



Terrestrial Vegetation Monitoring at Fort Matanzas National Monument

2019 Data Summary

Natural Resource Data Series NPS/SECN/NRDS—2022/1352





ON THIS PAGE

During this monitoring effort, Florida blue curls (*Trichostema species 2*) was observed within Fort Matanzas National Park. This perennial blue curls has been historically aggregated with either common blue curls (*T. dichotomum*) or scrub blue curls (*T. suffrutescens*), but recent molecular phylogeny work suggests a taxonomic split (McClelland and Weakley 2019 in Weakley et al. 2019). NPS photo / M. Forbes Boyle.

ON THE COVER

M. Forbes Boyle, SECN Botanist, searches for new plants within a species diverse backdune along the southern end of Anastasia Island. NPS photo / Elizabeth Rico.

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M. Forbes Boyle and Elizabeth Rico

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

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

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

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Right, Kyra Liedtke, former FOMA natural resource intern, measuring the diameter of a cabbage palm at Fort Matanzas National Monument. NPS photo / M. Forbes Boyle.



Executive Summary

The Southeast Coast Network (SECN) conducts long-term terrestrial vegetation monitoring as part of the nationwide Inventory and Monitoring Program of the National Park Service (NPS). The vegetation community vital sign is one of the primary-tier resources identified by SECN park managers, and it is currently 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.

2019 marks the first year of conducting this monitoring effort at four SECN parks, including Fort Matanzas National Monument (FOMA). Nine vegetation plots, located on Anastasia and Rattlesnake Islands, were established at Fort Matanzas National Monument in June. Data collected in each plot included species richness across multiple spatial scales, species-specific cover and constancy, species-specific woody stem seedling/sapling counts and adult tree (greater than 10 centimeters [3.9 inches {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 Fort Matanzas National Monument in 2019. Data were stratified across two dominant broadly defined habitats within the park (Maritime Upland Forests/Shrublands and Maritime Open Uplands). Noteworthy findings include:

- Eighty-two vascular plant taxa (species or lower) were observed across nine vegetation plots, including eight species not previously documented within the park.
- The most frequently encountered species in each broadly defined habitat included:
 - Maritime Upland Forests and Shrublands: saw palmetto (*Serenoa repens*), yaupon (*Ilex vomitoria*), southern/eastern red cedar (*Juniperus silicicola* + *virginiana*), American beautyberry (*Callicarpa americana*), and American burnweed (*Erectites hieraciifolius*).
 - Maritime Open Uplands: sea oats (*Uniola paniculata*), earleaf greenbriar (*Smilax auriculata*), and dixie sandmat (*Euphorbia bombensis*).
- One non-native species, Brazilian pepper (*Schinus terebinthifolia*), categorized as invasive by the Florida Exotic Pest Plant Council (FLEPPC 2019) was encountered in one Maritime Upland Forest and Shrubland plot during this monitoring effort.
- There were not any rare plants tracked by the Florida Department of Agriculture and Consumer Services (FDACS 2020) found during this monitoring effort. All plants located in these monitoring plots are fairly common throughout Florida, as well as across the Southeast Coast. Three species observed, however, are on the FDACS 2020 list of commercially exploited plants within the state. These include saw palmetto, cinnamon fern (*Osmundastrum cinnamomeum*), and coontie (*Zamia integrifolia* var. *umbrosa*).
- Southern/eastern red cedar and cabbage palmetto (*Sabal palmetto*) were the most dominant species within the tree stratum of the Maritime Upland Forest and Shrubland habitat type. Species that dominated the sapling and seedling strata of this type included yaupon and cabbage palmetto.
- More than 75% of the trees measured in the parks Maritime Upland Forest and Shrubland habitat type were alive and experiencing healthy vigor. Of the 22 trees that were dead, more than 50% of those were southern/eastern red cedar. Most of those individuals that were observed with moderate or severe decline and greater than 50% dieback were southern/eastern red cedars.
- Although red bay (*Persea borbonia*) was identified as one of the “principal understory tree” species within Fort Matanzas National Monument’s maritime forests in 2004 (Zomlefer et al. 2004), tree-sized individuals were rarely detected on plots during this monitoring effort. This may be in part due to the detection of laurel wilt disease within St. Johns County in 2006 (USDA 2021). Based on the low detection rate of tree-sized red bays from this current monitoring effort, it appears that the disease has had an impact on this species within the park. Continued monitoring of these plots will determine whether or not red bay returns as a component within the forest subcanopy of this habitat type within Fort Matanzas National Monument.

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 data set 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 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 (2020), 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 across network parks. Approximately 180 vegetation associations (i.e., fine-resolution floristic description), as defined by the National Vegetation and Classification Standard, Version 2.0 (FGDC 2008), occur in SECN park units. A diversity of vegetation resources is found in these parks, including dry grassland dunes, maritime oak and pine dominated forests, pyrogenic pine flatwoods, black and brown water floodplain forests, and Piedmont upland forests.

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

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

used by the Cumberland Piedmont Network (White et al. 2011) and Gulf Coast Network (Carlson et al. 2018).

This report provides a summary of data collected in June 2019 within Fort Matanzas National Monument (FOMA) as part of the SECN’s terrestrial vegetation monitoring effort. This report is intended to provide FOMA 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 Fort Matanzas National Monument utilizing the recently published SECN terrestrial vegetation monitoring protocol (Boyle et al. 2019). For this ‘baseline’ status report, 2019 data were synthesized to answer the following questions across broad habitat types within the park:

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

Methods

Study Area

Fort Matanzas National Monument (FOMA) is located along the Atlantic Ocean 14 miles (22.5 kilometers [km]) south of St. Augustine in St. Johns County, Florida (Figure 1). The Monument is contained within the 55,000-acre (22,258 hectares [ha]) Guana Tolomato Matanzas National Estuarine Research Reserve (GTM NERR). The 298-acre (120.6 ha) park is split between two parcels separated by the Matanzas River—the eastern parcel occurs on the southern tip of Anastasia Island while the western parcel is located on the northern third of Rattlesnake Island. Florida State Road A1A bisects the Anastasia Island parcel. Anastasia Island is composed of open beaches adjacent to the ocean; foredunes of terraces and blowout sites adjacent to the beach; and further inland, stabilized dunes and backdunes supporting herbaceous-dominated sand flats, maritime scrub, and maritime forest. Rattlesnake Island is composed largely of maritime scrub and forest vegetation. Salt marsh ecosystems bisect Rattlesnake Island west of the actual Fort Matanzas, and along the northwest edge of the park's property on Anastasia Island. Colonizing plants inhabit foredunes and occasional backdunes along the Anastasia Island landscape. The dominant species within these open upland habitats is sea oats (*Uniola paniculata*). Other colonizers often present within these habitats within the park include bitter panicgrass (*Panicum amarum*), saltmeadow cordgrass (*Spartina patens*), and largeleaf pennywort (*Hydrocotyle bonariensis*). Maritime scrub and forest vegetation on both islands of the park includes canopy species such as southern/eastern red cedar (*Juniperus silicicola + virginiana*), live oak (*Quercus virginiana*), and red bay (*Persea borbonia*); shrub species such as wax myrtle (*Morella cerifera*) and yaupon (*Ilex vomitoria*); and a diversity of woody vines (e.g., earleaf greenbrier [*Smilax auriculata*], Virginia creeper [*Parthenocissus quinquefolia*]).

Due to its location directly along the Atlantic Coast, Fort Matanzas National Monument ecosystems have always been subjected to high frequencies of storm-, wind-, tide-, and wave-driven processes. Historic and current vegetation composition and structure are largely a result of these highly dynamic processes, along with patterns of past land use. The 18th century stone-masonry fort (Fort Matanzas) is located

on the northeastern side of Rattlesnake Island. When the fort was constructed in 1740, the small portion of land it was built on was less than 2 acres in size. The northern end of Rattlesnake Island on which the Monument occurs is now 190 acres. Rattlesnake Island has been heavily impacted since the early 20th century by dredging of the adjacent Intracoastal Waterway (ICW). Although most of the island is less than 5 feet above sea level, a portion of the northern end reaches 17 feet where ICW fill has been deposited. Portions of Rattlesnake Island were also historically dredged and drained for mosquito control with remnants still evident in some areas (Byrne et al. 2012).

Zomlefer et al. (2004) report 237 vascular species within Fort Matanzas National Monument, including 14 cultivated species planted near park headquarters and an additional 46 non-native species (20.4% of the total). Of these 46 non-native plants, five are listed as either a Category I (altering native plant communities by displacing native species, changing communities' structures or ecological functions, or hybridizing with natives) or Category II (increasing in abundance or frequency but not yet altering plant communities in Florida to the extent shown by Cat I species) invasive species by the Florida Exotic Pest Plant Council (FLEPPC 2019). These include:

- Sprenger's asparagus fern (*Asparagus aethiopicus*; Cat I)
- Camphortree (*Cinnamomum camphora*; Cat I)
- Lantana (*Lantana strigocamara*; Cat I)
- Narrow swordfern (*Nephrolepis cordifolia*; Cat I)
- Ladder brake (*Pteris vittata*; Cat II)

There were no state or federally listed endangered or threatened species found on the park during the previous floristic survey nor were there any Florida endemics; however, two species listed as commercially exploited within the state by the Florida Department of Agriculture and Consumer Services (FDACS 2020) were present--saw palmetto (*Serenoa repens*) and coontie (*Zamia integrifolia* var. *umbrosa*) (Zomlefer et al. 2004).

Fort Matanzas National Monument Site Locations

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



Figure 1. Location Southeast Coast Network terrestrial vegetation monitoring plot locations within Fort Matanzas National Monument.

Sampling Design

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

Nine vegetation plots were established and sampled at Fort Matanzas National Monument in June 2019 (Figure 1). These plots were located in the following broadly defined habitats of the park: Maritime Upland Forests and Shrublands (5 plots) and Maritime Open Uplands (4 plots). Plot locations were determined using the generalized random-tessellation stratified (GRTS) sampling methodology, which creates a spatially balanced array of sample points across an area of interest while maintaining flexibility in a project's sample size (Stevens and Olsen 2004).

