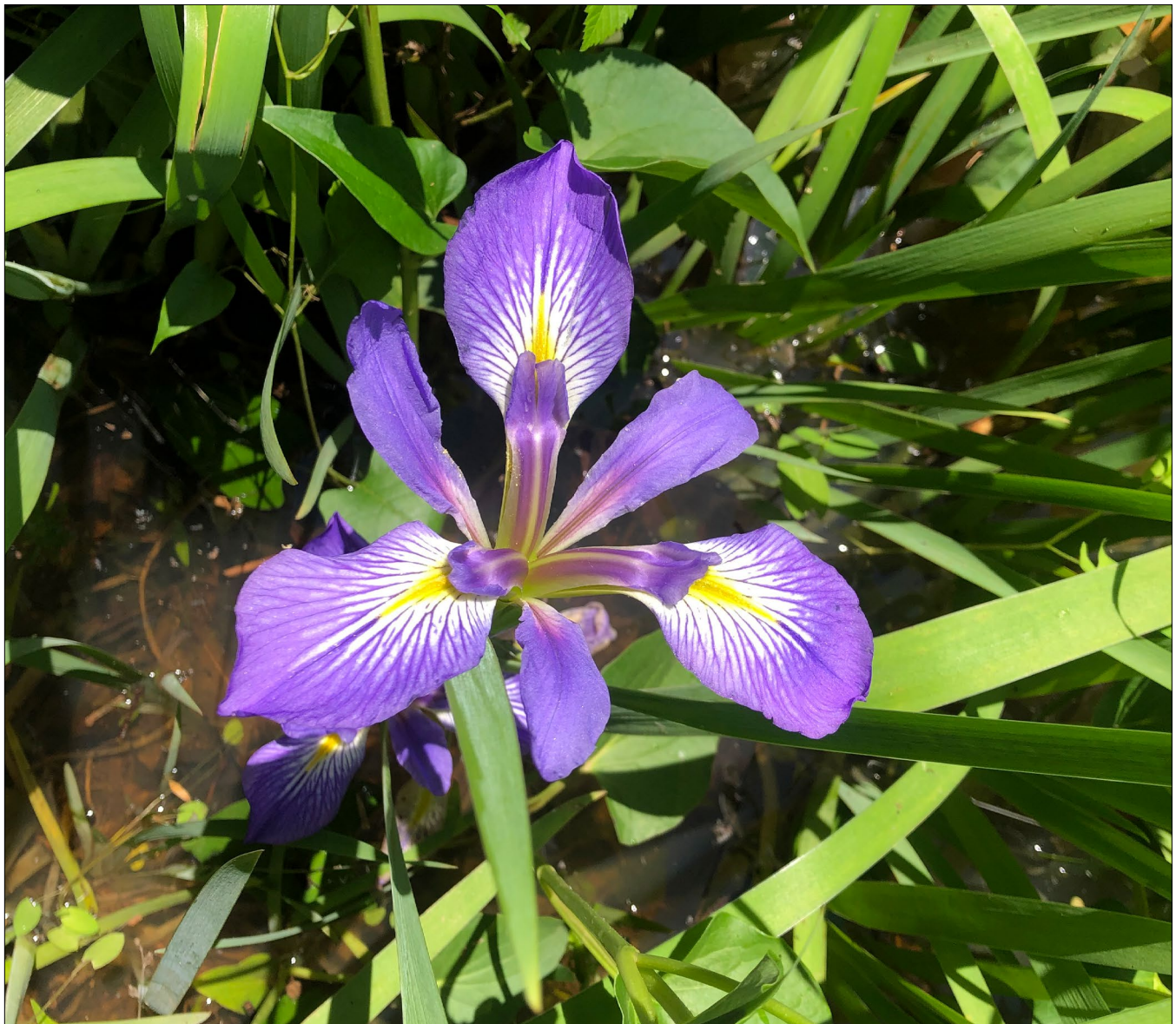




Terrestrial Vegetation Monitoring at Ocmulgee Mounds National Historical Park

2021 Data Summary

Natural Resource Data Series NPS/SECN/NRDS—2023/1394





ON THIS PAGE

Staff from Ocmulgee Mounds National Historical Park (OCMU) assist the SECN field crew with vegetation monitoring efforts in May 2021. From left to right, biological science technicians Zoe Nuhfer (OCMU), Christina Valdes (OCMU), and Elizabeth Rico (SECN), traverse across a marsh to access one of the eight SECN vegetation monitoring sites within the park.

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

ON THE COVER

The showy anglepod blue flag, or Dixie iris (*Iris hexagona*), occurs sporadically along pond shores, roadside ditches, and other marsh habitats of Ocmulgee Mounds National Historical Park.

NPS photo / M. Forbes Boyle.

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M. Forbes Boyle

Southeast Coast Inventory and Monitoring Network
National Park Service
Cumberland Island National Seashore
101 Wheeler Street
Saint Marys, Georgia 31558

July 2023
U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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.

This report is available from the [Southeast Coast Network website](#) and the [Inventory and Monitoring Reports and Publications](#). If you have difficulty accessing information in this publication, particularly if using assistive technology, please email irma@nps.gov.

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The staff of Ocmulgee Mounds National Historical Park (OCMU) provided valuable support during this monitoring effort. Special thanks go to two park biological science technicians, Zoe Nuhfer and Christina Valdes, who not only provided valuable guide service to the SECN staff during the field week, but assisted with data collection on all vegetation plots. Thanks also to Greg Luna Golya, OCMU's Integrated Resources Manager, who allowed Zoe and Christina to participate in the monitoring efforts throughout the week, and provided permit and other logistical support. Finally, thanks go to OCMU's Superintendent Carla Beasley who met with the SECN field crew to discuss management issues in the park and learn about our network's vegetation monitoring effort. The SECN Program Manager Brian Gregory and Editor Mark Hynds drove down from Athens, Georgia to assist with data collection efforts on one of the sampling days, and document the monitoring effort for an NPS Content Management System (CMS) article.

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 marks the first year of conducting this monitoring effort at Ocmulgee Mounds National Historical Park (OCMU). Eight vegetation plots were established throughout the park in early May. 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 Ocmulgee Mounds National Historical Park in 2021. Data were stratified across two dominant broadly defined habitats within the park, Coastal Plain Alluvial Wetlands and Coastal Plain Upland Forests. Noteworthy findings include:

- 142 vascular plant taxa (species or lower) were observed across eight vegetation plots, including 15 species not previously documented within the park.
- The most frequently encountered species in each broadly defined habitat included:
 - Coastal Plain Alluvial Wetlands: Chinese privet (*Ligustrum sinense*), Chinese tallow (*Triadica sebifera*), Japanese honeysuckle (*Lonicera japonica*), eastern poison ivy (*Toxicodendron radicans* var. *radicans*), and smallspike false nettle (*Boehmeria cylindrica*).
 - Coastal Plain Upland Forests: sweetgum (*Liquidambar styraciflua*), muscadine (*Muscadinia rotundifolia* var. *rotundifolia*), winged elm (*Ulmus alata*), water oak (*Quercus nigra*), loblolly pine (*Pinus taeda*), yaupon (*Ilex vomitoria*), Japanese honeysuckle, American beautyberry (*Callicarpa americana*), ebony spleenwort (*Asplenium platyneuron*), and multiple species of woody vines.

- Eleven non-native species invasive (Category 1 or Category 2) by the Georgia Exotic Pest Plant Council (GA-EPPC 2023) were encountered within the park during this monitoring effort. Three of these species—Chinese privet, Chinese tallow, and Japanese honeysuckle—were among the most frequent and abundant of all species observed within Coastal Plain Alluvial Wetland plots.
- There were no observations of vascular plant species listed as rare and tracked by the Georgia Department of Natural Resources (GADNR 2023) within these monitoring plots.
- Sweetgum, red maple (*Acer rubrum*), swamp tupelo (*Nyssa biflora*), and Chinese tallow were the most dominant species within the tree stratum of Coastal Plain Alluvial Wetland sites; water oak, loblolly pine, and sweetgum were the most dominant species of Coastal Plain Upland Forests.
- There were very few observable disturbances to natural and semi-natural vegetation communities documented during this monitoring effort, including very little to no impact of browsing by white-tailed deer, rooting by feral hogs, or presence of diseased or dying trees. The two most pronounced threats to native vegetation on the park are (1) the high prevalence of non-native, invasive plant species (particular within alluvial habitat, and (2) the altered hydrology of the park's alluvial wetlands from conversion of large berms for vehicle and railroad traffic. Long-term monitoring data will aid in understanding how these threats over time impact the park's forest communities.

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 (2023) 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 (2023), 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 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 is 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 Gulf Coast Network (Carlson et al. 2018).

This report provides a summary of data collected during early May 2021 within Ocmulgee Mounds National Historical Park (OCMU) as part of the SECN’s terrestrial vegetation monitoring effort. This report is intended to provide OCMU 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 Ocmulgee Mounds National Historical Park utilizing the recently published 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 the monitoring effort, 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

Ocmulgee Mounds National Historical Park (OCMU) is adjacent to Macon, Georgia (Bibb County), just below the “fall line,” the geologic boundary that separates the metamorphosed terrain of the South Atlantic Piedmont from the relatively flat upper continental shelf of the Atlantic Coastal Plain (Figure 1). Prior to a 2019 park boundary expansion, the park was composed of two tracts of land that encompassed 284 hectares (701 acres [ac]). The Main Unit (266 hectares [656.5 ac]) is adjacent to the city of Macon, while the Lamar Mounds Unit (18.2 hectares [45 ac]) is roughly 4 kilometers [km] or 2.5 miles [mi] south of the Main Unit (Burkholder et al. 2017). The Main Unit is bordered on the south by the Ocmulgee River while a main tributary of the river (Walnut Creek) passes through much of the park. Access to the park is via Highway 80 on the northern edge of the Main Unit. Ocmulgee Mounds National Historical Park has 8.9 kilometers (5.5 mi) of trails that connect the park’s forested areas to the numerous earthen mounds located on the site. These ceremonial mounds were constructed by Native Americans during the Mississippian Period between 900 and 1650 A.D., and collectively include between eight and 12 sites likely representing distinct cultures (Cotton et al. 2019). The park also includes prehistoric trenches and a colonial British trading post (Burkholder et al. 2017). Elevation within the park’s Main Unit is approximately 116 meters [m] (381 feet [ft]) above mean sea level (MSL), while low lying areas along Walnut Creek on the southern part of the unit are about 88 meters (290 ft) above MSL (DeVivo et al. 2008; Burkholder et al. 2017).

The land surrounding and occupied by Ocmulgee Mounds National Historical Park has a long history with human settlement and consequent impacts. For over 12,000 years prior to contact in the mid-17th century with Europeans, Native American tribes (e.g., Paleo-Indian, Archaic, Woodland, Mississippian, Lamar, and Creek) utilized present-day park land for hunting-gathering, farming, and the construction of ceremonial earthen mounds (see above), villages, storage pits, and trenches (Wheeler 2007). Following the Revolutionary War, the state of Georgia acquired Creek tribal lands and by 1828 part of this area was incorporated into the city of Macon (Zomlefer et al. 2013). The area around the mounds was used extensively for agriculture, manufacturing, grazing, and railroad construction throughout the 19th century which caused severe erosion and impacted understory vegetation (Wheeler 2007). From 1933 to 1942, the area of Ocmulgee Mounds National Historic Park experienced massive excavations for archeological studies by the Civilian Conservation Corps (CCC) that consequently stripped remaining vegetation across both the Main and Lamar Mounds Unit of the future park (Zomlefer et al. 2013). Findings during this survey led to the establishment of Ocmulgee National Monument in 1936. Vegetation and aquatic resources have been more recently impacted by urban growth surrounding Macon, including the establishment of the Macon Levee and development of Interstate 16 on the edge of the Ocmulgee River. The levee has significantly altered hydrology and changed floodplain dynamics within the riparian zones within the park (Wheeler 2007; Zomlefer et al. 2013).

