



Terrestrial Vegetation Monitoring at Cape Lookout National Seashore

2022 Data Summary



Sprawling live oaks (*Quercus virginiana*) and southern red cedar (*Juniperus virginiana*) dominate the canopy of a typical evergreen maritime forest on the Shackleford Banks unit of Cape Lookout National Seashore. Forested ecosystems of the Outer Banks are infrequent, and account for roughly 2% of the natural vegetation on Cape Lookout.

NPS / M. FORBES BOYLE (SECN Botanist).

Terrestrial vegetation monitoring at Cape Lookout National Seashore: 2022 data summary

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M. Forbes Boyle 

National Park Service
Southeast Coast Network
101 Wheeler St.
Saint Marys, GA 31558

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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. Like most barrier islands along the southeastern coast, the vegetation communities along Cape Lookout National Seashore range from open beach and foredune grasslands on the ocean-facing side to tidal marshes on the sound-facing side. Between is a mixture of interdune swales, backdunes, and enclosed wetlands. Open upland vegetation is found on foredunes and occasional backdunes within the seashore. Cape Lookout National Seashore ecosystems are subjected to high frequencies of storm-, wind-, tide-, and wave-driven processes. Historic and current vegetation composition and structure are largely a result of these highly dynamic processes. Current vegetation patterns and processes across the Outer Banks are impacted and will continue to be impacted by rising sea-levels. Vegetation communities are vulnerable to overwash, which moves sand from the island's ocean-side to the sound-side, brought on by more frequent and higher intensity storms. In 2019, Hurricane Dorian produced significant storm surge from the sound-side that overwashed the island and deposited sand into the ocean. Sand was scoured out from over 54 major cuts in the island, creating current ponds that are in various stages of succession. 2022 marked the first year of conducting this monitoring effort at Cape Lookout National Seashore. Forty-nine vegetation plots were established throughout the park in May and 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 four dominant broadly defined habitats within four park subunits: North Core Banks, South Core Banks, Cape Lookout, and Shackleford Banks. Broadly defined habitats monitored included: Open Upland Vegetation, Upland Forests and Shrublands, Nontidal Wetland Vegetation and Tidal Wetlands. One hundred and eighty-six vascular plant taxa were detected during this monitoring effort, including 11 taxa not detected in previous lists. Human-caused disturbances (e.g., historical plowing, shifting fire regimes, and altered hydrology) affecting plant communities within other SECN parks were not observed within these plots during this survey effort. Stunted plant growth was observed on several plots of Shackleford Banks and is likely caused by feral horse grazing. It is unclear from these data if grazing has impacted overall vegetation diversity and structure patterns across the island.

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 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 (e.g., 100 m²).

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

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

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

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

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

- **G5:** Secure-very low risk of extinction

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

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

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

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

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

Slope: The rise and fall of a land surface.

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

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

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

Acknowledgments

Jon Altman, Cape Lookout National Seashore (CALO) Biologist, offered valuable support prior to and throughout the duration of this monitoring effort. Jon helped the Southeast Coast Network (SECN) field crew procure lodging on North and South Core Banks, provided advice about ferry travel to the park, and arranged use of park ATVs on Shackleford Banks. Before the field season started, Jon was also helpful in determining efficient ways to navigate to plot locations across the park. Once fieldwork began, he maintained contact with the crew, ensuring that work was operating safely and productively. He provided boat transportation to the crew to access both Shackleford Banks and the most northerly portion of North Core Banks (Portsmouth Island). Jon also spent a day with the field crew at a monitoring site on Shackleford Banks. Finally, Jon graciously opened his home for a celebratory dinner for SECN vegetation field staff and others once the field season on the park was complete. The food was delicious!

This project was aided by those individuals who assisted with fieldwork in May and early June of 2022. Field crew members included Elizabeth Rico (former SECN Biological Technician), Abigail Gonzalez (former SECN Scientists in Parks intern), Scott Ward (University of North Carolina Botanical Gardens, NPS contractor), and this report's author. Scott also provided unknown plant identification support.



The 2022 vegetation monitoring field crew at Cape Lookout National Seashore (CALO) included (from left) Scott Ward, Abigail Gonzalez, Elizabeth Rico, M. Forbes Boyle (left image); CALO Biologist Jon Altman provided logistical support and assisted with fieldwork for a day on Shackleford Banks (right image). NPS photos / SECN staff.

Executive Summary

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

2022 marked the first year of conducting this monitoring effort at Cape Lookout National Seashore. Forty-nine vegetation plots were established throughout the park in May and 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 {in}]) diameter at breast height (DBH), overall tree health, landform, soil, observed disturbance, and woody biomass (i.e., fuel load) estimates.

This report summarizes the baseline (year 1) terrestrial vegetation data collected at Cape Lookout National Seashore in 2022. Data were stratified across four dominant broadly defined habitats within four park subunits: North Core Banks, South Core Banks, Cape Lookout, and Shackleford Banks. Broadly defined habitats monitored included Maritime Open Upland Vegetation, Maritime Upland Forests and Shrublands, Maritime Nontidal Wetland Vegetation and Tidal Wetlands. Noteworthy findings include:

- One hundred and eighty-six vascular plant taxa were observed across 49 vegetation plots, including 11 species not previously documented within the park.
- The most frequently encountered species in each broadly defined habitat included:
 - Maritime Open Uplands: sea oats (*Uniola paniculata*), dune pennywort (*Hydrocotyle bonariensis*), and seabeach evening primrose (*Oenothera humifusa*).
 - Maritime Upland Forests and Shrublands: wax-myrtle (*Morella cerifera*), southern red cedar (*Juniperus silicicola*), eastern poison ivy (*Toxicodendron radicans* var. *radicans*), yaupon (*Ilex vomitoria*), maritime catbriar (*Smilax bona-nox*), and Virginia creeper (*Parthenocissus quinquefolia*).
 - Maritime Nontidal Wetlands: black needle rush (*Juncus roemerianus*), wax-myrtle, saltmeadow cordgrass (*Spartina patens*), eastern poison ivy, and groundsel tree (*Baccharis halimifolia*).
 - Tidal Wetlands: saltmeadow cordgrass, black needle rush, saltgrass (*Distichlis spicata*), smooth cordgrass (*Spartina alterniflora*), and silver seaside oxeye (*Borrchia frutescens*).
- Non-native, invasive species had very low frequencies in these monitoring plots. The only observable, widespread disturbance to vegetation within these plots was related to grazing impacts from feral horses (*Equus caballus*). Shore little bluestem (*Schizachyrium littorale*) was not observed in any of the Maritime Open Upland plots of Shackleford Banks where

feral horse are present, though it did occur with high frequency in this habitat type on both North Core Banks and Cape Lookout subunits.

- Fifteen species listed as rare and tracked by the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022) were observed during this monitoring effort, including the state threatened blue witchgrass (*Dichanthelium caerulescens*). Rare plants occurred with the highest frequency in Maritime Upland Forests and Shrublands of Shackleford Banks and Maritime Nontidal Wetlands throughout.
- The most dominant species within the canopy of Maritime Upland Forest and Shrubland plots were slash pine (*Pinus elliottii*)—which was only found on the Cape Lookout subunit where it had been planted in previous decades—live oak (*Quercus virginiana*), and southern red cedar. Sand live oak (*Quercus geminata*) was a canopy co-dominant in a single plot located on the Shackleford Banks. This species of oak, which is closely related to the more common live oak, has not been reported along the Outer Banks of North Carolina.
- All plots are scheduled to be resampled during the spring or summer of 2026.



Cape Lookout National Seashore is home to several non-forested vegetation communities dominated by graminoids, including nontidal wetlands fed by rain and groundwater (top left), tidally-influenced wetlands (top right), and upland, dry grasslands of flat backdune swales (bottom left) or rolling principle foredunes adjacent to the open beach (bottom right). NPS / M. FORBES BOYLE (SECN Botanist).

Introduction

Overview

Vegetation communities are the primary drivers of a range of ecological processes and are integral to the proper function of park ecosystems. Moreover, vegetation communities integrate the biological and physical environment—they serve as the foundation for food webs, provide wildlife habitat for many species, function as a carbon sink, produce oxygen, and cycle nutrients and energy through an ecosystem. Parks within the Southeast Coast Network (SECN) host a diverse assemblage of plants and terrestrial communities. Vegetation communities vary widely. Approximately 180 vegetation associations (i.e., fine-resolution floristic description), as defined by the National Vegetation and Classification Standard, Version 2.0 (FGDC 2008), occur in SECN park units. A diversity of vegetation resources 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, and non-native species introduction.

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

This report provides a summary of data collected from May through June 2022 within Cape Lookout National Seashore (CALO) as part of the SECN’s terrestrial vegetation monitoring effort. This report is intended to provide CALO 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 Cape Lookout National Seashore 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

Cape Lookout National Seashore (CALO) covers approximately 11,430 hectares (28,243 acres [ac]) along a 91 kilometer (56.5 mile) stretch of the Atlantic Ocean in eastern North Carolina from Pamlico Sound and Ocracoke Inlet to Beaufort Inlet (Figure 1). The seashore is composed of three barrier islands: North Core Banks, South Core Banks, and Shackleford Banks; separated from the North Carolina mainland by Core and Back Sound. Collectively, these three islands represent the southern Outer Banks. The Outer Banks were formed following the most recent glaciation and are composed of relatively young coarse sand substrates deposited over limestone and unconsolidated soil materials. The landform of these islands is relatively flat; however, both interior island and ocean-facing dune systems can have complex topographies and are the highest elevations within the Outer Banks landscape. The dunes of Cape Lookout National Seashore generally range from 3.0 to 3.7 meters (10 to 12 feet) in elevation, with some dunes of Shackleford Banks reaching 10.7 meters (35 feet).

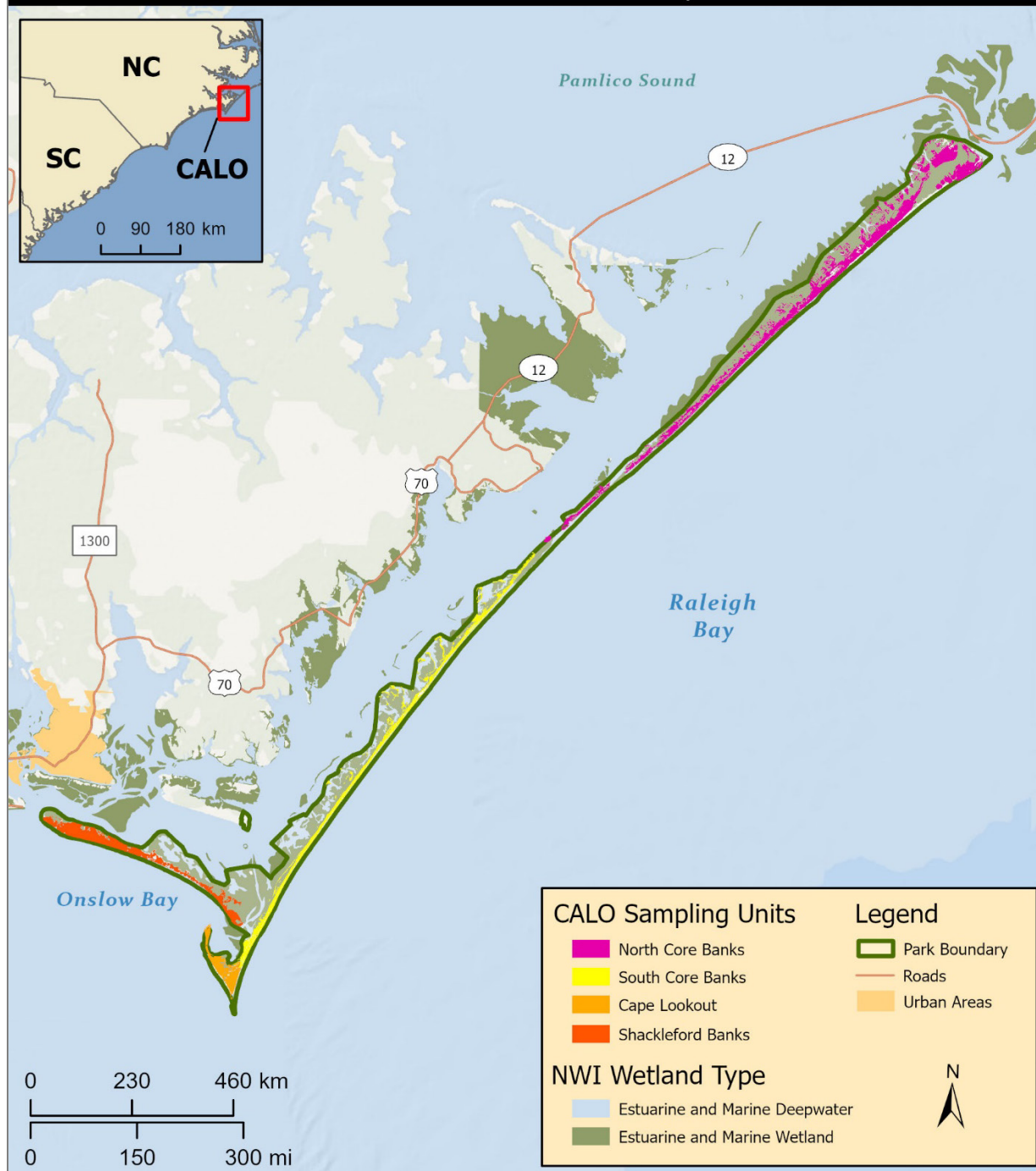


Figure 1. Location of Cape Lookout National Seashore along the North Carolina coast, Carteret County. The map also shows the location of targeted park units which were used to stratify plot locations.

Like most barrier islands along the southeastern coast, the vegetation communities along Cape Lookout National Seashore range from open beach and foredune grasslands on the ocean-facing side to tidal marshes on the sound-facing side. Between is a mixture of interdune swales, backdunes, and enclosed wetlands. Open upland vegetation is found on foredunes and occasional backdunes within the seashore. Dominant species include sea oats (*Uniola paniculata*) and bitter seabeach grass (*Panicum amarum*). Shrub-dominated interdunal swales or tidal flats that are irregularly flooded are dominated typically by wax-myrtle (*Morella cerifera*) and saltmeadow cordgrass (*Spartina patens*). Maritime forests are not common within Cape Lookout National Seashore, but where they do occur, like on the northern edge of Shackleford Banks, live oak (*Quercus virginiana*) dominates the canopy. Tidally influenced and nontidally influenced graminoid-dominated wetlands are composed of smooth cordgrass (*Spartina alterniflora*), black needle rush (*Juncus roemerianus*), saltmeadow cordgrass, cattails (*Typha* sp.), and common threesquare (*Schoenoplectus pungens* var. *pungens*).

Unlike Cape Hatteras National Seashore to the north, the Cape Lookout National Seashore's three barrier islands are only accessible by boat or ferry and there are no connecting roads between the islands. There is not a paved highway bisecting Cape Lookout's islands, like Highway 12 does throughout Cape Hatteras. However, off-road vehicle (ORV) use is allowed at Cape Lookout to provide access onto its beaches for recreational purposes. At the present, the park allows ORV and all-terrain vehicle (ATV) access to 73.2 kilometers (45.5 miles)—96% of beach on North and South Core Banks from March 15 through December 31 (Jon Altman [CALO Biologist], personal communication). Impacts from ORV and ATV use on vegetation of the seashore are not well known, although the federally threatened seabeach amaranth (*Amaranthus pumilus*), which has occurred historically within the park, can experience mortality by tire trampling (USFWS 1996; USFWS 2007). Cape Lookout National Seashore ecosystems are subjected to high frequencies of storm-, wind-, tide-, and wave-driven processes. Historic and current vegetation composition and structure are largely a result of these highly dynamic processes. Current vegetation patterns and processes across the Outer Banks are impacted and will continue to be impacted by rising sea-levels. Vegetation communities are vulnerable to overwash, which moves sand from the island's ocean-side to the sound-side, brought on by more frequent and higher intensity storms. In 2019, Hurricane Dorian produced significant storm surge from the sound-side that overwashed the island and deposited sand into the ocean. Sand was scoured out from over 54 major cuts in the island. These cuts are now ponds in various stages of succession. This was opposite of the usual ocean overwash process, but this appears to have happened infrequently in the past (Jon Altman [CALO Biologist], personal communication). Rising global air and sea temperatures are thought to increase the frequency of these storms (IPCC 2019). Erosion and accretion patterns, including the island's natural westward (inland) migration patterns, brought on by rising seas and intense storms will also impact vegetation communities on both sides of these barrier islands. Non-native, invasive plants do not pose a serious threat to terrestrial vegetation communities of Cape Lookout National Seashore compared to other parks within the Southeast Coast Network (DeVivo et al. 2008). Based on the National Park Service Certified Species List (NPSpecies; NPS 2024), 76 species that currently occur or historically have occurred within the seashore are non-native—12% of the total flora of the park. Non-native plants classified as invasive by the North Carolina Native Plant Society (Buchanan 2010)

and documented within Cape Lookout National Seashore from the park's most recent flora compilation (Sorrie 2021) include:

- Tree-of-heaven (*Ailanthus altissima*; Rank 1—Severe Threat)
- Field garlic (*Allium vineale*; Rank 3—Lesser Threat)
- Basket grass (*Arthraxon hispidus*; Rank 2—Significant Threat)
- Queen-Anne's-lace (*Daucus carota*; Rank 3—Lesser Threat)
- Japanese-clover (*Kummerowia striata*; Rank 3—Lesser Threat)
- Sericea lespedeza (*Lespedeza cuneata*; Rank 1—Severe Threat)
- Oxeye daisy (*Leucanthemum vulgare*; Rank 3—Lesser Threat)
- Japanese honeysuckle (*Lonicera japonica*; Rank 1—Severe Threat)
- Chinaberry (*Melia azedarach*; Watch List)
- Common reed (*Phragmites australis*; Rank 1—Severe Threat)
- Silver poplar (*Populus alba*; Rank 3—Lesser Threat)
- Multiflora rose (*Rosa multiflora*; Rank 1—Severe Threat)
- Groundsel (*Senecio vulgaris*; Rank 3—Lesser Threat)
- Common chickweed (*Stellaria media*; Rank 2—Significant Threat)
- Woolly mullein (*Verbascum thapsus*; Watch List)

Despite these stressors, the park hosts a diverse flora, and plays a crucial role in providing habitat for many rare species, including the federally threatened seabeach amaranth; several North Carolina listed species such as pinebarren sunrose (*Crocanthemum corymbosum*), Georgia sunrose (*Crocanthemum georgianum*), seabeach knotweed (*Polygonum glaucum*), and beach morning-glory (*Ipomoea imperati*); and a host of other rare plants tracked by the state's Natural Heritage Program (Wichmann and Wojcik 2022).

Sampling Design

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

Forty-nine vegetation plots were established and sampled on North Core Banks, South Core Banks, Cape Lookout, and Shackleford Banks subunits of Cape Lookout National Seashore in May and June 2022 (Figure 2). These plots were in the following broadly defined habitats of the park: Maritime

Open Upland Vegetation (16 plots), Maritime Upland Forests and Shrublands (8 plots), Maritime Nontidal Wetland Vegetation (18 plots), and Tidal Wetlands (7 plots). Plot locations were determined using the generalized random-tessellation stratified (GRTS) sampling methodology, which creates a spatially-balanced array of sample points across an area of interest while maintaining flexibility in a project's sample size (Stevens and Olsen 2004).

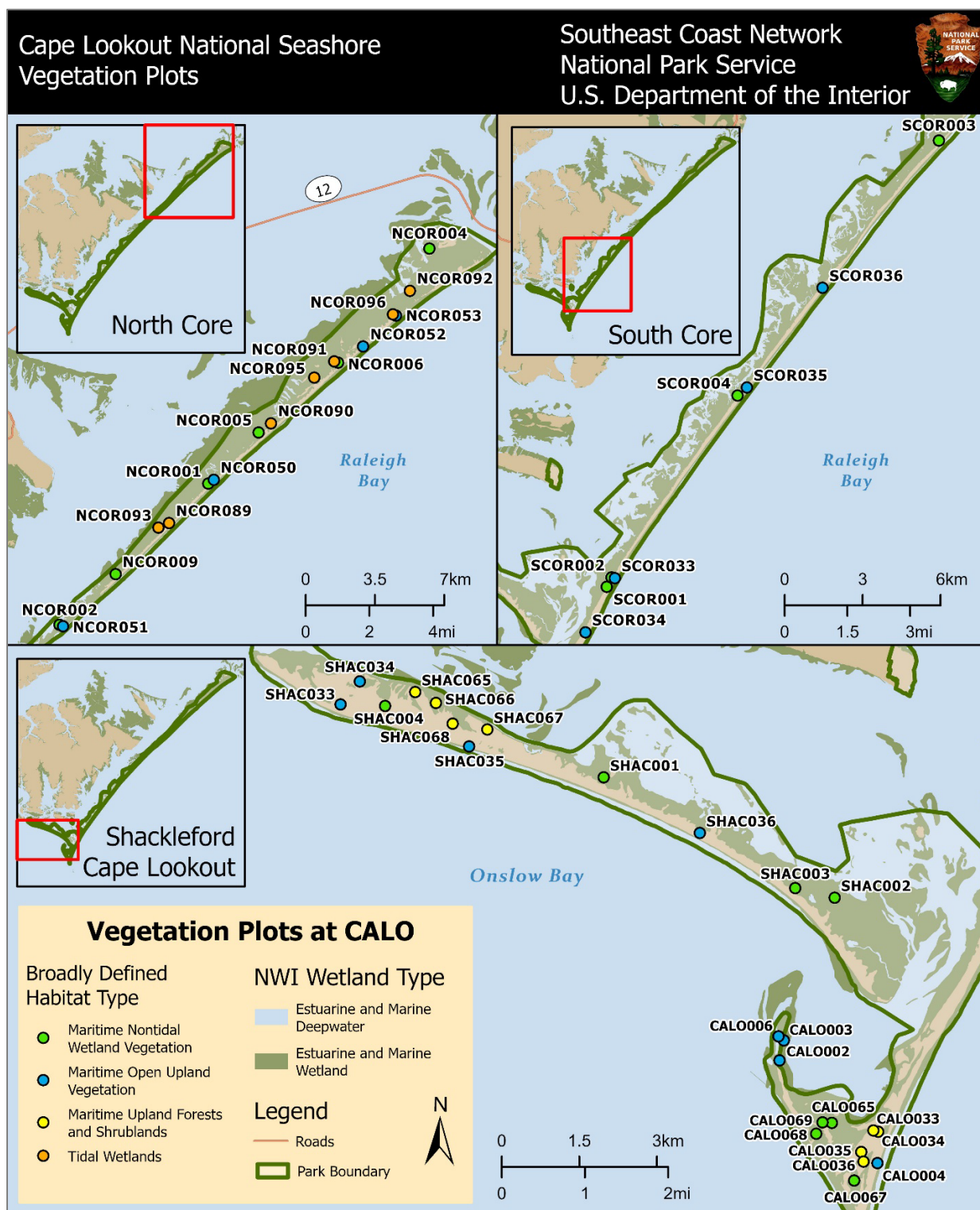


Figure 2. Southeast Coast Network terrestrial vegetation monitoring plot locations within Cape Lookout National Seashore.

