



Terrestrial Vegetation Monitoring at Moores Creek National Battlefield

2022 Data Summary



The vibrant corymbiform (round-topped) inflorescence of southern sneezeweed (*Helenium flexuosum*) was in full display in June 2022 within the wet savanna of Moores Creek National Battlefield. Vegetation plots occurring in this habitat had some of the highest vascular species diversity among all Southeast Coast Network (SECN) plots sampled between 2019 and 2022.

NPS / M. FORBES BOYLE

Terrestrial vegetation monitoring at Moores Creek National Battlefield: 2022 data summary

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Abstract

Parks within the Southeast Coast Network (SECN) host a diverse assemblage of plants and terrestrial vegetation communities. Vegetation communities are dynamic entities whose species composition, abundance, distribution, and structure are influenced by environmental factors and impacted over time by natural and anthropogenic disturbances. Determining trends in vegetation communities over time and identifying plant stressors is vital to understanding the ecological health of terrestrial ecosystems within SECN parks. Moores Creek National Battlefield lies within the Middle Atlantic Coastal Plain ecoregion of North Carolina. The distribution and composition of forested habitats within the park are largely determined by former land-use patterns (including clearing land for agriculture and timber removal), as well as by localized edaphic conditions. 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 and adjacent land use. The year 2022 marked the first year of this monitoring effort at Moores Creek National Battlefield. Eleven vegetation plots were established throughout the park in June. 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 diameter at breast height (DBH), overall tree health, landform, soil, observed disturbance, and woody biomass estimates. Data were stratified across three dominant broadly defined habitats within the park: Coastal Plain Alluvial Wetlands, Coastal Plain Nonalluvial Wetlands, and Coastal Plain Open Upland Woodlands. Two hundred twenty-nine vascular plant taxa were detected during this monitoring effort, including 30 taxa not detected in previous lists.

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, measured at 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 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 is 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 groups 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).

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Several people deserve recognition for their support prior to, during, and following fieldwork at Moores Creek National Battlefield (MOCR). Matthew Woods (MOCR Superintendent) met with the field crew prior to fieldwork to go over site logistics and to review the safety plan. Matthew also provided valuable information about site history and vegetation management issues within the park. Special thanks also go to Matt Wood (Fire Ecologist, NPS Appalachian-Piedmont-Coastal Fire Management Zone) and Aerin Land (Fire Ecologist, NPS South Florida Fire and Aviation Division) who aided with fieldwork for several days during this monitoring effort. Other field crew members included Abigail Gonzalez (former Southeast Coast Network Scientist in Parks intern) and this report's lead author. Finally, thanks to Scott Ward (University of North Carolina Botanical Gardens, NPS contractor) who assisted with identification of unknown plants; Scott also travelled to the park in early fall to locate late-season flowering specimens to aid in identification of unknown plants monitored in June.



The 2022 vegetation monitoring field crew at Moores Creek National Battlefield included staff support from the NPS Fire Ecology division (Matt Wood and Aerin Land), and former SECN intern Abigail Gonzalez. NPS / M. FORBES BOYLE

Executive Summary

The Southeast Coast Network (SECN) conducts long-term terrestrial vegetation monitoring as part of the National Park Service's (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.

The year 2022 marked the first year of conducting this monitoring effort at Moores Creek National Battlefield. Eleven vegetation plots were established throughout the park in June. 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]) diameter at breast height (DBH), overall tree health, landform, soil, observed disturbance, and woody biomass (i.e., fuel load) estimates. Data were stratified across three dominant broadly defined habitats within the park. Broadly defined habitats monitored included Coastal Plain Alluvial Wetlands, Coastal Plain Nonalluvial Wetlands, and Coastal Plain Open Upland Woodlands. Noteworthy findings include:

- Two hundred and twenty-nine vascular plant taxa were observed across 11 vegetation plots, including 30 species not previously documented within the park. Two new-to-park species included Oriental lady's thumb (*Persicaria longiseta*) and cogongrass (*Imperata cylindrica*). Both species are listed as Rank 2 (Significant Threat) invasive species by the North Carolina Invasive Plant Council.
- The most abundant and frequently encountered species in each broadly defined habitat included:
 - Coastal Plain Alluvial Wetlands: red maple (*Acer rubrum*), loblolly pine (*Pinus taeda*), sweetgum (*Liquidambar styraciflua*), swamp tupelo (*Nyssa biflora*), and common greenbriar (*Smilax rotundifolia*).
 - Coastal Plain Nonalluvial Wetlands: Erectleaf panicgrass (*Dichantherium erectifolium*), centella (*Centella erecta*), sweetgum, Virginia meadow-beauty (*Rhexia virginica*), savanna mint (*Pycnanthemum flexuosum*), and fewflower beaksedge (*Rhynchospora rariflora*).
 - Coastal Plain Open Upland Woodlands: loblolly pine, sweetgum, muscadine (*Muscadinia rotundifolia* var. *rotundifolia*), water oak (*Quercus nigra*), little gallberry (*Ilex glabra*), Virginia creeper (*Parthenocissus quinquefolia*), sassafras (*Sassafras albidum*), common sweetleaf (*Symplocos tinctoria*), and dangleberry (*Gaylussacia frondosa*).
- Non-native, invasive species had very low frequencies within Coastal Plain Nonalluvial Wetland and Coastal Plain Open Upland Woodland plots and moderate frequencies within

Coastal Plain Alluvial Wetland plots. Abundance of invasive species was low across all sites. Invasive species that were detected during this monitoring effort included centipede grass (*Eremochloa ophiuroides*), cogongrass, sericea lespedeza (*Lespedeza cuneata*), Chinese privet (*Ligustrum sinense*), mud-annie (*Murdannia keisak*), bahia grass (*Paspalum notatum*), Oriental lady's thumb, and Chinese wisteria (*Wisteria sinensis*).

- Hydrologic patterns and natural fire events within Nonalluvial Wetland and Open Upland Woodland habitat on the park have been disrupted by former land use activities such as agriculture, grazing, timber management, ditching for water control, and fire suppression. Reintroduction of frequent fire within these habitats over the past several decades have improved vegetation conditions. To promote longleaf pine (*Pinus palustris*), which historically was the matrix canopy tree of these habitats, plantings may be needed in addition to continued use of prescribed fire.
- Six species listed as rare and tracked by the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022) were observed during this monitoring effort, including small-leaved meadowrue (*Thalictrum macrostylum*) which is listed as Special Concern-Vulnerable within the state. Rare plants occurred with the highest frequency in both wetland habitats of the park.
- All plots are scheduled to be resampled during the spring/summer of 2026.

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 descriptions), 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 impacted over time by natural and anthropogenic disturbances. For communities to be considered “natural,” native species must be predominately distributed across the landscape because 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 introductions.

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 June 2022 within Moores Creek National Battlefield (MOCR) as part of the SECN’s terrestrial vegetation monitoring effort. This report is intended to provide MOCR 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 Moores Creek National Battlefield utilizing the SECN terrestrial vegetation monitoring protocol (Boyle et al. 2019). For this “baseline” status report, 2022 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

Moore's Creek National Battlefield (MOCR) is located within the Middle Atlantic Coastal Plain Ecoregion (Griffith et al. 2002) of southeastern North Carolina (Pender County) approximately 12.4 kilometers (20 miles) northwest of Wilmington (Figure 1). The park is approximately 40 hectares (88 acres) and is named for Moore's Creek—a tidally-influenced tributary of the Black River situated in the Cape Fear Watershed. Moore's Creek National Military Park was founded in 1926 to commemorate a pivotal battle during the Revolutionary War where American Patriots incurred a significant victory over Scottish Loyalists at the site of the Moore's Creek Bridge. This decisive victory during the Southern Campaign of the Revolutionary War was a factor that led to the signing of the Declaration of Independence. The National Park Service (NPS) began management of the park in 1933 (Capps and Davis 1999). Despite its small area and its foundational focus as a culturally significant site during the Revolutionary War, Moore's Creek National Battlefield houses a wide array of vegetation communities and is one of the most vegetatively biodiverse parks along the southeastern Atlantic Coast (McManamay et al. 2012).



Figure 1. Southeast Coast Network terrestrial vegetation monitoring plot locations within Moores Creek National Battlefield, Pender County, North Carolina. NPS / MALLORIE DAVIS

Most of the eastern half of the park is composed of upland pine woodlands dominated by loblolly pine (*Pinus taeda*) that likely represent second-growth forests which replaced extensive woodlands once dominated by longleaf pine (*Pinus palustris*; McCrain and Church 1985; McManamay et al. 2012). The southeastern Coastal Plain historically contained a vast mosaic of pine woodlands, typically dominated by an open canopy of longleaf pine, that covered over 90 million acres (36.4 million ha) from Virginia to Florida and west to Mississippi (Ware et al. 1993). Although these woodlands could occur across a range of edaphic conditions—from xeric sandy soils of rolling uplands to wet-mesic soils of low-lying flats (“flatwoods”)—they all were maintained by relatively frequent (generally three years or less), low intensity fire. Land use patterns over the past several hundred years—such as conversion to agriculture, grazing, logging, and fire suppression—have eliminated all but 2% (3.8 million acres [1.2 million ha]) of these terrestrial communities (Landers et al. 1995). In addition, the utilization of longleaf pine in the naval stores industry (i.e., harvesting of tar, pitch, rosin, and turpentine) also led to the widespread decline of longleaf pine throughout the Southeast (Frost 2006). Prior to the early 19th century and widespread devastation of longleaf pine

woodlands, the upland soils of Moores Creek National Battlefield would have undoubtedly supported this wide-ranging ecosystem (McCrain and Church 1985). Stressors to these uplands over the past century that further prevent the establishment of longleaf pine and associated species include the placement of deep ditches to divert water for timbering and road building (McManamay et al. 2012) as well as decades of fire management procedures that promoted fire suppression. In 1985, McCrain and Church recommended the following:

“Prescriptive burning should not be utilized as a primary management tool to control plant patterns. For the most part, regular maintenance has preempted the purpose and need for fire.”

They furthermore recommended, however, planting longleaf pine to “recreate upland 18th century conditions” (McCrain and Church 1985). It is now well established in the literature and by resource managers in the southeast that fire is the primary tool used to promote longleaf pine, both the species and the ecosystem.

Much of the western and northern portion of Moores Creek National Battlefield includes a diversity of alluvial wetland forest types (McManamay et al. 2012), including:

- Atlantic Coastal Plain Blackwater River Terrace and Ridge Forest,
- Atlantic Coastal Plain Bald-cypress (*Taxodium distichum*) – Swamp Tupelo/Blackgum (*Nyssa biflora*) Swamp,
- Loblolly Pine – Sweetgum (*Liquidambar styraciflua*) – Swamp Blackgum Successional Swamp Forest, and
- Blackwater Bottomland Hardwood – Pine Forest (High Type).

Moores Creek and its tributaries are characterized as “blackwater” rivers and streams. “Blackwater” rivers have headwaters that originate within the Coastal Plain, while “brownwater” rivers originate within the Mountains or Piedmont; “blackwater” rivers vary drastically in seasonality of flooding due to year-round storms and the water-holding capacity of depressional wetlands these rivers typically drain; and finally, these systems typically carry very little suspended material, thus having an inconspicuous floodplain (Christensen 2000; Edwards et al. 2013). Water flow in Moores Creek is tidally influenced, and during extreme rain events or wet years that coincide with high tides, flood water can cover portions of the park’s causeway, boardwalk, and part of the Moores Creek Bridge (DeVivo et al. 2008).

A small, less than 2 hectare (< 4 acre), wet meadow occurs due west of the park’s Visitor Center and has received much management attention over the past several decades. The site has been labeled a “savannah” (McCrain and Church 1985), “pine savanna wetland” (Thornberry-Ehrlich 2006), and in the most recent vegetation mapping report (McManamay et al. 2012) called both a Longleaf Pine / Pond Pine (*Pinus serotina*) Savanna (Wet Ultisol Type) and a Typic Sandhill Hillside Seep. Historically, the site contained a number of rare plants, including Venus flytrap (*Dionaea muscipula*) (Sieren 1982). In the early 20th century, the wetland was drained and subsequently converted to a

meadow dominated by weedy and non-native plants (Thornberry-Ehrlich 2006). Since 1996, there has been a significant effort to return the site to pre-disturbance, savanna-like, conditions by restoring natural hydrology, reintroduction of fire, and planting native grasses (Crichton and Sutter 2000).

Plant surveys within Moores Creek National Battlefield by Sieren (1982, 1984) in the early 1980s found more than 585 vascular species within the park. According to the current National Park Service Certified Species List (NPSpecies), there are over 650 vascular plant species categorized as “Present” within the park (NPS 2024); however, some of these (e.g., Venus flytrap) have not been observed within the park in several decades. Seventy-four of the species listed as present on the park are non-native—11% of the total (NPS 2024). Many of these non-native plants occupy ruderal sites, manicured lawns, and roadsides or have only a single site occurrence. Non-native plants that are classified as invasive by the North Carolina Invasive Plant Council (NC-IPC 2023) that have been documented within Moores Creek National Battlefield include (ranks from NC-IPC 2023):

- Mimosa (*Albizia julibrissin*; Rank 1—Severe Threat)
- Sweet vernal grass (*Anthoxanthum odoratum*; Rank 3—Lesser Threat)
- Common dayflower (*Commelina communis*; Watch List)
- Bermuda grass (*Cynodon dactylon*; Rank 3—Lesser Threat)
- Thorny-olive (*Elaeagnus pungens*; Rank 2—Significant Threat)
- Centipede grass (*Eremochloa ophiuroides*; Rank 3—Lesser Threat)
- Gill-over-the-ground / ground ivy (*Glechoma hederacea*; Rank 2—Significant Threat)
- Japanese-clover (*Kummerowia striata*; Rank 3—Lesser Threat)
- Sericea lespedeza (*Lespedeza cuneata*; Rank 1—Severe Threat)
- Japanese privet (*Ligustrum japonicum*; Rank 1—Severe Threat)
- Chinese privet (*Ligustrum sinense*; Rank 1—Severe Threat)
- Meadow fescue (*Lolium pratense*; Rank 3—Lesser Threat)
- Japanese honeysuckle (*Lonicera japonica*; Rank 1—Severe Threat)
- Chinaberry (*Melia azedarach*; Rank 3—Lesser Threat)
- Mud-annie / Marsh dewflower (*Murdannia keisak*; Rank 1—Severe Threat)
- Dallis grass (*Paspalum dilatatum* ssp. *dilatatum*; Rank 3—Lesser Threat)
- Bahia grass (*Paspalum notatum*; Rank 3—Lesser Threat)
- Vasey grass (*Paspalum urvillei*; Rank 3—Lesser Threat)
- Kentucky bluegrass (*Poa pratensis* ssp. *pratensis*; Rank 3—Lesser Threat)
- Multiflora rose (*Rosa multiflora*; Rank 1—Severe Threat)
- Common chickweed (*Stellaria media*; Rank 2—Significant Threat)

- Woolly mullein (*Verbascum thapsus*; Watch List)
- Common periwinkle (*Vinca minor*; Rank 2—Significant Threat)
- Chinese wisteria (*Wisteria sinensis*; Rank 1—Severe Threat)

Although Moores Creek National Battlefield is one of the smallest parks within the Southeast Coast Network, it disproportionately houses a large number of rare and state-protected plants, including the North Carolina endangered Carolina birds-in-a-nest (*Macbridea caroliniana*), Carolina sunrose (*Crocanthemum carolinianum*), and pink sandhill lupine (*Lupinus villosus*). Table 1 provides a list of rare and protected vascular plant species that either have been historically present within the park or are currently present. A year after these monitoring efforts, rediscovered populations of Carolina birds-in-a-nest were observed on the outer edge of the park's wet meadow (Hayley Zemeski, MOCR Community Volunteer Ambassador, pers. communication).

Table 1. Rare plant list from Moores Creek National Battlefield based on observation data obtained from National Park Service Certified Species List (NPSpecies) (NPS 2024). Many of these species have not been observed on the park in over 40 years.

Scientific Name	Common Name ^A	State Status ^A (North Carolina)	Federal Status	State Rank ^B (North Carolina)	Global Rank ^B	Last Observed Reference ^C	Reference Habitat
<i>Agalinis obtusifolia</i>	Blunt-leaf false-foxglove	W1	–	S3	G4	Sieren 1982	pine woods: extreme southeast corner of park
<i>Bacopa caroliniana</i>	Blue water-hyssop	T	–	S1	G4G5	NatureServe 2007	swamp forest: east of Patriot’s Hall Picnic Area
<i>Cleistesiosis divaricata</i>	Spreading pogonia	W7	–	S2S3	G4	Crichton and Sutter 2000	wet pine savanna / wet meadow
<i>Crataegus aestivalis</i>	Eastern mayhaw	W1	–	S2	G5	Sieren 1982	mixed open woods: northeast corner of the park
<i>Crocanthemum carolinianum</i>	Carolina sunrose	E	–	S1	G4	Sieren 1982	wet pine savanna / wet meadow
<i>Dichanthelium erectifolium</i>	Erect-leaved witchgrass	W1	–	S2	G4	NatureServe 2007	wet pine savanna / wet meadow
<i>Dionaea muscipula</i>	Venus flytrap	T	–	S2	G2	Sieren 1982	hillside: west of Visitor’s Center
<i>Eupatorium anomalum</i>	Florida thoroughwort	SR-T	–	S1	G2G3	Crichton and Sutter 2000	wet pine savanna / wet meadow
<i>Gelsemium rankinii</i>	Swamp jessamine	SC-V	–	S1S2	G5	Sieren 1982	creek bank: mid-southern end of Moores Creek
<i>Gratiola lutea</i>	Yellow hedge-hyssop	SC-V	–	S1	G5	Sieren 1982	creek bank: multiple locations along Moores Creek
<i>Ilex amelanchier</i>	Sarvis holly	W1	–	S3	G4	Sieren 1984	low woods: extreme western central edge of the park
<i>Ludwigia maritima</i>	Harper’s seedbox	W7	–	S2S3	G5	Sieren 1982	firebreak: extreme northeast corner of the park; wet pine savanna / wet meadow
<i>Lupinus villosus</i>	Pink sandhill lupine	E	–	S1	G4	Sieren 1984	fence row: extreme western central edge of the park
<i>Macbridea caroliniana</i>	Carolina birds-in-a-nest	E	–	S2	G2G3	Zemeski 2023	adjacent to the wet meadow
<i>Magnolia grandiflora</i>	Southern magnolia	W1	–	S2?	G5	Byrne et al. 2012	old homesites: multiple locations in the park
<i>Nuphar sagittifolia</i>	Cape Fear spatterdock	W1	–	S3	G5T2	Sieren 1984	No information provided
<i>Parnassia caroliniana</i>	Carolina grass-of-parnassus	T	–	S2	G3	Crichton and Sutter 2000	wet pine savanna / wet meadow
<i>Rhynchospora nitens</i>	Short-beaked beaksedge	W1	–	S3	G4?	Crichton and Sutter 2000	wet pine savanna / wet meadow

^A Information obtained from the North Carolina Natural Heritage Program’s 2022 Rare Plant List (Wichmann and Wojcik 2022). Status codes are as follows: E (Endangered) T (Threatened), SC-V (Special Concern-Vulnerable), SR-T (Significantly Rare-Throughout), W1 (Rare but Relatively Secure), W7 (Poorly Known in North Carolina).

