush	Native	Graminoid	–	–
Asterales	Asteraceae	<i>Elephantopus carolinianus</i>	Carolina elephantsfoot	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Elephantopus tomentosus</i>	devil's grandmother	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Elymus virginicus</i>	Virginia wildrye	Native	Graminoid	–	–
Aristolochiales	Aristolochiaceae	<i>Endodeca serpentaria</i>	Virginia snakeroot	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Erechtites hieraciifolius</i>	American burnweed	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Erianthus giganteus</i>	sugarcane plumegrass	Native	Graminoid	–	–
Asterales	Asteraceae	<i>Erigeron canadensis</i>	common horseweed	Native	Forb/herb	–	–
Celastrales	Celastraceae	<i>Euonymus americanus</i>	bursting-heart	Native	Forb/herb, Subshrub	–	–
Celastrales	Celastraceae	<i>Euonymus fortunei</i>	winter creeper	Non-native	Shrub	Category 3	–
Asterales	Asteraceae	<i>Eupatorium capillifolium</i>	dogfennel	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Eupatorium serotinum</i>	lateflowering thoroughwort	Native	Forb/herb	–	–
Euphorbiales	Euphorbiaceae	<i>Euphorbia corollata</i>	flowering spurge	Native	Forb/herb	–	–
Fagales	Fagaceae	<i>Fagus grandifolia</i> var. <i>caroliniana</i>	American beech	Native	Tree	–	–
Cyperales	Poaceae	<i>Festuca subverticillata</i>	nodding fescue	Native	Graminoid	–	–
Rhamnales	Rhamnaceae	<i>Frangula caroliniana</i>	Carolina buckthorn	Native	Shrub, Tree	–	–
Scrophulariales	Oleaceae	<i>Fraxinus americana</i>	white ash	Native	Tree	–	–
Scrophulariales	Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash	Native	Tree	–	–
Rubiales	Rubiaceae	<i>Galium aparine</i>	stickywilly	Native	Forb/herb, Vine	–	–

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Table A-1 (continued). Vascular plant species present in 30 vegetation monitoring plots within Chattahoochee River National Recreation Area, June-July 2021.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	Georgia Invasive Status ²	Georgia Rare-Protected Status ³
Rubiales	Rubiaceae	<i>Galium circaeans</i>	licorice bedstraw	Native	Forb/herb	–	–
Rubiales	Rubiaceae	<i>Galium obtusum</i> var. <i>filifolium</i>	bluntleaf bedstraw	Native	Forb/herb	–	–
Rubiales	Rubiaceae	<i>Galium uniflorum</i>	oneflower bedstraw	Native	Forb/herb	–	–
Gentianales	Loganiaceae	<i>Gelsemium sempervirens</i>	evening trumpetflower	Native	Vine, Shrub	–	–
Rosales	Rosaceae	<i>Geum canadense</i>	white avens	Native	Forb/herb	–	–
Lamiales	Lamiaceae	<i>Glechoma hederacea</i>	ground ivy	Non-native	Forb/herb	–	–
Gentianales	Asclepiadaceae	<i>Gonolobus suberosus</i> var. <i>suberosus</i>	angularfruit milkvine	Native	Forb/herb, Vine	–	–
Ebenales	Styracaceae	<i>Halesia carolina</i>	Carolina silverbell	Native	Shrub, Tree	–	–
Ebenales	Styracaceae	<i>Halesia tetraptera</i>	mountain silverbell	Native	Tree	–	–
Apiales	Araliaceae	<i>Hedera helix</i> var. <i>helix</i>	English ivy	Non-native	Vine	Category 1	–
Asterales	Asteraceae	<i>Helianthus microcephalus</i>	small woodland sunflower	Native	Forb/herb	–	–
Ranunculales	Ranunculaceae	<i>Hepatica americana</i>	roundlobe hepatica	Native	Forb/herb	–	–
Aristolochiales	Aristolochiaceae	<i>Hexastylis arifolia</i>	littlebrownjug	Native	Forb/herb	–	–
Rosales	Hydrangeaceae	<i>Hydrangea barbara</i>	woodvamp	Native	Vine	–	–
Fabales	Fabaceae	<i>Hylodesmum glutinosum</i>	pointedleaf ticktrefoil	Native	Forb/herb	–	–
Fabales	Fabaceae	<i>Hylodesmum nudiflorum</i>	nakedflower ticktrefoil	Native	Forb/herb	–	–
Theales	Clusiaceae	<i>Hypericum hypericoides</i>	St. Andrew's cross	Native	Subshrub, Shrub	–	–
Theales	Clusiaceae	<i>Hypericum nudiflorum</i>	early St. Johnswort	Native	Shrub, Subshrub	–	–
Theales	Clusiaceae	<i>Hypericum punctatum</i>	spotted St. Johnswort	Native	Forb/herb	–	–
Theales	Clusiaceae	<i>Hypericum stragulum</i>	St. Andrew's cross	Native	Shrub, Subshrub	–	–
Liliales	Liliaceae	<i>Hypoxis hirsuta</i>	common goldstar	Native	Forb/herb	–	–
Celastrales	Aquifoliaceae	<i>Ilex ambigua</i>	Carolina holly	Native	Shrub, Tree	–	–
Celastrales	Aquifoliaceae	<i>Ilex cornuta</i>	Chinese holly	Non-native	Shrub, Tree	Category 4	–
Celastrales	Aquifoliaceae	<i>Ilex decidua</i>	possumhaw	Native	Tree, Shrub	–	–
Celastrales	Aquifoliaceae	<i>Ilex opaca</i>	American holly	Native	Tree, Shrub	–	–
Celastrales	Aquifoliaceae	<i>Ilex vomitoria</i>	yaupon	Native	Shrub, Tree	–	–
Geraniales	Balsaminaceae	<i>Impatiens capensis</i>	jewelweed	Native	Forb/herb	–	–
Solanales	Convolvulaceae	<i>Ipomoea</i>	morning-glory	Unknown	Vine	–	–

