



Terrestrial Vegetation Monitoring at Canaveral National Seashore

2022 Data Summary

Natural Resource Data Series NPS/SECN/NRDS—2024/1408





ON THIS PAGE

Epiphytic plants grow on the surface of other plants and derive most of their nutrients from air and rain. Several species of epiphytes were present within hardwood-dominated coastal hammock plots of Canaveral National Seashore. From left to right, shoestring fern (*Vittaria lineata*), giant airplant (*Tillandsia utriculata*), and the state endangered hand fern (*Cheiroglossa palmata*) growing next to resurrection fern (*Pleopeltis michauxiana*).

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

ON THE COVER

One of 14 vegetation monitoring plots established on Canaveral National Seashore during the late spring of 2022 by the Southeast Coast Network (SECN) vegetation field crew. Open canopy woodlands ("flatwoods") dominated by slash pine (*Pinus elliottii*) with a mixed understory of shrubs, woody vines, forbs, and graminoids occur across the Seashore's Oak Hill (Bill's Hill) Unit and were sampled during this monitoring effort.

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

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2022 Data Summary

Natural Resource Data Series NPS/SECN/NRDS—2024/1408

M. Forbes Boyle

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

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U.S. Department of the Interior
National Park Service
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Fort Collins, Colorado

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

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

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

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

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This project was aided by the many individuals who assisted with fieldwork in April 2022. Field crew members included

Elizabeth Rico (former SECN Biological Technician), Brooke Shamblin (South Florida /Caribbean Network [SFCN] Vegetation Biological Technician), Michelle Prats (SFCN Biological Technician), and Brittnei McGuire (former Cumberland Island National Seashore [CUIS] Recreation Fee Technician). Thanks to Kevin Whelan (SFCN Community Ecologist) and Brian Witcher (former acting SFCN Program Manager) for supporting and arranging field support for Brooke and Michelle; and to Jill Hamilton-Anderson (former Chief of Interpretation and Education at CUIS) for supporting and arranging field support for Brittnei. Finally, thanks to Brooke for providing his expert botanical skills to aid in the identification of several unknown plants observed during this monitoring effort.



The 2022 vegetation monitoring field crew at Canaveral National Seashore included (from left), Michelle Prats, M. Forbes Boyle, Elizabeth Rico, Brooke Shamblin, and Brittnei McGuire. NPS photo / 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 Canaveral National Seashore (CANA). Fourteen vegetation plots were established throughout the park in April. 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 Canaveral National Seashore in 2022. Data were stratified across two dominant broadly defined habitats within the park, Coastal Plain Upland Open Woodlands and Maritime Upland Forests and Shrublands. Noteworthy findings include:

- 176 vascular plant taxa were observed across 14 vegetation plots, including seven species not previously documented within the park.
- The most frequently encountered species in each broadly defined habitat included:
 - Coastal Plain Upland Open Woodlands: saw palmetto (*Serenoa repens*), dune greenbrier (*Smilax auriculata*), Elliott's milkpea (*Galactia elliottii*), myrtle oak (*Quercus myrtifolia*), Chapman oak (*Quercus chapmanii*), and southern evergreen blueberry (*Vaccinium myrsinites*).
 - Maritime Upland Forests and Shrublands: live oak (*Quercus virginiana*), muscadine (*Muscadinia rotundifolia* var. *rotundifolia*), saw palmetto, cabbage palmetto (*Sabal palmetto*), dune greenbrier, and Virginia creeper (*Parthenocissus quinquefolia*).
- Four non-native species categorized as invasive by the Florida Invasive Species Council (FISC 2019) were encountered within Maritime Upland Forest and Shrubland plots during this monitoring effort. These included Brazilian peppertree (*Schinus terebinthifolia*), cogongrass (*Imperata cylindrica*), common lantana (*Lantana strigocamara*), and caesarweed (*Urena lobata*). There were no invasive species observed in Coastal Plain Upland Open Woodland plots.
- Two species listed as Endangered by the state of Florida (FDACS 2021) were encountered on the park during this monitoring effort and included hand fern (*Cheiroglossa palmata*) and Atlantic Coast Florida lantana (*Lantana depressa* var. *floridana*). Hand fern was observed in 30% of Maritime Upland Forest and Shrubland plots, while lantana was observed in one (10%) of Maritime Upland Forest and Shrubland plots. An additional five vascular species categorized as Commercially Exploited by the state of Florida (FDACS 2021) were also observed in these vegetation plots.
- Slash pine (*Pinus elliottii*) or South Florida slash pine (*Pinus densa*) and sand live oak (*Quercus geminata*) were the most dominant species within the tree stratum of Coastal Plain Upland Open Woodlands within the park; cabbage palmetto and live oak were the most dominant species of Maritime Upland Forests and Shrublands, although 11 other species large enough to be measured as trees (i.e., 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)) were also present within these plots.
- Based on these baseline findings, the most immediate threat to vegetation resources within Upland Open Woodlands of Canaveral National Seashore is related to exclusion of fire and an altered natural fire regime. These factors have likely led to a reduction of canopy species (pines) across all woody stem strata—tree, sapling, seedling—and an increase in abundance of woody shrub species (e.g., saw palmetto). These characteristics (low canopy species density and high woody shrub abundance) were observed in monitoring plots of this habitat type. The most immediate threat to Maritime Upland Forest and Shrubland habitat within the park is from potential expansion of non-native, invasive plant species, like Brazilian peppertree and cogongrass.
- All plots are scheduled to be resampled during the summer of 2026.

List of Terms

Aspect: The compass direction that a slope faces.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Slope: The rise and fall of a land surface.

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

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

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

Introduction

Overview

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

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

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

This report provides a summary of data collected in April 2022 within Canaveral National Seashore (CANA) as part of the SECN’s terrestrial vegetation monitoring effort. This report is intended to provide CANA 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 Canaveral 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 monitoring, and conversely, were there rare species detected?
- In forests, woodlands, and shrublands, what is the relative frequency of woody seedlings, saplings, and subcanopy or canopy species?
- Do observable stressors appear to impact vegetation communities?
- What is the current condition of soil nutrient chemistry and fuel volume?

Methods

Study Area

Canaveral National Seashore (CANA) is on the Atlantic Coast of Florida, stretching 39 kilometers (24 miles [mi]) from roughly New Smyrna Beach to Titusville. The Seashore was created in 1975 by Congress and included land parcels that were part of the northern section of the John F. Kennedy Space Center and Florida's Apollo Beach State Park. Today, the park is approximately 23,798 hectares (58,807 acres [ac]) and its southern portion is jointly managed by the National Park Service (NPS) and Merritt Island National Wildlife Refuge. Only units of the seashore that are not jointly managed by other agencies were sampled during this monitoring effort. Those units included Apollo Beach and Oak Hill (Figure 1). The most noticeable landscape feature of the Seashore is Mosquito Lagoon, which serves as the northernmost section of the 250 kilometers (155 mi) Indian River Lagoon. Indian River is an Environmental Protection Agency (EPA)-designated Estuary of National Significance and has one of the most diverse assemblages of aquatic species across the entire eastern seaboard of the U.S. (DeVivo et al. 2008).

The land including and surrounding Canaveral National Seashore has a long history with human settlement, human land use, and the consequential impact of each. First occupation of the Indian River by Native Americans was about 2000 years B.C., and when Europeans arrived in the early 1500s to the Florida coast they found tribes (Timucuan) along Cape Canaveral's waterways (Davison and Bratton 1986). Following European settlement, Canaveral's maritime upland hammocks and swamp forests were largely cleared of trees (e.g., live oak [*Quercus virginiana*]) removal for ship construction; cypress removal for building materials), wetlands were drained, and in the mid-1700s much of the land was modified to plantation agriculture for indigo and later for other cash crops (Davison and Bratton 1986). Pine-dominated flatwoods on Seashore parcels west of Mosquito Lagoon have also experienced impacts from human land use over the past several hundred years. The vegetation structure and diversity of pine flatwoods across Florida as well as other parts of the Southeastern U.S. have been significantly altered since the arrival of Europeans due to several factors including tree removal for timber, tree use in procuring naval stores, altered fire regimes, and land conversion (Frost 2006). According to Davison and Bratton (1986), the pines within Canaveral have been cut over twice since 1900, with tree ring cores taken from pines in Oak Hill (Bills Hill) suggesting an age of 30 years (now almost 70 years).

Climate patterns also impact the distribution of vegetation and influence forest structure within the park. Hurricanes are a periodic disturbance event in the summer and fall, while summer thunderstorms accompanied by lightning strikes are frequent (Winsberg 2003). Canaveral National Seashore is located along the gradient between two different climate zones (~the "frost line"), where the semi-tropical zone meets the temperate zone (CANA 2000). Many subtropical plants reach their northern range limit near this "frost line" and temperate plants reach their southern limit. For example, low salt marshes along the northern end of Canaveral National Seashore are dominated by saltmarsh cordgrass (*Spartina alterniflora*)—the typical tidal marsh species along the coast of Virginia, Carolinas, and Georgia—while subtropical mangroves (e.g., red [*Rhizophora mangle*] and black [*Avicennia germinans*]) dominate the southern end.

Threats to terrestrial vegetation are present along the seashore, including those that impact ecosystems well beyond the borders of the park (landscape-scale) and those that are mainly park-specific. Like most parks within the Southeast Coast Network, terrestrial ecosystems present within Canaveral National Seashore are impacted by the increase of **non-native, invasive plants**. 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). Terrestrial ecosystems across the Southeastern Coastal Plain, like many of those found within Canaveral National Seashore, rely on fire to maintain biodiversity, recycle nutrients, create microhabitats, and reduce biomass (Noss 2018). **Fire exclusion practices** across the southeast during the 19th and 20th centuries had profound negative impacts to these ecosystems. The land that was purchased by the National Aeronautics and Space Administration (NASA) in Brevard County, Florida and which would eventually become two-thirds of Canaveral National Seashore underwent a complete fire exclusion policy in the mid 1900s that lasted several decades; furthermore, prescribed fire was not a major component of the fire management plans of both Merritt Island National Wildlife Refuge (bordering the Seashore to the south) and the park until after 1981 (Davidson and Bratton 1986). The seashore currently utilizes prescribed fire and other fire surrogate treatments to restore upland pine-dominated woodlands (i.e., pine flatwoods) and reduce unnaturally high fuel loads across these and other forested units (CANA 2023), but threats remain to these communities

with cessation of these activities both at the species- and ecosystem-scale. **Feral hogs** (*Sus scrofa*), which are currently present on the park, pose another risk to terrestrial vegetation communities by their destructive behavior of “rooting” the forest floor, “digging” mud wallows, and creating trail networks. Park resources impacted include native vegetation (e.g., reduce tree regeneration, endanger populations of already rare plant species, and spread invasive plants), native wildlife (e.g., increase competition for resources, being eaten, and spread disease), soil (e.g., erosion), wetlands (e.g., increase bacteria waste into waterways), and archaeology sites. **Exotic insects** also present significant threats to the park flora, and include an introduced cactus moth (*Cactoblastis cactorum*) that impacts several species of prickly-pear (*Opuntia* sp.) within Florida (Zimmerman et al. 2001) and the red bay ambrosia beetle (*Xyleborus glabratus*) which infects trees and shrubs within the Laurel Family (Lauraceae) across the southeast—including red bay (*Persea borbonia*) and swamp bay (*Persea palustris*)—with the fungus (*Raffaelea lauricola*) that causes laurel wilt disease (LWD). Finally, impacts related to **rapidly changing climate patterns and sea-level rise** have the potential to alter vegetation patterns across the Seashore. As noted by Crumpacker et al. (2001) plant species within transitional areas (e.g., “frost line”) are particularly sensitive to climate change impacts. Because of its location directly along the Atlantic Coast, Canaveral National Seashore is particularly vulnerable to sea level rise impacts, such as overwash, inundation, and saltwater intrusion (Noss 2011).

Despite these stressors and threats, Canaveral National Seashore is home to a diverse flora. The most recent floristic survey within the park and its surrounding areas reported 679 vascular plant taxa (Schmalzer and Foster 2016) and NPSpecies lists 750 species as present within the park (NPS 2023). One species—fragrant prickly apple (*Harrisia fragrans*)—is listed as federally endangered. Fourteen taxa currently listed as either endangered (FL-E) or threatened (FL-T) within the state of Florida (FDACS 2021) included:

- Sand-dune spurge (*Chamaesyce cumulicola*; FL-E)
- Hand fern (*Cheiroglossa palmata*; FL-E)
- Coastal vervain (*Glandularia maritima*; FL-E)
- Fragrant prickly apple (FL-E)
- Sea rosemary (*Heliotropium gnaphalodes*; FL-E)
- Atlantic Coast Florida lantana (*Lantana depressa* var. *floridana*; FL-E)

- Pine pinweed (*Lechea divaricate*; FL-E)
- Twinberry (*Myrcianthes fragrans*; FL-T)
- Celestial lily (*Nemastylis floridana*; FL-E)
- Shell mound prickly-pear (*Opuntia stricta*; FL-T)
- Inkberry (*Scaevola plumieri*; FL-T)
- Coastal hoary-pea (*Tephrosia angustissima* var. *curtissii*; FL-E)
- Common wild-pine (*Tillandsia fasciculata*; FL-E)
- Giant wild-pine (*Tillandsia utriculata*; FL-E)

Other species of note present on the park from Schmalzer and Foster (2016) included the Florida imperiled (State Element Rank [S2]) yellow hibiscus (*Pavonia spinifex*; FNAI 2023) and the following species listed as Commercially Exploited by the state (FDACS 2021)—Florida butterfly orchid (*Encyclia tampensis*), green fly orchid (*Epidendrum conopseum*), royal fern (*Osmunda spectabilis*), cinnamon fern (*Osmundastrum cinnamomeum*), saw palmetto (*Serenoa repens*), and coontie (*Zamia integrifolia* var. *integrifolia*).

Over 30 species from the Schmalzer and Foster (2016) inventory are considered either a Category I or II invasive by the Florida Invasive Species Council (FISC 2019). Category I invasive species, or those that by definition alter native plant communities by displacing native species, change community structure or ecological functions, or hybridize with natives (FISC 2019) that are present on the park include:

- Rosarypea (*Abrus precatorius*)
- Mimosa (*Albizia julibrissin*)
- Sprenger’s asparagus fern (*Asparagus aethiopicus*)
- Mountain ebony (*Bauhinia variegata*)
- Australian pine (*Casuarina equisetifolia*)
- Gray she-oak (*Casuarina glauca*)
- Elephantgrass (*Cenchrus purpureus*)
- Asian nakedwood (*Colubrina asiatica*)
- Air-potato (*Dioscorea bulbifera*)
- Surinam cherry (*Eugenia uniflora*)
- Hydrilla (*Hydrilla verticillata*)

- Cogongrass (*Imperata cylindrica*)
- Common lantana (*Lantana strigocamara*)
- Primrose willow (*Ludwigia peruviana*)
- Natalgrass (*Melinis repens*)
- Guava (*Psidium guajava*)
- Kudzu (*Pueraria montana* var. *lobata*)
- Beach naupaka (*Scaevola taccada*)
- Brazilian peppertree (*Schinus terebinthifolius*)
- Caesarweed (*Urena lobata*)