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 (Buchanan 2010).

Sampling Methodology

The vegetation plot layout for this monitoring effort is based upon the plot design used by the Carolina Vegetation Survey (Peet et al. 1998; Lee et al. 2008) and the Cumberland Piedmont Network (White et al. 2011). The plot array consists of a 20 × 20 meters (65.6 × 65.6 ft) bounded square with multiple nested sampling frames ranging from 1 square meter (10.8 square feet [ft²]) to 400 square meters (4,305.5 ft²), three 25 meters (82.0 ft) fuel transects that cross both inside and outside the bounded square, and three soil sample frames located adjacent to the bounded square (Figure 3).

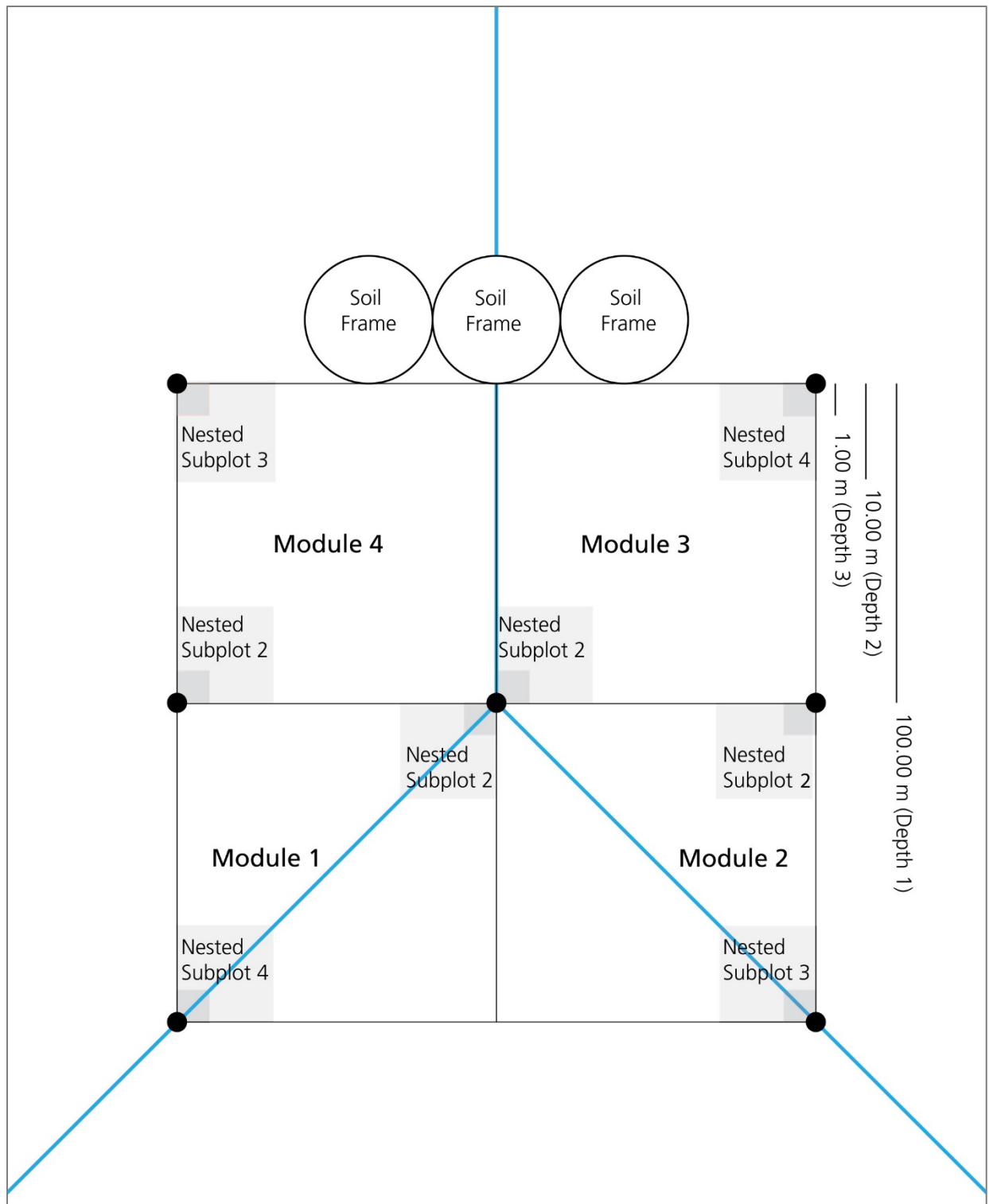


Figure 3. The layout of the sampling plot for the Southeast Coast Network, which is a modified version of the standard Level 5 Carolina Vegetation Survey plot. Ideal locations of rebar used as permanent structures to monument the plot are represented by black shaded circles. Blue lines represent locations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

Vascular plant species presence was determined at three scales within each of the four 100 square meters (1,076.4 ft²) modules: the 1 square meter (10.8 ft²) nested depth, the 10 square meters (107.6 ft²) nested depth, and the full modular depth. The nested depth “quadrats” were 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 1).

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

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

Individual woody stem data were also calculated within each module. For each stem greater than or equal to 10 centimeters (3.9 inches [in]; tree) in diameter at 1.4 meters (4.5 ft) linear distance from the ground layer, its species, DBH, and health status was recorded. Within the two 10 square-meter (107.6 ft²) nested depth “quadrats” used for detecting overall species presence (see Figure 3), 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 centimeter (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 Maritime Upland Forest and Shrubland or Maritime Nontidal Wetland Vegetation using the planar transect method for the standard fuel size classes: 1-hour (0–0.6 centimeters [cm]), 10-hour (0.6–2.5 cm), 100-hour (2.5–7.6 cm), and 1000-hour (> 7.6 cm), and duff and litter depths (Brown 1974). Counts of each fuel size class were tallied across three fuel transects, with diameter and decay class recorded for each piece of

1000-hour fuel. These field data were incorporated into equations using constant multipliers defined by Brown (1974)—including quadratic mean diameter, nonhorizontal correction factor, specific gravity, and bulk density—to estimate fuel load weight (units = tons/acre) within each plot.

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

Results and Discussion

One hundred and eighty-six vascular plant taxa were detected during this monitoring effort (Appendix A), including 11 taxa not detected in previous lists of Cape Lookout National Seashore documented in NPSpecies (NPS 2024), Southeast Regional Network of Expertise and Collections (SERNEC 2023), Sorrie 2021, or Heath and Byrne (2014; Table 2). Native richness ranged from four to 50 species per plot, while non-native richness was either nonexistent, like Tidal Wetland plots, or ranged between one and three species in other broadly defined habitats. Two Rank 1 invasive plants were observed in plots during this monitoring effort, including Japanese honeysuckle and common reed (*Phragmites australis*). However, these species were found to have occurred in very low frequencies. Japanese honeysuckle was found in two of eight (25%) Maritime Upland Forest and Shrubland plots and one of 18 (< 6%) Maritime Nontidal Wetland Vegetation plots, while European common reed was found in one of 18 (< 6%) Maritime Nontidal Wetland Vegetation plots. Tidal Wetland and Maritime Open Upland Vegetation plots did not have any invasive species present. Most native species observed in these plots are common throughout the Coastal Plain of the Southeastern U.S., and many species reach their southern limit in northeastern North Carolina. A few species reach their southern range limit at Cape Lookout National Seashore and its vicinity, including American searocket (*Cakile edentula*) and northern seaside goldenrod (*Solidago sempervirens*). Blue witchgrass (*Dichanthelium caeruleum*), listed as Threatened in North Carolina, was present in a single Maritime Nontidal Wetland plot within the Cape Lookout subunit, while another 14 vascular plants listed as rare by the North Carolina Natural Heritage Program (Wichman and Wojcik 2022) were observed across a wide range of plots, subunits, and broadly defined habitats of the seashore. In the Coastal Plain of the Southeastern U.S., 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 2. Vascular plant species, subspecies, or varieties not reported from NPSpecies (NPS 2024), Southeast Regional Network of Expertise and Collections (SERNEC 2023), Sorrie (2021), or Heath and Byrne (2014) but found at Cape Lookout National Seashore in 2022 through this current monitoring effort.

Scientific Name	Common Name ¹	Growth Form ¹	Native Status ¹	Global Rank ²	State Rank ² (North Carolina)
<i>Dichanthelium arenicoloides</i>	sand-loving witchgrass	Graminoid	Native	GNR	SNR
<i>Dichanthelium boscil</i>	Bosc's witchgrass	Graminoid	Native	G5	S5
<i>Dichanthelium caeruleum</i>	blue witchgrass	Graminoid	Native	G3	Threatened; S1
<i>Dichanthelium meridionale</i>	matting witchgrass	Graminoid	Native	G5	SNR
<i>Eleocharis baldwinii</i>	Baldwin's spikerush	Graminoid	Native	G4	S2
<i>Juncus acuminatus</i>	tapertip rush	Graminoid	Native	G5	S5
<i>Monarda punctata</i> var. <i>villicaulis</i>	spotted beebalm	Forb/herb	Native	T5	SNR
<i>Persicaria hydropiperoides</i>	swamp smartweed	Forb/herb	Native	G5	S5
<i>Quercus geminata</i>	sand live oak	Tree	Native	G5	S3
<i>Smilax smallii</i>	Jackson brier	Vine	Native	G5	S4
<i>Vaccinium formosum</i>	southern blueberry	Shrub	Native	G5	S5

¹ Information obtained from the PLANTS database (USDA 2024).

² Conservation Status (G5/S5: Species Secure; T5: Variety Secure; G4/S4: Apparently Secure; G3/S3: Vulnerable; G2/S2: Imperiled; G1/S1: Critically Imperiled; GNR/SNR: no ranking) obtained from NatureServe Explorer 2.0 (NatureServe 2024).

Maritime Open Upland Vegetation

Maritime Open Uplands of the Outer Banks include vegetated areas along coastal foredunes, backdunes, and occasional older dune complexes within the interior of the islands (Figure 4). These sites are strongly influenced by shifting sands and high levels of salt spray from the adjacent ocean. Plants that colonize these sites are typically short-lived and salt-tolerant. The primary grass that stabilizes maritime dunes is sea oats, which produces many adventitious roots from the main culm that capture sand and allow dunes to form. Other grasses that stabilize dunes along the Outer Banks include bitter seabeach grass and shore little bluestem (*Schizachyrium littorale*). Tree and shrub development is limited in these sites because of extreme salt spray and frequent storm overwash, although occasional salt-pruned, low lying shrub zones may be found in protected dune swales. Upland grassland flats with dense vegetation and less open sand occur on the island interior flats of stabilized dunes. Vegetation associations sampled in Cape Lookout National Seashore that belong to this broadly defined habitat type include (descriptions from NatureServe 2024):

- South Atlantic Loamy Coastal Dune Grassland (CEGL004039; 4 plots): This vegetation type occurs on foredunes with slightly loamier soils with more of an influence of riverine sediments than the Sea-oats Dune Grassland association (see Figure 4). Shore little bluestem typically shares dominance in these sites with sea-oats and bitter seabeach grass. (Global Status: G3— Vulnerable; State (NC) Status: No Status Rank)

- Sea-oats Dune Grassland (CEGL004040; 12 plots): The characteristic foredune vegetation community along the southeast Atlantic Coast and dominated by sea-oats. (Global Status: G3—Vulnerable; State (NC) Status: No Status Rank)



Figure 4. Sixteen plots were established in Maritime Open Uplands of Cape Lookout National Seashore during this monitoring effort (May–June 2022). This broadly defined habitat was present and sampled on all park subunits (North Core Banks, South Core Banks, Cape Lookout, and Shackleford Banks). NPS photo / SECN staff.

Species Diversity and Abundance

Native species richness ranged from seven to 26 (mean = 13.9) and herbaceous plants represented the most diverse growth form across all plot spatial scales (400 m², 100 m², 10 m², and 1 m²; Tables 3 and 4). Fifty vascular plant species were found collectively within these 16 plots, including 12 only found in the Maritime Open Upland habitat of the park; a complete species list, along with constancy and average cover per species, is listed in Appendix B, Table 11. Species with high constancy in this habitat are listed below, by growth form (constancy values in parentheses):

Herbs and Graminoids

- Sea-oats (100%)
- Dune pennywort (*Hydrocotyle bonariensis*; 100%)
- Seabeach evening-primrose (*Oenothera humifusa*; 100%)
- Dune camphorweed (*Heterotheca subaxillaris*; 94%)
- Southern horseweed (*Erigeron pusillus*; 88%)

Table 3. Vascular plant species richness across multiple spatial scales on Southeast Coast Network vegetation plots located within Cape Lookout National Seashore. 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 ¹	Non-Native ¹	Unknown ¹	T ¹	S ¹	V ¹	H ¹	G ¹	T ²	S ²	V ²	H ²	G ²
Maritime Open Upland Vegetation	CALO002	17.0	1.0	0.0	0.0	1.0	1.0	10.0	6.0	0.0	0.3	1.0	7.3	4.0
	CALO003	17.0	1.0	0.0	1.0	1.0	2.0	9.0	5.0	0.3	1.0	0.8	6.0	3.5
	CALO004	13.0	1.0	0.0	1.0	0.0	1.0	10.0	2.0	0.3	0.0	0.8	7.0	2.0
	CALO006	11.0	0.0	0.0	0.0	1.0	2.0	6.0	2.0	0.0	1.0	1.5	4.8	2.0
	NCOR050	26.0	0.0	0.0	1.0	0.0	4.0	15.0	6.0	0.5	0.0	1.3	11.8	4.8
	NCOR051	15.0	0.0	0.0	0.0	0.0	2.0	9.0	4.0	0.0	0.0	1.0	8.0	3.8
	NCOR052	18.0	0.0	0.0	0.0	1.0	0.0	12.0	5.0	0.0	0.3	0.0	10.3	3.8
	NCOR053	9.0	0.0	0.0	0.0	1.0	0.0	5.0	3.0	0.0	0.8	0.0	4.0	2.5
	SCOR033	12.0	1.0	0.0	0.0	1.0	1.0	8.0	3.0	0.0	0.5	0.3	6.0	1.8
	SCOR034	12.0	1.0	0.0	0.0	1.0	1.0	7.0	4.0	0.0	1.0	0.3	6.3	2.3
	SCOR035	19.0	1.0	0.0	0.0	2.0	3.0	11.0	4.0	0.0	0.8	1.5	8.3	3.0
	SCOR036	11.0	0.0	0.0	0.0	0.0	1.0	8.0	2.0	0.0	0.0	0.5	5.0	2.0
	SHAC033	9.0	1.0	0.0	0.0	0.0	0.0	7.0	3.0	0.0	0.0	0.0	5.3	2.3
	SHAC034	7.0	2.0	0.0	0.0	0.0	0.0	5.0	4.0	0.0	0.0	0.0	4.5	3.0
	SHAC035	13.0	1.0	0.0	0.0	0.0	1.0	10.0	3.0	0.0	0.0	0.3	6.8	2.5
	SHAC036	14.0	0.0	0.0	0.0	0.0	1.0	7.0	6.0	0.0	0.0	0.3	4.3	3.5
	average	13.9	0.6	0.0	0.2	0.6	1.3	8.7	3.9	0.1	0.3	0.6	6.6	2.9
	standard deviation	4.7	0.6	0.0	0.4	0.6	1.1	2.7	1.4	0.1	0.4	0.5	2.2	0.9
Maritime Upland Forests and Shrublands	CALO033	15.0	0.0	0.0	5.0	2.0	4.0	4.0	0.0	4.0	1.5	3.8	2.5	0.0
	CALO034	22.0	0.0	0.0	3.0	2.0	5.0	5.0	7.0	2.8	2.0	4.5	2.8	3.8
	CALO035	12.0	0.0	0.0	3.0	2.0	5.0	1.0	1.0	3.0	1.0	3.8	1.0	0.3

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

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

Table 3 (continued). Vascular plant species richness across multiple spatial scales on Southeast Coast Network vegetation plots located within Cape Lookout National Seashore. 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 ¹	Non-Native ¹	Unknown ¹	T ¹	S ¹	V ¹	H ¹	G ¹	T ²	S ²	V ²	H ²	G ²
Maritime Upland Forests and Shrublands (continued)	CALO036	22.0	1.0	0.0	3.0	2.0	4.0	5.0	9.0	2.8	1.5	3.3	3.0	5.3
	SHAC065	50.0	1.0	1.0	12.0	4.0	14.0	11.0	11.0	10.0	3.0	10.3	7.0	6.0
	SHAC066	48.0	1.0	1.0	10.0	5.0	9.0	13.0	13.0	7.8	3.5	7.3	6.5	7.8
	SHAC067	35.0	1.0	1.0	10.0	4.0	8.0	8.0	7.0	8.3	2.8	5.8	4.3	5.5
	SHAC068	35.0	0.0	2.0	8.0	4.0	8.0	7.0	10.0	6.0	2.5	6.3	6.0	7.0
	average	29.9	0.5	0.6	6.8	3.1	7.1	6.8	7.3	5.6	2.2	5.6	4.1	4.4
	standard deviation	14.4	0.5	0.7	3.7	1.2	3.4	3.9	4.6	2.8	0.9	2.3	2.2	2.9
Maritime Non-tidal Wetland Vegetation	CALO065	23.0	2.0	0.0	3.0	4.0	6.0	6.0	6.0	1.8	2.8	3.8	2.5	3.3
	CALO067	23.0	0.0	0.0	2.0	3.0	6.0	5.0	7.0	0.8	1.5	3.8	3.3	5.3
	CALO068	16.0	1.0	0.0	0.0	1.0	2.0	4.0	10.0	0.0	0.3	1.3	3.0	6.0
	CALO069	13.0	0.0	0.0	0.0	3.0	3.0	2.0	5.0	0.0	2.0	2.0	1.3	3.0
	NCOR001	20.0	0.0	1.0	1.0	5.0	5.0	4.0	6.0	0.8	4.8	4.5	3.0	3.8
	NCOR002	18.0	1.0	0.0	0.0	5.0	4.0	4.0	6.0	0.0	4.3	3.3	1.8	3.5
	NCOR004	21.0	0.0	0.0	1.0	5.0	5.0	3.0	7.0	0.8	3.5	3.8	1.5	5.5
	NCOR005	18.0	0.0	0.0	1.0	5.0	3.0	3.0	6.0	1.0	3.8	1.8	2.0	2.8
	NCOR006	18.0	1.0	0.0	1.0	4.0	3.0	5.0	6.0	0.3	3.3	1.8	3.8	4.3
	NCOR009	25.0	0.0	0.0	1.0	5.0	2.0	11.0	6.0	0.8	4.3	1.5	6.3	4.0
	SCOR001	27.0	2.0	0.0	1.0	6.0	6.0	8.0	8.0	0.3	3.3	4.5	5.3	3.8
	SCOR002	22.0	2.0	0.0	0.0	5.0	6.0	8.0	5.0	0.0	1.5	4.8	4.5	3.0
	SCOR003	19.0	0.0	0.0	0.0	3.0	6.0	5.0	5.0	0.0	2.0	5.0	3.3	4.3

