National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Vegetation Mapping at Canaveral National Seashore

Photointerpretation Key and Final Vegetation Map

Natural Resource Report NPS/SECN/NRR—2020/2084



ON THE COVER
Southern edge of Mosquito Lagoon facing the Vehicle Assembly Building.
Photograph by: David L Cotten, February 2015

Vegetation Mapping at Canaveral National Seashore

Photointerpretation Key and Final Vegetation Map

Natural Resource Report NPS/SECN/NRR—2020/2084

David L. Cotten, Brandon P. Adams, Nancy K. O'Hare, Sergio Bernardes, Thomas R. Jordan, and Marguerite Madden

Center for Geospatial Research
Department of Geography
University of Georgia
Athens, Georgia 30606

February 2020

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

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

The Natural Resource Report Series is used to disseminate comprehensive information and analysis about natural resources and related topics concerning lands managed by the National Park Service. The series supports the advancement of science, informed decision-making, and the achievement of the National Park Service mission. The series also provides a forum for presenting more lengthy results that may not be accepted by publications with page limitations.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This report received formal peer review by subject-matter experts who were not directly involved in the development or pilot implementation of the project. Peer review was conducted by highly qualified individuals with subject area technical expertise and was overseen by a peer review manager.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This project was conducted under the Piedmont South Atlantic Cooperative Ecosystem Study Unit Cooperation Agreement Number P13AC00443 (Task Agreement P13AC01319).

This report is available in digital format from the Southeast Coast Network Website and the Natural Resource Publications Management website. If you have difficulty accessing information in this publication, particularly if using assistive technology, please email irma@nps.gov.

Please cite this publication as:

Cotton, D. L., B. P. Adams, N. K. O'Hare, S. Bernardes, T. R. Jordan, and M. Madden. 2020. Vegetation mapping at Canaveral National Seashore: Photointerpretation key and final vegetation map. Natural Resource Report NPS/SECN/NRR—2020/2084. National Park Service, Fort Collins, Colorado.

NPS 639/167042, February 2020

Contents

Page

Figures v

Tables ix

Appendices xiii

Executive Summary xv

Acknowledgments xvii

Introduction 1

Canaveral National Seashore Vegetation Mapping Project 1

Vegetation Mapping Inventory Program 1

NPS Southeast Coast Inventory and Monitoring Network 1

Location of Canaveral National Seashore 2

Vegetation Classification System 5

Vegetation Mapping Workflow 9

Base Data and GIS Geodatabase Construction 10

Initial Photointerpretation Key and Vegetation Delineation 13

Field Surveys and Ground Truthing 15

Photointerpretation and GIS Methods 18

Final Vegetation Mapping and Summary Statistics 19

Accuracy Assessment 33

Point Selection 33

Point Acquisition 33

Accuracy of Vegetation Map 33

Quality Assurance of AA Plots 35

Potential Improvements 36

Conclusion 41

Literature Cited 43

Figures

Page

Figure 1. Location of Canaveral National Seashore and its position relative to the State of Florida. 3

Figure 2. Foundation Geodatabase created for Canaveral National Seashore. 12

Figure 3. NatureServe vegetation plots, Park boundary, and 500-meter buffer for Canaveral National Seashore. 14

Figure 4. Field data collection locations from Canaveral National Seashore overlaid on CIR imagery and visual imagery. 17

Figure 5. Vegetation map of the Park and Buffer sections of Canaveral NS. 24

Figure 6. Park vegetation classes organized by relative size. 25

Figure 7. All park classes organized by relative size. 26

Figure 8. Buffer classes, excluding the Atlantic Ocean, organized by relative size found in Canaveral National Seashore. 30

Figure 9. Accuracy assessment plot locations for Canaveral NS. 34

Figure A-1. Index to Aerial Photography. 45

Figure D-1. Example of South Atlantic Coastal Shell Midden Woodland. 92

Figure D-2. Map showing South Atlantic Coastal Shell Midden Woodland (3525). 92

Figure D-3. Example of Beachberry—Sea-grape/Sea-oats Shrubland. 94

Figure D-4. Map showing Beachberry—Sea-grape/Sea-oats Shrubland. (3781). 94

Figure D-5. Example of Brazilian-pepper Seasonally Flooded Shrubland. 96

Figure D-6. Map showing Brazilian-pepper Seasonally Flooded Shrubland. (3799). 96

Figure D-7. Example of Atlantic Coast Interdune Swale. 97

Figure D-8. Map showing Atlantic Coast Interdune Swale (3839). 98

Figure D-9. Example of Central Florida Sawgrass Marsh. 99

Figure D-10. Map showing Central Florida Sawgrass Marsh (3940). 100

Figure D-11. Example of Elephantgrass Herbaceous Vegetation. 101

Figure D-12. Map showing Elephantgrass Herbaceous Vegetation (3960). 102

Figure D-13. Example of Southeast Florida Beach Dune. 103

Figures (continued)

Page

Figure D-14. Map showing Southeast Florida Beach Dune (4001). 103

Figure D-15. Example of Short-Spike Bluestem—Southern Umbrella-sedge—Longleaf Three-awn Herbaceous Vegetation. 105

Figure D-16. Map showing Short-Spike Bluestem—Southern Umbrella-sedge—Longleaf Three-awn Herbaceous Vegetation (4235). 105

Figure D-17. Example of Florida Swamp Privet Spoil Island. 106

Figure D-18. Map showing Florida Swamp Privet Spoil Island (4237). 107

Figure D-19. Example of Central Florida Willow Thicket. 108

Figure D-20. Map showing Central Florida Willow Thicket (4423). 109

Figure D-21. Example of Chainfern Small Depression Pond. 110

Figure D-22. Map showing Chainfern Small Depression Pond (4475). 111

Figure D-23. Example of Watershield Pond. 112

Figure D-24. Map showing Watershield Pond (4527). 113

Figure D-25. Example of Brazilian Beefwood Forest. 114

Figure D-26. Map showing Brazilian Beefwood Forest (4830). 115

Figure D-27. Example of St. Augustine Grass Herbaceous Vegetation. 116

Figure D-28. Map showing St. Augustine Grass Herbaceous Vegetation (4883). 116

Figure D-29. Example of Sand Live Oak—(Live Oak)/Saw Palmetto—Rusty Fetterbush Forest. 117

Figure D-30. Map showing Sand Live Oak—(Live Oak)/Saw Palmetto—Rusty Fetterbush Forest (7020). 118

Figure D-31. Example of Sand Laurel Oak/Greenbrier species Forest. 119

Figure D-32. Map showing Sand Laurel Oak/Greenbrier species Forest (7021) 120

Figure D-33. Example of Live Oak/Farkleberry—Yaupon forest. 121

Figure D-34. Map showing Live Oak/Farkleberry—Yaupon forest (7028). 121

Figure D-35. Example of Palmetto—Live Oak Hydric Hammock 123

Figure D-36. Map showing Palmetto—Live Oak Hydric Hammock (7040) 123

Figures (continued)

Page

Figure D-37. Example of Mid- to Late-Successional Slash Pine Managed Forest. 125

Figure D-38. Map showing Mid- to Late-Successional Slash Pine Managed Forest (7171). 125

Figure D-39. Example of Oak—Cabbage Hammock and Maritime Live Oak Hammock and Florida Atlantic Coastal Tropical/Temperate Maritime Hammock. 127

Figure D-40. Map showing Oak—Cabbage Hammock and Maritime Live Oak Hammock and Florida Atlantic Coastal Tropical/Temperate Maritime Hammock (21007). 128

Figure D-41. Example of Buttonwood/bush Forest and Central Florida Buttonbush Pond and Buttonwood Forest. 131

Figure D-42. Map showing Buttonwood/bush Forest and Central Florida Buttonbush Pond and Buttonwood Forest (21012). 131

Figure D-43. Example of Mangroves and Black Mangrove Forest and Red Mangrove Fringe Forest. 133

Figure D-44. Map showing Mangroves and Black Mangrove Forest & Red Mangrove Fringe Forest (21013). 134

Figure D-45. Example of Pine Woodlands Peninsular Florida Scrubby Flatwoods and Maritime Slash Pine Upland Flatwoods 135

Figure D-46. Map showing Pine Woodlands Peninsular Florida Scrubby Flatwoods and Maritime Slash Pine Upland Flatwoods (22003). 136

Figure D-47. Example of Wet Pine Woodlands and Wet Longleaf—Pond Pine Flatwoods and Slash Pine Flatwoods. 139

Figure D-48. Map showing Wet Pine Woodlands and Wet Longleaf—Pond Pine Flatwoods and Slash Pine Flatwoods (22004). 139

Figure D-49. Example of Cabbage—Saw Woodlands and Cabbage Palmetto Hydric Hammock Cabbage/Saw Palmetto Woodland. 142

Figure D-50. Map showing Cabbage—Saw Woodlands and Cabbage Palmetto Hydric Hammock Cabbage/Saw Palmetto Woodland (22006). 142

Figure D-51. Example of Oak-Palmetto Shrubland and Live Oak-Saw Palmetto—(Yaupon) Shrubland and Northeast Florida Coastal Scrub. 144

Figure D-52. Map showing Oak-Palmetto Shrubland and Live Oak-Saw Palmetto—(Yaupon) Shrubland and Northeast Florida Coastal Scrub (23006). 145

Figures (continued)

Page

Figure D-53. Example of Florida Coastal Strand and Florida Coastal Strand (Southern Atlantic Temperate Type) and Florida Coastal Strand (Temperate Palmetto Type). 147

Figure D-54. Map showing Florida Coastal Strand and Florida Coastal Strand (Southern Atlantic Temperate Type) and Florida Coastal Strand (Temperate Palmetto Type; 23010). 147