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Table A-1 (continued). Vascular plant species present in 30 vegetation monitoring plots within Chattahoochee River National Recreation Area, June-July 2021.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	Georgia Invasive Status ²	Georgia Rare-Protected Status ³
Liliales	Iridaceae	<i>Iris cristata</i>	dwarf crested iris	Native	Forb/herb	–	–
Rosales	Grossulariaceae	<i>Itea virginica</i>	Virginia sweetspire	Native	Shrub	–	–
Juglandales	Juglandaceae	<i>Juglans nigra</i>	black walnut	Native	Tree	–	–
Juncales	Juncaceae	<i>Juncus antheratus</i>	greater poverty rush	Native	Graminoid	–	–
Juncales	Juncaceae	<i>Juncus diffusissimus</i>	slimpod rush	Native	Graminoid	–	–
Juncales	Juncaceae	<i>Juncus effusus</i> ssp. <i>solutus</i>	common rush	Native	Graminoid	–	–
Pinales	Cupressaceae	<i>Juniperus virginiana</i>	eastern redcedar	Native	Tree	–	–
Ericales	Ericaceae	<i>Kalmia latifolia</i>	mountain laurel	Native	Tree, Shrub	–	–
Asterales	Asteraceae	<i>Krigia virginica</i>	Virginia dwarf dandelion	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Leersia oryzoides</i>	rice cutgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Leersia virginica</i>	whitegrass	Native	Graminoid	–	–
Fabales	Fabaceae	<i>Lespedeza</i>	lespedeza	Unknown	Vine	–	–
Scrophulariales	Oleaceae	<i>Ligustrum sinense</i>	Chinese privet	Non-native	Tree, Shrub	Category 1	–
Laurales	Lauraceae	<i>Lindera benzoin</i>	northern spicebush	Native	Tree, Shrub	–	–
Hamamelidales	Hamamelidaceae	<i>Liquidambar styraciflua</i>	sweetgum	Native	Tree	–	–
Magnoliales	Magnoliaceae	<i>Liriodendron tulipifera</i> var. <i>tulipifera</i>	tuliptree	Native	Tree	–	–
Liliales	Liliaceae	<i>Liriope muscari</i>	big blue lilyturf	Non-native	Forb/herb	Category 3	–
Dipsacales	Caprifoliaceae	<i>Lonicera japonica</i>	Japanese honeysuckle	Non-native	Vine	Category 1	–
Dipsacales	Caprifoliaceae	<i>Lonicera sempervirens</i>	trumpet honeysuckle	Native	Vine	–	–
Polypodiales	Blechnaceae	<i>Lorinseria areolata</i>	netted chainfern	Native	Forb/herb	–	–
Myrtales	Onagraceae	<i>Ludwigia palustris</i>	marsh seedbox	Native	Forb/herb	–	–
Magnoliales	Magnoliaceae	<i>Magnolia grandiflora</i>	southern magnolia	Native	Tree	–	–
Magnoliales	Magnoliaceae	<i>Magnolia macrophylla</i>	bigleaf magnolia	Native	Tree	–	–
Magnoliales	Magnoliaceae	<i>Magnolia tripetala</i>	umbrella-tree	Native	Tree	–	–
Ranunculales	Berberidaceae	<i>Mahonia bealei</i>	Beale's barberry	Non-native	Shrub	Category 3	–
Orchidales	Orchidaceae	<i>Malaxis unifolia</i>	green adder's-mouth orchid	Native	Forb/herb	–	–
Rosales	Rosaceae	<i>Malus angustifolia</i>	southern crab apple	Native	Tree, Shrub	–	–
Cyperales	Poaceae	<i>Melica mutica</i>	twoflower melicgrass	Native	Graminoid	–	–

¹ Information obtained from the PLANTS database (USDA 2024)² Information obtained from the Georgia Exotic Pest Plant Council (GA-EPPC 2023)³ Information obtained from the Georgia Department of Natural Resources (GADNR 2024)

Table A-1 (continued). Vascular plant species present in 30 vegetation monitoring plots within Chattahoochee River National Recreation Area, June-July 2021.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	Georgia Invasive Status ²	Georgia Rare-Protected Status ³
Cyperales	Poaceae	<i>Melica nitens</i>	threeflower melicgrass	Native	Graminoid	–	–
Violales	Cucurbitaceae	<i>Melothria pendula</i>	Guadeloupe cucumber	Native	Forb/herb, Vine	–	–
Ranunculales	Menispermaceae	<i>Menispermum canadense</i>	common moonseed	Native	Vine	–	–
Cyperales	Poaceae	<i>Microstegium vimineum</i>	Japanese stiltgrass / Nepalese browntop	Non-native	Graminoid	Category 1	–
Asterales	Asteraceae	<i>Mikania scandens</i>	climbing hempvine	Native	Vine, Forb/herb	–	–
Fabales	Fabaceae	<i>Mimosa microphylla</i>	littleleaf sensitive-briar	Native	Vine, Forb/herb	–	–
Rubiales	Rubiaceae	<i>Mitchella repens</i>	partridgeberry	Native	Subshrub, Forb/herb	–	–
Lamiales	Lamiaceae	<i>Monarda fistulosa</i>	wild bergamot	Native	Subshrub, Forb/herb	–	–
Urticales	Moraceae	<i>Morus rubra</i>	red mulberry	Native	Tree	–	–
Lamiales	Lamiaceae	<i>Mosla dianthera</i>	miniature beefsteakplant	Non-native	Forb/herb	Category 3	–
Cyperales	Poaceae	<i>Muhlenbergia schreberi</i>	nimblewill	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Muhlenbergia tenuiflora</i>	slimflower muhly	Native	Graminoid	–	–
Rhamnales	Vitaceae	<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	muscadine	Native	Vine	–	–
Asterales	Asteraceae	<i>Nabalus altissimus</i>	tall rattlesnakeroot	Native	Forb/herb	–	–
Ranunculales	Berberidaceae	<i>Nandina domestica</i>	sacred bamboo	Non-native	Shrub	Category 2	–
Cornales	Cornaceae	<i>Nyssa biflora</i>	swamp tupelo	Native	Tree	–	–
Cornales	Cornaceae	<i>Nyssa sylvatica</i>	blackgum	Native	Tree	–	–
Polypodiales	Dryopteridaceae	<i>Onoclea sensibilis</i>	sensitive fern	Native	Forb/herb	–	–
Orchidales	Orchidaceae	<i>Orchidaceae</i>	Orchid Family	Native	Forb/herb	–	–
Apiales	Apiaceae	<i>Osmorhiza longistylis</i>	longstyle sweetroot	Native	Forb/herb	–	–
Fagales	Betulaceae	<i>Ostrya virginiana</i>	hophornbeam	Native	Tree, Shrub	–	–
Geraniales	Oxalidaceae	<i>Oxalis</i>	woodsorrel	Unknown	Forb/herb	–	–
Geraniales	Oxalidaceae	<i>Oxalis dillenii</i>	slender yellow woodsorrel	Native	Forb/herb	–	–
Geraniales	Oxalidaceae	<i>Oxalis stricta</i>	common yellow oxalis	Native	Forb/herb	–	–
Ericales	Ericaceae	<i>Oxydendrum arboreum</i>	sourwood	Native	Shrub, Tree	–	–
Asterales	Asteraceae	<i>Packera anonyma</i>	Small's ragwort	Native	Forb/herb	–	–
Rhamnales	Vitaceae	<i>Parthenocissus quinquefolia</i>	Virginia creeper	Native	Vine	–	–

¹ Information obtained from the PLANTS database (USDA 2024)² Information obtained from the Georgia Exotic Pest Plant Council (GA-EPPC 2023)³ Information obtained from the Georgia Department of Natural Resources (GADNR 2024)