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

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

Table 3 (continued). Vascular plant species richness across multiple spatial scales on Southeast Coast Network vegetation plots located within Cape Lookout National Seashore. 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 ¹	Non-Native ¹	Unknown ¹	T ¹	S ¹	V ¹	H ¹	G ¹	T ²	S ²	V ²	H ²	G ²
Maritime Non-tidal Wetland Vegetation (continued)	SCOR004	29.0	1.0	1.0	2.0	5.0	8.0	9.0	7.0	0.5	3.0	6.3	4.8	5.0
	SHAC001	30.0	1.0	2.0	1.0	4.0	6.0	10.0	12.0	1.0	3.5	4.3	4.3	5.5
	SHAC002	34.0	1.0	2.0	2.0	5.0	6.0	10.0	14.0	1.0	3.5	4.0	5.3	8.5
	SHAC003	17.0	1.0	2.0	1.0	3.0	1.0	6.0	9.0	0.3	2.5	1.0	3.3	7.0
	SHAC004	30.0	3.0	0.0	1.0	2.0	5.0	16.0	9.0	0.3	1.3	1.3	9.8	3.8
	average	22.4	0.9	0.4	1.0	4.1	4.6	6.6	7.4	0.5	2.8	3.2	3.8	4.6
	standard deviation	5.7	0.9	0.8	0.8	1.3	1.9	3.6	2.5	0.5	1.2	1.6	2.0	1.5
Tidal Wetlands	NCOR089	13.0	0.0	0.0	0.0	4.0	3.0	3.0	3.0	0.0	3.8	2.0	2.8	3.0
	NCOR090	5.0	0.0	0.0	0.0	0.0	0.0	1.0	4.0	0.0	0.0	0.0	1.0	4.0
	NCOR091	4.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	0.0	0.0	0.0	0.8	3.0
	NCOR092	16.0	0.0	0.0	0.0	2.0	1.0	6.0	7.0	0.0	1.5	1.0	3.5	4.0
	NCOR093	9.0	0.0	0.0	0.0	0.0	1.0	3.0	5.0	0.0	0.0	0.3	2.0	4.5
	NCOR095	8.0	0.0	0.0	0.0	0.0	0.0	4.0	4.0	0.0	0.0	0.0	2.8	4.0
	NCOR096	11.0	0.0	0.0	0.0	2.0	1.0	3.0	5.0	0.0	0.8	0.5	1.3	4.0
	average	9.4	0.0	0.0	0.0	1.1	0.9	3.0	4.4	0.0	0.9	0.5	2.0	3.8
	standard deviation	4.3	0.0	0.0	0.0	1.6	1.1	1.7	1.4	0.0	1.4	0.7	1.0	0.6

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

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

Table 4. Vascular plant species richness across multiple spatial scales on Southeast Coast Network vegetation plots located within Cape Lookout National Seashore. 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 ¹	Non-Native ¹	Unknown ¹	T ³	S ³	V ³	H ³	G ³	T ⁴	S ⁴	V ⁴	H ⁴	G ⁴
Maritime Open Upland Vegetation	CALO002	17.0	1.0	0.0	0.0	0.0	0.1	5.1	2.1	0.0	0.0	0.1	3.1	1.8
	CALO003	17.0	1.0	0.0	0.0	0.8	0.0	4.4	2.1	0.0	0.0	0.0	2.9	1.6
	CALO004	13.0	1.0	0.0	0.0	0.0	0.5	5.1	1.9	0.0	0.0	0.4	3.6	1.8
	CALO006	11.0	0.0	0.0	0.0	0.8	0.6	2.9	1.9	0.0	0.4	0.3	2.5	1.6
	NCOR050	26.0	0.0	0.0	0.0	0.0	0.9	6.6	2.4	0.0	0.9	0.8	4.4	2.0
	NCOR051	15.0	0.0	0.0	0.0	0.0	0.5	5.9	2.8	0.0	0.0	0.3	4.6	2.0
	NCOR052	18.0	0.0	0.0	0.0	0.1	0.0	6.8	2.5	0.0	0.0	0.0	3.9	2.0
	NCOR053	9.0	0.0	0.0	0.0	0.5	0.0	2.9	2.0	0.0	0.1	0.0	2.0	1.3
	SCOR033	12.0	1.0	0.0	0.0	0.3	0.1	4.6	1.4	0.0	0.1	0.0	3.8	1.1
	SCOR034	12.0	1.0	0.0	0.0	0.5	0.0	4.9	1.6	0.0	0.1	0.0	3.3	1.3
	SCOR035	19.0	1.0	0.0	0.0	0.0	0.0	6.1	1.9	0.0	0.0	0.0	4.4	4.4
	SCOR036	11.0	0.0	0.0	0.0	0.0	0.3	3.6	1.8	0.0	0.0	0.3	2.9	1.6
	SHAC033	9.0	1.0	0.0	0.0	0.0	0.0	3.6	2.0	0.0	0.0	0.0	2.5	1.1
	SHAC034	7.0	2.0	0.0	0.0	0.0	0.6	3.4	2.1	0.0	0.0	0.0	1.9	1.3
	SHAC035	13.0	1.0	0.0	0.0	0.0	0.1	3.8	2.0	0.0	0.0	0.1	2.3	1.4
	SHAC036	14.0	0.0	0.0	0.0	0.0	0.1	3.3	1.8	0.0	0.0	0.1	2.4	1.5
	average	13.9	0.6	0.0	0.0	0.2	0.2	4.6	2.0	0.0	0.1	0.1	3.1	1.7
	standard deviation	4.7	0.6	0.0	0.0	0.3	0.3	1.3	0.3	0.0	0.2	0.2	0.9	0.8

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

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

³ Mean species richness at the modular (100 square meters [1,076.3 ft²]) depth.

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

Table 4 (continued). Vascular plant species richness across multiple spatial scales on Southeast Coast Network vegetation plots located within Cape Lookout National Seashore. 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 ¹	Non-Native ¹	Unknown ¹	T ³	S ³	V ³	H ³	G ³	T ⁴	S ⁴	V ⁴	H ⁴	G ⁴
Maritime Upland Forests and Shrublands	CALO033	15.0	0.0	0.0	1.8	1.1	3.3	1.8	0.0	0.8	0.6	2.6	1.4	0.0
	CALO034	22.0	0.0	0.0	1.5	1.6	2.8	1.9	2.5	0.6	1.3	1.6	1.1	1.4
	CALO035	12.0	0.0	0.0	1.8	0.6	2.6	0.9	0.0	1.1	0.3	1.9	0.8	0.0
	CALO036	22.0	1.0	0.0	1.9	1.1	1.9	1.0	1.5	1.1	0.4	1.5	0.8	1.0
	SHAC065	50.0	1.0	1.0	4.8	1.9	7.3	3.1	2.5	1.5	0.5	1.9	1.9	1.1
	SHAC066	48.0	1.0	1.0	3.3	1.8	3.9	2.8	3.5	1.1	1.1	1.9	1.3	2.5
	SHAC067	35.0	1.0	1.0	6.0	1.6	4.4	2.0	3.4	3.9	1.1	3.6	1.0	2.1
	SHAC068	35.0	0.0	2.0	3.9	1.5	4.8	3.1	4.1	1.6	1.0	3.5	1.9	2.1
	average	29.9	0.5	0.6	3.1	1.4	3.8	2.1	2.2	1.5	0.8	2.3	1.3	1.3
	standard deviation	14.4	0.5	0.7	1.7	0.4	1.7	0.9	1.6	1.0	0.4	0.8	0.4	0.9
Maritime Non-tidal Wetland Vegetation	CALO065	23.0	2.0	0.0	0.4	1.8	2.4	2.1	1.9	0.0	0.4	1.4	1.8	1.6
	CALO067	23.0	0.0	0.0	0.3	0.9	2.9	1.9	3.0	0.0	0.6	1.6	1.1	1.9
	CALO068	16.0	1.0	0.0	0.0	0.0	0.5	1.5	3.8	0.0	0.0	0.4	0.9	2.8
	CALO069	13.0	0.0	0.0	0.0	0.8	1.4	1.0	1.6	0.0	0.3	0.8	1.0	1.5
	NCOR001	20.0	0.0	1.0	0.1	2.1	3.1	1.4	1.4	0.0	1.3	1.6	0.9	1.0
	NCOR002	18.0	1.0	0.0	0.0	2.0	1.6	1.3	1.4	0.0	0.5	0.6	1.0	1.0
	NCOR004	21.0	0.0	0.0	0.3	2.1	2.4	0.0	3.3	0.1	0.8	1.6	0.0	1.9
	NCOR005	18.0	0.0	0.0	0.3	2.3	0.5	0.1	0.6	0.0	0.8	0.5	0.0	0.1

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

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

³ Mean species richness at the modular (100 square meters [1,076.3 ft²]) depth.

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

Table 4 (continued). Vascular plant species richness across multiple spatial scales on Southeast Coast Network vegetation plots located within Cape Lookout National Seashore. 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 ¹	Non-Native ¹	Unknown ¹	T ³	S ³	V ³	H ³	G ³	T ⁴	S ⁴	V ⁴	H ⁴	G ⁴
Maritime Non-tidal Wetland Vegetation (continued)	NCOR006	18.0	1.0	0.0	0.1	1.9	1.3	1.8	3.0	0.0	1.3	0.8	1.6	1.8
	NCOR009	25.0	0.0	0.0	0.1	2.8	0.8	1.9	2.4	0.0	0.5	0.3	1.3	1.6
	SCOR001	27.0	2.0	0.0	0.0	1.6	3.0	3.5	2.1	0.0	0.1	2.4	2.5	1.8
	SCOR002	22.0	2.0	0.0	0.0	0.4	3.3	2.8	2.3	0.0	0.1	2.3	2.4	1.8
	SCOR003	19.0	0.0	0.0	0.0	1.3	3.3	2.4	3.0	0.0	0.4	2.4	2.0	1.9
	SCOR004	29.0	1.0	1.0	0.1	2.3	4.8	2.3	3.4	0.0	0.9	3.3	1.3	1.6
	SHAC001	30.0	1.0	2.0	0.9	2.3	2.5	1.9	2.5	0.6	1.5	1.3	0.4	1.3
	SHAC002	34.0	1.0	2.0	0.4	2.4	2.6	1.9	3.6	0.0	0.8	1.3	0.6	0.9
	SHAC003	17.0	1.0	2.0	0.1	1.4	0.4	1.9	3.4	0.0	0.8	0.3	1.3	2.1
	SHAC004	30.0	3.0	0.0	0.0	0.6	0.6	3.5	2.1	0.0	0.3	0.5	2.0	1.1
	average	22.4	0.9	0.4	0.2	1.6	2.1	1.8	2.5	0.0	0.6	1.3	1.2	1.5
	standard deviation	5.7	0.9	0.8	0.2	0.8	1.2	0.9	0.9	0.1	0.4	0.9	0.7	0.6
Tidal Wetlands	NCOR089	13.0	0.0	0.0	0.0	2.1	0.8	1.6	1.9	0.0	0.0	0.4	1.3	1.5
	NCOR090	5.0	0.0	0.0	0.0	0.0	0.0	0.5	2.3	0.0	0.9	0.0	0.3	1.8
	NCOR091	4.0	0.0	0.0	0.0	0.0	0.0	0.5	2.9	0.0	0.0	0.0	0.1	2.8
	NCOR092	16.0	0.0	0.0	0.0	0.8	0.6	2.3	2.4	0.0	0.0	0.4	1.9	1.5
	NCOR093	9.0	0.0	0.0	0.0	0.0	0.1	0.9	3.3	0.0	0.0	0.1	0.6	2.1

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

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

³ Mean species richness at the modular (100 square meters [1,076.3 ft²]) depth.

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

Table 4 (continued). Vascular plant species richness across multiple spatial scales on Southeast Coast Network vegetation plots located within Cape Lookout National Seashore. 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 ¹	Non-Native ¹	Unknown ¹	T ³	S ³	V ³	H ³	G ³	T ⁴	S ⁴	V ⁴	H ⁴	G ⁴
Tidal Wetlands (continued)	NCOR095	8.0	0.0	0.0	0.0	0.0	0.0	1.8	3.1	0.0	0.0	0.0	0.9	2.5
	NCOR096	11.0	0.0	0.0	0.0	0.3	0.1	0.4	3.0	0.0	0.0	0.1	0.1	2.4
	average	9.4	0.0	0.0	0.0	0.4	0.2	1.1	2.7	0.0	0.1	0.1	0.7	2.1
	standard deviation	4.3	0.0	0.0	0.0	0.8	0.3	0.7	0.5	0.0	0.3	0.2	0.7	0.5

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

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

³ Mean species richness at the modular (100 square meters [1,076.3 ft²]) depth.

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

Woody Stem Metrics

Stems greater than or equal to 10 centimeters (3.9 in, tree size class) and less than 10 centimeters (3.9 in, sapling size class) were essentially absent from these plots (Table 5). Most plots also lacked seedlings. Woody stems that did occur in a few of these plots included seacoast marsh elder (*Iva imbricata*), peppervine (*Nekemias arborea*), and maritime catbriar (*Smilax bona-nox* var. *littoralis*) (Appendix B, Table 12).

Table 5. Woody stem abundance and canopy metrics on Southeast Coast Network vegetation plots located in Cape Lookout National Seashore [m—meters; ha—hectares].

Broadly Defined Habitat	Plot	Tree Basal Area (m ² /ha)	Tree Density (400m ²)	Sapling Basal Area (m ² /ha)	Sapling Density (80m ²)	Seedling Density (8m ²)	Mean Canopy Cover (%)	Mean Height (m)
Maritime Open Upland Vegetation	CALO002	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CALO003	0.00	0.00	0.00	0.00	0.00	0.00	1.00
	CALO004	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CALO006	0.00	0.00	0.00	0.00	28.00	0.00	1.00
	NCOR050	0.00	0.00	0.00	0.00	17.00	0.00	0.00
	NCOR051	0.00	0.00	0.00	0.00	31.00	0.00	0.00
	NCOR052	0.00	0.00	0.00	0.00	1.00	0.00	0.00
	NCOR053	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SCOR033	0.00	0.00	0.00	0.00	4.00	0.00	0.00
	SCOR034	0.00	0.00	0.00	0.00	6.00	0.00	0.00
	SCOR035	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SCOR036	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SHAC033	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SHAC034	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SHAC035	0.00	0.00	0.00	0.00	1.00	0.00	0.00
	SHAC036	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	average	0.00	0.00	0.00	0.00	7.25	0.00	0.17
	standard deviation	0.00	0.00	0.00	0.00	10.34	0.00	0.34
Maritime Upland Forests and Shrublands	CALO033	43.93	42.00	31.09	42.00	134.00	85.13	19.00
	CALO034	31.84	46.00	47.21	28.00	64.00	84.63	16.33
	CALO035	22.17	16.00	58.38	95.00	126.00	58.38	19.33
	CALO036	19.72	24.00	51.77	58.00	159.00	79.00	7.33
	SHAC065	49.96	19.00	20.25	31.00	183.00	70.25	14.33
	SHAC066	22.00	33.00	41.82	42.00	76.00	66.94	8.33

Table 5 (continued). Woody stem abundance and canopy metrics on Southeast Coast Network vegetation plots located in Cape Lookout National Seashore [m—meters; ha—hectares].

Broadly Defined Habitat	Plot	Tree Basal Area (m ² /ha)	Tree Density (400m ²)	Sapling Basal Area (m ² /ha)	Sapling Density (80m ²)	Seedling Density (8m ²)	Mean Canopy Cover (%)	Mean Height (m)
Maritime Upland Forests and Shrublands (continued)	SHAC067	31.49	19.00	25.36	56.00	302.00	65.19	12.67
	SHAC068	27.13	26.00	25.46	26.00	270.00	95.44	10.33
	average	31.03	28.13	37.67	47.25	164.25	75.62	13.46
	standard deviation	10.88	11.15	14.06	22.72	85.15	12.46	4.60
Maritime Non-tidal Wetland Vegetation	CALO065	0.64	1.00	2.67	14.00	10.00	11.31	5.00
	CALO067	0.00	0.00	24.76	103.00	88.00	0.00	2.33
	CALO068	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CALO069	0.00	0.00	0.00	0.00	4.00	0.00	1.33
	NCOR001	2.90	3.00	24.51	116.00	65.00	32.00	5.67
	NCOR002	0.00	0.00	28.88	42.00	5.00	15.63	3.33
	NCOR004	5.27	5.00	14.49	79.00	76.00	36.44	8.33
	NCOR005	5.25	9.00	139.80	126.00	41.00	55.94	7.00
	NCOR006	0.00	0.00	7.72	36.00	8.00	0.44	2.33
	NCOR009	0.00	0.00	63.37	86.00	24.00	8.44	2.67
	SCOR001	4.46	14.00	1.36	13.00	84.00	0.00	2.33
	SCOR002	0.83	2.00	0.62	9.00	31.00	0.00	1.00
	SCOR003	0.24	1.00	0.04	2.00	25.00	0.00	1.33
	SCOR004	0.44	1.00	19.49	81.00	74.00	16.75	2.67
	SHAC001	0.00	0.00	98.65	155.00	52.00	52.31	5.00
	SHAC002	0.00	0.00	12.58	38.00	124.00	1.63	2.67
	SHAC003	0.00	0.00	0.28	3.00	36.00	0.00	1.67
	SHAC004	0.00	0.00	4.30	39.00	10.00	1.81	2.33
	average	1.11	2.00	24.64	52.33	42.06	12.93	3.17
	standard deviation	1.92	3.80	38.54	49.32	35.95	18.69	2.19

Table 5 (continued). Woody stem abundance and canopy metrics on Southeast Coast Network vegetation plots located in Cape Lookout National Seashore [m—meters; ha—hectares].

Broadly Defined Habitat	Plot	Tree Basal Area (m ² /ha)	Tree Density (400m ²)	Sapling Basal Area (m ² /ha)	Sapling Density (80m ²)	Seedling Density (8m ²)	Mean Canopy Cover (%)	Mean Height (m)
Tidal Wetlands	NCOR089	0.00	0.00	17.34	26.00	16.00	0.00	1.67
	NCOR090	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NCOR091	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NCOR092	0.00	0.00	0.00	0.00	0.00	0.00	1.00
	NCOR093	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NCOR095	0.00	0.00	0.00	0.00	0.00	0.00	0.67
	NCOR096	0.00	0.00	0.00	0.00	3.00	0.00	1.33
	average	0.00	0.00	2.48	3.71	2.71	0.00	0.67
	standard deviation	0.00	0.00	6.55	9.83	5.96	0.00	0.69

Disturbance and Threats

There were very few observed current or historical disturbances within Maritime Open Upland plots of Cape Lookout National Seashore (Table 6). Grazing impact from feral horses (*Equus caballus*) was observed in three of the four plots of this habitat type on Shackleford Banks. The wild horses of Shackleford Banks are a species of special management concern (SSMC) for the seashore, with Congress setting a target population of between 120 and 130 individuals annually and management being implemented by park staff and the Foundation for Shackleford Horses, Inc. (Burkholder et al. 2017). In Maritime Open Uplands (i.e., dunes), horses graze selectively on sea-oats and shore little bluestem; they cause soil compaction and create non-vegetated areas that hasten dune movement and soil erosion (Godfrey and Godfrey 1976). Centipede grass (*Eremochloa ophiuroides*), a non-native perennial lawn grass that naturalizes occasionally in open natural sites across the Southeastern U.S., is also a preferred forage for horses on Shackleford Banks (Stuska et al. 2009). Shore little bluestem, which is listed as a “Rare but Relatively Secure (W1)” species in North Carolina (Wichmann and Wojcik 2022), was not observed in any of the Maritime Open Upland plots of Shackleford Banks. It was observed in this habitat type on both North Core Banks and Cape Lookout subunits. Feral horses are not present on either of those subunits.

There were no state-listed nonnative, invasive plants observed in plots of this broad habitat type.

Table 6. Disturbance observations and abundance (% cover) measured on vegetation monitoring plots of Cape Lookout National Seashore.

Broadly Defined Habitat	Plot	Heavy Trash	Saltwater Intrusion	Windfall	Historic Road/Trail	Horse Browse
Maritime Open Upland Vegetation	CALO002	–	–	–	–	–
	CALO003	10	–	–	–	–
	CALO004	–	–	–	–	–
	CALO006	–	–	–	–	–
	NCOR050	–	–	–	–	–
	NCOR051	–	–	–	–	–
	NCOR052	–	–	–	–	–
	NCOR053	–	–	–	–	–
	SCOR033	–	–	–	–	–
	SCOR034	–	–	–	20	–
	SCOR035	–	–	–	–	–
	SCOR036	–	–	–	–	–
	SHAC033	–	–	–	–	–
	SHAC034	–	–	–	–	100
	SHAC035	–	–	–	–	40
	SHAC036	–	–	–	–	80

Table 6 (continued). Disturbance observations and abundance (% cover) measured on vegetation monitoring plots of Cape Lookout National Seashore.