Ocmulgee Mounds National Historical Park Site Locations

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

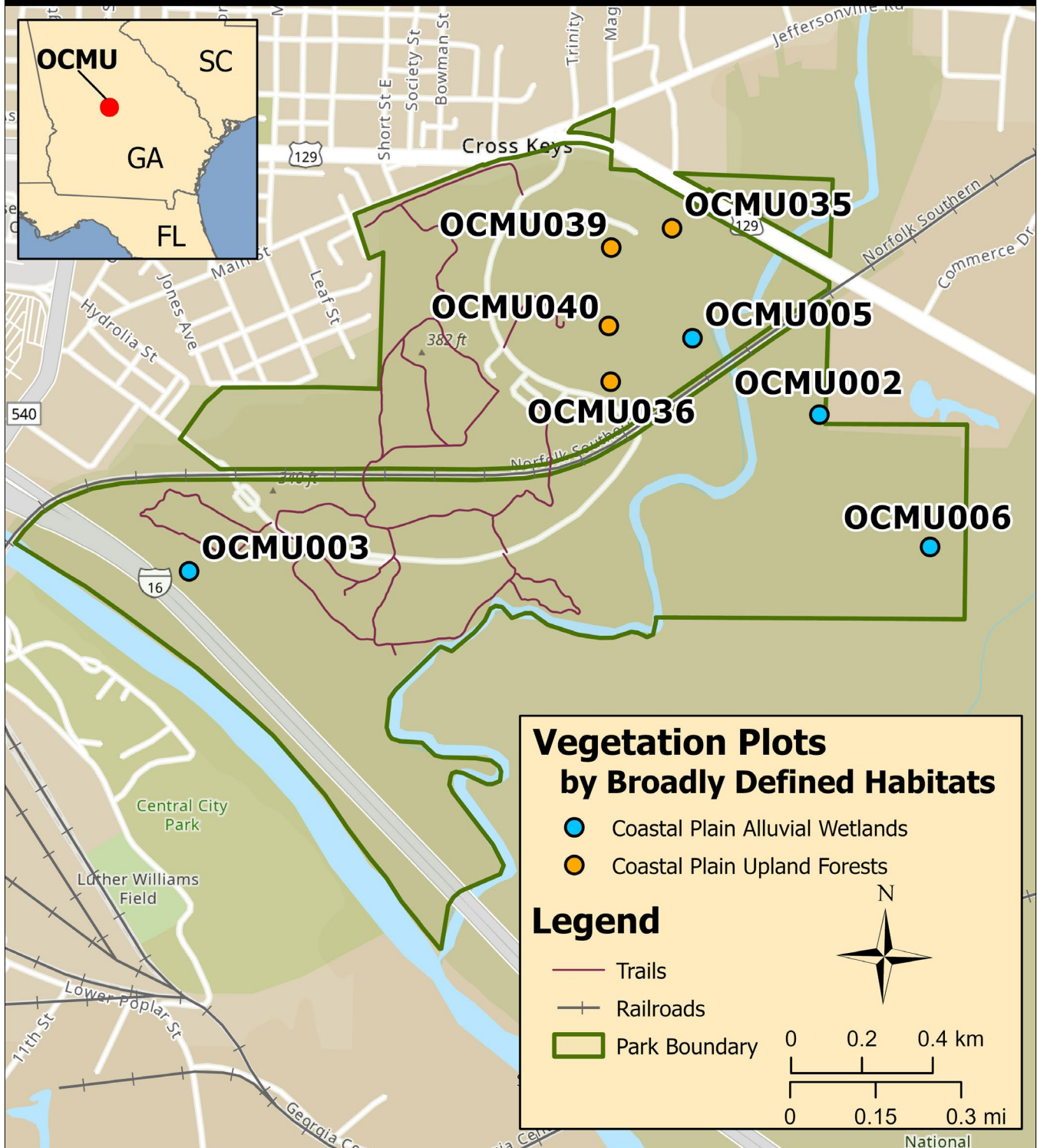


Figure 1. Southeast Coast Network terrestrial vegetation monitoring plot locations within the Main Unit of Ocmulgee Mounds National Historical Park, Bibb County, Georgia; open grassy fields are not mapped; and the smaller Lamar Mounds Unit and park boundary expansion lands of 2019 are not shown.

Current vegetation within Ocmulgee Mounds National Historical Park reflects recent historical land use both within and adjacent to the park. Mowed open fields surround the earthen mounds within the Main Unit, while a combination of mesic to dry forests comprise the Unit's remaining uplands (Figure 1). Alluvial wetlands, mostly forested, are found along Walnut Creek, Ocmulgee River, and the river's lesser tributaries on both the Main Unit and the Lamar Mounds Unit. The upland forests of the park are in early- to mid-seral-stages of development, and include a mixture of hardwoods (e.g., water oak [*Quercus nigra*], southern red oak [*Quercus falcata*], pignut hickory [*Carya glabra*], American beech [*Fagus grandifolia* var. *caroliniana*], red maple [*Acer rubrum*], and sweetgum [*Liquidambar styraciflua*]) and pine (e.g., loblolly pine [*Pinus taeda*]) present in the canopy (Zomlefer et al. 2013). The subcanopy of these forests is composed of canopy species and other species (e.g., smallflower pawpaw [*Asimina parviflora*], American hornbeam [*Carpinus caroliniana* var. *caroliniana*], hollies [*Ilex* sp.], and woody vines); common understory species include ebony spleenwort (*Asplenium platyneuron*), variable panicgrass (*Dichanthelium commutatum*), and Carolina elephantsfoot (*Elephantopus carolinianus*) (Zomlefer et al. 2013). Alluvial wetlands within the park include both floodplain forests and open marshes. Floodplain forest canopies are dominated by a mixture of wetland-tolerant species, including boxelder (*Acer negundo* var. *negundo*), green ash (*Fraxinus pennsylvanica*), swamp tupelo (*Nyssa biflora*), and American elm (*Ulmus americana* var. *americana*) (Zomlefer et al. 2013). Floodplains within the park historically may have supported extensive zones dominated by giant cane (*Arundinaria gigantea*) owing to the presence of this vegetation type downriver at Bond Swamp National Wildlife Refuge. These "canebrakes" have significantly declined throughout the Atlantic and Gulf drainages of the southeastern U.S. since European arrival (Baldwin et al. 2009). It is uncertain whether their decline is due to 19th and 20th century fire suppression efforts and/or woodland cattle grazing, or their prevalence across the landscape was a result of burning customs of Native Americans (Platt and Brantley 1997).

The most recent floristic survey within the park reported 436 vascular species, including three cultivated species not likely naturalized and an additional 106 non-native species (24% of the total; Zomlefer et al. 2013). Of the 106 non-native species observed, 37 were ranked in four invasive threat categories by the Georgia Exotic Pest Plant Council (Zomlefer et al. 2013; GA-EPPC 2023). Invasive species present on the park during

the 2013 survey ranked as either a Category 1 (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)
- Silktree (*Albizia julibrissin*; Cat 1)
- Alligatorweed (*Alternanthera philoxeroides*; Cat 1)
- English ivy (*Hedera helix* var. *helix*; Cat 1)
- Sericea lespedeza (*Lespedeza cuneata*; Cat 1)
- Chinese privet (*Ligustrum sinense*; Cat 1)
- Japanese honeysuckle (*Lonicera japonica*; Cat 1)
- Japanese climbing fern (*Lygodium japonicum*; Cat 1)
- Chinaberry tree (*Melia azedarach*; Cat 1)
- Marsh dayflower (*Murdannia keisak*; Cat 1)
- Kudzu (*Pueraria montana* var. *lobata*; Cat 1)
- Chinese tallow (*Triadica sebifera*; Cat 1)
- Chinese wisteria (*Wisteria sinensis*; Cat 1)
- Bermudagrass (*Cynodon dactylon*; Cat 2)
- Chinese yam (*Dioscorea polystachya*; Cat 2)
- Silverthorn (*Elaeagnus pungens*; Cat 2)
- Japanese privet (*Ligustrum japonicum*; Cat 2)
- Parrotfeather (*Myriophyllum aquaticum*; Cat 2)
- Sacred bamboo (*Nandina domestica*; Cat 2)
- Bahiagrass (*Paspalum notatum*; Cat 2)
- Golden bamboo (*Phyllostachys aurea*; Cat 2)
- Rattlebox (*Sesbania punicea*; Cat 2)

There were no federal or state threatened or endangered species found within the park during the previous floristic survey, and the only species of special concern listed by the Georgia Department of Natural Resources (GADNR 2023) observed was fivelobe melonleaf (*Cayaponia quinquelobia*).

Sampling Design

The Southeast Coast Network monitors vegetation in long-term plots located in natural and semi-natural habitats of targeted parks, including Ocmulgee Mounds National Historical Park. 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

Eight vegetation plots were established and sampled at Ocmulgee Mounds National Historical Park in May 2021 (Figure 1). These plots were located in the following broadly defined habitats of the park: Coastal Plain Alluvial Wetlands (4 plots) and Coastal Plain Upland Forests and Shrublands (4 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). The sampling frame was based on the size of the park prior to 2019's boundary expansion and thus plots were not distributed within any of the expansion acres.

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 2023) 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 2023) 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-meter (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-meter (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 2).

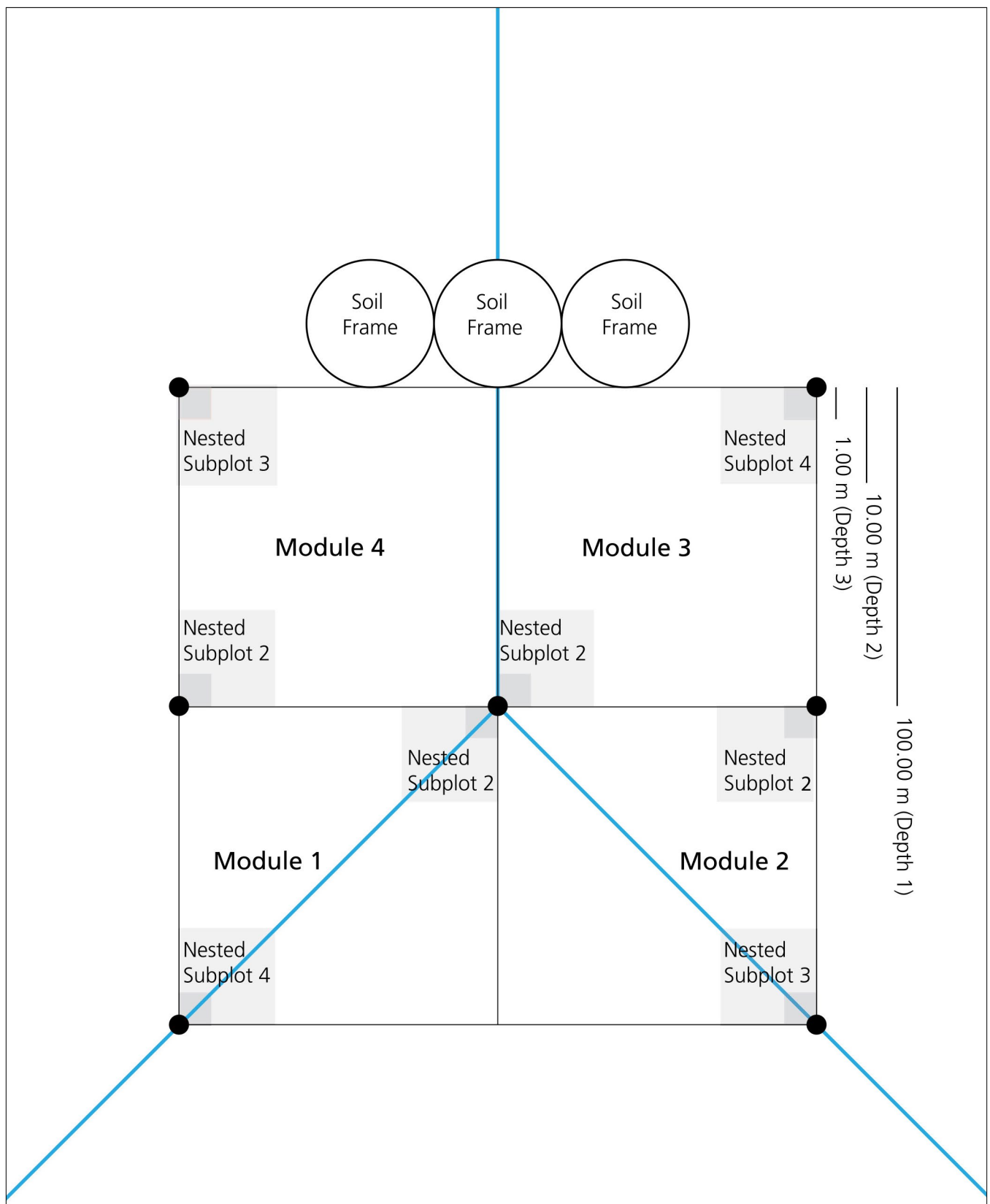


Figure 2. The layout of the sampling plot for the Southeast Coast Network, which is a modified version of the standard Level 5 Carolina Vegetation Survey plot. Ideal locations of rebar used as permanent structures to monument the plot are represented by black shaded circles. Blue lines represent locations 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 meters (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 ‘quadrats’ were located 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 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

One hundred and forty-two vascular plant species were detected during this monitoring effort (Appendix A), including 15 taxa not detected in previous lists documented in Zomlefer et al. (2013), Heath and Byrne (2014), or NPSpecies (NPS 2023; Table 2); seven of these species could also be new records for Bibb County, Ga.—Cherokee sedge (*Carex cherokeensis*), eastern star sedge (*Carex radiata*), smooth oxeye (*Heliopsis gracilis*), bog smartweed (*Persicaria setacea*), coastal plain willow (*Salix caroliniana*), smooth carrionflower (*Smilax herbacea*), and the state invasive (Category 3) hardy orange (*Citrus trifoliata*; Table 2).

Native richness ranged from 17 to 63 species per plot, and non-native species comprised between 8 and 16% of the total richness per plot (Table 3). Native species observed in these plots are common throughout the Coastal Plain and Piedmont of Georgia, and there were no federally listed, state listed, or state species of special concern with a conservation rank of S1 (critically imperiled) or S2 (imperiled) observed on these plots during this monitoring effort. Eleven species listed

by the GA-EPPC (2023) as invasive were observed in these monitoring plots, including eight ranked as either Category 1 or Category 2 (Appendix A). The frequency of Category 1 and 2 invasive plants in these monitoring plots of Ocmulgee Mounds National Historical Park was very high. Category 1 and 2 species observed (and their frequency) included Chinese privet (75% of plots), Chinese wisteria (37.5%), English ivy (12.5%), Japanese honeysuckle (100%), Japanese privet (12.5%), Nepalese browntop (*Microstegium vimineum*; 37.5%), sacred bamboo (37.5%), and Chinese tallow (62.5%).