Nomenclature Standard, Growth Form Determination, and Conservation Status

Species nomenclature for this report follows the *Flora of the Southern and Mid-Atlantic States* (Weakley 2019). Every attempt was made to identify all plants to species, variety, or subspecies; when this was not possible, the lowest level of identifiable taxa (e.g., genera, family) was used. Occasionally,

a taxonomic concept was created by 'lumping' several species of the same genus of known occurrence within a park. For example, both southern red cedar (*Juniperus silicicola*) and eastern red cedar (*J. virginiana*) occur on the park; both species occur in abundance in the natural and semi-natural habitats targeted by this monitoring effort; the species can often be difficult to distinguish based on vegetative features; and, finally, no other species within the genus *Juniperus* are known to occur within the park. A taxonomic concept was created—*Juniperus [silicicola + virginiana]*—that combined the two species into a single concept. This 'lumped' taxon is of finer scale taxonomic resolution than if these records had been identified as *Juniperus* sp. Once the final list was determined, each species was cross-referenced with the USDA Plants Database (USDA 2020) to determine growth form, native status, federal/state noxious status, and to provide a unique common name. When a single taxon linked to multiple growth forms, the lead author subjectively chose a single growth form to link with the taxa. The species list was also cross-referenced with the 575 protected plants in Florida to determine the state and federal conservation status (e.g., Endangered, Threatened, Commercially Exploited) of each species (FDACS 2020).

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 2).

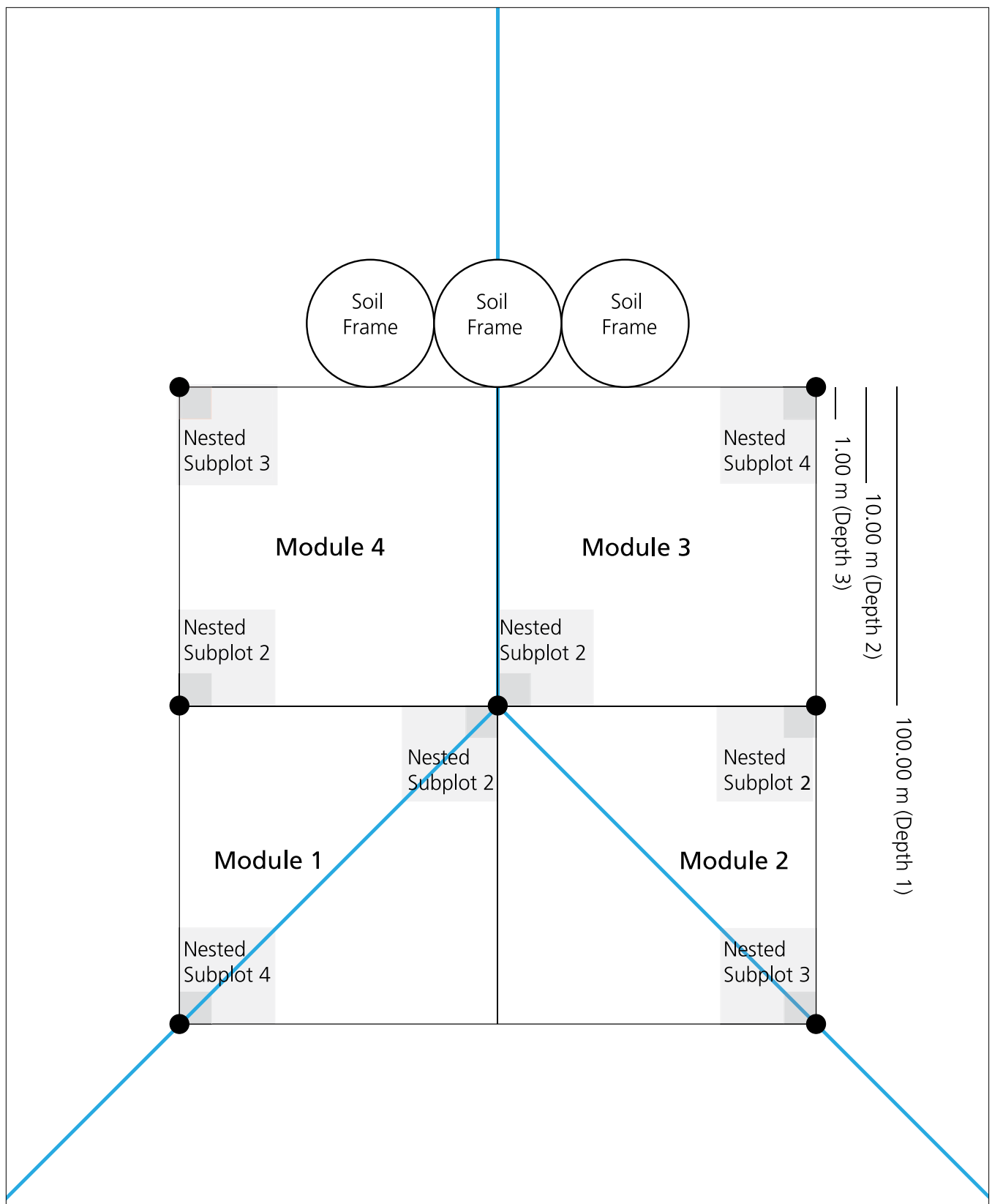


Figure 2. The layout of the sampling plot for the Southeast Coast Network, which is a modified version of the standard Level 5 Carolina Vegetation Survey plot. Ideal location of rebar used as permanent structures to monument the plot are black shaded circles. Blue lines represent location of the three 25-meter (82-foot) fuel transects.

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

Table 1. Vascular plant cover metrics of the Carolina Vegetation Survey (Peet et al. 1998) and used by the SECN Terrestrial Vegetation Monitoring protocol.

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 in; tree) in diameter at 1.4 meters (4.5 ft) linear distance from the ground layer, its species, DBH, and health status was recorded. Within the two 10 square-meter (107.6 ft²) nested depth ‘quadrats’ used for detecting overall species presence (see above), each woody stem that reached 1.4 meters (4.5 ft) in linear distance from the ground layer but was less than 10 centimeters (3.9 in) in diameter at this height (sapling) was identified to species and DBH was determined. Finally, each

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

Surface fuels were assessed at each plot site using the planar transect method for the standard fuel size classes: 1-hour (0–0.6 cm), 10-hour (0.6–2.5 cm), 100-hour (2.5–7.6 cm), and 1000-hour (> 7.6 cm), and duff and litter depths (Brown 1974). Counts of each fuel size class were tallied across three fuel transects, with diameter and decay class recorded for each piece of 1000-hour fuel.

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

Eighty-two vascular plant species were detected during this monitoring effort (Appendix A), including eight taxa not detected in previous lists documented in Zomlefer et al. (2004), Byrne et al. (2012), or NPS (2022; Table 2). All newly detected taxa are relatively widespread throughout Florida and are currently not of conservation concern. It should be noted that cinnamon fern (*Osmundastrum cinnamomeum*), as well as two other species detected during this monitoring effort—saw palmetto and coontie—are listed as commercially exploited within the state by the Florida Department of Agriculture and Consumer Services (FDACS 2020). Although all three of these species are common and relatively secure, they currently face the threat of removal in significant numbers from their native habitat in to be sold on the commercial market. Native richness ranged from 10 to 31 species per plot and at least one non-native plant was encountered in three of the nine plots (Table 3; Figure 3). Brazilian pepper (*Schinus terebinthifolia*) was encountered in one Maritime Upland Forest and Shrubland

plot and was the only species categorized as invasive by the Florida Exotic Pest Plant Council (FLEPPC 2019) that was observed in Fort Matanzas National Monument during this monitoring effort. Because of control efforts from park staff and NPS Florida and the Caribbean Invasive Plant Management Team since the park's 2004 floristic survey, it is believed that camphortree (*Cinnamomum camphora*) has been extirpated from Fort Matanzas National Monument (K. Foote, personal communication, Feb 7, 2022). In the southeastern Coastal Plain, small-scale vegetation diversity patterns are largely influenced by complex edaphic factors, those factors' associated relationship with steep environmental gradients (e.g., hydrology and substrate texture), and the variability of timing and impact from disturbance events (e.g., fire; Sorrie and Weakley 2001). What follows is a synopsis of vegetation and environmental data stratified by each of the broadly defined habitats sampled within the park.

Table 2. Vascular plant species, subspecies, or varieties not reported from Zomlefer et al. (2004), Byrne et al. (2012), or NPS (2022) but found at Fort Matanzas National Monument in 2019 through this current monitoring effort.

Scientific Name	Common Name ¹	Growth Form ¹	Federal/State Noxious Status ¹	Native Status ¹	Global Rank ²	State Rank (Florida) ²
<i>Buchnera floridana</i>	American bluehearts	Forb/herb	–	Native	G4	SNR
<i>Chasmanthium laxum</i>	slender woodoats	Graminoid	–	Native	G5	SNR
<i>Lythrum lineare</i>	wand lythrum	Forb/herb	–	Native	G5	SNR
<i>Osmundastrum cinnamomeum</i>	cinnamon fern	Forb/herb	–	Native	G5	S4
<i>Sabatia stellaris</i>	rose of Plymouth	Forb/herb	–	Native	G5	SNR
<i>Solanum carolinense</i>	Carolina horsenettle	Subshrub, Forb/herb	–	Native	G5	SNR
<i>Solidago mexicana</i>	seaside goldenrod	Forb/herb	–	Native	G5	SNR
<i>Spartina bakeri</i>	sand cordgrass	Graminoid	–	Native	G4	SNR

¹ Information obtained from the PLANTS database (USDA 2020)

² Conservation Status (G4: Apparently Secure; G5: Secure; SNR: Not Yet Accessed) obtained from NatureServe Explorer 2.0 (NatureServe 2020)

Table 3. Vascular plant species richness across multiple spatial scales on Southeast Coast Network vegetation plots located within Fort Matanzas National Monument. The data are summarized by total number of native versus non-native species/plot, and by vegetative growth forms (T: tree, S: shrub, V: vine, H: herbs/forbs, G: graminoids). Growth form information was obtained from the USDA Plants Database (USDA 2020).