^B Conservation Status obtained from NatureServe Explorer 2.0 (NatureServe 2024). State and Global ranks are as follows: S1/G1 (Critically Imperiled), S1S2/G1G2 (Uncertainty Range between 1 and 2), S2/G2 (Imperiled), S2S3/G2G3 (Uncertainty Range between 2 and 3), S3/G3 (Vulnerable), S3S4/G3G4 (Uncertainty Range between 3 and 4), S4/G4 (Apparently Secure), S4S5/G4G5 (Uncertainty Range between 4 and 5), S5/G5 (Secure). A “?” following a rank denotes an inexact numeric rank.

^C See reference section for full citations.

Table 1 (continued). Rare plant list from Moores Creek National Battlefield based on observation data obtained from National Park Service Certified Species List (NPSpecies) (NPS 2024). Many of these species have not been observed on the park in over 40 years.

Scientific Name	Common Name ^A	State Status ^A (North Carolina)	Federal Status	State Rank ^B (North Carolina)	Global Rank ^B	Last Observed Reference ^C	Reference Habitat
<i>Rhynchospora stenophylla</i>	Littleleaf beaksedge	W1	–	S3	G4	Sieren 1982	wet pine savanna / wet meadow
<i>Solidago gracillima</i>	Graceful goldenrod	W1	–	S3	G4?	Crichton and Sutter 2000	wet pine savanna / wet meadow
<i>Solidago verna</i>	Spring-flowering goldenrod	T	–	S3	G3	Crichton and Sutter 2000	wet pine savanna / wet meadow
<i>Thalictrum macrostylum</i>	Small-leaved meadowrue	SC-V	–	S2	G3G4	Boyle and Davis 2024, current report	wet pine savanna / wet meadow
<i>Viola brittoniana</i>	Northern coastal violet	W7	–	S2?	G4G5	Crichton and Sutter 2000	wet pine savanna / wet meadow
<i>Viola villosa</i>	Southern wooly violet	W7	–	S2	G5	Sieren 1984	roadbank-south of Patriot’s Hall Picnic Area

^A Information obtained from the North Carolina Natural Heritage Program’s 2022 Rare Plant List (Wichmann and Wojcik 2022). Status codes are as follows: E (Endangered) T (Threatened), SC-V (Special Concern-Vulnerable), SR-T (Significantly Rare-Throughout), W1 (Rare but Relatively Secure), W7 (Poorly Known in North Carolina).

^B Conservation Status obtained from NatureServe Explorer 2.0 (NatureServe 2024). State and Global ranks are as follows: S1/G1 (Critically Imperiled), S1S2/G1G2 (Uncertainty Range between 1 and 2), S2/G2 (Imperiled), S2S3/G2G3 (Uncertainty Range between 2 and 3), S3/G3 (Vulnerable), S3S4/G3G4 (Uncertainty Range between 3 and 4), S4/G4 (Apparently Secure), S4S5/G4G5 (Uncertainty Range between 4 and 5), S5/G5 (Secure). A “?” following a rank denotes an inexact numeric rank.

^C See reference section for full citations.

Sampling Design

The Southeast Coast Network monitors vegetation in long-term plots located in natural and semi-natural habitats of targeted parks, including Moores Creek National Battlefield. Sample size (i.e., number of plots) is determined by a combination of factors, including (1) priority plots which are located in broadly defined habitats that cover more than 30% of the total area of the 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; and (4) each of the secondary sample target habitat types is typically allotted four plots.

Eleven vegetation plots were established and sampled within Moores Creek National Battlefield during June 2022 (Figure 2). These plots were located in the following broadly defined habitats of the park: Coastal Plain Alluvial Wetlands (4 plots), Coastal Plain Nonalluvial Wetlands (3 plots), and Coastal Plain Open Upland Woodlands (4 plots).



Figure 2. Despite its small size, Moores Creek National Battlefield is home to three distinct broadly defined habitats, including wet, open savannas (upper two images), alluvial floodplain forests (bottom left image), and open pine-dominated woodlands (bottom right image). All three habitat types were included during this monitoring effort. NPS / M. FORBES BOYLE

Only three plots were established within the park's Nonalluvial Wetland type (i.e., the wet pine savannah meadow west of the Visitor's Center) due to its small size and to avoid plot boundaries overlapping (i.e., pseudoreplication error). All 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. 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 North Carolina plant lists to determine the state and federal conservation status (e.g., Endangered, Threatened, Rarity) of each species (Wichmann and Wojcik 2022) and the list of non-native invasive plants in North Carolina to determine the degree of invasiveness (NC-IPC 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 3).

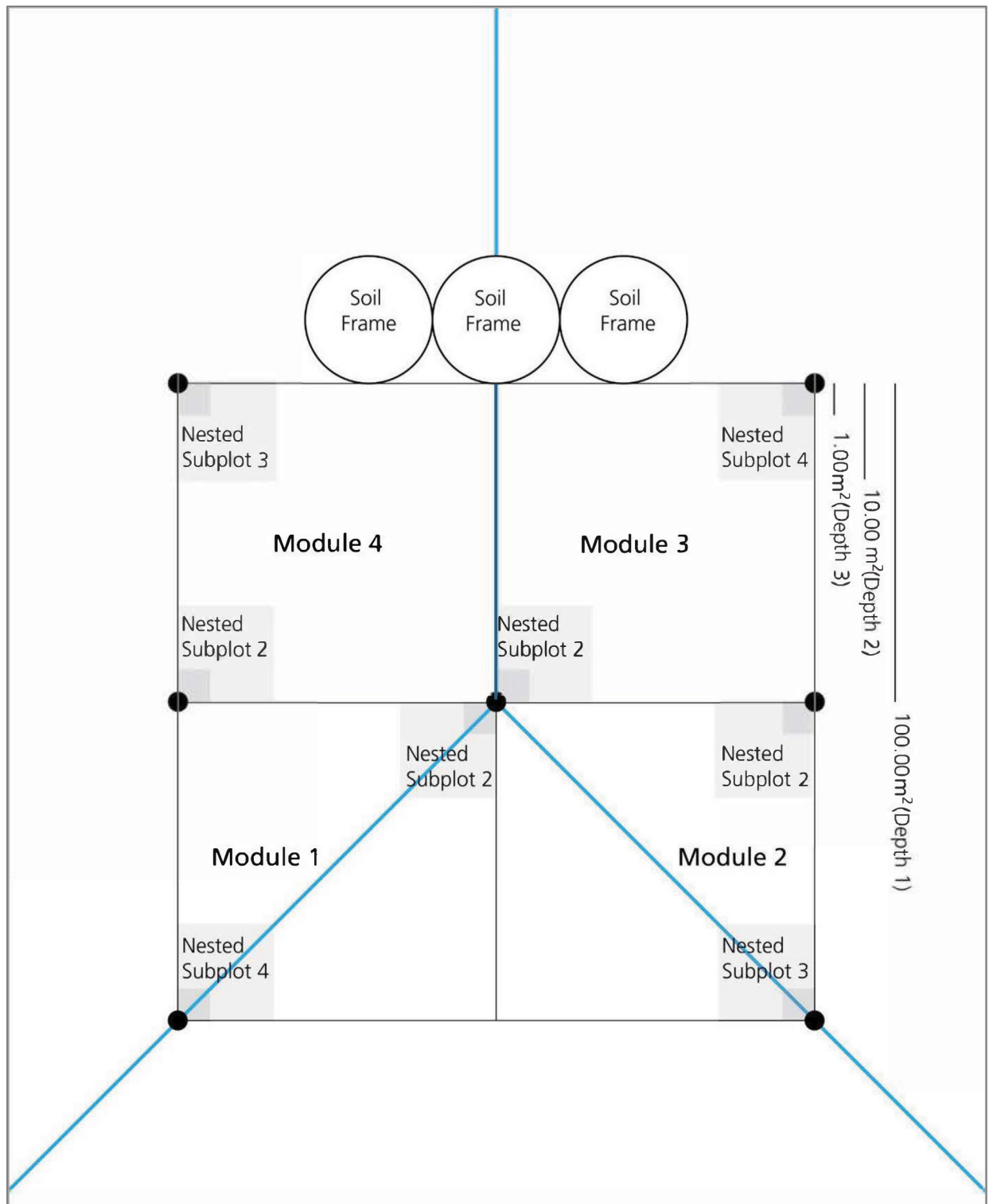


Figure 3. The layout of a sampling plot for the Southeast Coast Network, which is a modified version of the standard Level 5 Carolina Vegetation Survey plot. Ideal locations of rebar used as permanent structures to monument the plot are represented by black shaded circles. Blue lines represent locations of the three 25-meter (82-foot) fuel transects. NPS / M. FORBES BOYLE

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 meter (107.6 ft²) nested depth, and the full modular depth. The nested depth “quadrats” were in two of the 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 2).

Table 2. 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; 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 classified as either Coastal Plain Nonalluvial Wetlands or Coastal Plain Open Upland Woodlands 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 (unit = tons/acre) within each plot. Thousand-hour surface fuels were also collected in Coastal Plain Alluvial Wetland plots using the same method as described above to obtain a density estimate of coarse woody debris.

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 twenty-nine vascular plant taxa were detected during this monitoring effort (Appendix A, Table 9), including 30 taxa not detected in previous lists of Moores Creek National Battlefield vascular plant species documented in NPSpecies (NPS 2024), Southeast Regional Network of Expertise and Collections (SERNEC 2024), or previous Southeast Coast Network vegetation monitoring (Byrne et al. 2012; Table 3). One of these species, dwarf huckleberry (*Gaylussacia bigeloviana*), is listed on the North Natural Heritage Program's Rare Plant "Watch List" (Wichmann and Wojcik 2022). Two other plants, Oriental lady's thumb (*Persicaria longiseta*) and cogongrass (*Imperata cylindrica*), are listed as Rank 2 (Significant Threat) invasive species by the North Carolina Invasive Plant Council (NC-IPC 2023). Throughout all plots, native species richness ranged from 34 to 86 species per plot, while non-native richness ranged from zero to 4 species per plot (Table 4). Most native species observed within these plots are common throughout the Coastal Plain of North Carolina. Six vascular plant species listed as rare by the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022) were observed during this monitoring effort, including small-leaved meadowrue which is listed by the state as Special Concern-Vulnerable (Appendix A). Invasive species observed within the park during this monitoring effort included the two aforementioned species new to the park and centipede grass, sericea lespedeza, Chinese privet, mud-annie, bahia grass, and Chinese wisteria. Within the Coastal Plain of the southeastern United States, small-scale vegetation diversity patterns are largely influenced by complex edaphic factors, and 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 3. Vascular plant species, subspecies, or varieties not reported in NPSpecies (NPS 2024), Southeast Regional Network of Expertise and Collections (SERNEC 2024), or Byrne et al. (2012) but found at Moores Creek National Battlefield in 2022 through this current monitoring effort.

Scientific Name	Common Name ^A	Growth Form ^A	Native Status ^A	Global Rank ^B	State Rank ^B (North Carolina)	State Invasive Status ^C (North Carolina)
<i>Andropogon gyrans</i>	Elliott's bluestem	Graminoid	Native	G5	SNR	–
<i>Andropogon hirsutior</i>	bushy bluestem	Graminoid	Native	SNR	SNR	–
<i>Carex grayi</i>	Gray's sedge	Graminoid	Native	G4	S3	–
<i>Carex louisianica</i>	Louisiana sedge	Graminoid	Native	G5	S4	–
<i>Carex turgescens</i>	pine barren sedge	Graminoid	Native	G4	S3	–
<i>Chamaecrista nictitans</i> var. <i>nictitans</i>	sensitive partridge pea	Forb/herb	Native	T5	SNR	–
<i>Chasmanthium latifolium</i>	Indian woodoats	Graminoid	Native	G5	S4	–
<i>Dichanthelium leucothrix</i>	rough panicgrass	Graminoid	Native	G4	S3	–
<i>Dichanthelium lucidum</i>	cypress panicgrass	Graminoid	Native	G4	SNR	–
<i>Dichanthelium portoricense</i> ssp. <i>patulum</i>	hemlock rosette grass	Graminoid	Native	T5	SNR	–
<i>Dichanthelium scoparium</i>	velvet panicum	Graminoid	Native	G5	S5	–
<i>Dichanthelium tenue</i>	cypress panicgrass	Graminoid	Native	SNR	SNR	–
<i>Erianthus giganteus</i>	sugarcane plumegrass	Graminoid	Native	G5	S4	–
<i>Galium uniflorum</i>	oneflower bedstraw	Forb/herb	Native	G4	S2	–
<i>Gaylussacia bigeloviana</i>	dwarf huckleberry	Shrub	Native	G4	S2	–
<i>Impatiens capensis</i>	jewelweed	Forb/herb	Native	G5	S5	–
<i>Imperata cylindrica</i>	cogongrass	Graminoid	Non-native	SNR	SNR	Rank 2 (Significant Threat)
<i>Lespedeza hirta</i> var. <i>curtissii</i>	hairy lespedeza	Forb/herb	Native	SNR	S4	–
<i>Lobelia cardinalis</i>	cardinalflower	Forb/herb	Native	G5	S5	–
<i>Nekemias arborea</i>	peppervine	Shrub, Vine	Native	G5	S5	–
<i>Packera glabella</i>	butterweed	Forb/herb	Native	G5	S3	–

^A Information obtained from the PLANTS database (USDA 2024).

^B Conservation Status (G5/S5: Species Secure; T5: Variety Secure; G4/S4: Apparently Secure; G3/S3: Vulnerable; G2/S2: Imperiled; GNR/SNR: no ranking) obtained from NatureServe Explorer 2.0 (NatureServe 2024).

^C Information obtained from the North Carolina Invasive Plant Council (NC-IPC 2023).

Table 3 (continued). Vascular plant species, subspecies, or varieties not reported in NPSpecies (NPS 2024), Southeast Regional Network of Expertise and Collections (SERNEC 2024), or Byrne et al. (2012) but found at Moores Creek National Battlefield in 2022 through this current monitoring effort.

Scientific Name	Common Name ^A	Growth Form ^A	Native Status ^A	Global Rank ^B	State Rank ^B (North Carolina)	State Invasive Status ^C (North Carolina)
<i>Persicaria longisetata</i>	Oriental lady's thumb	Forb/herb	Non-native	SNR	SNR	Rank 2 (Significant Threat)
<i>Pluchea baccharis</i>	rosy camphorweed	Forb/herb	Native	G4	S2	–
<i>Prunus caroliniana</i>	Carolina laurelcherry	Tree, Shrub	Native	G5	S3	–
<i>Quercus hemisphaerica</i>	Darlington oak	Tree	Native	G5	S4	–
<i>Rudbeckia</i>	coneflower	Forb/herb	Native	SNR	SNR	–
<i>Scleria ciliata</i> var. <i>ciliata</i>	fringed nutrush	Graminoid	Native	SNR	SNR	–
<i>Scleria flaccida</i>	whip nutrush	Graminoid	Native	SNR	SNR	–
<i>Stylisma patens</i>	coastal plain dawnflower	Forb/herb, Vine	Native	G5	S4	–
<i>Thyrsanthella difformis</i>	climbing dogbane	Vine	Native	G4	S5	–

^A Information obtained from the PLANTS database (USDA 2024).

^B Conservation Status (G5/S5: Species Secure; T5: Variety Secure; G4/S4: Apparently Secure; G3/S3: Vulnerable; G2/S2: Imperiled; GNR/SNR: no ranking) obtained from NatureServe Explorer 2.0 (NatureServe 2024).

^C Information obtained from the North Carolina Invasive Plant Council (NC-IPC 2023).

Table 4. Vascular plant species richness across multiple spatial scales on Southeast Coast Network vegetation plots located within Moores Creek National Battlefield. 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 and nativity was obtained from the USDA Plants Database (USDA 2024).

Broadly Defined Habitat	Plot	Native	Non-Native	Unknown	Full Plot 400 m ² (4,305.6 ft ²)					Modular 100 m ² (1,076.3 ft ²)					Nested 10 m ² (107.6 ft ²)					Nested 1 m ² (10.8 ft ²)				
					T	S	V	H	G	T	S	V	H	G	T	S	V	H	G	T	S	V	H	G
Coastal Plain Alluvial Wetlands	MOCR033	40.0	1.0	0.0	12.0	2.0	8.0	16.0	3.0	8.8	1.5	5.0	7.8	1.5	4.8	0.9	2.6	2.1	0.1	2.0	0.3	0.9	0.8	0.0
	MOCR034	75.0	3.0	0.0	17.0	4.0	13.0	30.0	14.0	10.5	3.3	8.3	13.5	6.0	5.6	1.4	3.8	4.0	2.8	2.1	0.5	1.4	1.0	1.3
	MOCR035	53.0	1.0	0.0	14.0	4.0	6.0	23.0	7.0	9.8	2.3	4.3	11.8	3.3	5.3	0.9	2.4	3.1	1.8	2.3	0.1	1.5	0.5	1.1
	MOCR036	34.0	2.0	0.0	11.0	8.0	10.0	7.0	0.0	7.0	4.8	7.0	3.0	0.0	3.1	2.6	2.6	1.0	0.0	1.0	1.3	1.4	0.4	0.0
	average	50.5	1.8	0.0	13.5	4.5	9.3	19.0	6.0	9.0	2.9	6.1	9.0	2.7	4.7	1.4	2.8	2.6	1.2	1.8	0.5	1.3	0.7	0.6
	standard deviation	18.2	1.0	0.0	2.6	2.5	3.0	9.8	6.1	1.5	1.4	1.8	4.7	2.6	1.1	0.8	0.6	1.3	1.3	0.6	0.5	0.3	0.3	0.7
Coastal Plain Nonalluvial Wetlands	MOCR001	86.0	4.0	2.0	15.0	5.0	7.0	41.0	24.0	7.5	1.8	3.8	24.5	12.0	2.9	0.4	1.9	10.1	5.0	1.0	0.3	0.1	4.1	1.8
	MOCR002	46.0	1.0	1.0	5.0	1.0	4.0	26.0	12.0	2.5	0.3	1.0	14.8	7.0	0.9	0.1	0.5	7.1	3.5	0.4	0.1	0.0	3.4	1.9
	MOCR003	59.0	0.0	1.0	7.0	3.0	4.0	34.0	12.0	4.3	1.5	1.3	23.0	6.0	2.4	0.9	0.5	11.5	2.8	0.9	0.8	0.4	6.5	1.6
	average	63.7	1.7	1.3	9.0	3.0	5.0	33.7	16.0	4.8	1.2	2.0	20.8	8.3	2.0	0.5	1.0	9.6	3.8	0.8	0.4	0.2	4.7	1.8
	standard deviation	20.4	2.1	0.6	5.3	2.0	1.7	7.5	6.9	2.5	0.8	1.5	5.3	3.2	1.0	0.4	0.8	2.2	1.1	0.3	0.3	0.2	1.6	0.1
Coastal Plain Open Upland Woodlands	MOCR065	49.0	1.0	0.0	13.0	8.0	9.0	12.0	8.0	8.5	5.3	6.3	3.5	3.3	3.1	2.4	3.3	0.5	0.8	0.5	0.9	1.5	0.1	0.3
	MOCR066	39.0	0.0	0.0	13.0	6.0	9.0	5.0	6.0	9.3	4.3	7.3	1.5	2.3	4.1	2.0	4.9	0.4	0.6	1.1	0.6	1.8	0.3	0.1
	MOCR067	37.0	1.0	0.0	18.0	9.0	6.0	2.0	3.0	10.0	7.0	4.8	1.3	1.0	3.5	3.0	2.5	0.4	0.1	1.3	1.0	1.6	0.3	0.1
	MOCR068	49.0	1.0	0.0	12.0	9.0	7.0	14.0	8.0	8.3	7.3	5.5	7.8	4.0	4.6	3.5	3.4	2.5	1.5	1.3	1.9	1.5	0.5	0.9
	average	43.5	0.8	0.0	14.0	8.0	7.8	8.3	6.3	9.0	5.9	5.9	3.5	2.6	3.8	2.7	3.5	0.9	0.8	1.0	1.1	1.6	0.3	0.3
	standard deviation	6.4	0.5	0.0	2.7	1.4	1.5	5.7	2.4	0.8	1.4	1.1	3.0	1.3	0.7	0.7	1.0	1.0	0.6	0.4	0.5	0.1	0.2	0.4