Canaveral National Seashore Vegetation Sampling Units

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

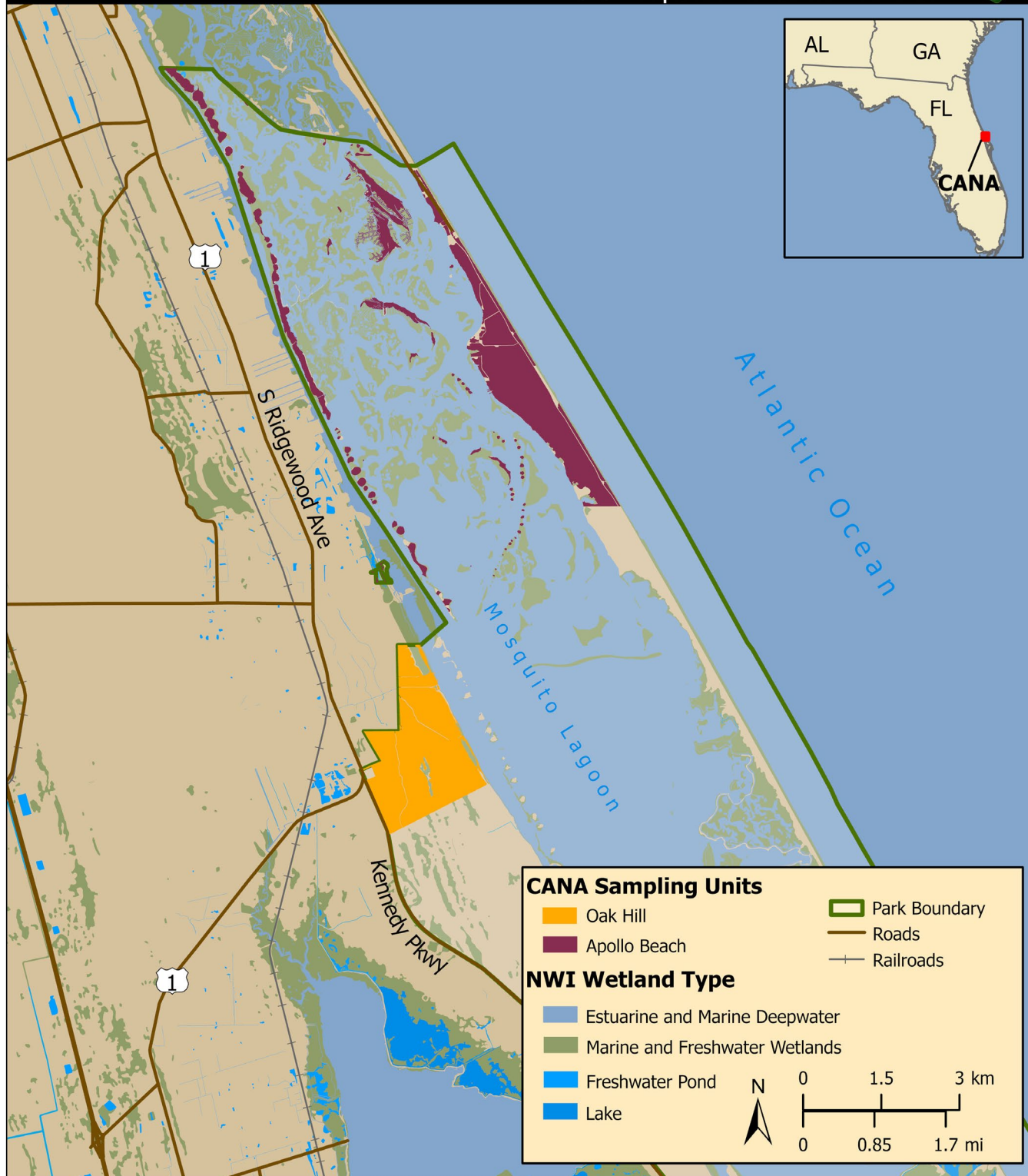


Figure 1. Location of the northern section of Canaveral National Seashore along the Atlantic Coast, in Volusia County, Florida. The map also shows the location of targeted land parcels (subunits) where vegetation plots were established within the park.

Sampling Design

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

semi-natural vegetation; and (4) each of the secondary sample target habitat types is allotted four plots.

Fourteen vegetation plots were established and sampled on the Apollo Beach and Oak Hill land parcels (subunits) of Canaveral National Seashore in April 2022 (Figure 2). These plots were located in the following broadly defined habitats of the park: Coastal Plain Upland Open Woodlands (4 plots) and Maritime Upland Forests and Shrublands (10 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).

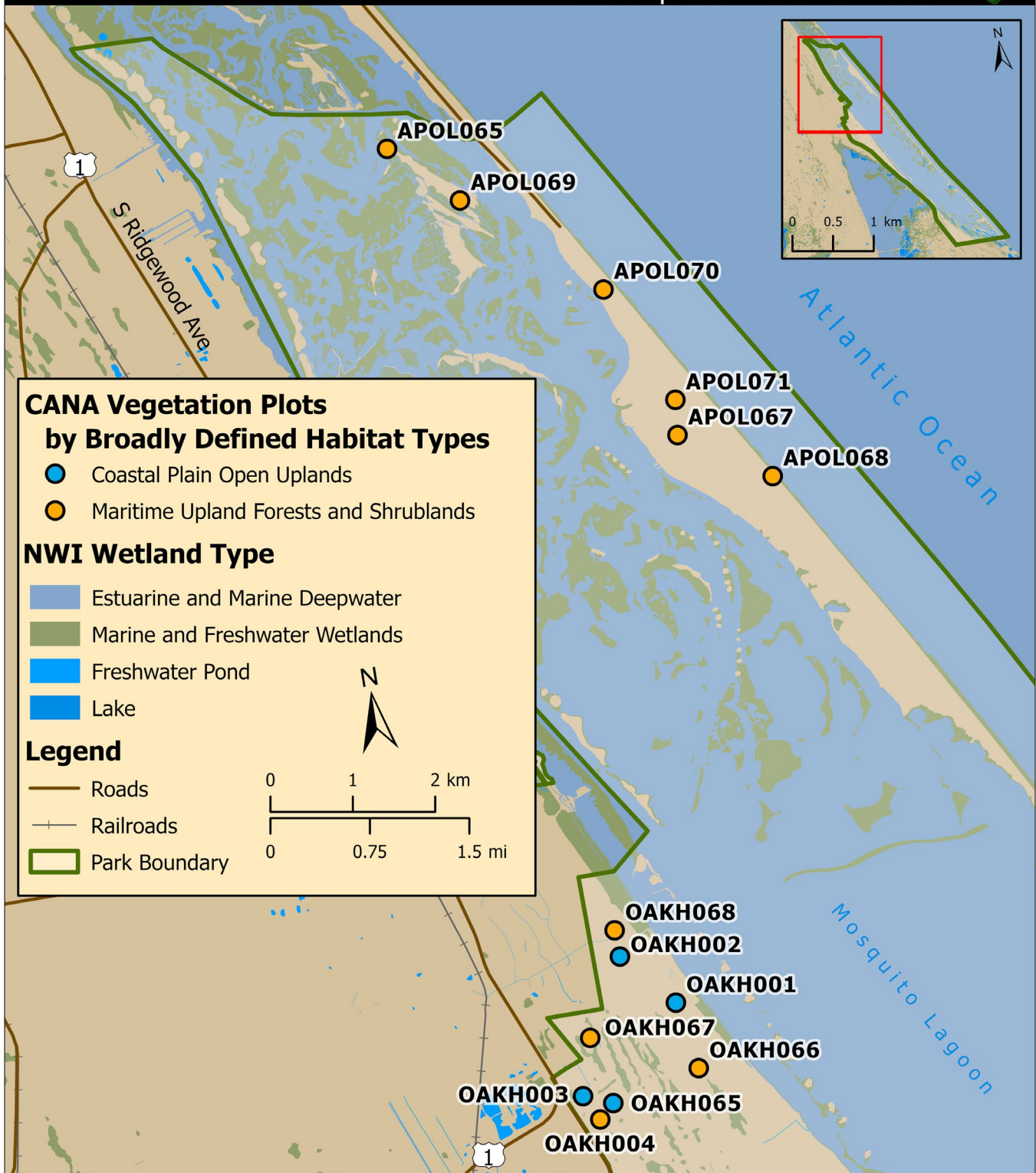


Figure 2. Southeast Coast Network terrestrial vegetation monitoring plot locations within Canaveral National Seashore.

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. Occasionally, a taxonomic concept was created by “lumping” several species of the same genus of known occurrence within a park. For example, both south Florida slash pine (*Pinus densa*) and slash pine (*Pinus elliottii*) occur in the park; both species occur in abundance in the natural and semi-natural habitats targeted by this monitoring effort; and both species can often be difficult to distinguish based on vegetative features. Thus, a taxonomic concept was created—*Pinus [densa + elliottii]*—that combined the two species into a single concept. This “lumped” taxon is of finer scale taxonomic resolution than if these records had been identified as any pine—i.e., *Pinus* sp. Once the final list was determined, each species was cross-referenced with the USDA Plants Database (USDA 2023) to determine growth form, native status, federal/state noxious status, and to

provide a unique common name. When a single taxon linked to multiple growth forms, the lead author subjectively chose a single growth form to link with the taxa. The species list was also cross-referenced with Florida plant lists to determine the state and federal conservation status (e.g., Endangered, Threatened, Rarity) of each species (FDACS 2021; FNAI 2023) and the list of non-native invasive plants in Florida to determine the degree of invasiveness (FISC 2019).

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).

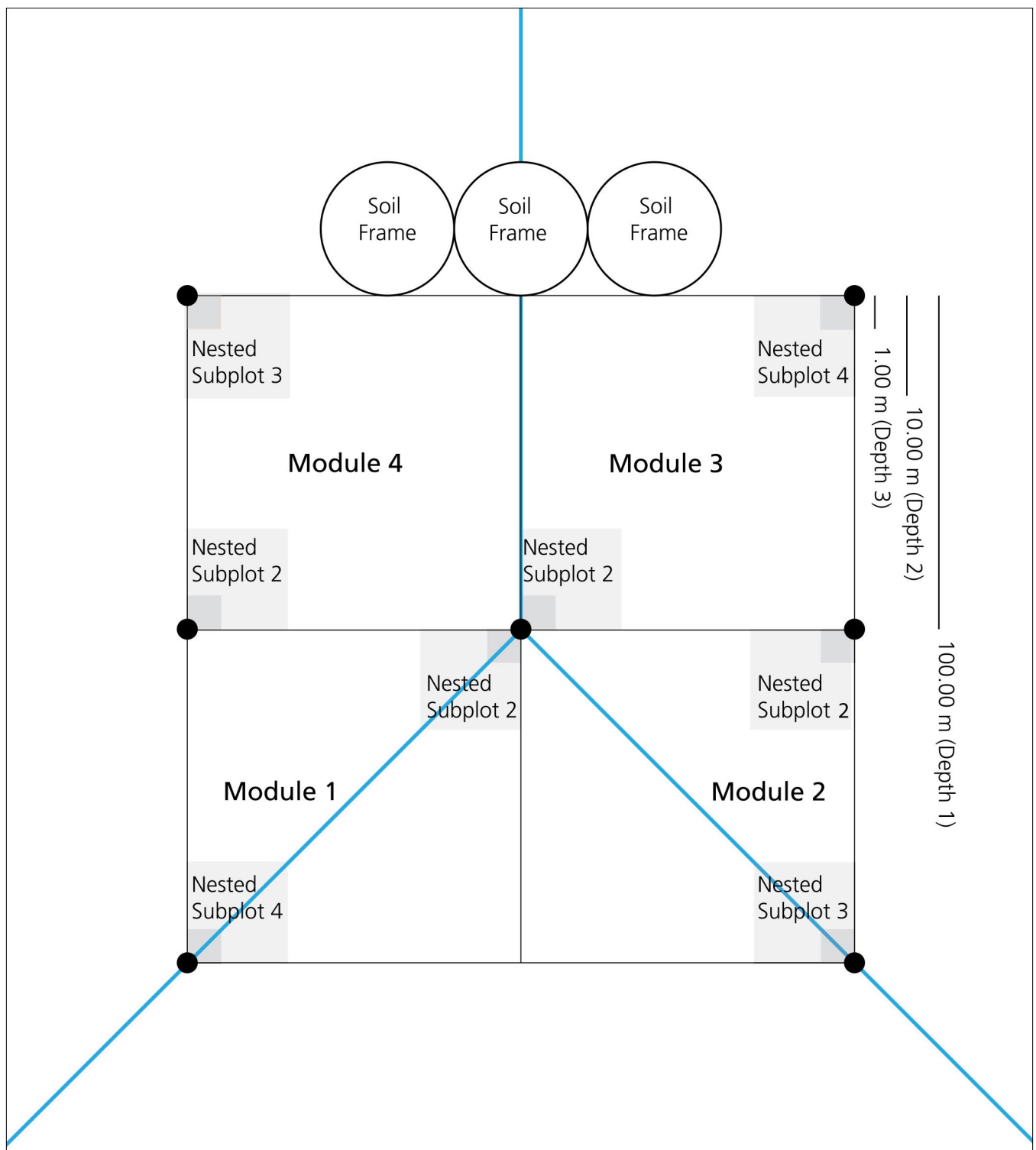


Figure 3. The layout of the sampling plot for the Southeast Coast Network, which is a modified version of the standard Level 5 Carolina Vegetation Survey plot. Ideal locations of rebar used as permanent structures to monument the plot are represented by black shaded circles. Blue lines represent locations 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 meter (1,076.4 ft²) modules: the 1 square meter (10.8 ft²) nested depth, the 10 square meters (107.6 ft²) nested depth, and the full modular depth. The nested depth “quadrat” were in two of four corners within each module. For each species either rooted in or overhanging a module, an areal cover value was assigned using the cover class codes developed by the Carolina Vegetation Survey (Peet et al. 1998; Table 1).

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

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

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

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

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

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

Results and Discussion

One hundred and seventy-six vascular plant taxa were detected during this monitoring effort (Appendix A), including eight taxa not detected in previous lists documented in Schmalzer and Foster (2016), Byrne et al. (2012), NPSpecies (NPS 2023), or Southeast Regional Network of Expertise and Collections (SERNEC 2023; Table 2). Native richness ranged from 18 to 63 species per plot, while non-native richness was either nonexistent—in Upland Open Woodland plots—or very stochastic (ranging from 0 to 4 species/plot)—in Upland Forests and Shrubland plots (Table 3). Four Category I invasive plants were observed in monitoring plots of the Apollo Beach and Oak Hill subunits. These species included Brazilian peppertree, caesarweed, cogongrass, and common lantana (Appendix A, Table A-1). Brazilian peppertree was by far the most frequently observed invasive species, occurring in 60% of the Maritime Upland Forest and Shrubland plots within the park (Figure 4). Most native species observed in these plots are common throughout Florida and are represented by a combination of species with a more southerly, subtropical

distribution (e.g., twinberry [*Myrcianthes fragrans*], colicwood [*Myrsine cubana*], and several epiphytic and non-epiphytic ferns) and species ranging well into the temperate north (e.g., yaupon [*Ilex vomitoria*] and Darlington (or sand laurel) oak [*Quercus hemisphaerica*]). Two state-listed Endangered species were observed within these monitoring plots, including hand fern and Atlantic Coast Florida lantana; five species listed as Commercially Exploited by the state of Florida (FDACS 2021) were also present within plots (Appendix A, Table A-1). Although these Commercially Exploited species can be common (e.g., saw palmetto). In the southeastern Coastal Plain, 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 Schmalzer and Foster (2016), Byrne et al. (2012), NPSpecies (NPS 2023), or Southeast Regional Network of Expertise and Collections (SERNEC 2023) but found at Canaveral National Seashore in 2022 through this monitoring effort.

Scientific Name	Common Name ¹	Growth Form ¹	Native Status ¹	Global Rank ²	State Rank ² (Florida)
<i>Acalypha arvensis</i>	field copperleaf	Forb/herb	Non-native	SNR	SNR
<i>Carex floridana</i>	Florida sedge	Graminoid	Native	G5	SNR
<i>Chasmanthium laxum</i>	slender woodoats	Graminoid	Native	G5	SNR
<i>Ludwigia octovalvis</i>	Mexican primrose-willow	Forb/herb	Native	G5	SNR
<i>Pinus palustris</i>	longleaf pine	Tree	Native	G5	SNR
<i>Rubus cuneifolius</i>	sand blackberry	Subshrub	Native	G5	SNR
<i>Sapindus marginatus</i>	wingleaf soapberry	Shrub, Tree	Native	G5	SNR
<i>Smilax pumila</i>	sarsparilla vine	Subshrub, Vine, Shrub	Native	G5	SNR

¹ Information obtained from the PLANTS database (USDA 2024)

² Conservation Status (G5: Species Secure; SNR: no ranking) obtained from NatureServe Explorer 2.0 (NatureServe 2024)

Table 3. Vascular plant species, subspecies, or varieties not reported from Schmalzer and Foster (2016), Byrne et al. (2012), NPSpecies (NPS 2023), or Southeast Regional Network of Expertise and Collections (SERNEC 2023) but found at Canaveral National Seashore in 2022 through this current monitoring effort.