Table A-1 (continued). Vascular plant species present in 30 vegetation monitoring plots within Chattahoochee River National Recreation Area, June-July 2021.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	Georgia Invasive Status ²	Georgia Rare-Protected Status ³
Violales	Passifloraceae	<i>Passiflora lutea</i>	yellow passionflower	Native	Forb/herb, Vine	–	–
Arales	Araceae	<i>Peltandra virginica</i>	green arrow arum	Native	Forb/herb	–	–
Polygonales	Polygonaceae	<i>Persicaria</i>	knotweed	Native	Forb/herb	–	–
Polygonales	Polygonaceae	<i>Persicaria hydropiperoides</i>	swamp smartweed	Native	Forb/herb	–	–
Polygonales	Polygonaceae	<i>Persicaria punctata</i>	dotted smartweed	Native	Forb/herb	–	–
Polygonales	Polygonaceae	<i>Persicaria virginiana</i>	jumpseed	Native	Forb/herb	–	–
Lamiales	Verbenaceae	<i>Phryma leptostachya</i>	American lopseed	Native	Forb/herb	–	–
Caryophyllales	Phytolaccaceae	<i>Phytolacca americana</i>	American pokeweed	Native	Forb/herb	–	–
Urticales	Urticaceae	<i>Pilea pumila</i>	Canadian clearweed	Native	Forb/herb	–	–
Pinales	Pinaceae	<i>Pinus echinata</i>	shortleaf pine	Native	Tree	–	–
Pinales	Pinaceae	<i>Pinus taeda</i>	loblolly pine	Native	Tree	–	–
Cyperales	Poaceae	<i>Piptochaetium avenaceum</i>	blackseed speargrass	Native	Graminoid	–	–
Hamamelidales	Platanaceae	<i>Platanus occidentalis</i>	American sycamore	Native	Tree	–	–
Polypodiales	Polypodiaceae	<i>Pleopeltis michauxiana</i>	resurrection fern	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Pluchea camphorata</i>	camphor pluchea	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Poa</i>	bluegrass	Unknown	Graminoid	–	–
Cyperales	Poaceae	<i>Poa autumnalis</i>	autumn bluegrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Poaceae</i>	Grass Family	Unknown	Graminoid	–	–
Ranunculales	Berberidaceae	<i>Podophyllum peltatum</i>	mayapple	Native	Forb/herb	–	–
Liliales	Liliaceae	<i>Polygonatum biflorum</i>	smooth Solomon's seal	Native	Forb/herb	–	–
Polypodiales	Dryopteridaceae	<i>Polystichum acrostichoides</i>	Christmas fern	Native	Forb/herb	–	–
Rosales	Rosaceae	<i>Potentilla canadensis</i>	dwarf cinquefoil	Native	Forb/herb	–	–
Rosales	Rosaceae	<i>Potentilla indica</i>	Indian strawberry	Non-native	Forb/herb	–	–
Rosales	Rosaceae	<i>Prunus</i>	plum	Unknown	Tree	–	–
Rosales	Rosaceae	<i>Prunus angustifolia</i>	Chickasaw plum	Native	Tree, Shrub	–	–
Rosales	Rosaceae	<i>Prunus avium</i>	sweet cherry	Non-native	Tree	–	–
Rosales	Rosaceae	<i>Prunus caroliniana</i>	Carolina laurelcherry	Native	Tree, Shrub	–	–
Rosales	Rosaceae	<i>Prunus mahaleb</i>	wild goose plum	Native	Tree, Shrub	–	–

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Table A-1 (continued). Vascular plant species present in 30 vegetation monitoring plots within Chattahoochee River National Recreation Area, June-July 2021.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	Georgia Invasive Status ²	Georgia Rare-Protected Status ³
Rosales	Rosaceae	<i>Prunus serotina</i> var. <i>serotina</i>	black cherry	Native	Shrub, Tree	–	–
Asterales	Asteraceae	<i>Pseudognaphalium obtusifolium</i>	rabbit-tobacco	Native	Forb/herb	–	–
Polypodiales	Dennstaedtiaceae	<i>Pteridium latiusculum</i>	western brackenfern	Native	Forb/herb	–	–
Lamiales	Lamiaceae	<i>Pycnanthemum incanum</i> var. <i>puberulum</i>	hoary mountainmint	Native	Forb/herb	–	–
Fagales	Fagaceae	<i>Quercus alba</i>	white oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus coccinea</i>	scarlet oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus falcata</i>	southern red oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus marilandica</i> var. <i>marilandica</i>	blackjack oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus michauxii</i>	swamp chestnut oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus montana</i>	chestnut oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus nigra</i>	water oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus phellos</i>	willow oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus rubra</i> var. <i>rubra</i>	northern red oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus shumardii</i>	Shumard's oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus stellata</i>	post oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus velutina</i>	black oak	Native	Tree	–	–
Ericales	Ericaceae	<i>Rhododendron calendulaceum</i>	flame azalea	Native	Shrub	–	–
Ericales	Ericaceae	<i>Rhododendron minus</i>	piedmont rhododendron	Native	Shrub	–	–
Ericales	Ericaceae	<i>Rhododendron periclymenoides</i>	pink azalea	Native	Shrub	–	–
Sapindales	Anacardiaceae	<i>Rhus copallinum</i>	winged sumac	Native	Tree, Shrub	–	–
Fabales	Fabaceae	<i>Robinia pseudoacacia</i>	black locust	Native	Tree	–	–
Rosales	Rosaceae	<i>Rosa multiflora</i>	multiflora rose	Non-native	Subshrub, Vine	Category 1	–
Rosales	Rosaceae	<i>Rubus</i>	blackberry	Unknown	Subshrub, Vine	–	–
Rosales	Rosaceae	<i>Rubus flagellaris</i>	northern dewberry	Native	Subshrub, Vine	–	–
Rosales	Rosaceae	<i>Rubus pensilvanicus</i>	sawtooth blackberry	Native	Subshrub	–	–
Scrophulariales	Acanthaceae	<i>Ruellia caroliniensis</i>	Carolina wild petunia	Native	Forb/herb	–	–
Alismatales	Alismataceae	<i>Sagittaria latifolia</i> var. <i>latifolia</i>	broadleaf arrowhead	Native	Forb/herb	–	–
Salicales	Salicaceae	<i>Salix nigra</i>	black willow	Native	Tree	–	–

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Table A-1 (continued). Vascular plant species present in 30 vegetation monitoring plots within Chattahoochee River National Recreation Area, June-July 2021.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	Georgia Invasive Status ²	Georgia Rare-Protected Status ³
Dipsacales	Caprifoliaceae	<i>Sambucus canadensis</i>	American black elderberry	Native	Shrub, Tree	–	–
Papaverales	Papaveraceae	<i>Sanguinaria canadensis</i>	bloodroot	Native	Forb/herb	–	–
Apiales	Apiaceae	<i>Sanicula canadensis</i> var. <i>canadensis</i>	Canadian blacksnakeroot	Native	Forb/herb	–	–
Apiales	Apiaceae	<i>Sanicula trifoliata</i>	largefruit blacksnakeroot	Native	Forb/herb	–	S1
Laurales	Lauraceae	<i>Sassafras albidum</i>	sassafras	Native	Tree, Shrub	–	–
Ophioglossales	Ophioglossaceae	<i>Sceptridium bitermum</i>	sparselobe grapefern	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	little bluestem	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Scirpus cyperinus</i>	woolgrass	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Scleria oligantha</i>	littlehead nutrush	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Scleria triglomerata</i>	whip nutrush	Native	Graminoid	–	–
Lamiales	Lamiaceae	<i>Scutellaria elliptica</i>	hairy skullcap	Native	Forb/herb	–	–
Liliales	Iridaceae	<i>Sisyrinchium angustifolium</i>	white blue-eyed grass	Native	Forb/herb	–	–
Liliales	Iridaceae	<i>Sisyrinchium mucronatum</i>	needletip blue-eyed grass	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Smilanthus uvedalia</i>	hairy leafcup	Native	Forb/herb	–	–
Liliales	Smilacaceae	<i>Smilax biltmoreana</i>	Biltmore's carrionflower	Native	Forb/herb, Vine	–	–
Liliales	Smilacaceae	<i>Smilax bona-nox</i> var. <i>bona-nox</i>	saw greenbrier	Native	Shrub, Vine	–	–
Liliales	Smilacaceae	<i>Smilax glauca</i>	cat greenbrier	Native	Shrub, Vine	–	–
Liliales	Smilacaceae	<i>Smilax rotundifolia</i>	roundleaf greenbrier	Native	Vine, Shrub	–	–
Liliales	Smilacaceae	<i>Smilax walteri</i>	coral greenbrier	Native	Shrub, Vine	–	–
Solanales	Solanaceae	<i>Solanum emulans</i>	West Indian nightshade	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Solidago</i>	goldenrod	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Sorghastrum nutans</i>	Indiangrass	Native	Graminoid	–	–
Cornales	Cornaceae	<i>Swida foemina</i>	stiff dogwood	Native	Tree, Shrub	–	–
Asterales	Asteraceae	<i>Symphyotrichum lateriflorum</i>	calico aster	Native	Forb/herb	–	–
Ebenales	Symplocaceae	<i>Symplocos tinctoria</i>	common sweetleaf	Native	Tree, Shrub	–	–
Ranunculales	Ranunculaceae	<i>Thalictrum thalictroides</i>	rue anemone	Native	Forb/herb	–	–
Malvales	Tiliaceae	<i>Tilia americana</i> var. <i>heterophylla</i>	American basswood	Native	Tree	–	–
Sapindales	Anacardiaceae	<i>Toxicodendron radicans</i> var. <i>radicans</i>	eastern poison ivy	Native	Forb/herb, Vine, Subshrub	–	–