In the southeastern Coastal Plain, small-scale vegetation diversity patterns are largely influenced by complex edaphic factors, those factors' associated relationship with steep environmental gradients (e.g., hydrology and substrate texture), and the variability of timing and impact from disturbance events (e.g., fire; Sorrie and Weakley 2001). What follows is a synopsis of vegetation and environmental data stratified by each of the broadly defined habitats sampled within the park.

Table 2. Vascular plant species, subspecies, or varieties not reported from Zomlefer et al. (2013), Heath and Byrne (2014), or NPSpecies (NPS 2023) but found at Ocmulgee Mounds National Historical Park in 2021 through this current monitoring effort.

Scientific Name	Common Name ¹	Growth Form ¹	Native Status ¹	State Invasive Status ²	Global Rank ³	State Rank ³ (Georgia)
<i>Carex cherokeensis</i>	Cherokee sedge	Graminoid	Native	–	G4	SNR
<i>Carex radiata</i>	eastern star sedge	Graminoid	Native	–	G5	S3?
<i>Carex tribuloides</i>	blunt broom sedge	Graminoid	Native	–	G5	SNR
<i>Chasmanthium sessiliflorum</i> var. <i>sessiliflorum</i>	longleaf woodoats	Graminoid	Native	–	G5	SNR
<i>Citrus trifoliata</i>	hardy orange	Shrub, Tree	Non-native	Category 3	SNR	SNR
<i>Galium pilosum</i>	hairy bedstraw	Forb/herb	Native	–	G5	SNR
<i>Galium tinctorium</i> var. <i>floridanum</i>	stiff marsh bedstraw	Forb/herb	Native	–	G5	SNR
<i>Heliopsis gracilis</i>	smooth oxeye	Forb/herb	Native	–	G5	SNR
<i>Hydrangea barbara</i>	woodvamp	Vine	Native	–	G5	SNR
<i>Mimosa microphylla</i>	littleleaf sensitive-briar	Vine, Forb/herb	Native	–	G5	SNR
<i>Persicaria setacea</i>	bog smartweed	Forb/herb	Native	–	G5	SNR
<i>Salix caroliniana</i>	coastal plain willow	Tree	Native	–	G5	SNR
<i>Scleria oligantha</i>	littlehead nutrush	Graminoid	Native	–	G5	SNR
<i>Sisyrinchium angustifolium</i>	narrowleaf blue-eyed grass	Forb/herb	Native	–	G5	SNR
<i>Smilax herbacea</i>	smooth carrionflower	Forb/herb, Vine	Native	–	G5	SNR

¹ Information obtained from the PLANTS database (USDA 2023)

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

³ Conservation Status (S3?: Inexact Rank, Vulnerable); G4 or S4: Apparently Secure; G5 or S5: Secure; SNR: Not Yet Accessed) obtained from NatureServe Explorer 2.0 (NatureServe 2023)

Table 3. Vascular plant species richness across multiple spatial scales on Southeast Coast Network vegetation plots located within Ocmulgee Mounds National Historical Park. 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 2023).

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
Coastal Plain Alluvial Wetlands	OCMU002	63.0	8.0	2.0	16.0	1.0	15.0	26.0	15.0	8.3	1.0	9.0	16.3	8.3	8.1	4.6	0.8	4.1	4.4	4.9	1.9	0.5	2.8	2.8
	OCMU003	17.0	3.0	0.0	8.0	0.0	4.0	6.0	2.0	3.5	0.0	2.5	2.0	1.0	0.8	0.3	0.0	2.0	1.1	0.5	0.1	0.0	0.8	0.3
	OCMU005	60.0	7.0	2.0	25.0	3.0	15.0	15.0	11.0	15.0	2.0	10.8	8.0	7.3	3.4	3.9	1.3	7.3	7.0	0.8	1.9	0.3	3.5	4.5
	OCMU006	45.0	4.0	3.0	8.0	2.0	8.0	21.0	13.0	5.8	1.3	5.3	12.3	7.8	4.9	3.5	0.5	3.0	1.9	1.9	1.3	0.3	1.4	0.6
	average	46.3	5.5	1.8	14.3	1.5	10.5	17.0	10.3	8.1	1.1	6.9	9.6	6.1	4.3	3.1	0.6	4.1	3.6	2.0	1.3	0.3	2.1	2.0
	standard deviation	21.0	2.4	1.3	8.1	1.3	5.4	8.6	5.7	5.0	0.8	3.7	6.1	3.4	3.1	1.9	0.5	2.3	2.7	2.0	0.8	0.2	1.3	2.0
Coastal Plain Upland Forests	OCMU035	27.0	5.0	0.0	14.0	4.0	9.0	2.0	3.0	7.5	3.0	7.8	1.3	2.5	0.4	0.9	1.4	3.6	5.1	0.1	0.4	0.5	1.8	3.0
	OCMU036	24.0	2.0	0.0	10.0	3.0	9.0	2.0	2.0	5.5	2.3	7.0	0.5	1.3	0.1	0.4	0.6	2.1	4.3	0.1	0.1	0.3	0.8	1.6
	OCMU039	28.0	4.0	0.0	9.0	6.0	10.0	3.0	4.0	7.0	4.0	7.0	1.0	1.0	0.5	0.1	1.4	4.5	5.1	0.0	0.0	0.4	2.4	2.8
	OCMU040	22.0	2.0	0.0	8.0	4.0	7.0	4.0	1.0	5.0	1.8	6.0	1.5	0.3	0.1	0.0	0.5	2.0	4.0	0.1	0.0	0.1	0.9	2.3
	average	25.3	3.3	0.0	10.3	4.3	8.8	2.8	2.5	6.3	2.8	6.9	1.1	1.3	0.3	0.3	1.0	3.1	4.6	0.1	0.1	0.3	1.4	2.4
	standard deviation	2.8	1.5	0.0	2.6	1.3	1.3	1.0	1.3	1.2	1.0	0.7	0.4	0.9	0.2	0.4	0.5	1.2	0.6	0.1	0.2	0.2	0.8	0.6

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

Coastal Plain Alluvial Wetlands

Alluvial habitats of the southeastern Coastal Plain include forested and non-forested wetlands adjacent to rivers and streams that are often influenced by occasional or periodic flooding. In Georgia and the Carolinas, these rivers are often subdivided into “brownwater” and “blackwater” types. “Brownwater” rivers (like the Ocmulgee River and its tributary streams within Ocmulgee Mounds National Historical Park) originate in the Piedmont or Mountains, experience higher flooding during the winter and early spring when evapotranspiration rates are low, and can deposit large loads of sediment resulting in well-defined, complex floodplain features; conversely, “blackwater” rivers begin in the Coastal Plain, vary drastically in seasonality of flooding due to year-round storms and the water-holding capacity of depressional wetlands these rivers typically drain, and typically carry very little suspended material and can have wide but sometimes an inconspicuous floodplain (Christensen 2000; Edwards et al. 2013). Riparian vegetation types in the southeastern U.S. largely correspond with topography in relation to the river, and are often distributed across an anaerobic gradient, from wet sloughs often covered with water year-round (e.g., cypress-gum swamps) to alluvial flats inundated during the winter and spring (e.g. bottomland hardwood forests) to higher levees adjacent to the river and upper terraces scattered across the floodplain or adjacent to the uplands (Christensen 2000). At Ocmulgee Mounds National Historical Park, alluvial forests are found along the Ocmulgee River and Walnut Creek, along the southern and western sections of the Main Unit, and across much of the Lamar Mounds Unit (Figure 3). Several vegetation associations corresponding with alluvial vegetation types

were sampled within the park during this monitoring effort, including (descriptions from NatureServe 2023):

- Ruderal Loblolly Pine – Sweetgum – Swamp Tupelo Floodplain Forest (CEGL004606; 1 plot): Younger-aged hardwood- and/or pine-dominated forests located on slightly elevated terraces and ridges of floodplains of the Atlantic Coastal Plain. (Global Status: No Status Rank; State (GA) Status: No Status Rank)
- Sweetgum – Tuliptree Brownwater Floodplain Forest (CEGL007329; 1 plot): Floodplain forests dominated by a canopy of sweetgum and tuliptree (*Liriodendron tulipifera*), as well as other species, and supporting a well-developed subcanopy, shrub/vine stratum, and herbaceous stratum. (Global Status: G4—Apparently Secure; State (GA) Status: No Status Rank)
- Ruderal Chinese Tallow Wet Forest (CEGL007412; 1 plot): Floodplain forests strongly dominated by the non-native, invasive Chinese tallow, with other wetland trees often present (Global Status: No Status Rank; State (GA) Status: No Status Rank)
- American Sycamore – Sugarberry – Green Ash Floodplain Forest (CEGL00730; 1 plot): 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 (*Platanus occidentalis*), sugarberry (*Celtis laevigata*), green ash, and boxelder. (Global Status: G4—Apparently Secure; State (GA) Status: No Status Rank)



Figure 3. Four Coastal Plain Alluvial Wetlands sites were sampled during this monitoring effort on Ocmulgee Mounds National Historical Park during May 2021, including irregularly flooded forests located on slightly elevated ridges along Walnut Creek (left) and frequently inundated early successional forests adjacent to the Macon Levee (near I-16; right). NPS photo / SECN staff.

Species Diversity and Abundance

Native species richness ranged from 17 to 63 (mean = 46.3) within vegetation plots of this broadly defined habitat type in Ocmulgee Mounds National Historical Park (Table 3). Richness was lowest in the one plot (OCMU003) that was completely inundated and adjacent to I-16. Herbaceous vegetation and trees represented the most diverse growth forms across all spatial scales within plots of this habitat (Table 3). Non-native species were frequent, with three or more species observed in each plot (Table 3). All eight of the invasive plants found within the park during this monitoring effort were encountered in Coastal Plain Alluvial Wetland plots; three of these species (Chinese privet, Chinese tallow, and Japanese honeysuckle) were among the most abundant of all species (Appendix B, Table B-1). Native vascular plants observed in these plots are fairly common across the Southeastern Coastal Plain, and there were no state- or federally-listed rare plants encountered. One hundred twenty-eight vascular plant species were found collectively within these four plots, and 91 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

- Chinese privet (100%)
- Chinese tallow (100%)
- Red maple (75%)
- Sweetgum (75%)
- Sugarberry (75%)
- Green ash (75%)

Vines

- Eastern poison ivy (*Toxicodendron radicans* var. *radicans*; 100%)

- Japanese honeysuckle (100%)
- Muscadine (*Muscadinia rotundifolia* var. *rotundifolia*; 86%)

Herbs/Forbs/Graminoids

- Smallspike false nettle (*Boehmeria cylindrica*; 100%)
- Giant cane (75%)
- Variable panicgrass (75%)
- Butterweed (*Packera glabella*; 75%)
- Lizard's tail (*Saururus cernuus*; 75%)

Woody Stem Metrics

Total basal area (BA) of trees ranged from 15.1 to 29.5 m²/ha with an overall average of 23.4 m²/ha; density of canopy stems ranged from 14 to 34 per plot, with an average of 24.0 (Table 4). Canopy height ranged from 19 to 35 meters (average 25.8), and canopy cover ranged from 76 to 84% (average = 78.7%; Table 4). The most dominant canopy species included sweetgum (mean BA = 4.51 m²/ha, mean density = 19/ha), red maple (mean BA = 3.90 5.03 m²/ha, mean density = 181/ha), swamp tupelo (mean BA = 3.59 m²/ha, mean density = 38/ha), and Chinese tallow (mean BA 2.57 m²/ha, mean density = 94/ha; Appendix B, Table B-2). Sapling density at the 80-meter square scale ranged from 12 to 77 stems, with an average of 43.8, while seedling density at the 8-meter square scale ranged from four (in the inundated plot—OCMU003) to 166 stems, with an average of 102.3 across all plots (Table 4). Dominant sapling species included stiff dogwood (*Swida foemina*), red maple, Chinese privet, boxelder, and bitternut hickory (*Carya cordiformis*); dominant seedlings included eastern poison ivy, Japanese honeysuckle, Chinese privet, and loblolly pine (Appendix B, Table B-2).