Broadly Defined Habitat	Plot	Native ¹	Non-native ¹	Unknown ¹	T ¹	S ¹	V ¹	H ¹	G ¹	T ²	S ²	V ²	H ²	G ²	T ³	S ³	V ³	H ³	G ³	T ⁴	S ⁴	V ⁴	H ⁴	G ⁴
Maritime Upland Forests and Shrublands	FOMA001	10	0	0	4	5	1	0	0	2.3	3.3	0.8	0.0	0.0	1.3	1.4	0.0	0.0	0.0	0.9	0.5	0.0	0.0	0.0
	FOMA002	13	1	2	2	5	2	3	4	1.3	2.3	0.8	2.0	2.8	0.9	1.3	0.4	1.5	1.0	0.4	0.5	0.0	0.8	0.3
	FOMA003	22	1	1	5	6	6	5	2	2.8	4.5	3.0	2.5	0.5	0.6	3.0	1.5	1.3	0.3	0.4	2.1	0.8	0.9	0.1
	FOMA004	18	0	0	5	5	6	1	1	4.3	3.5	3.0	0.3	0.3	2.5	1.6	1.1	0.1	0.1	1.5	1.0	0.0	0.0	0.0
	FOMA005	25	0	1	4	7	1	12	2	2.3	4.8	0.5	6.8	2.3	0.6	1.5	0.1	2.3	0.3	0.1	0.8	0.0	0.9	0.1
	average	17.6	0.4	0.8	4.0	5.6	3.2	4.2	1.8	2.6	3.7	1.6	2.3	1.2	1.2	1.8	0.6	1.0	0.3	0.7	1.0	0.2	0.5	0.1
	standard deviation	6.2	0.5	0.7	1.1	0.8	2.3	4.3	1.3	1.0	0.9	1.1	2.4	1.1	0.7	0.6	0.6	0.9	0.4	0.5	0.6	0.3	0.4	0.1
Maritime Open Uplands	FOMA041	31	0	1	3	3	3	17	6	2.0	1.3	2.5	11.8	6.0	0.6	0.3	1.9	6.9	2.3	0.1	0.0	1.1	3.8	1.0
	FOMA042	19	0	1	0	0	1	11	8	0.0	0.0	0.5	7.0	6.5	0.0	0.0	0.0	4.5	2.3	0.0	0.0	0.0	3.0	0.5
	FOMA043	11	1	0	3	2	1	3	3	2.0	0.5	0.3	2.5	2.3	1.3	0.1	0.0	1.6	1.3	0.6	0.0	0.0	0.4	1.1
	FOMA044	15	0	0	1	1	1	9	3	0.3	0.3	1.0	5.8	3.3	0.0	0.0	0.3	3.3	1.4	0.0	0.0	0.0	2.1	0.9
	average	19.0	0.3	0.5	1.8	1.5	1.5	10.0	5.0	1.1	0.5	1.1	6.8	4.5	0.5	0.1	0.5	4.1	1.8	0.2	0.0	0.3	2.3	0.9
	standard deviation	8.6	0.5	0.6	1.5	1.3	1.0	5.8	2.4	1.1	0.5	1.0	3.8	2.1	0.6	0.1	0.9	2.2	0.5	0.3	0.0	0.6	1.5	0.3

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

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

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

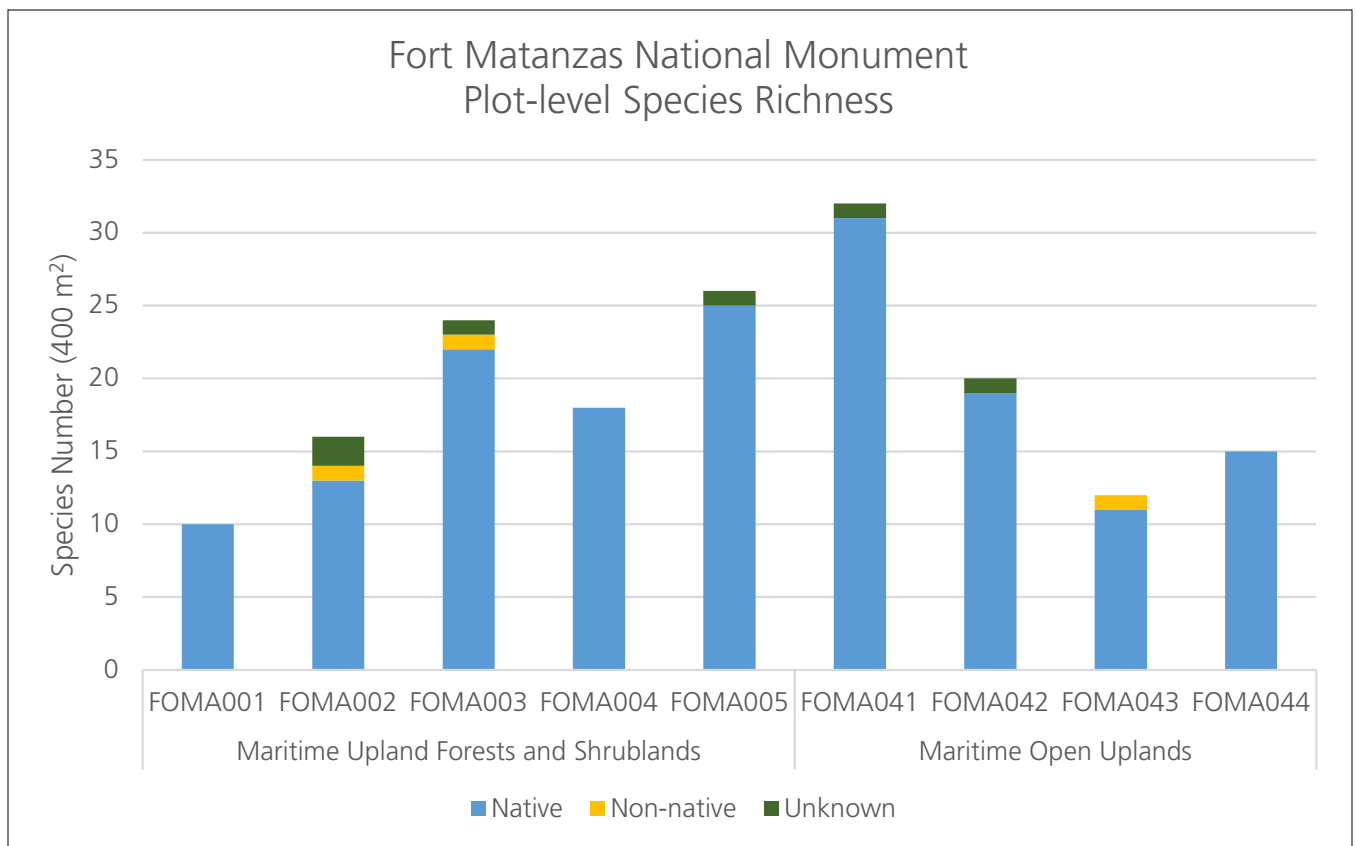


Figure 3. Native and non-native species diversity at the 400 square meter (4,306 ft²)-scale on 2019 vegetation monitoring plots within Fort Matanzas National Monument.

Maritime Upland Forests and Shrublands

Maritime 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 4). 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. Vegetation associations sampled at Fort Matanzas National Monument that belong to this broadly defined habitat type include (descriptions from NatureServe 2020):

- Florida Coastal Strand (Temperate Palmetto Type) (CEGL003812; 4 plots): Scrublands occurring as a continuous strip behind foredunes and dominated by saw palmetto and yaupon (*Ilex vomitoria*) with dwarfed individuals of cabbage palmetto (*Sabal palmetto*) and tough bully (*Sideroxylon tenax*) (Global Status: G1—Critically Imperiled; State [FL] Status: No Status Rank)
- Maritime Live Oak Hammock (CEGL007032; 1 plot): Forests located on linear strands behind frontal dunes, on xeric to mesic sites; nutrient input is typically from salt spray and precipitation. (Global Status: G2—Imperiled; State (FL) Status: No Status Rank)



Figure 4. Five Maritime Upland Forest and Shrubland sites were sampled during this monitoring effort on Rattlesnake and Anastasia Islands.

Species Diversity and Abundance

Native species richness ranged from 10 to 25 (mean =17.6) within vegetation plots of this broadly defined habitat type in Fort Matanzas National Monument (Table 3; Figure 3). Collectively, shrubs represented the most diverse growth form across all spatial scales; however, one plot (FOMA005) had higher herbaceous species diversity owing to canopy openings brought on by recent windthrow events (Table 3). Two of the five Maritime Upland Forest and Shrubland plots contained at least one non-native species (Table 3; Figure 3), including the invasive Brazilian pepper located in FOMA003. Fifty-one vascular plant species were found collectively within these five plots; 32 of these were only found in this broadly defined habitat (Appendix B, Table B-1). A complete species list, along with constancy and average cover per species, is located in Appendix B, Table B-1. Species with high constancy in this habitat are listed below, by growth form:

Trees

- Southern/eastern red-cedar (*Juniperus silicicola* + *virginiana*; 80%)
- Cabbage palmetto (60%)

Shrubs

- Saw palmetto (100%)
- Yaupon (100%)
- American beautyberry (*Callicarpa americana*; 80%)
- Eastern baccharis (*Baccharis halimifolia*; 60%)
- Jesuit's bark (*Iva frutescens* var. *frutescens*; 60%)
- Wax myrtle (*Morella cerifera*; 60%)
- Aloe yucca (*Yucca aloifolia*; 60%)

Vines

- Earleaf greenbriar (*Smilax auriculata*; 60%)
- Summer grape (*Vitis aestivalis* var. *aestivalis*; 60%)

Herbs/Forbs/Graminoids

- American burnweed (*Erectites hieracifolius*; 80%)
- Dogfennel (*Eupatorium capillifolium*; 60%)
- Coastal bedstraw (*Galium bermudense*; 60%)

Woody Stem Metrics

Total basal area (BA) of trees was highly variable within these plots and ranged from 9.8 to 77.2 m²/ha with an overall average of 37.3 m²/ha; density of canopy stems ranged from 11 to 24 per plot, with an average of 16.6 (Table 4). Canopy height ranged from 5.3 to 15.0 meters (average 8.9), and canopy cover ranged from 64 to 73% (average=66.4%; Table 4). The most dominant canopy species included cabbage palmetto (mean BA = 27.53 m²/ha, mean density = 240/ha) and southern/eastern red cedar (mean BA=8.67 m²/ha, mean density = 110/ha; Appendix B, Table B-2). Sapling density at the 80 square meter scale ranged from 47 to 137 stems, with an average of 78.6, while seedling density at the 8 meter square scale ranged from 9 to 84 stems, with an average of 37.4 across all plots (Table 4). Dominant sapling species included yaupon, cabbage palmetto, and saw palmetto; dominant seedlings yaupon, live oak (*Quercus virginiana*), and saw palmetto (Appendix B, Table B-2).