Figure D-55. Example of Natal—Guinea Grass and Natal Grass Herbaceous Vegetation and Guinea Grass Herbaceous Vegetation. 150

Figure D-56. Map showing Natal—Guinea Grass and Natal Grass Herbaceous Vegetation and Guinea Grass Herbaceous Vegetation (24002). 150

Figure D-57. Example of Cattails and South Florida Cattail Marsh and Broadleaf Cattail—Pickerelweed Herbaceous Vegetation. 152

Figure D-58. Map showing Cattails and South Florida Cattail Marsh and Broadleaf Cattail—Pickerelweed Herbaceous Vegetation (24010). 152

Figure D-59. Example of Saltwort/Saltgrass and Saltwort—Woody Glasswort Dwarf-shrubland and Salt Flat (Woody Glasswort Type) and Seaside Oxeye Tidal Shrub Flat and Saltgrass—(Saltmarsh Dropseed) Herbaceous Vegetation and Saltmarsh Dropseed—Saltgrass Herbaceous Vegetation and Crowngrass Interdune Swale. 154

Figure D-60. Map showing Saltwort/Saltgrass and Saltwort—Woody Glasswort Dwarf-shrubland and Salt Flat (Woody Glasswort Type) and Seaside Oxeye Tidal Shrub Flat and Saltgrass—(Saltmarsh Dropseed) Herbaceous Vegetation and Saltmarsh Dropseed—Saltgrass Herbaceous Vegetation and Crowngrass Interdune Swale (24018). 155

Figure D-61. Example of Spartina—Juncus and Sand Cordgrass Interdune Swale and Needlerush High Marsh and Sand Cordgrass—Seashore Mallow Herbaceous Vegetation. 158

Figure D-62. Map showing Spartina—Juncus and Sand Cordgrass Interdune Swale and Needlerush High Marsh and Sand Cordgrass—Seashore Mallow Herbaceous Vegetation (24020). 159

Tables

Page

Table 1. The 48 land cover classes found within the park area of Canaveral National Seashore during the initial assessment based on the National Vegetation Classification System. 6

Table 2. Data sets, descriptions, source, date, and scale imported into the Geodatabase. 11

Table 3. Field visits and number of data points collected for Canaveral National Seashore. 16

Table 4. Land cover classes found within the park area of Canaveral National Seashore based on the National Vegetation Classification System. 19

Table 5. Combined park classes found within the park area of Canaveral National Seashore based on the National Vegetation Classification System. 21

Table 6. Land cover/land use classes found within the buffer of Canaveral National Seashore. 22

Table 7. Modifiers used throughout the park area and buffer of Canaveral National Seashore. 23

Table 8. Community element global code (CEGL) classes, frequency of occurrence, mean area, total area, and percentage of total area within the park boundary of Canaveral National Seashore. 26

Table 9. Land use/land cover code, description, frequency of occurrence, mean area, total area, percentage of area (ha) not including the Atlantic Ocean, and percentage of total area (ha) within the buffer area of Canaveral National Seashore. 29

Table 10. Modifiers used throughout the park and buffer areas, including code, description, frequency of occurrence, mean area, and total area. 31

Table 11. Classes based on Community element global code (CEGL), frequency of occurrence, mean area, total area, and percentage total area for Canaveral National Seashore. 35

Table 12a. Confusion matrix for the accuracy assessment. 38

Table 12b. Accuracy and error for the confusion matrix. 39

Table B-1. NatureServe plots with coordinates, surveyor names, and classifications. 47

Table C-1. The Accuracy Assessment points were collected by I. Weber, J. Armstrong, J. Mansuetti, and N. Panico on behalf of Amec-Foster-Wheeler Environmental & Infrastructure, Inc. on October 3–5, 12–21, 24–28, 31, and November 1–2, 2016. 55

Tables (continued)

Page

Table D-1. Attributes and descriptions of South Atlantic Coastal Shell Midden Woodland. 91

Table D-2. Attributes and descriptions of Beachberry—Sea-grape/Sea-oats Shrubland. 93

Table D-3. Attributes and descriptions of Brazilian-pepper Seasonally Flooded Shrubland. 95

Table D-4. Attributes and descriptions of Atlantic Coast Interdune Swale. 97

Table D-5. Attributes and descriptions of Central Florida Sawgrass Marsh. 99

Table D-6. Attributes and descriptions of Elephantgrass Herbaceous Vegetation. 101

Table D-7. Attributes and descriptions of Southeast Florida Beach Dune. 102

Table D-8. Attributes and descriptions of Short-Spike Bluestem—Southern Umbrella-sedge—Longleaf Three-awn Herbaceous Vegetation. 104

Table D-9. Attributes and descriptions of Florida Swamp Privet Spoil Island. 106

Table D-10. Attributes and descriptions of Central Florida Willow Thicket. 108

Table D-11. Attributes and descriptions of Chainfern Small Depression Pond. 110

Table D-12. Attributes and descriptions of Watershield Pond. 112

Table D-13. Attributes and descriptions of Brazilian Beefwood Forest. 114

Table D-14. Attributes and descriptions of St. Augustine Grass Herbaceous Vegetation. 115

Table D-15. Attributes and descriptions of Sand Live Oak—(Live Oak)/Saw Palmetto—Rusty Fetterbush Forest. 117

Table D-16. Attributes and descriptions of Sand Laurel Oak/Greenbrier species Forest. 119

Table D-17. Attributes and descriptions of Live Oak/Farkleberry—Yaupon forest. 120

Table D-18. Attributes and descriptions of Palmetto—Live Oak Hydric Hammock. 122

Table D-19. Attributes and descriptions of Mid- to Late-Successional Slash Pine Managed Forest. 124

Table D-20. Attributes and descriptions of Oak—Cabbage Hammock and Maritime Live Oak Hammock and Florida Atlantic Coastal Tropical/Temperate Maritime Hammock. 126

Table D-21. Attributes and descriptions of Buttonwood/bush Forest and Central Florida Buttonbush Pond and Buttonwood Forest. 130

Tables (continued)

Page

Table D-22. Attributes and descriptions of Mangroves and Black Mangrove Forest and Red Mangrove Fringe Forest. 133

Table D-23. Attributes and descriptions of Pine Woodlands Peninsular Florida Scrubby Flatwoods and Maritime Slash Pine Upland Flatwoods. 135

Table D-24. Attributes and descriptions of Wet Pine Woodlands and Wet Longleaf—Pond Pine Flatwoods and Slash Pine Flatwoods. 138

Table D-25. Attributes and descriptions of Cabbage—Saw Woodlands and Cabbage Palmetto Hydric Hammock Cabbage/Saw Palmetto Woodland. 141

Table D-26. Attributes and descriptions of Oak-Palmetto Shrubland and Live Oak-Saw Palmetto—(Yaupon) Shrubland and Northeast Florida Coastal Scrub 144

Table D-27. Attributes and descriptions of Florida Coastal Strand and Florida Coastal Strand (Southern Atlantic Temperate Type) and Florida Coastal Strand (Temperate Palmetto Type). 146

Table D-28. Attributes and descriptions of Natal—Guinea Grass and Natal Grass Herbaceous Vegetation and Guinea Grass Herbaceous Vegetation. 149

Table D-29. Attributes and descriptions of Cattails and South Florida Cattail Marsh and Broadleaf Cattail—Pickerelweed Herbaceous Vegetation. 151

Table D-30. Attributes and descriptions of Saltwort/Saltgrass and Saltwort—Woody Glasswort Dwarf-shrubland and Salt Flat (Woody Glasswort Type) and Seaside Oxeye Tidal Shrub Flat and Saltgrass—(Saltmarsh Dropseed) Herbaceous Vegetation and Saltmarsh Dropseed—Saltgrass Herbaceous Vegetation and Crowngrass Interdune Swale. 153

Table D-31. Attributes and descriptions of Spartina—Juncus and Sand Cordgrass Interdune Swale and Needlerush High Marsh and Sand Cordgrass—Seashore Mallow Herbaceous Vegetation. 158

Appendices

Page

Appendix A. Flight Line 45

Appendix B. NatureServe Plot Locations 47

Appendix C. Accuracy Assessment Plot Notes 55

Appendix D. Photointerpretation Key 91

Executive Summary

The University of Georgia Department of Geography's Center for Geospatial Research (CGR), with the support of the National Park Service (NPS) Vegetation Mapping Inventory (VMI) Program, described and mapped vegetation at Canaveral National Seashore (CANA). This mapping effort was accomplished through collaboration with the NPS Southeast Coast Network (SECN), the North Carolina office of NatureServe (Durham, N.C.), and Amec-Foster-Wheeler Environmental & Infrastructure, Inc.

The area included in Canaveral National Seashore has been used by humans for over 4,000 years (Parker 2008). The seashore's existence and preservation today can be attributed to the United States aerospace program because it originated out of lands acquired by the Federal government to support the facilities designated for the nation's aerospace program. The lands surrounding the aerospace facilities at Cape Canaveral were acquired to provide safety and security to both the public and the government facilities. Currently the seashore covers an area roughly 58,807 acres (23,799 hectares [ha]) in size.

Through the use of NatureServe vegetation plots, aerial photos, and data collected in the field, vegetation communities were delineated and assigned attributes. Using dominant vegetation classes and secondary vegetation classes as well as modifiers to describe the diversity of species, detailed vegetation maps were created for Canaveral National Seashore, both inside the seashore and within a 500-meter (1,640-foot [ft]) buffer. The buffer polygons and attributes were created on a broader scale using a system based on the Anderson Level II classification scheme, which includes anthropogenic and land use/land cover (LULC) classes. Within the seashore, the more detailed community element global (CEGL) codes were used.