Table 4. Woody stem abundance and canopy metrics on Southeast Coast Network vegetation plots located in Ocmulgee Mounds National Historical Park [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)
Coastal Plain Alluvial Wetlands	OCMU002	28.8	22.0	15.4	72.0	111.0	78.2	27.7
	OCMU003	15.1	26.0	79.8	77.0	4.0	84.4	18.7
	OCMU005	20.1	14.0	9.9	12.0	166.0	76.4	35.0
	OCMU006	29.5	34.0	29.9	14.0	128.0	75.9	22.0
	average	23.4	24.0	33.7	43.8	102.3	78.7	25.8
	standard deviation	7.0	8.3	31.8	35.6	69.4	3.9	7.2
Coastal Plain Upland Forests	OCMU035	18.8	13.0	5.9	23.0	105.0	81.1	31.0
	OCMU036	19.2	23.0	6.0	16.0	49.0	84.4	22.0
	OCMU039	15.4	16.0	6.6	24.0	114.0	87.5	35.3
	OCMU040	15.8	13.0	10.2	62.0	74.0	77.4	25.0
	average	17.3	16.3	7.2	31.3	85.5	82.6	28.3
	standard deviation	2.0	4.7	2.1	20.8	29.8	4.3	6.0

Based on stem count (density) alone, maple (red + southern sugar [*Acer floridanum*]) comprised over 31% of the relative abundance among species within the tree stratum, while the invasive Chinese tallow comprised 16% (Figure 4). The sapling stratum was dominated by stiff dogwood and giant cane, while the seedling stratum was dominated by native woody vines (e.g., eastern poison ivy), Japanese honeysuckle, Chinese privet, and loblolly pine (Figure 4).

Most of the measured trees in these monitoring plots were living (93%) and the majority were categorized with healthy vigor and minimal dieback (Figure 5). 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 half of the trees measured in these plots made up the forest canopy (co-dominant), while 33% were of intermediate height class, and 13% were completely overtopped (Figure 5).

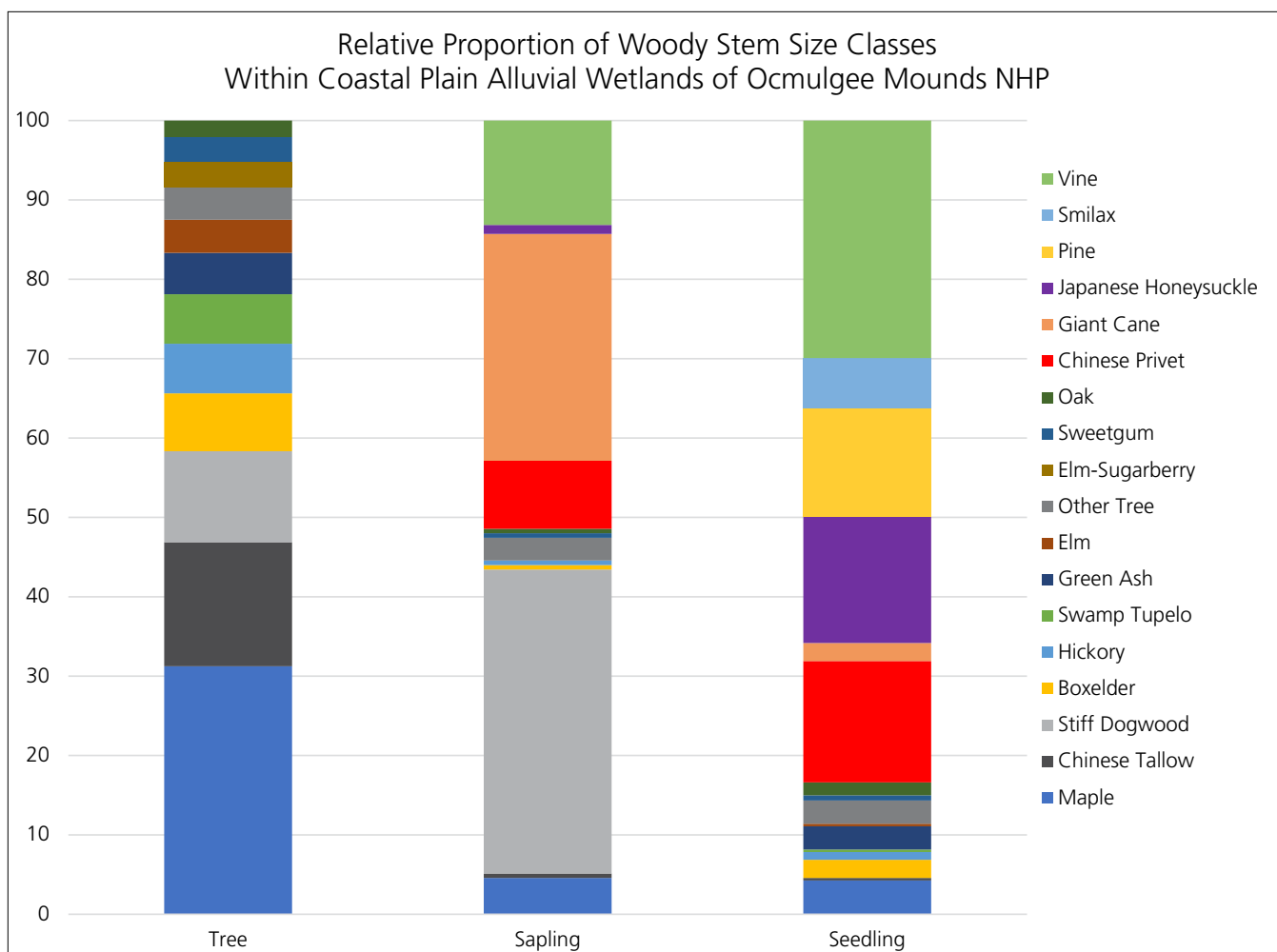


Figure 4. Relative proportion of species groups across three woody stem strata—trees, saplings, and seedlings—within Coastal Plain Alluvial Wetlands monitoring plots of Ocmulgee Mounds National Historical Park.

Health Condition of Trees Observed at Coastal Plain Alluvial Wetlands Habitat of Ocmulgee Mounds NHP

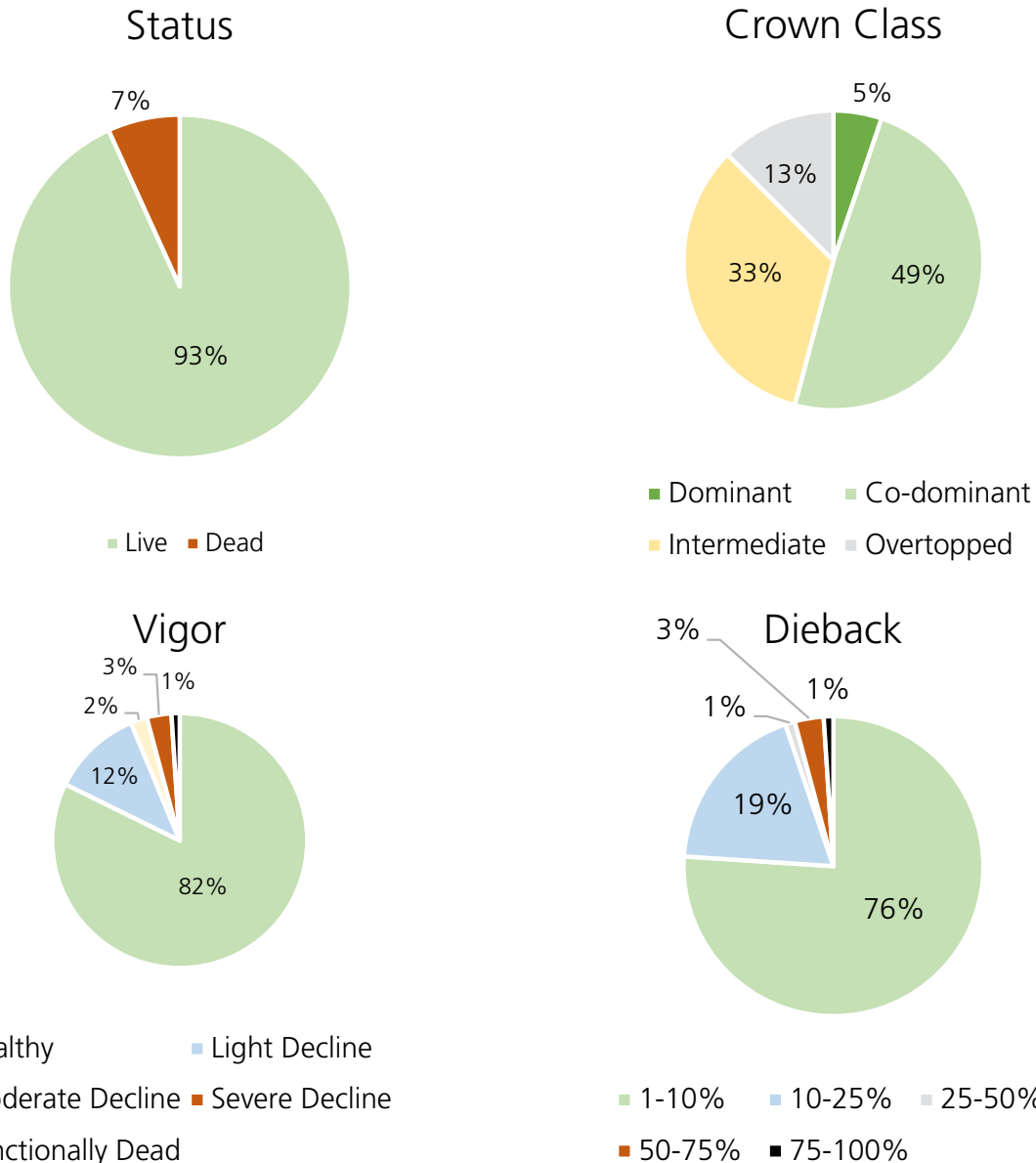


Figure 5. Health status of woody stems greater than or equal to 10 centimeters (3.9 in) DBH ('trees') measured on Coastal Plain Alluvial Wetlands monitoring plots of Ocmulgee Mounds National Historical Park.

Disturbance and Threats

The two most obvious threats to this broad habitat type based on data collected from these plots are related to abundance of non-native invasive plants and changes in hydrology due to large unnatural berms along Interstate 16, and to lesser extent the railroad bank. As discussed previously (see Study Area), the development of Interstate Highway 16 and the Macon Levee in the mid-20th century has had a significant impact on the hydrology of the Ocmulgee River floodplain. One impact was the creation of the Walnut Creek wetlands—a zone of permanent flooding on the park—following an extreme flood event in 1994 (Zomlefer et al. 2013). This unnatural berm has undoubtedly decreased seasonal variation of water flow across the Ocmulgee floodplain, and thus altered natural successional pathways of the park’s alluvial forests. The Interstate 16 road bank directly impacted the one Coastal Plain Alluvial Wetlands plot sampled during this monitoring effort (OCMU003), which was observed with 100% standing water and minimal seedling regeneration (Table 5). It is uncertain how these hydrologic changes will impact vegetation community health and forest succession. However, data collected from these monitoring plots will aid in the understanding of how these wetland ecosystems are changing over time. Long-term monitoring will also 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 (McNab and Loftis 2002; Christen and Matlack 2006) are a present and increasing reality for the landscape of Ocmulgee Mounds National Historical Park. 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.

Table 5. Disturbance observations and abundance (%cover) measured on vegetation monitoring plots of Ocmulgee Mounds National Historical Park.

Broadly Defined Habitat	Plot	Adjacent Road Bank	Windthrow	Historic Trail/Road
Coastal Plain Alluvial Wetlands	OCMU002	–	–	–
	OCMU003	100	–	–
	OCMU005	–	20	–
	OCMU006	–	–	–
Coastal Plain Upland Forests	OCMU035	–	–	35
	OCMU036	–	–	–
	OCMU039	–	–	–
	OCMU040	–	–	–

Geomorphology and Soil

Plots located within Coastal Plain Alluvial Wetland habitats of Ocmulgee Mounds National Historical Park occurred on relatively flat (0 degree) landforms with concave shapes (terrain shape indices > 0 ;Table 6). As noted above, plot OCMU003 was 100% submerged at the time of sampling. Although the three other plots did not have an abundance of standing water, they all have the potential to flood at other times of the year or following extreme rain events (Table 6). Coastal Plain Alluvial

Wetland soils of Ocmulgee Mounds National Historical Park were moderately acidic and had the highest exchangeable cation levels than any other habitat sampled on the park during this monitoring event (Table 7). Alluvial floodplains of the Georgia Coastal Plain 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 (Edwards et al. 2013).

Table 6. Local landform and hydrologic condition from vegetation monitoring plots at Ocmulgee Mounds National Historical Park.