Based on stem count alone, cabbage palmetto comprised nearly 60% of the relative abundance among species within the tree stratum, while southern/eastern red cedar comprised 26% (Figure 5). The sapling and seedling strata were both dominated by yaupon (Figure 5).

Most of the measured trees in Maritime Upland Forest and Shrubland plots were living (79%; Figure 6). Of the 22 stems that were dead, approximately 59% of those were southern/eastern red cedar. The majority of trees were categorized with healthy vigor and minimal (< 10%) dieback (Figure 6). Most of those individuals that were observed with moderate or severe decline and > 50% dieback were southern/eastern red cedars.

Table 4. Woody stem abundance and canopy metrics on Southeast Coast Network vegetation plots located in Fort Matanzas National Monument [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)
Maritime Upland Forests and Shrublands	FOMA001	41.8	14	8.5	137	24	73	15
	FOMA002	77.2	24	10.4	48	9	64	9
	FOMA003	10.5	15	5.9	88	53	70	5
	FOMA004	9.8	11	4.0	73	84	64	7
	FOMA005	47.4	19	2.5	47	17	61	8
	average	37.3	16.6	6.3	78.6	37.4	66.4	8.9
	standard deviation	28.2	5.0	3.2	37.0	30.9	4.9	3.6
Maritime Open Uplands	FOMA041	12.1	2	1.2	44	7	15	6
	FOMA042	0.0	0	0.0	0	0	0	0
	FOMA043	4.9	1	0.6	1	2	18	6
	FOMA044	0.0	0	0.0	0	0	0	0
	average	4.3	0.8	0.4	11.3	2.3	8.3	2.9
	standard deviation	5.7	1.0	0.6	21.8	3.3	9.7	3.4

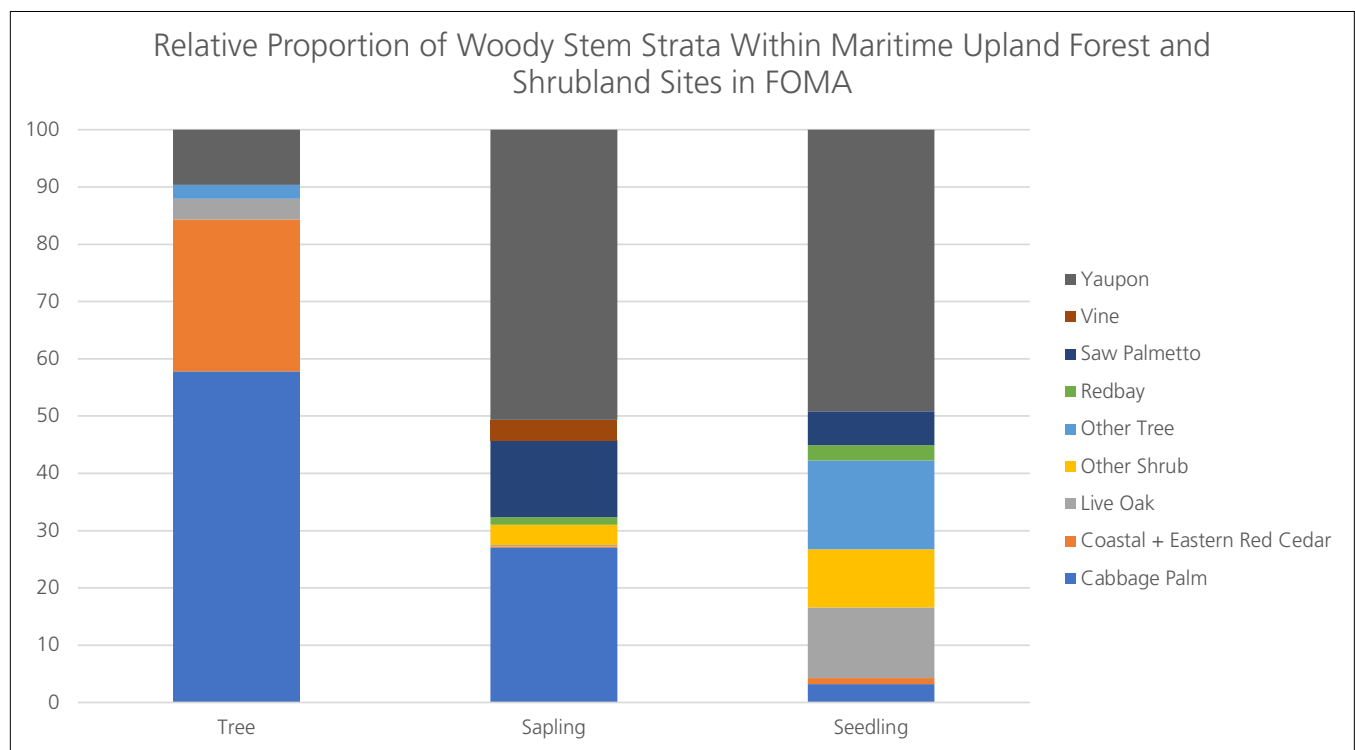


Figure 5. Relative proportion of species groups across three woody stem strata—trees, saplings, and seedlings— within Maritime Upland Forest and Shrubland vegetation monitoring plots of Fort Matanzas National Monument.

Overall Health of Trees Observed Within Maritime Forest and Shrubland Sites of FOMA

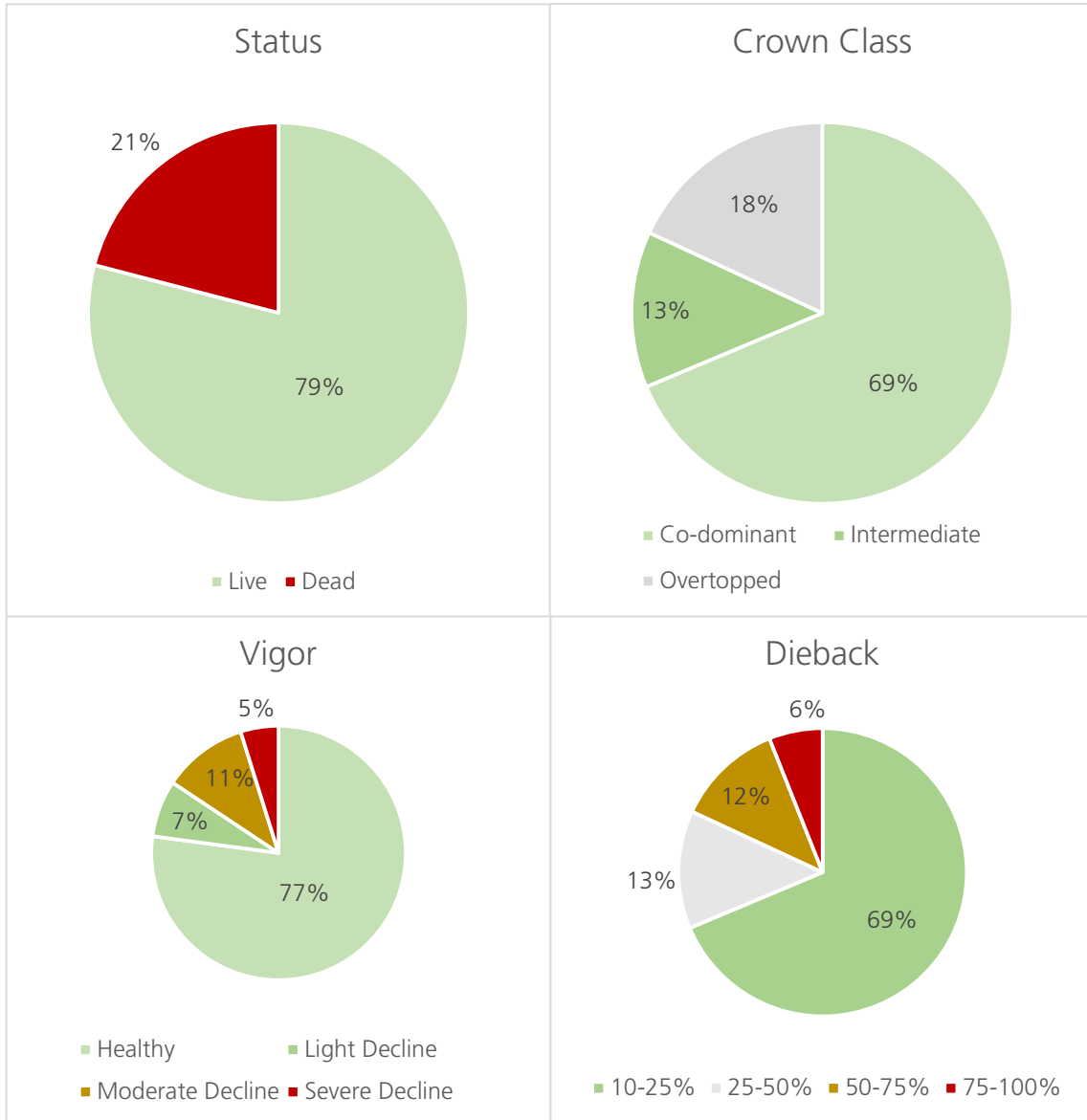


Figure 6. Health status of woody stems greater than or equal to 10 centimeters (3.9 in) DBH ('trees') measured on Maritime Upland Forests and Shrubland vegetation monitoring plots of Fort Matanzas National Monument.

Disturbance and Threats

The most frequent and noticeable disturbance type affecting this habitat type was associated with windthrow; this is not an uncommon natural disturbance event in these ecosystems (Table 5). It should be noted that although red bay (*Persea borbonia*) was identified as one of the “principal understory tree” species within this habitat type in the most recent floristic survey of the park in 2003/2004 (Zomlefer et al. 2004), tree-sized individuals were rarely detected on plots during this monitoring effort. This may be in part due to the detection of laurel wilt disease within St. Johns County in 2006 (USDA 2021). The disease is comprised of a fungus (*Raffaelea lauricola*) spread by an invasive, nonnative ambrosia beetle (*Xyleborus glabratus*) and affects several species within the

Lauraceae Family (Fraedrich et al. 2008). Infected plants typically die within months after succumbing to the disease. The disease was not detected on the park during neither the previous park floristic survey (Zomlefer et al. 2004) nor the previous vegetation monitoring effort (Byrne et al. 2012). However, laurel wilt disease has recently caused a significant decline of red bay on the park, evidenced by park-wide zero detection rates of tree-sized red bay individuals during this monitoring effort. Red bay was detected within the seedling strata on two of the five (40%) Maritime Upland Forest and Shrubland plots within the park. Continued monitoring of these plots will determine whether or not red bay returns as a component within the forest subcanopy of this habitat type within Fort Matanzas National Monument.