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 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 upstream 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 have an inconspicuous floodplain (Christensen 2000; Edwards et al. 2013). Moores Creek and its tributaries are categorized as a “blackwater,” low flow stream (Figure 4; McManamay et al. 2012). The four vegetation plots established within this habitat of Moores Creek National Battlefield were classified into three distinct vegetation associations, including (descriptions from McManamay et al. 2012 and NatureServe 2024):

- Atlantic Coastal Plain Bald-cypress – Tupelo Floodplain Forest (CEGL004733; 1 plot): This forest occurs on Coastal Plain streams of North and South Carolina which generally lack clay sediment. Sites are usually prone to inundation for long periods during the winter. The canopy is typically dominated by a combination of bald-cypress and swamp tupelo. (Global Status: G3—Vulnerable; State (NC) Status: No Status Rank)
- Blackwater Bottomland Hardwood – Pine Forest (High Type) (CEGL004736; 2 plots): Alluvial forests of the Atlantic Coastal Plain occurring on higher slope positions of blackwater streams and rivers and dominated by loblolly pine and laurel oak (*Quercus laurifolia*). The shrub layer includes several species of blueberries (*Vaccinium* sp.) and cane (*Arundinaria* sp.). (Global Status: G3—Vulnerable; State (NC) Status: No Status Rank)
- Atlantic Coastal Plain Blackwater River Terrace and Ridge Forest (CEGL004737; 1 plot): This community type occurs on low blackwater bottomland river terraces and ridges in the Atlantic Coastal Plain of the Carolinas. Sites experience a longer hydroperiod than other blackwater forest types of this alliance. The canopy is typically dominated by laurel oak and overcup oak (*Quercus lyrata*). (Global Status: G4—Apparently Secure; State (NC) Status: No Status Rank)



Figure 4. Four plots were established in Coastal Plain Alluvial Wetlands of Moores Creek National Battlefield during this monitoring effort (June 2022). This broadly defined habitat type included floodplain forests dominated by a mixture of bald-cypress (*Taxodium distichum*), swamp tupelo (*Nyssa biflora*), loblolly pine (*Pinus taeda*), and oaks (*Quercus* spp). NPS / M. FORBES BOYLE

Species Diversity and Abundance

Native species richness ranged from 34 to 75 (mean = 50.5) within plots of this broadly defined habitat type in Moores Creek National Battlefield and all plots had at least one non-native species present (Table 4). Five of the eight invasive plants found within the park during this monitoring effort were encountered in these Coastal Plain Alluvial Wetland plots. Mud-annie occurred in 50% of the plots and had the highest constancy of any of the other invasive plants within this habitat type (Appendix B, Table 10). Native vascular plants observed in these plots are common across the southeastern Coastal Plain. However, plots within this broadly defined habitat did include three state rare species, including sarvis holly (*Ilex amelanichier*) which was found in 50% of these sites (Appendix B, Table 10). Herbaceous species represented the most diverse growth form across the full-plot scale, while tree species represented the most diverse growth form at smaller, nested scales (Table 4). One hundred fifteen vascular plants were found collectively within these four plots and 57 of these were only found within plots of this broadly defined habitat (Appendix B, Table 10). A complete species list, along with constancy and average cover per species, is in Appendix B,

Table 10. Species with high constancy in this habitat are listed below, by growth form (constancy values in parentheses):

Trees

- Sweetgum (100%)
- Loblolly pine (100%)
- Red maple (*Acer rubrum*; 100%)
- Swamp tupelo (100%)

Shrubs

- Elliott's blueberry (*Vaccinium elliotii*; 75%)
- Virginia-willow (*Itea virginica*; 75%)

Vines

- Eastern poison ivy (*Toxicodendron radicans* var. *radicans*; 100%)
- Laurel greenbriar (*Smilax laurifolia*; 100%)
- Common greenbriar (*Smilax rotundifolia*; 100%)

Herbs/Forbs/Graminoids

- Royal fern (*Osmunda spectabilis*; 75%)
- Lizard's tail (*Saururus cernuus*; 75%)
- Goldenrod (*Solidago* sp.; 75%)
- Violet (*Viola* sp.; 75%)
- Virginia chainfern (*Anchistea virginica*; 75%)
- Swamp-nettle (*Boehmeria cylindrica*; 75%)
- Greater bladder sedge (*Carex intumescens* var. *intumescens*; 75%)
- Coastal Carolina spiderlily (*Hymenocallis crassifolia*; 75%)
- Curtis' star-grass (*Hypoxis curtissii*; 75%)
- Walter's marsh St. John's-wort (*Triadenum walteri*; 75%)

Woody Stem Metrics

Total BA of tree stems ranged from 43.4 to 71.7 m²/ha in these plots, with an overall average of 59.3 m²/ha; density of canopy stems ranged from 17 to 56 per plot, with an average of 34 (Table 5).

Canopy height ranged from 24.0 to 36.3 meters (average = 29.2) and canopy cover ranged from 80.9% to 95.6% (average = 91.7%; Table 5). The most dominant canopy species included loblolly pine (mean BA = 16.65 m²/ha, mean density = 95/ha), bald-cypress (mean BA = 13.70 m²/ha, mean density = 162/ha), and swamp tupelo (mean BA = 12.18 m²/ha, mean density = 287/ha; Appendix B,

Table 11). Sapling density at the 80 square meter scale ranged from six to 128 stems, with an average of 53.8, while seedling density at the 8-meter square scale ranged from 60 to 111 stems, with an average of 77.5 across all plots (Table 5). Dominant sapling species included Carolina ash (*Fraxinus caroliniana*), common greenbriar, and shining fetterbush (*Lyonia lucida*); dominant seedlings included loblolly pine, swamp tupelo, shining fetterbush and Carolina ash (Appendix B, Table 11).

Based on stem count alone, swamp tupelo comprised just over 33% of the relative abundance among species within the tree stratum, while bald-cypress comprised 19% (Figure 5; Appendix B, Table 11). The sapling stratum was dominated by shining fetterbush, while the seedling stratum was dominated by shining fetterbush and loblolly pine (Figure 5; Appendix B, Table 11).

Table 5. Woody stem abundance and canopy metrics on Southeast Coast Network vegetation plots located in Moores Creek National Battlefield [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	MOCR033	68.2	56.0	41.7	54.0	64.0	95.8	26.3
	MOCR034	43.4	20.0	4.5	6.0	111.0	80.9	30.0
	MOCR035	71.7	43.0	45.8	27.0	60.0	95.3	24.0
	MOCR036	53.8	17.0	83.4	128.0	75.0	94.9	36.3
	average	59.3	34.0	43.9	53.8	77.5	91.7	29.2
	standard deviation	13.1	18.7	32.3	53.3	23.2	7.2	5.4
Coastal Plain Nonalluvial Wetlands	MOCR001	0.0	0.0	0.1	6.0	54.0	0.0	6.7
	MOCR002	0.0	0.0	0.0	2.0	8.0	0.0	0.0
	MOCR003	0.0	0.0	0.2	12.0	91.0	0.0	1.0
	average	0.0	0.0	0.1	6.7	51.0	0.0	2.6
	standard deviation	0.0	0.0	0.1	5.0	41.6	0.0	3.6
Coastal Plain Open Upland Woodlands	MOCR065	24.2	11.0	0.1	7.0	152.0	65.9	26.3
	MOCR066	44.6	15.0	1.8	12.0	157.0	74.8	26.3
	MOCR067	45.7	15.0	16.9	80.0	149.0	84.9	29.3
	MOCR068	12.1	3.0	0.3	17.0	258.0	24.2	28.7
	average	31.6	11.0	4.8	29.0	179.0	62.5	27.7
	standard deviation	16.4	5.7	8.1	34.2	52.8	26.7	1.6

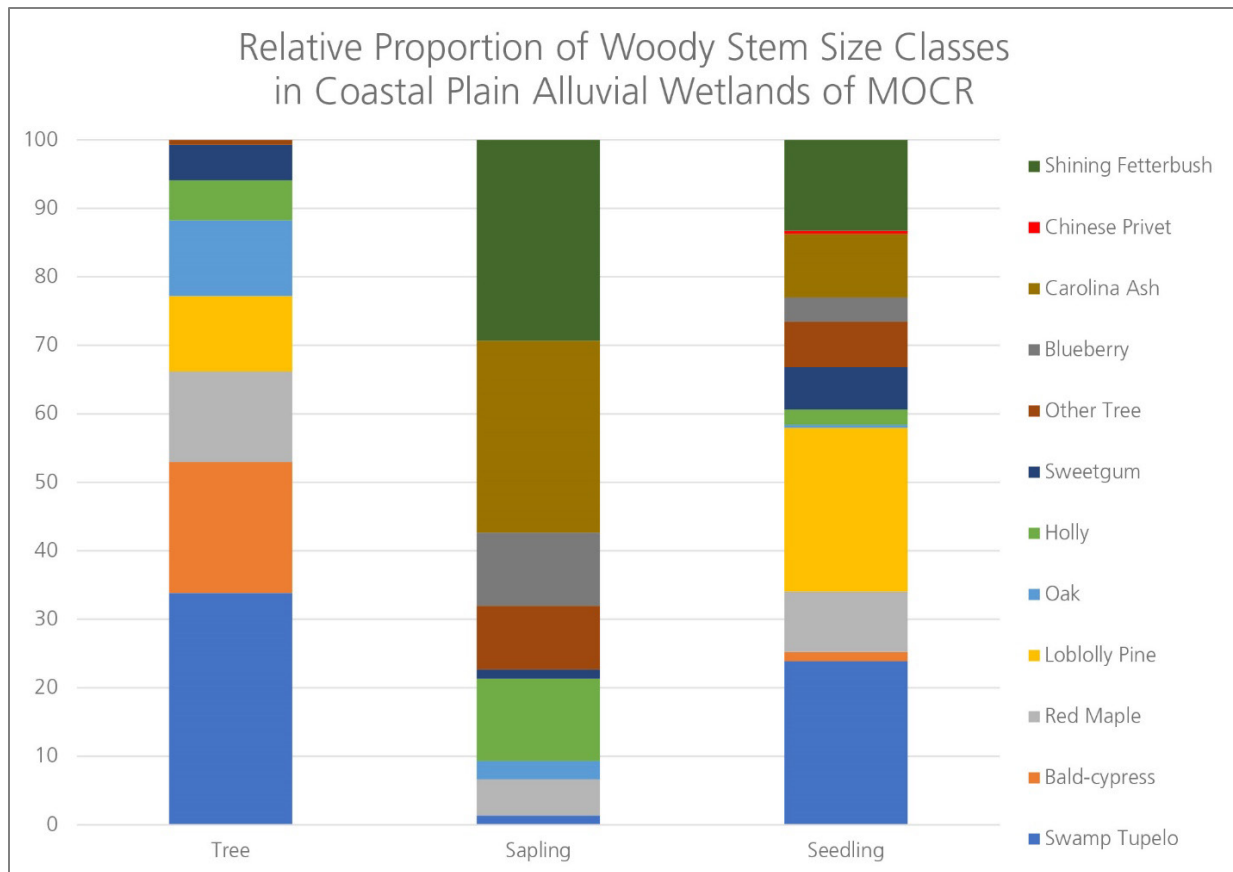


Figure 5. Relative proportion of species groups across three woody stem strata—trees, saplings, and seedlings— within Coastal Plain Alluvial Wetland monitoring plots of Moores Creek National Battlefield. NPS / M. FORBES BOYLE

Most of the trees within Coastal Plain Alluvial Wetland plots of Moores Creek National Battlefield were living (94%) and the majority of living trees were characterized with healthy vigor (85%) and minimal dieback (89%; Figure 6). These baseline data suggest that tree-sized woody stems within the park's alluvial wetlands have an overall healthy condition status.

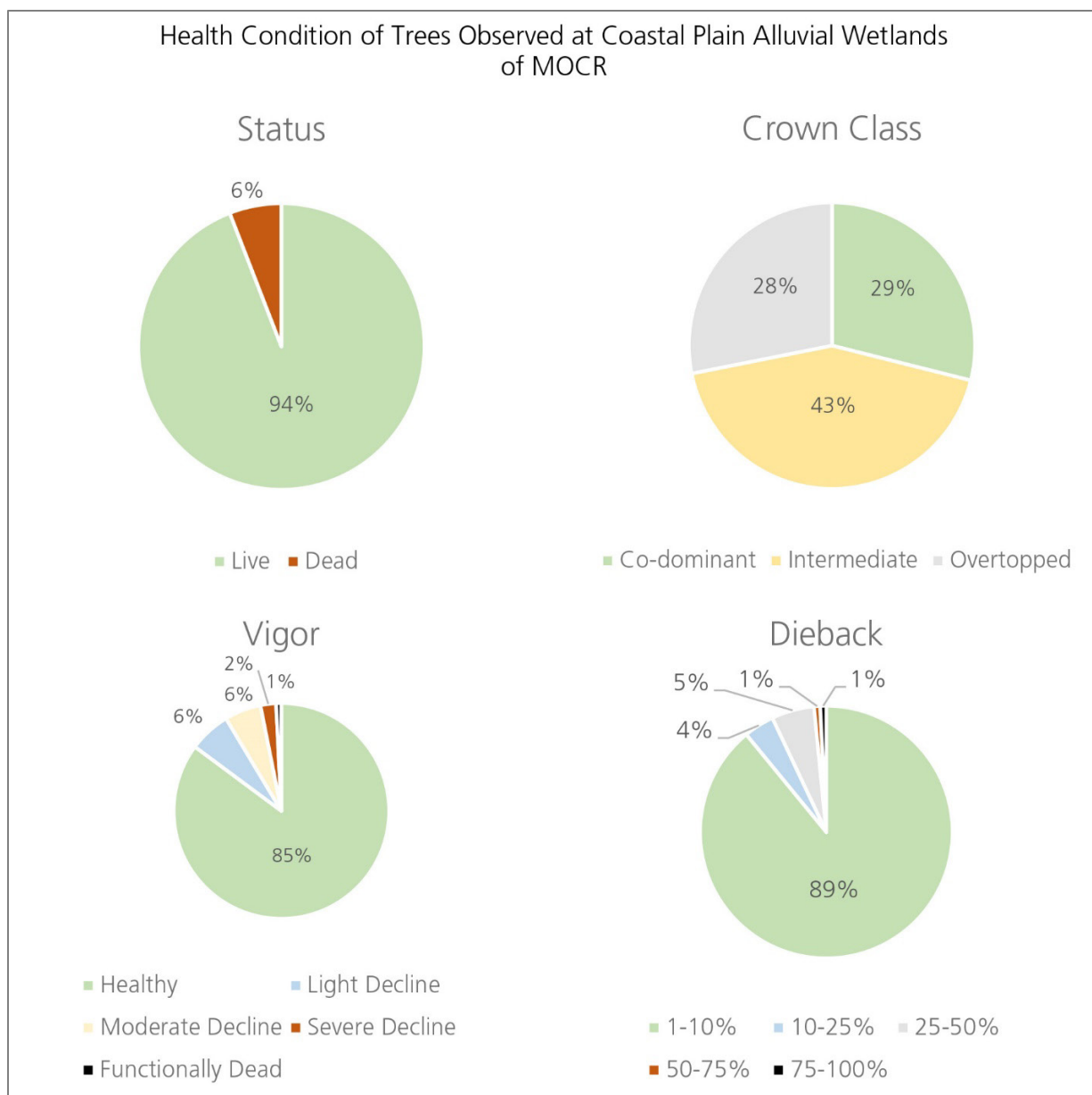


Figure 6. Health status of woody stems greater than or equal to 10 centimeters (3.9 in) DBH ('trees') measured on Coastal Plain Alluvial Wetlands of Moores Creek National Battlefield. NPS / M. FORBES BOYLE

Disturbance and Threats

There were no observed human-caused disturbances within plots of Coastal Plain Alluvial Wetlands within the park (Table 6). Fallen trees due to wind events were observed in three of the four plots (Table 6). As noted by Schafale (2024), natural mortality of trees within Coastal Plain Floodplains is caused by wind, lightning, or disease and not typically by flooding. The other noticeable threat to these ecosystems within the park is the presence of non-native, invasive species, such as mud-annie, sericea lespedeza, Chinese privet, Chinese wisteria, and bahia grass. None of these species were found in high abundance on any of these alluvial plots (Appendix B, Table 10). 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). Furthermore, 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 a suite of invasive species will respond to both local-scale management efforts and landscape-scale changes (e.g., climate change), especially in these understudied, blackwater streams of Moores Creek National Battlefield. 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 6. Disturbance observations and abundance (% cover) measured on vegetation monitoring plots of Moores Creek National Battlefield.

Broadly Defined Habitat	Plot	Historic Fire	Historic Logging	Historic Plowing/Ditching	Logging Deck	Mowing	Recent Fire	Windfall
Coastal Plain Alluvial Wetlands	MOCR033	–	–	–	–	–	–	–
	MOCR034	–	–	–	–	–	–	30
	MOCR035	–	–	–	–	–	–	10
	MOCR036	–	–	–	–	–	–	30
Coastal Plain Nonalluvial Wetlands	MOCR001	100	–	–	–	100	100	–
	MOCR002	100	–	100	–	10	100	–
	MOCR003	100	–	–	–	–	100	–
Coastal Plain Open Upland Woodlands	MOCR065	100	100	20	20	–	100	–
	MOCR066	100	–	20	–	–	100	–
	MOCR067	100	10	–	–	–	–	–
	MOCR068	100	–	20	–	–	100	–

Geomorphology and Soil

Plots located within Coastal Plain Alluvial Wetlands of Moores Creek National Battlefield occurred on flat (0 degree) landforms in flood zones and there was standing water present on two of the four plots (Table 7). Soil nutrient analysis of samples collected from these four plots indicated pH ranges from 4.3 (strongly acidic) to 5.3 (moderately acidic) and elevated organic matter content, particularly noticeable from the sample collected in MOCR033 on the southwestern corner of the park (Table 8). Soil survey information from Pender County, North Carolina maps the soil unit for all of these plots as Muckalee loam, frequently flooded (NCSS 2024). Muckalee soils are poorly drained and formed from loamy and sandy alluvial materials.

Table 7. Local landform and hydrologic condition from vegetation monitoring plots at Moores Creek National Battlefield.