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Table A-1 (continued). Vascular plant species present in 30 vegetation monitoring plots within Chattahoochee River National Recreation Area, June-July 2021.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	Georgia Invasive Status ²	Georgia Rare-Protected Status ³
Liliales	Liliaceae	<i>Trillium</i>	trillium	Native	Forb/herb	–	–
Liliales	Liliaceae	<i>Trillium catesbaei</i>	bashful wakerobin	Native	Forb/herb	–	–
Liliales	Liliaceae	<i>Trillium cuneatum</i>	little sweet Betsy	Native	Forb/herb	–	–
Campanulales	Campanulaceae	<i>Triodanis perfoliata</i>	clasping Venus' looking-glass	Native	Forb/herb	–	–
Urticales	Ulmaceae	<i>Ulmus alata</i>	winged elm	Native	Tree	–	–
Urticales	Ulmaceae	<i>Ulmus rubra</i>	slippery elm	Native	Tree	–	–
Unknown	Unknown	<i>Unknown</i>	Unknown	Unknown	Unknown	–	–
Liliales	Liliaceae	<i>Uvularia puberula</i>	mountain bellwort	Native	Forb/herb	–	–
Liliales	Liliaceae	<i>Uvularia sessilifolia</i>	sessileleaf bellwort	Native	Forb/herb	–	–
Ericales	Ericaceae	<i>Vaccinium arboreum</i>	farkleberry	Native	Tree, Shrub	–	–
Ericales	Ericaceae	<i>Vaccinium elliotii</i>	Elliott's blueberry	Native	Shrub	–	–
Ericales	Ericaceae	<i>Vaccinium fuscatum</i>	southern blueberry	Native	Shrub	–	–
Ericales	Ericaceae	<i>Vaccinium pallidum</i>	Blue Ridge blueberry	Native	Subshrub, Shrub	–	–
Ericales	Ericaceae	<i>Vaccinium stamineum</i>	deerberry	Native	Shrub	–	–
Asterales	Asteraceae	<i>Verbesina alternifolia</i>	wingstem	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Verbesina occidentalis</i>	yellow crownbeard	Native	Forb/herb	–	–
Dipsacales	Caprifoliaceae	<i>Viburnum acerifolium</i>	mapleleaf viburnum	Native	Shrub, Subshrub	–	–
Dipsacales	Caprifoliaceae	<i>Viburnum prunifolium</i>	blackhaw	Native	Tree, Shrub	–	–
Dipsacales	Caprifoliaceae	<i>Viburnum rufidulum</i>	rusty blackhaw	Native	Tree, Shrub	–	–
Dipsacales	Caprifoliaceae	<i>Viburnum setigerum</i>	tea viburnem	Non-native	Shrub	–	–
Violales	Violaceae	<i>Viola</i>	violet	Native	Forb/herb	–	–
Violales	Violaceae	<i>Viola palmata</i>	common blue violet	Native	Forb/herb	–	–
Rhamnales	Vitaceae	<i>Vitis aestivalis</i> var. <i>aestivalis</i>	summer grape	Native	Vine	–	–
Asterales	Asteraceae	<i>Youngia japonica</i>	Oriental false hawksbeard	Non-native	Forb/herb	–	–

¹ Information obtained from the PLANTS database (USDA 2024)² Information obtained from the Georgia Exotic Pest Plant Council (GA-EPPC 2023)³ Information obtained from the Georgia Department of Natural Resources (GADNR 2024)

Appendix B. Species Diversity, Abundance, and Woody Stem Metrics Summarized by Broadly Defined Habitats at Chattahoochee River National Recreation Area

Table B-1. Constancy and average cover class for all vascular plant species observed in 30 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: PAWV = Piedmont Alluvial Wetland Vegetation (13 plots) and PUF = Piedmont Upland Forests (17 plots). Cover classes are as follows: 1: 0–0.1%, 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: 95–100%.

Species	PAWV Constancy	PAWV Cover	PUF Constancy	PUF Cover
<i>Acalypha rhomboidea</i>	23	–	–	–
<i>Acer floridanum</i>	23	5	6	3
<i>Acer leucoderme</i>	8	5	41	6
<i>Acer negundo</i> var. <i>negundo</i>	77	7	6	1
<i>Acer rubrum</i>	69	6	65	5
<i>Actaea pachypoda</i>	–	–	6	1
<i>Actaea racemosa</i>	–	–	6	1
<i>Aesculus sylvatica</i>	–	–	47	4
<i>Ageratina altissima</i>	8	3	–	–
<i>Ageratina aromatica</i>	–	–	6	1
<i>Agrimonia pubescens</i>	8	1	12	2
<i>Albizia julibrissin</i>	8	1	6	2
<i>Allium</i>	8	1	–	–
<i>Ambrosia artemisiifolia</i>	8	1	–	–
<i>Amelanchier arborea</i>	–	–	29	3
<i>Amphicarpaea bracteata</i>	–	–	12	1
<i>Andersonglossum virginianum</i>	15	2	18	2
<i>Andropogon glomeratus</i>	8	2	–	–
<i>Andropogon virginicus</i> var. <i>virginicus</i>	–	–	6	2
<i>Antennaria plantaginifolia</i>	–	–	6	1
<i>Apocynum cannabinum</i>	–	–	12	1
<i>Aralia spinosa</i>	8	2	–	–
<i>Arisaema dracontium</i>	8	2	6	2
<i>Arisaema triphyllum</i>	23	2	12	1
<i>Arthraxon hispidus</i>	8	1	–	–
<i>Arundinaria appalachiana</i>	–	–	18	4
<i>Arundinaria gigantea</i>	15	4	–	–
<i>Arundinaria tecta</i>	8	2	–	–
<i>Asclepias variegata</i>	–	–	6	1
<i>Asimina parviflora</i>	–	–	88	3
<i>Asimina triloba</i>	8	2	–	–
<i>Asplenium platyneuron</i>	46	2	35	2
<i>Athyrium asplenoides</i>	8	2	6	1
<i>Benthamidia florida</i>	–	–	76	4
<i>Betula nigra</i>	46	6	–	–
<i>Bignonia capreolata</i>	38	2	18	2
<i>Boehmeria cylindrica</i>	85	2	–	–
<i>Calycanthus floridus</i>	–	–	6	1

Table B-1 (continued). Constancy and average cover class for all vascular plant species observed in 30 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: PAWV = Piedmont Alluvial Wetland Vegetation (13 plots) and PUF = Piedmont Upland Forests (17 plots). Cover classes are as follows: 1: 0–0.1%, 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: 95–100%.