Broadly Defined Habitat	Plot	Slope (°)	Aspect (°)	TSI ¹ (°)	Landform Type	Water Source	Submerged (%)
Coastal Plain Alluvial Wetlands	OCMU002	0	n/a	0.250	alluvial plain	Flood zones	0
	OCMU003	0	n/a	1.125	backswamp	Permanent water	100
	OCMU005	4	49	1.250	alluvial plain	Temporary Streams	10
	OCMU006	0	n/a	0.500	alluvial plain	Flood zones	0
Coastal Plain Upland Forests	OCMU035	5	90	-0.375	side slope	None	0
	OCMU036	3	126	0.625	side slope	None	0
	OCMU039	10	90	-1.250	gap/saddle	None	0
	OCMU040	11	136	1.250	side slope	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 Ocmulgee Mounds National and Historical Park. 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
Coastal Plain Alluvial Wetlands	OCMU002	9.84	5.50	4.99	6.00	868.00	206.00	54.00	15.00	0.41	225.00	188.00	2.62	5.41	468.00
	OCMU003	9.18	5.20	5.94	12.00	740.00	118.00	79.00	17.00	0.76	341.00	192.00	5.27	10.65	777.00
	OCMU005	3.73	4.90	4.49	21.00	220.00	52.00	44.00	11.00	0.29	202.00	34.00	1.18	1.33	723.00
	OCMU006	8.72	5.30	4.72	14.00	687.00	162.00	50.00	17.00	0.39	236.00	33.00	4.31	3.15	635.00
	average	7.87	5.23	5.04	13.25	628.75	134.50	56.75	15.00	0.46	251.00	111.75	3.35	5.14	650.75
	standard deviation	2.80	0.25	0.64	6.18	282.89	65.69	15.39	2.83	0.21	61.65	90.37	1.81	4.04	135.16
Coastal Plain Upland Forests	OCMU035	2.11	4.80	2.48	18.00	128.00	24.00	14.00	8.00	0.10	101.00	67.00	0.98	5.24	460.00
	OCMU036	3.20	4.50	4.01	24.00	164.00	30.00	22.00	10.00	0.23	154.00	23.00	0.28	1.39	679.00
	OCMU039	2.29	4.30	3.11	19.00	93.00	24.00	15.00	8.00	0.10	112.00	5.00	0.10	1.20	386.00
	OCMU040	1.46	4.80	2.10	28.00	77.00	20.00	15.00	9.00	0.10	122.00	64.00	0.45	1.51	718.00
	average	2.27	4.60	2.93	22.25	115.50	24.50	16.50	8.75	0.13	122.25	39.75	0.45	2.34	560.75
	standard deviation	0.72	0.24	0.83	4.65	38.72	4.12	3.70	0.96	0.07	22.84	30.65	0.38	1.94	162.68

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).

Coastal Plain Upland Forests and Shrublands

Coastal Plain Upland Forests of Ocmulgee Mounds National Historical Park include mixed hardwood and pine forests located on dry slopes or ridge tops, and more mesic forests located on lower slopes adjacent to alluvial habitats (Cotton et al. 2019; Figure 6). The canopy and subcanopy of these forests within the park are dominated by loblolly pine, water oak, southern red oak, and winged elm (*Ulmus alata*), and sweetgum (Cotton 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. Across the Coastal Plain of the southeast, these forests occupy a wider range of upland sites than in the past when fire activity across the landscape would have promoted more open pine woodland habitat (Edwards et al. 2013). Within Ocmulgee Mounds National Historical Park, this broadly defined habitat is scattered throughout the interior of the Main Unit on slopes and ridges not typically flooded by

the Ocmulgee River or Walnut Creek. Vegetation associations sampled within the park that belong to this habitat type include (descriptions from NatureServe 2023):

- 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 or 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)
- Southeastern Coastal Plain Ruderal Sweetgum – Oak – Loblolly Pine Forest (CEGL007726; 1 plot): Semi-natural forests dominated by sweetgum and oaks, occasionally with an emergent canopy of loblolly pine; these forests develop on abandoned agriculture lands throughout the southeastern Coastal Plain. (Global Status: No Status Rank; State (GA) Status: No Status Rank)



Figure 6. Four plots within Coastal Plain Upland Forest habitat of Ocmulgee Mounds National Historical Park were sampled during this monitoring event. NPS photo / SECN staff.

Species Diversity and Abundance

Native species richness ranged from 22 to 28 (mean = 25.3) within vegetation plots of this broadly defined habitat type, and all plots were observed with multiple non-native species present (Table 3). At the full plot (400 m²)- and module (100 m²)-scales, trees and vines exhibited the highest richness, while at the smaller nested depths herbaceous and graminoid species at the highest richness (Table 3). Six of the eight Category 1 and 2 invasive plants found within the park during this monitoring effort were encountered in Coastal Plain Upland Forest plots (Appendix B, Table B-1). Native vascular plants observed in these plots are fairly common across the Southeastern Coastal Plain, and there were no state or federally listed rare plants encountered. Fifty-one vascular plant species were found collectively within these four plots, and 14 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 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 (100%)
- Water oak (100%)
- Winged elm (100%)
- Loblolly pine (100%)

Shrubs

- Yaupon (*Ilex vomitoria*); 100%)
- American beautyberry (*Callicarpa americana*; 100%)

Vines

- Muscadine (100%)
- Japanese honeysuckle (100%)
- Eastern poison ivy (100%)
- Virginia creeper (*Parthenocissus quinquefolia*; 100%)
- Saw greenbrier (*Smilax bona-nox* var. *bona-nox*; 100%)

- Cat greenbrier (*Smilax glauca*; 100%)
- Roundleaf greenbrier (*Smilax rotundifolia*; 100%)

Herbs/Forbs/Graminoids

- Ebony spleenwort (100%)

Woody Stem Metrics

Total basal area (BA) of trees ranged from 15.4 to 19.2 m²/ha with an overall average of 17.3 m²/ha; density of canopy stems ranged from 13 to 23 per plot, with an average of 16.3 (Table 4). Canopy height ranged from 22 to 35 meters (average 28.3), and canopy cover ranged from 77 to 88% (average = 82.6%; Table 4). The most dominant canopy species included water oak (mean BA = 6.81 m²/ha, mean density = 100/ha), loblolly pine (mean BA = 5.28 m²/ha, mean density = 44/ha), and sweetgum (mean BA = 2.58 m²/ha, mean density = 119/ha) (Appendix B, Table B-2). Sapling density at the 80-meter square scale ranged from 16 to 62 stems, with an average of 31.3, while seedling density at the 8-meter square scale ranged from 49 to 114 stems, with an average of 85.5 across all plots (Table 4). Dominant sapling species included muscadine, sweetgum, and winged elm; dominant seedlings included Japanese honeysuckle, muscadine, roundleaf greenbrier, and Virginia creeper (Appendix B, Table B-2).

Based on stem count (density) alone, sweetgum and water oak comprised over 50% of the relative abundance among species within the tree stratum (Figure 7). The sapling stratum was heavily dominated by woody vines (e.g., muscadine), while the seedling stratum was dominated by native woody vines (e.g., muscadine and eastern poison ivy) and the non-native, invasive Japanese honeysuckle (Figure 7).

Most of the measured trees in these monitoring plots were living (96%) and the majority were categorized with healthy vigor and minimal dieback (Figure 8). 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. Over half of the trees measured in these plots made up the forest canopy (dominant or co-dominant), while 31% were of intermediate height class, and 15% were completely overtopped (Figure 8).

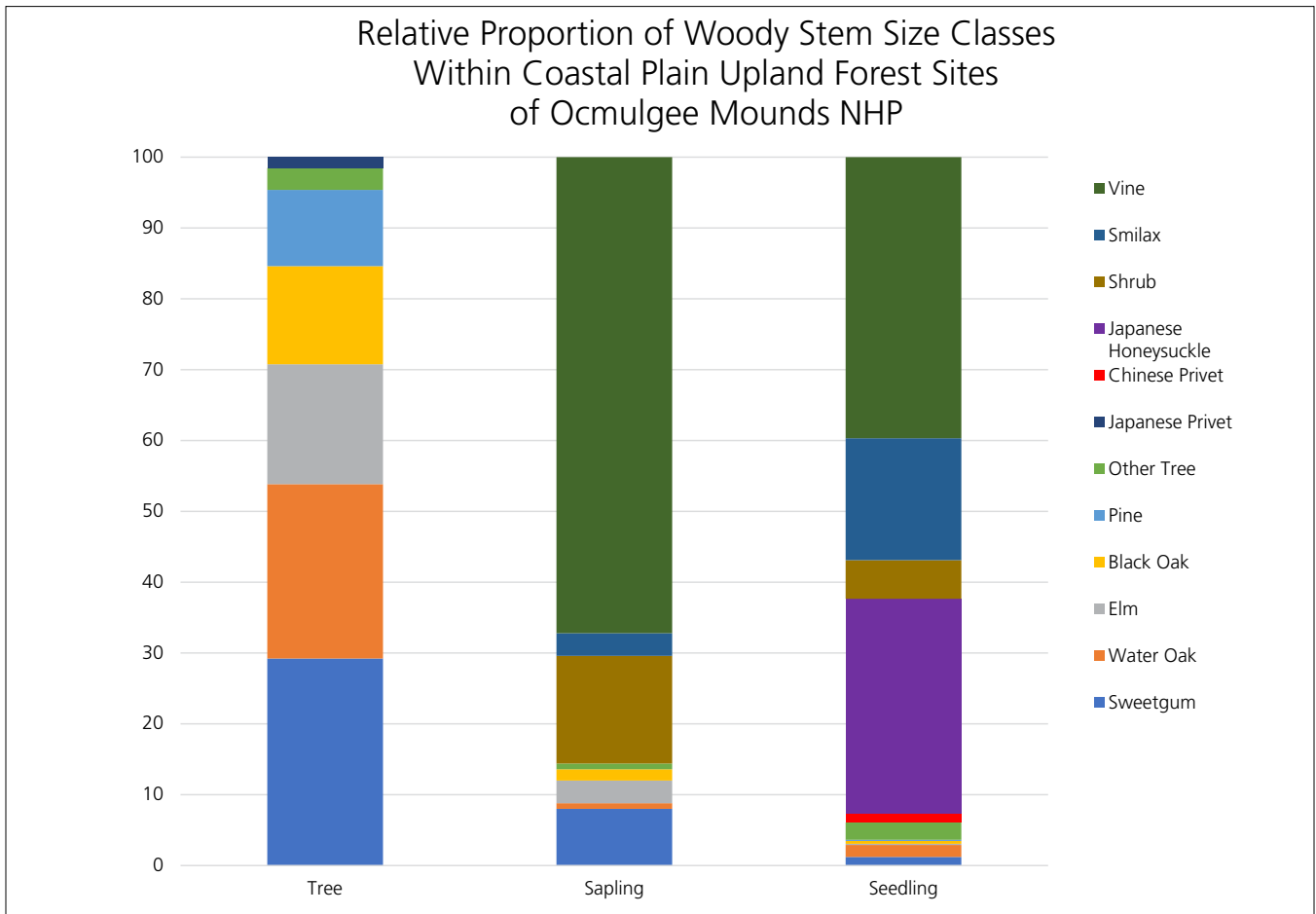


Figure 7. Relative proportion of species groups across three woody stem strata—trees, saplings, and seedlings—within Coastal Plain Upland Forest monitoring plots of Ocmulgee Mounds National Historical Park.

Health Condition of Trees Observed at Coastal Plain Upland Forest Habitat of Ocmulgee Mounds NHP

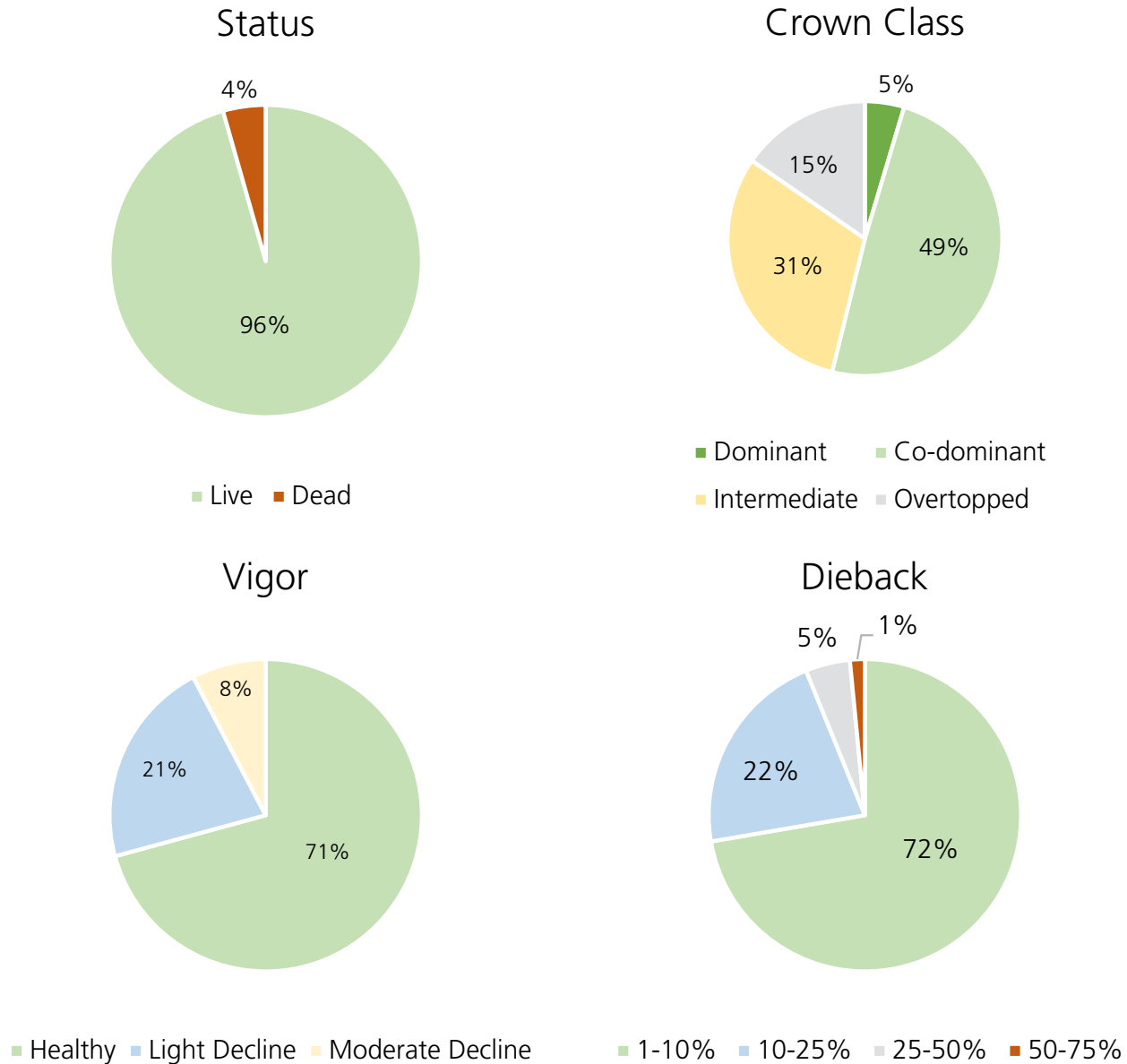


Figure 8. Health status of woody stems greater than or equal to 10 centimeters (3.9 in) DBH ('trees') measured on Coastal Plain Upland Forest monitoring plots of Ocmulgee Mounds National Historical Park.