Broadly Defined Habitat	Plot	Slope (°)	Aspect (°)	TSI^A (°)	Landform Type	Water Source	Submerged (%)
Coastal Plain Alluvial Wetland	MOCR033	0	–	0.0	alluvial plain	Permanent water	10
	MOCR034	0	–	0.0	alluvial plain	Flood zones	0
	MOCR035	0	–	0.0	alluvial plain	Flood zones	10
	MOCR036	0	–	0.0	alluvial plain	Flood zones	0
Coastal Plain Nonalluvial Wetland	MOCR001	3	315	–0.6	side slope	Flood zones	0
	MOCR002	0	–	0.0	flat plain	Flood zones	0
	MOCR003	0	–	0.0	flat plain	Flood zones	0
Coastal Plain Open Upland Woodlands	MOCR065	0	–	0.0	flat plain	Flood zones	0
	MOCR066	0	–	0.0	flat plain	Flood zones	0
	MOCR067	4	315	–0.3	side slope	None	0
	MOCR068	0	–	0.0	flat plain	Flood zones	0

^A 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 8. Soil nutrient status from vegetation monitoring plots at Moores Creek National Battlefield. 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 2024).

Broadly Defined Habitat	Plot	TEC (ME/100 g)	pH	OM (%)	P ^A	Ca ^A	Mg ^A	K ^A	Na ^A	B ^A	Fe ^A	Mn ^A	Cu ^A	Zn ^A	Al ^A
Coastal Plain Alluvial Wetlands	MOCR033	7.7	5.3	52.2	17.0	557.0	130.0	52.0	94.0	0.3	155.0	3.0	0.1	1.5	411.0
	MOCR034	4.6	5.1	6.0	12.0	331.0	57.0	40.0	22.0	0.3	413.0	0.5	0.1	0.4	1152.0
	MOCR035	4.5	4.9	7.1	29.0	257.0	57.0	54.0	28.0	0.2	400.0	0.5	0.1	1.1	627.0
	MOCR036	10.4	4.3	8.2	16.0	531.0	55.0	46.0	28.0	0.3	420.0	0.5	0.1	1.1	611.0
	average	6.8	4.9	18.4	18.5	419.0	74.8	48.0	43.0	0.3	347.0	1.1	0.1	1.0	700.3
	standard deviation	2.8	0.4	22.5	7.3	147.8	36.8	6.3	34.1	0.1	128.3	1.3	0.0	0.4	316.8
Coastal Plain Nonalluvial Wetlands	MOCR001	15.1	5.5	6.1	5.0	1435.0	215.0	37.0	121.0	0.8	421.0	7.0	0.1	0.9	262.0
	MOCR002	4.7	5.1	4.5	38.0	384.0	27.0	20.0	46.0	0.3	236.0	2.0	0.1	1.0	783.0
	MOCR003	3.7	4.7	5.8	21.0	240.0	24.0	21.0	15.0	0.1	259.0	0.5	0.1	0.4	742.0
	average	7.8	5.1	5.5	21.3	686.3	88.7	26.0	60.7	0.4	305.3	3.2	0.1	0.8	595.7
	standard deviation	6.3	0.4	0.8	16.5	652.3	109.4	9.5	54.5	0.4	100.8	3.4	0.0	0.3	289.7
Coastal Plain Open Upland Woodlands	MOCR065	3.5	4.8	3.0	29.0	222.0	32.0	25.0	18.0	0.1	254.0	3.0	0.1	1.4	509.0
	MOCR066	6.7	3.9	5.5	71.0	252.0	29.0	20.0	21.0	0.1	214.0	0.5	0.1	1.0	644.0
	MOCR067	3.8	4.4	4.6	8.0	173.0	34.0	36.0	12.0	0.3	387.0	1.0	0.1	0.7	694.0
	MOCR068	11.4	4.3	6.6	36.0	619.0	49.0	44.0	15.0	0.1	245.0	5.0	73.7	23.2	484.0
	average	6.4	4.4	4.9	36.0	316.5	36.0	31.3	16.5	0.1	275.0	2.4	18.5	6.6	582.8
	standard deviation	3.7	0.4	1.5	26.2	204.3	8.9	10.8	3.9	0.1	76.6	2.1	36.8	11.1	102.2

^A Anions (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 Nonalluvial Wetlands

This broadly defined habitat represents the area of Moores Creek National Battlefield identified as the wet meadow west of the park's Visitor's Center (Figure 7). Over the years, this site has been given unique names by different researchers (see discussion above under Study Area). In the latest vegetation mapping project for Moores Creek National Battlefield, McManamay et al. (2012) discuss why they changed the classification of the site from a Typic Sandhill Hillside Seep—proposed by NatureServe (2007)—to a Longleaf Pine/Pond Pine Savanna (Wet Ultisol Type). Their reasoning was based on aspects of Typic Sandhill Hillside Seeps that were missing in the wet meadow (e.g., abundant shrub cover and community nominal species) and the fact that this community typically occurs along side-slopes within the Fall-line Sandhills of the Carolinas and Georgia (McManamay et al. 2012). It should be noted, however, that Typic Sandhill Hillside Seeps can be found occasionally along scarps and sand ridges within the Outer Coastal Plain—where Moores Creek National Battlefield is located—and shrub abundance can be heterogenous, and not always dense, due to small-scale edaphic factors and fire frequency (NatureServe 2024). Additionally, the current presence of longleaf pine within the wet meadow, which is a necessary component of Longleaf Pine/Pond Pine Savannas, is due to hand planting of longleaf pine seedlings over the past several decades. Finally, it should be noted that historical accounts of the wet meadow site at the time of and before the Battle of Moores Creek in 1776 describe the area as being maintained by periodic fire and having scattered trees (McCrain et al. 1985).



Figure 7. Three plots were established in Coastal Plain Nonalluvial Wetlands of Moores Creek National Battlefield during this monitoring effort (June 2022). This broadly defined habitat represents the wet meadow west of the Visitor's Center. The site historically has harbored many rare and unusual plants and has been and currently is a management focus within the park. NPS / M. FORBES BOYLE

Whether its classification is more closely tied to a wet pine savanna or seepage wetland, the wet meadow does represent a unique vegetation community distinct from the surrounding upland woodlands and blackwater alluvial forests of the park. Furthermore, both wet pine savannas and seepage wetlands share common biotic and abiotic attributes. Hydrologically, both community types are seasonally saturated near the ground surface during wet seasons. Fire is crucial in maintaining herbaceous diversity and minimizing shrub abundance in both communities. Also, both wet pine savannas and seepage wetlands exhibit high degrees of variation within their respective sites, owing to complicated factors such as impact from former land use, small-scale differences in soil texture and chemistry, and hydrology patterns (Schafale 2024). For this report, the three vegetation plots sampled in this broadly defined habitat were classified as both a Typic Sandhill Hillside Seep and a Longleaf Pine/Pond Pine Savanna (Wet Ultisol Type), with the caveat that their unique vegetation composition and structure described at the time of this monitoring effort links well to both community types. Descriptions of each type by NatureServe (2024) are provided below:

- Longleaf Pine – Pond Pine Savanna (Wet Ultisol Type) (CEGL003660; 3 plots): This saturated pine woodland is restricted to wet Ultisol soils of the Atlantic Coastal Plain from North Carolina to Florida. The canopy is dominated by a mixture of longleaf pine and pond pine (*Pinus serotina*) and the shrub stratum is usually absent. (Global Status: G1—Critically Imperiled; State (NC) Status: S1—Critically Imperiled)
- Typic Sandhill Hillside Seep (CEGL004468; 3 plots): This community type occurs on gentle to steep slopes along sand ridges or sandhill areas where water is forced to the surface by a clay lens within the upper soil stratum. Vegetation ranges from open to dense growth of various wetland and upland shrubs and herbs. Fire plays a crucial role in determining composition and the various structure types, with frequently burned sites having the greatest herbaceous diversity. (Global Status: G3—Vulnerable; State (NC) Status: No Status Rank)

Species Diversity and Abundance

Native species richness within the Moores Creek National Battlefield wet meadow ranged from 46 to 86 (mean = 63.7) and represented some of the highest species diversity among all vegetation monitoring plots within Southeast Coast Network Plots (Table 4). Not surprisingly, herbaceous plants represented the most diverse growth form across all plot spatial scales (400 m², 100 m², 10 m², and 1 m²; Table 4). At least one non-native species was present in two of the three plots (Table 4). Invasive species observed within this broadly defined habitat included bahia grass and Oriental lady's thumb (Appendix B, Table 10). One hundred twenty-eight vascular plant species were found collectively within these three plots, including 68 only found in this particular habitat of the park. Three species listed as rare and of special concern by the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022) were observed within these plots, including small-leaved meadowrue (special concern-vulnerable), erectleaf panicgrass (*Dichanthelium erectifolium*; watch list), and dwarf huckleberry (watch list). A complete species list, along with constancy and average cover per species, is listed in Appendix B, Table 10. Species with high constancy in this habitat are listed below, by growth form (constancy values in parentheses):

Trees

- Sweetgum (100%)
- Loblolly pine (100%)

Shrubs

- Dwarf huckleberry (100%)
- Titi (*Cyrilla racemiflora*; 67%)
- Little gallberry (*Ilex glabra*; 67%)

Vines

- Whiteleaf greenbriar (*Smilax glauca*; 100%)
- Trumpet creeper (*Campsis radicans*; 100%)

Herbs/Forbs/Graminoids

- Annual ragweed (*Ambrosia artemisiifolia*; 100%)
- Centella (*Centella erecta*; 100%)
- Erectleaf panicgrass (100%)
- Velvet panicum (*Dichanthelium scoparium*; 100%)
- Dogfennel (*Eupatorium capillifolium*; 100%)
- Narrowleaf sunflower (*Helianthus angustifolius*; 100%)
- Savanna seedbox (*Ludwigia virgata*; 100%)
- Juniperleaf (*Polypremum procumbens*; 100%)
- Savanna mint (*Pycnanthemum flexuosum*; 100%)
- Virginia meadow-beauty (*Rhexia virginica*; 100%)
- Angle-stem beaksedge (*Rhynchospora caduca*; 100%)
- Fewflower beaksedge (*Rhynchospora rariflora*; 100%)
- Narrowleaf skullcap (*Scutellaria integrifolia*; 100%)

Woody Stem Metrics

Stems greater than or equal to 10 centimeters (3.9 in) (tree size class) were absent from these plots and stems less than 10 centimeters (3.9 in; sapling size class) were essentially absent from these plots (Table 5). Seedlings that were present in relatively large abundance included little gallberry, titi, winged sumac (*Rhus copallinum* var. *copallinum*), sweetgum, and Atlantic poison oak (*Toxicodendron pubescens*) (Appendix B, Table 11).

Disturbance and Threats

Historic impacts from early 20th century efforts to drain the wet meadow were observed in one of the three plots sampled during this monitoring effort but undoubtedly had an impact across the entire site (Table 6). The scale of how ditching has altered plant composition and structure within these wetlands is poorly understood, although it is likely to have increased habitat suitability for upland, non-wetland tolerant, species. Restoration efforts to “plug” ditches or level them to actual site elevation can aid in returning savannas’ natural hydrology (Harper et al. 1997), but the intensity of such efforts could have profound effect on current vegetation patterns. The other noticeable impacts to vegetation within the wet meadow are related to fire and mechanical (e.g., mowing) disturbances. As mentioned above, fire is a necessary ecological component in this ecosystem. In Noss (2013), the author describes fire within southeastern grasslands (like the wet meadow) not as a “negative disturbance,” but as a “fundamental architect of species-rich ecosystems” and lists six essential ecological roles of fire: (1) reduction in competition of resources, (2) promotion of regeneration, (3) maintenance of fire-adapted species, (4) inhibition of fire-intolerant species, (5) the recycling of nutrients and impact on sediment delivery in watersheds, and (6) creation of shifting mosaics of habitat structure. The use of fire as tool to restore and maintain the wet savanna has been a

management priority for over 30 years at Moores Creek National Battlefield. The March 2022 burn treatment initiated by the NPS Appalachian/Piedmont/Coastal Fire Management Zone (APC FMZ) represents the seventh year in a row of annual burning within the wet meadow and the NPS has been responsible for conducting burns within the park since 2010 (Wood et al. 2022). Table K-1 in Wood et al. (2022) lists all fire and mechanical treatments, acres, and units treated since spring 1989. Results from fire effects monitoring effort show that recent annual burns are successful at reducing woody encroachment from undesirable species (e.g., sweetgum, loblolly pine). Continued monitoring efforts of the APC FMZ and the Southeast Coast Network can be used to detect further impact of fire on species diversity patterns within the wet meadow.

Geomorphology and Soil

Plots within Coastal Plain Nonalluvial Wetlands of Moores Creek National Battlefield occurred on flat or gradually sloping landforms that could flood with elevated rain events or when adjacent floodplain banks rise above typical levels (Table 7). The plots were all dry on the surface with no standing water at the time of this monitoring event. Soil survey information from Pender County, North Carolina maps the soil unit for all of these plots as Torhunta mucky fine sandy loam (NCSS 2024). Torhunta soils are very poorly drained Inceptisols that form on Carolina bay marine terraces or depressions on stream terraces. Soil nutrient analysis of samples collected from these plots revealed moderately acidic conditions with lower organic matter content when compared with neighboring alluvial floodplain sites (Table 8). Soils from the wet meadow had higher calcium and magnesium content than plots within the other broadly defined habitats of the park (Table 8).

Coastal Plain Open Upland Woodlands

Coastal Plain Open Upland Woodlands of Moores Creek National Battlefield comprise much of the park's eastern and southern portions (Figure 8) and are characterized by a moderately closed canopy of loblolly pine with a subcanopy of sweetgum, blackgum (*Nyssa sylvatica*), and water oak (*Quercus nigra*; McManamay et al. 2012). According to McCrain and Church (1985), these forests represent the remnants of early- to mid-successional communities that “replaced the extensive long leaf (sic) pine stands which were so prevalent throughout the area in the early 18th century.” Regionally, this broad category includes open-spaced forests and savannas occurring on low, flat topography and on dry (xeric) to mesic, and occasionally wet (hydric) soils. They are typically maintained by a combination of frequent fire and water availability—which can vary widely among sites depending on soil texture, microtopography, and seasonal precipitation. Soils are typically imperfectly to poorly drained and are usually acidic. Open pine-dominated woodlands in the southeastern United States were once widespread across the Coastal Plain mainland from Virginia to Mississippi, but close to 98% of their original coverage has been eliminated due to land conversion to agriculture or urban environments, timber management, and fire suppression (Noss et al. 1985; Ware et al. 1993). Former land use history (e.g., timber management, agricultural practices, ditching, and fire suppression) on the park's approximately 16 hectares (40 acres) of uplands have resulted in extreme shifts in overall biodiversity and ecosystem function within this habitat type. However, one of the park goals is to convert loblolly pine-dominated stands to longleaf pine. In the early 1990s, Moores Creek National Battlefield planted 1,000 longleaf pines primarily in areas near the park entrance and the historical Highway 210 roadbed (DeVivo et al. 2008), and since 2014, the National Park Service has actively

been reintroducing fire into park uplands (Woods et al. 2022). Prescribed burns have been implemented on a dedicated two-year rotation in these early- to mid-successional pine-dominated systems of the park for the past 10 years. Vegetation associations sampled within the park that belong to this habitat type include (descriptions from McManamay et al. 2012 and NatureServe 2024):

- Ruderal Loblolly Pine / Sweetgum – Red Maple Forest (CEGL006011; 4 plots): This vegetation association represents forested stands where loblolly pine is the sole dominant tree in the overstory and the subcanopy includes well-developed hardwoods (e.g., sweet gum and red maple). These forests occur on well-drained soils and followed agricultural cropping or silviculture site preparation. The shrub layer can be diverse where fire has been excluded for many years and the herbaceous layer is very sparse. (Global Status: No Status Rank; State (NC) Status: No Status Rank)



Figure 8. The eastern portion of Moores Creek National Battlefield is dominated by a mid-successional upland loblolly pine forest. Since 2014, the National Park Service has actively been reintroducing fire into this unit; prescribed burns have been implemented on a two-year rotation with the most recent burn occurring in March 2022, just over two months prior to this monitoring event (Woods et al. 2022). NPS / M. FORBES BOYLE

Species Diversity and Abundance

Native species richness ranged from 37 to 49 (mean = 43.5) within vegetation plots of this broadly defined habitat type and three of the four plots had one non-native species present (Table 4). Non-native invasive species that were present included centipede grass and cogongrass (Appendix B, Table 10). 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. Tree species exhibited the highest richness across the full plot, module, and nested 10 m² (107.6 ft²) scales while vine species had the highest richness across the nested 1 m² (10.8 ft²) scale (Table 4). Eighty-three vascular plant species were found collectively within these four plots, and 30 of these were only found in this broadly defined habitat; a complete species list, along with constancy and average cover per species, is in Appendix B, Table 10. Species with high constancy in this habitat are listed below by growth form and their frequency of occurrence (%) within Coastal Plain Open Upland Woodland plots are in parentheses:

Trees

- Loblolly pine (100%)
- Sweetgum (100%)
- Water oak (100%)
- Sassafras (*Sassafras albidum*; 100%)
- Sweetbay (*Magnolia virginiana* var. *virginiana*; 100%)
- Swamp bay (*Persea palustris*; 100%)
- Winged sumac (*Rhus copallinum* var. *copallinum*; 100%)
- Common persimmon (*Diospyros virginiana*; 100%)

Shrubs

- Little gallberry (100%)
- Common sweetleaf (*Symplocos tinctoria*; 100%)
- Dangleberry (*Gaylussacia frondosa*; 100%)
- Common wax-myrtle (*Morella cerifera*; 100%)
- Coastal sweet-pepperbush (*Clethra alnifolia*; 100%)
- Southern highbush blueberry (*Vaccinium formosum*; 100%)

Vines

- Muscadine (*Muscadinia rotundifolia* var. *rotundifolia*; 100%)
- Virginia creeper (*Parthenocissus quinquefolia*; 100%)
- Carolina jessamine (*Gelsemium sempervirens*; 100%)
- Whiteleaf greenbriar (100%)

Herbs/Forbs/Graminoids

- Broomsedge (*Andropogon virginicus* var. *virginicus*; 75%)
- Eastern blackberry (*Rubus pensilvanicus*; 75%)
- Baldwin's flatsedge (*Cyperus croceus*; 75%)
- Velvet panicum (75%)
- Roundleaf thoroughwort (*Eupatorium rotundifolium*; 75%)

Woody Stem Metrics

Total basal area (BA) of trees ranged from 12.1 to 45.7 m²/ha in these plots, with an overall average of 31.6 m²/ha; density of canopy stems ranged from three to 15 per plot, with an average of 11.0 (Table 5). Canopy height ranged from 26.3 to 29.3 meters (average 27.7), and canopy cover ranged from 24 to 85% (average = 62.5%; Table 5). Canopy structure was highly variable among these four plots, which may be explained by small-scale differences in burn severity during the past 10 years of prescribed fire across the park's upland stands. The most dominant canopy species was loblolly pine (mean BA = 25.07 m²/ha, mean density = 175/ha; Appendix B, Table 11). Sapling density at the 80-meter square scale ranged from seven to 80 stems, with an average of 29.0, while seedling density at the 8-meter square scale ranged from 149 to 258 stems, with an average of 179.0 across all plots (Table 5). Small-scale differences in burn severity may explain the heterogeneity in sapling density as well. Dominant sapling species included muscadine and sweetgum; dominant seedlings included dangleberry, little gallberry, Carolina jessamine, and muscadine (Appendix B, Table 11).