Species	PAWV Constancy	PAWV Cover	PUF Constancy	PUF Cover
<i>Campsis radicans</i>	69	2	24	1
<i>Carex</i>	23	2	6	2
<i>Carex amphibola</i>	31	2	24	3
<i>Carex blanda</i>	–	–	6	2
<i>Carex cumberlandensis</i>	–	–	6	2
<i>Carex digitalis</i> var. <i>digitalis</i>	–	–	12	2
<i>Carex festucacea</i>	8	2	6	2
<i>Carex frankii</i>	15	2	–	–
<i>Carex laxiculmis</i>	8	2	–	–
<i>Carex laxiflora</i>	–	–	18	2
<i>Carex leavenworthii</i>	–	–	18	1
<i>Carex lupulina</i>	8	8	–	–
<i>Carex nigromarginata</i>	–	–	94	2
<i>Carex normalis</i>	46	2	–	–
<i>Carex picta</i>	–	–	12	3
<i>Carex radiata</i>	8	2	6	2
<i>Carex scoparia</i>	8	2	–	–
<i>Carpinus caroliniana</i>	46	6	35	5
<i>Carya</i>	8	1	–	–
<i>Carya cordiformis</i>	38	6	6	1
<i>Carya glabra</i>	15	4	65	6
<i>Carya pallida</i>	–	–	29	3
<i>Carya tomentosa</i>	–	–	94	6
<i>Celtis laevigata</i>	46	4	12	2
<i>Cephalanthus occidentalis</i>	8	3	–	–
<i>Cercis canadensis</i>	–	–	47	5
<i>Chasmanthium latifolium</i>	8	2	–	–
<i>Chimaphila maculata</i>	–	–	41	2
<i>Chionanthus virginicus</i>	–	–	6	2
<i>Clematis terniflora</i>	8	4	–	–
<i>Clematis virginiana</i>	8	3	–	–
<i>Cocculus carolinus</i>	8	2	–	–
<i>Commelina virginica</i>	23	2	–	–
<i>Crataegus</i>	15	1	18	2
<i>Crataegus macrosperma</i>	15	2	18	3
<i>Crataegus spathulata</i>	–	–	6	2
<i>Crataegus uniflora</i>	–	–	6	1
<i>Danthonia sericea</i>	–	–	12	2
<i>Danthonia spicata</i>	–	–	12	2
<i>Desmodium rotundifolium</i>	8	1	–	–
<i>Dichanthelium boscii</i>	–	–	29	2
<i>Dichanthelium clandestinum</i>	8	1	–	–

Table B-1 (continued). Constancy and average cover class for all vascular plant species observed in 30 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: PAWV = Piedmont Alluvial Wetland Vegetation (13 plots) and PUF = Piedmont Upland Forests (17 plots). Cover classes are as follows: 1: 0–0.1%, 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: 95–100%

Species	PAWV Constancy	PAWV Cover	PUF Constancy	PUF Cover
<i>Dichanthelium commutatum</i>	15	2	76	2
<i>Dichanthelium depauperatum</i>	8	1	12	2
<i>Dichanthelium dichotomum</i> var. <i>dichotomum</i>	8	1	35	2
<i>Dichanthelium laxiflorum</i>	8	1	12	2
<i>Dichanthelium scoparium</i>	8	1	–	–
<i>Dioscorea villosa</i>	8	2	18	1
<i>Diospyros virginiana</i>	8	1	65	2
<i>Elaeagnus pungens</i>	–	–	12	2
<i>Elaeagnus umbellata</i>	23	6	24	2
<i>Eleocharis acicularis</i>	8	2	–	–
<i>Elephantopus carolinianus</i>	23	2	–	–
<i>Elephantopus tomentosus</i>	–	–	12	2
<i>Elymus virginicus</i>	23	2	–	–
<i>Endodeca serpentaria</i>	8	1	41	2
<i>Erechtites hieraciifolius</i>	54	2	12	2
<i>Erianthus giganteus</i>	8	6	–	–
<i>Erigeron canadensis</i>	–	–	6	1
<i>Euonymus americanus</i>	15	2	65	2
<i>Euonymus fortunei</i>	23	2	6	2
<i>Eupatorium capillifolium</i>	–	–	12	2
<i>Eupatorium serotinum</i>	8	2	6	1
<i>Euphorbia corollata</i>	8	1	6	2
<i>Fagus grandifolia</i> var. <i>caroliniana</i>	–	–	88	6
<i>Festuca subverticillata</i>	8	1	–	–
<i>Frangula caroliniana</i>	–	–	6	3
<i>Fraxinus americana</i>	8	1	24	5
<i>Fraxinus pennsylvanica</i>	77	4	24	2
<i>Galium aparine</i>	8	2	–	–
<i>Galium circaezans</i>	–	–	47	2
<i>Galium obtusum</i> var. <i>filifolium</i>	8	1	41	2
<i>Galium uniflorum</i>	–	–	18	2
<i>Gelsemium sempervirens</i>	–	–	6	3
<i>Geum canadense</i>	15	1	–	–
<i>Glechoma hederacea</i>	15	4	–	–
<i>Gonolobus suberosus</i> var. <i>suberosus</i>	23	2	18	2
<i>Halesia carolina</i>	15	5	–	–
<i>Halesia tetraptera</i>	8	2	–	–
<i>Hedera helix</i> var. <i>helix</i>	38	2	18	2
<i>Helianthus microcephalus</i>	–	–	6	1
<i>Hepatica americana</i>	–	–	6	1
<i>Hexastylis arifolia</i>	–	–	29	2
<i>Hydrangea barbara</i>	8	2	6	3

Table B-1 (continued). Constancy and average cover class for all vascular plant species observed in 30 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: PAWV = Piedmont Alluvial Wetland Vegetation (13 plots) and PUF = Piedmont Upland Forests (17 plots). Cover classes are as follows: 1: 0–0.1%, 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: 95–100%.

Species	PAWV Constancy	PAWV Cover	PUF Constancy	PUF Cover
<i>Hylodesmum glutinosum</i>	8	1	–	–
<i>Hylodesmum nudiflorum</i>	–	–	29	2
<i>Hypericum hypericoides</i>	8	1	–	–
<i>Hypericum nudiflorum</i>	8	2	–	–
<i>Hypericum punctatum</i>	15	2	–	–
<i>Hypericum stragulum</i>	–	–	6	1
<i>Hypoxis hirsuta</i>	–	–	6	1
<i>Ilex ambigua</i>	–	–	18	2
<i>Ilex cornuta</i>	46	2	12	2
<i>Ilex decidua</i>	8	1	–	–
<i>Ilex opaca</i>	15	2	47	5
<i>Ilex vomitoria</i>	–	–	6	2
<i>Impatiens capensis</i>	31	2	–	–
<i>Ipomoea</i>	8	1	6	2
<i>Iris cristata</i>	–	–	6	1
<i>Itea virginica</i>	8	2	–	–
<i>Juglans nigra</i>	31	4	–	–
<i>Juncus antheratus</i>	8	2	–	–
<i>Juncus diffusissimus</i>	8	1	–	–
<i>Juncus effusus</i> ssp. <i>solutus</i>	15	7	–	–
<i>Juniperus virginiana</i>	–	–	12	2
<i>Kalmia latifolia</i>	–	–	12	5
<i>Krigia virginica</i>	8	1	–	–
<i>Leersia oryzoides</i>	23	2	6	1
<i>Leersia virginica</i>	–	–	6	1
<i>Lespedeza</i>	–	–	6	1
<i>Ligustrum sinense</i>	92	6	53	2
<i>Lindera benzoin</i>	8	1	6	1
<i>Liquidambar styraciflua</i>	92	6	82	6
<i>Liriodendron tulipifera</i> var. <i>tulipifera</i>	69	6	100	6
<i>Liriope muscari</i>	8	2	12	3
<i>Lonicera japonica</i>	62	3	59	2
<i>Lonicera sempervirens</i>	8	6	–	–
<i>Lorinseria areolata</i>	8	3	–	–
<i>Ludwigia palustris</i>	15	2	–	–
<i>Magnolia grandiflora</i>	15	5	24	2
<i>Magnolia macrophylla</i>	–	–	6	5
<i>Magnolia tripetala</i>	–	–	6	2
<i>Mahonia bealei</i>	8	1	18	2
<i>Malaxis unifolia</i>	–	–	12	2
<i>Malus angustifolia</i>	8	4	6	1
<i>Melica mutica</i>	–	–	12	2