Broadly Defined Habitat	Plot	Native¹	Non-native¹	Unknown¹	T¹	S¹	V¹	H¹	G¹	T²	S²	V²	H²	G²	T³	S³	V³	H³	G³	T⁴	S⁴	V⁴	H⁴	G⁴
Coastal Plain Upland Open Woodlands	OAKH001	18.0	0.0	0.0	7.0	4.0	3.0	0.0	4.0	5.3	2.5	1.5	0.0	1.8	2.5	1.4	1.1	0.0	0.6	0.8	0.6	0.6	0.0	0.8
	OAKH002	19.0	0.0	0.0	7.0	4.0	4.0	0.0	3.0	5.0	2.5	2.5	0.0	0.8	3.6	1.8	1.1	0.0	0.1	1.8	1.0	0.4	0.0	0.0
	OAKH003	34.0	0.0	0.0	7.0	9.0	3.0	10.0	5.0	4.5	7.3	2.5	5.8	3.3	2.1	5.0	1.4	1.8	1.5	1.0	2.6	1.1	0.8	0.0
	OAKH004	32.0	0.0	0.0	6.0	8.0	2.0	10.0	6.0	4.0	6.0	1.3	5.0	3.0	1.8	4.8	0.6	1.5	1.1	0.8	2.9	0.4	0.3	1.0
	average	25.8	0.0	0.0	6.8	6.3	3.0	5.0	4.5	4.7	4.6	1.9	2.7	2.2	2.5	3.2	1.1	0.8	0.8	1.1	1.8	0.6	0.3	0.7
	standard deviation	8.4	0.0	0.0	0.5	2.6	0.8	5.8	1.3	0.6	2.4	0.7	3.1	1.2	0.8	1.9	0.3	0.9	0.6	0.5	1.1	0.4	0.4	0.8
Maritime Upland Forests and Shrublands	APOL065	28.0	3.0	0.0	15.0	2.0	5.0	7.0	1.0	9.0	1.5	3.3	3.0	0.3	5.1	0.6	1.3	1.5	0.0	2.6	0.5	0.3	0.5	0.3
	APOL067	29.0	0.0	0.0	12.0	1.0	6.0	6.0	4.0	9.0	1.0	3.0	3.5	2.0	5.3	0.6	0.9	0.5	0.5	3.5	0.1	0.3	0.0	0.1
	APOL068	19.0	0.0	0.0	7.0	1.0	7.0	4.0	0.0	4.8	1.0	2.5	1.0	0.0	2.3	1.0	0.9	0.1	0.0	1.1	1.0	0.0	0.1	0.1
	APOL069	25.0	1.0	0.0	10.0	1.0	4.0	9.0	2.0	5.8	0.5	1.0	4.8	0.5	3.0	0.0	0.4	0.6	0.3	1.9	0.0	0.1	0.1	0.5
	APOL070	26.0	1.0	0.0	9.0	5.0	6.0	2.0	5.0	7.3	3.5	4.5	1.0	3.5	4.5	1.9	1.6	0.1	1.3	2.5	1.0	0.5	0.1	0.1
	APOL071	30.0	0.0	0.0	10.0	3.0	7.0	4.0	5.0	8.0	1.5	4.8	1.5	3.3	5.6	1.0	1.8	0.1	1.6	3.8	0.5	1.1	0.1	0.3
	OAKH065	63.0	4.0	1.0	12.0	2.0	8.0	32.0	13.0	8.0	1.0	3.8	17.5	7.3	3.5	0.3	1.9	8.5	4.0	1.1	0.0	0.6	3.3	0.0
	OAKH066	27.0	1.0	0.0	11.0	1.0	9.0	4.0	3.0	6.0	1.0	5.8	2.0	2.5	2.4	1.0	1.8	0.4	1.0	0.5	0.8	0.5	0.1	0.4
	OAKH067	33.0	1.0	0.0	13.0	5.0	5.0	7.0	4.0	6.8	2.5	3.3	2.8	1.5	2.5	1.5	1.9	1.6	0.6	0.4	0.9	0.6	1.0	1.5
	OAKH068	40.0	3.0	1.0	13.0	4.0	6.0	13.0	7.0	6.0	2.8	3.8	7.3	4.0	2.5	0.6	1.5	2.1	1.9	1.3	0.0	0.4	1.1	1.0
	average	32.0	1.4	0.2	11.2	2.5	6.3	8.8	4.4	7.1	1.6	3.6	4.4	2.5	3.7	0.9	1.4	1.6	1.1	1.9	0.5	0.4	0.7	0.4
	standard deviation	12.2	1.4	0.4	2.3	1.6	1.5	8.7	3.7	1.4	1.0	1.3	5.0	2.2	1.3	0.6	0.5	2.5	1.2	1.2	0.4	0.3	1.0	0.4

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

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

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

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

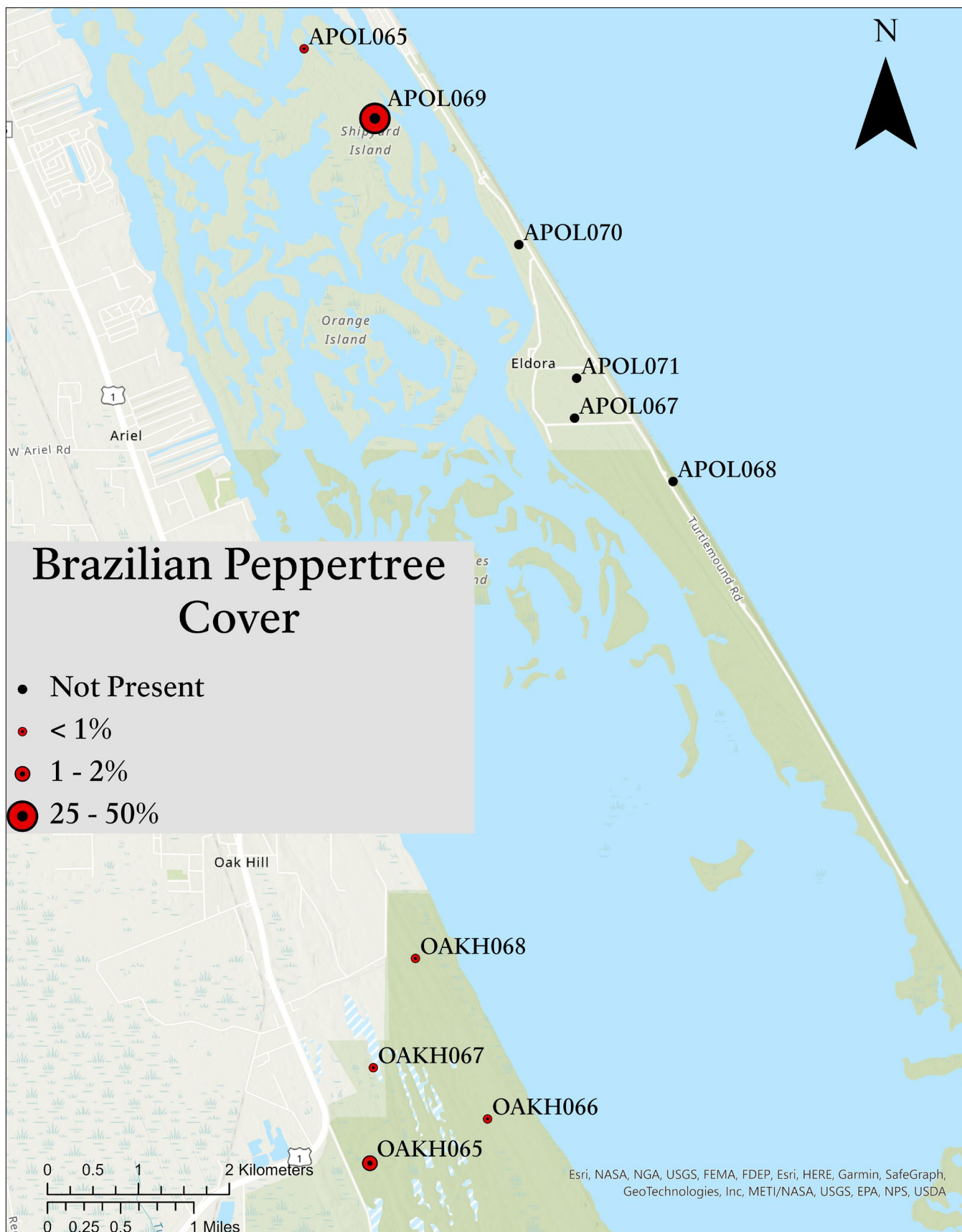


Figure 4. Plot-level abundance (cover) of Brazilian peppertree (*Schinus terebinthifolia*) in Maritime Upland Forest and Shrubland sites within Canaveral National Seashore, April 2022.

Coastal Plain Upland Open Woodlands

This broad category includes both open-spaced forests occurring on low, flat topography (hence the common local name “flatwoods”) across a dry (xeric) to wet (hydric) gradient and dense, dry-site uplands dominated by a combination of evergreen, shrubby oaks (e.g., sand live oak [*Quercus geminata*], Chapman oak [*Quercus chapmanii*], myrtle oak [*Quercus myrtifolia*]) and other sclerophyllous plants (“scrub”) (Figure 5). Fire return intervals differ between Florida’s flatwoods, which naturally would have experienced low intensity, but frequent (1–3 years) fires (Frost 2006) and scrub, which is maintained by high intensity, less frequent (10–100 years) fire (Myers 1990). The park currently uses prescribed fire and mechanical treatments to reduce hazardous fuel loads and to promote ecosystem stability within this broadly defined habitat (CANA 2023). Pine flatwoods and scrub ecosystems are mostly found within the Bills Hill subunit of the Seashore. Several vegetation associations corresponding with upland open woodland vegetation types were sampled within

Canaveral National Seashore during this monitoring effort, including (descriptions from NatureServe 2023):

- Northeast Florida Coastal Scrub (CEGL003821; 2 plots): Scrub communities occurring as a narrow strip along the coast in acidic soils; the stunted canopy is composed of sand live oak, myrtle oak, and chapman oak, along with other woody species (e.g., saw palmetto, wax-myrtle [*Morella cerifera*]). (Global Status: G2—Imperiled; State (FL) Status: No Status Rank)
- Peninsular Florida Scrubby Longleaf Pine Flatwoods (CEGL007750; 2 plots): This scrubby flatwoods association is composed of an open canopy of longleaf and slash pine along with a moderately dense shrub stratum of scrub oaks, saw palmetto and other species; southern wiregrass (*Aristida beyrichiana*) can be important within the herbaceous stratum. (Global Status: G2—Imperiled; State (FL) Status: No Status Rank)



Figure 5. Four plots were established in Coastal Plain Upland Open Woodlands of Canaveral National Seashore during this monitoring effort (April 2022). All plots of this habitat were located on the Oak Hill subunit of the park. This habitat included open-canopy woodlands dominated by pines (*Pinus* sp., pictured above) as well as dense evergreen oak (*Quercus* sp.)-dominated shrublands. Both communities are pyrogenic, meaning fire is necessary for their maintenance and species utilizing these habitats have developed certain fire-adaptive traits NPS photo / SECN staff.

Species Diversity and Abundance

Native species richness ranged from 18 to 34 (mean = 25.8) (Table 3). Richness was lowest in the two scrub plots. There was a fairly even distribution of richness values at the full plot scale (400 m²; 4,305.5 ft²) across all species growth forms (trees, shrubs, vines, herbs, and graminoids), while shrub diversity was highest at smaller, nested scales (Table 3). There were no non-native species observed within any of these four plots, although non-native species were present in adjacent plots of the Maritime Upland Forest and Shrubland habitat type (Table 3). There were no federal nor state protected plants observed in these plots. Fifty-six vascular plant species were found collectively within these four plots, including 24 only found in this particular habitat of the park; a complete species list, along with constancy and average cover per species, is listed in Appendix B, Table B-1. Species with high constancy in this habitat are listed below, by growth form (constancy values in parentheses):

Trees

- Chapman oak (100%)
- Myrtle oak (100%)
- Sand live oak (75%)

Shrubs

- Saw palmetto (100%)
- Southern evergreen blueberry (*Vaccinium myrsinites*; 100%)
- Wax myrtle (75%)
- Shining fetterbush (*Lyonia lucida*; 75%)

Vines

- Elliott's milkpea (*Galactia elliottii*; 100%)
- Dune greenbriar (*Smilax auriculata*; 100%)

Herbs and Graminoids

- Variable witchgrass (*Dichanthelium commutatum*; 75%)
- Florida bluestem (*Andropogon floridanus*; 75%)

Woody Stem Metrics

Total basal area (BA) of trees ranged from 0.3 to 8.3 m²/ha with an overall average of 4.1 m²/ha; density of canopy stems ranged from one to seven per plot, with an average of 3.0 (Table 4). Canopy height ranged from 6.3 to 17.3 meters (21 to 57 ft) [average 11.0 meters {36 ft}], and canopy cover ranged from 11 to 80% (average = 43%; Table 4). Abundance of trees, canopy height, and canopy cover differed between flatwood plots (OAKH003 and OAKH004) and scrub plots (OAKH001 and OAKH002), with abundance and height greater and cover lower in flatwood associations. The most dominant canopy species included slash pine (mean BA = 2.99 m²/ha, mean density = 56/ha) and sand live oak (mean BA = 1.09 m²/ha, mean density = 19/ha) (Appendix B, Table B-2). Sapling density at the 80-meter square scale ranged from 20 to 99 stems, with an average of 69, while seedling density at the 8-meter square scale ranged from 53 to 167 stems, with an average of 109 across all plots (Table 4). Dominant sapling species included sand live oak, Chapman oak, and rusty staggerbush (*Lyonia ferruginea*); dominant seedlings included saw palmetto, shining fetterbush, sand live oak, and gallberry (*Ilex glabra*) (Appendix B, Table B-2).

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

Broadly Defined Habitat	Plot	Tree Basal Area (m ² /ha)	Tree Density (400 m ²)	Sapling Basal Area (m ² /ha)	Sapling Density (80 m ²)	Seedling Density (8 m ²)	Mean Canopy Cover (%)	Mean Height (m)
Coastal Plain Upland Open Woodlands	OAKH001	4.03	2.00	84.21	78.00	53.00	80.44	8.00
	OAKH002	0.33	1.00	59.27	99.00	74.00	67.50	6.33
	OAKH003	8.32	7.00	11.01	79.00	143.00	11.19	17.33
	OAKH004	3.65	2.00	1.50	20.00	167.00	11.81	12.33
	average	4.08	3.00	39.00	69.00	109.25	42.73	11.00
	standard deviation	3.27	2.71	39.35	34.07	54.41	36.45	4.92
Maritime Upland Forests and Shrublands	APOL065	37.72	14.00	125.61	148.00	80.00	82.25	13.67
	APOL067	51.36	24.00	53.91	59.00	99.00	67.94	12.67
	APOL068	0.00	0.00	3.43	17.00	126.00	0.00	1.67
	APOL069	27.80	14.00	51.84	83.00	50.00	76.69	11.00
	APOL070	27.62	58.00	59.93	127.00	85.00	70.56	5.67
	APOL071	54.48	30.00	35.70	76.00	147.00	67.00	12.33
	OAKH065	65.49	40.00	21.92	34.00	11.00	51.00	10.00
	OAKH066	37.35	23.00	21.70	64.00	42.00	67.25	19.00
	OAKH067	17.00	10.00	22.11	56.00	42.00	77.69	14.00
	OAKH068	51.03	25.00	8.81	13.00	17.00	80.56	9.33
	average	36.98	23.80	40.49	67.70	69.90	64.09	10.93
	standard deviation	19.62	16.40	35.54	43.71	45.32	24.26	4.76

Based on stem count (density) alone, slash pine accounted for 75% of the relative abundance among species within the tree stratum (Figure 6). The sapling stratum was dominated by sand live oak, species within the genus *Lyonia* (e.g., rusty staggerbush and shining fetterbush), and scrub oaks (Chapman and myrtle; Figure 6). Saw palmetto and a mix of shrub species (e.g., gallberry) dominated the seedling stratum (Figure 6).

Half of the trees within these monitoring plots were dead and included 12 slash pine and two sand live oak (Figure 7). Tree

mortality is necessary in most forested ecosystems, including flatwoods, to create canopy gaps to promote canopy tree regeneration. However, illustrated by the minimal relative density of slash pine in earlier age classes of these plots (e.g., seedling and sapling strata, see Figure 6), these canopy gaps created by the high frequency of dead trees do not appear to aid in pine regeneration. Most of the live trees did show signs of healthy vigor and reduced stem dieback (Figure 7).