Broadly Defined Habitat	Plot	Heavy Trash	Saltwater Intrusion	Windfall	Historic Road/Trail	Horse Browse
Maritime Upland Forests and Shrublands	CALO033	–	20	–	–	–
	CALO034	–	–	–	–	–
	CALO035	–	–	70	–	–
	CALO036	–	100	20	–	–
	SHAC065	–	–	10	–	–
	SHAC066	10	–	–	–	–
	SHAC067	–	–	–	–	–
	SHAC068	–	–	–	–	–
Maritime Non-tidal Wetland Vegetation	CALO065	–	–	–	–	–
	CALO067	–	–	–	–	–
	CALO068	–	–	–	–	–
	CALO069	–	–	–	–	–
	NCOR001	–	–	20	–	–
	NCOR002	–	–	–	–	–
	NCOR004	–	–	–	–	–
	NCOR005	–	10	–	–	–
	NCOR006	–	–	–	–	–
	NCOR009	–	–	–	–	–
	SCOR001	–	–	–	–	–
	SCOR002	–	–	–	–	–
	SCOR003	–	–	–	–	–
	SCOR004	–	–	–	–	–
	SHAC001	–	–	–	–	–
	SHAC002	–	–	–	–	100
	SHAC003	–	–	–	–	10
	SHAC004	–	–	–	–	100
Tidal Wetlands	NCOR089	–	–	–	–	–
	NCOR090	–	–	–	–	–
	NCOR091	–	–	–	–	–
	NCOR092	–	–	–	–	–
	NCOR093	–	–	–	–	–
	NCOR095	–	–	–	–	–
	NCOR096	–	–	–	–	–

Geomorphology and Soil

Plots within Maritime Open Uplands of Cape Lookout National Seashore occurred on landforms with complex rolling topography with multiple slopes and aspects (Table 7). Soil samples were slightly to moderately alkaline with pH values typically higher than 8.0; organic matter content was low (Tables 8 and 9).

Table 7. Local landform and hydrologic condition from vegetation monitoring plots at Cape Lookout National Seashore.

Broadly Defined Habitat	Plot	Slope (°)	Aspect (°)	TSI ¹ (°)	Landform Type	Water Source	Submerged (%)
Maritime Open Upland Vegetation	CALO002	complex	complex	n/a	rolling upland	None	0
	CALO003	complex	complex	n/a	rolling upland	None	0
	CALO004	complex	complex	n/a	rolling upland	None	0
	CALO006	complex	complex	n/a	rolling upland	None	0
	NCOR050	complex	complex	n/a	rolling upland	None	0
	NCOR051	complex	complex	n/a	rolling upland	None	0
	NCOR052	complex	complex	n/a	rolling upland	None	0
	NCOR053	complex	complex	n/a	rolling upland	None	0
	SCOR033	complex	complex	n/a	rolling upland	None	0
	SCOR034	complex	complex	n/a	rolling upland	None	0
	SCOR035	complex	complex	n/a	rolling upland	None	0
	SCOR036	complex	complex	n/a	rolling upland	None	0
	SHAC033	complex	complex	n/a	rolling upland	None	0
	SHAC034	complex	complex	n/a	rolling upland	None	0
	SHAC035	complex	complex	n/a	rolling upland	None	0
	SHAC036	complex	complex	n/a	rolling upland	None	0
Maritime Upland Forests and Shrublands	CALO033	0	n/a	0	flat plain	Flood zones	0
	CALO034	0	n/a	0	flat plain	Flood zones	0
	CALO035	0	n/a	0	flat plain	Flood zones	0
	CALO036	0	n/a	0	flat plain	Flood zones	0
	SHAC065	4	45	-3.250	rolling upland	None	0
	SHAC066	10	45	-3.875	flat plain	None	0
	SHAC067	6	315	-2.375	rolling upland	None	0
	SHAC068	6	270	-0.500	rolling upland	None	0
Maritime Non-tidal Wetland Vegetation	CALO065	0	n/a	0	flat plain	Flood zones	0
	CALO067	0	n/a	0	flat plain	Flood zones	0
	CALO068	0	n/a	0	flat plain	Flood zones	0
	CALO069	0	n/a	0	flat plain	Flood zones	0

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

Table 7 (continued). Local landform and hydrologic condition from vegetation monitoring plots at Cape Lookout National Seashore.

Broadly Defined Habitat	Plot	Slope (°)	Aspect (°)	TSI ¹ (°)	Landform Type	Water Source	Submerged (%)
Maritime Non-tidal Wetland Vegetation (continued)	NCOR001	0	n/a	0	flat plain	Flood zones	0
	NCOR002	0	n/a	0	flat plain	Flood zones	0
	NCOR004	0	n/a	0	flat plain	Flood zones	0
	NCOR005	0	n/a	0	flat plain	Flood zones	0
	NCOR006	0	n/a	0	flat plain	Flood zones	0
	NCOR009	0	n/a	0	flat plain	Flood zones	0
	SCOR001	0	n/a	0	flat plain	Flood zones	0
	SCOR002	0	n/a	0	flat plain	Flood zones	0
	SCOR003	0	n/a	0	flat plain	Flood zones	0
	SCOR004	0	n/a	0	flat plain	Flood zones	0
	SHAC001	0	n/a	0	flat plain	Flood zones	10
	SHAC002	0	n/a	0	flat plain	Perm. water	70
	SHAC003	0	n/a	0	flat plain	Flood zones	0
	SHAC004	0	n/a	0	seep/swale	Flood zones	0
Tidal Wetlands	NCOR089	0	n/a	0	tidal flat	Flood zones	0
	NCOR090	0	n/a	0	tidal flat	Flood zones	0
	NCOR091	0	n/a	0	tidal flat	Flood zones	0
	NCOR092	0	n/a	0	tidal flat	Flood zones	0
	NCOR093	0	n/a	0	tidal flat	Flood zones	90
	NCOR095	0	n/a	0	tidal flat	Flood zones	0
	NCOR096	0	n/a	0	tidal flat	Flood zones	20

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

Table 8. Soil nutrient status from vegetation monitoring plots at Cape Lookout National Seashore. 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 H ₂ O 1:1	OM (%)	P ¹	Ca ¹	Mg ¹	K ¹
Maritime Open Upland Vegetation	CALO002	6.79	8.00	0.15	10.00	1208.00	44.00	8.00
	CALO003	20.16	8.30	0.33	4.00	3769.00	40.00	9.00
	CALO004	9.64	8.20	0.32	7.00	1749.00	44.00	12.00
	CALO006	8.23	8.30	0.33	9.00	1487.00	40.00	11.00
	NCOR050	10.66	8.40	0.30	6.00	1950.00	44.00	12.00
	NCOR051	4.65	8.20	0.18	7.00	799.00	43.00	10.00
	NCOR052	3.52	7.50	0.36	9.00	506.00	56.00	18.00
	NCOR053	5.78	8.30	0.15	8.00	1008.00	49.00	9.00
	SCOR033	18.92	8.70	0.17	3.00	3537.00	38.00	10.00
	SCOR034	4.92	8.30	0.11	5.00	870.00	34.00	8.00
	SCOR035	7.16	8.40	0.17	6.00	1295.00	36.00	8.00
	SCOR036	8.45	8.50	0.11	5.00	1529.00	45.00	7.00
	SHAC033	6.61	7.90	0.12	14.00	1167.00	41.00	10.00
	SHAC034	5.80	8.10	0.30	26.00	1050.00	28.00	8.00
	SHAC035	17.19	8.30	0.49	6.00	3154.00	55.00	12.00
	SHAC036	7.25	8.30	0.20	14.00	1314.00	36.00	10.00
	average	9.11	8.23	0.24	8.69	1649.50	42.06	10.13
	standard deviation	5.15	0.27	0.11	5.58	984.38	7.27	2.63
Maritime Upland Forests and Shrublands	CALO033	16.05	6.90	4.80	15.00	1349.00	644.00	57.00
	CALO034	6.00	7.60	2.31	5.00	453.00	310.00	39.00
	CALO035	9.72	8.30	0.33	3.00	1811.00	20.00	4.00
	CALO036	11.99	7.20	1.54	5.00	2128.00	73.00	11.00

¹ 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).

Table 8 (continued). Soil nutrient status from vegetation monitoring plots at Cape Lookout National Seashore. 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 H ₂ O 1:1	OM (%)	P ¹	Ca ¹	Mg ¹	K ¹
Maritime Upland Forests and Shrublands (continued)	SHAC065	9.10	4.60	4.63	7.00	494.00	94.00	27.00
	SHAC066	4.61	5.00	3.07	7.00	185.00	117.00	28.00
	SHAC067	2.64	4.70	1.78	7.00	129.00	38.00	12.00
	SHAC068	3.12	5.40	1.35	10.00	231.00	68.00	22.00
	average	7.90	6.21	2.48	7.38	847.50	170.50	25.00
	standard deviation	4.67	1.45	1.59	3.70	796.00	211.32	17.10
Maritime Non-tidal Wetland Vegetation	CALO065	11.04	8.00	0.72	13.00	1065.00	268.00	59.00
	CALO067	3.92	5.80	1.09	7.00	418.00	74.00	13.00
	CALO068	12.70	8.20	0.74	12.00	2218.00	87.00	15.00
	CALO069	18.22	6.90	1.57	27.00	794.00	488.00	124.00
	NCOR001	13.01	7.00	3.44	10.00	571.00	554.00	111.00
	NCOR002	16.28	6.40	1.90	21.00	491.00	456.00	133.00
	NCOR004	22.35	6.40	3.14	30.00	580.00	568.00	174.00
	NCOR005	12.93	6.80	8.95	12.00	581.00	580.00	156.00
	NCOR006	18.50	7.20	3.35	16.00	1070.00	653.00	160.00
	NCOR009	2.41	7.80	0.74	7.00	237.00	95.00	23.00
	SCOR001	10.19	8.20	0.34	5.00	1753.00	61.00	27.00
	SCOR002	8.41	8.30	0.58	6.00	1443.00	72.00	25.00
	SCOR003	20.37	7.60	3.09	23.00	1131.00	524.00	138.00
	SCOR004	16.50	7.80	1.46	19.00	1475.00	381.00	99.00
	SHAC001	27.34	4.50	3.60	12.00	298.00	271.00	111.00
	SHAC002	16.84	5.20	1.14	9.00	389.00	261.00	75.00

¹ 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).

Table 8 (continued). Soil nutrient status from vegetation monitoring plots at Cape Lookout National Seashore. 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 H2O 1:1	OM (%)	P ¹	Ca ¹	Mg ¹	K ¹
Maritime Non-tidal Wetland Vegetation (continued)	SHAC003	14.03	5.60	1.62	9.00	271.00	280.00	78.00
	SHAC004	6.35	6.10	0.88	22.00	235.00	160.00	39.00
	average	13.97	6.88	2.13	14.44	834.44	324.06	86.67
	standard deviation	6.41	1.12	2.03	7.54	581.41	205.27	54.53
Tidal Wetlands	NCOR089	14.94	7.80	0.52	12.00	1669.00	191.00	52.00
	NCOR090	36.36	5.30	1.48	15.00	404.00	493.00	177.00
	NCOR091	21.54	8.10	0.46	7.00	1539.00	382.00	138.00
	NCOR092	16.84	6.60	0.99	13.00	286.00	390.00	179.00
	NCOR093	79.74	6.40	18.11	17.00	1042.00	1588.00	616.00
	NCOR095	43.80	5.60	1.57	15.00	497.00	664.00	274.00
	NCOR096	73.20	6.00	21.57	28.00	789.00	1409.00	553.00
	average	40.92	6.54	6.39	15.29	889.43	731.00	284.14
	standard deviation	26.48	1.06	9.25	6.45	550.27	545.43	216.14

¹ 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).

Table 9. Soil nutrient status from vegetation monitoring plots at Cape Lookout National Seashore. 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	Na ¹	B ¹	Fe ¹	Mn ¹	Cu ¹	Zn ¹	Al ¹
Maritime Open Upland Vegetation	CALO002	30.00	0.10	40.00	4.00	0.10	0.51	15.00
	CALO003	77.00	0.10	20.00	3.00	0.10	0.20	5.00
	CALO004	43.00	0.26	44.00	3.00	0.10	0.45	26.00
	CALO006	42.00	0.23	27.00	2.00	0.10	0.48	8.00
	NCOR050	44.00	0.31	43.00	4.00	0.10	0.56	25.00
	NCOR051	27.00	0.21	56.00	3.00	0.10	0.54	32.00
	NCOR052	79.00	0.25	57.00	2.00	0.10	0.74	36.00
	NCOR053	30.00	0.30	52.00	3.00	0.10	0.45	32.00
	SCOR033	87.00	0.26	18.00	2.00	0.10	0.20	2.00
	SCOR034	26.00	0.10	46.00	3.00	0.10	0.20	33.00
	SCOR035	34.00	0.10	37.00	2.00	0.10	0.20	14.00
	SCOR036	39.00	0.22	46.00	3.00	0.10	0.42	15.00
	SHAC033	40.00	0.21	61.00	3.00	0.10	0.20	38.00
	SHAC034	25.00	0.10	66.00	3.00	0.10	1.74	44.00
	SHAC035	91.00	0.41	20.00	2.00	0.10	0.61	0.50
	SHAC036	30.00	0.10	40.00	3.00	0.10	0.62	25.00
	average	46.50	0.20	42.06	2.81	0.10	0.51	21.91
	standard deviation	23.07	0.10	14.83	0.66	0.00	0.37	13.66
Maritime Upland Forests and Shrublands	CALO033	651.00	1.18	69.00	1.00	0.10	0.40	39.00
	CALO034	189.00	1.04	62.00	2.00	0.10	0.63	41.00
	CALO035	42.00	0.10	58.00	2.00	0.10	0.56	8.00
	CALO036	49.00	0.58	104.00	0.50	0.10	0.65	25.00

¹ 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).

Table 9 (continued). Soil nutrient status from vegetation monitoring plots at Cape Lookout National Seashore. 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	Na ¹	B ¹	Fe ¹	Mn ¹	Cu ¹	Zn ¹	Al ¹
Maritime Upland Forests and Shrublands (continued)	SHAC065	48.00	0.10	56.00	0.50	0.10	0.97	47.00
	SHAC066	51.00	0.10	37.00	0.50	0.10	0.48	31.00
	SHAC067	21.00	0.10	37.00	0.50	0.10	0.20	26.00
	SHAC068	24.00	0.10	112.00	7.00	0.10	2.98	57.00
	average	134.38	0.41	66.88	1.75	0.10	0.86	34.25
	standard deviation	215.52	0.46	27.84	2.22	0.00	0.89	15.13
Maritime Non-tidal Wetland Vegetation	CALO065	679.00	2.35	79.00	2.00	0.10	1.57	60.00
	CALO067	29.00	0.25	39.00	0.50	0.10	0.55	69.00
	CALO068	102.00	0.71	38.00	0.50	0.21	0.56	29.00
	CALO069	2017.00	3.92	85.00	0.50	0.10	0.99	88.00
	NCOR001	1076.00	2.46	148.00	4.00	0.10	1.38	85.00
	NCOR002	1704.00	2.24	151.00	0.50	0.10	0.94	107.00
	NCOR004	2562.00	1.81	102.00	0.50	0.27	0.73	204.00
	NCOR005	876.00	2.39	131.00	0.50	0.10	1.08	80.00
	NCOR006	1500.00	3.92	299.00	3.00	0.10	1.31	71.00
	NCOR009	66.00	0.55	98.00	1.00	0.10	0.67	56.00
	SCOR001	121.00	0.23	41.00	3.00	0.10	0.67	20.00
	SCOR002	62.00	0.50	90.00	3.00	0.10	0.46	25.00
	SCOR003	2121.00	3.70	246.00	0.50	0.10	1.26	169.00
	SCOR004	1174.00	2.41	138.00	3.00	0.10	0.82	39.00
	SHAC001	1374.00	0.66	35.00	0.50	0.10	0.48	51.00
	SHAC002	1100.00	0.57	18.00	0.50	0.10	0.61	23.00

¹ 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).

Table 9 (continued). Soil nutrient status from vegetation monitoring plots at Cape Lookout National Seashore. 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	Na ¹	B ¹	Fe ¹	Mn ¹	Cu ¹	Zn ¹	Al ¹
Maritime Non-tidal Wetland Vegetation (continued)	SHAC003	1262.00	1.13	32.00	0.50	0.10	0.20	55.00
	SHAC004	588.00	0.81	92.00	0.50	0.10	0.48	58.00
	average	1022.94	1.70	103.44	1.36	0.12	0.82	71.61
	standard deviation	777.77	1.27	74.94	1.25	0.05	0.38	48.59
Tidal Wetlands	NCOR089	996.00	0.93	117.00	1.00	0.10	0.20	40.00
	NCOR090	3270.00	1.97	192.00	0.50	0.10	1.12	136.00
	NCOR091	2207.00	1.37	112.00	2.00	0.10	0.55	53.00
	NCOR092	2272.00	1.30	219.00	2.00	0.10	0.94	118.00
	NCOR093	11168.00	5.89	102.00	0.50	0.10	0.51	170.00
	NCOR095	4724.00	3.70	208.00	1.00	0.10	0.62	94.00
	NCOR096	9467.00	5.13	188.00	0.50	0.10	0.80	143.00
	average	4872.00	2.90	162.57	1.07	0.10	0.68	107.71
	standard deviation	3920.62	2.01	50.11	0.67	0.00	0.30	47.95

¹ 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).

Maritime Upland Forests and Shrublands

Maritime Forests and Shrublands of the North Carolina Outer Banks are located on old, stabilized dunes within wider portions of the barrier islands (Figure 5). These upland communities are typically less exposed to salt spray and tidal inundation than neighboring Open Upland habitats adjacent to the ocean, but occasionally they can flood during strong storm surge events. Natural maritime forests dominated by live oak and sand laurel oak (*Quercus hemisphaerica*) are uncommon across Cape Lookout National Seashore and are only located in small zones on the northern edge (sound side) of Shackleford Banks (Figure 5, left image). For this monitoring effort, we included planted pine stands of the Cape Lookout subunit within this broadly defined habitat (Figure 5, right image). The eight vegetation plots established within this habitat were classified into two distinct vegetation associations, including (descriptions from NatureServe 2024):



Figure 5. Eight plots were established in Maritime Upland Forests and Shrublands of Cape Lookout National Seashore during this monitoring effort (May–June 2022). This broadly defined habitat type included oak-dominated forests of stable dune systems on the sound-side of Shackleford Banks (left) and forests composed of self-regenerating pines planted decades ago within the Cape Lookout subunit (right). NPS photo / SECN staff.

- Atlantic Coast Maritime Evergreen Forest (CEGL007027; 4 plots): Forests that occur on sand flats and stabilized dunes that are protected from flooding, but experience salt spray. Soils are typically well- to excessively well-drained. This is the typical maritime oak forest from Virginia to South Carolina. (Global Status: G2—Imperiled; State (NC) Status: No Status Rank)
- Slash Pine Plantation (CST007170; 4 plots): This community includes cultivated stands of slash pine (*Pinus elliottii*) that occur both within and outside the natural range of the species. These forests typically occur on upland sites but can occasionally occur on wetlands. (Global Status: No Status Rank; State (NC) Status: No Status Rank)

Species Diversity and Abundance

Native species richness ranged from 12 to 50 (mean = 29.9) within plots of this broadly defined habitat type in Cape Lookout National Seashore and was the highest among all other habitats at the full plot scale (Table 3). Four of the eight Upland Forest and Shrubland plots contained at least one nonnative species (Table 3) and the state invasive Japanese honeysuckle was observed in two plots on the Shackleford Banks subunit. Species richness was highest among woody vines across all spatial scales (Table 3). One hundred and ten vascular plant species were found collectively within these eight plots; 54 of these were only found in this broadly defined habitat during this monitoring effort (Appendix B, Table 11). Eight species classified as rare by the state (Wichmann and Wojcik 2022) were observed in these plots, and all Maritime Upland Forest and Shrubland plots on Shackleford Banks had at least one state rare species. Rare plants located within these sites included halfsweet sedge (*Carex calcifugens*), sand spikerush (*Eleocharis montevidensis*), basketgrass (*Oplismenus setarius*), perennial dune whitlow-wort (*Paronychia baldwinii* ssp. *riparia*), red bay (*Persea borbonia*), shore little bluestem, buckthorn bully (*Sideroxylon lycioides*), and rough vervain (*Verbena scabra*). Other species found within these plots are common across the Outer Coastal Plain of the Southeastern Coast. Species with high constancy in this habitat are listed below, by growth form (constancy values in parentheses):

Trees

- Southern red cedar (*Juniperus silicicola*; 100%)
- Swamp bay (*Persea palustris*; 75%)

Shrubs

- Wax-myrtle (100%)
- Yaupon (*Ilex vomitoria*; 100%)

Vines

- Maritime catbriar (100%)
- Eastern poison ivy (*Toxicodendron radicans* var. *radicans*; 100%)
- Virginia creeper (*Parthenocissus quinquefolia*; 100%)
- Muscadine (*Muscadinia rotundifolia* var. *rotundifolia*; 87%)

Herbs and Graminoids

- Dune pennywort (*Hydrocotyle bonariensis*; 62%)

Woody Stem Metrics

Total BA of tree stems ranged from 19.7 to 50.0 m²/ha in these plots, with an overall average of 31.0 m²/ha; density of canopy stems ranged from 16 to 46 per plot, with an average of 28 (Table 5). Canopy height ranged from 7.3 to 19.3 meters (average = 13.5), and canopy cover ranged from 58% to 85% (average = 75.6%; Table 5). The most dominant canopy species included slash pine (mean BA = 8.52 m²/ha, mean density = 244/ha), live oak (mean BA = 6.88 m²/ha, mean density = 87/ha), and southern red cedar (mean BA = 5.82 m²/ha, mean density = 147/ha; Appendix B, Table 12). Sapling density at the 80-square meter scale ranged from 26 to 95 stems, with an average of 47.2,

while seedling density at the 8-meter square scale ranged from 64 to 302 stems, with an average of 164.2 across all plots (Table 5). Dominant sapling species included slash pine, southern red cedar, wax-myrtle, and American holly (*Ilex opaca*); dominant seedlings included an array of woody vine species, yaupon, slash pine, and live oak (Appendix B, Table 12).