A final vegetation map for Canaveral NS was created to represent the vegetation occurring within the park during 2012. This product represents the final of four steps necessary to produce an accurate vegetation map based upon aerial photographs. This includes the determination of the community element global (CEGL) codes (2008) and acquisition of aerial imagery (2012), using the aerial imagery, with five ground truthing points (2014), to create a draft vegetation map, performing an accuracy assessment (2016), and then using all the available information to create a final vegetation map.

Because of the extensive coverage of the park and the wide range of vegetation classes from saltwater marshes to upland forests to freshwater wetlands including fire managed areas, using the National Vegetation Classification System (NVCS) to the association level was challenging. Determining community element global (CEGL) codes was particularly difficult because NVCS was designed for ground based classification. Some classes were indistinguishable from each other when using aerial photos and other areas contained classes that changed from the time NatureServe did their vegetation surveys to the time aerial images were acquired and some locations had changed classes again by the time we were able to perform our ground surveys. Because of these difficulties some classes were grouped together that were indistinguishable from aerial photos. Through the use of NatureServe vegetation plots, aerial photos, and data collected in the field, vegetation

communities were delineated and assigned attributes. Using dominant vegetation classes and modifiers to describe the diversity of species, detailed vegetation maps were created for Canaveral NS, both inside the seashore and within a 500-meter (1,640-ft) buffer. The buffer polygons and attributes were created on a broader scale using a system based on the Anderson Level II classification scheme and the Florida Land Cover Classification System (FLDCS), which includes anthropogenic and land use/land cover (LULC) classes. While within the seashore, the more detailed CEGL codes were used.

Over 68% of Canaveral National Seashore's (CANA) area is open-water, with the Atlantic Ocean making up 13.4% of that open-water area. The most common vegetation class found in the seashore is Mangroves (21013), covering approximately 5% of total park area, and 16% of the vegetated area in the park. The second most common class, Oak-Palmetto Shrubland (23006), was nearly equal, representing15% of vegetated area within the park. Pine woodlands (7750 and 4658), Oak—Cabbage Hammock (7032 and 7033), and Salt wort—Salt grass (3956, 2278, 3824, 7694, 7663, and 4114) are the only other classes representing greater than 10% of the total vegetative cover (14%, 13%, and 13%, respectively). While a total of thirty-eight individual vegetation classes were identified; the five above mentioned, dominant classes represent more than 70% of vegetation cover at Canaveral NS. A rigorous accuracy assessment was conducted on the map classes identified within the boundary of the seashore representing floristic types within the National Vegetation Classification System. This accuracy assessment determined a 70% accuracy and a kappa rating of 67% using the 427 different accuracy assessment plots.

The products generated from this project include vegetation maps, a photointerpretation key, summary statistics of each vegetation class, and a detailed geodatabase with digital maps.

Acknowledgments

We would like to thank the CANA staff for helping us with this project. They provided us with information regarding the historical context of the park, the presence of exotics, current management practices, and access to restricted areas.

Kristen Kneifl, Canaveral National Seashore Resource Management Specialist, provided us keys to access areas off limits to the public, thus making some of our ground truthing sites more accessible.

Doug Mullan, law enforcement officer, provided our team much needed boat access to the numerous islands located with Mosquito Lagoon.

Introduction

Canaveral National Seashore Vegetation Mapping Project

As part of the National Park Service (NPS) Vegetation Inventory Program (Schmoldt et al. 1994; Fancy et al. 2009), The University of Georgia Center for Geospatial Research (CGR) in the Department of Geography was asked to produce vegetation maps of eight park units in the NPS Inventory and Monitoring Program Southeast Coast Network (SECN) using mapping standards defined under the National Vegetation Classification System (NVCS; Jennings et al. 2009). Under Task Agreement # P13AC01319, CGR agreed to analyze existing leaf-on color infrared (CIR) aerial photography to develop photointerpretation keys, accuracy assessment study plans, final digital maps of vegetation, geodatabases and associated metadata in accordance with NPS vegetation mapping standards, and field verification surveys in accordance with standard mapping practices. The Canaveral National Seashore (CANA) Vegetation Mapping project was coordinated by the University of Georgia Center for Geospatial Research (CGR) in the Department of Geography between 2014 and 2018, with assistance from the NPS Southeast Coast Network (SECN), the North Carolina (Durham) office of NatureServe (for the vegetation classification portion of the project), and Amec-Foster-Wheeler Environmental & Infrastructure, Inc. (for accuracy assessment).

While the National Vegetation Classification System intends to capture stable vegetation categories, either man-made or natural disturbances may change some areas during the eight years required to produce a vegetation map, from determining the community element global (CEGL) codes (2008) and acquiring aerial imagery (2012) to performing an accuracy assessment (2016). For example, changes in non-tree dominated areas, which are typically wetlands in this region, may shift annually depending upon local weather, or cover by invasive exotics may change rapidly. More importantly, both of these natural and anthropogenic changes will likely continue in the future. Therefore, the vegetation map should be evaluated as a snapshot of the park in 2012.

Vegetation Mapping Inventory Program

The Vegetation Mapping Inventory (VMI) Program is an effort by the NPS to classify, describe, inventory, and map vegetation communities in more than 280 national park units across the United States. The primary objective of the Vegetation Mapping Inventory Program is to produce high-quality, standardized maps and associated data sets of vegetation and other land-cover occurring within parks. Since vegetation species and communities are unique from park to park, the inventory of these resources assists park managers on a wide array of management issues. For more information about the Vegetation Mapping Inventory Program, visit the program website (see NPS 2019a).

NPS Southeast Coast Inventory and Monitoring Network

National Park managers across the country need a broad-based understanding about the status and trends of park natural resources. The NPS Inventory and Monitoring Division (IMD) systematically gathers and analyzes information on the plants, animals, and ecosystems that are within parks. Parks use this information for planning, research, education, and to help guide decisions related to park management. Results are also shared widely with other agencies, researchers, and scientists. The

IMD staff and networks share a set of common goals, established when the division was first launched:

- Inventory the natural resources under NPS stewardship to determine their nature and status.
- Monitor park ecosystems to better understand their dynamic nature and condition and to provide reference points for comparisons with other, altered environments.
- Establish natural resource inventory and monitoring as a standard practice throughout the National Park system that transcends traditional program, activity, and funding boundaries.
- Integrate natural resource inventory and monitoring information into NPS planning, management, and decision making.
- Share NPS accomplishments and information with other natural resource organizations and form partnerships for attaining common goals and objectives.

To accomplish these goals, more than 280 parks with significant natural resources were grouped into the 32 IMD networks, which were determined based on geography and shared natural resource characteristics. The network organization increases collaboration among parks, information sharing, and economies of scale in natural resource inventory and monitoring (NPS 2019b).

The Southeast Coast Network (SECN) includes 17 parks with significant natural resources, in 15 administrative units. SECN extends along the Atlantic Coast from the North Carolina-Virginia border southward to Cape Canaveral, Florida and inland to Atlanta, Georgia and the Alabama Coastal Plain. The network's purpose is to provide parks with data and information about their natural resources, and to help with information sharing in natural resource monitoring (NPS 2019c).

Location of Canaveral National Seashore

Canaveral National Seashore (CANA) is located on the eastern coast of Florida making up 24 miles (38.6 kilometers [km]) of its border with the Atlantic Ocean (Figure 1). Over 120 archeological sites have been found within the park dating back as far as 4,000 years (Parker 2008). The boundary of the park encompasses approximately 23,798 hectares (58,807 acres [ac]) and was originally part of land set aside by the United States government for the aerospace program. The southwestern side of the park is bordered by the Merritt Island National Wildlife Refuge. The seashore encompasses two different climate zones because it is located where the semi-tropical climate zone meets the temperate climate zone (CANA 2000). This was evident because certain species were only seen in the southern portion of the park surrounding the lagoon but not in the northern part with similar land cover.