Disturbance and Threats

Except for the presence of an old trail or road running through plot OCMU035, there were no observed threats or disturbances within these plots. Invasive plants were abundant in this upland habitat, as they were within the Coastal Plain Alluvial Wetlands habitat. See previous discussion (Coastal Plain Alluvial Wetlands, Disturbance and Threats section) for information related to invasive plants on the park. Although feral hogs (*Sus scrofa*) have been documented on Ocmulgee Mounds National Historical Park in the past, their impacts (e.g., rooting) were not observed in any of these monitoring plots; significant impacts from browsing by white-tailed deer (*Odocoileus virginianus*) were also not observed. In the past, upland pine forests on the park have been impacted by outbreaks of southern pine beetle (*Dendroctonus frontalis*), one of the most destructive forest insect pests in the southeastern United States (Clarke 1995). Neither impacts from previous outbreaks (e.g., dead standing trees or high pine coarse woody debris [CWD] volume) nor recent infestations were observed in these four monitoring plots. Finally, there was no evidence of fire history observed in any of the four upland forest plots. As noted in the opening paragraph to Coastal Plain Upland Forests, hardwood dominated upland forests would have historically been limited to occurring on steep or lower protected slopes that would not have been subjected to frequent fire activity. Fire exclusion over the past century has resulted in the conversion of open pine-dominated woodlands that require frequent burning to forests dominated

by fire-intolerant hardwood species (Edwards et al. 2013). Due to the high lightning frequency during the growing season in the inner Coastal Plain of Georgia, and the Native American's historical practice of burning, it is very likely that many of the upper slopes and ridges within Ocmulgee Mounds National Historical Park would have historically supported an open natural pine (e.g. longleaf pine [*Pinus palustris*]) woodland habitat.

Geomorphology and Soil

Plots located within Coastal Plain Upland Forests of Ocmulgee Mounds National Historical Park occurred on east to southeast facing slopes with moderate slopes and variable slope shapes (Table 6). The soils collected from these plots were acidic (average pH = 4.6) and had low cation content (Total Exchange Capacity [TEC] = 2.27; Table 7).

Fuel Load Estimates

Fuel loads ranged from 7.6 to 35.8 (average=19.9) tons/acre (1.7 to 8.0 kg/m²) in Coastal Plain Upland Forest plots of Ocmulgee Mounds National Historical Park (Figure 9). There was high variability between fuel loads among vegetation plots in the park. Variation in fuel loads among sites is typical and related to differences in live and dead vegetation structure, disturbance history, hydrology, and edaphic conditions. Coarse woody debris (1000-hour fuels), duff, and litter contributed to most of the fuel loads within these sites (Figure 9).

Ocmulgee Mounds National Historical Park Fuel Loads

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

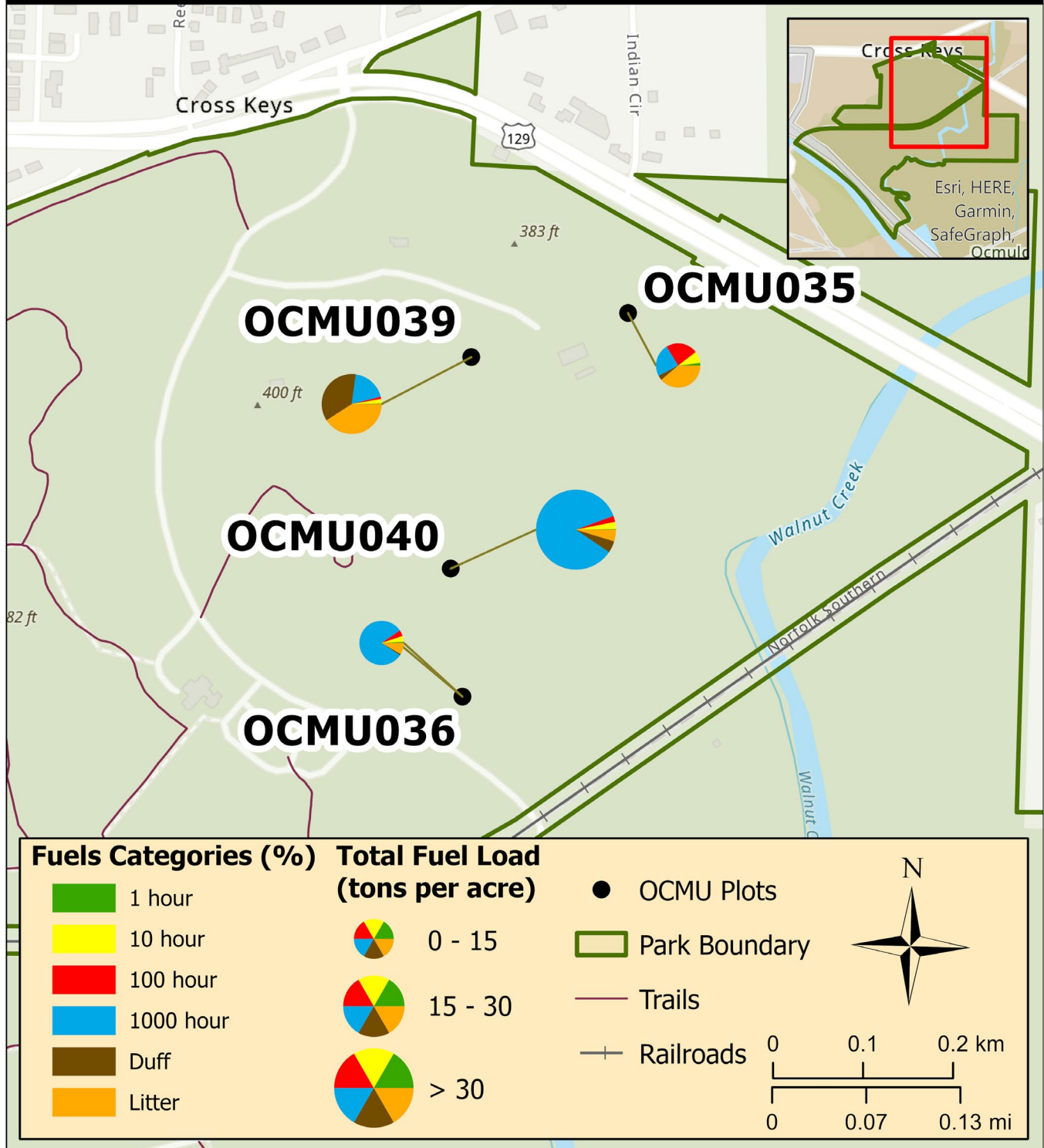


Figure 9. Fuel load estimates from vegetation plots located within Coastal Plain Upland Forests of pre-boundary expansion land of Ocmulgee Mounds National Historical Park.

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Appendix A. Vascular Plants Observed During the 2021 Southeast Coast Network Terrestrial Vegetation Monitoring Effort at Ocmulgee Mounds National Historical Park

Table A-1. Vascular plant species present in eight vegetation monitoring plots within Ocmulgee Mounds National Historical Park, May 2021.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State 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 negundo</i> var. <i>negundo</i>	boxelder	Native	Tree	–	–
Sapindales	Aceraceae	<i>Acer rubrum</i>	red maple	Native	Tree	–	–
Sapindales	Hippocastanaceae	<i>Aesculus sylvatica</i>	painted buckeye	Native	Shrub, Tree	–	–
Asterales	Asteraceae	<i>Ambrosia artemisiifolia</i>	annual ragweed	Native	Forb/herb	–	–
Fabales	Fabaceae	<i>Amphicarpaea bracteata</i>	American hogpeanut	Native	Forb/herb, Vine	–	–
Apiales	Araliaceae	<i>Aralia spinosa</i>	devil's walkingstick	Native	Shrub, Tree	–	–
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>Arundinaria gigantea</i>	giant cane	Native	Subshrub, Shrub, Graminoid	–	–
Magnoliales	Annonaceae	<i>Asimina parviflora</i>	smallflower pawpaw	Native	Shrub, Tree	–	–
Magnoliales	Annonaceae	<i>Asimina triloba</i>	pawpaw	Native	Shrub, Tree	–	–
Polypodiales	Aspleniaceae	<i>Asplenium platyneuron</i>	ebony spleenwort	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Asteraceae</i>	aster family	Unknown	Forb/herb	–	–
Polypodiales	Dryopteridaceae	<i>Athyrium asplenoides</i>	southern ladyfern	Native	Forb/herb	–	–
Rhamnales	Rhamnaceae	<i>Berchemia scandens</i>	Alabama supplejack	Native	Vine	–	–
Asterales	Asteraceae	<i>Bidens bipinnata</i>	Spanish needles	Native	Forb/herb	–	–
Scrophulariales	Bignoniaceae	<i>Bignonia capreolata</i>	crossvine	Native	Vine	–	–
Urticales	Urticaceae	<i>Boehmeria cylindrica</i>	smallspike false nettle	Native	Forb/herb	–	–
Polygonales	Polygonaceae	<i>Brunnichia ovata</i>	American buckwheat vine	Native	Vine	–	–
Lamiales	Verbenaceae	<i>Callicarpa americana</i>	American beautyberry	Native	Shrub	–	–
Cyperales	Cyperaceae	<i>Carex amphibola</i>	eastern narrowleaf sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex cherokeensis</i>	Cherokee sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex debilis</i>	white edge sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex jorii</i>	cypress swamp sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex laxiflora</i>	broad looseflower sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex lupulina</i>	hop sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex lurida</i>	shallow sedge	Native	Graminoid	–	–

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

Table A-1 (continued). Vascular plant species present in eight vegetation monitoring plots within Ocmulgee Mounds National Historical Park, May 2021.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	Georgia Rare-Protected Status ³
Cyperales	Cyperaceae	<i>Carex nigromarginata</i>	black edge sedge	Native	Graminoid		–
Cyperales	Cyperaceae	<i>Carex radiata</i>	eastern star sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex retroflexa</i>	reflexed sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex striatula</i>	lined sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex tribuloides</i>	blunt broom sedge	Native	Graminoid	–	–
Fagales	Betulaceae	<i>Carpinus caroliniana</i> var. <i>caroliniana</i>	American hornbeam	Native	Shrub, Tree	–	–
Juglandales	Juglandaceae	<i>Carya cordiformis</i>	bitternut hickory	Native	Tree	–	–
Juglandales	Juglandaceae	<i>Carya glabra</i>	pignut hickory	Native	Tree	–	–
Urticales	Ulmaceae	<i>Celtis laevigata</i>	sugarberry	Native	Shrub, Tree	–	–
Cyperales	Poaceae	<i>Chasmanthium latifolium</i>	Indian woodoats	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Chasmanthium laxum</i>	slender woodoats	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Chasmanthium sessiliflorum</i> var. <i>sessiliflorum</i>	longleaf woodoats	Native	Graminoid		–
Sapindales	Rutaceae	<i>Citrus trifoliata</i>	hardy orange	Non-native	Shrub, Tree	Category 3	–
Ranunculales	Menispermaceae	<i>Cocculus carolinus</i>	Carolina coralbead	Native	Vine	–	–
Cyperales	Poaceae	<i>Coleataenia anceps</i> ssp. <i>anceps</i>	beaked panicgrass	Native	Graminoid	–	–
Rosales	Rosaceae	<i>Crataegus</i>	hawthorn	Native	Tree	–	–
Cyperales	Poaceae	<i>Dichanthelium commutatum</i>	variable panicgrass	Native	Graminoid	–	–
Ebenales	Ebenaceae	<i>Diospyros virginiana</i>	common persimmon	Native	Tree	–	–
Asterales	Asteraceae	<i>Elephantopus carolinianus</i>	Carolina elephantsfoot	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Erechtites hieraciifolius</i>	American burnweed	Native	Forb/herb	–	–
Celastrales	Celastraceae	<i>Euonymus americanus</i>	bursting-heart	Native	Forb/herb, Subshrub	–	–
Fagales	Fagaceae	<i>Fagus grandifolia</i> var. <i>caroliniana</i>	American beech	Native	Tree	–	–
Scrophulariales	Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash	Native	Tree	–	–
Rubiales	Rubiaceae	<i>Galium aparine</i>	stickywilly	Native	Forb/herb, Vine		–
Rubiales	Rubiaceae	<i>Galium pilosum</i>	hairy bedstraw	Native	Forb/herb		–
Rubiales	Rubiaceae	<i>Galium tinctorium</i> var. <i>floridanum</i>	stiff marsh bedstraw	Native	Forb/herb		–
Rubiales	Rubiaceae	<i>Galium triflorum</i>	fragrant bedstraw	Native	Forb/herb		–
Asterales	Asteraceae	<i>Gamochaeta</i>	everlasting	Unknown	Forb/herb		–