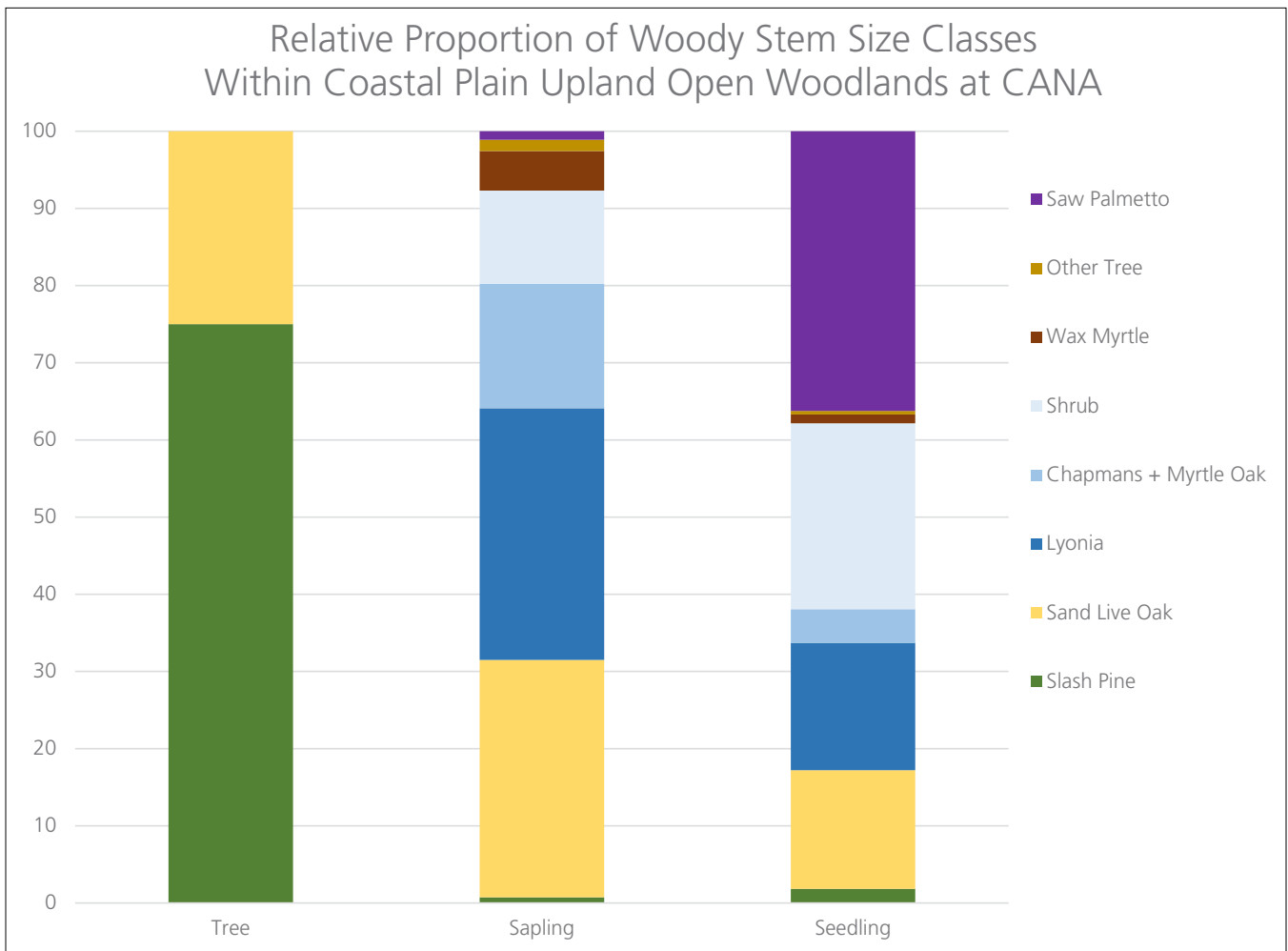


Figure 6. Relative proportion of species groups across three woody stem strata—trees, saplings, and seedlings— within Coastal Plain Upland Open Woodland monitoring plots of Canaveral National Seashore.

Health Condition of Trees Observed at Coastal Plain Upland Open Woodlands at CANA

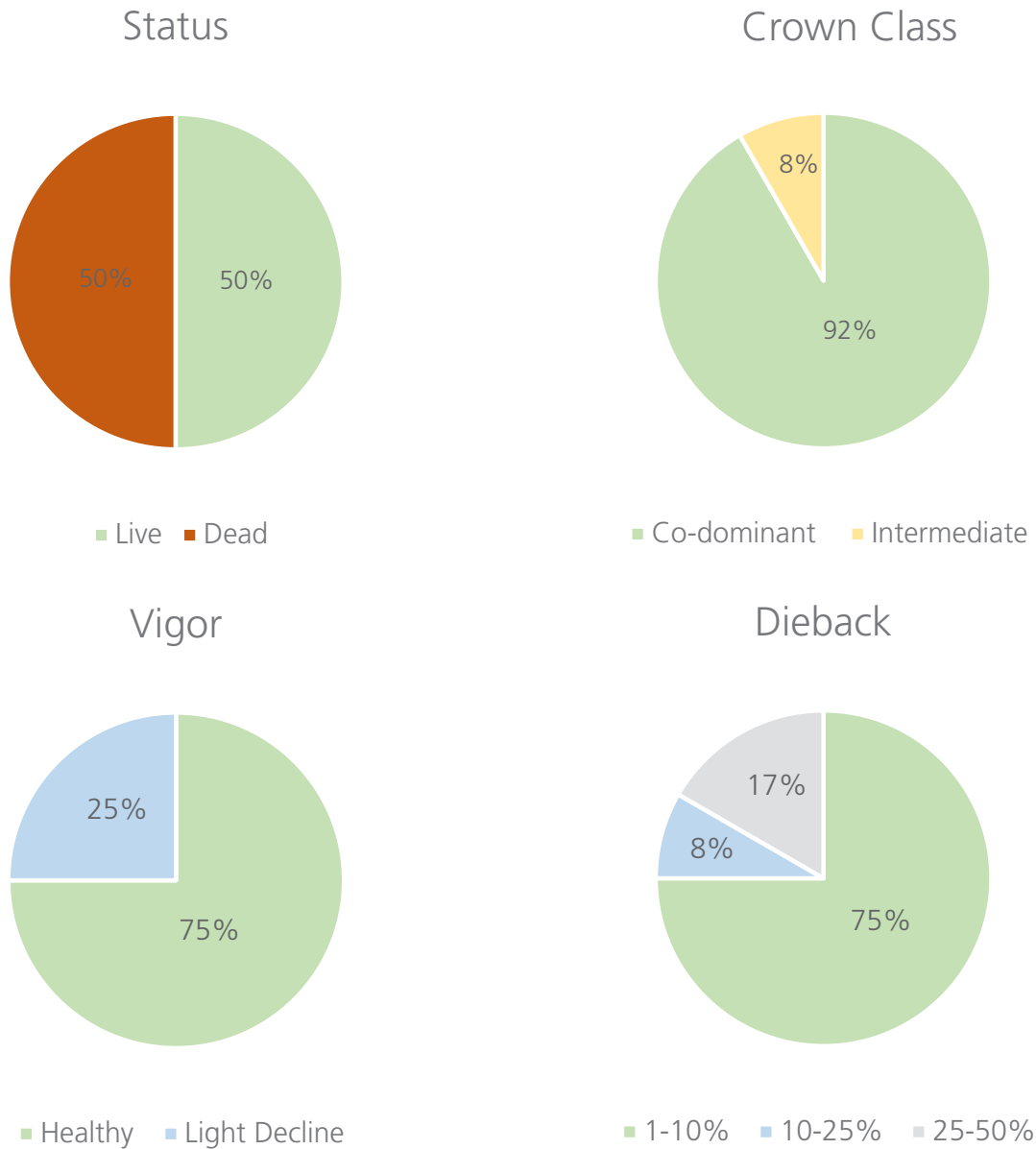


Figure 7. Health status of woody stems greater than or equal to 10 centimeters (3.9 in) DBH ("trees") measured on Coastal Plain Upland Open Woodland monitoring plots of Canaveral National Seashore.

Disturbances and Threats

Fire scars on trees and other noticeable features of historic burning (> 1 year from sampling) were observed on all plots of this broadly defined habitat of the park (Table 5). Although fire acts as a short-term disturbance in these ecosystems by removing ground cover, it is a necessary, natural component of these ecosystems (see discussion above). The threat to these sites, related to fire, is its exclusion. The Bills Hill subunit of Canaveral National Seashore—where all four plots are located—has not burned since 2016 (Kristen Kneifl [CANA Resource Management Specialist], personal communication). Although this return interval is normal for the scrub vegetation associations within the unit, it is beyond the threshold of one to three year return intervals for a healthy, functioning flatwoods ecosystem (Abrahamson and Hartnett 1990; Frost 2006). Return of fire is critical to maintain the site’s biodiversity and reduce the buildup of unnaturally high volume of fuel—which can create more intense, severe fires that increase canopy tree mortality and destroy soil seed banks. The only other disturbance observed in these plots was the

presence of ruts (i.e., historic plowing) probably related to former land use activities like timber management and grazing land for hogs and cattle within the Bills Hill subunit of the park.

Although no non-native, invasive plants were observed in these Upland Open Woodland sites, both cogongrass and Brazilian peppertree were present in Maritime Upland Forest and Shrubland plots nearby within the same Bills Hill subunit. Vegetation management approaches that mimic fire (e.g., roller chopping, mowing, or cutting; also known as fire surrogate treatments) are often necessary when fuel loads have increased overtime in the absence fire, in order to reduce impacts from heavy smoke and catastrophic flame lengths. However, these mechanical treatments have the tendency to increase the expansion of non-native plants into flatwoods (Noss 2018). Long-term monitoring of these plots can be used to detect both the presence of undesirable invasive plants and unnatural vegetation structure within this habitat of the Seashore.

Table 5. Disturbance observations and abundance (%cover) measured on vegetation monitoring plots of Canaveral National Seashore.

Broadly Defined Habitat	Plot	Recent Fire	Historic Fire	Heavy Windthrow	Heavy Erosion	Flood Scour	Feral Hog Damage	Historic Logging	Historic Plowing	ATV Trails
Coastal Plain Upland Open Woodlands	OAKH001	–	100	–	–	–	–	–	–	–
	OAKH002	–	100	–	–	–	–	–	–	–
	OAKH003	–	100	–	–	–	–	–	–	–
	OAKH004	–	100	–	–	–	–	–	20	–
Maritime Upland Forests and Shrublands	APOL065	–	–	–	–	–	–	–	–	–
	APOL067	–	100	–	–	–	10	–	–	–
	APOL068	–	–	–	–	–	–	–	–	–
	APOL069	–	–	–	–	–	–	–	–	–
	APOL070	–	–	–	–	–	–	–	–	–
	APOL071	–	–	–	–	–	–	–	–	–
	OAKH065	–	100	–	–	–	–	–	–	–
	OAKH066	–	–	–	–	–	–	–	–	–
	OAKH067	–	100	–	–	–	–	–	–	–
	OAKH068	–	100	–	–	–	–	–	–	80

Geomorphology and Soil

Plots located within Coastal Plain Upland Open Woodlands of Canaveral National Seashore occurred on flat (0 degree) landforms (Table 6). Because of their flat topography, flatwoods can experience standing water and flooding during rainy months; however, they can alternatively be droughty during the spring and summer months when evapotranspiration rates are high. Hydrology of flatwoods in the southeast is also influenced by slight changes in elevation and topography that may not be picked up by the precision

of this monitoring effort. Soils of Coastal Plain Upland Open Woodlands are typically composed of fine textured sands that are acidic and contain low levels of extractable nutrients. Soil data from these plots suggest similar patterns. Soil pH values were acidic, ranging from 4.8 to 4.9; meanwhile total exchange capacity was low, ranging from 3.6 to 4.5 milliequivalent (ME)/100 g (Table 7). Individual nutrient values in these soils were also low, particularly when compared to soil samples collected from neighboring Maritime Upland Forest and Shrubland plots with higher organic matter (Table 7).

Table 6. Local landform and hydrologic condition from vegetation monitoring plots at Canaveral National Seashore.

Broadly Defined Habitat	Plot	Slope (°)	Aspect (°)	TSI ¹ (°)	Landform Type	Water Source	Submerged (%)
Coastal Plain Upland Open Woodlands	OAKH001	0	n/a	0	flat plain	None	0
	OAKH002	0	n/a	0	flat plain	None	0
	OAKH003	0	n/a	0	flat plain	Flood zones	0
	OAKH004	0	n/a	0	flat plain	Flood zones	0
Maritime Upland Forests and Shrublands	APOL065	complex	complex	complex	rolling upland	Flood zones	0
	APOL067	0	n/a	0	flat plain	None	0
	APOL068	complex	complex	complex	rolling upland	None	0
	APOL069	0	n/a	0	flat plain	Flood zones	0
	APOL070	complex	complex	complex	rolling upland	None	0
	APOL071	0	n/a	0	flat plain	None	0
	OAKH065	0	n/a	0	flat plain	Flood zones	20
	OAKH066	0	n/a	0	flat plain	Flood zones	20
	OAKH067	complex	complex	complex	rolling upland	None	0
	OAKH068	0	n/a	0	flat plain	None	0

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

Table 7. Soil nutrient status from vegetation monitoring plots at Canaveral 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/100g)	pH H ₂ O 1:1	OM (%)	P ¹	Ca ¹	Mg ¹	K ¹	Na ¹	B ¹	Fe ¹	Mn ¹	Cu ¹	Zn ¹	Al ¹
Coastal Plain Upland Open Woodlands	OAKH001	4.41	4.90	1.32	14.00	334.00	30.00	12.00	12.00	0.10	56.00	1.00	0.10	0.20	281.00
	OAKH002	4.08	4.90	1.37	11.00	311.00	25.00	14.00	12.00	0.10	77.00	0.50	0.10	0.20	142.00
	OAKH003	4.52	4.80	1.84	5.00	272.00	60.00	13.00	14.00	0.10	22.00	2.00	0.10	0.69	77.00
	OAKH004	3.60	4.90	1.15	7.00	247.00	38.00	9.00	14.00	0.10	24.00	0.50	0.10	0.20	101.00
	average	4.15	4.88	1.42	9.25	291.00	38.25	12.00	13.00	0.10	44.75	1.00	0.10	0.32	150.25
	standard deviation	0.41	0.05	0.30	4.03	38.93	15.46	2.16	1.15	0.00	26.55	0.71	0.00	0.25	91.20
Maritime Upland Forests and Shrublands	APOL065	16.55	7.60	7.49	34.00	1704.00	800.00	83.00	119.00	1.53	117.00	13.00	0.28	4.24	98.00
	APOL067	2.90	6.10	1.38	7.00	357.00	56.00	20.00	13.00	0.10	19.00	5.00	0.10	0.49	57.00
	APOL068	65.56	8.10	2.96	6.00	12173.00	198.00	17.00	193.00	0.86	17.00	5.00	0.20	0.20	24.00
	APOL069	8.66	6.10	3.59	10.00	699.00	354.00	46.00	109.00	0.49	38.00	6.00	1.42	2.35	52.00
	APOL070	9.86	5.00	6.55	11.00	640.00	146.00	35.00	43.00	0.10	58.00	4.00	0.10	1.61	76.00
	APOL071	6.38	7.30	2.52	11.00	958.00	137.00	23.00	30.00	0.64	60.00	16.00	0.10	0.20	40.00
	OAKH065	10.18	6.70	4.27	24.00	1715.00	50.00	23.00	45.00	0.53	88.00	0.50	0.33	1.07	844.00
	OAKH066	8.86	5.90	2.72	14.00	1178.00	75.00	20.00	47.00	0.29	94.00	1.00	0.10	0.20	98.00
	OAKH067	15.00	4.60	5.36	7.00	799.00	192.00	23.00	38.00	0.24	60.00	0.50	0.10	0.42	133.00
	OAKH068	3.28	5.20	1.12	45.00	247.00	50.00	19.00	16.00	0.29	187.00	7.00	1.91	2.96	141.00
	average	14.72	6.26	3.80	16.90	2047.00	205.80	30.90	65.30	0.51	73.80	5.80	0.46	1.37	156.30
	standard deviation	18.39	1.16	2.12	13.22	3592.51	228.93	20.33	57.25	0.43	51.02	5.18	0.65	1.40	244.66