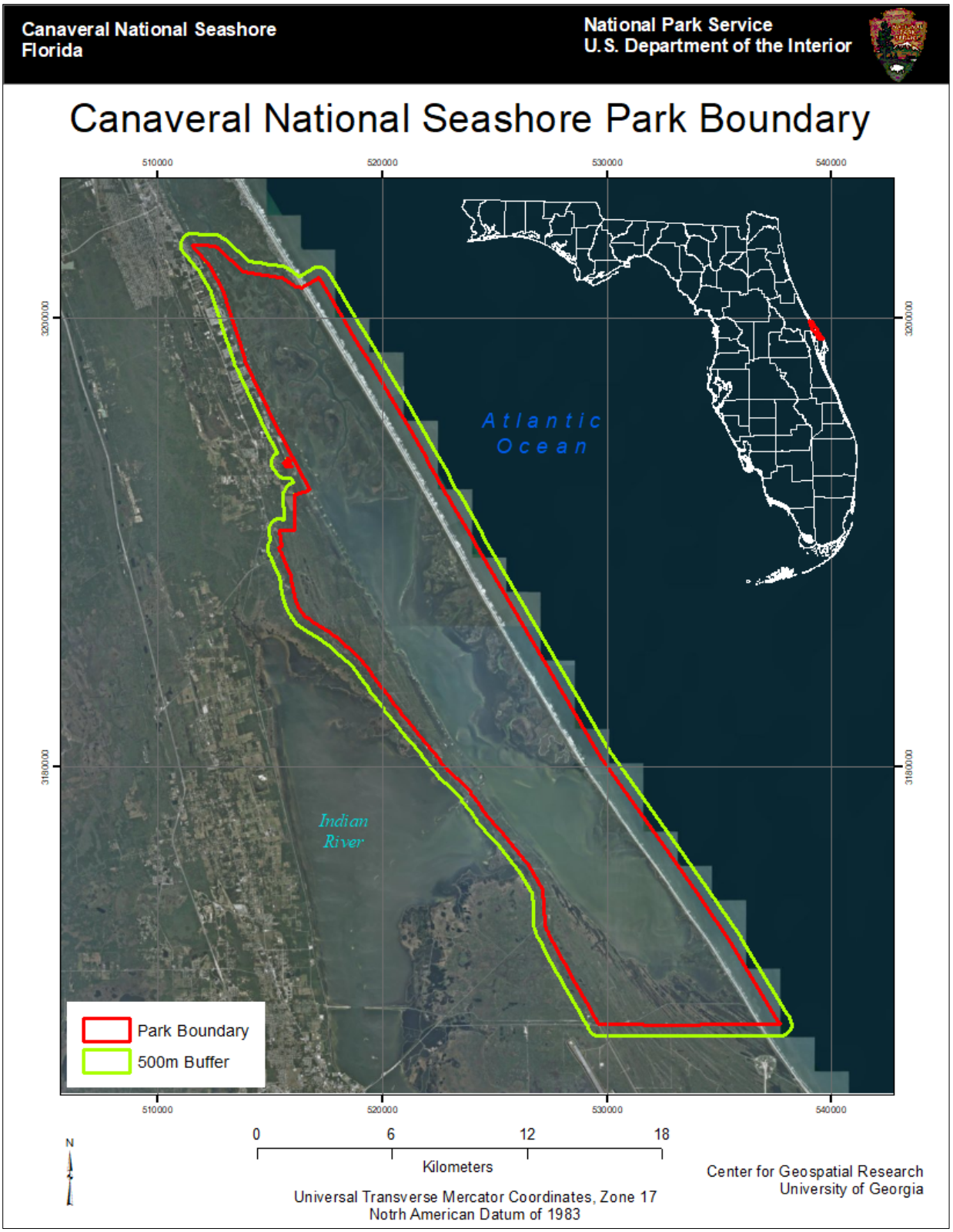


Figure 1. Location of Canaveral National Seashore and its position relative to the State of Florida.

The most visible feature within the seashore is Mosquito Lagoon, with its many spoil islands, which reaches from the farthest northern extents of the park to within a just few hundred meters of the southern border. The western region of the park also contains a portion of the Intracoastal Waterway which follows the Indian River south through the park for approximately 16 miles (25.7 km), before exiting the park.

Canaveral National Seashore averaged around 1,000,000 visitors per year from 2006–2013 with 2014 and 2015 showing an increase in visitors to about 1,500,000 visitors per year (NPS Stats 2019).

Vegetation Classification System

The task agreement for mapping required that the National Vegetation Classification System (NVCS) be used for areas inside each park. The NVCS was developed by the Nature Conservancy (Anderson et al. 1998; Grossman et al. 1998). It is primarily based upon vegetation rather than climatic or edaphic factors. It emphasizes the existing natural vegetation and recognizes that vegetation communities form a continuum. The system has seven hierarchical levels so that vegetation can be described at multiple scales, depending upon the amount of information available. Higher levels can be broken down to lower levels as more information is available; conversely, lower levels can be aggregated to upper levels. The five upper levels (formation class, formation subclass, formation group, formation subgroup, and formation) describe vegetation physiognomy rather than actual species composition and are a modification of the UNESCO World Physiognomic Classification of Vegetation (UNESCO 1973). The two lowest levels (the alliance and association) are determined by floristic composition. The alliance level is determined by the species composition of the dominant or diagnostic species in the most prevalent stratum. A diagnostic species does not have to be dominant. For example, *Juniperus virginiana* (red cedar) is a characteristic species found in the Palmetto-Live Oak Hydric Hammock but is not a dominant species.

The association level is determined by diagnostic species in all strata (tree canopy, subcanopy, tall-shrub, short-shrub, herbaceous, non-vascular, vine/liana, and epiphyte), recognizing that each of these stratums may not occur in every association. The tallest stratum may not be the diagnostic/dominant stratum. The association level is assigned a unique community element global code (CEGL). The CEGL code for the vegetation association is the target vegetation classification specified in the task agreement.

The dominant species in the tallest stratum are always visible in leaf-on aerial photographs. If the tallest stratum is dense, with a closed canopy, then the shorter subcanopy and understory layers are obstructed from the camera's view and are not visible. In vegetation communities where the tallest stratum is open, other strata will be visible in the aerial photograph. In some cases, a CEGL code can be determined solely by identifying its location (e.g., on a spoil island or along the coast) and viewing the uppermost stratum. In other cases, a lower stratum (or strata) not visible in the aerial photography must be used to determine CEGL code. In such cases, it is impossible to use only aerial photographs recorded during leaf-on conditions to accurately determine the NVCS code at the association level. If it was not possible to determine the association-level class, a second vegetation was assigned as a supplement to the dominant vegetation code. This is most evident for some of the dwarf shrub lands and herbaceous vegetation, which were indistinguishable from satellite imagery.

Prior to the University of Georgia Center for Geospatial Research's photointerpretation, NatureServe conducted field surveys in accordance with standard practices (Jennings et al. 2009) to create a list of NVCS CEGL codes for Canaveral NS, see Table 1 (NatureServe 2009). Their detailed report includes a dichotomous key for separating the CEGL codes described for the seashore. Many of the couplets in the dichotomous key relied upon differences in the dominant vegetation in the tallest stratum or the presence or absence of diagnostic species. However, some couplets relied upon lower

strata which may not be evident in the aerial photographs and/or edaphic factors[1] (e.g. soil pH) which would not be evident in leaf-on CIR photographs. The NatureServe report also includes comprehensive descriptions of diagnostic species for each CEGL, and additional information on both the global and local expressions of the vegetation community type.

Table 1. The 48 land cover classes found within the park area of Canaveral National Seashore during the initial assessment based on the National Vegetation Classification System.

Code	Description
2278	Salt Flat (Woody Glasswort Type)
3525	South Atlantic Coastal Shell Midden Woodland
3527	Cabbage Palmetto Hydric Hammock
3643	Slash Pine Flatwoods
3781	Beachberry-Sea grape/Sea-oats Shrubland
3796	Cabbage Palmetto/Saw Palmetto Woodland
3799	Brazilian-pepper Seasonally Flooded Shrubland
3811	Florida Coastal Strand (Southern Atlantic Temperate)
3812	Florida Coastal Strand (Temperate Palmetto)
3821	Northeast Florida Coastal Scrub
3824	Seaside Oxeye Tidal Shrub Flat
3839	Atlantic Coast Interdune Swale
3940	Central Florida Sawgrass Marsh
3956	Saltwort - Woody Glasswort Dwarf-shrubland
3960	Elephantgrass Herbaceous Vegetation
3988	South Florida Cattail Marsh
4001	Southeast Florida Beach Dune
4114	Crowngrass Interdune Swale
4186	Needlerush High Marsh
4194	Sand Cordgrass - Seashore Mallow Herbaceous Vegetation
4235	Short-spike Bluestem-Southern Umbrella-sedge–Longleaf Three-awn Herbaceous Vegetation
4237	Florida Swamp Privet Spoil Island

[1] Vegetation tends to reflect edaphic factors. Yet if the indicator vegetation is not visible in the aerial photograph, edaphic factors cannot be inferred.

Table 1 (continued). The 48 land cover classes found within the park area of Canaveral National Seashore during the initial assessment based on the National Vegetation Classification System.

Code	Description
4241	Live Oak - Saw Palmetto – (Yaupon) Shrubland
4423	Central Florida Willow Thicket
4457	Central Florida Buttonbush Pond
4462	Broadleaf Cattail – Pickerelweed Herbaceous Vegetation
4475	Chainfern Small Depression Pond
4511	Sand Cordgrass Interdune Swale
4527	Watershield Pond
4658	Maritime Slash Pine Upland Flatwoods
4764	Red Mangrove Fringe Forest
4791	Wet Slash - Pond Pine Flatwoods
4827	Black Mangrove Forest
4830	Brazilian Beefwood Forest
4883	St. Augustine Grass Herbaceous Vegetation
7020	Southeastern Florida Maritime Hammock
7021	Sand Laurel Oak / Greenbrier species Forest
7028	Xeric Live Oak Hammock
7032	Maritime Live Oak Hammock
7033	Florida Atlantic Coastal Tropical/Temperate Maritime Hammock
7040	Palmetto - Live Oak Hydric Hammock
7171	Mid-Late Successional Slash Pine Managed Forest
7600	Buttonwood Forest
7653	Guinea Grass Herbaceous Vegetation
7654	Natal Grass Herbaceous Vegetation
7663	Saltmarsh Dropseed-Saltgrass Herbaceous Vegetation
7694	Saltgrass-(Saltmarsh Dropseed) Herbaceous Vegetation
7750	Peninsular Florida Scrubby Flatwoods

In general, the NVCS is best suited to natural or semi-natural vegetation communities that have been relatively undisturbed long enough for vegetation communities to develop in accordance with the environmental and climatic conditions of the site (Anderson et al. 1998; Grossman et al. 1998). Areas that are regularly or extensively disturbed by fire or human activities are not easily classified with the

NVCS. For this reason, the University of Georgia Department of Geography's Center for Geospatial Research augmented the NVCS classes identified by NatureServe as occurring in Canaveral NS to include additional disturbed modified classes, along with alphanumerical modifiers to provide detailed information to users of the vegetation databases and maps. Modifiers to the NVCS classes reflected variations of a particular NVCS class that are characteristic for the local site, but atypical of the global NVCS description. Additionally, due to the dynamic nature of particular vegetation communities some NVCS classes had to be grouped together. This became evident when particular NatureServe plots did not match the vegetation on the ground during our field work. Specifically, locations dominated by *Distichlis spicata*, *Sporobolus virginicus*, *Paspalum vaginatum*, *Batis maritima*, and *Sarcocornia perennis* had vegetation plots that did not match with aerial photos and aerial photos that did not match our field work. The classes dominated by these species were grouped together based on the dynamic nature of the vegetation, i.e., changing dominance from season to season.