Based on stem count alone, pines—both slash and loblolly (*Pinus taeda*)—comprised nearly 45% of the relative abundance among species within the tree stratum, while southern red cedar and live oak comprised 25% and 18%, respectively (Figure 6). The sapling stratum was dominated by wax-myrtle and pines, while the seedling stratum was dominated by yaupon (Figure 6).

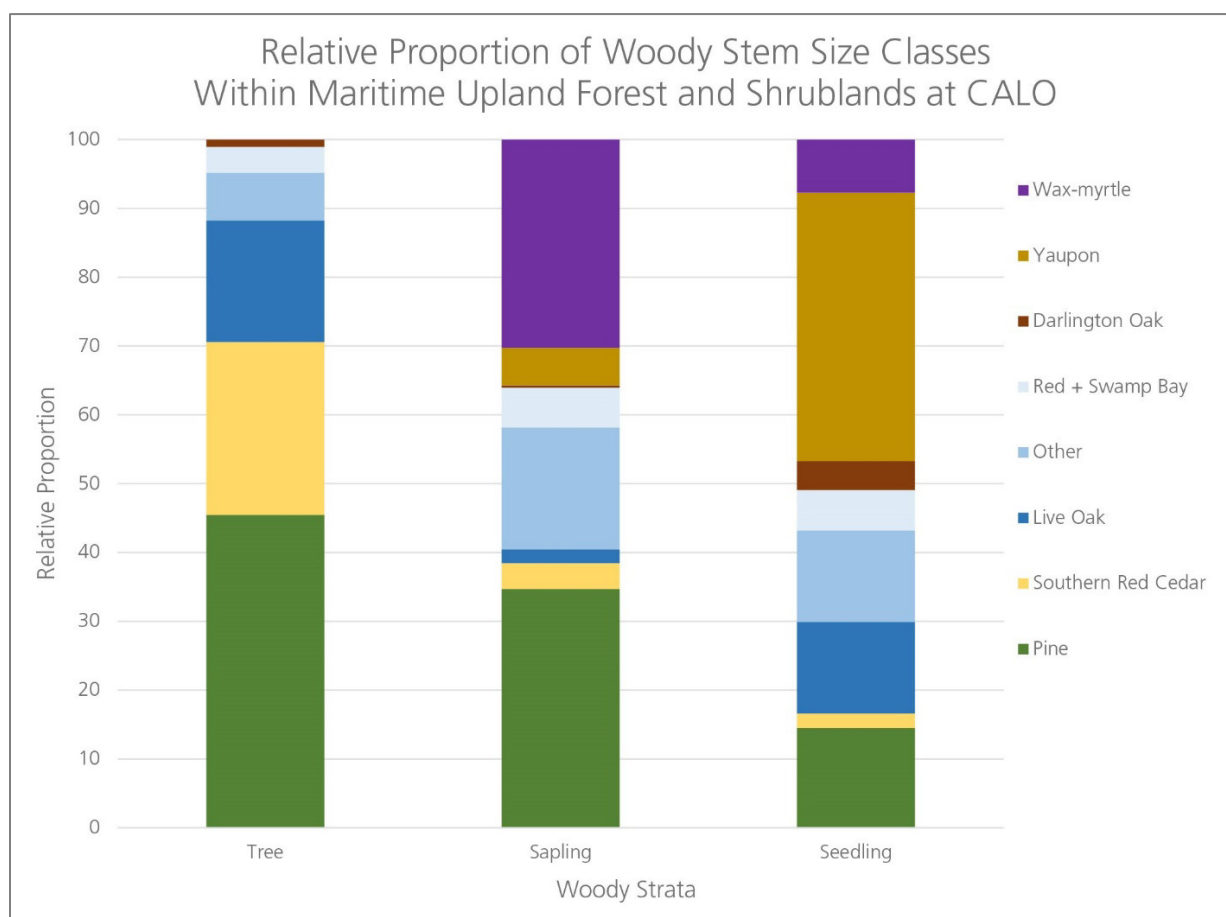


Figure 6. Relative proportion of species groups across three woody stem strata—trees, saplings, and seedlings— within Maritime Upland Forest and Shrubland monitoring plots of Cape Lookout National Seashore.

Most of the trees in Maritime Upland Forest and Shrubland plots were living (83%; Figure 7). Of the 38 trees that were dead, 26 were pines on the Cape Lookout subunit. Dead pines account for about 18% of all standing pines within this subunit. It is expected that fuel loads (see Fuel Load Estimates) will increase dramatically in these stands once these dead trees fall. Most other tree species across the park were categorized with healthy vigor and minimal (< 10%) dieback (Figure 7). However, all living red bay and swamp bay trees measured exhibited symptoms like those brought on by laurel

wilt disease (see discussion below under Disturbance and Threats). Finally, it should be noted that sand live oak (*Quercus geminata*) was a canopy co-dominant in one Maritime Upland Forest and Shrubland plot on the Shackleford Banks subunit (SHAC066). This species of oak, which is closely related to the more common live oak, has not been reported along the Outer Banks of North Carolina (Sorrie 2021).

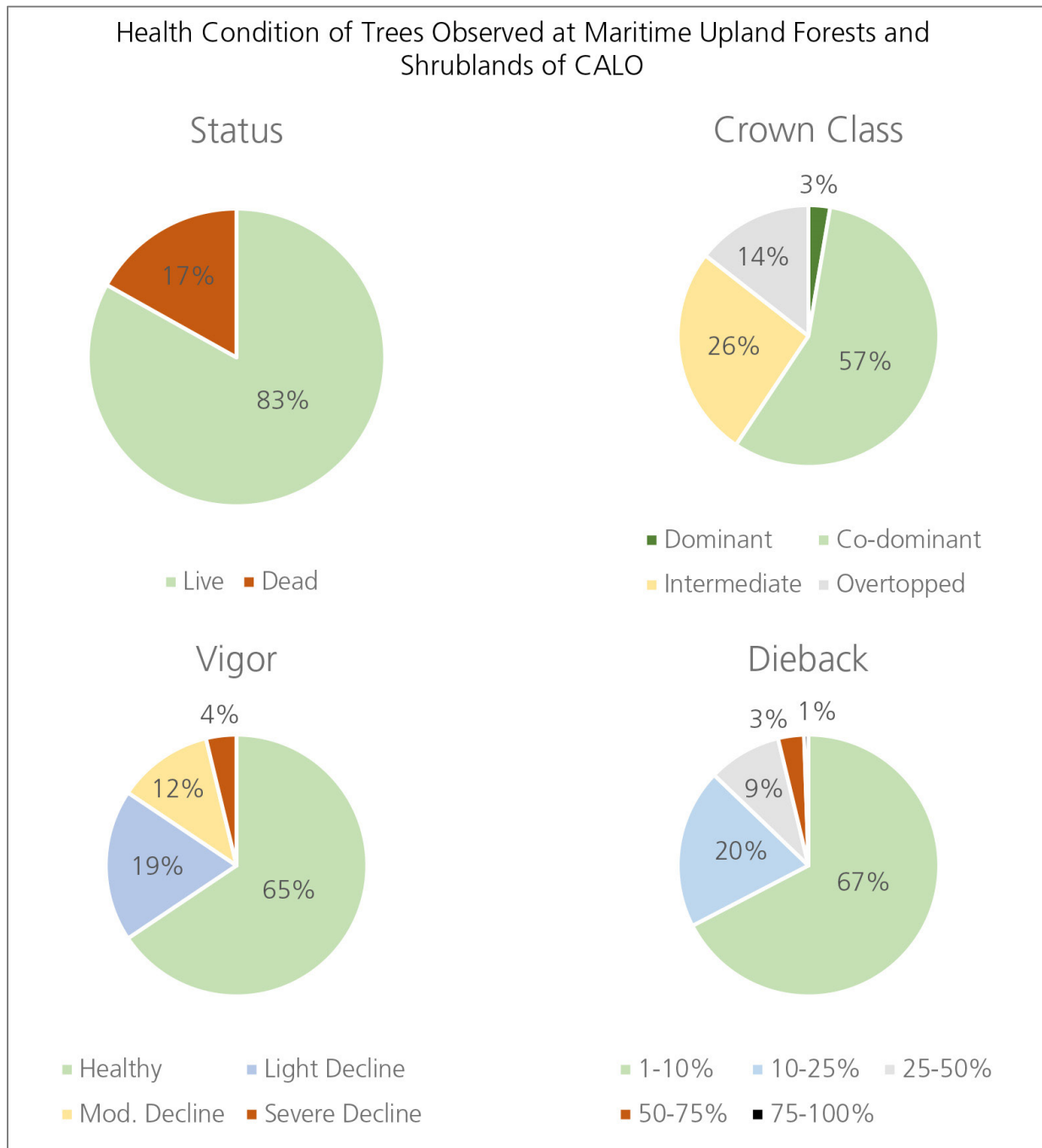


Figure 7. Health status of woody stems greater than or equal to 10 centimeters (3.9 in) DBH (“trees”) measured on Maritime Upland Forest and Shrubland monitoring plots of Cape Lookout National Seashore.

Disturbance and Threats

The possible detection of laurel wilt disease on a majority of swamp bay and red bay trees within the park could become a serious threat to a frequent species of Maritime Forests and Shrublands, as well as of other broadly defined habitats. The disease is comprised of a fungus (*Raffaelea lauricola*) spread by an invasive, nonnative ambrosia beetle (*Xyleborus glabratus*) and affects several species within the Lauraceae Family (Fraedrich et al. 2008). Infected red bay (*Persea borbonia*) and swamp bay typically die within months after succumbing to the disease. These individuals exhibit crowns of brownish-red dead leaves. As of 2022, laurel wilt disease has been confirmed in Carteret County, North Carolina (USDA Forest Service 2022). It is possible that the declining swamp bay and red bay trees observed in this monitoring effort were impacted by another type of ambrosia beetle—there are other species that cause crown and branch dieback—or another disturbance altogether. In either case, long-term monitoring of these sites will detect the degree of mortality in swamp bays across the park.

Another major threat to Maritime Forests and Shrublands of Cape Lookout National Seashore is the eroding shoreline on the sound-side of Shackleford Banks, which results in overall loss of forested habitat within the seashore (Jon Altman [CALO Biologist], personal communication). Two of the four Upland Forest and Shrubland plots on the Cape Lookout subunit exhibited signs of saltwater intrusion, including high mortality of trees and encroachment of tidal wetland plants (Table 6). These effects may be site related—i.e., these maritime “forests” on the Cape Lookout subunit are not completely “natural”; instead, upland tree species were planted on areas of the park that were likely tidal- or non-tidal-influenced wetlands. Impacts from sea water on these sites may also be exacerbated by sea-level rise.

The other noticeable threat to these ecosystems within the park is the presence of a non-native invasive species—Japanese honeysuckle. 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 an invasive species, like Japanese honeysuckle, will respond to both local-scale management efforts and landscape-scale changes (e.g., climate change), especially in these understudied, rare maritime forests of Cape Lookout National Seashore. 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.

Geomorphology and Soil

Plots located within Maritime Upland Forests and Shrublands of Cape Lookout National Seashore either occurred on flat (0°) landforms or gentle to moderate slopes on westerly to northeasterly aspects (Table 7). Forests of the Cape Lookout subunit were in flood zones, another factor classifying these sites to former wetland vegetation types. Soil chemistry of the “natural,” oak-dominated,

Maritime Upland Forests and Shrublands of Shackleford Banks aligned with edaphic conditions in older dune systems of the South Atlantic Coast that support forested vegetation. Soils were acidic and typically had low cation exchange rates on forest plots of Shackleford Banks (Table 8). Soil pH was high on forest plots of the Cape Lookout subunit and similar to soil conditions of plots classified as Maritime Nontidal Wetlands (Table 8).

Maritime Nontidal Wetland Vegetation

This broad category of wetlands includes marshes and shrublands of protected backdunes and barrier island flats that do not experience tidal floods (Figure 8). These sites are often influenced by a high-water table but can be seasonally or permanently saturated. Nontidal wet grasslands of the North Carolina Outer Banks are often species diverse and can contain multiple rare plants (Sorrie 2021). Vegetation associations sampled within the park that belong to this broadly defined habitat type include (descriptions from NatureServe 2024):

- Marsh Fimbry - Common Threesquare Marsh (CEGL003790; 1 plot): Graminoid-dominated wet swales, typically with standing water present in the spring; dominated by common threesquare (*Schoenoplectus pungens* var. *pungens*) and marsh fimbry (*Fimbristylis castanea*). (Global Status: No Status Rank; State (NC) Status: No Status Rank)
- Atlantic Coast Interdune Swale (CEGL003839; 17 plots): Shrublands occurring within interdune swales, backdunes, and wetland flats characterized by a moderately open to dense canopy of wax-myrtle; the substrate is typically composed of sand, or loamy sand. (Global Status: G3—Vulnerable; State (NC) Status: No Status Rank)



Figure 8. Nontidal wetlands of Cape Lookout National Seashore occur on flat or concave landforms that do not receive regular inundation from tidal fluctuations. Vegetation communities can be shrub or graminoid/forbs dominant, and occasionally a combination of both. This broadly defined habitat was present in all four subunits of the park (North Core Banks, South Core Banks, Cape Lookout, and Shackleford Banks). Eighteen plots were established in Maritime Nontidal Wetlands of Cape Lookout National Seashore during this monitoring effort (May–June 2022). NPS photo / SECN staff.

Species Diversity and Abundance

Native species richness ranged from 13 to 34 (mean = 22.4) within plots of this broadly defined habitat type in Cape Lookout National Seashore, and richness was highest among graminoids across all spatial scales (Table 4). Eleven of the 18 Nontidal Wetland plots contained at least one nonnative species (Table 4), but invasive plants were largely absent from these sites. One plot on North Core Banks (NCOR006) contained a heavy abundance of common reed and Japanese honeysuckle was present within one plot on South Core Banks (SCOR004). One hundred and fifteen vascular plant species were found collectively within these 18 plots; 44 were only found in this broadly defined habitat during this monitoring effort (Appendix B, Table 11). Eight species classified as rare by the state (Wichmann and Wojcik 2022) were observed in these plots, including the state threatened blue witchgrass. Other state rare plants observed within these sites included false-willow (*Baccharis angustifolia*), sand spikerush, salt-marsh wild-rye (*Elymus halophilus*), red bay, maritime pokeweed (*Phytolacca rigida*), shore little bluestem, and Spanish dagger (*Yucca aloifolia*). Other species found

within these plots are common across the Outer Coastal Plain of the Southeastern Coast. Species with high constancy in this habitat are listed below, by growth form (constancy values in parentheses):

Trees

- Southern red cedar (67%)

Shrubs

- Wax-myrtle (94%)
- Groundsel tree (*Baccharis halimifolia*; 83%)
- Yaupon (67%)
- False-willow (67%)
- Marsh-elder (*Iva frutescens*; 67%)

Vines

- Eastern poison ivy (89%)
- Swallow-wort (*Patalias palustre*; 78%)
- Saltmarsh morning-glory (*Ipomoea sagittata*; 72%)

Herbs and Graminoids

- Black needle rush (100%)
- Saltmeadow cordgrass (94%)
- Silver seaside oxeye (*Borrchia frutescens*; 78%)
- Southern seaside goldenrod (*Solidago mexicana*; 72%)
- Dune pennywort (67%)

Woody Stem Metrics

Occurrence of tree-sized woody stems was sporadic in plots of this habitat, and generally only included southern red cedar (Appendix B, Table 12). Canopy heights were short, ranging from 1 to 8.3 meters (3.3 to 27.2 ft) when trees or shrubs were present (Table 5). Sapling density at the 80-square meter scale ranged from two to 155 stems when small trees or shrubs were present (Table 5). Dominant sapling species included yaupon, wax-myrtle, southern red cedar, and groundsel tree; dominant seedlings included slash pine, southern red cedar, wax-myrtle, and American holly (*Ilex opaca*); dominant seedlings included eastern poison ivy, yaupon, and wax-myrtle (Appendix B, Table 12).

Disturbance and Threats

There were very few observed current or historical disturbances on these plots, except for noticeable horse grazing impacts within sites on the Shackleford Banks subunit (Table 6). Maritime wet grasslands of Dare County and Hyde County, North Carolina to the north and east of Cape Lookout National Seashore are of exceptional quality because of the absence of grazing feral horses (Sorrie 2021; see discussion above under Maritime Open Upland Vegetation). Threats to this broadly defined habitat include coastal development pressure and altered hydrology from low to high salinity

across its global range. Although observable stressors were relatively absent from these vegetation plots, monitoring over time will provide insight to how these sites are responding to hydrologic shifts brought on by rising sea levels along the Outer Banks.

Geomorphology and Soil

Plots located within Maritime Nontidal Wetlands of Cape Lookout National Seashore occurred on very flat (0°) landforms with terrain shape indices equal to 0 (Table 7). Standing water was only observed in two of these 18 plots, although flooding or inundation is probably common in all sites at other times of the year. Soil pH values ranged from acidic to alkaline, with an average of 6.5 (Table 8).

Tidal Wetlands

Within Cape Lookout National Seashore, this broadly defined habitat type includes both graminoid- and herbaceous-dominated marshes and occasionally red cedar forests influenced by tidal patterns, salinity fluctuations, and sediment deposition (Figure 9). Although not sampled during this monitoring effort, tidal salt marshes along with their embedded salt pans exhibit the highest salinity levels among Maritime Tidal Wetlands due to daily fluctuations of sea water. Brackish tidal marshes within the park are dominated by needlegrass rush and experience daily fluctuations of lower salinity water—often a combination of sea water and freshwater from the Pamlico and Albemarle Sounds. These marshes also were not sampled during this monitoring effort. For an explanation of why these higher salinity marshes (i.e., “low” marshes) were excluded from this effort, despite their occasional dominance on the sound side of Cape Lookout National Seashore, refer to the SECN terrestrial vegetation monitoring protocol (Boyle et al. 2019). Tidal wetlands sampled within the park included freshwater sites at the upper margins of brackish marsh, where salinity levels are minimal (i.e., “high” marshes). These sites are typically saturated throughout the year and can experience frequent or infrequent flooding from tidal fluctuations, either lunar- or wind-driven. Unlike tidal salt and brackish marshes which are homogenous in vegetation composition, tidal freshwater wetlands are often characterized by a patchy mosaic of vegetation diversity. They can be composed of zones of tall or short graminoids, or an array of herbaceous plants. Although this broadly defined habitat is present across the entirety of the park, plots were established solely on the North Core Banks subunit during this sampling effort due to their relative rarity compared to other habitat types on other subunits. Vegetation associations sampled within the park that belong to this broadly defined habitat type include (descriptions from NatureServe 2024):

- Seaside-tansy Tidal Shrub Flat (CEGL003924; 1 plot): Low-statured shrublands occurring along tidal marsh edges, often in narrow bands adjacent to other tidal shrublands; typically dominated by silver seaside oxeye (Global Status: G4—Apparently Secure; State (NC) Status: No Status Rank)
- Mid and Southern Atlantic High Salt Marsh (CEGL004197; 6 plots): Tidal marshes that experience irregular flooding and are at slightly higher elevations than adjacent, regularly flooded low salt marshes; typically dominated by saltmeadow cordgrass. (Global Status: G4—Apparently Secure; State (NC) Status: No Status Rank)



Figure 9. Seven Tidal Wetland sites were sampled during this monitoring effort. These “freshwater” marshes are typically permanently saturated and experience flooding of oligohaline water from the “Sound”-side of the Outer Banks. These sites were all on North Core Banks. NPS photo / SECN staff.

Species Diversity and Abundance

Native species richness ranged from four to 16 (mean = 9.4) within plots of this broadly defined habitat type in Cape Lookout National Seashore, and richness was highest among graminoids across all spatial scales (Table 4). Nonnative species were not present in any of the seven plots sampled in this habitat type (Table 4). Twenty-three vascular plant species were found collectively within these plots and only two of these were solely found in this broadly defined habitat during this monitoring effort—smooth cordgrass and southern sea-blite (*Suaeda linearis*; Appendix B, Table 11). Species with high constancy in this habitat are listed below, by growth form (constancy values in parentheses):

Herbs and Graminoids

- Saltmeadow cordgrass (100%)
- Black needle rush (86%)
- Saltgrass (*Distichlis spicata*; 86%)
- Smooth cordgrass (86%)

- Silver seaside oxeye (86%)
- Southern seaside goldenrod (71%)

Woody Stem Metrics

Trees were not present in plots of this broadly defined habitat within Cape Lookout National Seashore, and sapling-sized woody stems were not abundant (Table 5). The only plot that saplings were present in was NCOR089; woody species in this plot included false-willow, groundsel tree, wax-myrtle, and marsh-elder (Appendix B, Table 12).

Disturbance and Threats

There were no observed current or historical disturbances on these plots (Table 6). Throughout their range, freshwater tidal and high salt marshes have been impacted by draining, ditching, and other factors that shift their natural hydrology. The sites sampled during this effort at Cape Lookout National Seashore appear to be relatively secure from these threats.