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

Maritime Upland Forests and Shrublands

Piedmont Maritime Upland Forests and Shrublands of the South Atlantic outer Coastal Plain are located on stabilized dunes of barrier islands and ridges and bluffs of mainland settings adjacent to the coast (Figure 8). These upland communities are typically protected from tidal inundation, but occasionally can flood during strong storm surge. More persistent natural disturbances include aerosol salt spray, strong winds, and sandy, low productive soils. These conditions are more pronounced on the forest edges of Maritime Upland Forests and Shrublands, where they border ocean and dune habitat or salt marsh habitat. At Canaveral National Seashore, these broadly defined habitats include shrublands (e.g., coastal strand, coastal scrub) occurring on recent dunes inland from primary, early-age dunes and dominated by saw palmetto with a mixture of tropical and temperate hardwoods; and live oak-dominated hardwood hammocks that develop on older dune systems that can range from hydric to xeric moisture availability depending on edaphic and topographic conditions. Several vegetation associations corresponding with this broadly defined habitat type were sampled within both subunits (Apollo Beach, Oak Hill) of Canaveral National Seashore during this monitoring effort, including (descriptions from Cotton et al. 2020 and NatureServe 2023):

- South Atlantic Coastal Shell Midden Woodland (CEGL3525) (1 plot): Forests that occur on calcareous sands, shell hashes, Native American shell middens, and natural shell deposits, typically occurring between marsh and other matrix maritime forests. (Global Status: G2—Imperiled; State (FL) Status: No Status Rank)
- Florida Coastal Strand (Southern Atlantic Temperate Type) (CEGL003811; 1 plot): This community occurs as a narrow band of shrubs located between the sea oats (*Uniola paniculata*)-dominated foredunes adjacent to the open beach and interior maritime forest; soils are typically circumneutral because of the mixture of shell deposits occurring with quartzite sands; saw palmetto is usually dominant, along with small trees of both subtropical and temperate distribution. (Global Status: G2—Imperiled; State (FL) Status: No Status Rank)
- Live Oak – Saw Palmetto – (Yaupon) Shrubland (CEG004241; 1 plot): Maritime shrublands of central Florida dominated by a short, but dense, shrub stratum of saw palmetto and yaupon along with a taller stratum of live oak (Global Status: No Status Rank; State (FL) Status: No Status Rank)
- Ruderal Darlington Oak Forest (CEGL007021; 1 plot): Fire-suppressed early successional forests developing on high hammocks or old fields and dominated by an exclusive canopy of Darlington oak with cabbage palmetto (*Sabal palmetto*) and Carolina laurelcherry (*Prunus caroliniana*) in the understory. (Global Status: No Status Rank; State (FL) Status: No Status Rank)
- Florida Atlantic Coastal Tropical/Temperate Maritime Hammock (CEGL007033; 3 plots): Maritime forests of the eastern coast of Florida characterized by an oak canopy with a subcanopy dominated by subtropical species (e.g., colicwood); this association has been reduced substantially across its range by coastal development (Global Status: G1—Critically Imperiled; State (FL) Status: No Status Rank)
- Palmetto – Live Oak Hydric Hammock (CEGL007040; 3 plots): These maritime forests are characterized by a canopy co-dominated by live oak and cabbage palmetto, with occasional southern redcedar (*Juniperus silicicola*); sites where this association develops are prone to flooding and can have either a substantial calcareous component associated with coastal sands and shell hash, or an influence from brackish flooding; these forests occupy a wetter soil moisture regime (i.e., hydric) than other maritime forests within the landscape. (Global Status: G3—Vulnerable; State (FL) Status: No Status Rank)



Figure 8. Ten plots were established in Maritime Upland Forests and Shrublands of Canaveral National Seashore during this monitoring effort (April 2022). Plots of this habitat were located within both the Apollo Beach and Oak Hill subunit of the park. This habitat included coastal strand shrublands dominated by dense saw palmetto (left photo) and live-oak dominated forests (right photo). NPS photos / SECN staff.

Species Diversity and Abundance

Native species richness ranged from 19 to 63 (mean = 32.0) (Table 3). Richness was lowest in the Florida Coastal Strand plot (APOL068, left image in Figure 8) and tended to be higher in maritime forests of the Oak Hill subunit. Richness was highest across all spatial scales for species within the tree growth form (Table 3). Non-native plants occurred in 70% of the Maritime Upland Forest and Shrubland plots of Canaveral National Seashore, and three plots had more than one non-native species (Table 3). Brazilian peppertree was observed in 60% of these plots, while cogongrass, caesarweed, and common lantana were present in 10% of the plots (Appendix B, Table B-1). The Florida Endangered Atlantic Coast Florida lantana was observed in one plot within the Oak Hill subunit and the Florida Endangered hand fern was present within three plots of the Apollo Beach subunit. One hundred fifty-two vascular plant taxa were found collectively within these 10 plots, including 120 only found in this particular habitat of the park; a complete species list, along with constancy and average cover per species, is listed in Appendix B, Table B-1. Species with high constancy in this habitat are listed below, by growth form (constancy values in parentheses):

Trees

- Live oak (100%)
- Cabbage palmetto (90%)
- Brazilian peppertree (60%)

- Red bay (60%)
- Colicwood (60%)

Shrubs

- Saw palmetto (90%)
- Yaupon (70%)

Vines

- Muscadine (*Muscadinia rotundifolia* var. *rotundifolia*; 100%)
- Dune greenbriar (*Smilax auriculata*; 90%)
- Virginia creeper (*Parthenocissus quinquefolia*; 90%)

Herbs and Graminoids

Basketgrass (*Oplismenus setarius*; 60%)

Woody Stem Metrics

Total basal area (BA) of trees ranged from 0.0 to 65.5 m²/ha with an overall average of 37.0 m²/ha; density of canopy stems ranged from 0 to 58 per plot, with an average of 23.8 (Table 4). Canopy height ranged from 1.7 to 19.0 meters (5.6 to 62.3 ft) [average 11.0 meters {36.1 ft}], and canopy cover ranged from 0 to 82% (average = 64%; Table 4). Plots with low tree abundance either occurred in openings within matrix maritime forests or in scrub habitat with little to no tree-sized individuals present (Figure 8, left image). The most dominant canopy species included cabbage palmetto (mean BA = 22.84 m²/ha, mean

density = 294/ha) and live oak (mean BA = 16.30 m²/ha, mean density = 281/ha) (Appendix B, Table B-2). Sapling density at the 80-meter square scale ranged from 13 to 148 stems, with an average of 68, while seedling density at the 8-meter square scale ranged from 11 to 147 stems, with an average of 70 across all plots (Table 4). Dominant sapling species included twinberry, white stopper (*Eugenia axillaris*), saw palmetto, yaupon, and cabbage palmetto; dominant seedlings included saw palmetto, yaupon, wild coffee (*Psychotria nervosa*), and live oak (Appendix B, Table B-2). Based on stem count (density) alone, cabbage palmetto and live oak accounted for more than 80% of the relative abundance among species within the tree stratum (Figure 9). The sapling and seedling strata were dominated by saw palmetto and species with affinities to coastal Florida hammocks (e.g., twinberry, white stopper, and colicwood), along with live oak in the seedling stratum (Figure 9).

Most of the measured trees within Maritime Upland Forest and Shrubland plots were living (93%) and the majority of trees were observed with healthy vigor and minimal dieback (Figure 10). Almost half of the dead trees (eight of 17 total stems) were live oak. One tree species that occurred with notably low frequency within these vegetation plots was red bay, which accounted for only two of the 238 living trees that were measured within these plots. Based on the report by Schmalzer and Foster (2016), red bay, along with cabbage palmetto, was frequent within live oak-dominated coastal hammocks of the park. Undoubtedly, since their survey, much of this species has been wiped out from the canopy of these forests by laurel wilt disease which first appeared in Brevard County Florida in 2007 and Volusia County in 2008 (Laurel Wilt Public Dashboard 2023).



Figure 9. Relative proportion of species groups across three woody stem strata—trees, saplings, and seedlings— within Maritime Upland Forest and Shrubland monitoring plots of Canaveral National Seashore.

Health Condition of Trees Observed at Maritime Upland Forests and Shrublands at CANA

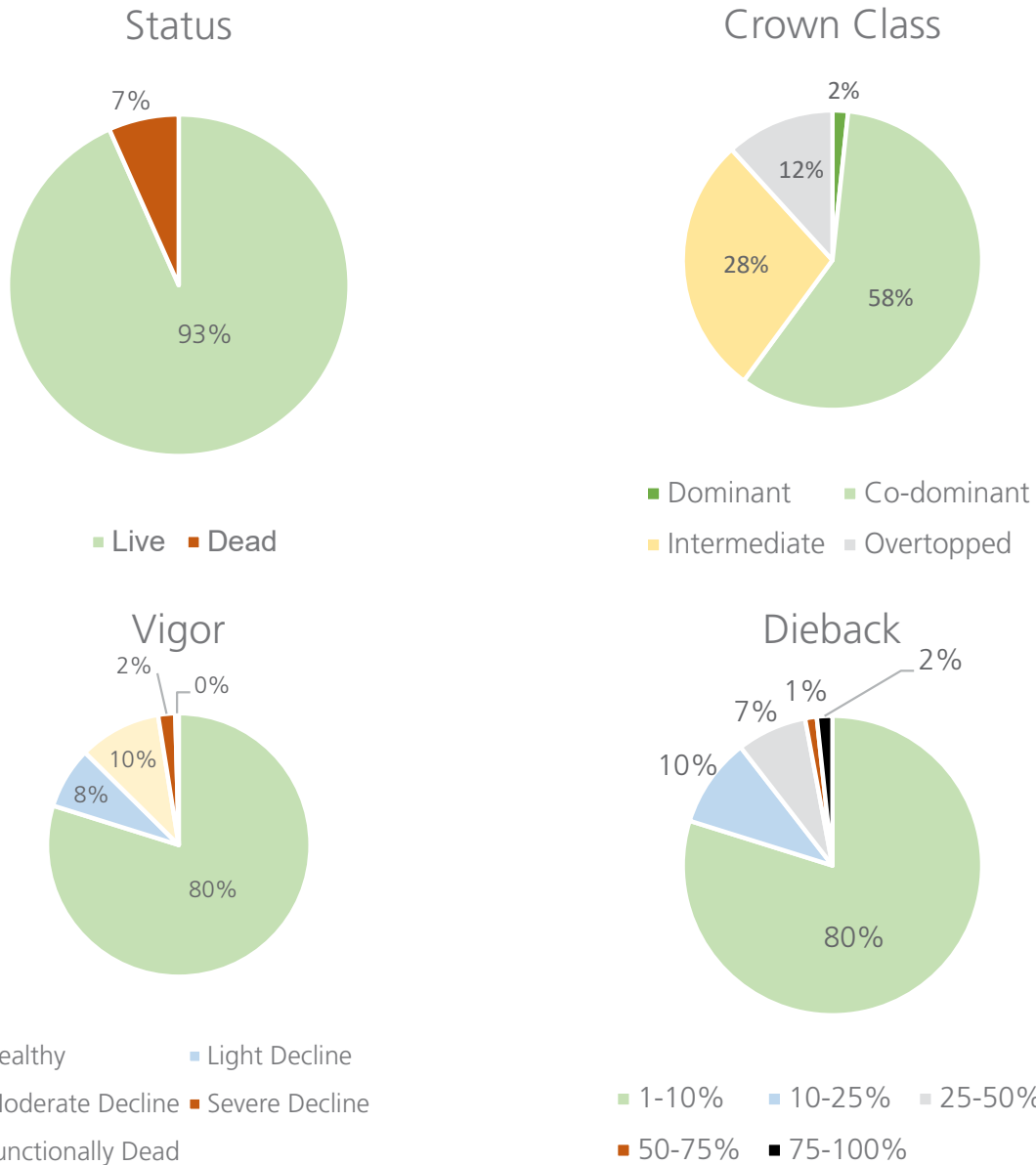


Figure 10. Health status of woody stems greater than or equal to 10 centimeters (3.9 in) DBH ('trees') measured on Maritime Upland Forest and Shrubland monitoring plots of Canaveral National Seashore.

Disturbances and Threats

Fire scars on trees and other noticeable features of historic burning (> 1 year from sampling) were observed on four of the 10 plots sampled within this broadly defined habitat of the park (Table 5). The role of natural fire in oak-dominated forests of southeastern Atlantic barrier islands and mainland maritime hammocks is not as clear as its role in the formation and maintenance of pine flatwoods, savannas, and other broad habitat types within the same geography. However, fire was used by Native Americans and early European settlers to clear land for agriculture and promote habitat for grazing within Maritime Upland Forests and Shrublands of the Outer Coastal Plain (Bellis 1995). Furthermore, lightning caused fires have been observed on barrier islands even in recent years, although litter in oak stands is typically fire resistant and produces less intense fire than pine-dominated stands (Edwards et al. 2013). Much more frequently common in these upland oak-dominated systems is the impact from climate patterns that cause strong and persistent winds on a daily scale and even stronger wind events during seasonal tropical storm (e.g., hurricanes); occasional flooding from adjacent saltwater zones; and aerosol salt spray and deposition. Although these factors clearly help shape Maritime Upland Forests and Shrublands of Canaveral National Seashore, there were no observable impacts from high winds (e.g., windthrow) or water damage noticed in these plots.

Based on observations from these plots, the biggest threat to this habitat type on the park is from non-native, invasive species—particularly Brazilian peppertree (see discussion above under Species Diversity and Abundance). Factors that facilitate pathways for invasion, such as increased density of roadways, land clearings, and urbanization (McNab and Loftis 2002; Christen and Matlack 2006) are a present and increasing reality for the landscape of Canaveral National Seashore. The historical legacy from agriculture can also be a factor that leads to the establishment and spread of invasive plants (Kuhman et al. 2011). Management efforts that target reduction of certain non-native species can lead to increased abundances of undesirable native species, other non-native species, or the targeted non-native species (see Royo and Carson 2006), which may have consequences on forest regeneration and ground cover diversity. It is difficult to predict how species will respond to both local-scale management efforts and landscape-scale changes (e.g., climate change). However, data from vegetation monitoring plots which track trends over

time of non-native and native species abundance and forest regeneration patterns with regards to specific non-native control efforts can provide keen insight to park managers on the condition of their forest vegetation resources.

Other human-caused disturbances or threats to vegetation resources noticed in these plots, although in very low frequency, were damage caused by feral hogs (one plot) and damage from social trails created by ATV usage (one plot) (Table 5).

Geomorphology and Soil

Plots located within Maritime Upland Forests and Shrublands of Canaveral National Seashore occurred on either flat (0 degree) landforms or older, stabilized dunes with complex slope shapes (Table 6). Although these plots were classified as uplands, many of them can experience flooding from seasonal rainfall events, particularly those that occur on flat slope positions (e.g., hydric hammocks). All plots, regardless of upland status, have the capacity to flood during extreme storm events. Soils of Maritime Upland Forests and Shrublands are sandy, typically acidic, hold few nutrients, and drain quickly; although older landscapes of barrier islands formed during the Pleistocene can exhibit more complex soil development and nutrient status (Edwards et al. 2013). Soils from Maritime Upland Forest and Shrubland plots on Canaveral National Seashore ranged from very strongly acidic (pH values < 5.0) to moderately alkaline (pH values between 7.9 to 8.4; Table 7). Plots with high pH values occurred on hammocks with high densities of shell within the soil substrate of the Apollo Beach subunit of park. These soils also had high levels of calcium (Table 7).

Fuel Load Estimates

Fuel loads ranged from 4.9 to 15.5 (average=10.3) tons/acre (1.1 to 3.5 kg/m²) in Coastal Plain Upland Open Woodlands and 2.2 to 14.5 (average = 7.4) tons/acre (0.5 to 3.3. kg/m²) in Maritime Upland Forests and Shrublands of Canaveral National Seashore (Figure 11). There was high variability between fuel loads among vegetation plots within the park's uplands. Variation in fuel loads among sites is typical and related to differences in live and dead vegetation structure, disturbance history, hydrology, and edaphic conditions. Duff and litter contributed to most of the fuel loads within these vegetation plots (Figure 11).