The task agreement also required mapping a 500-meter (1,640-ft) buffer around each park. The buffer area contained extensive areas of human influence; consequently, the NVCS system was not applicable. Buffer areas were therefore mapped using guidelines derived from the Anderson Level II classification system in conjunction with the locally derived Florida Land Cover Classification System (FLDCS), which includes human influences and water categories (Anderson et al. 1976; Kawula 2009). Modifiers were also greatly utilized within the buffer to increase the knowledge base about what LULC categories surround Canaveral NS, though different modifiers were generally used in the buffer compared to within the seashore.

In summary, Canaveral NS was mapped to the association (CEGL) level of the NVCS when possible. Otherwise a combination of CEGL classes were used to describe certain species that were indistinguishable from each other when using photo interpretation, i.e. 24020— Spartina-Juncus represents a combination of Sand Cordgrass Interdune Swale (CEGL004511), Sand Cordgrass—Seashore Mallow Herbaceous Vegetation (CEGL004194), and Needlerush High Marsh (CEGL004186). The buffer area was more appropriately mapped using Anderson Level II/FLDCS guidelines. Modifiers to these classification systems were used, as appropriate, to ensure a meaningful classification system for this particular park, i.e. burn was used to modify areas of the park that were recently burned.

Vegetation Mapping Workflow

The general workflow for this vegetation mapping followed a series of steps, including:

1. Define CEGL codes within the study area based upon plot-level ground data (completed by NatureServe)

2. Contact park staff to discuss their needs and concerns as applicable to the final vegetation map, obtain any existing background information on management activities to include in a GIS database (see below), and arrange access

3. Collect base data and construct a GIS foundation geodatabase

    a. Collect and inventory the aerial photographs

    b. If needed, scan and orthorectify the aerial photographs

    c. Obtain available GIS layers on exotic plant removal or prescribed burns that may affect vegetation communities

4. Create an initial photointerpretation key

    a. Overlay NatureServe Vegetation Survey points on photos

    b. Examine photos to understand signatures of vegetation communities as identified by ELCodes or CEGL number

5. Perform initial delineation of vegetation communities on CIR aerial photographs, supplemented by other leaf-off imagery using photointerpretation from both stereo-pairs and 2D imagery by heads-up GIS methods

    a. Identify spectral signatures dissimilar to the example spectral signatures around the NatureServe ground plots so that vegetation can be evaluated in field visits

6. Field visits

    a. Schedule field trips to the site to visit specific areas where questions exist

    b. Verify vegetation communities present

    c. Reconcile photo signature with NatureServe CEGL code

    d. Refine classification as necessary with reference to field work and ongoing communication with park staff regarding results

    e. If needed, assign additional CEGL numbers or combine certain CEGL numbers if specific classes exist within the park that were not discovered by the NatureServe Vegetation Survey or were indiscernible through aerial interpretation

7. Refine and extend photointerpretation key and delineation of polygons
    a. As needed, print photos and vegetation polygons for review and refinement
8. Prepare draft deliverable products
    a. Prepare draft GIS files
    b. Clean up line work and attribute tables
    c. Compute statistics for vegetation polygons
    d. Prepare metadata for vegetation polygon files
    e. Finalize photointerpretation keys
9. Accuracy Assessment
    a. Using accuracy assessment guidelines points are chosen for a separate team to visit and quantify
    b. Overlay Accuracy Assessment data points on photos and draft vegetation maps
    c. Calculate percent accuracy and kappa for the polygons
10. Prepare final deliverable products
    a. Prepare final GIS files
    b. Clean up line work and attribute tables using accuracy assessment data as a guide
    c. Compute statistics for vegetation polygons
    d. Prepare metadata for vegetation polygon files
    e. Finalize photointerpretation keys

Note that steps 4–7 reflect an iterative, rather than a linear, process. Steps 1, 2, and 3 are self-explanatory; the detailed workflow for the other steps, as pertains to the mapping of Canaveral National Seashore, is described below.

Base Data and GIS Geodatabase Construction

Relevant publicly available GIS data sets that cover the study area were downloaded and archived on a local server in the University of Georgia Center for Geospatial Research. Data sets include roads, hydrology, boundary files (political and NPS), digital elevation models (DEMs), and additional aerial photographs. These data are available from sources such as the NPS Integrated Resource Management Applications (IRMA) portal, the Florida Geographic Data Library, the U.S. Geological Survey National Map, and the National Oceanic and Atmospheric Administration (NOAA) Digital Coast websites. The data sets used to populate the foundation GIS database were from different

sources, compiled for different reasons, and may not be in the same map projection. The task agreement specified that the spatial data be projected to the Universal Transverse Mercator (UTM) Coordinate System, North American Datum of 1983 (NAD83). Where necessary, datasets were projected to UTM Zone 17. Finally, a geodatabase in ArcGIS 10.2 format was created as a container to store and organize the data. See Table 2 and Figure 2 for details of this database.

Color infrared (CIR) aerial photographs of the park at 1:12,000 scale were acquired by Aero-Metric, Inc. on May 11–12, 2012. These photos were scanned and converted to digital orthophotographs at 0.3-meter (1-ft) resolution before they were delivered to the National Park Service. Digital orthophotographs and hardcopy photographs in both film transparency and paper print formats were provided to the University of Georgia Center for Geospatial Research. A total of 165 photos in five flight lines were required to cover Canaveral National Seashore (see Appendix A).

The mapping area was split in two sections: park and buffer. The park was defined as the area within the prescribed seashore boundaries while the buffer pertained to the region within 500 meters (1,640 ft) outside of the seashore boundary. Detailed vegetation mapping using CEGL codes was performed within the park whereas more general mapping using a revised Anderson-type II hierarchical classification scheme in conjunction with the locally derived Florida Land Cover Classification System (FLDCS) was used in the buffer area.

Table 2. Data sets, descriptions, source, date, and scale imported into the Geodatabase.

Dataset	Description	Source	Date	Scale/Resolution
County Boundary	Outline of St. Johns	US Census Bureau via FGDL	2011	n/a
Park Boundary	Outline of CASA	NPS via FGDL	2012	n/a
Parcels	Florida Parcel Data by County	FDOR via FGDL	2014	n/a
Vegetation Plots	Sample Vegetation Locations	NatureServe	2006-07	n/a
DEM	30-m resolution USGS Digital Elevation Model	University of Florida GeoPlan Center via FGDL	2012	15 meters
Color Infrared Imagery	Color Infrared Imagery	Aero-Metrics via NPS	2012	1 foot
True Color Imagery	True Color Imagery	FDOT	2010	1 foot
True Color Imagery	True Color Imagery	FDOT	2014	0.8 feet
NAIP Imagery	National Agriculture Imagery Program	USDA via FGDL	2010	1 meter

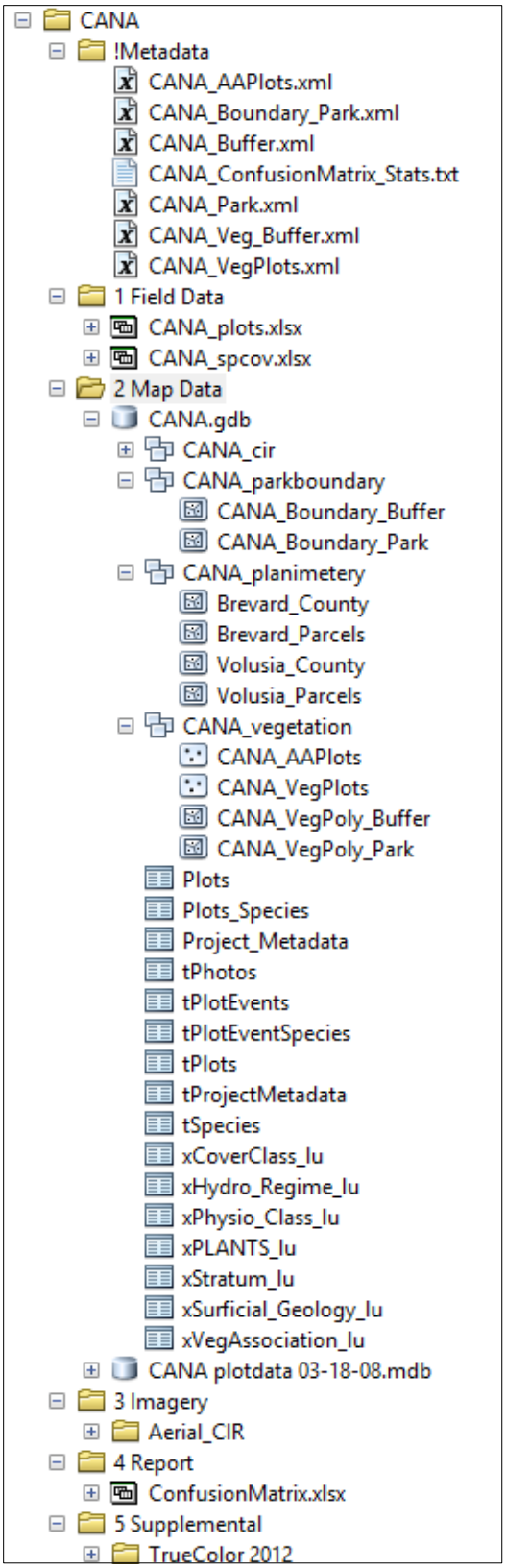


Figure 2. Foundation Geodatabase created for Canaveral National Seashore.