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

Table A-1 (continued). Vascular plant species present in eight vegetation monitoring plots within Ocmulgee Mounds National Historical Park, May 2021.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	Georgia Rare-Protected Status ³
Gentianales	Loganiaceae	<i>Gelsemium sempervirens</i>	evening trumpetflower	Native	Vine, Shrub	–	–
Gentianales	Asclepiadaceae	<i>Gonolobus suberosus</i> var. <i>suberosus</i>	angularfruit milkvine	Native	Forb/herb, Vine	–	–
Scrophulariales	Scrophulariaceae	<i>Gratiola virginiana</i>	roundfruit hedgehyssop	Native	Forb/herb	–	–
Apiales	Araliaceae	<i>Hedera helix</i> var. <i>helix</i>	English ivy	Non-native	Vine	Category 1	–
Asterales	Asteraceae	<i>Heliopsis gracilis</i>	smooth oxeye	Native	Forb/herb	–	–
Rosales	Hydrangeaceae	<i>Hydrangea barbara</i>	woodvamp	Native	Vine	–	–
Theales	Clusiaceae	<i>Hypericum hypericoides</i>	St. Andrew's cross	Native	Shrub, Subshrub	–	–
Celastrales	Aquifoliaceae	<i>Ilex ambigua</i>	Carolina holly	Native	Tree, Shrub	–	–
Celastrales	Aquifoliaceae	<i>Ilex cornuta</i>	Chinese holly	Non-native	Shrub, Tree	Category 4	–
Celastrales	Aquifoliaceae	<i>Ilex opaca</i>	American holly	Native	Tree, Shrub	–	–
Celastrales	Aquifoliaceae	<i>Ilex vomitoria</i>	yaupon	Native	Tree, Shrub	–	–
Geraniales	Balsaminaceae	<i>Impatiens capensis</i>	jewelweed	Native	Forb/herb	–	–
Juncales	Juncaceae	<i>Juncus</i>	rush	Native	Graminoid	–	–
Juncales	Juncaceae	<i>Juncus coriaceus</i>	leathery rush	Native	Graminoid	–	–
Juncales	Juncaceae	<i>Juncus dichotomus</i>	forked rush	Native	Graminoid	–	–
Scrophulariales	Acanthaceae	<i>Justicia ovata</i>	looseflower water-willow	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Leersia oryzoides</i>	rice cutgrass	Native	Graminoid	–	–
Scrophulariales	Oleaceae	<i>Ligustrum japonicum</i>	Japanese privet	Non-native	Shrub, Tree	Category 2	–
Scrophulariales	Oleaceae	<i>Ligustrum sinense</i>	Chinese privet	Non-native	Shrub, Tree	Category 1	–
Hamamelidales	Hamamelidaceae	<i>Liquidambar styraciflua</i>	sweetgum	Native	Tree	–	–
Dipsacales	Caprifoliaceae	<i>Lonicera japonica</i>	Japanese honeysuckle	Non-native	Vine	Category 1	–
Polypodiales	Blechnaceae	<i>Lorinseria areolata</i>	netted chainfern	Native	Forb/herb	–	–
Magnoliales	Magnoliaceae	<i>Magnolia grandiflora</i>	southern magnolia	Native	Tree	–	–
Cyperales	Poaceae	<i>Melica mutica</i>	twoflower melicgrass	Native	Graminoid	–	–
Ranunculales	Menispermaceae	<i>Menispermum canadense</i>	common moonseed	Native	Vine	–	–
Cyperales	Poaceae	<i>Microstegium vimineum</i>	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	Forb/herb, Subshrub	–	–

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

Table A-1 (continued). Vascular plant species present in eight vegetation monitoring plots within Ocmulgee Mounds National Historical Park, May 2021.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	Georgia Rare-Protected Status ³
Urticales	Moraceae	<i>Morus rubra</i>	red mulberry	Native	Tree	–	–
Rhamnales	Vitaceae	<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	muscadine	Native	Vine	–	–
Lamiales	Boraginaceae	<i>Myosotis macrosperma</i>	largeseed forget-me-not	Native	Forb/herb	–	–
Ranunculales	Berberidaceae	<i>Nandina domestica</i>	sacred bamboo	Non-native	Shrub	Category 2	–
Rhamnales	Vitaceae	<i>Nekemias arborea</i>	peppervine	Native	Shrub, Vine	–	–
Cornales	Cornaceae	<i>Nyssa biflora</i>	swamp tupelo	Native	Tree	–	–
Cyperales	Poaceae	<i>Oplismenus setarius</i>	basketgrass	Native	Graminoid	–	–
Orchidales	Orchidaceae	<i>Orchidaceae</i>	orchid family	Native	Forb/herb	–	–
Fagales	Betulaceae	<i>Ostrya virginiana</i>	hophornbeam	Native	Shrub, Tree	–	–
Asterales	Asteraceae	<i>Packera glabella</i>	butterweed	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Panicum virgatum</i> var. <i>virgatum</i>	switchgrass	Native	Graminoid	–	–
Rhamnales	Vitaceae	<i>Parthenocissus quinquefolia</i>	Virginia creeper	Native	Vine	–	–
Polygonales	Polygonaceae	<i>Persicaria hydropiperoides</i>	swamp smartweed	Native	Forb/herb	–	–
Polygonales	Polygonaceae	<i>Persicaria setacea</i>	bog smartweed	Native	Forb/herb	–	–
Pinales	Pinaceae	<i>Pinus taeda</i>	loblolly pine	Native	Tree	–	–
Cyperales	Poaceae	<i>Piptochaetium avenaceum</i>	blackseed speargrass	Native	Graminoid	–	–
Urticales	Ulmaceae	<i>Planera aquatica</i>	planertree	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 annua</i>	annual bluegrass	Non-native	Graminoid	Category 3	–
Cyperales	Poaceae	<i>Poa autumnalis</i>	autumn bluegrass	Native	Graminoid	–	–
Polypodiales	Dryopteridaceae	<i>Polystichum acrostichoides</i>	Christmas fern	Native	Forb/herb	–	–
Rosales	Rosaceae	<i>Prunus caroliniana</i>	Carolina laurelcherry	Native	Shrub, Tree	–	–
Rosales	Rosaceae	<i>Prunus serotina</i> var. <i>serotina</i>	black cherry	Native	Shrub, Tree	–	–
Fagales	Fagaceae	<i>Quercus michauxii</i>	swamp 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 velutina</i>	black oak	Native	Tree	–	–
Rosales	Rosaceae	<i>Rubus</i>	blackberry	Native	Shrub	–	–

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

Table A-1 (continued). Vascular plant species present in eight vegetation monitoring plots within Ocmulgee Mounds National Historical Park, May 2021.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	Georgia Rare-Protected Status ³
Rosales	Rosaceae	<i>Rubus pensilvanicus</i>	sawtooth blackberry	Native	Subshrub	–	–
Arecales	Arecaceae	<i>Sabal minor</i>	dwarf palmetto	Native	Shrub, Tree	–	–
Salicales	Salicaceae	<i>Salix caroliniana</i>	coastal plain willow	Native	Tree	–	–
Apiales	Apiaceae	<i>Sanicula canadensis</i>	Canadian blacksnakeroot	Native	Forb/herb	–	–
Piperales	Saururaceae	<i>Saururus cernuus</i>	lizard's tail	Native	Forb/herb	–	–
Cyperales	Cyperaceae	<i>Scleria oligantha</i>	littlehead nutrush	Native	Graminoid	–	–
Liliales	Iridaceae	<i>Sisyrinchium angustifolium</i>	narrowleaf blue-eyed grass	Native	Forb/herb	–	–
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 herbacea</i>	smooth carrionflower	Native	Forb/herb, Vine	–	–
Liliales	Smilacaceae	<i>Smilax laurifolia</i>	laurel greenbrier	Native	Shrub, Vine	–	–
Liliales	Smilacaceae	<i>Smilax rotundifolia</i>	roundleaf greenbrier	Native	Shrub, Vine	–	–
Liliales	Smilacaceae	<i>Smilax walteri</i>	coral greenbrier	Native	Shrub, Vine	–	–
Asterales	Asteraceae	<i>Solidago</i>	goldenrod	Native	Forb/herb	–	–
Cornales	Cornaceae	<i>Swida foemina</i>	stiff dogwood	Native	Shrub, Tree	–	–
Sapindales	Anacardiaceae	<i>Toxicodendron radicans</i> var. <i>radicans</i>	eastern poison ivy	Native	Shrub, Subshrub, Vine	–	–
Commelinales	Commelinaceae	<i>Tradescantia ohiensis</i>	bluejacket	Native	Forb/herb	–	–
Theales	Clusiaceae	<i>Triadenum walteri</i>	greater marsh St. Johnswort	Native	Forb/herb	–	–
Euphorbiales	Euphorbiaceae	<i>Triadica sebifera</i>	Chinese tallow	Non-native	Tree	Category 1	–
Fabales	Fabaceae	<i>Trifolium dubium</i>	suckling clover	Non-native	Forb/herb	–	–
Urticales	Ulmaceae	<i>Ulmus alata</i>	winged elm	Native	Tree	–	–
Urticales	Ulmaceae	<i>Ulmus americana</i> var. <i>americana</i>	American elm	Native	Tree	–	–
Urticales	Ulmaceae	<i>Ulmus rubra</i>	slippery elm	Native	Tree	–	–
Asterales	Asteraceae	<i>Verbesina occidentalis</i>	yellow crownbeard	Native	Forb/herb	–	–
Violales	Violaceae	<i>Viola</i>	violet	Unknown	Forb/herb	–	–
Fabales	Fabaceae	<i>Wisteria sinensis</i>	Chinese wisteria	Non-native	Vine	Category 1	–
Liliales	Agavaceae	<i>Yucca filamentosa</i>	Adam's needle	Native	Forb/herb, Shrub, Subshrub	–	–

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

Appendix B. Species Diversity, Abundance, and Woody Stem Metrics Summarized by Broadly Defined Habitats at Ocmulgee Mounds National Historical Park

Table B-1. Constancy and average cover class for all vascular plant species observed in eight Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: CPAW = Coastal Plain Alluvial Wetlands (four plots) and CPUF = Coastal Plain Upland Forests (four 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	CPAW Constancy	CPAW Cover	CPUF Constancy	CPUF Cover
<i>Acalypha rhomboidea</i>	50	2	0	–
<i>Acer floridanum</i>	25	4	0	–
<i>Acer negundo</i> var. <i>negundo</i>	50	6	0	–
<i>Acer rubrum</i>	75	6	25	1
<i>Aesculus sylvatica</i>	25	2	25	1
<i>Ambrosia artemisiifolia</i>	50	2	0	–
<i>Amphicarpaea bracteata</i>	25	2	0	–
<i>Aralia spinosa</i>	25	1	0	–
<i>Arisaema dracontium</i>	50	2	0	–
<i>Arisaema triphyllum</i>	25	1	0	–
<i>Arundinaria gigantea</i>	75	5	0	–
<i>Asimina parviflora</i>	0	–	75	2
<i>Asimina triloba</i>	25	2	0	–
<i>Asplenium platyneuron</i>	25	2	100	2
Asteraceae	75	2	0	–
<i>Athyrium asplenoides</i>	25	2	0	–
<i>Berchemia scandens</i>	50	2	0	–
<i>Bidens bipinnata</i>	25	2	0	–
<i>Bignonia capreolata</i>	25	2	25	2
<i>Boehmeria cylindrica</i>	100	2	0	–
<i>Brunnichia ovata</i>	25	3	0	–
<i>Callicarpa americana</i>	25	4	100	3
<i>Carex amphibola</i>	25	2	0	–
<i>Carex cherokeensis</i>	25	1	0	–
<i>Carex debilis</i>	75	2	0	–
<i>Carex jorii</i>	25	1	0	–
<i>Carex laxiflora</i>	25	4	25	1
<i>Carex lupulina</i>	50	2	0	–
<i>Carex lurida</i>	25	1	0	–
<i>Carex nigromarginata</i>	0	–	25	2
<i>Carex radiata</i>	25	1	0	–
<i>Carex retroflexa</i>	25	2	0	–
<i>Carex striatula</i>	25	2	0	–
<i>Carex tribuloides</i>	25	3	0	–
<i>Carpinus caroliniana</i> var. <i>caroliniana</i>	50	2	0	–
<i>Carya cordiformis</i>	25	6	0	–
<i>Carya glabra</i>	25	2	75	3