Table 5. Disturbance observations and abundance (%cover) measured on vegetation monitoring plots in Fort Matanzas National Monument.

Broadly Defined Habitat	Plot	Windthrow	Trash	Pest
Maritime Upland Forests and Shrublands	FOMA001	10	–	–
	FOMA002	–	30	–
	FOMA003	–	–	–
	FOMA004	–	–	–
	FOMA005	20	–	–
Maritime Open Uplands	FOMA041	–	–	10
	FOMA042	–	–	–
	FOMA043	–	–	–
	FOMA044	–	–	–

Geomorphology and Soil

Plots located within Maritime Upland Forests and Shrublands within Fort Matanzas National Monument occurred on landforms with varying slope steepness, aspect, and shape (Table 6). Although classified as uplands, these forests can occasionally flood during extreme storm events. At the time of

this monitoring effort, none of these plots had any standing water present (Table 6). Upland Forest and Shrubland soils within the park ranged from slightly acidic to alkaline, and typically had higher cation volumes than soils of Open Upland habitats (Table 7).

Table 6. Local landform and hydrologic condition from vegetation monitoring plots at Fort Matanzas National Monument.

Broadly Defined Habitat	Plot	Slope (°)	Aspect (°)	TSI ¹ (°)	Landform Type	Water Source	Submerged (%)
Maritime Forests and Shrublands	FOMA001	0	–	0	flat plain	None	0
	FOMA002	3	45	1.143	side slope	Flood zones	0
	FOMA003	5	0	-3.143	seep/swale	None	0
	FOMA004	3.5	254	1	seep/swale	None	0
	FOMA005	0	–	0	flat plain	None	0
Maritime Open Uplands	FOMA041	4	310	3.857	seep/swale	None	0
	FOMA042	0	–	0	flat plain	None	0
	FOMA043	5	0	3.429	seep/swale	None	0
	FOMA044	–	–	–	seep/swale	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 Fort Matanzas National Monument. 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 on the [Brookside Laboratories, Inc website](#) (BL 2021).

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
Maritime Upland Forests and Shrublands	FOMA001	13.44		7.9	1.58	19	2198	182	33	88	0.79	95	6	0.67	0.57	208
	FOMA002	3.07		5.9	0.83	38	243	113	29	26	< 0.20	106	2	0.41	1.92	62
	FOMA003	14.04		5.3	6.26	12	873	403	36	50	0.64	63	9	0.71	3.4	57
	FOMA004	4.61		6.1	1.69	34	540	104	24	27	0.43	59	8	0.85	1.66	43
	FOMA005	11.24		6.2	5.71	25	617	461	91	493	1.05	290	< 1	0.5	0.73	173
	average	9.28		6.28	3.21	25.60	894.20	252.60	42.60	136.80	0.73	122.60	–	0.63	1.66	108.60
	standard deviation	5.10		0.97	2.56	10.64	762.68	167.78	27.43	200.70	0.26	95.73	–	0.17	1.13	76.10
Maritime Open Uplands	FOMA041	3.58		6.3	0.47	99	450	68	20	35	0.2	52	2	0.7	1.44	42
	FOMA042	5.87		7.5	0.45	73	991	61	14	33	0.68	62	1	0.49	0.98	31
	FOMA043	2.37		6.4	0.34	78	322	39	8	19	< 0.20	93	< 1	0.55	< 0.4	69
	FOMA044	7.24		8.1	0.2	69	1306	36	6	36	0.32	43	2	0.56	0.47	27
	average	4.77		7.08	0.37	79.75	767.25	51.00	12.00	30.75	0.40	62.50	–	0.58	0.96	42.25
	standard deviation	2.20		0.87	0.12	13.35	461.60	15.90	6.32	7.93	0.25	21.76	–	0.09	0.49	18.93

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

Maritime Open Uplands

Maritime Open Uplands of Florida's Atlantic Coast include vegetated areas along coastal foredunes and backdunes adjacent to the open beach as well as occasional non-forested zones within older dune complexes located further inland (Figure 7). These sites are strongly influenced by shifting sands and high levels of salt spray from the adjacent ocean. Plants that colonize these sites are typically short-lived and salt-tolerant. The primary grass that stabilizes maritime dunes is sea oats, which produces many adventitious roots from the main culm that capture sand and allow dunes to form. Other grasses that serve to stabilize dunes within Fort Matanzas National Monument include bitter panicgrass and saltmeadow cordgrass (Zomlefer et al. 2004). Backdunes occur on generally more stable landforms than adjacent foredunes and serve as an ecotone between foredunes and Maritime Upland

Forest and Shrubland habitat. Vegetation of backdunes can include a mixture of grasses and herbaceous species typical of foredunes, other herbaceous species, and stunted shrubs. 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. Vegetation associations sampled at Fort Matanzas National Monument that belong to this broadly defined habitat type include (descriptions from NatureServe 2020):

- Sea-oats Dune Grassland (CEGL004040; 4 plots): The characteristic foredune vegetation community along the southeast Atlantic Coast and dominated by sea-oats. (Global Status: G3—Vulnerable; State (FL) Status: No Status Rank)



Figure 7. Four plots within Maritime Open Upland habitat were sampled during this monitoring event, including backdune vegetation on southern Anastasia Island.

Species Diversity and Abundance

Native species richness ranged from 11 to 31 (mean = 19.0) within vegetation plots of this broadly defined habitat type, and only a single plot (FOMA043) had a single non-native species present (bahigrass [*Paspalum notatum*]) (Table 3 and Figure 3). Herbaceous and graminoid diversity was higher in these plots than Maritime Upland and Forest and Shrubland plots across all spatial scales—full plot to 1 square meter (10.8 ft²). Fifty-two vascular plant species were found collectively within these four plots, including 33 that were only found in this broadly defined habitat (Appendix B, Table B-1). A complete species list, along with constancy and average cover per species, is located in Appendix B, Table B-1. Species with high constancy are listed below, by growth form (Appendix B, Table B-1):

Vines

- Earleaf greenbriar (100%)

Herbs/Forbs/Graminoids

- Sea oats (100%)
- Dixie sandmat (*Euphorbia bombensis*; 100%)
- Flatsedge (*Cyperus* sp.; 75%)
- Camphorweed (*Heterotheca subaxillaris*; 75%)

Most of the vascular plant species observed in these plots are common throughout dune habitats of Florida. One interesting plant observation of note within this broadly defined habitat was Florida blue curls (*Trichostema species 2*). This perennial blue curls has been historically aggregated in other floras (e.g., Small 1913; Wunderlin 1998) with either common blue curls (*T. dichotomum*) or scrub blue curls (*T. suffrutescens*), but recent molecular phylogeny work suggests a taxonomic split (McClelland and Weakley 2019 in Weakley et al. 2019).

Woody Stem Metrics

Woody stems were absent from two of the four Open Upland plots in Fort Matanzas National Monument (Table 4). A total of three cabbage palm trees (greater than or equal to 10 cm [3.9 in]) were found across the other two plots (Appendix B, Table B-2).

Disturbance and Threats

There were very few observed current or historical disturbances on these plots (Table 5). A few declining individuals of prickly-pear (*Opuntia* sp.) were observed within and adjacent to plot FOMA041. Declining symptoms included pad yellowing and pad collapse, similar to signs of infestation caused by the cactus moth (*Cactoblastis cactorum*). The moth is native to South America and was introduced into the Caribbean in the 1950s to control prickly-pear species (Simmonds and Bennett 1966). It has become a serious threat to prickly-pear diversity in Florida since its introduction to the state in 1989 (Zimmerman et al. 2001; Stiling et al. 2004). There are currently no effective control measures for this pest.

Geomorphology and Soil

Plots located within Maritime Open Uplands within Fort Matanzas National Monument occurred on landforms with varying slope steepness, aspect, and shape (Table 6). Open Upland soils within the park were sandy, had slightly neutral to alkaline pH levels, and very little organic matter content (Table 7).

Fuel Load Estimates

Total fuel loads ranged from 22.5 to 34.3 (average=30.4) tons/acre (5.0 to 7.7 kg/m²) in Maritime Upland Forest and Shrubland plots and 6.8 to 7.9 (average=7.4) tons/acre (1.5 to 1.8 kg/m²) in Maritime Open Upland plots (Figure 8). Duff and litter provided the greatest volume of all fuel types within Fort Matanzas National Monument (Figure 8). Plot FOMA002 on the northern end of Rattlesnake Island had the highest estimated amount of downed coarse woody debris (1,000-hour fuel type; Figure 8).