Initial Photointerpretation Key and Vegetation Delineation

Classifying the different vegetation communities within the park was aided by a photointerpretation key. The initial photointerpretation key was based upon the NVCS vegetation classes at the association level. These associates were determined by NatureServe through independent plot level vegetation surveys in accordance with standard NVCS field methods (Jennings et al. 2009). Plot sizes in Canaveral NS ranged in size between 100 and 1,000 square meters (1,076 and 10,764 square miles [sq mi]). Plot level species presence or abundance was used to assign a four-digit CEGL number. The results of the survey are reported as a list of point locations and CEGL codes, as well as descriptions and field notes (Figure 3; Appendix B). The vegetation associations for Canaveral NS were determined by NatureServe from 128 plots. The University of Georgia Center for Geospatial Research visited 389 points to interpret the CIR signatures of these vegetation associations to delineate vegetation. The accuracy assessment of The University of Georgia Center for Geospatial Research's vegetation map was performed by Amec-Foster-Wheeler Environmental & Infrastructure, Inc. and included 582 accuracy assessment plots (Appendix C).

The NatureServe vegetation plot points were overlaid on the CIR aerial photographs and the photo signature was examined. Most CEGL codes were represented at least once in the park, however some were not sampled at all. Still others were represented by multiple point locations. As a result, multiple signatures exist for these codes. The NVCS recognizes that vegetation communities form a continuum both within and between CEGL codes; spectral signatures are also likely to reflect this natural variation.

The photointerpretation key was developed to assist in the extension of the signatures at the plot level to the remainder of the park. The key noted color, tree crown shapes and sizes, texture, context, and any other characteristics that could help to differentiate one community from the others on the spectral signature of the leaf-on CIR aerial photography. The orthophotographs were examined on-screen in heads-up mode using the ArcGIS software. Where needed, the hardcopy photographs were viewed in stereo/3D using a light table and a mirror stereoscope. This method is excellent for using relative heights of the trees and terrain to assist in determining the vegetation community and to delineate the boundaries of the individual features.

This key was later reduced to better represent the new group classes consisting of indistinguishable vegetation types. The final key for Canaveral NS was reduced from 48 classes provided by NatureServe to a total of 31 categories based on visual cues found in the CIR imagery and data collected in the field (Appendix D). 19 The CEGL codes were kept as individual classes while 12 represent combined classes based on the indistinguishability of the original CEGL codes using photointerpretation techniques, i.e. Maritime Live Oak Hammock (CEGL007032) and Florida Atlantic Coastal Tropical/Temperate Maritime Hammock (CEGL007033) were reclassified as Oak-Cabbage Hammock (21007).

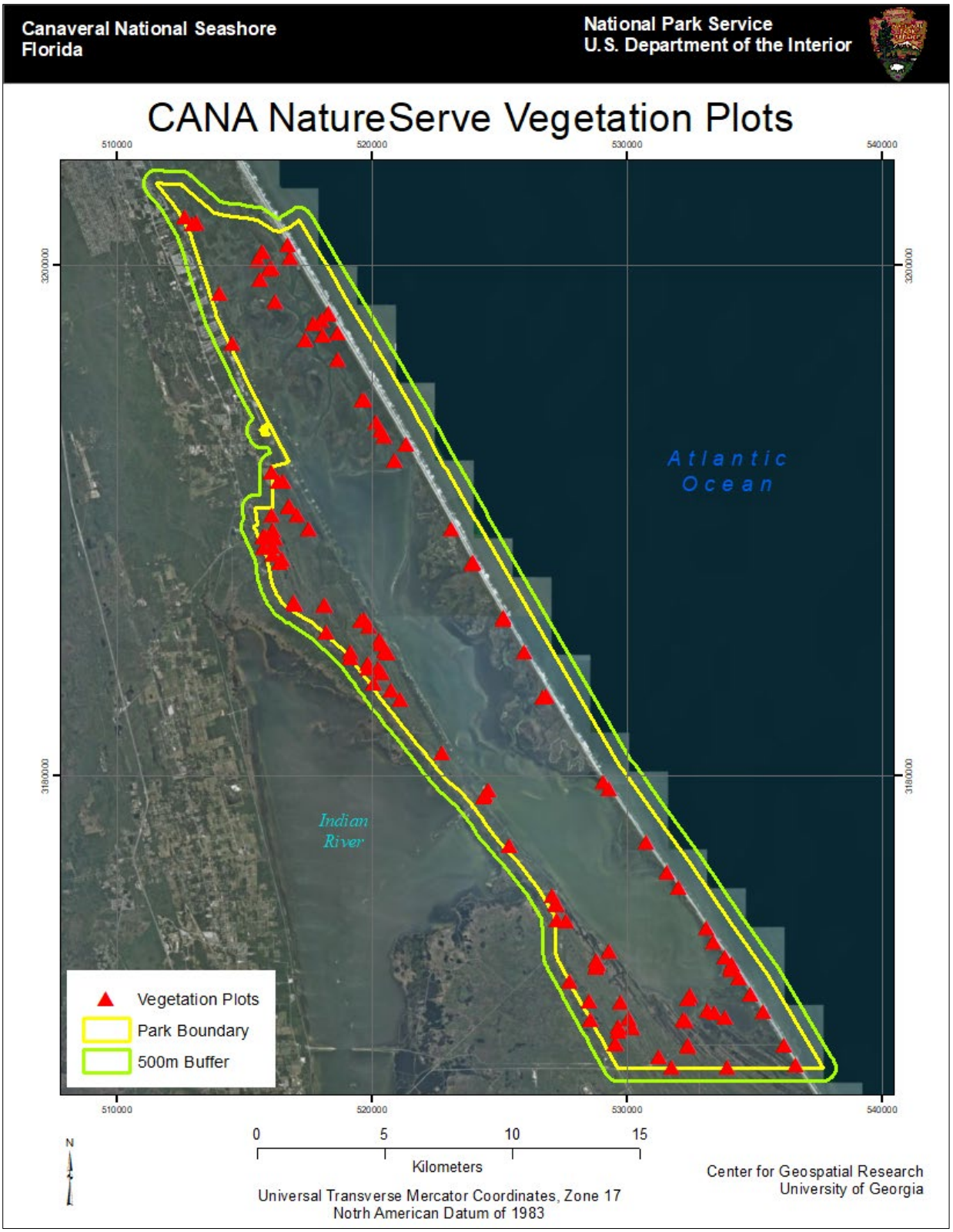


Figure 3. NatureServe vegetation plots, Park boundary, and 500-meter (1,640-ft) buffer for Canaveral National Seashore.

Color (varying from green to pink to purple), tone (light to dark), and texture (fine to coarse) were used to describe the strength and intensity. Other categories were based on canopy structure such as pattern (open to dense canopy) and height (short to tall). The remaining categories were used to express how the different codes are interrelated. These include shape (elongated to broad), size (based on total area, average size, and standard deviations of the polygons in a given class), location (relative to specific areas in the park), association (communities typically found near the specific class), and comments (to express any hints or issues that may arise). Also included are images taken from the field in order to provide a ground-level perspective that can be compared to the sample image chips taken from the airborne CIR images. The NatureServe summary of the vegetation association and its distribution both globally and within Canaveral NS are included for each class following the visual cue description.

The CEGL codes are listed in ascending numerical order in the key. While the NVCS itself is hierarchical, the numbering system for the codes is not hierarchical. Thus, it is impossible to determine physiognomy, species composition, or edaphic factors (e.g. soil saturation or inundation, soil pH, slope) from the CEGL code alone.

Using ArcGIS software, standard GIS methods, and a minimum mapping unit (MMU) of 0.5 hectares (1.2 ac), preliminary lines were drawn to delineate areas of uniform signature. Where the vegetation communities were clearly identifiable, polygons were tagged with the appropriate CEGL code. Where confusion existed, the polygons were tagged with an 'unknown' code until field visits could determine the appropriate CEGL.

Field Surveys and Ground Truthing

In the course of developing the photointerpretation keys and delineating vegetation communities based upon their CIR signatures, a number of signatures were found that did not easily match the signatures from the NatureServe survey of 134 ground plots. These areas required field visits to clarify vegetation communities.

Field work and ground truthing for Canaveral NS took place in November 2014 and February and September 2015. Field visits were aimed at giving specific attention to representative habitats, rare and important communities, areas that have been managed, disturbed, or invaded, and plots previously surveyed by NatureServe to collect data on canopy species composition, diagnostic species for NVCS, and terrain, similar to NatureServe's "Quick Plot" surveys.

Field crews carried paper field maps with the UTM grid coordinates, elevations, roads, rivers, initial vegetation polygons with CEGL codes, and points of interest superimposed on CIR photographs. They also used a Trimble Geo 6000 XH Global Positioning System (GPS) handheld receiver loaded with similar GIS layers. On some trips, a Samsung Galaxy with a geoPDF (Wuthrich 2006; Pardue 2008) replaced paper field maps. The geoPDF gave the user both a higher level of detail of the original CIR compared paper maps, along with the ability to determine location in real-time using the device's internal GPS relative to the overlay of the line work. However due to the large size of Canaveral NS the entire seashore was divided up into 26 individual data driven maps to use as geoPDFs otherwise the files would have been too large. This revealed a flaw in the geoPDF system,

which was later fixed by the company after we revealed the software bug. By having multiple maps in use some data points and field images were overwritten resulting in a loss of both attributes and images. The total number of lost field points and images are unknown, but this error only occurred on the November 6–7, 2014 trip and was resolved by the next field trip.

At each sampling site, researchers recorded GPS position, species data, canopy cover, and topography (e.g. relative slope and aspect) inside an area between 250 and 1,000 square meters (2,691 and 10,764 square feet [ft^2]), based upon visual uniformity. Also noted were the presence of exotics, evidence of past or present human influence (e.g., agriculture, grazing, logging, mowing, exotic vegetation removal, old home sites), damage by insects, wild hogs, blow down, or fire. Prior to leaving a sampling location, researchers determined the primary association type, i.e. CEGL code (Grossman et al. 1994; Anderson et al. 1998; Grossman et al. 1998). Some sites were located in a mixed area indicative of an ecotone or an area of successional recovery. In such cases, secondary associations were determined in addition to dominant associations. Tertiary modifiers were often determined as well. For this reason, all polygons have the possibility of having a secondary association and a modifier in addition to the required dominate association. In cases where researchers were unable to determine a clear match to a NVCS CEGL in the field, more detailed notes were taken in order to assign an appropriate CEGL or CGR-merged class after further review of CIR signatures.