Table B-1 (continued). Constancy and average cover class for all vascular plant species observed in eight Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: CPAW = Coastal Plain Alluvial Wetlands (four plots) and CPUF = Coastal Plain Upland Forests (four 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	CPAW Constancy	CPAW Cover	CPUF Constancy	CPUF Cover
<i>Celtis laevigata</i>	75	5	25	1
<i>Chasmanthium latifolium</i>	50	4	25	2
<i>Chasmanthium laxum</i>	0	–	25	3
<i>Chasmanthium sessiliflorum</i> var. <i>sessiliflorum</i>	0	–	25	4
<i>Citrus trifoliata</i>	25	1	0	–
<i>Cocculus carolinus</i>	25	3	0	–
<i>Coleataenia anceps</i> ssp. <i>anceps</i>	75	2	0	–
<i>Crataegus</i>	0	–	50	1
<i>Dichanthelium commutatum</i>	75	3	50	2
<i>Diospyros virginiana</i>	25	2	50	2
<i>Elephantopus carolinianus</i>	25	2	0	–
<i>Erechtites hieraciifolius</i>	25	2	0	–
<i>Euonymus americanus</i>	25	1	0	–
<i>Fagus grandifolia</i> var. <i>caroliniana</i>	25	6	0	–
<i>Fraxinus pennsylvanica</i>	75	4	0	–
<i>Galium aparine</i>	50	2	50	1
<i>Galium pilosum</i>	0	–	25	1
<i>Galium tinctorium</i> var. <i>floridanum</i>	25	2	0	–
<i>Galium triflorum</i>	50	1	0	–
<i>Gamochaeta</i>	25	1	0	–
<i>Gelsemium sempervirens</i>	25	2	75	2
<i>Gonolobus suberosus</i> var. <i>suberosus</i>	25	2	0	–
<i>Gratiola virginiana</i>	25	1	0	–
<i>Hedera helix</i> var. <i>helix</i>	25	2	0	–
<i>Heliopsis gracilis</i>	25	1	0	–
<i>Hydrangea barbara</i>	50	1	0	–
<i>Hypericum hypericoides</i>	0	–	25	1
<i>Ilex ambigua</i>	75	2	50	2
<i>Ilex cornuta</i>	0	–	50	1
<i>Ilex opaca</i>	25	1	0	–
<i>Ilex vomitoria</i>	0	–	100	4
<i>Impatiens capensis</i>	75	2	0	–
<i>Juncus</i>	25	2	0	–
<i>Juncus coriaceus</i>	25	1	0	–
<i>Juncus dichotomus</i>	25	1	0	–
<i>Justicia ovata</i>	25	1	0	–
<i>Leersia oryzoides</i>	75	2	0	–
<i>Ligustrum japonicum</i>	0	–	25	4
<i>Ligustrum sinense</i>	100	4	50	2
<i>Liquidambar styraciflua</i>	75	6	100	6
<i>Lonicera japonica</i>	100	3	100	3

Table B-1 (continued). Constancy and average cover class for all vascular plant species observed in eight Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: CPAW = Coastal Plain Alluvial Wetlands (four plots) and CPUF = Coastal Plain Upland Forests (four 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	CPAW Constancy	CPAW Cover	CPUF Constancy	CPUF Cover
<i>Lorinseria areolata</i>	50	2	0	–
<i>Magnolia grandiflora</i>	25	1	50	4
<i>Melica mutica</i>	25	2	0	–
<i>Menispermum canadense</i>	25	2	25	1
<i>Microstegium vimineum</i>	75	2	0	–
<i>Mikania scandens</i>	50	2	0	–
<i>Mimosa microphylla</i>	25	1	0	–
<i>Mitchella repens</i>	25	2	25	2
<i>Morus rubra</i>	25	4	25	3
<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	75	3	100	6
<i>Myosotis macrosperma</i>	25	1	0	–
<i>Nandina domestica</i>	25	1	50	2
<i>Nekemias arborea</i>	75	2	0	–
<i>Nyssa biflora</i>	25	7	0	–
<i>Oplismenus setarius</i>	25	2	25	1
Orchidaceae	25	1	0	–
<i>Ostrya virginiana</i>	25	6	0	–
<i>Packera glabella</i>	75	3	0	–
<i>Panicum virgatum</i> var. <i>virgatum</i>	25	4	0	–
<i>Parthenocissus quinquefolia</i>	75	2	100	2
<i>Persicaria hydropiperoides</i>	50	2	0	–
<i>Persicaria setacea</i>	50	2	0	–
<i>Pinus taeda</i>	50	3	100	5
<i>Piptochaetium avenaceum</i>	0	–	50	2
<i>Planera aquatica</i>	25	4	0	–
<i>Pleopeltis michauxiana</i>	25	1	0	–
<i>Pluchea camphorata</i>	25	1	0	–
<i>Poa annua</i>	25	3	0	–
<i>Poa autumnalis</i>	50	2	0	–
<i>Polystichum acrostichoides</i>	50	2	25	1
<i>Prunus caroliniana</i>	0	–	75	2
<i>Prunus serotina</i> var. <i>serotina</i>	25	2	0	–
<i>Quercus michauxii</i>	25	3	0	–
<i>Quercus nigra</i>	25	2	100	6
<i>Quercus phellos</i>	50	2	0	–
<i>Quercus velutina</i>	50	4	75	5
<i>Rubus</i>	25	2	50	2
<i>Rubus pensilvanicus</i>	50	2	0	–
<i>Sabal minor</i>	25	1	0	–
<i>Salix caroliniana</i>	25	4	0	–
<i>Sanicula canadensis</i>	75	2	0	–
<i>Saururus cernuus</i>	75	3	0	–

Table B-1 (continued). Constancy and average cover class for all vascular plant species observed in eight Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: CPAW = Coastal Plain Alluvial Wetlands (four plots) and CPUF = Coastal Plain Upland Forests (four 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	CPAW Constancy	CPAW Cover	CPUF Constancy	CPUF Cover
<i>Scleria oligantha</i>	25	2	0	–
<i>Sisyrinchium angustifolium</i>	25	1	0	–
<i>Smilax bona-nox</i> var. <i>bona-nox</i>	50	2	100	2
<i>Smilax glauca</i>	25	2	100	2
<i>Smilax herbacea</i>	25	2	0	–
<i>Smilax laurifolia</i>	0	–	25	2
<i>Smilax rotundifolia</i>	50	2	100	2
<i>Smilax walteri</i>	75	2	0	–
<i>Solidago</i>	75	2	0	–
<i>Swida foemina</i>	25	9	0	–
<i>Toxicodendron radicans</i> var. <i>radicans</i>	100	3	100	2
<i>Tradescantia ohiensis</i>	50	2	0	–
<i>Triadenum walteri</i>	50	2	0	–
<i>Triadica sebifera</i>	100	4	25	2
<i>Trifolium dubium</i>	25	1	0	–
<i>Ulmus alata</i>	25	3	100	6
<i>Ulmus americana</i> var. <i>americana</i>	50	4	0	–
<i>Ulmus rubra</i>	25	2	0	–
<i>Verbesina occidentalis</i>	25	2	0	–
<i>Viola</i>	75	2	0	–
<i>Wisteria sinensis</i>	50	2	25	1
<i>Yucca filamentosa</i>	0	–	25	2

Table B-2. Basal area (BA, m²/ha) and density (Den, count/ha) of woody vascular plant species observed in eight Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: CPAW = Coastal Plain Alluvial Wetlands (four plots) and CPUF = Coastal Plain Upland Forests (four plots).

Species	CPAW Tree BA	CPAW Tree DEN	CPAW Sapling BA	CPAW Sapling Den	CPAW Seedling Den	CPUF Tree BA	CPUF Tree DEN	CPUF Sapling BA	CPUF Sapling Den	CPUF Seedling Den
<i>Acer floridanum</i>	0.47	6	–	–	625	–	–	–	–	–
<i>Acer negundo</i> var. <i>negundo</i>	1.52	44	2.21	500	2188	–	–	–	–	–
<i>Acer rubrum</i>	3.90	181	14.36	4000	3463	–	–	–	–	–
<i>Arundinaria gigantea</i>	–	–	0.60	25000	2188	–	–	–	–	–
<i>Asimina parviflora</i>	–	–	–	–	–	–	–	0.03	1667	3438
<i>Asimina triloba</i>	–	–	–	–	625	–	–	–	–	–
<i>Berchemia scandens</i>	–	–	–	–	625	–	–	–	–	–
<i>Bignonia capreolata</i>	–	–	–	–	938	–	–	–	–	313
<i>Brunnichia ovata</i>	–	–	1.04	8000	–	–	–	–	–	–
<i>Callicarpa americana</i>	–	–	–	–	938	–	–	0.15	2000	313
<i>Carpinus caroliniana</i> var. <i>caroliniana</i>	–	–	0.55	500	313	–	–	–	–	–
<i>Carya cordiformis</i>	0.62	31	4.42	1000	938	–	–	–	–	–
<i>Carya glabra</i>	0.13	6	–	–	–	–	–	–	–	–
<i>Celtis laevigata</i>	1.04	6	–	–	–	–	–	–	–	–
<i>Diospyros virginiana</i>	–	–	–	–	313	–	–	0.24	1000	–
<i>Fagus grandifolia</i> var. <i>caroliniana</i>	0.17	13	–	–	–	–	–	–	–	–
<i>Fraxinus pennsylvanica</i>	1.19	31	–	–	2813	–	–	–	–	–
<i>Gelsemium sempervirens</i>	–	–	–	–	625	–	–	–	–	938
<i>Ilex ambigua</i>	–	–	–	–	313	–	–	–	–	–
<i>Ilex vomitoria</i>	–	–	–	–	–	–	–	1.41	5000	463
<i>Ligustrum japonicum</i>	–	–	–	–	–	0.05	6	–	–	–
<i>Ligustrum sinense</i>	–	–	1.93	3750	14688	–	–	–	–	938
<i>Liquidambar styraciflua</i>	4.51	19	0.55	500	625	2.58	119	1.14	2500	938
<i>Lonicera japonica</i>	–	–	0.01	500	15313	–	–	–	–	23438
<i>Magnolia grandiflora</i>	–	–	–	–	–	0.34	13	–	–	–
<i>Morus rubra</i>	0.20	6	–	–	–	–	–	–	–	–
<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	–	–	1.47	2500	1875	–	–	3.60	21000	14688
<i>Nekemias arborea</i>	–	–	0.26	2000	–	–	–	–	–	–
<i>Nyssa biflora</i>	3.59	38	–	–	313	–	–	–	–	–
<i>Ostrya virginiana</i>	–	–	1.83	4000	313	–	–	–	–	–
<i>Parthenocissus quinquefolia</i>	–	–	–	–	8438	–	–	–	–	9375

Table B-2 (continued). Basal area (BA, m²/ha) and density (Den, count/ha) of woody vascular plant species observed in eight Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: CPAW = Coastal Plain Alluvial Wetlands (four plots) and CPUF = Coastal Plain Upland Forests (four plots).

Species	CPAW Tree BA	CPAW Tree DEN	CPAW Sapling BA	CPAW Sapling Den	CPAW Seedling Den	CPUF Tree BA	CPUF Tree DEN	CPUF Sapling BA	CPUF Sapling Den	CPUF Seedling Den
<i>Pinus taeda</i>	–	–	–	–	13125	5.28	44	–	–	125
<i>Planera aquatica</i>	0.61	13	–	–	–	–	–	–	–	–
<i>Prunus caroliniana</i>	–	–	–	–	–	–	–	–	–	1875
<i>Quercus michauxii</i>	0.08	6	–	–	–	–	–	–	–	–
<i>Quercus nigra</i>	–	–	–	–	938	6.81	100	0.06	250	1313
<i>Quercus phellos</i>	–	–	–	–	625	–	–	–	–	–
<i>Quercus velutina</i>	0.26	6	0.24	1000	–	1.62	56	0.67	1000	313
<i>Salix caroliniana</i>	1.38	6	–	–	–	–	–	–	–	–
<i>Smilax bona-nox</i> var. <i>bona-nox</i>	–	–	–	–	313	–	–	0.02	1000	125
<i>Smilax glauca</i>	–	–	–	–	313	–	–	–	–	25
<i>Smilax laurifolia</i>	–	–	–	–	–	–	–	0.26	2000	–
<i>Smilax rotundifolia</i>	–	–	–	–	5313	–	–	–	–	13125
<i>Smilax walteri</i>	–	–	–	–	125	–	–	–	–	–
<i>Swida foemina</i>	0.67	69	77.37	67000	–	–	–	–	–	–
<i>Toxicodendron radicans</i> var. <i>radicans</i>	–	–	0.60	3000	15938	–	–	–	–	5313
<i>Triadica sebifera</i>	2.57	94	0.55	500	313	–	–	–	–	–
<i>Ulmus alata</i>	0.22	6	–	–	–	0.63	69	1.47	1333	125
<i>Ulmus americana</i> var. <i>americana</i>	0.17	13	–	–	313	–	–	–	–	–
<i>Ulmus rubra</i>	0.10	6	–	–	–	–	–	–	–	–
<i>Wisteria sinensis</i>	–	–	–	–	313	–	–	–	–	–

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