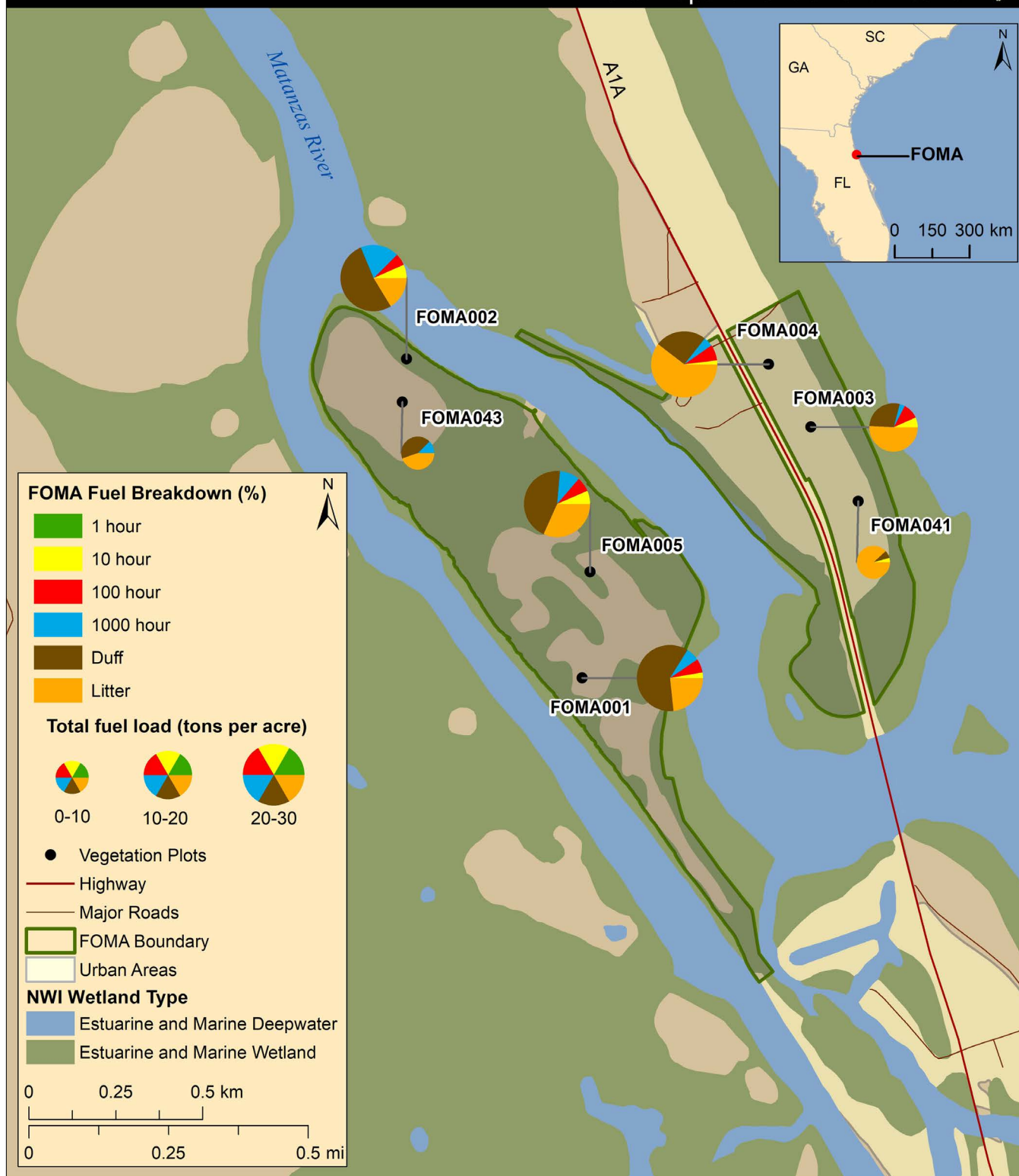


Figure 8. Fuel load estimates from vegetation monitoring plots located at Fort Matanzas National Monument.

Literature Cited

- Boyle, M. F., M. B. Gregory, M. W. Byrne, P. Capece, and S. Corbett. 2019. Terrestrial vegetation monitoring in Southeast Coast Network parks: Protocol implementation plan. Natural Resource Report NPS/SECN/NRR—2019/1930. National Park Service, Fort Collins, Colorado. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2263392> (last accessed January 2022).
- Brookside Laboratories, Inc (BL). 2021. Soil Analysis. Available at: <https://www.blinc.com/services/soil-analysis> (last accessed January 2022).
- Brown, J. K. 1974. Handbook for inventorying downed woody material. USDA For. Sew. Gen. Tech. Rep. INT-16, 24 p. Intermt. For. and Range Exp. Stn., Ogden, Utah.
- Byrne, M. W., S. L. Corbett, and J. C. DeVivo. 2012. Vegetation community monitoring at Fort Matanzas National Monument, 2009. Natural Resource Data Series NPS/SECN/NRDS—2012/255. National Park Service, Fort Collins, Colorado. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2184104> (last accessed January 2022).
- Carlson, J. E., J. Bracewell, W. Granger, and M. Segura. 2018. Monitoring vegetation in Gulf Coast Network parks: Protocol implementation plan. Natural Resource Report NPS/GULN/NRR—2018/1746. National Park Service, Fort Collins, Colorado. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2256507> (last accessed January 2022).
- Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological systems of the United States: a working classification of U.S. terrestrial systems. Arlington, VA: NatureServe.
- DeVivo, J. C., C. J. Wright, M. W. Byrne, E. DiDonato, and T. Curtis. 2008. Vital signs monitoring in the Southeast Coast Inventory & Monitoring Network. Natural Resource Report NPS/SECN/NRR—2008/061. National Park Service, Fort Collins, Colorado. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/660552> (last accessed January 2022).
- Federal Geographic Data Committee (FGDC). 2008. National vegetation classification standard, version 2: vegetation subcommittee, Federal Geographic Data Committee. FGDC-STD-005-2008 (Version 2).
- Florida Department of Agriculture and Consumer Services (FDACS). 2020. Endangered, threatened, and commercially exploited plants of Florida, Nov. 2018 spreadsheet. Available at: [Endangered, Threatened and Commercially Exploited Plants of Florida / Florida's Endangered Plants / Botany / Protect Our Environment / Consumer Resources / Home - Florida Department of Agriculture & Consumer Services \(fdacs.gov\)](https://www.fdacs.gov/Endangered%2C%20Threatened%2C%20and%20Commercially%20Exploited%20Plants%20of%20Florida%2C%20Nov%202018%20spreadsheet) (last accessed January 2022).
- Florida Exotic Pest Plant Council (FLEPPC). 2019. List of invasive plant species. http://bugwoodcloud.org/CDN/fleppc/plantlists/2019/2019_Plant_List_ABSOLUTE_FINAL.pdf (last accessed January 2022).
- Foster, D. R., G. Motzkin, and B. Slater. 1998. Land-use history as long-term broad-scale disturbance: Regional forest dynamics in central New England. *Ecosystems* 1:96–119.
- Fraedrich, S. W., T. C. Harrington, R. J. Rabaglia, M. D. Ulyshen, A. E. Mayfield, III, J. L. Hanula, J. M. Eickwort, and D. R. Miller. 2008. A fungal symbiont of the redbay ambrosia beetle causes a lethal wilt in redbay and other Lauraceae in the southeastern USA. *Plant Disease* 92:215–224.
- Lee, M. T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2008. CVS-EEP protocol for recording vegetation, all levels of plot sampling, version 4.2. Carolina Vegetation Survey. Available at: <http://cvs.bio.unc.edu/protocol/cvs-EEP-protocol-v4.2-lev1-5.pdf> (last accessed January 2022).
- McClelland, R. K. S., and A. S. Weakley. 2019. A new species of *Trichostema* (Lamiaceae, Ajugoideae) from barrier island systems of North and South Carolina, in Weakley, A.S., R.K.S. McClelland, R. J. LeBlond, K.A. Bradley, J.F. Matthews, C. Anderson, A.R. Franck, and J. Lange. 2019. Studies in the vascular flora of the southeastern United States. *Journal of the Botanical Research Institute of Texas* 13:107–129.

- NatureServe. 2020. NatureServe Explorer 2.0: an online encyclopedia of life [web application]. NatureServe, Arlington, Virginia. Available at: <https://explorer.natureserve.org/> (last accessed January 2022).
- National Park Service (NPS). 2022. NPSpecies: Information on species in national parks. Available at: <https://irma.nps.gov/NPSpecies/> (last accessed January 2022).
- Peet, R. K., T. R. Wentworth, and P. S. White. 1998. The North Carolina Vegetation Survey protocol: a flexible, multipurpose method for recording vegetation composition and structure. *Castanea* 63:262–274.
- Simmonds, F. J., and F. D. Bennett. 1966. Biological control of *Opuntia* spp. by *Cactoblastis cactorum* in the Leeward Islands (West Indies). *Entomophaga* 11:183–189.
- Small, J. K. 1913. Flora of the southeastern United States: Being descriptions of the seed-plants, ferns and fern-allies growing naturally in North Carolina, South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, and in Oklahoma and Texas east of the one hundredth meridian. New York, New York, USA.
- Sorrie, B. A., and A. S. Weakley. 2001. Coastal Plain plant endemics: phytogeographic patterns. *Castanea* 66:50–82.
- Stevens, D. L., and A. N. Olsen. 2004. Spatially balanced sampling of natural resources. *Journal of American Statistical Association* 99(465):262–278.
- Stiling, P., D. Moon, and D. Gordon. 2004. Endangered cactus restoration: Mitigating the non-target effects of a biological control agent (*Cactoblastis cactorum*) in Florida. *Restoration Ecology* 12:605–610.
- Turner, II, B. L., W. C. Clark, R. W. Kates, J. F. Richards, J. T. Mathews, and W. B. Meyer, editors. 1990. The earth as transformed by human action: Global and regional changes in the biosphere over the past 300 years. Cambridge University Press, Cambridge, United Kingdom.
- U.S. Department of Agriculture (USDA), Forest Service, The Southern Region. 2021. Laurel wilt infestation map – updated 10 March 2021. Available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd669956.pdf (last accessed January 2022).
- U.S. Department of Agriculture (USDA), Natural Resources Conservation Service. 2020. The PLANTS Database.. National Plant Data Team, Greensboro, N.C. 27401-4901 USA. Available at: <http://plants.usda.gov> (last accessed January 2022).
- Weakley, A. S. 2019. Flora of the southern and mid-Atlantic states: working draft of 2019. University of North Carolina Herbarium (NCU), Chapel Hill, North Carolina.
- White, R., C. Nordman, L. Smart, T. Leibfreid, B. Moore, R. Smyth, and T. Govus. 2011. Vegetation monitoring protocol for the Cumberland Piedmont Network, Version 1. Natural Resource Report NPS/CUPN/NRR—2011/XXX. National Park Service. Fort Collins, Colorado. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2192468> (last accessed January 2022).
- Wunderlin, R. P. 1998. Guide to the vascular plants of Florida. University Press of Florida, Gainesville, Florida, USA.
- Zimmerman, H. G., V. C. Moran, J. H. Hoffmann. 2001. The renowned cactus moth, *Cactoblastis cactorum*, (Lepidoptera: Pyralidae): Its natural history and threat to native *Opuntia* floras in Mexico and the United States of America. *Florida Entomologist* 84:543–551.
- Zomlefer, W. B., D. E. Giannasi, W. S. Judd, L. M. Kruse, and K. A. Bettinger. 2004. A floristic survey of Fort Matanzas National Monument, St. Johns County, Florida. *SIDA* 21(2):1081–1106.