Based on stem count (density) alone, loblolly pine comprised close to 80% of the relative abundance among species within the tree stratum; sweetgum, the next most dense species within the tree stratum, comprised 14% (Figure 9; Appendix B, Table 11). The sapling stratum was heavily dominated by sweetgum and oak (e.g., water oak); the seedling stratum was co-dominated by a mix of loblolly pine, wax-myrtle, and a host of other hardwood species (Figure 9; Appendix B, Table 11). It should be noted that there were no tree-sized, seedling-sized, nor sapling-sized longleaf pine stems observed in any of these four plots.

Most of the measured trees in these monitoring plots were living (93%) and the majority were categorized with healthy vigor and minimal dieback (Figure 10).

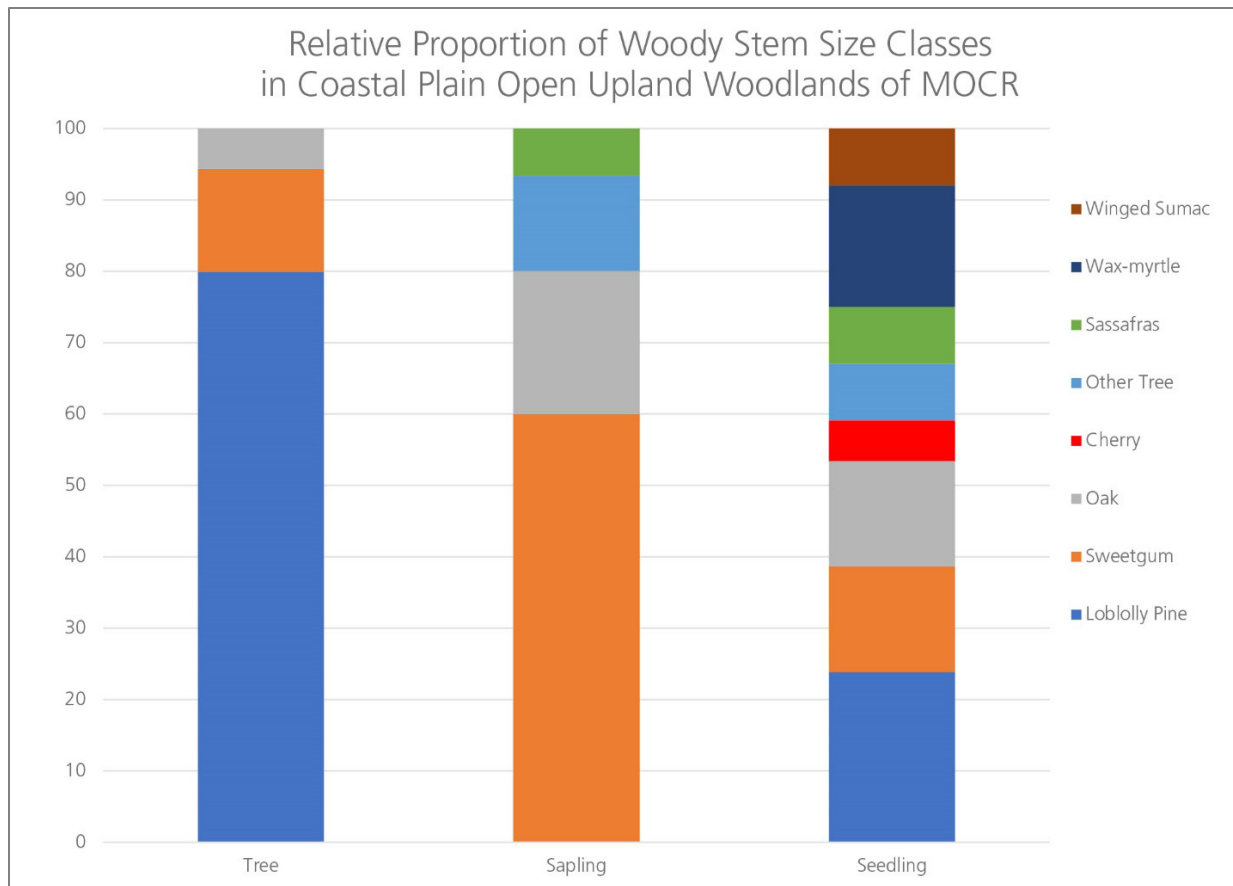


Figure 9. Relative proportion of species groups across three woody stem strata—trees, saplings, and seedlings—within Coastal Plain Open Upland Woodland monitoring plots of Moores Creek National Battlefield. NPS / M. FORBES BOYLE

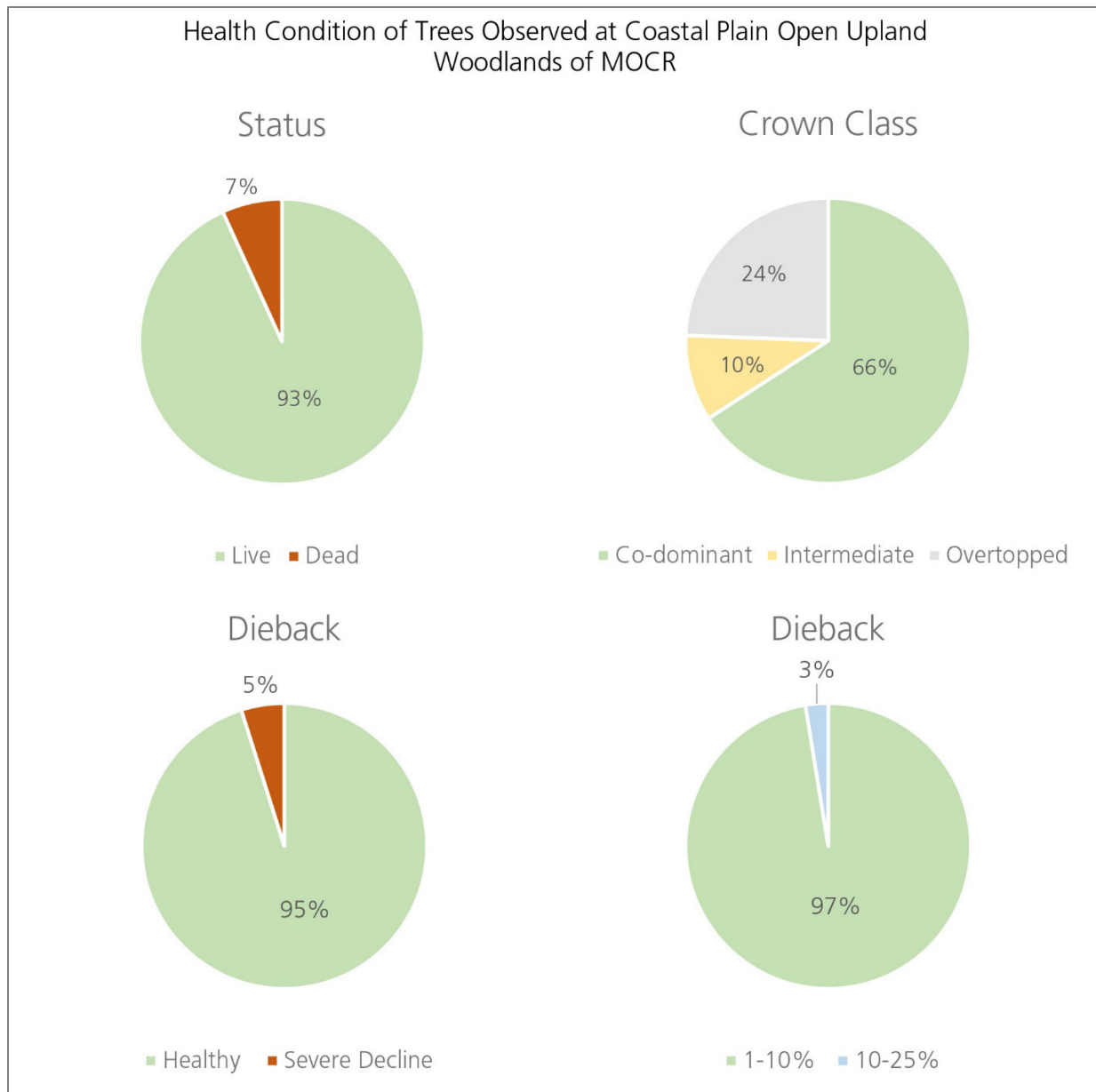


Figure 10. Health status of woody stems greater than or equal to 10 centimeters (3.9 in) DBH ('trees') measured on Coastal Plain Open Upland Woodland monitoring plots of Moores Creek National Battlefield. NPS / M. FORBES BOYLE

Disturbance and Threats

All Coastal Plain Open Upland Woodland plots of Moores Creek National Battlefield had observable disturbances related to former land-use events, including impacts from ditching, logging, and farming (Table 6). Fire scars from recent and historic fires were noticeable in all but one plot. Most of the plots located in the upland unit were burned in March 2022 (Woods et al. 2022). Continued use of fire applied at a one-to-three-year rotation should continue to improve ground cover conditions within this habitat of Moores Creek National Battlefield. However, plantings of longleaf pine may be necessary to replace the current monospecific loblolly pine from dominating the canopy.

Geomorphology and Soil

Plots within Coastal Plain Open Upland Woodlands of Moores Creek National Battlefield occurred on flat or gradually sloping landforms that could flood with elevated rain events or when adjacent floodplain banks rise above typical levels (Table 7). Soil survey information from Pender County, North Carolina maps the soil units of these plots as either Marvyn and Craven soils, Alpin fine sand, or Leon fine sand (NCSS 2024). Marvyn and Craven soils are very deep, well-drained Ultisols; Alpin fine sand consists of excessively drained, moderately to rapidly permeable soils of uplands and river terraces of the Coastal Plain; and Leon series soils are Spodosols of very deep, poorly drained upland flats. Soil nutrient analysis of samples collected from these plots revealed acidic conditions with lower organic matter content when compared with other broad habitat types within the park (Table 8). Soil from MOCR068 had elevated rates of copper and zinc (Table 8), which could be a result of past agriculture, livestock, or timber land use. It is unclear what these elevated values of trace elements may imply for environmental health (although most publications cite copper values within soil at >100 ppm for environmental health concerns) or plant regeneration.

Fuel Load Estimates

Fuel load totals ranged from 2.7 to 7.2 tons/acre (0.6 to 1.6 kg/m²) within Nonalluvial Wetlands (i.e., the wet meadow) of Moores Creek National Battlefield (Figure 11). Litter and duff volume contributed the highest percentage among fuel types within these plots (Figure 11). Annual burns within this habitat type have undoubtedly contributed to low observed fuel loads. Within Open Upland Woodlands of the park, fuel load totals ranged from 19.2 to 103.3 tons/acre (4.3 to 23.2 kg/m²; Figure 11). Large piles of coarse woody debris (i.e., 1000-hour fuels) contributed to high fuel loads within the park's upland plots (Figure 11). Continued burning within this habitat should reduce these fuel load amounts over time.

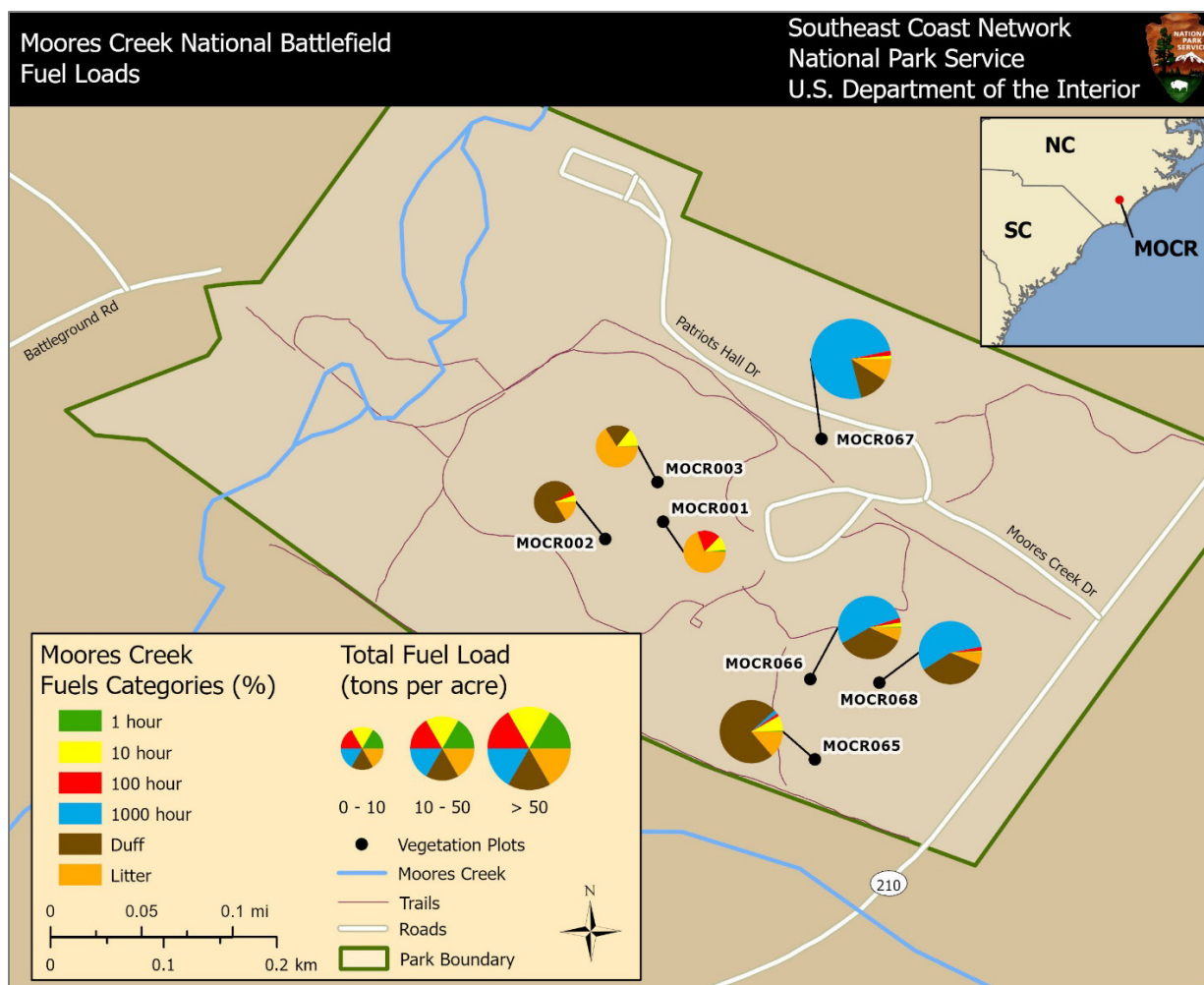


Figure 11. Fuel load estimates from vegetation monitoring plots located throughout Moore's Creek National Battlefield. NPS / MALLORIE DAVIS

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Appendix A. Vascular Plants Observed During the 2022 Southeast Coast Network Terrestrial Vegetation Monitoring Effort at Moores Creek National Battlefield

All vascular species present within 2022 Southeast Coast Network monitoring plots of Moores Creek National Battlefield are included in Table 9. Each species is cross-walked to its nativity, growth form, invasive status (where applicable), and rarity (where applicable).

Table 9. Vascular plants observed during the 2022 SECN terrestrial vegetation monitoring effort at Moores Creek National Battlefield.

Order ^A	Family ^A	Scientific Name	Common Name ^A	Native Status ^A	Growth Form ^A	State Invasive Status ^B	North Carolina Rare Protected Status ^C
Euphorbiales	Euphorbiaceae	<i>Acalypha gracilens</i>	slender threeseed mercury	Native	Forb/herb	–	–
Euphorbiales	Euphorbiaceae	<i>Acalypha rhomboidea</i>	common threeseed mercury	Native	Forb/herb	–	–
Sapindales	Aceraceae	<i>Acer rubrum</i>	red maple	Native	Tree	–	–
Asterales	Asteraceae	<i>Ambrosia artemisiifolia</i>	annual ragweed	Native	Forb/herb	–	–
Rosales	Rosaceae	<i>Amelanchier obovalis</i>	coastal serviceberry	Native	Shrub	–	–
Polypodiales	Blechnaceae	<i>Anchistea virginica</i>	Virginia chainfern	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Andropogon gyrans</i>	Elliott's bluestem	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Andropogon hirsutior</i>	bushy bluestem	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Andropogon virginicus</i> var. <i>virginicus</i>	broomsedge bluestem	Native	Graminoid	–	–
Capparales	Brassicaceae	<i>Arabidopsis thaliana</i>	mouseear cress	Non–native	Forb/herb	–	–
Apiales	Araliaceae	<i>Aralia spinosa</i>	devil's walking stick	Native	Shrub, Tree	–	–
Rosales	Rosaceae	<i>Aronia arbutifolia</i>	red chokeberry	Native	Shrub, Tree	–	–
Cyperales	Poaceae	<i>Arundinaria tecta</i>	switchcane	Native	Subshrub, Graminoid, Shrub	–	–

^A Information obtained from the PLANTS database (USDA 2023).

^B Information obtained from the North Carolina Invasive Plant Council (NC-IPC 2023).

^C North Carolina Natural Heritage rarity and watch list status (SC-V: Special Concern-Vulnerable; W1: Watch List, category 1; W7: Watch List, category 7) and imperilment rank (S2: Imperiled; S3: Vulnerable) information obtained from the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022).

Table 9 (continued). Vascular plants observed during the 2022 SECN terrestrial vegetation monitoring effort at Moores Creek National Battlefield.

Order ^A	Family ^A	Scientific Name	Common Name ^A	Native Status ^A	Growth Form ^A	State Invasive Status ^B	North Carolina Rare Protected Status ^C
Asterales	Asteraceae	<i>Baccharis halimifolia</i>	eastern baccharis	Native	Tree, Shrub	–	–
Fagales	Betulaceae	<i>Betula nigra</i>	river birch	Native	Tree	–	–
Asterales	Asteraceae	<i>Bidens aristosa</i>	bearded beggarticks	Native	Forb/herb	–	–
Scrophulariales	Bignoniaceae	<i>Bignonia capreolata</i>	crossvine	Native	Vine	–	–
Urticales	Urticaceae	<i>Boehmeria cylindrica</i>	swamp–nettle / smallspike false nettle	Native	Forb/herb	–	–
Scrophulariales	Bignoniaceae	<i>Campsis radicans</i>	trumpet creeper	Native	Vine	–	–
Cyperales	Cyperaceae	<i>Carex</i>	sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex albolutescens</i>	greenwhite sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex debilis</i>	white edge sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex glaucescens</i>	southern waxy sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex grayi</i>	Gray's sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex intumescens</i> var. <i>intumescens</i>	greater bladder sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex louisianica</i>	Louisiana sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex turgescens</i>	pine barren sedge	Native	Graminoid	–	W1; S3
Fagales	Betulaceae	<i>Carpinus caroliniana</i> var. <i>caroliniana</i>	American hornbeam	Native	Tree, Shrub	–	–
Juglandales	Juglandaceae	<i>Carya tomentosa</i>	mockernut hickory	Native	Tree	–	–
Apiales	Apiaceae	<i>Centella erecta</i>	centella / coinleaf	Native	Forb/herb	–	–
Fabales	Fabaceae	<i>Chamaecrista nictitans</i> var. <i>nictitans</i>	sensitive partridge pea	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Chasmanthium latifolium</i>	Indian woodoats	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Chasmanthium laxum</i>	slender woodoats	Native	Graminoid	–	–

^A Information obtained from the PLANTS database (USDA 2023).