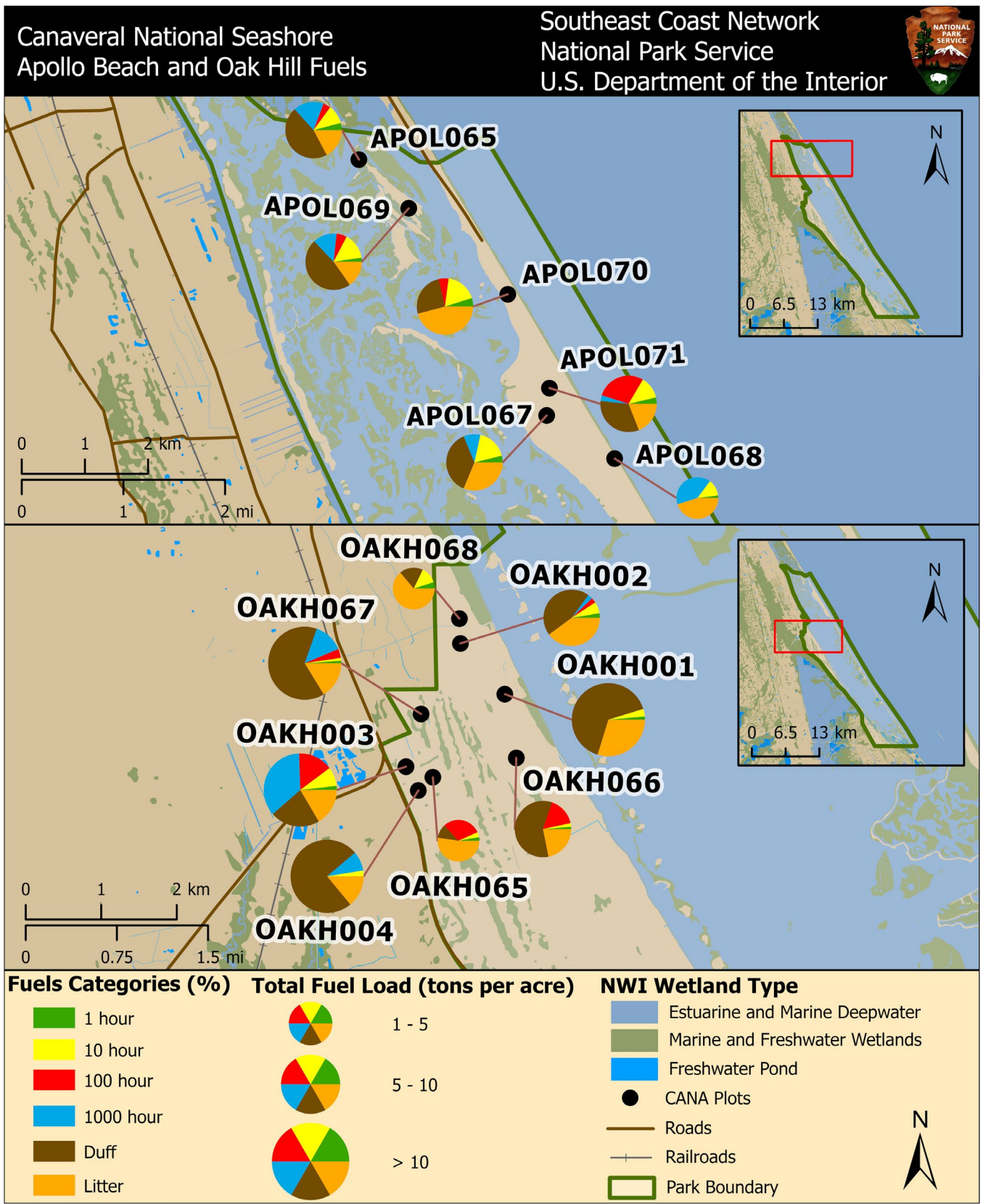


Figure 11. Fuel load estimates from vegetation monitoring plots located at Canaveral National Seashore.

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

Table A-1. Vascular plant species present in 14 vegetation monitoring plots within Canaveral National Seashore, April 2022.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	Florida Rare and Protected Status ³
Euphorbiales	Euphorbiaceae	<i>Acalypha arvensis</i>	field copperleaf	Non-native	Forb/herb	–	–
Sapindales	Aceraceae	<i>Acer rubrum</i>	red maple	Native	Tree	–	–
Polypodiales	Pteridaceae	<i>Acrostichum danaeifolium</i>	inland leatherfern	Native	Forb/herb	–	–
Sapindales	Rutaceae	<i>Amyris elemifera</i>	sea torchwood	Native	Tree, Shrub	–	–
Polypodiales	Blechnaceae	<i>Anchistea virginica</i>	Virginia chainfern	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Andropogon cretaceus</i>	purple bluestem	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Andropogon floridanus</i>	Florida bluestem	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Andropogon hirsutior</i>	bushy bluestem	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Andropogon tenuispatheus</i>	bushy bluestem	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Andropogon virginicus</i> var. <i>decipiens</i>	broomsedge bluestem	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Andropogon virginicus</i> var. <i>virginicus</i>	broomsedge bluestem	Native	Graminoid	–	–
Primulales	Myrsinaceae	<i>Ardisia escallonioides</i>	island marlberry	Native	Tree, Shrub	–	–
Cyperales	Poaceae	<i>Aristida beyrichiana</i>	southern wiregrass / Beyrich threeawn	Native	Graminoid	–	–
Magnoliales	Annonaceae	<i>Asimina reticulata</i>	netted pawpaw	Native	Shrub	–	–
Asterales	Asteraceae	<i>Baccharis halimifolia</i>	eastern baccharis	Native	Tree, Shrub	–	–
Scrophulariales	Scrophulariaceae	<i>Bacopa monnieri</i>	herb of grace	Native	Forb/herb	–	–
Ericales	Ericaceae	<i>Bejaria racemosa</i>	flyweed	Native	Shrub	–	–
Rhamnales	Rhamnaceae	<i>Berchemia scandens</i>	Alabama supplejack	Native	Vine	–	–
Asterales	Asteraceae	<i>Bidens alba</i> var. <i>radiata</i>	romerillo	Native	Forb/herb	–	–
Urticales	Urticaceae	<i>Boehmeria cylindrica</i>	smallspike false nettle	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Borrchia frutescens</i>	bushy seaside tansy	Native	Subshrub	–	–
Lamiales	Verbenaceae	<i>Callicarpa americana</i>	American beautyberry	Native	Shrub	–	–
Fabales	Fabaceae	<i>Canavalia rosea</i>	baybean	Native	Vine, Forb/herb	–	–
Cyperales	Cyperaceae	<i>Carex floridana</i>	Florida sedge	Native	Graminoid	–	–
Asterales	Asteraceae	<i>Carphephorus corymbosus</i>	coastal plain chaffhead	Native	Forb/herb	–	–
Scrophulariales	Oleaceae	<i>Cartrema americanum</i>	devilwood	Native	Tree, Shrub	–	–
Juglandales	Juglandaceae	<i>Carya floridana</i>	scrub hickory	Native	Tree	–	–

¹ Information obtained from the PLANTS database (USDA 2024)² Information obtained from the Florida Invasive Species Council (FISC 2019)³ Information obtained from the Florida Natural Areas Inventory (FNAI 2023) and the Florida Regulated Plant Index (FDACS 2021)

Table A-1 (continued). Vascular plant species present in 14 vegetation monitoring plots within Canaveral National Seashore, April 2022.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	Florida Rare and Protected Status ³
Urticales	Ulmaceae	<i>Celtis laevigata</i>	sugarberry	Native	Tree, Shrub	–	–
Apiales	Apiaceae	<i>Centella asiatica</i>	erect centella	Native	Forb/herb	–	–
Fabales	Fabaceae	<i>Chamaecrista nictitans</i> var. <i>aspera</i>	sensitive partridge pea	Native	Forb/herb, Subshrub	–	–
Cyperales	Poaceae	<i>Chasmanthium laxum</i>	slender woodoats	Native	Graminoid	–	–
Ophioglossales	Ophioglossaceae	<i>Cheiroglossa palmata</i>	hand fern	Native	Forb/herb	–	Endangered; S3
Rubiales	Rubiaceae	<i>Chiococca alba</i>	West Indian milkberry	Native	Vine, Tree, Shrub	–	–
Asterales	Asteraceae	<i>Cirsium horridulum</i> var. <i>vittatum</i>	yellow thistle	Native	Forb/herb	–	–
Sapindales	Rutaceae	<i>Citrus xaurantium</i>	sour orange	Non-native	Tree, Shrub	–	–
Cyperales	Cyperaceae	<i>Cladium jamaicense</i>	Jamaica swamp sawgrass	Native	Graminoid	–	–
Euphorbiales	Euphorbiaceae	<i>Cnidoscolus stimulosus</i>	finger rot	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Coleataenia anceps</i> ssp. <i>anceps</i>	beaked panicgrass	Native	Graminoid	–	–
Commelinales	Commelinaceae	<i>Commelina erecta</i>	whitemouth dayflower	Native	Forb/herb	–	–
Cyperales	Cyperaceae	<i>Cyperaceae</i>	Sedge Family	Unknown	Graminoid	–	–
Cyperales	Cyperaceae	<i>Cyperus</i>	flatsedge	Unknown	Graminoid	–	–
Cyperales	Cyperaceae	<i>Cyperus haspan</i>	haspan flatsedge	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Cyperus tetragonus</i>	fourangle flatsedge	Native	Graminoid	–	–
Fabales	Fabaceae	<i>Desmodium incanum</i>	zarzabacoa comun	Non-native	Forb/herb, Subshrub	–	–
Fabales	Fabaceae	<i>Desmodium paniculatum</i> var. <i>paniculatum</i>	panicledleaf ticktrefoil	Native	Forb/herb	–	–
Fabales	Fabaceae	<i>Desmodium triflorum</i>	threeflower ticktrefoil	Non-native	Forb/herb	–	–
Cyperales	Poaceae	<i>Dichanthelium commutatum</i>	variable witchgrass / variable panicgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium dichotomum</i> var. <i>nitidum</i>	cypress panicgrass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium fusiforme</i>	needleleaf rosette grass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium portoricense</i> ssp. <i>patulum</i>	hemlock rosette grass	Native	Graminoid	–	–
Cyperales	Poaceae	<i>Dichanthelium strigosum</i> var. <i>leucoblepharis</i>	roughhair rosette grass	Native	Graminoid	–	–
Ebenales	Ebenaceae	<i>Diospyros virginiana</i>	common persimmon	Native	Tree	–	–
Cyperales	Cyperaceae	<i>Eleocharis geniculata</i>	Canada spikesedge	Native	Graminoid	–	–

¹ Information obtained from the PLANTS database (USDA 2024)² Information obtained from the Florida Invasive Species Council (FISC 2019)³ Information obtained from the Florida Natural Areas Inventory (FNAI 2023) and the Florida Regulated Plant Index (FDACS 2021)

Table A-1 (continued). Vascular plant species present in 14 vegetation monitoring plots within Canaveral National Seashore, April 2022.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	Florida Rare and Protected Status ³
Orchidales	Orchidaceae	<i>Epidendrum conopseum</i>	green fly orchid	Native	Forb/herb	–	Commercially Exploited
Cyperales	Poaceae	<i>Erianthus giganteus</i>	sugarcane plumegrass	Native	Graminoid	–	–
Fabales	Fabaceae	<i>Erythrina herbacea</i>	redcardinal	Native	Tree, Subshrub, Shrub	–	–
Myrtales	Myrtaceae	<i>Eugenia axillaris</i>	white stopper	Native	Tree, Shrub	–	–
Asterales	Asteraceae	<i>Eupatorium capillifolium</i>	dogfennel	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Eupatorium serotinum</i>	lateflowering thoroughwort	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Eustachys petraea</i>	pinewoods fingergrass	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Fimbristylis dichotoma</i>	forked fimbry	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Fimbristylis puberula</i>	hairy fimbry	Native	Graminoid	–	–
Scrophulariales	Oleaceae	<i>Forestiera segregata</i>	Florida swampprivet	Native	Shrub, Tree	–	–
Fabales	Fabaceae	<i>Galactia elliotii</i>	Elliott's milkpea	Native	Forb/herb, Vine	–	–
Ericales	Ericaceae	<i>Gaylussacia dumosa</i>	dwarf huckleberry	Native	Subshrub, Shrub	–	–
Asterales	Asteraceae	<i>Helianthus debilis</i> ssp. <i>debilis</i>	cucumberleaf sunflower	Native	Forb/herb	–	–
Apiales	Apiaceae	<i>Hydrocotyle umbellata</i>	manyflower marshpennywort	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Hymenachne hemitomon</i>	maidencane	Native	Graminoid	–	–
Theales	Clusiaceae	<i>Hypericum brachyphyllum</i>	coastal plain St. Johnswort	Native	Forb/herb, Shrub	–	–
Theales	Clusiaceae	<i>Hypericum fasciculatum</i>	peelbark St. Johnswort	Native	Shrub, Subshrub	–	–
Theales	Clusiaceae	<i>Hypericum hypericoides</i>	St. Andrew's cross	Native	Subshrub, Shrub	–	–
Theales	Clusiaceae	<i>Hypericum tetrapetalum</i>	fourpetal St. Johnswort	Native	Subshrub, Shrub	–	–
Liliales	Liliaceae	<i>Hypoxis juncea</i>	fringed yellow star-grass	Native	Forb/herb	–	–
Lamiales	Lamiaceae	<i>Hyptis alata</i> var. <i>alata</i>	clustered bushmint	Native	Forb/herb	–	–
Celastrales	Aquifoliaceae	<i>Ilex cassine</i>	dahoon	Native	Tree, Shrub	–	–
Celastrales	Aquifoliaceae	<i>Ilex glabra</i>	gallberry / inkberry	Native	Shrub	–	–
Celastrales	Aquifoliaceae	<i>Ilex vomitoria</i>	yaupon	Native	Tree, Shrub	–	–
Cyperales	Poaceae	<i>Imperata cylindrica</i>	cogongrass	Non-native	Graminoid	Category I	–
Solanales	Convolvulaceae	<i>Ipomoea alba</i>	tropical white morning-glory	Native	Vine, Forb/herb	–	–
Asterales	Asteraceae	<i>Iva frutescens</i> var. <i>frutescens</i>	Jesuit's bark	Native	Forb/herb, Subshrub	–	–