The GPS points collected in the field were superimposed on CIR images in ArcMap. Field points were used in conjunction with the aerial photographs to refine vegetation delineation and assigned classification attributes (dominant CEGL, secondary CEGL, and modifiers, as appropriate). Additional field visits were conducted during the iterative interpretation process on an as-needed basis in order to refine interpretations, identify communities with unusual signatures, and resolve any questions. Maps were updated between field visits to reflect the ongoing process of photointerpretation of vegetation communities. Any areas visited that were already classified were checked for accuracy throughout the mapping process.

A total of three field visits/investigations and 389 discrete point locations were collected at Canaveral NS (Table 3 and Figure 4). The number of sites visited in a single day ranged from 16 to 82 and was often influenced by terrain, weather, and point of interest density. Crossing some of the creeks and accessing islands while traversing the park was a particular challenge.

Table 3. Field visits and number of data points collected for Canaveral National Seashore.

Dates	Team Member(s)	Number of Data Points
November 6–7, 2014	D. L. Cotten, N. K. O'Hare, B. P. Adams	126
February 9–11, 2015	D. L. Cotten, B. P. Adams	204
September 22–23, 2015	D. L. Cotten, B. P. Adams	59
Total	–	389

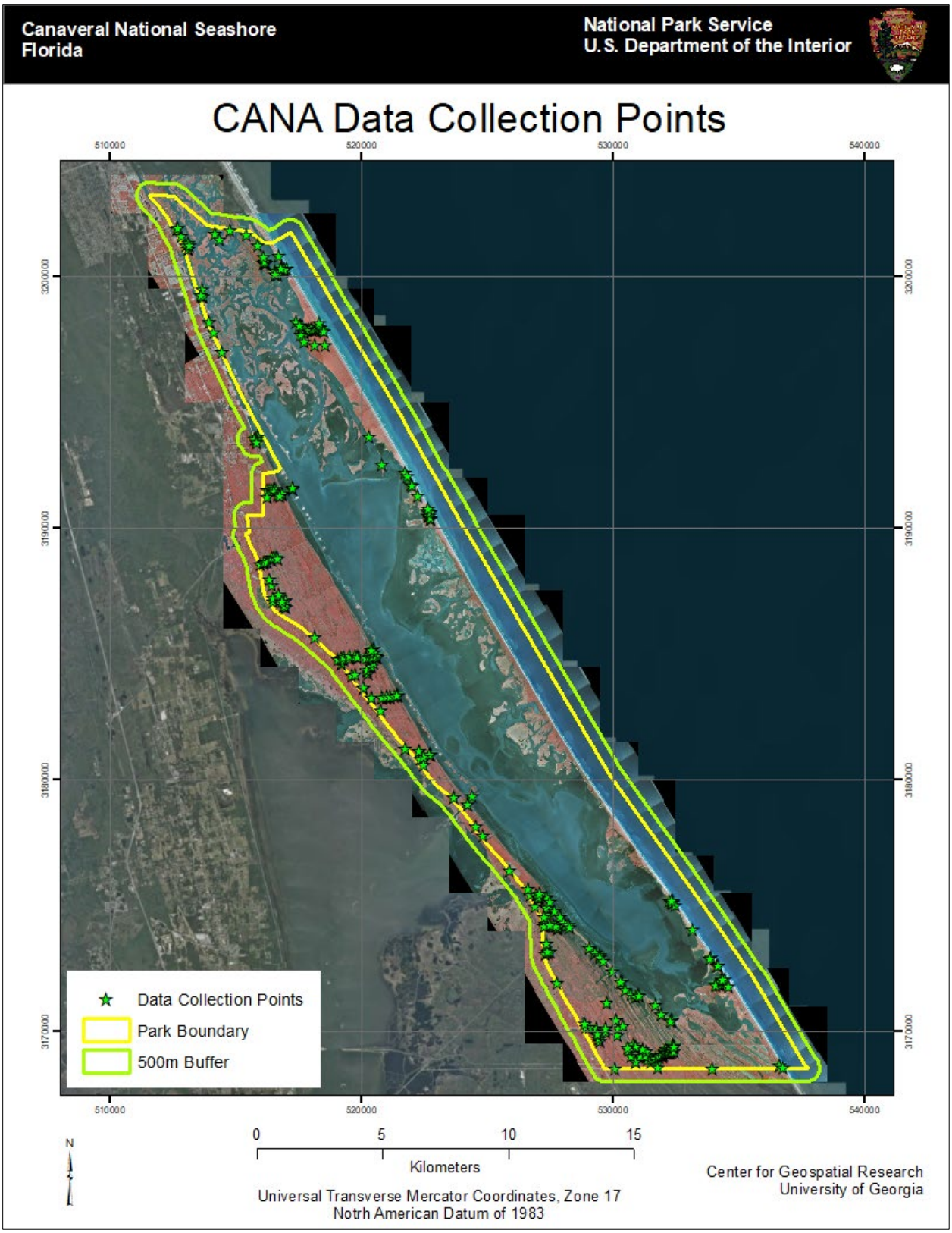


Figure 4. Field data collection locations from Canaveral National Seashore overlaid on CIR imagery and visual imagery.

Photointerpretation and GIS Methods

The industry-standard GIS software, ArcGIS, offers a variety of methods and procedures to do most common mapping tasks. For the purposes of this project, photointerpretation was performed using heads-up digitizing methods in ArcGIS 10.2 using the CIR digital orthophotographs as the primary source material. Lines were drawn on-screen delineating the boundaries between different classes of vegetation. Where ecotones between features were broad, the line was drawn in the middle of the transition area. While the minimum mapping unit (MMU) for this project was one half of a hectare (1.2 ac), features smaller than this threshold that were distinct and could be easily mapped were delineated.

As vegetation areas were delineated with vector lines, points were digitized within each delineated area. These points were assigned attribute information such as the dominate vegetation (a CEGL value if located within the park or an Anderson/FLDCS type code for the buffer), secondary vegetation, a modifier, the interpreter's initials, the date, the confidence of the classification, and other relevant information.

After the line work was completed and points attributed, the lines were converted to polygons and the attributes assigned to each polygon by joining the tables of the point features and polygons based on spatial location. In this operation, the attributes of the point closest to the polygon were assigned to that polygon. A 'distance' field was also assigned which indicates the distance of the point location from the polygon. If the distance was zero, the point was inside the polygon. Any other value greater than zero meant that the point used to populate the attribute fields was outside of the polygon. Consequently, the 'distance > 0' values were used as flags to select and examine polygons that were not properly attributed. Where necessary, additional points were added to the database to complete the map. The process was repeated until all polygons were properly attributed.

The initial draft maps were plotted at large scale on 'E-size' (34 × 48 inches [86.4 × 121.9 centimeters {cm}]) paper such that the hollow polygons with their respective CEGL labels were overlaid on the original aerial photographs. Each polygon was individually inspected by a person not directly involved in the original mapping to make sure that that the line work followed the vegetation feature properly, and that the CEGL codes were consistent with spectral signature. Edits were marked on the hardcopy maps and then applied to the database within ArcGIS. This review process was repeated to ensure completeness.

Additional editing and refinement was performed as necessary using information collected during the field surveys.

Final Vegetation Mapping and Summary Statistics

A total of 38 classes were used within the park, 19 distinct NVCS CEGL association level vegetation communities, 12 grouped NVCS CEGL association level vegetation communities, and seven miscellaneous categories were found in the park (Table 4 and Table 5). In the buffer zone, there were 29 distinct Anderson Level II/ FLDCS codes (Table 6).

Additionally, the park was further classified through the use of modifiers (Table 7). These 13 modifiers were generated by the University of Georgia Center for Geospatial Research to provide additional information regarding species size or areas with a large human influence.

See Figure 5 for the final vegetation map of the park and buffer sections of Canaveral NS.

Table 4. Land cover classes found within the park area of Canaveral NS based on the National Vegetation Classification System.

Code	Class	Description
3525	Woodlands	South Atlantic Coastal Shell Midden Woodland
3781	Shrublands	Beachberry-Sea grape/Sea-oats Shrubland
3799	Shrublands	Brazilian-pepper Seasonally Flooded Shrubland
3839	Shrublands	Atlantic Coast Interdune Swale
3940	Herbaceous and Graminoid Vegetation	Central Florida Sawgrass Marsh
3960	Herbaceous and Graminoid Vegetation	Elephantgrass Herbaceous Vegetation
4001	Herbaceous and Graminoid Vegetation	Southeast Florida Beach Dune
4235	Herbaceous and Graminoid Vegetation	Short-spike Bluestem-Southern Umbrella-sedge–Longleaf Three-awn Herbaceous Vegetation
4237	Shrublands	Florida Swamp Privet Spoil Island
4423	Forests	Central Florida Willow Thicket
4475	Herbaceous and Graminoid Vegetation	Chainfern Small Depression Pond
4527	Herbaceous and Graminoid Vegetation	Watershield Pond
4830	Forests	Brazilian Beefwood Forest
4883	Herbaceous and Graminoid Vegetation	St. Augustine Grass Herbaceous Vegetation
7020	Forests	Southeastern Florida Maritime Hammock
7021	Forests	Sand Laurel Oak / Greenbrier species Forest
7028	Forests	Xeric Live Oak Hammock

* Not an NVCS Code. This value is a combination of two or more NVCS codes.