^B Information obtained from the North Carolina Invasive Plant Council (NC-IPC 2023).

^C North Carolina Natural Heritage rarity and watch list status (SC-V: Special Concern-Vulnerable; W1: Watch List, category 1; W7: Watch List, category 7) and imperilment rank (S2: Imperiled; S3: Vulnerable) information obtained from the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022).

Table 9 (continued). Vascular plants observed during the 2022 SECN terrestrial vegetation monitoring effort at Moores Creek National Battlefield.

Order ^A	Family ^A	Scientific Name	Common Name ^A	Native Status ^A	Growth Form ^A	State Invasive Status ^B	North Carolina Rare Protected Status ^C
Asterales	Asteraceae	<i>Cirsium horridulum</i> var. <i>horridulum</i>	yellow thistle	Native	Forb/herb	–	–
Cyperales	Cyperaceae	<i>Cladium jamaicense</i>	Jamaica swamp sawgrass	Native	Graminoid	–	–
Ericales	Clethraceae	<i>Clethra alnifolia</i>	coastal sweetpepperbush	Native	Shrub	–	–
Cyperales	Poaceae	<i>Coleataenia anceps</i> ssp. <i>rhizomata</i>	beaked panicgrass	Native	Graminoid	–	–
Commelinales	Commelinaceae	<i>Commelina erecta</i> var. <i>erecta</i>	whitemouth dayflower	Native	Forb/herb	–	–
Rosales	Rosaceae	<i>Crataegus aestivalis</i>	may hawthorn	Native	Shrub, Tree	–	W1; S2
Rosales	Rosaceae	<i>Crataegus flava</i>	yellowleaf hawthorn	Native	Shrub, Tree	–	–
Fabales	Fabaceae	<i>Crotalaria rotundifolia</i>	rabbitbells	Native	Forb/herb	–	–
Myrtales	Lythraceae	<i>Cuphea carthagenensis</i>	Colombian waxweed	Non–native	Forb/herb	–	–
Cyperales	Cyperaceae	<i>Cyperus</i>	flatsedge	Unknown	Graminoid	–	–
Cyperales	Cyperaceae	<i>Cyperus croceus</i>	Baldwin’s flatsedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Cyperus retrorsus</i>	pine barren flatsedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Cyperus rotundus</i>	nutgrass	Non–native	Graminoid	–	–
Ericales	Cyrillaceae	<i>Cyrilla racemiflora</i>	titi	Native	Tree, Shrub	–	–
Cyperales	Poaceae	<i>Danthonia sericea</i>	downy danthonia	Native	Graminoid	–	–
Fabales	Fabaceae	<i>Desmodium paniculatum</i>	panicledleaef ticktrefoil	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Dichanthelium commutatum</i>	variable panicgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium ensifolium</i>	cypress panicgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium erectifolium</i>	erectleaf panicgrass	Native	Graminoid	–	W1; S2
Cyperales	Poaceae	<i>Dichanthelium laxiflorum</i>	openflower rosette grass	Native	Graminoid	–	–

^A Information obtained from the PLANTS database (USDA 2023).

^B Information obtained from the North Carolina Invasive Plant Council (NC-IPC 2023).

^C North Carolina Natural Heritage rarity and watch list status (SC-V: Special Concern-Vulnerable; W1: Watch List, category 1; W7: Watch List, category 7) and imperilment rank (S2: Imperiled; S3: Vulnerable) information obtained from the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022).

Table 9 (continued). Vascular plants observed during the 2022 SECN terrestrial vegetation monitoring effort at Moores Creek National Battlefield.

Order ^A	Family ^A	Scientific Name	Common Name ^A	Native Status ^A	Growth Form ^A	State Invasive Status ^B	North Carolina Rare Protected Status ^C
Cyperales	Poaceae	<i>Dichantherium leucothrix</i>	rough panicgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichantherium lucidum</i>	cypress panicgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichantherium portoricense</i> ssp. <i>patulum</i>	hemlock rosette grass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichantherium scoparium</i>	velvet panicum	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichantherium tenue</i>	cypress panicgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichantherium villosissimum</i> var. <i>villosissimum</i>	whitehair rosette grass	Native	Graminoid	–	–
Rubiales	Rubiaceae	<i>Diodia virginiana</i>	Virginia buttonweed	Native	Forb/herb	–	–
Ebenales	Ebenaceae	<i>Diospyros virginiana</i>	common persimmon	Native	Tree	–	–
Cyperales	Cyperaceae	<i>Eleocharis tuberculosa</i>	cone–cup spikerush	Native	Graminoid	–	–
Asterales	Asteraceae	<i>Elephantopus tomentosus</i>	devil's grandmother	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Erechtites hieraciifolius</i>	American burnweed	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Eremochloa ophiuroides</i>	centipede grass	Non–native	Graminoid	Rank 3 (Lesser Threat)	–
Cyperales	Poaceae	<i>Erianthus giganteus</i>	sugarcane plumegrass	Native	Graminoid	–	–
Asterales	Asteraceae	<i>Erigeron canadensis</i>	Canadian horseweed	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Erigeron vernus</i>	early whitetop fleabane	Native	Forb/herb	–	–
Eriocaulales	Eriocaulaceae	<i>Eriocaulon decangulare</i> var. <i>decangulare</i>	tenangle pipewort	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Eupatorium capillifolium</i>	dogfennel	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Eupatorium compositifolium</i>	yankeeweed	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Eupatorium rotundifolium</i>	roundleaf thoroughwort	Native	Forb/herb	–	–

^A Information obtained from the PLANTS database (USDA 2023).

^B Information obtained from the North Carolina Invasive Plant Council (NC-IPC 2023).

^C North Carolina Natural Heritage rarity and watch list status (SC-V: Special Concern-Vulnerable; W1: Watch List, category 1; W7: Watch List, category 7) and imperilment rank (S2: Imperiled; S3: Vulnerable) information obtained from the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022).

Table 9 (continued). Vascular plants observed during the 2022 SECN terrestrial vegetation monitoring effort at Moores Creek National Battlefield.

Order ^A	Family ^A	Scientific Name	Common Name ^A	Native Status ^A	Growth Form ^A	State Invasive Status ^B	North Carolina Rare Protected Status ^C
Euphorbiales	Euphorbiaceae	<i>Euphorbia maculata</i>	spotted sandmat	Native	Forb/herb	–	–
Scrophulariales	Oleaceae	<i>Fraxinus caroliniana</i>	Carolina ash	Native	Tree	–	–
Rubiales	Rubiaceae	<i>Galium obtusum</i> var. <i>filifolium</i>	bluntleaf bedstraw	Native	Forb/herb	–	–
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 uniflorum</i>	oneflower bedstraw	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Gamochaeta coarctata</i>	gray everlasting	Non–native	Forb/herb	–	–
Ericales	Ericaceae	<i>Gaylussacia bigeloviana</i>	dwarf huckleberry	Native	Shrub	–	W7; S2
Ericales	Ericaceae	<i>Gaylussacia frondosa</i>	dangleberry / blue huckleberry	Native	Shrub	–	–
Gentianales	Loganiaceae	<i>Gelsemium sempervirens</i>	Carolina jessamine	Native	Vine, Shrub	–	–
Asterales	Asteraceae	<i>Helenium flexuosum</i>	southern sneezeweed / purplehead sneezeweed	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Helianthus angustifolius</i>	narrowleaf sunflower / swamp sunflower	Native	Forb/herb	–	–
Aristolochiales	Aristolochiaceae	<i>Hexastylis arifolia</i>	littlebrownjug	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Hieracium gronovii</i>	queendevil	Native	Forb/herb	–	–
Apiales	Apiaceae	<i>Hydrocotyle verticillata</i>	whorled marshpennywort	Native	Forb/herb	–	–
Liliales	Liliaceae	<i>Hymenocallis crassifolia</i>	coastal Carolina spiderlily	Native	Forb/herb	–	–
Theales	Clusiaceae	<i>Hypericum cistifolium</i>	roundpod St. Johnswort	Native	Forb/herb	–	–
Theales	Clusiaceae	<i>Hypericum crux–andreae</i>	St. Peterswort	Native	Subshrub, Shrub	–	–
Theales	Clusiaceae	<i>Hypericum densiflorum</i>	bushy St. Johnswort	Native	Shrub	–	–
Theales	Clusiaceae	<i>Hypericum galioides</i>	bedstraw St. Johnswort	Native	Forb/herb	–	–

^A Information obtained from the PLANTS database (USDA 2023).

^B Information obtained from the North Carolina Invasive Plant Council (NC-IPC 2023).

^C North Carolina Natural Heritage rarity and watch list status (SC-V: Special Concern-Vulnerable; W1: Watch List, category 1; W7: Watch List, category 7) and imperilment rank (S2: Imperiled; S3: Vulnerable) information obtained from the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022).

Table 9 (continued). Vascular plants observed during the 2022 SECN terrestrial vegetation monitoring effort at Moores Creek National Battlefield.

Order ^A	Family ^A	Scientific Name	Common Name ^A	Native Status ^A	Growth Form ^A	State Invasive Status ^B	North Carolina Rare Protected Status ^C
Theales	Clusiaceae	<i>Hypericum hypericoides</i>	St. Andrew's cross	Native	Subshrub, Shrub	–	–
Theales	Clusiaceae	<i>Hypericum mutilum</i>	dwarf St. Johnswort	Native	Forb/herb	–	–
Liliales	Liliaceae	<i>Hypoxis curtissii</i>	Curtis' star-grass	Native	Forb/herb	–	–
Liliales	Liliaceae	<i>Hypoxis hirsuta</i>	common goldstar	Native	Forb/herb	–	–
Celastrales	Aquifoliaceae	<i>Ilex amelanchier</i>	sarvis holly	Native	Shrub, Tree	–	W1; S3
Celastrales	Aquifoliaceae	<i>Ilex coriacea</i>	large gallberry	Native	Shrub	–	–
Celastrales	Aquifoliaceae	<i>Ilex glabra</i>	little gallberry / inkberry	Native	Shrub	–	–
Celastrales	Aquifoliaceae	<i>Ilex opaca</i>	American holly	Native	Tree, Shrub	–	–
Geraniales	Balsaminaceae	<i>Impatiens capensis</i>	jewelweed	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Imperata cylindrica</i>	cogongrass	Non-native	Graminoid	Rank 2 (Significant Threat)	–
Rosales	Grossulariaceae	<i>Itea virginica</i>	Virginia–willow / sweetspire	Native	Shrub	–	–
Juncals	Juncaceae	<i>Juncus acuminatus</i>	tapertip rush	Native	Graminoid	–	–
Juncals	Juncaceae	<i>Juncus biflorus</i>	bog rush	Native	Graminoid	–	–
Juncals	Juncaceae	<i>Juncus coriaceus</i>	leathery rush	Native	Graminoid	–	–
Liliales	Haemodoraceae	<i>Lachnanthes caroliniana</i>	Carolina redroot	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Lactuca graminifolia</i> var. <i>graminifolia</i>	grassleaf lettuce	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Leersia oryzoides</i>	rice cutgrass	Native	Graminoid	–	–
Fabales	Fabaceae	<i>Lespedeza angustifolia</i>	narrowleaf lespedeza	Native	Forb/herb	–	–

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^B Information obtained from the North Carolina Invasive Plant Council (NC-IPC 2023).

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Table 9 (continued). Vascular plants observed during the 2022 SECN terrestrial vegetation monitoring effort at Moores Creek National Battlefield.

Order ^A	Family ^A	Scientific Name	Common Name ^A	Native Status ^A	Growth Form ^A	State Invasive Status ^B	North Carolina Rare Protected Status ^C
Fabales	Fabaceae	<i>Lespedeza capitata</i>	roundhead lespedeza	Native	Forb/herb	–	–
Fabales	Fabaceae	<i>Lespedeza cuneata</i>	sericea lespedeza	Non–native	Forb/herb	Rank 1 (Severe Threat)	–
Fabales	Fabaceae	<i>Lespedeza hirta</i> var. <i>curtissii</i>	hairy lespedeza	Native	Forb/herb	–	–
Fabales	Fabaceae	<i>Lespedeza stuevei</i>	tall lespedeza	Native	Forb/herb	–	–
Scrophulariales	Oleaceae	<i>Ligustrum sinense</i>	Chinese privet	Non–native	Tree, Shrub	Rank 1 (Severe Threat)	–
Linales	Linaceae	<i>Linum curtissii</i>	stiff yellow flax	Native	Forb/herb	–	–
Hamamelidales	Hamamelidaceae	<i>Liquidambar styraciflua</i>	sweetgum	Native	Tree	–	–
Magnoliales	Magnoliaceae	<i>Liriodendron tulipifera</i>	tuliptree	Native	Tree	–	–
Campanulales	Campanulaceae	<i>Lobelia cardinalis</i>	cardinalflower	Native	Forb/herb	–	–
Campanulales	Campanulaceae	<i>Lobelia glandulosa</i>	glade lobelia	Native	Forb/herb	–	–
Polypodiales	Blechnaceae	<i>Lorinseria areolata</i>	netted chainfern	Native	Forb/herb	–	–
Myrtales	Onagraceae	<i>Ludwigia alternifolia</i>	seedbox	Native	Forb/herb	–	–
Myrtales	Onagraceae	<i>Ludwigia palustris</i>	marsh seedbox	Native	Forb/herb	–	–
Myrtales	Onagraceae	<i>Ludwigia virgata</i>	savanna seedbox / savannah primrose–willow	Native	Forb/herb	–	–
Lycopodiales	Lycopodiaceae	<i>Lycopodiella alopecuroides</i>	foxtail clubmoss	Native	Forb/herb	–	–
Ericales	Ericaceae	<i>Lyonia lucida</i>	shining fetterbush / fetterbush lyonia	Native	Shrub	–	–
Magnoliales	Magnoliaceae	<i>Magnolia grandiflora</i>	southern magnolia	Native	Tree	–	–
Magnoliales	Magnoliaceae	<i>Magnolia virginiana</i> var. <i>virginiana</i>	sweetbay	Native	Tree, Shrub	–	–

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^B Information obtained from the North Carolina Invasive Plant Council (NC-IPC 2023).

^C North Carolina Natural Heritage rarity and watch list status (SC-V: Special Concern-Vulnerable; W1: Watch List, category 1; W7: Watch List, category 7) and imperilment rank (S2: Imperiled; S3: Vulnerable) information obtained from the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022).

Table 9 (continued). Vascular plants observed during the 2022 SECN terrestrial vegetation monitoring effort at Moores Creek National Battlefield.

Order ^A	Family ^A	Scientific Name	Common Name ^A	Native Status ^A	Growth Form ^A	State Invasive Status ^B	North Carolina Rare Protected Status ^C
Asterales	Asteraceae	<i>Mikania scandens</i>	climbing hempvine	Native	Vine, Forb/herb	–	–
Rubiales	Rubiaceae	<i>Mitchella repens</i>	partridgeberry	Native	Subshrub, Forb/herb	–	–
Gentianales	Loganiaceae	<i>Mitreola sessilifolia</i>	swamp hornpod	Native	Forb/herb	–	–
Myricales	Myricaceae	<i>Morella cerifera</i>	wax myrtle	Native	Tree, Subshrub, Shrub	–	–
Commelinales	Commelinaceae	<i>Murdannia keisak</i>	mud–annie / marsh dewflower	Non–native	Forb/herb	Rank 1 (Severe Threat)	–
Rhamnales	Vitaceae	<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	muscadine	Native	Vine	–	–
Rhamnales	Vitaceae	<i>Nekemias arborea</i>	peppervine	Native	Shrub, Vine	–	–
Cornales	Cornaceae	<i>Nyssa biflora</i>	swamp tupelo	Native	Tree	–	–
Cornales	Cornaceae	<i>Nyssa sylvatica</i>	blackgum	Native	Tree	–	–
Caryophyllales	Cactaceae	<i>Opuntia mesacantha</i> ssp. <i>mesacantha</i>	devil’s–tongue	Native	Forb/herb	–	–
Polypodiales	Osmundaceae	<i>Osmunda spectabilis</i>	royal fern	Native	Forb/herb	–	–
Polypodiales	Osmundaceae	<i>Osmundastrum cinnamomeum</i>	cinnamon fern	Native	Forb/herb	–	–
Geraniales	Oxalidaceae	<i>Oxalis stricta</i>	common yellow oxalis	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Packera glabella</i>	butterweed	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Packera tomentosa</i>	woolly ragwort	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Panicum</i>	panicgrass	Native	Graminoid	–	–
Rhamnales	Vitaceae	<i>Parthenocissus quinquefolia</i>	Virginia creeper	Native	Vine	–	–

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Table 9 (continued). Vascular plants observed during the 2022 SECN terrestrial vegetation monitoring effort at Moores Creek National Battlefield.

Order ^A	Family ^A	Scientific Name	Common Name ^A	Native Status ^A	Growth Form ^A	State Invasive Status ^B	North Carolina Rare Protected Status ^C
Cyperales	Poaceae	<i>Paspalum notatum</i>	bahia grass	Non–native	Graminoid	Rank 3 (Lesser Threat)	–
Cyperales	Poaceae	<i>Paspalum setaceum var. villosissimum</i>	thin paspalum	Native	Graminoid	–	–
Laurales	Lauraceae	<i>Persea palustris</i>	swamp bay	Native	Shrub, Tree	–	–
Polygonales	Polygonaceae	<i>Persicaria hydropiperoides</i>	swamp smartweed	Native	Forb/herb	–	–
Polygonales	Polygonaceae	<i>Persicaria longiseta</i>	Oriental lady’s thumb	Non–native	Forb/herb	Rank 2 (Significant Threat)	–
Polygonales	Polygonaceae	<i>Persicaria pensylvanica</i>	Pennsylvania smartweed	Native	Forb/herb	–	–
Pinales	Pinaceae	<i>Pinus palustris</i>	longleaf pine	Native	Tree	–	–
Pinales	Pinaceae	<i>Pinus taeda</i>	loblolly pine	Native	Tree	–	–
Asterales	Asteraceae	<i>Pityopsis nervosa</i>	narrowleaf silkgrass	Native	Forb/herb	–	–
Polypodiales	Polypodiaceae	<i>Pleopeltis michauxiana</i>	resurrection fern	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Pluchea baccharis</i>	rosy camphorweed	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Pluchea camphorata</i>	camphor pluchea	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Poaceae</i>	Grass Family	Unknown	Graminoid	–	–
Polygalales	Polygalaceae	<i>Polygala lutea</i>	orange milkwort	Native	Forb/herb	–	–
Scrophulariales	Buddlejaceae	<i>Polypremum procumbens</i>	juniper leaf	Native	Forb/herb	–	–
Salicales	Salicaceae	<i>Populus heterophylla</i>	swamp cottonwood	Native	Tree	–	–
Haloragales	Haloragaceae	<i>Proserpinaca palustris</i>	marsh mermaidweed	Native	Forb/herb	–	–
Rosales	Rosaceae	<i>Prunus caroliniana</i>	Carolina laurelcherry	Native	Tree, Shrub	–	–

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Table 9 (continued). Vascular plants observed during the 2022 SECN terrestrial vegetation monitoring effort at Moores Creek National Battlefield.