Appendix A. Vascular Plants Observed During the 2019 Southeast Coast Network Terrestrial Vegetation Monitoring Effort at Fort Matanzas National Monument

Table A-1. Vascular plant species present in nine vegetation monitoring plots within Fort Matanzas National Monument, June 2019.

Order	Family	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	Federal Noxious Status ¹	State Noxious Status ¹	Federal T/E Status ²	Florida T/E Status ²
Cyperales	Poaceae	<i>Andropogon</i>	bluestem	Native	Graminoid	–	–	–	–
Cyperales	Poaceae	<i>Andropogon tenuispathus</i>	bushy bluestem	Native	Graminoid	–	–	–	–
Asterales	Asteraceae	<i>Baccharis halimifolia</i>	eastern baccharis	Native	Tree, Shrub	–	–	–	–
Scrophulariales	Scrophulariaceae	<i>Buchnera floridana</i>	American bluehearts	Native	Forb/herb	–	–	–	–
Lamiales	Verbenaceae	<i>Callicarpa americana</i>	American beautyberry	Native	Shrub	–	–	–	–
Urticales	Ulmaceae	<i>Celtis laevigata</i>	sugarberry	Native	Tree, Shrub	–	–	–	–
Fabales	Fabaceae	<i>Chamaecrista fasciculata</i>	partridge pea	Native	Forb/herb	–	–	–	–
Cyperales	Poaceae	<i>Chasmanthium laxum</i>	slender woodoats	Native	Graminoid	–	–	–	–
Caryophyllales	Chenopodiaceae	<i>Chenopodium album</i>	lambsquarters	Native	Forb/herb	–	–	–	–
Asterales	Asteraceae	<i>Cirsium horridulum</i> var. <i>horridulum</i>	yellow thistle	Native	Forb/herb	–	–	–	–
Euphorbiales	Euphorbiaceae	<i>Cnidoscolus stimulosus</i>	finger rot	Native	Forb/herb	–	–	–	–
Commelinales	Commelinaceae	<i>Commelina erecta</i>	whitemouth dayflower	Native	Forb/herb	–	–	–	–
Euphorbiales	Euphorbiaceae	<i>Croton punctatus</i>	gulf croton	Native	Subshrub, Forb/herb	–	–	–	–
Cyperales	Cyperaceae	<i>Cyperaceae</i>	sedge	Native	Graminoid	–	–	–	–
Cyperales	Cyperaceae	<i>Cyperus</i>	flatsedge	Native	Graminoid	–	–	–	–
Cyperales	Poaceae	<i>Dichanthelium</i>	rosette grass	Native	Graminoid	–	–	–	–
Cyperales	Cyperaceae	<i>Eleocharis</i>	spikerush	Native	Graminoid	–	–	–	–
Asterales	Asteraceae	<i>Erechtites hieraciifolius</i>	American burnweed	Native	Forb/herb	–	–	–	–
Asterales	Asteraceae	<i>Erigeron pusillus</i>	Canadian horseweed	Native	Forb/herb	–	–	–	–
Fabales	Fabaceae	<i>Erythrina herbacea</i>	redcardinal	Native	Tree, Subshrub, Shrub	–	–	–	–
Asterales	Asteraceae	<i>Eupatorium capillifolium</i>	dogfennel	Native	Forb/herb	–	–	–	–
Euphorbiales	Euphorbiaceae	<i>Euphorbia bombensis</i>	dixie sandmat	Native	Forb/herb	–	–	–	–
Cyperales	Poaceae	<i>Eustachys petraea</i>	pinewoods fingergrass	Native	Graminoid	–	–	–	–
Scrophulariales	Oleaceae	<i>Forestiera segregata</i>	Florida swampprivet	Native	Shrub, Tree	–	–	–	–
Asterales	Asteraceae	<i>Gaillardia pulchella</i>	Indian blanket	Native	Forb/herb, Subshrub	–	–	–	–
Fabales	Fabaceae	<i>Galactia volubilis</i>	downy milkpea	Native	Vine, Forb/herb	–	–	–	–
Rubiales	Rubiaceae	<i>Galium bermudense</i>	coastal bedstraw	Native	Forb/herb	–	–	–	–
Asterales	Asteraceae	<i>Helianthus debilis</i> ssp. <i>debilis</i>	cucumberleaf sunflower	Native	Forb/herb	–	–	–	–
Asterales	Asteraceae	<i>Heterotheca subaxillaris</i>	camphorweed	Native	Forb/herb	–	–	–	–
Apiales	Apiaceae	<i>Hydrocotyle bonariensis</i>	largeleaf pennywort	Native	Forb/herb	–	–	–	–

¹ Information obtained from the PLANTS database (USDA 2020)² Information obtained from the Florida Regulated Plant Index (FDACS 2020)

Table A-1 (continued). Vascular plant species present in nine vegetation monitoring plots within Fort Matanzas National Monument, June 2019.

Order	Family	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	Federal Noxious Status ¹	State Noxious Status ¹	Federal T/E Status ²	Florida T/E Status ²
Theales	Clusiaceae	<i>Hypericum gentianoides</i>	orangegrass	Native	Forb/herb	–	–	–	–
Celastrales	Aquifoliaceae	<i>Ilex vomitoria</i>	yaupon	Native	Tree, Shrub	–	–	–	–
Solanales	Convolvulaceae	<i>Ipomoea</i>	morning-glory	Unknown	Vine, Forb/herb	–	–	–	–
Solanales	Polemoniaceae	<i>Ipomopsis rubra</i>	standing-cypress	Native	Forb/herb	–	–	–	–
Asterales	Asteraceae	<i>Iva frutescens</i> var. <i>frutescens</i>	Jesuit's bark	Native	Forb/herb, Subshrub	–	–	–	–
Asterales	Asteraceae	<i>Iva imbricata</i>	seacoast marsh elder	Native	Forb/herb, Subshrub	–	–	–	–
Pinales	Cupressaceae	<i>Juniperus [silicicola + virginiana]</i>	eastern redcedar	Native	Tree	–	–	–	–
Capparales	Brassicaceae	<i>Lepidium virginicum</i>	Virginia pepperweed	Native	Forb/herb	–	–	–	–
Myrtales	Lythraceae	<i>Lythrum lineare</i>	wand lythrum	Native	Forb/herb	–	–	–	–
Asterales	Asteraceae	<i>Mikania scandens</i>	climbing hempvine	Native	Vine, Forb/herb	–	–	–	–
Lamiales	Lamiaceae	<i>Monarda punctata</i> var. <i>punctata</i>	spotted beebalm	Native	Forb/herb, Subshrub	–	–	–	–
Myricales	Myricaceae	<i>Morella cerifera</i>	wax myrtle	Native	Tree, Subshrub, Shrub	–	–	–	–
Cyperales	Poaceae	<i>Muhlenbergia sericea</i>	gulfhairawn muhly	Native	Graminoid	–	–	–	–
Rhamnales	Vitaceae	<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	muscadine	Native	Vine	–	–	–	–
Myrtales	Onagraceae	<i>Oenothera humifusa</i>	seabeach evening primrose	Native	Subshrub, Forb/herb	–	–	–	–
Myrtales	Onagraceae	<i>Oenothera laciniata</i>	cutleaf evening primrose	Native	Forb/herb	–	–	–	–
Myrtales	Onagraceae	<i>Oenothera simulans</i>	southern beeblossom	Native	Forb/herb	–	–	–	–
Caryophyllales	Cactaceae	<i>Opuntia drummondii</i>	cockspur pricklypear	Native	Subshrub, Shrub	–	–	–	–
Polypodiales	Osmundaceae	<i>Osmundastrum cinnamomeum</i>	cinnamon fern	Native	Forb/herb	–	–	–	Commercially Exploited
Geraniales	Oxalidaceae	<i>Oxalis corniculata</i>	creeping woodsorrel	Native	Forb/herb	–	–	–	–
Cyperales	Poaceae	<i>Panicum amarum</i>	bitter panicgrass	Native	Graminoid	–	–	–	–
Rhamnales	Vitaceae	<i>Parthenocissus quinquefolia</i>	Virginia creeper	Native	Vine	–	–	–	–
Cyperales	Poaceae	<i>Paspalum</i>	crowgrass	Unknown	Graminoid	–	–	–	–
Cyperales	Poaceae	<i>Paspalum notatum</i>	bahiagrass	Non-native	Graminoid	–	–	–	–
Laurales	Lauraceae	<i>Persea borbonia</i>	redbay	Native	Tree, Shrub	–	–	–	–
Solanales	Solanaceae	<i>Physalis walteri</i>	Walter's groundcherry	Native	Forb/herb	–	–	–	–
Caryophyllales	Phytolaccaceae	<i>Phytolacca americana</i>	American pokeweed	Native	Forb/herb	–	–	–	–
Pinales	Pinaceae	<i>Pinus elliottii</i>	slash pine	Native	Tree	–	–	–	–

¹ Information obtained from the PLANTS database (USDA 2020)² Information obtained from the Florida Regulated Plant Index (FDACS 2018)

Table A-1 (continued). Vascular plant species present in nine vegetation monitoring plots within Fort Matanzas National Monument, June 2019.