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Table A-1 (continued). Vascular plant species present in 14 vegetation monitoring plots within Canaveral National Seashore, April 2022.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	Florida Rare and Protected Status ³
Juncales	Juncaceae	<i>Juncus marginatus</i>	grassleaf rush	Native	Graminoid	–	–
Juncales	Juncaceae	<i>Juncus scirpoides</i> var. <i>scirpoides</i>	needlepod rush	Native	Graminoid	–	–
Pinales	Cupressaceae	<i>Juniperus silicicola</i>	southern redcedar	Native	Tree	–	–
Malvales	Malvaceae	<i>Kosteletzkya pentacarpos</i>	Virginia saltmarsh mallow	Native	Subshrub, Forb/herb	–	–
Lamiales	Verbenaceae	<i>Lantana depressa</i> var. <i>floridana</i>	Atlantic Coast Florida lantana	Native	Shrub	–	Endangered; S1
Lamiales	Verbenaceae	<i>Lantana strigocamara</i>	common lantana	Non-native	Shrub, Vine	Category I	–
Polypodiales	Blechnaceae	<i>Lorinseria areolata</i>	netted chainfern	Native	Forb/herb	–	–
Myrtales	Onagraceae	<i>Ludwigia microcarpa</i>	smallfruit primrose-willow	Native	Forb/herb	–	–
Myrtales	Onagraceae	<i>Ludwigia octovalvis</i>	Mexican primrose-willow	Native	Subshrub, Forb/herb	–	–
Ericales	Ericaceae	<i>Lyonia ferruginea</i>	rusty staggerbush	Native	Tree, Shrub	–	–
Ericales	Ericaceae	<i>Lyonia fruticosa</i>	coastal plain staggerbush	Native	Shrub	–	–
Ericales	Ericaceae	<i>Lyonia lucida</i>	shining fetterbush / fetterbush lyonia	Native	Shrub	–	–
Scrophulariales	Scrophulariaceae	<i>Mecardonia acuminata</i> var. <i>peninsularis</i>	axilflower	Native	Forb/herb, Subshrub	–	–
Violales	Cucurbitaceae	<i>Melothria pendula</i>	Guadeloupe cucumber	Native	Forb/herb, Vine	–	–
Asterales	Asteraceae	<i>Mikania cordifolia</i>	Florida Keys hempvine	Native	Forb/herb, Vine	–	–
Asterales	Asteraceae	<i>Mikania scandens</i>	climbing hempvine	Native	Vine, Forb/herb	–	–
Myricales	Myricaceae	<i>Morella cerifera</i>	wax myrtle	Native	Tree, Subshrub, Shrub	–	–
Urticales	Moraceae	<i>Morus rubra</i>	red mulberry	Native	Tree	–	–
Rhamnales	Vitaceae	<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	muscadine	Native	Vine	–	–
Myrtales	Myrtaceae	<i>Myrcianthes fragrans</i>	twinberry / Simpson's stopper	Native	Shrub, Tree	–	–
Primulales	Myrsinaceae	<i>Myrsine cubana</i>	colicwood	Native	Shrub, Tree	–	–
Rhamnales	Vitaceae	<i>Nekemias arborea</i>	peppervine	Native	Shrub, Vine	–	–
Cyperales	Poaceae	<i>Oplismenus setarius</i>	basketgrass	Native	Graminoid	–	–
Polypodiales	Osmundaceae	<i>Osmunda spectabilis</i>	royal fern	Native	Forb/herb	–	Commercially Exploited
Polypodiales	Osmundaceae	<i>Osmundastrum cinnamomeum</i>	cinnamon fern	Native	Forb/herb	–	Commercially Exploited
Geraniales	Oxalidaceae	<i>Oxalis corniculata</i>	creeping woodsorrel	Native	Forb/herb	–	–

¹ Information obtained from the PLANTS database (USDA 2024)² Information obtained from the Florida Invasive Species Council (FISC 2019)³ Information obtained from the Florida Natural Areas Inventory (FNAI 2023) and the Florida Regulated Plant Index (FDACS 2021)

Table A-1 (continued). Vascular plant species present in 14 vegetation monitoring plots within Canaveral National Seashore, April 2022.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	Florida Rare and Protected Status ³
Rhamnales	Vitaceae	<i>Parthenocissus quinquefolia</i>	Virginia creeper	Native	Vine	–	–
Cyperales	Poaceae	<i>Paspalum setaceum</i>	thin paspalum	Non-native	Graminoid	–	–
Violales	Passifloraceae	<i>Passiflora incarnata</i>	purple passionflower	Native	Vine, Forb/herb	–	–
Violales	Passifloraceae	<i>Passiflora pallida</i>	corkystem passionflower	Native	Vine, Forb/herb	–	–
Gentianales	Asclepiadaceae	<i>Pattalias palustre</i>	swallow-wort	Native	Forb/herb, Vine	–	–
Laurales	Lauraceae	<i>Persea borbonia</i>	redbay	Native	Tree, Shrub	–	–
Polygonales	Polygonaceae	<i>Persicaria hydropiperoides</i>	swamp smartweed	Native	Forb/herb	–	–
Polypodiales	Polypodiaceae	<i>Phlebodium aureum</i>	golden polypody	Native	Forb/herb	–	–
Solanales	Solanaceae	<i>Physalis walteri</i>	Walter's groundcherry	Native	Forb/herb	–	–
Pinales	Pinaceae	<i>Pinus [densa + elliottii]</i>	South Florida slash pine + slash pine	Native	Tree	–	–
Pinales	Pinaceae	<i>Pinus palustris</i>	longleaf pine	Native	Tree	–	–
Polypodiales	Polypodiaceae	<i>Pleopeltis michauxiana</i>	resurrection fern	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Pluchea baccharis</i>	rosy camphorweed	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Pluchea odorata</i>	sweetscent	Native	Subshrub, Forb/herb	–	–
Polygalales	Polygalaceae	<i>Polygala nana</i>	candyroot	Native	Forb/herb	–	–
Rosales	Rosaceae	<i>Prunus caroliniana</i>	Carolina laurelcherry	Native	Tree, Shrub	–	–
Psilotales	Psilotaceae	<i>Psilotum nudum</i>	whisk fern	Native	Forb/herb	–	–
Rubiales	Rubiaceae	<i>Psychotria nervosa</i>	wild coffee / Seminole balsamo	Native	Tree, Shrub	–	–
Polypodiales	Dennstaedtiaceae	<i>Pteridium pseudocaudatum</i>	southern brackenfern	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Pterocaulon pycnostachyum</i>	dense-spike blackroot	Native	Forb/herb, Subshrub	–	–
Fagales	Fagaceae	<i>Quercus chapmanii</i>	Chapman oak	Native	Tree, Shrub	–	–
Fagales	Fagaceae	<i>Quercus geminata</i>	sand live oak	Native	Tree, Shrub	–	–
Fagales	Fagaceae	<i>Quercus hemisphaerica</i>	Darlington oak	Native	Tree	–	–
Fagales	Fagaceae	<i>Quercus myrtifolia</i>	myrtle oak	Native	Tree, Shrub	–	–
Fagales	Fagaceae	<i>Quercus virginiana</i>	live oak	Native	Tree	–	–
Sapindales	Anacardiaceae	<i>Rhus copallinum</i> var. <i>copallinum</i>	winged sumac	Native	Tree, Shrub	–	–
Cyperales	Cyperaceae	<i>Rhynchospora colorata</i>	starrush whitetop	Native	Graminoid	–	–
Cyperales	Cyperaceae	<i>Rhynchospora odorata</i>	fragrant beaksedge	Native	Graminoid	–	–

¹ Information obtained from the PLANTS database (USDA 2024)² Information obtained from the Florida Invasive Species Council (FISC 2019)³ Information obtained from the Florida Natural Areas Inventory (FNAI 2023) and the Florida Regulated Plant Index (FDACS 2021)

Table A-1 (continued). Vascular plant species present in 14 vegetation monitoring plots within Canaveral National Seashore, April 2022.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	Florida Rare and Protected Status ³
Rosales	Rosaceae	<i>Rubus cuneifolius</i>	sand blackberry	Native	Subshrub	–	–
Rosales	Rosaceae	<i>Rubus pensilvanicus</i>	sawtooth blackberry	Native	Subshrub	–	–
Rosales	Rosaceae	<i>Rubus trivialis</i>	southern dewberry	Native	Subshrub, Vine	–	–
Arecales	Arecaceae	<i>Sabal palmetto</i>	cabbage palmetto	Native	Tree	–	–
Rhamnales	Rhamnaceae	<i>Sageretia minutiflora</i>	smallflower mock buckthorn	Native	Vine, Shrub	–	–
Alismatales	Alismataceae	<i>Sagittaria lancifolia</i> var. <i>lancifolia</i>	bulltongue arrowhead	Native	Forb/herb	–	–
Primulales	Primulaceae	<i>Samolus parviflorus</i>	seaside brookweed	Native	Forb/herb	–	–
Sapindales	Sapindaceae	<i>Sapindus marginatus</i>	wingleaf soapberry	Native	Shrub, Tree	–	–
Sapindales	Anacardiaceae	<i>Schinus terebinthifolia</i>	Brazilian peppertree	Non-native	Tree, Shrub	Category I	–
Santalales	Olacaceae	<i>Schoepfia schreberi</i>	gulf graytwig	Native	Tree, Shrub	–	–
Cyperales	Cyperaceae	<i>Scleria</i>	nutrush	Native	Graminoid	–	–
Arecales	Arecaceae	<i>Serenoa repens</i>	saw palmetto	Native	Tree, Shrub	–	Commercially Exploited
Ebenales	Sapotaceae	<i>Sideroxylon reclinatum</i> ssp. <i>reclinatum</i>	Florida bully	Native	Shrub	–	–
Ebenales	Sapotaceae	<i>Sideroxylon tenax</i>	tough bully	Native	Tree, Shrub	–	–
Liliales	Iridaceae	<i>Sisyrinchium miamiense</i>	narrowleaf blue-eyed grass	Native	Forb/herb	–	–
Liliales	Smilacaceae	<i>Smilax auriculata</i>	dune greenbriar / earleaf greenbriar	Native	Shrub, Vine	–	–
Liliales	Smilacaceae	<i>Smilax laurifolia</i>	laurel greenbriar	Native	Shrub, Vine	–	–
Liliales	Smilacaceae	<i>Smilax pumila</i>	sarsparilla vine	Native	Subshrub, Vine, Shrub	–	–
Asterales	Asteraceae	<i>Solidago chapmanii</i>	Chapman's goldenrod	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Solidago fistulosa</i>	pine barren goldenrod	Native	Forb/herb	–	–
Cyperales	Poaceae	<i>Spartina bakeri</i>	sand cordgrass	Native	Graminoid	–	–
Cornales	Cornaceae	<i>Swida foemina</i>	stiff dogwood	Native	Shrub, Tree	–	–
Asterales	Asteraceae	<i>Symphyotrichum</i>	aster	Native	Forb/herb	–	–
Polypodiales	Blechnaceae	<i>Telmatoblechnum serrulatum</i>	swamp fern	Native	Forb/herb	–	–
Bromeliales	Bromeliaceae	<i>Tillandsia recurvata</i>	small ballmoss	Native	Forb/herb	–	–
Bromeliales	Bromeliaceae	<i>Tillandsia usneoides</i>	Spanish moss	Native	Vine, Forb/herb	–	–
Bromeliales	Bromeliaceae	<i>Tillandsia fasciculata</i> var. <i>densispica</i>	quill-leaf airplant	Native	Forb/herb	–	Endangered

¹ Information obtained from the PLANTS database (USDA 2024)² Information obtained from the Florida Invasive Species Council (FISC 2019)³ Information obtained from the Florida Natural Areas Inventory (FNAI 2023) and the Florida Regulated Plant Index (FDACS 2021)

Table A-1 (continued). Vascular plant species present in 14 vegetation monitoring plots within Canaveral National Seashore, April 2022.

Order ¹	Family ¹	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	State Invasive Status ²	Florida Rare and Protected Status ³
Sapindales	Anacardiaceae	<i>Toxicodendron radicans</i> var. <i>radicans</i>	eastern poison ivy	Native	Forb/herb, Vine, Subshrub	–	–
Lamiales	Lamiaceae	<i>Trichostema dichotomum</i>	forked bluecurls	Native	Forb/herb	–	–
Asterales	Asteraceae	<i>Trilisa odoratissima</i>	vanilla-leaf	Native	Forb/herb	–	–
Malvales	Malvaceae	<i>Urena lobata</i>	caesarweed	Non-native	Subshrub	Category I	–
Ericales	Ericaceae	<i>Vaccinium myrsinites</i>	southern evergreen blueberry / shiny blueberry	Native	Shrub	–	–
Ericales	Ericaceae	<i>Vaccinium stamineum</i> var. <i>caesium</i>	deerberry	Native	Shrub	–	–
Lamiales	Verbenaceae	<i>Verbena scabra</i>	sandpaper vervain	Native	Subshrub, Forb/herb	–	–
Asterales	Asteraceae	<i>Verbesina virginica</i> var. <i>laciniata</i>	white crownbeard	Native	Forb/herb	–	–
Fabales	Fabaceae	<i>Vicia acutifolia</i>	fourleaf vetch	Native	Vine, Forb/herb	–	–
Rhamnales	Vitaceae	<i>Vitis aestivalis</i> var. <i>aestivalis</i>	summer grape	Native	Vine	–	–
Rhamnales	Vitaceae	<i>Vitis shuttleworthii</i>	calloose grape	Native	Vine	–	–
Polypodiales	Vittariaceae	<i>Vittaria lineata</i>	shoestring fern	Native	Forb/herb	–	–
Commelinales	Xyridaceae	<i>Xyris brevifolia</i>	shortleaf yelloweyed grass	Native	Forb/herb	–	–
Cycadales	Zamiaceae	<i>Zamia integrifolia</i> var. <i>integrifolia</i>	coontie	Native	Subshrub	–	Commercially Exploited
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 Florida Invasive Species Council (FISC 2019)³ Information obtained from the Florida Natural Areas Inventory (FNAI 2023) and the Florida Regulated Plant Index (FDACS 2021)

Appendix B. Species Diversity, Abundance, and Woody Stem Metrics Summarized by Broadly Defined Habitats at Canaveral National Seashore

Table B-1. Constancy and average cover class for all vascular plant species observed in 14 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MUFS = Maritime Upland Forests and Shrublands (10 plots) and CPUOW = Coastal Plain Upland Open Woodlands (four plots). Cover classes are as follows: 1: 0–0.1%, 2: 0.1–1%, 3: 1–2%, 4: 2–5%, 5: 5–10%, 6: 10–25%, 7: 25–50%, 8: 50–75%, 9: 75–95%, 10: 95–100%.

Species	MUFS Constancy	MUFS Cover	CPUOW Constancy	CPUOW Cover
<i>Acalypha arvensis</i>	10	2	0	–
<i>Acer rubrum</i>	10	1	0	–
<i>Acrostichum danaeifolium</i>	10	6	0	–
<i>Amyris elemifera</i>	10	4	0	–
<i>Anchistea virginica</i>	20	3	25	2
<i>Andropogon cretaceus</i>	0	–	25	2
<i>Andropogon floridanus</i>	0	–	75	1
<i>Andropogon hirsutior</i>	10	4	0	–
<i>Andropogon tenuispathus</i>	10	2	0	–
<i>Andropogon virginicus</i> var. <i>decipiens</i>	10	4	50	2
<i>Andropogon virginicus</i> var. <i>virginicus</i>	10	2	0	–
<i>Ardisia escallonioides</i>	50	4	0	–
<i>Aristida beyrichiana</i>	0	–	25	4
<i>Asimina reticulata</i>	0	–	50	2
<i>Baccharis halimifolia</i>	20	3	25	2
<i>Bacopa monnieri</i>	10	1	0	–
<i>Bejaria racemosa</i>	0	–	50	4
<i>Berchemia scandens</i>	10	1	0	–
<i>Bidens alba</i> var. <i>radiata</i>	40	1	0	–
<i>Boehmeria cylindrica</i>	10	2	0	–
<i>Borrchia frutescens</i>	10	2	0	–
<i>Callicarpa americana</i>	50	2	0	–
<i>Canavalia rosea</i>	10	2	0	–
<i>Carex floridana</i>	20	2	0	–
<i>Carphephorus corymbosus</i>	0	–	25	3
<i>Cartrema americanum</i>	10	6	25	2
<i>Carya floridana</i>	0	–	50	2
<i>Celtis laevigata</i>	40	1	0	–
<i>Centella asiatica</i>	10	1	0	–
<i>Chamaecrista nictitans</i> var. <i>aspera</i>	10	2	25	1
<i>Chasmanthium laxum</i>	10	3	0	–
<i>Cheiroglossa palmata</i>	30	2	0	–
<i>Chiococca alba</i>	20	4	0	–
<i>Cirsium horridulum</i> var. <i>vittatum</i>	10	3	0	–
<i>Citrus xaurantium</i>	10	3	0	–
<i>Cladium jamaicense</i>	10	1	0	–
<i>Cnidoscolus stimulosus</i>	10	2	0	–
<i>Coleataenia anceps</i> ssp. <i>anceps</i>	20	2	0	–

Table B-1 (continued). Constancy and average cover class for all vascular plant species observed in 14 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MUFS = Maritime Upland Forests and Shrublands (10 plots) and CPUOW = Coastal Plain Upland Open Woodlands (four plots). Cover classes are as follows: 1: 0–0.1%, 2: 0.1–1%, 3: 1–2%, 4: 2–5%, 5: 5–10%, 6: 10–25%, 7: 25–50%, 8: 50–75%, 9: 75–95%, 10: 95–100%.