Table B-1 (continued). Constancy and average cover class for all vascular plant species observed in 30 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: PAWV = Piedmont Alluvial Wetland Vegetation (13 plots) and PUF = Piedmont Upland Forests (17 plots). Cover classes are as follows: 1: 0–0.1%, 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: 95–100%

Species	PAWV Constancy	PAWV Cover	PUF Constancy	PUF Cover
<i>Melica nitens</i>	–	–	6	2
<i>Melothria pendula</i>	8	2	–	–
<i>Menispermum canadense</i>	–	–	6	2
<i>Microstegium vimineum</i>	54	6	35	2
<i>Mikania scandens</i>	23	2	–	–
<i>Mimosa microphylla</i>	–	–	6	1
<i>Mitchella repens</i>	8	1	–	–
<i>Monarda fistulosa</i>	–	–	6	2
<i>Morus rubra</i>	8	4	24	4
<i>Mosla dianthera</i>	23	2	–	–
<i>Muhlenbergia schreberi</i>	15	2	6	1
<i>Muhlenbergia tenuiflora</i>	8	1	–	–
<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	85	4	94	6
<i>Nabalus altissimus</i>	–	–	35	2
<i>Nandina domestica</i>	–	–	6	2
<i>Nyssa biflora</i>	8	3	–	–
<i>Nyssa sylvatica</i>	–	–	76	5
<i>Onoclea sensibilis</i>	15	1	–	–
Orchidaceae	–	–	6	1
<i>Osmorhiza longistylis</i>	8	2	–	–
<i>Ostrya virginiana</i>	–	–	47	6
<i>Oxalis</i>	23	2	18	2
<i>Oxalis dillenii</i>	–	–	18	2
<i>Oxalis stricta</i>	–	–	6	1
<i>Oxydendrum arboreum</i>	–	–	65	6
<i>Packera anonyma</i>	–	–	6	2
<i>Parthenocissus quinquefolia</i>	77	2	100	2
<i>Passiflora lutea</i>	15	2	29	2
<i>Peltandra virginica</i>	8	2	–	–
<i>Persicaria</i>	31	2	–	–
<i>Persicaria hydropiperoides</i>	46	4	–	–
<i>Persicaria punctata</i>	31	2	–	–
<i>Persicaria virginiana</i>	15	2	–	–
<i>Phryma leptostachya</i>	15	2	–	–
<i>Phytolacca americana</i>	23	2	6	3
<i>Pilea pumila</i>	15	2	–	–
<i>Pinus echinata</i>	–	–	29	4
<i>Pinus taeda</i>	38	6	82	6
<i>Piptochaetium avenaceum</i>	–	–	24	2
<i>Platanus occidentalis</i>	38	5	–	–
<i>Pleopeltis michauxiana</i>	8	1	6	1
<i>Pluchea camphorata</i>	8	2	–	–

Table B-1 (continued). Constancy and average cover class for all vascular plant species observed in 30 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: PAWV = Piedmont Alluvial Wetland Vegetation (13 plots) and PUF = Piedmont Upland Forests (17 plots). Cover classes are as follows: 1: 0–0.1%, 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: 95–100%

Species	PAWV Constancy	PAWV Cover	PUF Constancy	PUF Cover
<i>Poa</i>	8	1	–	–
<i>Poa autumnalis</i>	31	3	–	–
<i>Poaceae</i>	8	2	–	–
<i>Podophyllum peltatum</i>	–	–	12	2
<i>Polygonatum biflorum</i>	–	–	59	2
<i>Polystichum acrostichoides</i>	38	1	65	4
<i>Potentilla canadensis</i>	8	1	–	–
<i>Potentilla indica</i>	38	2	–	–
<i>Prunus</i>	–	–	6	2
<i>Prunus angustifolia</i>	–	–	12	2
<i>Prunus avium</i>	8	4	–	–
<i>Prunus caroliniana</i>	8	1	–	–
<i>Prunus mahaleb</i>	–	–	6	2
<i>Prunus serotina</i> var. <i>serotina</i>	77	2	88	3
<i>Pseudognaphalium obtusifolium</i>	–	–	6	1
<i>Pteridium latiusculum</i>	–	–	6	1
<i>Pycnanthemum incanum</i> var. <i>puberulum</i>	–	–	6	2
<i>Quercus alba</i>	15	3	88	7
<i>Quercus coccinea</i>	–	–	24	6
<i>Quercus falcata</i>	–	–	65	5
<i>Quercus marilandica</i> var. <i>marilandica</i>	–	–	6	3
<i>Quercus michauxii</i>	–	–	6	1
<i>Quercus montana</i>	–	–	18	3
<i>Quercus nigra</i>	69	6	65	5
<i>Quercus phellos</i>	23	2	53	2
<i>Quercus rubra</i> var. <i>rubra</i>	8	1	71	6
<i>Quercus shumardii</i>	8	4	–	–
<i>Quercus stellata</i>	–	–	41	4
<i>Quercus velutina</i>	–	–	71	5
<i>Rhododendron calendulaceum</i>	–	–	6	3
<i>Rhododendron minus</i>	–	–	6	3
<i>Rhododendron periclymenoides</i>	–	–	12	2
<i>Rhus copallinum</i>	8	1	–	–
<i>Robinia pseudoacacia</i>	15	2	6	2
<i>Rosa multiflora</i>	23	2	–	–
<i>Rubus</i>	23	2	29	1
<i>Rubus flagellaris</i>	23	2	6	1
<i>Rubus pensilvanicus</i>	15	3	6	2
<i>Ruellia caroliniensis</i>	8	1	–	–
<i>Sagittaria latifolia</i> var. <i>latifolia</i>	8	1	–	–
<i>Salix nigra</i>	15	2	–	–
<i>Sambucus canadensis</i>	8	2	–	–

Table B-1 (continued). Constancy and average cover class for all vascular plant species observed in 30 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: PAWV = Piedmont Alluvial Wetland Vegetation (13 plots) and PUF = Piedmont Upland Forests (17 plots). Cover classes are as follows: 1: 0–0.1%, 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: 95–100%