Geomorphology and Soil

Plots within Tidal Wetlands of Cape Lookout National Seashore occurred on very flat (0°) landforms with terrain shape indices equal to 0 (Table 7). Standing water was only observed in two of these seven plots, although flooding or inundation is common in all sites based on wind events that push water from the estuary onto the marsh. Soil pH values ranged from acidic to alkaline (5.5 to 8.2) and generally high organic matter content (Table 8).

Fuel Load Estimates

Results are summarized below for each subunit within Cape Lookout National Seashore. There was high variability between fuel loads among vegetation plots in the park, even within similar subunits and broadly defined habitat types. Variation in fuel loads is typical and related to differences in vegetation structure (e.g., abundance and height) and disturbance history between sites.

North Core Banks

Fuel load totals across the six Maritime Nontidal Wetland plots sampled on North Core Banks ranged from 9.7 to 26.6 tons/acre (2.2 to 6.0 kg/m²) and the highest values were in plots on the north-central portion of the island (Figure 10). The litter and duff components contributed to the highest proportion of available burnable fuel types (Figure 10).

South Core Banks

Fuel loads were lowest across South Core Banks relative to the other subunits sampled during this monitoring effort. Total values ranged from 6.8 to 10.8 tons/acre (1.5 to 2.4 kg/m²) across the four Maritime Nontidal Wetland plots on the island and the litter and duff components contributed to the highest proportion of available burnable fuel types (Figure 10).

Shackleford Banks

Fuel load totals across the four Maritime Nontidal Wetland plots and four Maritime Upland Forest and Shrubland plots sampled on Shackleford Banks ranged from 1.1 to 19.4 tons/acre (0.2 to 4.4 kg/m², Figure 10). There was high variation of total fuel loads and fuel components contributing to total loads across all plots (Figure 10).

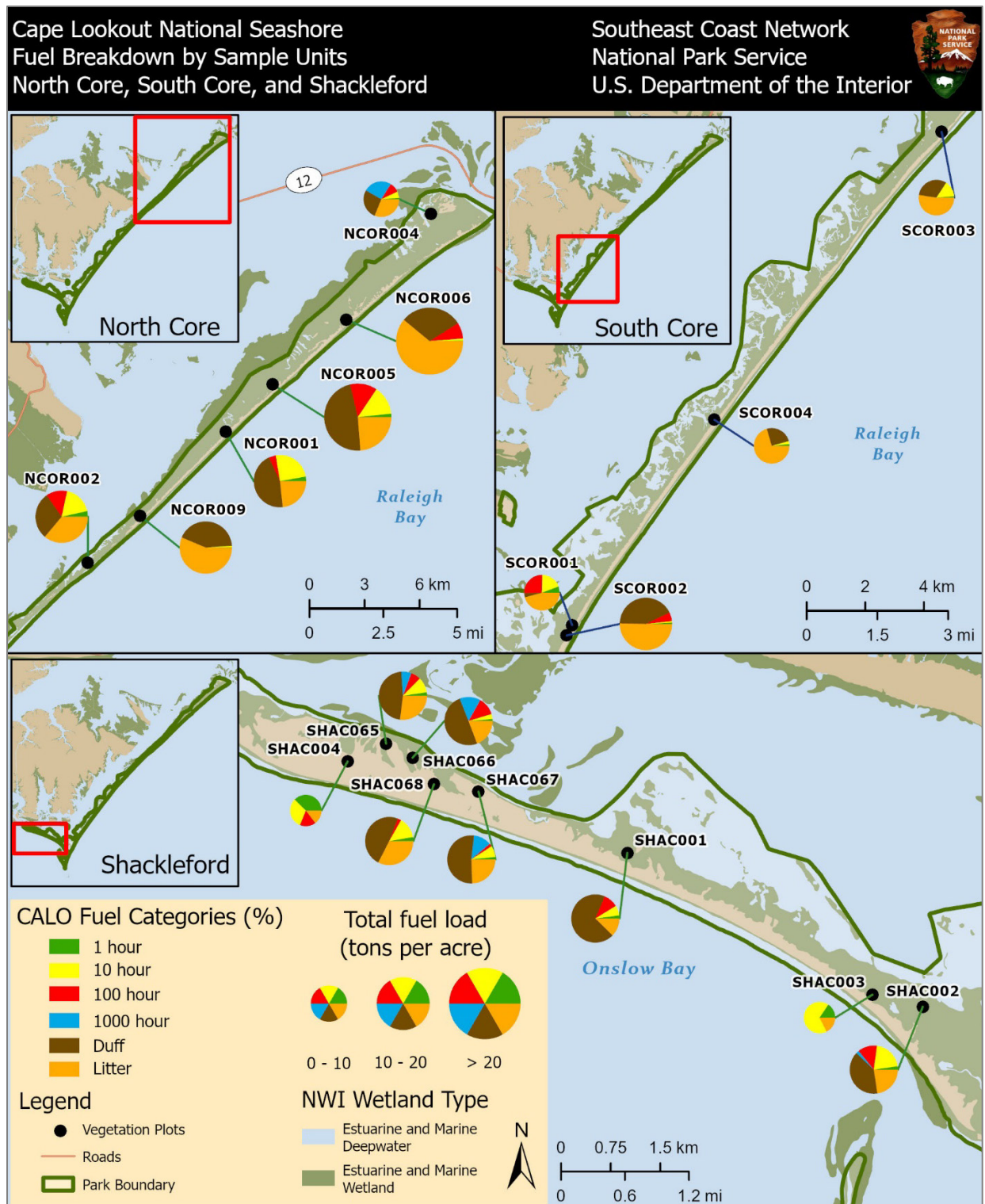


Figure 10. Fuel load estimates from vegetation monitoring plots on the North Core, South Core, and Shackleford Banks subunits of Cape Lookout National Seashore.

Cape Lookout

Fuel loads were highest across the Cape Lookout subunit relative to the other subunits sampled during this monitoring effort. Total values ranged from 6.2 to 54.9 tons/acre (1.4 to 12.3 kg/m²) and large diameter fallen woody debris (i.e., 1000-hour fuels) contributed to large fuel loads among the subunit's planted slash pine forests (Figure 11). Like Maritime Nontidal Wetland sites across other park subunits, duff and litter contributed to the highest proportion of available burnable fuel types within this broadly defined habitat of the Cape Lookout subunit (Figure 11).

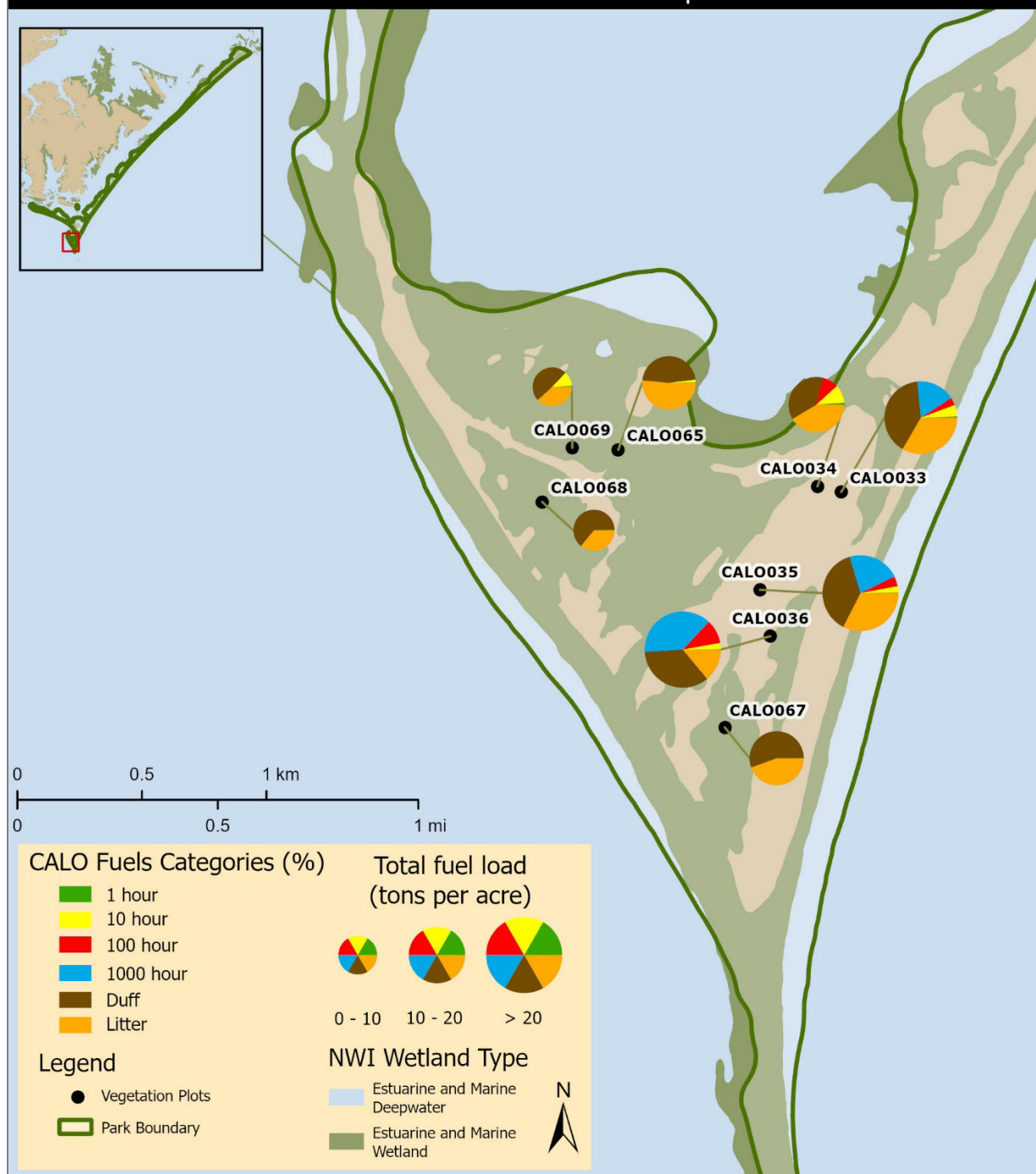


Figure 11. Fuel load estimates from vegetation monitoring plots on the Cape Lookout subunit of Cape Lookout National Seashore.

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Appendix A. Vascular Plants Observed During the 2022 Southeast Coast Network Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore

Table 10. Vascular Plants Observed During the 2022 SECN Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	North Carolina Rare Protected Status ³
Asterales	Asteraceae	<i>Ambrosia artemisiifolia</i>	annual ragweed	Native	Forb/ herb	–	–
Polypodiales	Blechnaceae	<i>Anchistea virginica</i>	Virginia chainfern	Native	Forb/ herb	–	–
Cyperales	Poaceae	<i>Andropogon tenuispathus</i>	bushy bluestem	Native	Graminoid	–	–
Polypodiales	Aspleniaceae	<i>Asplenium platyneuron</i>	ebony spleenwort	Native	Forb/herb	–	–
Caryophyllales	Chenopodiaceae	<i>Atriplex patula</i>	spear saltbush	Non-native	Forb/herb	–	–
Caryophyllales	Chenopodiaceae	<i>Atriplex prostrata</i>	triangle orache	Non-native	Forb/herb	–	–
Scrophulariales	Scrophulariaceae	<i>Aureolaria flava</i>	smooth yellow false foxglove	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Baccharis angustifolia</i>	false-willow	Native	Shrub	–	W1: Rare but Relatively Secure; S2: Imperiled
Asterales	Asteraceae	<i>Baccharis halimifolia</i>	groundsel tree; eastern baccharis	Native	Tree, Shrub	–	–
Cornales	Cornaceae	<i>Benthamidia florida</i>	flowering dogwood	Native	Tree, Shrub	–	–

¹ Information obtained from the PLANTS database (USDA 2024).

² Information obtained from the North Carolina Native Plant Society (Buchanan 2010).

³ Information obtained from the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022).

Table 10 (continued). Vascular Plants Observed During the 2022 SECN Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	North Carolina Rare Protected Status ³
Rhamnales	Rhamnaceae	<i>Berchemia scandens</i>	Alabama supplejack	Native	Vine	–	–
Asterales	Asteraceae	<i>Borrchia frutescens</i>	silver seaside oxeye; bushy seaside tansy	Native	Subshrub	–	–
Capparales	Brassicaceae	<i>Cakile edentula</i>	American searocket	Native	Forb/herb	–	–
Capparales	Brassicaceae	<i>Cakile harperi</i>	Harper's searocket	Native	Forb/herb	–	–
Lamiales	Verbenaceae	<i>Callicarpa americana</i>	American beautyberry	Native	Shrub	–	–
Cyperales	Cyperaceae	<i>Carex</i>	sedge	Unknown	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex calcifugens</i>	Halfsweet sedge; calcium-hating sedge	Native	Graminoid	–	SC-V: Special Concern-Vulnerable; S2?: Imperiled, Inexact Numeric Rank
Cyperales	Cyperaceae	<i>Carex floridana</i>	Florida sedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Carex longii</i>	Long's sedge	Native	Graminoid	–	–
Fagales	Betulaceae	<i>Carpinus caroliniana</i> var. <i>caroliniana</i>	American hornbeam	Native	Tree, Shrub	–	–
Scrophulariales	Oleaceae	<i>Cartrema americanum</i>	devilwood	Native	Shrub, Tree	–	–

¹ Information obtained from the PLANTS database (USDA 2024).

² Information obtained from the North Carolina Native Plant Society (Buchanan 2010).

³ Information obtained from the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022).

Table 10 (continued). Vascular Plants Observed During the 2022 SECN Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	North Carolina Rare Protected Status ³
Cyperales	Poaceae	<i>Cenchrus tribuloides</i>	sanddune sandbur	Native	Graminoid	–	–
Apiales	Apiaceae	<i>Centella asiatica</i>	erect centella	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Chasmanthium laxum</i>	slender woodoats	Native	Graminoid	–	–
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	–	–
Euphorbiales	Euphorbiaceae	<i>Cnidioscolus stimulosus</i>	finger rot	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Coleataenia rigidula</i> ssp. <i>condensa</i>	redtop panicgrass	Native	Graminoid	–	–
Commelinales	Commelinaceae	<i>Commelina erecta</i> var. <i>angustifolia</i>	whitemouth dayflower	Native	Forb/herb	–	–
Euphorbiales	Euphorbiaceae	<i>Croton punctatus</i>	gulf croton	Native	Subshrub, Forb/herb	–	–
Cyperales	Poaceae	<i>Cynodon dactylon</i>	Bermudagrass	Non-native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Cyperus</i>	flatsedge	Unknown	Graminoid	–	–
Fabales	Fabaceae	<i>Desmodium glabellum</i>	Dillenius' ticktrefoil	Native	Forb/herb	–	–
Fabales	Fabaceae	<i>Desmodium paniculatum</i> var. <i>paniculatum</i>	panickedleaf ticktrefoil	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Dichanthelium</i>	rosette grass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium acuminatum</i> var. <i>acuminatum</i>	woolly witchgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium arenicoloides</i>	sand-loving witchgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium boscii</i>	Bosc's witchgrass	Native	Graminoid	–	–

¹ Information obtained from the PLANTS database (USDA 2024).

² Information obtained from the North Carolina Native Plant Society (Buchanan 2010).

³ Information obtained from the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022).

Table 10 (continued). Vascular Plants Observed During the 2022 SECN Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	North Carolina Rare Protected Status ³
Cyperales	Poaceae	<i>Dichanthelium caeruleum</i>	blue witchgrass	Native	Graminoid	–	T: Threatened; S2: Imperiled
Cyperales	Poaceae	<i>Dichanthelium commutatum</i> var. <i>commutatum</i>	variable panicgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium dichotomum</i> var. <i>dichotomum</i>	cypress panicgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium laxiflorum</i>	openflower rosette grass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium meridionale</i>	matting witchgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium portoricense</i> ssp. <i>patulum</i>	Nash's witchgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium sphaerocarpon</i>	round-fruited witchgrass	Native	Graminoid	–	–
Rubiales	Rubiaceae	<i>Diodia virginiana</i>	Virginia buttonweed	Native	Subshrub, Forb/herb	–	–
Ebenales	Ebenaceae	<i>Diospyros virginiana</i>	common persimmon	Native	Tree	–	–
Cyperales	Poaceae	<i>Distichlis spicata</i>	saltgrass	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Eleocharis</i>	spikerush	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Eleocharis albida</i>	white spikerush	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Eleocharis ambigens</i>	two-branched creeping spikerush	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Eleocharis baldwinii</i>	Baldwin's spikerush	Native	Graminoid	–	–

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³ Information obtained from the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022).

Table 10 (continued). Vascular Plants Observed During the 2022 SECN Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	North Carolina Rare Protected Status ³
Cyperales	Cyperaceae	<i>Eleocharis montevidensis</i>	sand spikerush	Native	Graminoid	–	SR-P: Significantly Rare- Peripheral; S1: Critically Imperiled
Asterales	Asteraceae	<i>Elephantopus tomentosus</i>	devil's grandmother	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Elymus halophilus</i>	salt-marsh wild-rye; Virginia wildrye	Native	Graminoid	–	SR-P: Significantly Rare- Peripheral; S1: Critically Imperiled
Cyperales	Poaceae	<i>Eragrostis spectabilis</i>	purple lovegrass	Native	Graminoid	–	–
Asterales	Asteraceae	<i>Erechtites hieraciifolius</i>	American burnweed	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Eremochloa ophiuroides</i>	centipede grass	Non-native	Graminoid	–	–
Asterales	Asteraceae	<i>Erigeron pussilus</i>	southern horseweed	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Eupatorium capillifolium</i>	dogfennel	Native	Forb/herb	–	–

¹ Information obtained from the PLANTS database (USDA 2024).

² Information obtained from the North Carolina Native Plant Society (Buchanan 2010).

³ Information obtained from the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022).

Table 10 (continued). Vascular Plants Observed During the 2022 SECN Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	North Carolina Rare Protected Status ³
Euphorbiales	Euphorbiaceae	<i>Euphorbia [bombensis + polygonifolia]</i>	dixie + seaside sandmat	Native	Forb/herb	–	SR-T: Significantly Rare-Throughout; S2?: Imperiled, Inexact Numeric Rank; Only for <i>E. bombensis</i>
Cyperales	Poaceae	<i>Eustachys petraea</i>	pinewoods fingergrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Festuca octoflora</i>	sixweeks fescue	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Fimbristylis castanea</i>	marsh fimbry	Native	Graminoid	–	–
Asterales	Asteraceae	<i>Gaillardia pulchella</i> var. <i>drummondii</i>	Indian blanket	Non-native	Forb/herb, Subshrub	–	–
Fabales	Fabaceae	<i>Galactia volubilis</i>	downy milkpea	Native	Vine, Forb/herb	–	–
Rubiales	Rubiaceae	<i>Galium bermudense</i>	coastal bedstraw	Native	Forb/herb	–	–
Rubiales	Rubiaceae	<i>Galium tinctorium</i>	stiff marsh bedstraw	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Gamochaeta calviceps</i>	narrowleaf purple everlasting	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Gamochaeta pensylvanica</i>	Pennsylvania everlasting	Non-native	Forb/herb	–	–

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Table 10 (continued). Vascular Plants Observed During the 2022 SECN Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	North Carolina Rare Protected Status ³
Gentianales	Loganiaceae	<i>Gelsemium sempervirens</i>	evening trumpetflower	Native	Vine, Shrub	–	–
Gentianales	Asclepiadaceae	<i>Gonolobus suberosus</i> var. <i>suberosus</i>	angularfruit milkvine	Native	Vine	–	–
Asterales	Asteraceae	<i>Heterotheca subaxillaris</i>	camphorweed	Native	Forb/herb	–	–
Rubiales	Rubiaceae	<i>Hexasepalum teres</i>	poorjoe	Native	Forb/herb	–	–
Apiales	Apiaceae	<i>Hydrocotyle bonariensis</i>	dune pennyworth; largeleaf pennywort	Native	Forb/herb	–	–
Apiales	Apiaceae	<i>Hydrocotyle umbellata</i>	manyflower marshpennywort	Native	Forb/herb	–	–
Theales	Clusiaceae	<i>Hypericum hypericoides</i>	St. Andrew's cross	Native	Subshrub, Shrub	–	–
Celastrales	Aquifoliaceae	<i>Ilex opaca</i>	American holly	Native	Tree, Shrub	–	–
Celastrales	Aquifoliaceae	<i>Ilex vomitoria</i>	yaupon	Native	Tree, Shrub	–	–
Solanales	Convolvulaceae	<i>Ipomoea imperati</i>	beach morning-glory	Native	Forb/herb, Vine	–	SC-V: Special Concern-Vulnerable; S2S3: Imperiled-Vulnerable

¹ Information obtained from the PLANTS database (USDA 2024).