Order ^A	Family ^A	Scientific Name	Common Name ^A	Native Status ^A	Growth Form ^A	State Invasive Status ^B	North Carolina Rare Protected Status ^C
Asterales	Asteraceae	<i>Pseudognaphalium obtusifolium</i>	rabbit–tobacco	Native	Forb/herb	–	–
Polypodiales	Dennstaedtiaceae	<i>Pteridium pseudocaudatum</i>	western brackenfern	Native	Forb/herb	–	–
Lamiales	Lamiaceae	<i>Pycnanthemum flexuosum</i>	Savanna mint / Appalachian mountainmint	Native	Forb/herb	–	–
Fagales	Fagaceae	<i>Quercus hemisphaerica</i>	Darlington oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus laurifolia</i>	laurel oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus lyrata</i>	overcup oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus margarettiae</i>	sand post oak	Native	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 stellata</i>	post oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus velutina</i>	black oak	Native	Tree	–	–
Myrtales	Melastomataceae	<i>Rhexia alifanus</i>	savannah meadowbeauty	Native	Forb/herb	–	–
Myrtales	Melastomataceae	<i>Rhexia petiolata</i>	fringed meadowbeauty	Native	Forb/herb	–	–
Myrtales	Melastomataceae	<i>Rhexia virginica</i>	Virginia meadow–beauty / handsome Harry	Native	Forb/herb	–	–
Ericales	Ericaceae	<i>Rhododendron atlanticum</i>	dwarf azalea	Native	Shrub	–	–
Sapindales	Anacardiaceae	<i>Rhus copallinum</i> var. <i>copallinum</i>	winged sumac	Native	Shrub, Tree	–	–
Cyperales	Cyperaceae	<i>Rhynchospora caduca</i>	anglestem beaksedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Rhynchospora rariflora</i>	fewflower beaksedge	Native	Graminoid	–	–
Rosales	Rosaceae	<i>Rubus cuneifolius</i>	sand blackberry	Native	Subshrub, Vine	–	–

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^B Information obtained from the North Carolina Invasive Plant Council (NC-IPC 2023).

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Table 9 (continued). Vascular plants observed during the 2022 SECN terrestrial vegetation monitoring effort at Moores Creek National Battlefield.

Order ^A	Family ^A	Scientific Name	Common Name ^A	Native Status ^A	Growth Form ^A	State Invasive Status ^B	North Carolina Rare Protected Status ^C
Rosales	Rosaceae	<i>Rubus pensilvanicus</i>	eastern blackberry / sawtooth blackberry	Native	Subshrub, Vine	–	–
Rosales	Rosaceae	<i>Rubus trivialis</i>	southern dewberry	Native	Subshrub, Vine	–	–
Asterales	Asteraceae	<i>Rudbeckia</i>	coneflower	Native	Forb/herb	–	–
Gentianales	Gentianaceae	<i>Sabatia difformis</i>	lanceleaf rose gentian	Native	Forb/herb	–	–
Salicales	Salicaceae	<i>Salix</i>	willow	Native	Tree	–	–
Lamiales	Lamiaceae	<i>Salvia lyrata</i>	lyreleaf sage	Native	Forb/herb	–	–
Laurales	Lauraceae	<i>Sassafras albidum</i>	sassafras	Native	Shrub, Tree	–	–
Piperales	Saururaceae	<i>Saururus cernuus</i>	lizard's tail	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	little bluestem	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Scleria</i>	nutrush	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Scleria ciliata</i> var. <i>ciliata</i>	fringed nutrush	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Scleria flaccida</i>	whip nutrush	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Scleria pauciflora</i> var. <i>pauciflora</i>	fewflower nutrush	Native	Graminoid	–	–
Lamiales	Lamiaceae	<i>Scutellaria integrifolia</i>	narrowleaf skullcap / helmet flower	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Setaria parviflora</i>	marsh bristlegrass	Native	Graminoid	–	–
Liliales	Iridaceae	<i>Sisyrinchium fuscatum</i>	coastal plain blue-eyed grass	Native	Forb/herb	–	–
Liliales	Smilacaceae	<i>Smilax auriculata</i>	earleaf greenbriar	Native	Shrub, Vine	–	–
Liliales	Smilacaceae	<i>Smilax bona-nox</i> var. <i>bona-nox</i>	saw greenbriar	Native	Shrub, Vine	–	–
Liliales	Smilacaceae	<i>Smilax glauca</i>	whiteleaf greenbriar	Native	Shrub, Vine	–	–

^A Information obtained from the PLANTS database (USDA 2023).

^B Information obtained from the North Carolina Invasive Plant Council (NC-IPC 2023).

^C North Carolina Natural Heritage rarity and watch list status (SC-V: Special Concern-Vulnerable; W1: Watch List, category 1; W7: Watch List, category 7) and imperilment rank (S2: Imperiled; S3: Vulnerable) information obtained from the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022). **Table 9 (continued).** Vascular plants observed during the 2022 SECN terrestrial vegetation monitoring effort at Moores Creek National Battlefield.

Table 9 (continued). Vascular plants observed during the 2022 SECN terrestrial vegetation monitoring effort at Moores Creek National Battlefield.

Order ^A	Family ^A	Scientific Name	Common Name ^A	Native Status ^A	Growth Form ^A	State Invasive Status ^B	North Carolina Rare Protected Status ^C
Liliales	Smilacaceae	<i>Smilax laurifolia</i>	laurel greenbriar	Native	Shrub, Vine	–	–
Liliales	Smilacaceae	<i>Smilax rotundifolia</i>	common greenbriar / roundleaf greenbriar	Native	Shrub, Vine	–	–
Liliales	Smilacaceae	<i>Smilax walteri</i>	coral greenbriar	Native	Shrub, Vine	–	–
Asterales	Asteraceae	<i>Solidago</i>	goldenrod	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Solidago fistulosa</i>	pine barren goldenrod	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Sporobolus indicus</i>	smut grass	Non–native	Graminoid	–	–
Euphorbiales	Euphorbiaceae	<i>Stillingia sylvatica</i>	queen’s–delight	Native	Forb/herb	–	–
Solanales	Convolvulaceae	<i>Stylisma patens</i>	coastal plain dawnflower	Native	Forb/herb, Vine	–	–
Cornales	Cornaceae	<i>Swida foemina</i>	stiff dogwood	Native	Shrub, Tree	–	–
Asterales	Asteraceae	<i>Symphotrichum</i>	aster	Native	Forb/herb	–	–
Ebenales	Symplocaceae	<i>Symplocos tinctoria</i>	common sweetleaf	Native	Shrub, Tree	–	–
Pinales	Cupressaceae	<i>Taxodium distichum</i>	bald–cypress	Native	Tree	–	–
Fabales	Fabaceae	<i>Tephrosia hispida</i>	sprawling hoarypea	Native	Forb/herb	–	–
Ranunculales	Ranunculaceae	<i>Thalictrum macrostylum</i>	small–leaved meadowrue	Native	Forb/herb	–	SC–V; S2
Gentianales	Apocynaceae	<i>Thyrsanthella difformis</i>	climbing dogbane	Native	Vine	–	–
Sapindales	Anacardiaceae	<i>Toxicodendron pubescens</i>	Atlantic poison oak	Native	Forb/herb	–	–
Sapindales	Anacardiaceae	<i>Toxicodendron radicans</i> var. <i>radicans</i>	eastern poison ivy	Native	Forb/herb, Shrub, Subshrub, Vine	–	–
Theales	Clusiaceae	<i>Triadenum walteri</i>	Walter’s marsh St. John’s–wort / greater marsh St. Johnswort	Native	Forb/herb	–	–

^A Information obtained from the PLANTS database (USDA 2023).

^B Information obtained from the North Carolina Invasive Plant Council (NC-IPC 2023).

^C North Carolina Natural Heritage rarity and watch list status (SC-V: Special Concern-Vulnerable; W1: Watch List, category 1; W7: Watch List, category 7) and imperilment rank (S2: Imperiled; S3: Vulnerable) information obtained from the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022).

Table 9 (continued). Vascular plants observed during the 2022 SECN terrestrial vegetation monitoring effort at Moores Creek National Battlefield.

Order ^A	Family ^A	Scientific Name	Common Name ^A	Native Status ^A	Growth Form ^A	State Invasive Status ^B	North Carolina Rare Protected Status ^C
Unknown	Unknown	<i>Unknown</i>	unknown	Unknown	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 formosum</i>	southern highbush blueberry	Native	Shrub	–	–
Ericales	Ericaceae	<i>Vaccinium fuscatum</i>	black highbush blueberry	Native	Shrub	–	–
Ericales	Ericaceae	<i>Vaccinium tenellum</i>	small black blueberry	Native	Shrub	–	–
Violales	Violaceae	<i>Viola</i>	violet	Native	Forb/herb	–	–
Fabales	Fabaceae	<i>Wisteria sinensis</i>	Chinese wisteria	Non–native	Vine	Rank 1 (Severe Threat)	–
Commelinales	Xyridaceae	<i>Xyris</i>	yelloweyed grass	Native	Forb/herb	–	–

^A Information obtained from the PLANTS database (USDA 2023).

^B Information obtained from the North Carolina Invasive Plant Council (NC-IPC 2023).

^C North Carolina Natural Heritage rarity and watch list status (SC-V: Special Concern-Vulnerable; W1: Watch List, category 1; W7: Watch List, category 7) and imperilment rank (S2: Imperiled; S3: Vulnerable) information obtained from the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022).

Appendix B. Species Diversity, Abundance, and Woody Stem Metrics Summarized by Broadly Defined Habitats at Moores Creek National Battlefield

Constancy and cover values for each vascular plant species observed within vegetation monitoring plots of Moores Creek National Battlefield (Table 10). Constancy represents the overall percentage of a species observed within plots of a particular broadly defined habitat. Table 11 summarizes basal area and density of woody stems across broadly defined habitats of Moores Creek National Battlefield.

Table 10. Constancy and average cover class for all vascular plant species observed in 11 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: CPAW = Coastal Plain Alluvial Wetlands (4 plots), CPNW = Coastal Plain Nonalluvial Wetlands (3 plots), and CPOUW = Coastal Plain Open Upland Woodlands (4 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	CPNW Constancy	CPNW Cover	CPOUW Constancy	CPOUW Cover
<i>Acalypha gracilens</i>	–	–	67	2	–	–
<i>Acalypha rhomboidea</i>	–	–	–	–	25	1
<i>Acer rubrum</i>	100	7	67	3	–	–
<i>Ambrosia artemisiifolia</i>	–	–	100	2	–	–
<i>Amelanchier obovalis</i>	25	1	–	–	50	1
<i>Anchistea virginica</i>	75	3	–	–	25	3
<i>Andropogon gyrans</i>	–	–	33	3	–	–
<i>Andropogon hirsutior</i>	–	–	33	1	–	–
<i>Andropogon virginicus</i> var. <i>virginicus</i>	25	2	67	2	75	2
<i>Arabidopsis thaliana</i>	–	–	33	2	–	–
<i>Aralia spinosa</i>	–	–	–	–	25	4
<i>Aronia arbutifolia</i>	–	–	67	2	50	2
<i>Arundinaria tecta</i>	75	4	33	2	75	4
<i>Baccharis halimifolia</i>	25	2	–	–	–	–
<i>Betula nigra</i>	50	2	–	–	–	–
<i>Bidens aristosa</i>	25	1	–	–	–	–
<i>Bignonia capreolata</i>	50	2	–	–	50	1
<i>Boehmeria cylindrica</i>	75	2	–	–	–	–
<i>Campsis radicans</i>	75	4	100	2	25	1
<i>Carex</i>	–	–	–	–	25	1
<i>Carex albolutescens</i>	–	–	33	1	–	–
<i>Carex debilis</i>	25	1	–	–	–	–

Table 10 (continued). Constancy and average cover class for all vascular plant species observed in 11 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: CPAW = Coastal Plain Alluvial Wetlands (4 plots), CPNW = Coastal Plain Nonalluvial Wetlands (3 plots), and CPOUW = Coastal Plain Open Upland Woodlands (4 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	CPNW Constancy	CPNW Cover	CPOUW Constancy	CPOUW Cover
<i>Carex glaucescens</i>	25	2	67	4	–	–
<i>Carex grayi</i>	25	2	–	–	–	–
<i>Carex intumescens</i> var. <i>intumescens</i>	75	3	–	–	–	–
<i>Carex louisianica</i>	25	1	–	–	–	–
<i>Carex turgescens</i>	25	2	–	–	–	–
<i>Carpinus caroliniana</i> var. <i>caroliniana</i>	25	1	–	–	–	–
<i>Carya tomentosa</i>	–	–	–	–	25	1
<i>Centella erecta</i>	25	3	100	5	–	–
<i>Chamaecrista nictitans</i> var. <i>nictitans</i>	25	1	67	2	–	–
<i>Chasmanthium latifolium</i>	25	2	–	–	–	–
<i>Chasmanthium laxum</i>	–	–	33	1	50	2
<i>Cirsium horridulum</i> var. <i>horridulum</i>	–	–	33	1	–	–
<i>Cladium jamaicense</i>	–	–	33	2	–	–
<i>Clethra alnifolia</i>	25	5	–	–	100	2
<i>Coleataenia anceps</i> ssp. <i>rhizomata</i>	–	–	–	–	25	3
<i>Commelina erecta</i> var. <i>erecta</i>	–	–	–	–	25	1
<i>Crataegus aestivalis</i>	25	3	–	–	–	–
<i>Crataegus flava</i>	–	–	–	–	25	1
<i>Crotalaria rotundifolia</i>	–	–	33	4	–	–
<i>Cuphea carthagenensis</i>	–	–	33	1	–	–
<i>Cyperus</i>	–	–	33	1	–	–
<i>Cyperus croceus</i>	–	–	–	–	75	2
<i>Cyperus retrorsus</i>	25	1	–	–	–	–
<i>Cyperus rotundus</i>	–	–	33	1	–	–
<i>Cyrilla racemiflora</i>	75	4	67	3	50	2
<i>Danthonia sericea</i>	–	–	33	4	–	–
<i>Desmodium paniculatum</i>	25	1	33	2	–	–
<i>Dichanthelium commutatum</i>	25	2	–	–	–	–
<i>Dichanthelium ensifolium</i>	–	–	–	–	25	1
<i>Dichanthelium erectifolium</i>	–	–	100	6	–	–
<i>Dichanthelium laxiflorum</i>	–	–	67	2	–	–

Table 10 (continued). Constancy and average cover class for all vascular plant species observed in 11 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: CPAW = Coastal Plain Alluvial Wetlands (4 plots), CPNW = Coastal Plain Nonalluvial Wetlands (3 plots), and CPOUW = Coastal Plain Open Upland Woodlands (4 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	CPNW Constancy	CPNW Cover	CPOUW Constancy	CPOUW Cover
<i>Dichanthelium leucothrix</i>	50	6	33	4	–	–
<i>Dichanthelium lucidum</i>	25	2	–	–	–	–
<i>Dichanthelium portoricense</i> ssp. <i>patulum</i>	–	–	–	–	25	2
<i>Dichanthelium scoparium</i>	–	–	100	2	75	1
<i>Dichanthelium tenue</i>	–	–	33	2	50	1
<i>Dichanthelium villosissimum</i> var. <i>villosissimum</i>	–	–	33	2	50	2
<i>Diodia virginiana</i>	–	–	67	2	–	–
<i>Diospyros virginiana</i>	25	2	33	4	100	2
<i>Eleocharis tuberculosa</i>	25	1	33	4	–	–
<i>Elephantopus tomentosus</i>	–	–	33	2	–	–
<i>Erechtites hieraciifolius</i>	50	2	33	1	50	2
<i>Eremochloa ophiuroides</i>	–	–	–	–	25	2
<i>Erianthus giganteus</i>	–	–	67	2	–	–
<i>Erigeron canadensis</i>	–	–	67	3	–	–
<i>Erigeron vernus</i>	–	–	33	2	–	–
<i>Eriocaulon decangulare</i> var. <i>decangulare</i>	–	–	33	2	–	–
<i>Eupatorium capillifolium</i>	50	3	100	3	25	2
<i>Eupatorium compositifolium</i>	25	2	67	2	–	–
<i>Eupatorium rotundifolium</i>	–	–	67	4	75	1
<i>Euphorbia maculata</i>	–	–	33	1	–	–
<i>Fraxinus caroliniana</i>	75	6	–	–	–	–
<i>Galium obtusum</i> var. <i>filifolium</i>	25	2	33	2	25	2
<i>Galium pilosum</i>	–	–	33	1	–	–
<i>Galium tinctorium</i> var. <i>floridanum</i>	50	2	–	–	–	–
<i>Galium uniflorum</i>	–	–	67	2	50	2
<i>Gamochaeta coarctata</i>	25	2	–	–	–	–
<i>Gaylussacia bigeloviana</i>	–	–	100	1	–	–
<i>Gaylussacia frondosa</i>	–	–	–	–	100	4
<i>Gelsemium sempervirens</i>	50	2	33	1	100	3
<i>Helenium flexuosum</i>	50	2	33	5	–	–
<i>Helianthus angustifolius</i>	–	–	100	2	–	–

Table 10 (continued). Constancy and average cover class for all vascular plant species observed in 11 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: CPAW = Coastal Plain Alluvial Wetlands (4 plots), CPNW = Coastal Plain Nonalluvial Wetlands (3 plots), and CPOUW = Coastal Plain Open Upland Woodlands (4 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	CPNW Constancy	CPNW Cover	CPOUW Constancy	CPOUW Cover
<i>Hexastylis arifolia</i>	25	1	–	–	25	2
<i>Hieracium gronovii</i>	–	–	33	2	–	–
<i>Hydrocotyle verticillata</i>	50	2	–	–	–	–
<i>Hymenocallis crassifolia</i>	75	2	–	–	–	–
<i>Hypericum cistifolium</i>	–	–	–	–	25	1
<i>Hypericum crux-andreae</i>	–	–	33	1	50	2
<i>Hypericum densiflorum</i>	50	1	–	–	–	–
<i>Hypericum galioides</i>	25	2	–	–	–	–
<i>Hypericum hypericoides</i>	25	3	–	–	–	–
<i>Hypericum mutilum</i>	50	2	–	–	–	–
<i>Hypoxis curtissii</i>	75	3	–	–	–	–
<i>Hypoxis hirsuta</i>	–	–	–	–	25	1
<i>Ilex amelanchier</i>	50	4	–	–	–	–
<i>Ilex coriacea</i>	25	3	–	–	–	–
<i>Ilex glabra</i>	25	2	67	3	100	4
<i>Ilex opaca</i>	75	6	33	2	75	2
<i>Impatiens capensis</i>	25	1	–	–	–	–
<i>Imperata cylindrica</i>	–	–	–	–	25	1
<i>Itea virginica</i>	75	2	–	–	–	–
<i>Juncus acuminatus</i>	50	1	–	–	–	–
<i>Juncus biflorus</i>	25	2	67	2	–	–
<i>Juncus coriaceous</i>	–	–	67	1	–	–
<i>Lachnanthes caroliniana</i>	–	–	67	4	–	–
<i>Lactuca graminifolia</i> var. <i>graminifolia</i>	–	–	33	2	25	1
<i>Leersia oryzoides</i>	50	1	67	4	–	–
<i>Lespedeza angustifolia</i>	–	–	33	4	–	–
<i>Lespedeza capitata</i>	25	1	–	–	–	–
<i>Lespedeza cuneata</i>	25	2	–	–	–	–
<i>Lespedeza hirta</i> var. <i>curtissii</i>	–	–	33	2	–	–
<i>Lespedeza stuevei</i>	–	–	33	2	–	–
<i>Ligustrum sinense</i>	25	1	–	–	–	–
<i>Linum curtissii</i>	–	–	33	2	–	–