Species	PAWV Constancy	PAWV Cover	PUF Constancy	PUF Cover
<i>Sanguinaria canadensis</i>	–	–	18	2
<i>Sanicula canadensis</i> var. <i>canadensis</i>	38	2	41	2
<i>Sanicula trifoliata</i>	–	–	6	2
<i>Sassafras albidum</i>	–	–	29	2
<i>Sceptridium bitermum</i>	23	1	29	1
<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	–	–	6	1
<i>Scirpus cyperinus</i>	8	3	–	–
<i>Scleria oligantha</i>	–	–	18	2
<i>Scleria triglomerata</i>	–	–	18	2
<i>Scutellaria elliptica</i>	8	1	12	2
<i>Sisyrinchium angustifolium</i>	8	1	–	–
<i>Sisyrinchium mucronatum</i>	–	–	6	1
<i>Smallanthus uvedalia</i>	8	2	–	–
<i>Smilax biltmoreana</i>	15	2	6	2
<i>Smilax bona-nox</i> var. <i>bona-nox</i>	23	2	41	1
<i>Smilax glauca</i>	46	2	100	2
<i>Smilax rotundifolia</i>	54	2	82	2
<i>Smilax walteri</i>	8	1	–	–
<i>Solanum emulans</i>	–	–	6	1
<i>Solidago</i>	15	1	6	2
<i>Sorghastrum nutans</i>	–	–	6	1
<i>Swida foemina</i>	8	4	–	–
<i>Symphyotrichum lateriflorum</i>	–	–	6	1
<i>Symplocos tinctoria</i>	–	–	12	3
<i>Thalictrum thalictroides</i>	8	1	6	1
<i>Tilia americana</i> var. <i>heterophylla</i>	31	4	18	5
<i>Toxicodendron radicans</i> var. <i>radicans</i>	92	2	100	3
<i>Trillium</i>	–	–	6	1
<i>Trillium catesbaei</i>	–	–	18	2
<i>Trillium cuneatum</i>	8	1	–	–
<i>Triodanis perfoliata</i>	–	–	6	2
<i>Ulmus alata</i>	54	4	29	6
<i>Ulmus rubra</i>	15	4	–	–
Unknown	–	–	6	1
<i>Uvularia puberula</i>	–	–	6	1
<i>Uvularia sessilifolia</i>	–	–	12	2
<i>Vaccinium arboreum</i>	–	–	41	4
<i>Vaccinium elliotii</i>	–	–	12	2
<i>Vaccinium fuscum</i>	–	–	6	2
<i>Vaccinium pallidum</i>	–	–	41	3
<i>Vaccinium stamineum</i>	–	–	18	2
<i>Verbesina alternifolia</i>	38	6	6	1

Table B-1 (continued). Constancy and average cover class for all vascular plant species observed in 30 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: PAWV = Piedmont Alluvial Wetland Vegetation (13 plots) and PUF = Piedmont Upland Forests (17 plots). Cover classes are as follows: 1: 0–0.1%, 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: 95–100%

Species	PAWV Constancy	PAWV Cover	PUF Constancy	PUF Cover
<i>Verbesina occidentalis</i>	23	3	6	1
<i>Viburnum acerifolium</i>	–	–	12	2
<i>Viburnum prunifolium</i>	–	–	6	3
<i>Viburnum rufidulum</i>	–	–	18	2
<i>Viburnum setigerum</i>	–	–	6	2
<i>Viola</i>	46	2	47	2
<i>Viola palmata</i>	–	–	6	1
<i>Vitis aestivalis</i> var. <i>aestivalis</i>	15	1	6	2
<i>Youngia japonica</i>	8	1	18	2

Table B-2. Basal area (BA, m²/ha) and density (Den, count/ha) of woody vascular plant species observed in 30 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: PAWV = Piedmont Alluvial Wetland Vegetation (13 plots) and PUF = Piedmont Upland Forests (17 plots).

Species	PAWV Tree BA	PAWV Tree DEN	PAWV Sapling BA	PAWV Sapling Den	PAWV Seedling Den	PUF Tree BA	PUF Tree DEN	PUF Sapling BA	PUF Sapling Den	PUFS Seedling Den
<i>Acer floridanum</i>	0.12	3.85	0.02	76.92	0.00	–	–	–	–	–
<i>Acer leucoderme</i>	–	–	0.31	692.31	288.46	0.10	2.94	0.41	823.53	441.18
<i>Acer negundo</i> var. <i>negundo</i>	3.39	103.85	4.39	2692.31	8269.23	–	–	–	–	–
<i>Acer rubrum</i>	0.78	26.92	1.28	538.46	3750.00	0.42	17.65	0.40	235.29	1176.47
<i>Aesculus sylvatica</i>	–	–	–	–	–	–	–	0.36	764.71	661.76
<i>Amelanchier arborea</i>	–	–	–	–	–	–	–	0.00	0.00	1102.94
<i>Arundinaria appalachiana</i>	–	–	–	–	–	–	–	0.00	0.00	1544.12
<i>Arundinaria gigantea</i>	–	–	0.04	1000.00	0.00	–	–	–	–	–
<i>Asimina parviflora</i>	–	–	–	–	–	–	–	0.00	58.82	514.71
<i>Asimina triloba</i>	–	–	0.00	0.00	96.15	–	–	–	–	–
<i>Benthamidia florida</i>	–	–	–	–	–	0.10	8.82	0.34	294.12	147.06
<i>Betula nigra</i>	2.47	19.23	0.00	0.00	96.15	–	–	–	–	–
<i>Bignonia capreolata</i>	–	–	0.01	307.69	576.92	–	–	0.00	0.00	294.12
<i>Campsis radicans</i>	–	–	0.00	0.00	769.23	–	–	0.00	0.00	147.06
<i>Carpinus caroliniana</i>	0.34	15.38	1.46	769.23	769.23	0.06	5.88	0.63	529.41	0.00
<i>Carya cordiformis</i>	0.72	9.62	0.00	0.00	480.77	–	–	–	–	–
<i>Carya glabra</i>	–	–	–	–	–	0.80	11.76	0.08	117.65	882.35
<i>Carya pallida</i>	–	–	–	–	–	–	–	0.06	58.82	882.35
<i>Carya tomentosa</i>	–	–	–	–	–	2.31	44.12	1.37	823.53	294.12
<i>Celtis laevigata</i>	0.46	7.69	0.36	153.85	2019.23	–	–	0.00	0.00	73.53
<i>Cercis canadensis</i>	–	–	–	–	–	0.12	5.88	1.31	588.24	1470.59
<i>Chionanthus virginicus</i>	–	–	–	–	–	–	–	0.01	58.82	0.00
<i>Crataegus</i>	–	–	–	–	–	–	–	0.00	0.00	73.53
<i>Crataegus macrosperma</i>	–	–	–	–	–	–	–	0.00	0.00	73.53
<i>Crataegus spathulata</i>	–	–	–	–	–	–	–	0.01	58.82	0.00
<i>Diospyros virginiana</i>	–	–	–	–	–	–	–	0.52	117.65	0.00
<i>Elaeagnus umbellata</i>	–	–	0.81	3538.46	1057.69	–	–	–	–	–
<i>Endodeca serpentaria</i>	–	–	0.00	0.00	96.15	–	–	–	–	–
<i>Fagus grandifolia</i> var. <i>caroliniana</i>	–	–	–	–	–	0.22	16.18	4.47	1823.53	73.53
<i>Fraxinus americana</i>	–	–	–	–	–	0.21	2.94	0.03	117.65	0.00
<i>Fraxinus pennsylvanica</i>	0.17	7.69	0.99	692.31	4519.23	–	–	0.06	58.82	367.65

Table B-2 (continued). Basal area (BA, m²/ha) and density (Den, count/ha) of woody vascular plant species observed in 30 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: PAWV = Piedmont Alluvial Wetland Vegetation (13 plots) and PUF = Piedmont Upland Forests (17 plots).