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Table 10 (continued). Vascular Plants Observed During the 2022 SECN Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	North Carolina Rare Protected Status ³
Solanales	Convolvulaceae	<i>Ipomoea sagittata</i>	saltmarsh morning-glory	Native	Vine, Forb/herb	–	–
Asterales	Asteraceae	<i>Iva frutescens</i>	maritime marsh-elder; Jesuit's bark	Native	Subshrub, Forb/herb	–	–
Asterales	Asteraceae	<i>Iva imbricata</i>	seacoast marsh elder	Native	Forb/herb, Subshrub	–	–
Juncales	Juncaceae	<i>Juncus acuminatus</i>	tapertip rush	Native	Graminoid	–	–
Juncales	Juncaceae	<i>Juncus biflorus</i>	bog rush	Native	Graminoid	–	–
Juncales	Juncaceae	<i>Juncus coriaceus</i>	leathery rush	Native	Graminoid	–	–
Juncales	Juncaceae	<i>Juncus megacephalus</i>	bighead rush	Native	Graminoid	–	–
Juncales	Juncaceae	<i>Juncus roemerianus</i>	black needle rush; needlegrass rush	Native	Graminoid	–	–
Pinales	Cupressaceae	<i>Juniperus silicicola</i>	southern red cedar	Native	Tree	–	–
Malvales	Malvaceae	<i>Kosteletzkya pentacarpos</i>	Virginia saltmarsh mallow	Native	Subshrub, Forb/herb	–	–
Asterales	Asteraceae	<i>Lactuca graminifolia</i> var. <i>graminifolia</i>	grassleaf lettuce	Native	Forb/herb	–	–
Violales	Cistaceae	<i>Lechea mucronata</i>	hairy pinweed	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Leersia oryzoides</i>	rice cutgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Leersia virginica</i>	whitegrass	Native	Graminoid	–	–

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Table 10 (continued). Vascular Plants Observed During the 2022 SECN Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	North Carolina Rare Protected Status ³
Capparales	Brassicaceae	<i>Lepidium virginicum</i> var. <i>virginicum</i>	Virginia pepperweed	Native	Forb/herb	–	–
Linales	Linaceae	<i>Linum curtissii</i>	stiff yellow flax	Native	Forb/herb	–	–
Dipsacales	Caprifoliaceae	<i>Lonicera japonica</i>	Japanese honeysuckle	Non-native	Vine	Rank 1 (Severe Threat)	–
Dipsacales	Caprifoliaceae	<i>Lonicera sempervirens</i>	trumpet honeysuckle	Native	Vine	–	–
Cyperales	Poaceae	<i>Melica mutica</i>	twoflower melicgrass	Native	Graminoid	–	–
Asterales	Asteraceae	<i>Mikania scandens</i>	climbing hempvine	Native	Vine, Forb/herb	–	–
Rubiales	Rubiaceae	<i>Mitchella repens</i>	partridgeberry	Native	Subshrub, Forb/herb	–	–
Lamiales	Lamiaceae	<i>Monarda punctata</i> var. <i>villicaulis</i>	spotted beebalm	Native	Subshrub, Forb/herb	–	–
Myricales	Myricaceae	<i>Morella cerifera</i>	wax myrtle	Native	Tree, Subshrub, Shrub	–	–
Urticales	Moraceae	<i>Morus rubra</i>	red mulberry	Native	Tree	–	–
Cyperales	Poaceae	<i>Muhlenbergia sericea</i>	hairawn muhly	Native	Graminoid	–	–
Rhamnales	Vitaceae	<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	muscadine	Native	Vine	–	–

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³ Information obtained from the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022).

Table 10 (continued). Vascular Plants Observed During the 2022 SECN Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	North Carolina Rare Protected Status ³
Rhamnales	Vitaceae	<i>Nekemias arborea</i>	peppervine	Native	Shrub, Vine	–	–
Myrtales	Onagraceae	<i>Oenothera humifusa</i>	seabeach evening primrose	Native	Subshrub, Forb/herb	–	–
Ophioglossales	Ophioglossaceae	<i>Ophioglossum petiolatum</i>	longstem adderstongue	Non-native	Forb/herb	–	–
Cyperales	Poaceae	<i>Oplismenus setarius</i>	basketgrass	Native	Graminoid	–	SR-P: Significantly Rare-Peripheral; S1: Critically Imperiled
Caryophyllales	Cactaceae	<i>Opuntia drummondii</i>	dune pricklypear	Native	Subshrub, Shrub	–	–
Geraniales	Oxalidaceae	<i>Oxalis dillenii</i>	slender yellow woodsorrel	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Panicum [amarulum + amarum]</i>	southern seabeach grass + bitter seabeach grass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Panicum virgatum</i> var. <i>spissum</i>	switchgrass	Native	Graminoid	–	–

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Table 10 (continued). Vascular Plants Observed During the 2022 SECN Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	North Carolina Rare Protected Status ³
Caryophyllales	Caryophyllaceae	<i>Paronychia baldwinii</i> ssp. <i>riparia</i>	Perennial dune whitlow-wort; Baldwin's nailwort	Native	Forb/herb	–	W7: Poorly Known in N.C.; S1S3: Critically Imperiled-Vulnerable
Rhamnales	Vitaceae	<i>Parthenocissus quinquefolia</i>	Virginia creeper	Native	Vine	–	–
Cyperales	Poaceae	<i>Paspalum setaceum</i>	thin paspalum	Native	Graminoid	–	–
Violales	Passifloraceae	<i>Passiflora lutea</i>	yellow passion-flower	Native	Vine, Forb/herb	–	–
Gentianales	Asclepiadaceae	<i>Pattalias palustre</i>	swallow-wort	Native	Forb/herb, Vine	–	–
Laurales	Lauraceae	<i>Persea borbonia</i>	redbay	Native	Shrub, Tree	–	W7: Poorly Known in N.C.; S2: Imperiled
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 punctata</i>	dotted swampweed	Native	Forb/herb	–	–

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Table 10 (continued). Vascular Plants Observed During the 2022 SECN Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	North Carolina Rare Protected Status ³
Cyperales	Poaceae	<i>Phragmites australis</i>	common reed	Non-native	Graminoid	Rank 1 (Severe Threat)	–
Lamiales	Verbenaceae	<i>Phyla nodiflora</i> var. <i>nodiflora</i>	turkey tangle fogfruit	Native	Forb/herb	–	–
Solanales	Solanaceae	<i>Physalis walteri</i>	Walter's groundcherry	Native	Forb/herb	–	–
Caryophyllales	Phytolaccaceae	<i>Phytolacca rigida</i>	Maritime pokeweed	Native	Forb/herb	–	W1: Rare but Relatively Secure; S2: Imperiled
Urticales	Urticaceae	<i>Pilea pumila</i>	Canadian clearweed	Native	Forb/herb	–	–
Pinales	Pinaceae	<i>Pinus elliotii</i>	slash pine	Native	Tree	–	–
Pinales	Pinaceae	<i>Pinus taeda</i>	loblolly pine	Native	Tree	–	–
Pinales	Pinaceae	<i>Pinus thunbergii</i>	Japanese black pine	Non-native	Tree	–	–
Cyperales	Poaceae	<i>Piptochaetium avenaceum</i>	blackseed speargrass	Native	Graminoid	–	–
Polypodiales	Polypodiaceae	<i>Pleopeltis michauxiana</i>	resurrection fern	Native	Forb/herb, Vine	–	–
Cyperales	Poaceae	<i>Poa annua</i>	annual bluegrass	Non-native	Graminoid	–	–
Cyperales	Poaceae	<i>Poaceae</i>	Grass Family	Unknown	Graminoid	–	–

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Table 10 (continued). Vascular Plants Observed During the 2022 SECN Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	North Carolina Rare Protected Status ³
Scrophulariales	Buddlejaceae	<i>Polypremum procumbens</i>	juniper leaf	Native	Forb/herb, Vine	–	–
Rosales	Rosaceae	<i>Prunus caroliniana</i>	Carolina laurelcherry	Native	Shrub, Tree	–	–
Rosales	Rosaceae	<i>Prunus serotina</i> var. <i>serotina</i>	black cherry	Native	Shrub, Tree	–	–
Fagales	Fagaceae	<i>Quercus geminata</i>	sand live oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus hemisphaerica</i>	Sand laurel oak, Darlington oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus virginiana</i>	live oak	Native	Tree	–	–
Cyperales	Cyperaceae	<i>Rhynchospora colorata</i>	starrush whitetop	Native	Graminoid	–	–
Rosales	Rosaceae	<i>Rubus pensilvanicus</i>	sawtooth blackberry	Native	Subshrub	–	–
Rosales	Rosaceae	<i>Rubus trivialis</i>	southern dewberry	Native	Subshrub	–	–
Arecales	Arecaceae	<i>Sabal minor</i>	dwarf palmetto	Native	Tree, Shrub	–	–
Gentianales	Gentianaceae	<i>Sabatia stellaris</i>	rose of Plymouth	Native	Forb/herb	–	–
Caryophyllales	Caryophyllaceae	<i>Sagina decumbens</i>	trailing pearlwort	Native	Forb/herb	–	–
Caryophyllales	Chenopodiaceae	<i>Salicornia ambigua</i>	perennial glasswort	Native	Forb/herb, Subshrub	–	–
Primulales	Primulaceae	<i>Samolus parviflorus</i>	water pimpernal	Native	Forb/herb	–	–
Apiales	Apiaceae	<i>Sanicula canadensis</i> var. <i>floridana</i>	Canadian blacksnakeroot	Native	Forb/herb	–	–

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Table 10 (continued). Vascular Plants Observed During the 2022 SECN Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	North Carolina Rare Protected Status ³
Cyperales	Poaceae	<i>Schizachyrium littorale</i>	shore little bluestem	Native	Graminoid	–	W1: Rare but Relatively Secure; S2S3: Imperiled-Vulnerable
Cyperales	Cyperaceae	<i>Schoenoplectus pungens</i> var. <i>pungens</i>	common threesquare	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Scleria flaccida</i>	whip nutrush	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Setaria</i>	bristlegass	Unknown	Graminoid	–	–
Cyperales	Poaceae	<i>Setaria pumila</i>	yellow foxtail	Non-native	Graminoid	–	–
Ebenales	Sapotaceae	<i>Sideroxylon lycioides</i>	buckthorn bully	Native	Shrub, Tree	–	W1: Rare but Relatively Secure; S2S3: Imperiled-Vulnerable
Liliales	Iridaceae	<i>Sisyrinchium atlanticum</i>	eastern blue-eyed grass	Native	Forb/herb	–	–
Liliales	Smilacaceae	<i>Smilax auriculata</i>	earleaf greenbrier	Native	Shrub, Vine	–	–
Liliales	Smilacaceae	<i>Smilax bona-nox</i> var. <i>littoralis</i>	maritime catbriar; saw greenbrier	Native	Shrub, Vine	–	–

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Table 10 (continued). Vascular Plants Observed During the 2022 SECN Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	North Carolina Rare Protected Status ³
Liliales	Smilacaceae	<i>Smilax glauca</i>	cat greenbrier	Native	Shrub, Vine	–	–
Liliales	Smilacaceae	<i>Smilax hispida</i>	bristly greenbrier	Native	Shrub, Vine	–	–
Liliales	Smilacaceae	<i>Smilax smallii</i>	Jackson brier	Native	Shrub, Vine	–	–
Asterales	Asteraceae	<i>Solidago mexicana</i>	southern seaside goldenrod	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Solidago odora</i>	anisescented goldenrod	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Solidago sempervirens</i>	northern seaside goldenrod	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Spartina alterniflora</i>	smooth cordgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Spartina patens</i>	saltmeadow cordgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Sphenopholis obtusata</i>	prairie wedgescale	Native	Graminoid	–	–
Orchidales	Orchidaceae	<i>Spiranthes vernalis</i>	spring lady's tresses	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Stenotaphrum secundatum</i>	carpet grass	Native	Graminoid	–	–
Fabales	Fabaceae	<i>Strophostyles helvola</i>	amberique-bean	Native	Vine, Forb/herb	–	–
Caryophyllales	Chenopodiaceae	<i>Suaeda linearis</i>	southern sea-blite; annual seepweed	Native	Forb/herb, Subshrub	–	–
Asterales	Asteraceae	<i>Symphyotrichum</i>	aster	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Symphyotrichum tenuifolium</i>	perennial saltmarsh aster	Native	Forb/herb	–	–

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Table 10 (continued). Vascular Plants Observed During the 2022 SECN Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	North Carolina Rare Protected Status ³
Bromeliales	Bromeliaceae	<i>Tillandsia usneoides</i>	Spanish moss	Native	Forb/herb, Vine	–	–
Sapindales	Anacardiaceae	<i>Toxicodendron radicans</i> var. <i>radicans</i>	eastern poison ivy	Native	Vine	–	–
Cyperales	Poaceae	<i>Tripsacum dactyloides</i> var. <i>dactyloides</i>	eastern gamagrass	Native	Graminoid	–	–
Typhales	Typhaceae	<i>Typha domingensis</i>	southern cattail	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Uniola paniculata</i>	seaoats	Native	Graminoid	–	–
–	–	<i>Unknown</i>	unknown	Unknown	Forb/herb	–	–
Ericales	Ericaceae	<i>Vaccinium arboreum</i>	farkleberry	Native	Tree, Shrub	–	–
Ericales	Ericaceae	<i>Vaccinium formosum</i>	southern blueberry	Native	Shrub	–	–
Lamiales	Verbenaceae	<i>Verbena scabra</i>	rough vervain; sandpaper vervain	Native	Forb/herb, Subshrub	–	W7: Poorly Known in N.C.; S2?: Imperiled, Inexact Numeric Rank
Rhamnales	Vitaceae	<i>Vitis aestivalis</i> var. <i>aestivalis</i>	summer grape	Native	Vine	–	–

¹ Information obtained from the PLANTS database (USDA 2024).

² Information obtained from the North Carolina Native Plant Society (Buchanan 2010).

³ Information obtained from the North Carolina Natural Heritage Program (Wichmann and Wojcik 2022).

Table 10 (continued). Vascular Plants Observed During the 2022 SECN Terrestrial Vegetation Monitoring Effort at Cape Lookout National Seashore.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	North Carolina Rare Protected Status ³
Liliales	Agavaceae	<i>Yucca aloifolia</i>	Spanish dagger; aloe yucca	Native	Shrub, Tree	–	W1: Rare but Relatively Secure; S2?: Imperiled, Inexact Numeric Rank
Sapindales	Rutaceae	<i>Zanthoxylum clava-herculis</i>	Hercules' club	Native	Tree, Shrub	–	–

¹ Information obtained from the PLANTS database (USDA 2024).

² Information obtained from the North Carolina Native Plant Society (Buchanan 2010).

³ 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 Cape Lookout National Seashore

Table 11. Constancy and average cover class for all vascular plant species observed in 49 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MOUV = Maritime Open Upland Vegetation (16 plots), MUFS = Maritime Upland Forests and Shrublands (8 plots), Maritime Nontidal Wetland Vegetation (18 plots), and TW = Tidal Wetlands (7 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	MOUV Constancy	MOUV Cover	MUFS Constancy	MUFS Cover	MNTW Constancy	MNTW Cover	TW Constancy	TW Cover
<i>Ambrosia artemisiifolia</i>	–	–	–	–	11	2	–	–
<i>Anchistea virginica</i>	–	–	13	2	–	–	–	–
<i>Andropogon tenuispatheus</i>	–	–	25	2	56	2	29	2
<i>Asplenium platyneuron</i>	–	–	13	3	–	–	–	–
<i>Atriplex patula</i>	–	–	–	–	6	1	–	–
<i>Atriplex prostrata</i>	–	–	13	1	6	1	–	–
<i>Aureolaria flava</i>	–	–	13	4	–	–	–	–
<i>Baccharis angustifolia</i>	–	–	–	–	67	4	29	4
<i>Baccharis halimifolia</i>	6	2	–	–	83	4	29	3
<i>Benthamidia florida</i>	–	–	38	3	–	–	–	–
<i>Berchemia scandens</i>	–	–	25	3	6	2	–	–
<i>Borrchia frutescens</i>	6	1	13	2	78	5	86	4
<i>Cakile edentula</i>	6	2	–	–	–	–	–	–
<i>Cakile harperi</i>	6	1	–	–	–	–	–	–
<i>Callicarpa americana</i>	–	–	50	4	6	1	–	–
<i>Carex</i>	–	–	13	2	–	–	–	–
<i>Carex calcifugens</i>	–	–	13	2	–	–	–	–
<i>Carex floridana</i>	–	–	13	2	–	–	–	–
<i>Carex longii</i>	–	–	–	–	22	2	–	–

Table 11 (continued). Constancy and average cover class for all vascular plant species observed in 49 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MOUV = Maritime Open Upland Vegetation (16 plots), MUFS = Maritime Upland Forests and Shrublands (8 plots), Maritime Nontidal Wetland Vegetation (18 plots), and TW = Tidal Wetlands (7 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	MOUV Constancy	MOUV Cover	MUFS Constancy	MUFS Cover	MNTW Constancy	MNTW Cover	TW Constancy	TW Cover
<i>Carpinus caroliniana</i> var. <i>caroliniana</i>	–	–	38	6	–	–	–	–
<i>Cartrema americanum</i>	–	–	50	4	–	–	–	–
<i>Cenchrus tribuloides</i>	63	2	–	–	–	–	–	–
<i>Centella asiatica</i>	–	–	13	1	33	2	–	–
<i>Chasmanthium laxum</i>	–	–	50	3	6	3	–	–
<i>Cirsium horridulum</i> var. <i>horridulum</i>	38	2	13	1	11	2	–	–
<i>Cladium jamaicense</i>	–	–	–	–	17	2	–	–
<i>Cnidioscolus stimulosus</i>	6	1	25	1	–	–	–	–
<i>Coleataenia rigidula</i> ssp. <i>condensa</i>	–	–	–	–	6	2	–	–
<i>Commelina erecta</i> var. <i>angustifolia</i>	56	2	13	2	28	2	–	–
<i>Croton punctatus</i>	56	3	–	–	–	–	–	–
<i>Cynodon dactylon</i>	13	2	–	–	–	–	–	–
<i>Cyperus</i>	–	–	50	2	17	2	–	–
<i>Desmodium glabellum</i>	–	–	50	2	6	1	–	–
<i>Desmodium paniculatum</i> var. <i>paniculatum</i>	–	–	–	–	6	1	–	–
<i>Dichantherium</i>	–	–	–	–	6	2	–	–
<i>Dichantherium acuminatum</i> var. <i>acuminatum</i>	–	–	13	1	17	2	–	–
<i>Dichantherium arenicoloides</i>	–	–	13	2	–	–	–	–
<i>Dichantherium boscii</i>	–	–	13	1	–	–	–	–
<i>Dichantherium caeruleascens</i>	–	–	–	–	6	1	–	–
<i>Dichantherium commutatum</i> var. <i>commutatum</i>	–	–	50	3	–	–	–	–
<i>Dichantherium dichotomum</i> var. <i>dichotomum</i>	–	–	13	2	–	–	–	–
<i>Dichantherium laxiflorum</i>	–	–	13	1	–	–	–	–

Table 11 (continued). Constancy and average cover class for all vascular plant species observed in 49 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MOUV = Maritime Open Upland Vegetation (16 plots), MUFS = Maritime Upland Forests and Shrublands (8 plots), MNTW = Maritime Nontidal Wetland Vegetation (18 plots), and TW = Tidal Wetlands (7 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	MOUV Constancy	MOUV Cover	MUFS Constancy	MUFS Cover	MNTW Constancy	MNTW Cover	TW Constancy	TW Cover
<i>Dichanthelium meridionale</i>	–	–	13	2	–	–	–	–
<i>Dichanthelium portoricense</i> ssp. <i>patulum</i>	–	–	–	–	6	4	–	–
<i>Dichanthelium sphaerocarpon</i>	–	–	13	2	–	–	–	–
<i>Diodia virginiana</i>	6	1	–	–	–	–	–	–
<i>Diospyros virginiana</i>	–	–	25	2	6	2	–	–
<i>Distichlis spicata</i>	6	1	13	1	33	2	86	6
<i>Eleocharis</i>	–	–	–	–	22	2	–	–
<i>Eleocharis albida</i>	–	–	–	–	6	1	–	–
<i>Eleocharis ambigens</i>	–	–	–	–	6	2	–	–
<i>Eleocharis baldwinii</i>	–	–	13	3	–	–	–	–
<i>Eleocharis montevidensis</i>	–	–	13	2	11	2	–	–
<i>Elephantopus tomentosus</i>	–	–	50	4	–	–	–	–
<i>Elymus halophilus</i>	–	–	–	–	11	2	–	–
<i>Eragrostis spectabilis</i>	13	2	–	–	11	1	–	–
<i>Erechtites hieraciifolius</i>	–	–	–	–	6	2	–	–
<i>Eremochloa ophiuroides</i>	13	5	–	–	22	2	–	–
<i>Erigeron pusillus</i>	88	2	–	–	6	1	14	1
<i>Eupatorium capillifolium</i>	–	–	–	–	11	2	–	–
<i>Euphorbia</i> [bombensis + polygonifolia]	25	2	–	–	–	–	14	1
<i>Eustachys petraea</i>	25	2	13	2	22	2	14	1
<i>Festuca octoflora</i>	–	–	–	–	17	2	–	–
<i>Fimbristylis castanea</i>	6	2	–	–	11	2	29	2
<i>Gaillardia pulchella</i> var. <i>drummondii</i>	31	4	–	–	11	2	–	–