Table 10 (continued). Constancy and average cover class for all vascular plant species observed in 11 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: CPAW = Coastal Plain Alluvial Wetlands (4 plots), CPNW = Coastal Plain Nonalluvial Wetlands (3 plots), and CPOUW = Coastal Plain Open Upland Woodlands (4 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	CPNW Constancy	CPNW Cover	CPOUW Constancy	CPOUW Cover
<i>Liquidambar styraciflua</i>	100	6	100	4	100	6
<i>Liriodendron tulipifera</i>	25	2	–	–	–	–
<i>Lobelia cardinalis</i>	50	2	–	–	–	–
<i>Lobelia glandulosa</i>	–	–	67	2	–	–
<i>Lorinseria areolata</i>	50	4	–	–	–	–
<i>Ludwigia alternifolia</i>	–	–	33	2	25	1
<i>Ludwigia palustris</i>	25	2	–	–	–	–
<i>Ludwigia virgata</i>	–	–	100	3	–	–
<i>Lycopodiella alopecuroides</i>	–	–	33	1	–	–
<i>Lyonia lucida</i>	25	6	–	–	50	4
<i>Magnolia grandiflora</i>	–	–	–	–	25	2
<i>Magnolia virginiana</i> var. <i>virginiana</i>	25	4	33	2	100	3
<i>Mikania scandens</i>	75	2	33	1	–	–
<i>Mitchella repens</i>	25	1	–	–	–	–
<i>Mitreola sessilifolia</i>	–	–	67	1	–	–
<i>Morella cerifera</i>	–	–	–	–	100	3
<i>Murdannia keisak</i>	50	1	–	–	–	–
<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	75	6	33	1	100	6
<i>Nekemias arborea</i>	–	–	33	1	–	–
<i>Nyssa biflora</i>	100	6	33	1	–	–
<i>Nyssa sylvatica</i>	–	–	–	–	50	2
<i>Opuntia mesacantha</i> ssp. <i>mesacantha</i>	–	–	–	–	25	1
<i>Osmunda spectabilis</i>	75	2	33	1	–	–
<i>Osmundastrum cinnamomeum</i>	25	3	33	2	25	3
<i>Oxalis stricta</i>	25	2	33	1	–	–
<i>Packera glabella</i>	50	2	–	–	–	–
<i>Packera tomentosa</i>	–	–	67	1	–	–
<i>Panicum</i>	–	–	33	2	–	–
<i>Parthenocissus quinquefolia</i>	75	2	33	3	100	4
<i>Paspalum notatum</i>	25	1	33	3	–	–
<i>Paspalum setaceum</i> var. <i>villosissimum</i>	–	–	67	2	–	–

Table 10 (continued). Constancy and average cover class for all vascular plant species observed in 11 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: CPAW = Coastal Plain Alluvial Wetlands (4 plots), CPNW = Coastal Plain Nonalluvial Wetlands (3 plots), and CPOUW = Coastal Plain Open Upland Woodlands (4 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	CPNW Constancy	CPNW Cover	CPOUW Constancy	CPOUW Cover
<i>Persea palustris</i>	25	5	–	–	100	3
<i>Persicaria hydropiperoides</i>	25	1	–	–	–	–
<i>Persicaria longiseta</i>	–	–	33	1	–	–
<i>Persicaria pensylvanica</i>	50	1	–	–	–	–
<i>Pinus palustris</i>	–	–	33	3	–	–
<i>Pinus taeda</i>	100	6	100	2	100	7
<i>Pityopsis nervosa</i>	–	–	–	–	25	2
<i>Pleopeltis michauxiana</i>	25	1	–	–	–	–
<i>Pluchea baccharis</i>	25	3	67	4	25	1
<i>Pluchea camphorata</i>	50	1	–	–	–	–
<i>Poaceae</i>	–	–	67	1	–	–
<i>Polygala lutea</i>	–	–	33	2	–	–
<i>Polypremum procumbens</i>	–	–	100	2	–	–
<i>Populus heterophylla</i>	25	1	–	–	–	–
<i>Proserpinaca palustris</i>	50	2	–	–	–	–
<i>Prunus caroliniana</i>	–	–	33	1	75	1
<i>Pseudognaphalium obtusifolium</i>	–	–	67	2	–	–
<i>Pteridium pseudocaudatum</i>	–	–	–	–	50	2
<i>Pycnanthemum flexuosum</i>	–	–	100	4	–	–
<i>Quercus hemisphaerica</i>	–	–	–	–	25	2
<i>Quercus laurifolia</i>	75	6	–	–	–	–
<i>Quercus lyrata</i>	25	7	–	–	–	–
<i>Quercus margarettiae</i>	–	–	33	2	–	–
<i>Quercus michauxii</i>	25	1	–	–	–	–
<i>Quercus nigra</i>	50	5	67	2	100	5
<i>Quercus phellos</i>	–	–	33	2	25	1
<i>Quercus stellata</i>	–	–	33	3	25	2
<i>Quercus velutina</i>	–	–	–	–	50	2
<i>Rhexia alifanus</i>	–	–	33	2	–	–
<i>Rhexia petiolata</i>	–	–	67	2	–	–
<i>Rhexia virginica</i>	25	1	100	4	25	1
<i>Rhododendron atlanticum</i>	–	–	–	–	25	2
<i>Rhus copallinum</i> var. <i>copallinum</i>	–	–	67	2	100	2

Table 10 (continued). Constancy and average cover class for all vascular plant species observed in 11 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: CPAW = Coastal Plain Alluvial Wetlands (4 plots), CPNW = Coastal Plain Nonalluvial Wetlands (3 plots), and CPOUW = Coastal Plain Open Upland Woodlands (4 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	CPNW Constancy	CPNW Cover	CPOUW Constancy	CPOUW Cover
<i>Rhynchospora caduca</i>	25	1	100	2	–	–
<i>Rhynchospora rariflora</i>	–	–	100	4	–	–
<i>Rubus cuneifolius</i>	–	–	33	2	50	2
<i>Rubus pensilvanicus</i>	50	2	–	–	75	2
<i>Rubus trivialis</i>	–	–	33	2	–	–
<i>Rudbeckia</i>	–	–	33	2	–	–
<i>Sabatia difformis</i>	–	–	67	2	–	–
<i>Salix</i>	–	–	33	1	–	–
<i>Salvia lyrata</i>	–	–	67	1	50	1
<i>Sassafras albidum</i>	50	1	–	–	100	4
<i>Saururus cernuus</i>	75	2	33	2	–	–
<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	–	–	67	1	–	–
<i>Scleria</i>	–	–	33	1	–	–
<i>Scleria ciliata</i> var. <i>ciliata</i>	–	–	–	–	50	2
<i>Scleria flaccida</i>	25	4	–	–	–	–
<i>Scleria pauciflora</i> var. <i>pauciflora</i>	–	–	–	–	25	2
<i>Scutellaria integrifolia</i>	–	–	100	2	–	–
<i>Setaria parviflora</i>	–	–	33	2	–	–
<i>Sisyrinchium fuscatum</i>	–	–	33	1	–	–
<i>Smilax auriculata</i>	–	–	–	–	75	2
<i>Smilax bona-nox</i> var. <i>bona-nox</i>	25	2	33	2	50	2
<i>Smilax glauca</i>	75	2	100	2	100	2
<i>Smilax laurifolia</i>	100	2	33	1	–	–
<i>Smilax rotundifolia</i>	100	5	–	–	25	3
<i>Smilax walteri</i>	75	5	–	–	75	2
<i>Solidago</i>	75	2	33	1	–	–
<i>Solidago fistulosa</i>	–	–	–	–	25	1
<i>Sporobolus indicus</i>	–	–	–	–	25	1
<i>Stillingia sylvatica</i>	–	–	–	–	25	2
<i>Stylisma patens</i>	–	–	67	2	–	–
<i>Swida foemina</i>	50	2	–	–	–	–
<i>Symphotrichum</i>	25	2	–	–	–	–

Table 10 (continued). Constancy and average cover class for all vascular plant species observed in 11 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: CPAW = Coastal Plain Alluvial Wetlands (4 plots), CPNW = Coastal Plain Nonalluvial Wetlands (3 plots), and CPOUW = Coastal Plain Open Upland Woodlands (4 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	CPNW Constancy	CPNW Cover	CPOUW Constancy	CPOUW Cover
<i>Symplocos tinctoria</i>	25	5	–	–	100	4
<i>Taxodium distichum</i>	75	6	–	–	–	–
<i>Tephrosia hispidula</i>	–	–	67	3	–	–
<i>Thalictrum macrostylum</i>	–	–	33	1	–	–
<i>Thyrsanthella difformis</i>	25	2	–	–	–	–
<i>Toxicodendron pubescens</i>	–	–	33	2	–	–
<i>Toxicodendron radicans</i> var. <i>radicans</i>	100	3	–	–	75	2
<i>Triadenum walteri</i>	75	2	–	–	–	–
Unknown	–	–	33	1	–	–
<i>Vaccinium arboreum</i>	25	1	33	1	25	3
<i>Vaccinium elliotii</i>	75	4	–	–	–	–
<i>Vaccinium formosum</i>	25	4	–	–	100	2
<i>Vaccinium fuscatum</i>	–	–	33	1	–	–
<i>Vaccinium tenellum</i>	–	–	33	2	–	–
<i>Viola</i>	75	2	33	1	–	–
<i>Wisteria sinensis</i>	25	1	–	–	–	–
<i>Xyris</i>	–	–	100	2	–	–

Table 11. Basal area (BA, m²/ha) and density (Den, count/ha) of woody vascular plant species observed in 11 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: CPAW = Coastal Plain Alluvial Wetlands (4 plots), CPNW = Coastal Plain Nonalluvial Wetlands (3 plots), and CPOUW = Coastal Plain Open Upland Woodlands (4 plots). [Sap—Sapling; Seed—Seedling].

Species	CPAW					CPNW					CPOUW				
	Tree BA	Tree Den	Sap BA	Sap Den	Seed Den	Tree BA	Tree Den	Sap BA	Sap Den	Seed Den	Tree BA	Tree Den	Sap BA	Sap Den	Seed Den
<i>Acer rubrum</i>	2.50	112.50	2.49	1000.00	6250.00	—	—	—	—	416.67	—	—	—	—	—
<i>Amelanchier obovalis</i>	—	—	—	—	312.50	—	—	—	—	—	—	—	—	—	—
<i>Aronia arbutifolia</i>	—	—	—	—	—	—	—	—	—	833.33	—	—	—	—	—
<i>Baccharis halimifolia</i>	—	—	—	—	312.50	—	—	—	—	—	—	—	—	—	—
<i>Betula nigra</i>	0.22	6.25	—	—	312.50	—	—	—	—	—	—	—	—	—	—
<i>Crataegus aestivalis</i>	—	—	1.10	250.00	312.50	—	—	—	—	—	—	—	—	—	—
<i>Fraxinus caroliniana</i>	—	—	8.14	5250.00	6562.50	—	—	—	—	—	—	—	—	—	—
<i>Gaylussacia bigeloviana</i>	—	—	—	—	—	—	—	—	—	2083.33	—	—	—	—	—
<i>Ilex amelanchier</i>	—	—	4.97	1500.00	—	—	—	—	—	—	—	—	—	—	—
<i>Ilex coriacea</i>	—	—	—	—	312.50	—	—	—	—	—	—	—	—	—	—
<i>Ilex opaca</i>	0.89	50.00	2.48	750.00	1250.00	—	—	—	—	416.67	—	—	—	—	—
<i>Itea virginica</i>	—	—	—	—	1250.00	—	—	—	—	—	—	—	—	—	—
<i>Ligustrum sinense</i>	—	—	—	—	312.50	—	—	—	—	—	—	—	—	—	—
<i>Liriodendron tulipifera</i>	—	—	—	—	625.00	—	—	—	—	—	—	—	—	—	—
<i>Nyssa biflora</i>	12.18	287.50	1.10	250.00	16875.00	—	—	—	—	—	—	—	—	—	—
<i>Quercus</i>	0.95	6.25	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Quercus laurifolia</i>	2.51	37.50	1.10	250.00	—	—	—	—	—	—	—	—	—	—	—
<i>Quercus lyrata</i>	3.67	31.25	—	—	312.50	—	—	—	—	—	—	—	—	—	—
<i>Quercus phellos</i>	—	—	—	—	—	—	—	0.01	666.67	1250.00	—	—	—	—	—
<i>Smilax laurifolia</i>	—	—	0.06	250.00	1250.00	—	—	—	—	—	—	—	—	—	—
<i>Taxodium distichum</i>	13.70	162.50	—	—	937.50	—	—	—	—	—	—	—	—	—	—
<i>Toxicodendron pubescens</i>	—	—	—	—	—	—	—	—	—	6250.00	—	—	—	—	—
<i>Toxicodendron radicans</i> var. <i>radicans</i>	—	—	1.99	1250.00	1250.00	—	—	—	—	—	—	—	—	—	—

Table 11 (continued). Basal area (BA, m²/ha) and density (Den, count/ha) of woody vascular plant species observed in 11 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: CPAW = Coastal Plain Alluvial Wetlands (4 plots), CPNW = Coastal Plain Nonalluvial Wetlands (3 plots), and CPOUW = Coastal Plain Open Upland Woodlands (4 plots). [Sap—Sapling; Seed—Seedling].

Species	CPAW					CPNW					CPOUW				
	Tree BA	Tree Den	Sap BA	Sap Den	Seed Den	Tree BA	Tree Den	Sap BA	Sap Den	Seed Den	Tree BA	Tree Den	Sap BA	Sap Den	Seed Den
Unknown	—	—	—	—	—	0.14	6.25	—	—	—	—	—	—	—	—
<i>Vaccinium elliotii</i>	—	—	0.04	2000.00	2500.00	—	—	—	—	—	—	—	—	—	—
<i>Gaylussacia frondosa</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	49687.50
<i>Ilex glabra</i>	—	—	—	—	—	—	—	—	—	24583.33	—	—	0.10	2250.00	32187.50
<i>Gelsemium sempervirens</i>	—	—	—	—	312.50	—	—	—	—	—	—	—	0.03	1750.00	25312.50
<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	—	—	0.74	1500.00	4062.50	—	—	—	—	—	—	—	2.12	12750.00	20937.50
<i>Lyonia lucida</i>	—	—	5.18	5500.00	9375.00	—	—	—	—	—	—	—	0.01	500.00	14062.50
<i>Parthenocissus quinquefolia</i>	—	—	—	—	312.50	—	—	—	—	833.33	—	—	—	—	12812.50
<i>Symplocos tinctoria</i>	—	—	1.38	500.00	—	—	—	—	—	—	—	—	0.09	2000.00	8437.50
<i>Pinus taeda</i>	16.65	93.75	—	—	16875.00	—	—	—	—	833.33	25.07	175.00	—	—	6562.50
<i>Cyrilla racemiflora</i>	—	—	—	—	1562.50	—	—	—	—	7500.00	—	—	0.00	250.00	6250.00
<i>Smilax glauca</i>	—	—	0.12	500.00	312.50	—	—	—	—	2083.33	—	—	0.00	250.00	5625.00
<i>Clethra alnifolia</i>	—	—	0.06	250.00	1250.00	—	—	—	—	—	—	—	0.00	250.00	5000.00
<i>Morella cerifera</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4687.50
<i>Liquidambar styraciflua</i>	5.56	43.75	0.28	250.00	4375.00	—	—	0.05	2666.67	6250.00	4.53	43.75	1.84	2250.00	4062.50
<i>Smilax bona-nox</i> var. <i>bona-nox</i>	—	—	—	—	—	—	—	—	—	—	—	—	0.40	1000.00	3437.50
<i>Quercus nigra</i>	0.44	18.75	1.10	250.00	—	—	—	0.01	666.67	—	1.78	43.75	0.01	750.00	3437.50
<i>Rhododendron atlanticum</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2500.00
<i>Smilax auriculata</i>	—	—	—	—	—	—	—	—	—	—	—	—	0.01	500.00	2500.00
<i>Smilax walteri</i>	—	—	0.88	5250.00	4375.00	—	—	—	—	—	—	—	0.00	250.00	2500.00
<i>Rhus copallinum</i> var. <i>copallinum</i>	—	—	—	—	—	—	—	—	—	7083.33	—	—	—	—	2187.50
<i>Sassafras albidum</i>	—	—	—	—	312.50	—	—	—	—	—	—	—	0.00	250.00	2187.50
<i>Bignonia capreolata</i>	—	—	—	—	312.50	—	—	—	—	—	—	—	—	—	1875.00

Table 11 (continued). Basal area (BA, m²/ha) and density (Den, count/ha) of woody vascular plant species observed in 11 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: CPAW = Coastal Plain Alluvial Wetlands (4 plots), CPNW = Coastal Plain Nonalluvial Wetlands (3 plots), and CPOUW = Coastal Plain Open Upland Woodlands (4 plots). [Sap—Sapling; Seed—Seedling].

Species	CPAW					CPNW					CPOUW				
	Tree BA	Tree Den	Sap BA	Sap Den	Seed Den	Tree BA	Tree Den	Sap BA	Sap Den	Seed Den	Tree BA	Tree Den	Sap BA	Sap Den	Seed Den
<i>Arundinaria tecta</i>	–	–	0.20	1500.00	3437.50	–	–	–	–	–	–	–	0.12	3250.00	1875.00
<i>Prunus caroliniana</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1562.50
<i>Persea palustris</i>	–	–	0.28	500.00	625.00	–	–	–	–	–	–	–	0.00	250.00	937.50
<i>Quercus stellata</i>	–	–	–	–	–	–	–	0.01	333.33	2916.67	–	–	–	–	625.00
<i>Aralia spinosa</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	312.50
<i>Carya tomentosa</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	312.50
<i>Crataegus flava</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	312.50
<i>Diospyros virginiana</i>	–	–	–	–	–	–	–	0.05	2333.33	–	–	–	–	–	312.50
<i>Smilax rotundifolia</i>	–	–	6.56	23750.00	5625.00	–	–	–	–	–	–	–	–	–	312.50
<i>Vaccinium formosum</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	312.50
<i>Campsis radicans</i>	–	–	2.48	750.00	2500.00	–	–	–	–	416.67	–	–	0.00	250.00	312.50
<i>Magnolia virginiana</i> var. <i>virginiana</i>	–	–	1.11	500.00	312.50	–	–	–	–	–	–	–	0.00	250.00	312.50

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