Species	PAWV Tree BA	PAWV Tree DEN	PAWV Sapling BA	PAWV Sapling Den	PAWV Seedling Den	PUF Tree BA	PUF Tree DEN	PUF Sapling BA	PUF Sapling Den	PUFS Seedling Den
<i>Gelsemium sempervirens</i>	–	–	–	–	–	–	–	0.00	235.29	147.06
<i>Halesia carolina</i>	0.04	1.92	0.02	153.85	0.00	–	–	–	–	–
<i>Hedera helix</i> var. <i>helix</i>	–	–	0.00	76.92	576.92	–	–	–	–	–
<i>Hydrangea barbara</i>	–	–	–	–	–	–	–	0.02	117.65	73.53
<i>Ilex ambigua</i>	–	–	–	–	–	–	–	0.00	0.00	147.06
<i>Ilex cornuta</i>	–	–	0.00	0.00	288.46	–	–	–	–	–
<i>Ilex opaca</i>	–	–	0.00	0.00	96.15	0.08	5.88	0.84	235.29	367.65
<i>Juglans nigra</i>	0.07	3.85	–	–	–	–	–	–	–	–
<i>Ligustrum sinense</i>	0.06	5.77	16.12	37846.15	46538.46	–	–	0.01	58.82	661.76
<i>Liquidambar styraciflua</i>	1.81	46.15	0.81	769.23	2211.54	1.16	29.41	2.39	1352.94	7132.35
<i>Liriodendron tulipifera</i> var. <i>tulipifera</i>	8.46	88.46	0.00	0.00	673.08	3.13	38.24	0.32	117.65	3161.76
<i>Lonicera japonica</i>	–	–	0.01	615.38	12980.77	–	–	0.01	352.94	6323.53
<i>Lonicera sempervirens</i>	–	–	0.00	0.00	384.62	–	–	–	–	–
<i>Magnolia grandiflora</i>	0.10	5.77	–	–	–	–	–	–	–	–
<i>Magnolia macrophylla</i>	–	–	–	–	–	0.03	2.94	–	–	–
<i>Malus angustifolia</i>	0.06	1.92	–	–	–	–	–	–	–	–
<i>Morus rubra</i>	–	–	–	–	–	0.02	1.47	0.01	58.82	0.00
<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	–	–	0.89	692.31	2788.46	–	–	1.21	3000.00	13823.53
<i>Nyssa sylvatica</i>	–	–	–	–	–	0.34	10.29	1.32	941.18	808.82
<i>Ostrya virginiana</i>	–	–	–	–	–	0.10	7.35	2.36	1470.59	73.53
<i>Oxydendrum arboreum</i>	–	–	–	–	–	1.42	55.88	1.70	529.41	73.53
<i>Parthenocissus quinquefolia</i>	–	–	0.04	153.85	12211.54	–	–	0.00	0.00	10220.59
<i>Pinus echinata</i>	–	–	–	–	–	0.46	5.88	0.00	0.00	2500.00
<i>Pinus taeda</i>	4.75	44.23	0.00	0.00	3461.54	3.72	33.82	0.26	58.82	5882.35
<i>Platanus occidentalis</i>	1.41	9.62	–	–	–	–	–	–	–	–
<i>Prunus</i>	–	–	–	–	–	–	–	0.00	0.00	514.71
<i>Prunus avium</i>	0.02	1.92	–	–	–	–	–	–	–	–
<i>Prunus caroliniana</i>	–	–	0.00	0.00	96.15	–	–	–	–	–
<i>Prunus serotina</i> var. <i>serotina</i>	0.13	1.92	0.08	76.92	961.54	0.28	4.41	0.00	58.82	1691.18
<i>Quercus alba</i>	–	–	–	–	–	4.07	45.59	0.65	647.06	441.18
<i>Quercus coccinea</i>	–	–	–	–	–	0.78	5.88	0.26	58.82	73.53

Table B-2 (continued). Basal area (BA, m²/ha) and density (Den, count/ha) of woody vascular plant species observed in 30 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: PAWV = Piedmont Alluvial Wetland Vegetation (13 plots) and PUF = Piedmont Upland Forests (17 plots).

Species	PAWV Tree BA	PAWV Tree DEN	PAWV Sapling BA	PAWV Sapling Den	PAWV Seedling Den	PUF Tree BA	PUF Tree DEN	PUF Sapling BA	PUF Sapling Den	PUFS Seedling Den
<i>Quercus falcata</i>	–	–	–	–	–	1.03	13.24	0.26	176.47	808.82
<i>Quercus montana</i>	–	–	–	–	–	0.04	1.47	0.06	58.82	0.00
<i>Quercus nigra</i>	1.03	9.62	0.02	76.92	576.92	0.38	11.76	1.76	705.88	588.24
<i>Quercus phellos</i>	–	–	0.00	0.00	192.31	–	–	–	–	–
<i>Quercus rubra</i> var. <i>rubra</i>	–	–	–	–	–	1.86	11.76	0.41	294.12	147.06
<i>Quercus stellata</i>	–	–	–	–	–	0.30	4.41	0.13	117.65	0.00
<i>Quercus velutina</i>	–	–	–	–	–	1.64	23.53	0.00	117.65	294.12
<i>Rhododendron minus</i>	–	–	–	–	–	–	–	0.39	176.47	294.12
<i>Robinia pseudoacacia</i>	0.33	5.77	–	–	–	–	–	0.00	0.00	73.53
<i>Sassafras albidum</i>	–	–	–	–	–	–	–	0.00	0.00	220.59
<i>Smilax biltmoreana</i>	–	–	0.00	0.00	384.62	–	–	0.00	0.00	73.53
<i>Smilax bona-nox</i> var. <i>bona-nox</i>	–	–	–	–	–	–	–	0.00	0.00	73.53
<i>Smilax glauca</i>	–	–	0.00	76.92	192.31	–	–	0.00	235.29	5808.82
<i>Smilax rotundifolia</i>	–	–	0.04	538.46	576.92	–	–	0.02	941.18	808.82
<i>Swida foemina</i>	–	–	0.59	307.69	384.62	–	–	–	–	–
<i>Symplocos tinctoria</i>	–	–	–	–	–	–	–	0.00	0.00	220.59
<i>Tilia americana</i> var. <i>heterophylla</i>	–	–	0.00	0.00	–	0.29	5.88	0.26	58.82	0.00
<i>Toxicodendron radicans</i> var. <i>radicans</i>	–	–	0.34	76.92	2307.69	–	–	0.11	411.76	2867.65
<i>Ulmus alata</i>	0.20	1.92	0.00	0.00	96.15	0.27	8.82	0.41	294.12	147.06
<i>Ulmus rubra</i>	0.04	3.85	–	–	–	–	–	–	–	–
<i>Vaccinium arboreum</i>	–	–	–	–	–	–	–	0.04	176.47	220.59
<i>Vaccinium fuscatum</i>	–	–	–	–	–	–	–	0.00	58.82	0.00
<i>Vaccinium pallidum</i>	–	–	–	–	–	–	–	0.00	0.00	1470.59
<i>Vaccinium stamineum</i>	–	–	–	–	–	–	–	0.00	58.82	294.12
<i>Viburnum setigerum</i>	–	–	–	–	–	–	–	0.00	0.00	73.53

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