Table 11 (continued). Constancy and average cover class for all vascular plant species observed in 49 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MOUV = Maritime Open Upland Vegetation (16 plots), MUFS = Maritime Upland Forests and Shrublands (8 plots), Maritime Nontidal Wetland Vegetation (18 plots), and TW = Tidal Wetlands (7 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	MOUV Constancy	MOUV Cover	MUFS Constancy	MUFS Cover	MNTW Constancy	MNTW Cover	TW Constancy	TW Cover
<i>Galactia volubilis</i>	–	–	13	3	11	2	–	–
<i>Galium bermudense</i>	–	–	38	2	6	2	–	–
<i>Galium tinctorium</i>	–	–	13	2	6	1	–	–
<i>Gamochaeta calviceps</i>	–	–	–	–	6	2	–	–
<i>Gamochaeta pensylvanica</i>	–	–	–	–	6	1	–	–
<i>Gelsemium sempervirens</i>	–	–	25	2	–	–	–	–
<i>Gonolobus suberosus</i> var. <i>suberosus</i>	–	–	13	2	–	–	–	–
<i>Heterotheca subaxillaris</i>	94	3	–	–	6	1	–	–
<i>Hexasepalum teres</i>	13	2	–	–	–	–	–	–
<i>Hydrocotyle bonariensis</i>	100	4	63	4	67	4	29	2
<i>Hydrocotyle umbellata</i>	–	–	13	2	11	2	–	–
<i>Hypericum hypericoides</i>	–	–	38	2	–	–	–	–
<i>Ilex opaca</i>	–	–	50	6	–	–	–	–
<i>Ilex vomitoria</i>	–	–	100	5	67	5	–	–
<i>Ipomoea imperati</i>	6	2	–	–	–	–	–	–
<i>Ipomoea sagittata</i>	–	–	–	–	72	3	14	2
<i>Iva frutescens</i>	–	–	13	2	67	4	43	5
<i>Iva imbricata</i>	38	4	–	–	11	5	–	–
<i>Juncus acuminatus</i>	–	–	13	2	–	–	–	–
<i>Juncus biflorus</i>	–	–	–	–	11	2	–	–
<i>Juncus coriaceus</i>	–	–	–	–	6	3	–	–
<i>Juncus megacephalus</i>	–	–	25	2	11	2	–	–
<i>Juncus roemerianus</i>	6	1	38	2	100	6	86	7

Table 11 (continued). Constancy and average cover class for all vascular plant species observed in 49 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MOUV = Maritime Open Upland Vegetation (16 plots), MUFS = Maritime Upland Forests and Shrublands (8 plots), Maritime Nontidal Wetland Vegetation (18 plots), and TW = Tidal Wetlands (7 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	MOUV Constancy	MOUV Cover	MUFS Constancy	MUFS Cover	MNTW Constancy	MNTW Cover	TW Constancy	TW Cover
<i>Juniperus silicicola</i>	13	1	100	6	67	5	–	–
<i>Kosteletzkya pentacarpos</i>	–	–	–	–	17	2	–	–
<i>Lactuca graminifolia</i> var. <i>graminifolia</i>	13	2	–	–	6	2	–	–
<i>Lechea mucronata</i>	–	–	–	–	6	1	–	–
<i>Leersia oryzoides</i>	–	–	–	–	6	2	–	–
<i>Leersia virginica</i>	–	–	13	2	6	1	–	–
<i>Lepidium virginicum</i> var. <i>virginicum</i>	31	2	–	–	6	1	–	–
<i>Linum curtissii</i>	–	–	–	–	11	2	–	–
<i>Lonicera japonica</i>	–	–	25	3	6	1	–	–
<i>Lonicera sempervirens</i>	–	–	25	1	11	3	–	–
<i>Melica mutica</i>	–	–	38	2	39	2	–	–
<i>Mikania scandens</i>	–	–	13	1	17	2	–	–
<i>Mitchella repens</i>	–	–	38	2	–	–	–	–
<i>Monarda punctata</i> var. <i>villicaulis</i>	6	2	–	–	6	2	–	–
<i>Morella cerifera</i>	13	2	100	6	94	6	14	6
<i>Morus rubra</i>	–	–	13	3	–	–	–	–
<i>Muhlenbergia sericea</i>	–	–	13	3	6	1	–	–
<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	–	–	88	4	17	2	–	–
<i>Nekemias arborea</i>	13	4	13	3	17	4	–	–
<i>Oenothera humifusa</i>	100	3	–	–	6	2	–	–
<i>Ophioglossum petiolatum</i>	6	1	–	–	–	–	–	–
<i>Opismenus setarius</i>	–	–	13	2	–	–	–	–
<i>Opuntia drummondii</i>	31	2	13	1	6	1	–	–

Table 11 (continued). Constancy and average cover class for all vascular plant species observed in 49 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MOUV = Maritime Open Upland Vegetation (16 plots), MUFS = Maritime Upland Forests and Shrublands (8 plots), MNTW = Maritime Nontidal Wetland Vegetation (18 plots), and TW = Tidal Wetlands (7 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	MOUV Constancy	MOUV Cover	MUFS Constancy	MUFS Cover	MNTW Constancy	MNTW Cover	TW Constancy	TW Cover
<i>Oxalis dillenii</i>	–	–	–	–	6	1	–	–
<i>Panicum [amarulum + amarum]</i>	63	2	–	–	22	4	–	–
<i>Panicum virgatum</i> var. <i>spissum</i>	–	–	–	–	6	1	–	–
<i>Paronychia baldwinii</i> ssp. <i>riparia</i>	–	–	13	1	–	–	–	–
<i>Parthenocissus quinquefolia</i>	–	–	100	4	56	3	–	–
<i>Paspalum setaceum</i>	–	–	13	1	–	–	–	–
<i>Passiflora lutea</i>	–	–	13	2	–	–	–	–
<i>Pattalias palustre</i>	19	2	38	2	78	2	57	2
<i>Persea borbonia</i>	–	–	25	5	6	1	–	–
<i>Persea palustris</i>	–	–	75	5	17	2	–	–
<i>Persicaria hydropiperoides</i>	–	–	13	2	–	–	–	–
<i>Persicaria punctata</i>	–	–	–	–	6	3	–	–
<i>Phragmites australis</i>	–	–	–	–	6	6	–	–
<i>Phyla nodiflora</i> var. <i>nodiflora</i>	–	–	–	–	39	2	–	–
<i>Physalis walteri</i>	69	2	13	1	22	2	14	2
<i>Phytolacca rigida</i>	–	–	–	–	6	2	–	–
<i>Pilea pumila</i>	–	–	13	1	–	–	–	–
<i>Pinus elliottii</i>	–	–	50	7	–	–	–	–
<i>Pinus taeda</i>	–	–	38	4	–	–	–	–
<i>Pinus thunbergii</i>	–	–	–	–	6	1	–	–
<i>Piptochaetium avenaceum</i>	–	–	50	3	–	–	–	–
<i>Pleopeltis michauxiana</i>	–	–	25	2	–	–	–	–
<i>Poa annua</i>	–	–	–	–	11	3	–	–

Table 11 (continued). Constancy and average cover class for all vascular plant species observed in 49 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MOUV = Maritime Open Upland Vegetation (16 plots), MUFS = Maritime Upland Forests and Shrublands (8 plots), Maritime Nontidal Wetland Vegetation (18 plots), and TW = Tidal Wetlands (7 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	MOUV Constancy	MOUV Cover	MUFS Constancy	MUFS Cover	MNTW Constancy	MNTW Cover	TW Constancy	TW Cover
<i>Poaceae</i>	–	–	–	–	6	1	–	–
<i>Polypremum procumbens</i>	–	–	–	–	6	2	–	–
<i>Prunus caroliniana</i>	–	–	38	3	–	–	–	–
<i>Prunus serotina</i> var. <i>serotina</i>	–	–	13	4	–	–	–	–
<i>Quercus geminata</i>	–	–	13	7	–	–	–	–
<i>Quercus hemisphaerica</i>	–	–	50	4	–	–	–	–
<i>Quercus virginiana</i>	–	–	38	7	–	–	–	–
<i>Rhynchospora colorata</i>	–	–	13	2	11	2	–	–
<i>Rubus pensilvanicus</i>	–	–	–	–	6	1	–	–
<i>Rubus trivialis</i>	13	2	50	2	44	2	–	–
<i>Sabal minor</i>	–	–	38	2	6	2	–	–
<i>Sabatia stellaris</i>	6	2	–	–	–	–	–	–
<i>Sagina decumbens</i>	–	–	–	–	6	1	–	–
<i>Salicornia ambigua</i>	–	–	13	3	6	2	57	2
<i>Samolus parviflorus</i>	–	–	–	–	6	3	–	–
<i>Sanicula canadensis</i> var. <i>floridana</i>	–	–	25	2	–	–	–	–
<i>Schizachyrium littorale</i>	25	6	25	2	11	4	–	–
<i>Schoenoplectus pungens</i> var. <i>pungens</i>	–	–	–	–	33	3	14	2
<i>Scleria flaccida</i>	–	–	50	4	–	–	–	–
<i>Setaria</i>	–	–	–	–	11	2	–	–
<i>Setaria pumila</i>	–	–	13	2	11	1	–	–
<i>Sideroxylon lycioides</i>	–	–	13	2	–	–	–	–
<i>Sisyrinchium atlanticum</i>	–	–	13	2	22	2	–	–

Table 11 (continued). Constancy and average cover class for all vascular plant species observed in 49 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MOUV = Maritime Open Upland Vegetation (16 plots), MUFS = Maritime Upland Forests and Shrublands (8 plots), Maritime Nontidal Wetland Vegetation (18 plots), and TW = Tidal Wetlands (7 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	MOUV Constancy	MOUV Cover	MUFS Constancy	MUFS Cover	MNTW Constancy	MNTW Cover	TW Constancy	TW Cover
<i>Smilax auriculata</i>	25	3	50	3	22	4	–	–
<i>Smilax bona-nox</i> var. <i>littoralis</i>	6	2	100	4	56	3	–	–
<i>Smilax glauca</i>	–	–	13	1	–	–	–	–
<i>Smilax hispida</i>	–	–	13	2	–	–	–	–
<i>Smilax smallii</i>	–	–	25	3	–	–	–	–
<i>Solidago mexicana</i>	6	3	13	2	72	2	71	2
<i>Solidago odora</i>	–	–	–	–	6	2	–	–
<i>Solidago sempervirens</i>	50	2	–	–	–	–	–	–
<i>Spartina alterniflora</i>	–	–	–	–	–	–	86	6
<i>Spartina patens</i>	56	4	38	3	94	6	100	6
<i>Sphenopholis obtusata</i>	–	–	–	–	6	1	–	–
<i>Spiranthes vernalis</i>	6	2	13	1	–	–	–	–
<i>Stenotaphrum secundatum</i>	–	–	13	3	–	–	–	–
<i>Strophostyles helvola</i>	50	2	13	1	6	1	–	–
<i>Suaeda linearis</i>	–	–	–	–	–	–	14	1
<i>Symphyotrichum</i>	–	–	13	1	–	–	–	–
<i>Symphyotrichum tenuifolium</i>	–	–	–	–	6	2	–	–
<i>Tillandsia usneoides</i>	–	–	13	2	–	–	–	–
<i>Toxicodendron radicans</i> var. <i>radicans</i>	6	2	100	6	89	5	14	2
<i>Tripsacum dactyloides</i> var. <i>dactyloides</i>	–	–	13	1	–	–	–	–
<i>Typha domingensis</i>	–	–	–	–	11	1	–	–
<i>Uniola paniculata</i>	100	7	–	–	6	2	–	–
Unknown	–	–	–	–	11	2	–	–

Table 11 (continued). Constancy and average cover class for all vascular plant species observed in 49 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MOUV = Maritime Open Upland Vegetation (16 plots), MUFS = Maritime Upland Forests and Shrublands (8 plots), MNTW = Maritime Nontidal Wetland Vegetation (18 plots), and TW = Tidal Wetlands (7 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	MOUV Constancy	MOUV Cover	MUFS Constancy	MUFS Cover	MNTW Constancy	MNTW Cover	TW Constancy	TW Cover
<i>Vaccinium arboreum</i>	–	–	13	5	–	–	–	–
<i>Vaccinium formosum</i>	–	–	13	1	–	–	–	–
<i>Verbena scabra</i>	–	–	13	1	–	–	–	–
<i>Vitis aestivalis</i> var. <i>aestivalis</i>	–	–	13	3	–	–	–	–
<i>Yucca aloifolia</i>	–	–	–	–	6	1	–	–
<i>Zanthoxylum clava-herculis</i>	6	2	–	–	–	–	–	–

Table 12. Basal area (BA, m²/ha) and density (Den, count/ha) of woody vascular plant species observed in 49 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MOUV = Maritime Open Upland Vegetation (16 plots), MUFS = Maritime Upland Forests and Shrublands (8 plots), Maritime Nontidal Wetland Vegetation (18 plots), and TW = Tidal Wetlands (7 plots) [Sap—Sapling; Seed—Seedling].

Species	MOUV Tree BA	MOUV Tree Den	MOUV Sap BA	MOUV Sap Den	MOUV Seed Den	MUFS Tree BA	MUFS Tree Den	MUFS Sap BA	MUFS Sap Den	MUFS Seed Den
<i>Baccharis angustifolia</i>	—	—	—	—	—	—	—	—	—	—
<i>Baccharis halimifolia</i>	—	—	—	—	—	—	—	—	—	—
<i>Benthamidia florida</i>	—	—	—	—	—	0.03	3.13	—	—	156.25
<i>Berchemia scandens</i>	—	—	—	—	—	—	—	0.41	375.00	625.00
<i>Callicarpa americana</i>	—	—	—	—	—	—	—	0.00	125.00	312.50
<i>Carpinus caroliniana</i> var. <i>caroliniana</i>	—	—	—	—	—	0.73	18.75	0.72	375.00	1718.75
<i>Cartrema americanum</i>	—	—	—	—	—	—	—	0.61	1750.00	2812.50
<i>Ilex opaca</i>	—	—	—	—	—	0.47	18.75	3.19	4375.00	4062.50
<i>Ilex vomitoria</i>	—	—	—	—	—	—	—	0.61	2000.00	26093.75
<i>Iva frutescens</i>	—	—	—	—	—	—	—	—	—	312.50
<i>Iva imbricata</i>	—	—	—	—	6250.00	—	—	—	—	—
<i>Juniperus silicicola</i>	—	—	—	—	—	5.82	146.88	3.41	1375.00	1406.25
<i>Lonicera japonica</i>	—	—	—	—	—	—	—	—	—	1562.50
<i>Lonicera sempervirens</i>	—	—	—	—	—	—	—	—	—	312.50
<i>Morella cerifera</i>	—	—	—	—	178.57	—	—	7.82	11125.00	5156.25
<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	—	—	—	—	—	—	—	0.35	1125.00	3750.00
<i>Nekemias arborea</i>	—	—	—	—	5714.29	—	—	—	—	468.75
<i>Parthenocissus quinquefolia</i>	—	—	—	—	—	—	—	0.31	750.00	11562.50
<i>Persea borbonia</i>	—	—	—	—	—	0.04	3.13	0.20	375.00	2343.75
<i>Persea palustris</i>	—	—	—	—	—	0.22	18.75	2.85	1750.00	1562.50
<i>Pinus elliotii</i>	—	—	—	—	—	8.52	243.75	11.19	11375.00	9218.75

Table 12 (continued). Basal area (BA, m²/ha) and density (Den, count/ha) of woody vascular plant species observed in 49 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MOUV = Maritime Open Upland Vegetation (16 plots), MUFS = Maritime Upland Forests and Shrublands (8 plots), Maritime Nontidal Wetland Vegetation (18 plots), and TW = Tidal Wetlands (7 plots) [Sap—Sapling; Seed—Seedling].

Species	MOUV Tree BA	MOUV Tree Den	MOUV Sap BA	MOUV Sap Den	MOUV Seed Den	MUFS Tree BA	MUFS Tree Den	MUFS Sap BA	MUFS Sap Den	MUFS Seed Den
<i>Pinus taeda</i>	—	—	—	—	—	0.50	21.88	2.55	1375.00	468.75
<i>Prunus caroliniana</i>	—	—	—	—	—	—	—	—	—	156.25
<i>Quercus geminata</i>	—	—	—	—	—	0.79	15.63	0.00	125.00	1718.75
<i>Quercus hemisphaerica</i>	—	—	—	—	—	0.28	6.25	0.03	125.00	2812.50
<i>Quercus virginiana</i>	—	—	—	—	—	6.88	87.50	1.72	625.00	7187.50
<i>Smilax auriculata</i>	—	—	—	—	714.29	—	—	0.28	1375.00	7968.75
<i>Smilax bona-nox</i> var. <i>littoralis</i>	—	—	—	—	1964.29	—	—	0.11	2875.00	8593.75
<i>Smilax glauca</i>	—	—	—	—	—	—	—	—	—	312.50
<i>Smilax hispida</i>	—	—	—	—	—	—	—	—	—	312.50
<i>Smilax smallii</i>	—	—	—	—	—	—	—	—	125.00	7187.50
<i>Toxicodendron radicans</i> var. <i>radicans</i>	—	—	—	—	892.86	—	—	1.30	3750.00	94843.75
<i>Vitis aestivalis</i> var. <i>aestivalis</i>	—	—	—	—	—	—	—	—	—	312.50

Table 13. Basal area (BA, m²/ha) and density (Den, count/ha) of woody vascular plant species observed in 49 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MOUV = Maritime Open Upland Vegetation (16 plots), MUFS = Maritime Upland Forests and Shrublands (8 plots), Maritime Nontidal Wetland Vegetation (18 plots), and TW = Tidal Wetlands (7 plots) [Sap—Sapling; Seed—Seedling].

Species	MNVV Tree BA	MNVV Tree Den	MNVV Sap BA	MNVV Sap Den	MNVV Seed Den	TW Tree BA	TW Tree Den	TW Sap BA	TW Sap Den	TW Seed Den
<i>Baccharis angustifolia</i>	—	—	0.82	2529.41	1029.41	—	—	1.20	5000.00	2500.00
<i>Baccharis halimifolia</i>	—	—	1.33	4117.65	3014.71	—	—	0.36	1500.00	—
<i>Benthamidia florida</i>	—	—	—	—	—	—	—	—	—	—
<i>Berchemia scandens</i>	—	—	0.01	294.12	147.06	—	—	—	—	—
<i>Callicarpa americana</i>	—	—	—	—	—	—	—	—	—	—
<i>Carpinus caroliniana</i> var. <i>caroliniana</i>	—	—	—	—	—	—	—	—	—	—
<i>Cartrema americanum</i>	—	—	—	—	—	—	—	—	—	—
<i>Ilex opaca</i>	—	—	—	—	—	—	—	—	—	—
<i>Ilex vomitoria</i>	—	—	12.09	14941.18	6250.00	—	—	—	—	—
<i>Iva frutescens</i>	—	—	0.33	3117.65	3455.88	—	—	1.59	3000.00	9375.00
<i>Iva imbricata</i>	—	—	—	—	1250.00	—	—	—	—	—
<i>Juniperus silicicola</i>	2.94	130.00	1.46	705.88	220.59	—	—	—	—	—
<i>Lonicera japonica</i>	—	—	—	—	—	—	—	—	—	—
<i>Lonicera sempervirens</i>	—	—	—	—	—	—	—	—	—	—
<i>Morella cerifera</i>	0.06	5.00	9.68	19000.00	4044.12	—	—	5.52	3500.00	—
<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	—	—	—	58.82	147.06	—	—	—	—	—
<i>Nekemias arborea</i>	—	—	—	—	1250.00	—	—	—	—	—
<i>Parthenocissus quinquefolia</i>	—	—	0.08	2588.24	3529.41	—	—	—	—	—
<i>Persea borbonia</i>	—	—	—	—	—	—	—	—	—	—
<i>Persea palustris</i>	—	—	0.06	58.82	—	—	—	—	—	—

Table 13 (continued). Basal area (BA, m²/ha) and density (Den, count/ha) of woody vascular plant species observed in 49 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MOUV = Maritime Open Upland Vegetation (16 plots), MUFS = Maritime Upland Forests and Shrublands (8 plots), Maritime Nontidal Wetland Vegetation (18 plots), and TW = Tidal Wetlands (7 plots) [Sap—Sapling; Seed—Seedling].

Species	MNVV Tree BA	MNVV Tree Den	MNVV Sap BA	MNVV Sap Den	MNVV Seed Den	TW Tree BA	TW Tree Den	TW Sap BA	TW Sap Den	TW Seed Den
<i>Pinus elliotii</i>	—	—	—	—	—	—	—	—	—	—
<i>Pinus taeda</i>	—	—	—	—	—	—	—	—	—	—
<i>Prunus caroliniana</i>	—	—	—	—	—	—	—	—	—	—
<i>Quercus geminata</i>	—	—	—	—	—	—	—	—	—	—
<i>Quercus hemisphaerica</i>	—	—	—	—	—	—	—	—	—	—
<i>Quercus virginiana</i>	—	—	—	—	—	—	—	—	—	—
<i>Smilax auriculata</i>	—	—	0.03	1470.59	73.53	—	—	—	—	—
<i>Smilax bona-nox</i> var. <i>littoralis</i>	—	—	0.07	3411.76	2279.41	—	—	—	—	—
<i>Smilax glauca</i>	—	—	—	—	—	—	—	—	—	—
<i>Smilax hispida</i>	—	—	—	—	—	—	—	—	—	—
<i>Smilax smallii</i>	—	—	—	—	—	—	—	—	—	—
<i>Toxicodendron radicans</i> var. <i>radicans</i>	—	—	0.13	3117.65	28970.59	—	—	—	—	—
<i>Vitis aestivalis</i> var. <i>aestivalis</i>	—	—	—	—	—	—	—	—	—	—

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1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525