Species	MUFS Constancy	MUFS Cover	CPUOW Constancy	CPUOW Cover
<i>Commelina erecta</i>	10	2	0	–
<i>Cyperaceae</i>	10	1	0	–
<i>Cyperus</i>	10	1	0	–
<i>Cyperus haspan</i>	10	2	0	–
<i>Cyperus tetragonus</i>	30	2	0	–
<i>Desmodium incanum</i>	10	2	0	–
<i>Desmodium paniculatum</i> var. <i>paniculatum</i>	10	2	0	–
<i>Desmodium triflorum</i>	10	1	0	–
<i>Dichanthelium commutatum</i>	40	2	75	2
<i>Dichanthelium dichotomum</i> var. <i>nitidum</i>	0	–	25	2
<i>Dichanthelium fusiforme</i>	20	2	0	–
<i>Dichanthelium portoricense</i> ssp. <i>patulum</i>	10	2	25	1
<i>Dichanthelium strigosum</i> var. <i>leucoblepharis</i>	30	2	25	2
<i>Diospyros virginiana</i>	40	2	0	–
<i>Eleocharis geniculata</i>	10	1	0	–
<i>Epidendrum conopseum</i>	10	2	0	–
<i>Erianthus giganteus</i>	10	1	0	–
<i>Erythrina herbacea</i>	50	2	0	–
<i>Eugenia axillaris</i>	10	8	0	–
<i>Eupatorium capillifolium</i>	20	1	25	1
<i>Eupatorium serotinum</i>	10	3	0	–
<i>Eustachys petraea</i>	10	3	0	–
<i>Fimbristylis dichotoma</i>	0	–	25	3
<i>Fimbristylis puberula</i>	0	–	25	1
<i>Forestiera segregata</i>	10	4	0	–
<i>Galactia elliottii</i>	30	2	100	4
<i>Gaylussacia dumosa</i>	0	–	50	3
<i>Helianthus debilis</i> ssp. <i>debilis</i>	10	2	0	–
<i>Hydrocotyle umbellata</i>	20	2	0	–
<i>Hymenachne hemitomon</i>	10	1	0	–
<i>Hypericum brachyphyllum</i>	0	–	25	2
<i>Hypericum fasciculatum</i>	0	–	25	1
<i>Hypericum hypericoides</i>	30	2	0	–
<i>Hypericum tetrapetalum</i>	0	–	25	2
<i>Hypoxis juncea</i>	0	–	25	1
<i>Hyptis alata</i> var. <i>alata</i>	10	1	0	–
<i>Ilex cassine</i>	20	2	0	–
<i>Ilex glabra</i>	10	3	50	6
<i>Ilex vomitoria</i>	70	6	0	–
<i>Imperata cylindrica</i>	10	3	0	–
<i>Ipomoea alba</i>	10	1	0	–
<i>Iva frutescens</i> var. <i>frutescens</i>	10	2	0	–

Table B-1 (continued). Constancy and average cover class for all vascular plant species observed in 14 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MUFS = Maritime Upland Forests and Shrublands (10 plots) and CPUOW = Coastal Plain Upland Open Woodlands (four plots). Cover classes are as follows: 1: 0–0.1%, 2: 0.1–1%, 3: 1–2%, 4: 2–5%, 5: 5–10%, 6: 10–25%, 7: 25–50%, 8: 50–75%, 9: 75–95%, 10: 95–100%.

Species	MUFS Constancy	MUFS Cover	CPUOW Constancy	CPUOW Cover
<i>Juncus marginatus</i>	10	1	25	1
<i>Juncus scirpoides</i> var. <i>scirpoides</i>	10	2	0	–
<i>Juniperus silicicola</i>	50	4	0	–
<i>Kosteletzkya pentacarpos</i>	10	3	0	–
<i>Lantana depressa</i> var. <i>floridana</i>	10	1	0	–
<i>Lantana strigocamara</i>	10	3	0	–
<i>Lorinseria areolata</i>	10	1	0	–
<i>Ludwigia microcarpa</i>	10	2	0	–
<i>Ludwigia octovalvis</i>	10	2	0	–
<i>Lyonia ferruginea</i>	20	2	50	6
<i>Lyonia fruticosa</i>	0	–	50	5
<i>Lyonia lucida</i>	10	1	75	6
<i>Mecardonia acuminata</i> var. <i>peninsularis</i>	10	2	0	–
<i>Melothria pendula</i>	10	2	0	–
<i>Mikania cordifolia</i>	50	2	0	–
<i>Mikania scandens</i>	40	2	0	–
<i>Morella cerifera</i>	40	5	75	4
<i>Morus rubra</i>	30	4	0	–
<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	100	4	50	2
<i>Myrcianthes fragrans</i>	40	6	0	–
<i>Myrsine cubana</i>	60	4	0	–
<i>Nekemias arborea</i>	40	2	0	–
<i>Oplismenus setarius</i>	60	2	0	–
<i>Osmunda spectabilis</i>	10	2	0	–
<i>Osmundastrum cinnamomeum</i>	10	1	0	–
<i>Oxalis corniculata</i>	20	1	0	–
<i>Parthenocissus quinquefolia</i>	90	2	0	–
<i>Paspalum setaceum</i>	10	2	0	–
<i>Passiflora incarnata</i>	20	1	0	–
<i>Passiflora pallida</i>	10	2	0	–
<i>Pattalias palustre</i>	20	2	0	–
<i>Persea borbonia</i>	60	4	50	2
<i>Persicaria hydropiperoides</i>	20	2	0	–
<i>Phlebodium aureum</i>	50	2	0	–
<i>Physalis walteri</i>	10	1	0	–
<i>Pinus [densa + elliotii]</i>	20	2	50	5
<i>Pinus palustris</i>	0	–	25	2
<i>Pleopeltis michauxiana</i>	50	3	0	–
<i>Pluchea baccharis</i>	10	2	25	1
<i>Pluchea odorata</i>	10	2	0	–
<i>Polygala nana</i>	0	–	50	2
<i>Prunus caroliniana</i>	20	2	0	–

Table B-1 (continued). Constancy and average cover class for all vascular plant species observed in 14 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MUFS = Maritime Upland Forests and Shrublands (10 plots) and CPUOW = Coastal Plain Upland Open Woodlands (four plots). Cover classes are as follows: 1: 0–0.1%, 2: 0.1–1%, 3: 1–2%, 4: 2–5%, 5: 5–10%, 6: 10–25%, 7: 25–50%, 8: 50–75%, 9: 75–95%, 10: 95–100%.

Species	MUFS Constancy	MUFS Cover	CPUOW Constancy	CPUOW Cover
<i>Psilotum nudum</i>	20	2	0	–
<i>Psychotria nervosa</i>	40	4	0	–
<i>Pteridium pseudocaudatum</i>	20	2	50	2
<i>Pterocaulon pycnostachyum</i>	0	–	25	2
<i>Quercus chapmanii</i>	10	1	100	6
<i>Quercus geminata</i>	10	2	75	8
<i>Quercus hemisphaerica</i>	20	7	0	–
<i>Quercus myrtifolia</i>	20	2	100	4
<i>Quercus virginiana</i>	100	7	0	–
<i>Rhus copallinum</i> var. <i>copallinum</i>	10	2	50	2
<i>Rhynchospora colorata</i>	10	1	0	–
<i>Rhynchospora odorata</i>	10	2	0	–
<i>Rubus cuneifolius</i>	10	2	0	–
<i>Rubus pensilvanicus</i>	10	1	0	–
<i>Rubus trivialis</i>	10	1	0	–
<i>Sabal palmetto</i>	90	6	25	2
<i>Sageretia minutiflora</i>	20	2	0	–
<i>Sagittaria lancifolia</i> var. <i>lancifolia</i>	10	1	0	–
<i>Samolus parviflorus</i>	10	4	0	–
<i>Sapindus marginatus</i>	10	1	0	–
<i>Schinus terebinthifolia</i>	60	5	0	–
<i>Schoepfia schreberi</i>	10	3	0	–
<i>Scleria</i>	20	2	50	1
<i>Serenoa repens</i>	90	7	100	6
<i>Sideroxylon reclinatum</i> ssp. <i>reclinatum</i>	20	6	50	3
<i>Sideroxylon tenax</i>	20	2	0	–
<i>Sisyrinchium miamiense</i>	10	1	0	–
<i>Smilax auriculata</i>	90	2	100	2
<i>Smilax laurifolia</i>	0	–	25	2
<i>Smilax pumila</i>	10	4	0	–
<i>Solidago chapmanii</i>	10	2	50	2
<i>Solidago fistulosa</i>	10	2	0	–
<i>Spartina bakeri</i>	10	1	0	–
<i>Swida foemina</i>	20	2	0	–
<i>Symphyotrichum</i>	0	–	25	1
<i>Telmatoblechnum serrulatum</i>	10	2	0	–
<i>Tillandsia recurvata</i>	20	2	0	–
<i>Tillandsia usneoides</i>	40	3	0	–
<i>Tillandsia fasciculata</i> var. <i>densispica</i>	30	2	0	–
<i>Toxicodendron radicans</i> var. <i>radicans</i>	40	1	0	–
<i>Trichostema dichotomum</i>	10	2	0	–
<i>Trilisa odoratissima</i>	0	–	50	4

Table B-1 (continued). Constancy and average cover class for all vascular plant species observed in 14 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MUFS = Maritime Upland Forests and Shrublands (10 plots) and CPUOW = Coastal Plain Upland Open Woodlands (four plots). Cover classes are as follows: 1: 0–0.1%, 2: 0.1–1%, 3: 1–2%, 4: 2–5%, 5: 5–10%, 6: 10–25%, 7: 25–50%, 8: 50–75%, 9: 75–95%, 10: 95–100%.

Species	MUFS Constancy	MUFS Cover	CPUOW Constancy	CPUOW Cover
<i>Urena lobata</i>	10	2	0	–
<i>Vaccinium myrsinites</i>	20	2	100	4
<i>Vaccinium stamineum</i> var. <i>caesium</i>	0	–	50	2
<i>Verbena scabra</i>	20	1	0	–
<i>Verbesina virginica</i> var. <i>laciniata</i>	10	1	0	–
<i>Vicia acutifolia</i>	10	2	0	–
<i>Vitis aestivalis</i> var. <i>aestivalis</i>	30	2	25	1
<i>Vitis shuttleworthii</i>	10	2	0	–
<i>Vittaria lineata</i>	40	2	0	–
<i>Xyris brevifolia</i>	0	–	25	1
<i>Zamia integrifolia</i> var. <i>integrifolia</i>	10	1	0	–
<i>Zanthoxylum clava-herculis</i>	10	1	0	–

Table B-2. Basal area (BA, m²/ha) and density (Den, count/ha) of woody vascular plant species observed in 14 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MUFS = Maritime Upland Forests and Shrublands (10 plots) and CPUOW = Coastal Plain Upland Open Woodlands (four plots).

Species	MUFS Tree BA	MUFS Tree DEN	MUFS Sapling BA	MUFS Sapling Den	MUFS Seedling Den	CPUOW Tree BA	CPUOW Tree DEN	CPUOW Sapling BA	CPUOW Sapling Den	CPUOW Seedling Den
<i>Amyris elemifera</i>	–	–	0.02	100.00	–	–	–	–	–	–
<i>Bejaria racemosa</i>	–	–	–	–	–	–	–	0.01	500.00	312.50
<i>Citrus xaurantium</i>	–	–	0.44	100.00	–	–	–	–	–	–
<i>Erythrina herbacea</i>	0.07	8.33	1.13	600.00	–	–	–	–	–	–
<i>Gaylussacia dumosa</i>	–	–	–	–	–	–	–	–	–	8750.00
<i>Juniperus silicicola</i>	0.74	5.56	–	–	–	–	–	–	–	–
<i>Lyonia ferruginea</i>	–	–	0.13	200.00	–	–	–	5.22	8250.00	312.50
<i>Lyonia fruticosa</i>	–	–	–	–	–	–	–	0.08	1250.00	625.00
<i>Lyonia lucida</i>	–	–	–	–	–	–	–	1.02	12750.00	21562.50
<i>Morus rubra</i>	0.06	2.78	–	–	–	–	–	–	–	–
<i>Pinus [densa + elliotii]</i>	–	–	0.55	200.00	–	2.99	56.25	1.38	500.00	2500.00
<i>Quercus chapmanii</i>	–	–	–	–	–	–	–	6.21	9750.00	5937.50
<i>Quercus geminata</i>	–	–	–	–	–	1.09	18.75	21.77	21000.00	20937.50
<i>Quercus myrtifolia</i>	–	–	0.13	200.00	–	–	–	0.41	1250.00	–
<i>Rhus copallinum</i> var. <i>copallinum</i>	0.02	2.78	–	–	–	–	–	0.06	250.00	–
<i>Sageretia minutiflora</i>	–	–	0.02	100.00	–	–	–	–	–	–
<i>Swida foemina</i>	–	–	0.22	200.00	–	–	–	–	–	–
<i>Vaccinium myrsinites</i>	–	–	–	–	–	–	–	–	–	9375.00
<i>Serenoa repens</i>	0.06	2.78	5.29	19000.00	26000.00	–	–	0.18	750.00	49375.00
<i>Ilex vomitoria</i>	0.02	2.78	4.91	9300.00	11625.00	–	–	–	–	–
<i>Psychotria nervosa</i>	–	–	–	–	9875.00	–	–	–	–	–
<i>Quercus virginiana</i>	16.30	280.56	1.33	300.00	9875.00	–	–	–	–	–
<i>Eugenia axillaris</i>	–	–	5.85	7500.00	4375.00	–	–	–	–	–
<i>Schinus terebinthifolia</i>	0.16	13.89	3.25	2700.00	3500.00	–	–	–	–	–
<i>Myrsine cubana</i>	–	–	0.92	2600.00	2625.00	–	–	–	–	–
<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	–	–	0.81	1300.00	2375.00	–	–	–	–	–
<i>Myrcianthes fragrans</i>	0.11	11.11	6.02	4100.00	2375.00	–	–	–	–	–
<i>Sabal palmetto</i>	22.84	294.44	4.09	8400.00	2250.00	–	–	–	–	312.50
<i>Parthenocissus quinquefolia</i>	–	–	0.00	200.00	2000.00	–	–	–	–	–
<i>Persea borbonia</i>	0.05	5.56	0.43	700.00	2000.00	–	–	–	–	–

Table B-2 (continued). Basal area (BA, m²/ha) and density (Den, count/ha) of woody vascular plant species observed in 14 Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MUFS = Maritime Upland Forests and Shrublands (10 plots) and CPUOW = Coastal Plain Upland Open Woodlands (four plots).

Species	MUFS Tree BA	MUFS Tree DEN	MUFS Sapling BA	MUFS Sapling Den	MUFS Seedling Den	CPUOW Tree BA	CPUOW Tree DEN	CPUOW Sapling BA	CPUOW Sapling Den	CPUOW Seedling Den
<i>Ardisia escallonioides</i>	–	–	0.75	2500.00	1500.00	–	–	–	–	–
<i>Morella cerifera</i>	–	–	2.40	3400.00	1500.00	–	–	1.27	3500.00	1562.50
<i>Quercus hemisphaerica</i>	0.59	25.00	0.55	200.00	1250.00	–	–	–	–	–
<i>Ilex glabra</i>	–	–	0.10	800.00	1000.00	–	–	0.43	7750.00	14375.00
<i>Forestiera segregata</i>	–	–	0.11	100.00	625.00	–	–	–	–	–
<i>Baccharis halimifolia</i>	–	–	0.07	300.00	500.00	–	–	–	–	–
<i>Sideroxylon reclinatum</i> ssp. <i>reclinatum</i>	–	–	0.47	500.00	500.00	–	–	0.83	750.00	312.50
<i>Celtis laevigata</i>	–	–	–	–	250.00	–	–	–	–	–
<i>Diospyros virginiana</i>	–	–	0.11	300.00	250.00	–	–	–	–	–
<i>Vitis aestivalis</i> var. <i>aestivalis</i>	–	–	–	–	250.00	–	–	–	–	–
<i>Cartrema americanum</i>	0.06	5.56	–	–	125.00	–	–	–	–	–
<i>Chiococca alba</i>	–	–	0.05	400.00	125.00	–	–	–	–	–
<i>Nekemias arborea</i>	–	–	–	–	125.00	–	–	–	–	–
<i>Schoepfia schreberi</i>	–	–	0.02	100.00	125.00	–	–	–	–	–
<i>Sideroxylon tenax</i>	–	–	–	–	125.00	–	–	–	–	–
<i>Smilax auriculata</i>	–	–	0.27	1300.00	125.00	–	–	0.13	750.00	312.50
<i>Smilax pumila</i>	–	–	–	–	125.00	–	–	–	–	–

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