Order	Family	Scientific Name	Common Name ¹	Native Status ¹	Growth Form ¹	Federal Noxious Status ¹	State Noxious Status ¹	Federal T/E Status ²	Florida T/E Status ²
Polypodiales	Polypodiaceae	<i>Pleopeltis michauxiana</i>	resurrection fern	Native	Forb/herb	—	—	—	—
Asterales	Asteraceae	<i>Pluchea odorata</i>	sweetscent	Native	Subshrub, Forb/herb	—	—	—	—
Cyperales	Poaceae	<i>Poaceae</i>	grass	Unknown	Graminoid	—	—	—	—
Fagales	Fagaceae	<i>Quercus chapmanii</i>	Chapman oak	Native	Tree, Shrub	—	—	—	—
Fagales	Fagaceae	<i>Quercus virginiana</i>	live oak	Native	Tree	—	—	—	—
Arecales	Arecaceae	<i>Sabal palmetto</i>	cabbage palmetto	Native	Tree	—	—	—	—
Gentianales	Gentianaceae	<i>Sabatia stellaris</i>	rose of Plymouth	Native	Forb/herb	—	—	—	—
Sapindales	Anacardiaceae	<i>Schinus terebinthifolia</i>	Brazilian peppertree	Non-native	Tree, Shrub	—	Yes	—	—
Arecales	Arecaceae	<i>Serenoa repens</i>	saw palmetto	Native	Tree, Shrub	—	—	—	Commercially Exploited
Ebenales	Sapotaceae	<i>Sideroxylon tenax</i>	tough bully	Native	Tree, Shrub	—	—	—	—
Liliales	Smilacaceae	<i>Smilax auriculata</i>	earleaf greenbrier	Native	Shrub, Vine	—	—	—	—
Solanales	Solanaceae	<i>Solanum carolinense</i>	Carolina horsenettle	Native	Subshrub, Forb/herb	—	—	—	—
Asterales	Asteraceae	<i>Solidago mexicana</i>	seaside goldenrod	Native	Forb/herb	—	—	—	—
Cyperales	Poaceae	<i>Spartina bakeri</i>	sand cordgrass	Native	Graminoid	—	—	—	—
Cyperales	Poaceae	<i>Sporobolus virginicus</i>	seashore dropseed	Native	Graminoid	—	—	—	—
Bromeliales	Bromeliaceae	<i>Tillandsia recurvata</i>	small ballmoss	Native	Forb/herb	—	—	—	—
Bromeliales	Bromeliaceae	<i>Tillandsia usneoides</i>	Spanish moss	Native	Vine, Forb/herb	—	—	—	—
Sapindales	Anacardiaceae	<i>Toxicodendron radicans</i> var. <i>radicans</i>	eastern poison ivy	Native	Forb/herb, Vine, Subshrub	—	—	—	—
Lamiales	Lamiaceae	<i>Trichostema species 2</i>	forked bluecurls	Native	Forb/herb	—	—	—	—
Cyperales	Poaceae	<i>Uniola paniculata</i>	seaoats	Native	Graminoid	—	—	—	—
Rhamnales	Vitaceae	<i>Vitis aestivalis</i> var. <i>aestivalis</i>	summer grape	Native	Vine	—	—	—	—
Liliales	Agavaceae	<i>Yucca aloifolia</i>	aloe yucca	Native	Tree, Shrub	—	—	—	—
Cycadales	Zamiaceae	<i>Zamia integrifolia</i> var. <i>umbrosa</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 2020)² Information obtained from the Florida Regulated Plant Index (FDACS 2018)

Appendix B. Species Diversity, Abundance, and Woody Stem Metrics Summarized by Broadly Defined Habitats at Fort Matanzas National Monument

Table B-1. Constancy and average cover class for all vascular plant species observed in nine Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MUFS = Maritime Upland Forests and Shrublands (five plots) and MOU = Maritime Open Uplands (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	MOU Constancy	MOU Cover
<i>Andropogon</i>	–	–	25	1
<i>Andropogon tenuispathus</i>	–	–	25	1
<i>Baccharis halimifolia</i>	60	2	25	2
<i>Buchnera floridana</i>	–	–	25	2
<i>Callicarpa americana</i>	80	2	–	–
<i>Celtis laevigata</i>	20	5	–	–
<i>Chamaecrista fasciculata</i>	–	–	25	4
<i>Chasmanthium laxum</i>	20	1	–	–
<i>Chenopodium album</i>	20	1	–	–
<i>Cirsium horridulum</i> var. <i>horridulum</i>	–	–	25	2
<i>Cnidoscolus stimulosus</i>	–	–	25	2
<i>Commelina erecta</i>	20	2	50	2
<i>Croton punctatus</i>	–	–	25	1
<i>Cyperaceae</i>	20	1	–	–
<i>Cyperus</i> sp. 1	20	1	75	2
<i>Cyperus</i> sp. 2	–	–	25	2
<i>Cyperus</i> sp. 3	–	–	25	1
<i>Dichanthelium</i>	20	1	–	–
<i>Eleocharis</i>	20	1	–	–
<i>Erechtites hieraciifolius</i>	80	2	–	–
<i>Erigeron pusillus</i>	–	–	50	2
<i>Erythrina herbacea</i>	20	1	–	–
<i>Eupatorium capillifolium</i>	60	4	–	–
<i>Euphorbia bombensis</i>	–	–	100	2
<i>Eustachys petraea</i>	–	–	50	2
<i>Forestiera segregata</i>	40	1	–	–
<i>Gaillardia pulchella</i>	–	–	50	3
<i>Galactia volubilis</i>	20	1	25	2
<i>Galium bermudense</i>	60	2	25	2
<i>Helianthus debilis</i> ssp. <i>debilis</i>	–	–	50	3
<i>Heterotheca subaxillaris</i>	–	–	75	3
<i>Hydrocotyle bonariensis</i>	20	2	50	2
<i>Hypericum gentianoides</i>	–	–	50	2
<i>Ilex vomitoria</i>	100	7	50	2
<i>Ipomoea</i>	40	2	–	–
<i>Ipomopsis rubra</i>	–	–	50	2
<i>Iva frutescens</i> var. <i>frutescens</i>	60	2	–	–
<i>Iva imbricata</i>	20	1	25	2
<i>Juniperus</i> [<i>silicicola</i> + <i>virginiana</i>]	80	5	25	2

Table B-1 (continued). Constancy and average cover class for all vascular plant species observed in nine Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MUFS = Maritime Upland Forests and Shrublands (five plots) and MOU = Maritime Open Uplands (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%. Natio ve, mendam qua pro,

Species	MUFS Constancy	MUFS Cover	MOU Constancy	MOU Cover
<i>Lepidium virginicum</i>	–	–	25	1
<i>Lythrum lineare</i>	–	–	25	1
<i>Mikania scandens</i>	40	2	25	2
<i>Monarda punctata</i> var. <i>punctata</i>	–	–	25	3
<i>Morella cerifera</i>	60	3	25	2
<i>Muhlenbergia sericea</i>	–	–	50	2
<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	40	5	–	–
<i>Oenothera humifusa</i>	–	–	50	2
<i>Oenothera laciniata</i>	20	1	–	–
<i>Oenothera simulans</i>	–	–	25	2
<i>Opuntia drummondii</i>	–	–	50	2
<i>Osmundastrum cinnamomeum</i>	20	2	–	–
<i>Oxalis corniculata</i>	20	1	–	–
<i>Panicum amarum</i>	–	–	25	2
<i>Parthenocissus quinquefolia</i>	40	2	–	–
<i>Paspalum</i>	–	–	25	2
<i>Paspalum notatum</i>	20	3	25	1
<i>Persea borbonia</i>	40	4	25	1
<i>Physalis walteri</i>	–	–	25	1
<i>Phytolacca americana</i>	–	–	25	2
<i>Pinus elliotii</i>	20	2	–	–
<i>Pleopeltis michauxiana</i>	20	1	–	–
<i>Pluchea odorata</i>	20	4	–	–
<i>Poaceae</i>	40	2	25	1
<i>Quercus chapmanii</i>	20	6	–	–
<i>Quercus virginiana</i>	40	4	–	–
<i>Sabal palmetto</i>	60	7	50	4
<i>Sabatia stellaris</i>	–	–	25	3
<i>Schinus terebinthifolia</i>	20	2	–	–
<i>Serenoa repens</i>	100	3	25	5
<i>Sideroxylon tenax</i>	20	1	50	–
<i>Smilax auriculata</i>	60	2	100	2
<i>Solanum carolinense</i>	20	1	–	–
<i>Solidago mexicana</i>	–	–	25	1
<i>Spartina bakeri</i>	20	2	–	–
<i>Sporobolus virginicus</i>	–	–	25	1
<i>Tillandsia recurvata</i>	20	1	–	–
<i>Tillandsia usneoides</i>	20	1	–	–
<i>Toxicodendron radicans</i> var. <i>radicans</i>	20	1	–	–
<i>Trichostema species 2</i>	–	–	25	1
<i>Uniola paniculata</i>	–	–	100	5
<i>Vitis aestivalis</i> var. <i>aestivalis</i>	60	1	–	–
<i>Yucca aloifolia</i>	60	2	–	–

Table B-1 (continued). Constancy and average cover class for all vascular plant species observed in nine Southeast Coast Network vegetation monitoring plots. Broad Habitat Type Codes are as follows: MUFS = Maritime Upland Forests and Shrublands (five plots) and MOU = Maritime Open Uplands (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	MOU Constancy	MOU Cover
<i>Zamia integrifolia</i> var. <i>umbrosa</i>	20	2	–	–
<i>Zanthoxylum clava-herculis</i>	20	2	25	4

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

Species	MUFS Tree BA	MUFS Tree DEN	MUFS Sapling BA	MUFS Sapling Den	MUFS Seedling Den	MOU Tree BA	MOU Tree DEN	MOU Sapling BA	MOU Sapling Den	MOU Seedling Den
<i>Baccharis halimifolia</i>	–	–	–	–	500	–	–	–	–	–
<i>Callicarpa americana</i>	–	–	0.00	50	2000	–	–	–	–	–
<i>Celtis laevigata</i>	0.40	5	–	–	--	–	–	–	–	–
<i>Ilex vomitoria</i>	0.44	40	3.73	4975	23000	–	–	–	–	–
<i>Iva frutescens</i> var. <i>frutescens</i>	–	–	0.01	125	750	–	–	–	–	–
<i>Juniperus [silicicola + virginiana]</i>	8.67	110	0.11	25	500	–	–	0.14	31	–
<i>Morella cerifera</i>	–	–	0.02	175	1250	–	–	–	–	–
<i>Muscadinia rotundifolia</i> var. <i>rotundifolia</i>	–	–	0.03	175	--	–	–	–	–	–
<i>Persea borbonia</i>	–	–	0.05	125	1250	–	–	–	–	313
<i>Quercus chapmanii</i>	–	–	–	–	7250	–	–	–	–	–
<i>Quercus virginiana</i>	0.22	15	0.11	25	5750	–	–	–	–	–
<i>Sabal palmetto</i>	27.53	240	1.78	2650	1500	8.51	38	0.08	313	313
<i>Serenoa repens</i>	–	–	0.42	1325	2750	–	–	0.22	906	–
<i>Sideroxylon tenax</i>	–	–	–	–	–	–	–	0.02	63	313
<i>Smilax auriculata</i>	–	–	0.02	175	–	–	–	0.00	94	1875
<i>Yucca aloifolia</i>	–	–	–	–	250	–	–	–	–	–
<i>Zanthoxylum clava-herculis</i>	0.07	5	–	–	–	–	–	–	–	–

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