† Not an NVCS Code

Table 4 (continued). Land cover classes found within the park area of Canaveral NS based on the National Vegetation Classification System.

Code	Class	Description
7040	Forests	Palmetto - Live Oak Hydric Hammock
7171	Forests	Mid-Late Successional Slash Pine Managed Forest
21007*	7032 7033	Oak - Cabbage Hammock
21012*	4457 7600	Buttonwood Forest
21013*	4827 4764	Mangroves
22003*	7750 4658	Pine woodlands
22004*	4791 3643	Wet Pine Woodlands
22006*	3527 3796	Cabbage - Saw Woodlands
23006*	4241 3821	Oak-Palmetto Shrubland
23010*	3811 3812	Florida Coastal Strand
24002*	7654 7653	Natal - Guinea Grass
24010*	3988 4462	Cattails
24018*	3956 2278 3924 7694 7633 4114	Saltwort - Saltgrass
24020*	4511 4186 4194	Spartina - Juncus
99992†	Nonvegetated Cover	Mud
99993†	Nonvegetated Cover	Development Spoil
99994†	Nonvegetated Cover	Transportation
99995†	Nonvegetated Cover	Atlantic Ocean
99997†	Nonvegetated Cover	Sand
99998†	Nonvegetated Cover	Building
99999†	Nonvegetated Cover	Water

* Not an NVCS Code. This value is a combination of two or more NVCS codes.

† Not an NVCS Code

Table 5. Combined park classes found within the park area of Canaveral NS based on the National Vegetation Classification System.

Code/ Name	CEGL	CEGL Descriptions
21007/ Oak - Cabbage Hammock	7032	Maritime Live Oak Hammock
	7033	Florida Atlantic Coastal Tropical/Temperate Maritime Hammock
21012/ Buttonwood Forest	4457	Central Florida Buttonbush Pond
	7600	Buttonwood Forest
21013/ Mangroves	4827	Black Mangrove Forest
	4764	Red Mangrove Fringe Forest
22003/ Pine Woodlands	7750	Peninsular Florida Scrubby Flatwoods
	4658	Maritime Slash Pine Upland Flatwoods
22004/ Wet Pine Woodlands	4791	Wet Slash - Pond Pine Flatwoods
	3643	Slash Pine Flatwoods
22006/ Cabbage-Saw Woodlands	3796	Cabbage Palmetto/Saw Palmetto Woodland
	3527	Cabbage Palmetto Hydric Hammock
23006/ Oak-Palmetto Shrubland	4241	Live Oak - Saw Palmetto – (Yaupon) Shrubland
	3821	Northeast Florida Coastal Scrub
23010/ Florida Coastal Strand	3811	Florida Coastal Strand (Southern Atlantic Temperate)
	3812	Florida Coastal Strand (Temperate Palmetto)
24002/ Natal - Guinea Grass	7654	Natal Grass Herbaceous Vegetation
	7653	Guinea Grass Herbaceous Vegetation
24010/ Cattails	3988	South Florida Cattail Marsh
	4462	Broadleaf Cattail – Pickerelweed Herbaceous Vegetation
24018/ Saltwort-Saltgrass	3956	Saltwort - Woody Glasswort Dwarf-shrubland
	2278	Salt Flat (Woody Glasswort Type)
	3824	Seaside Oxeye Tidal Shrub Flat
	7694	Saltgrass-(Saltmarsh Dropseed) Herbaceous Vegetation
	7663	Saltmarsh Dropseed-Saltgrass Herbaceous Vegetation
	4114	Crowngrass Interdune Swale
24020/ Spartina-Juncus	4511	Sand Cordgrass Interdune Swale
	4186	Needlerush High Marsh
	4194	Sand Cordgrass - Seashore Mallow Herbaceous Vegetation

Table 6. Land cover/land use classes found within the buffer of Canaveral NS.

Code	Description
1112	Mixed Upland Hardwood
1120	Mesic Hammock
1124	Pine - Mesic Oak
1125	Cabbage Palm
1126	Oak - Cabbage Palm
1210	Scrub
1211	Oak Scrub
1214	Coastal Scrub
1220	Upland Mixed Woodland
1230	Upland Pine
1570	Sand (Dry)
1711	Vegetative Berm
1730	Agriculture
1733	Tree Plantations
1740	Transportation
2130	Fresh Water Taller Marsh
2232	Hydric Hammock
5241	Short Salt Grass
5242	Cordgrass/Needle Rush
5251	Mangrove
5331	Spoil Island
9999	Water
17211	Open Land
17212	Residential <1 per acre
17213	Grass
17221	Residential 2-5 per acre
17222	Residential >5 per acre
17223	Commercial and Services
17225	Institutional

Table 7. Modifiers used throughout the park area and buffer of Canaveral NS.

Code	Description
ag	Agriculture
Bay	Mosquito Lagoon
burn	Burned
ds	Dwarf Vegetation
hi	Human Influence
Inland	Inland Spoil Locations
IS1	Impervious Surface < 25%
IS2	Impervious Surface 25% -75%
IS3	Impervious Surface > 75%
Man	Mangroves
sand	Sand
treated	Treated exotics
water	Water

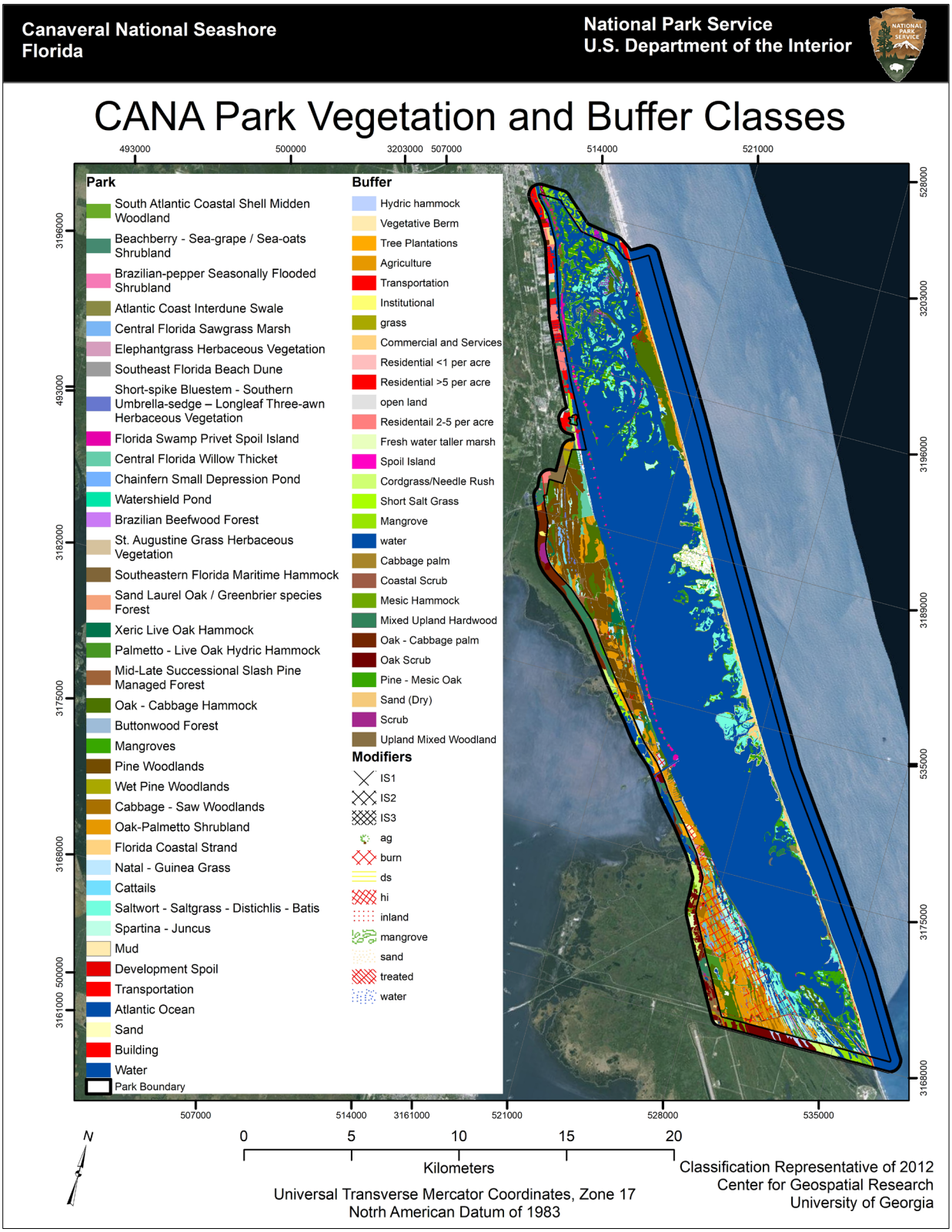


Figure 5. Vegetation map of the Park and Buffer sections of Canaveral NS.

The most common class found in Canaveral NS was water (99999) covering over 55% of the Seashore with the Atlantic Ocean making up an additional 13.4%, meaning that over 68% of the Seashore is covered in water (Figures 6, and 7; Table 8). The most common non-water class is Mangroves, 21013 (CEGL 4827 and 4764), covering approximately 5% of the park and 16% of the vegetated regions of the park. This was nearly equal to the second most common class, Oak—Palmetto Shrubland, 23006 (CEGL 4241 and 3821), at 15% of the vegetated regions of the park. Pine woodlands (CEGL 7750 and 4658), Oak - Cabbage Hammock (CEGL 7032 and 7033), and Salt wort—Salt grass (CEGL 3956, 2278, 3824, 7694, 7663, and 4114) are the only other classes with more than 10% of the vegetative cover, 14%, 13%, and 13%, respectively. The five dominant classes reflect the general makeup of the park. The western part of the park, which is wider than the eastern portion, is mainly comprised of oak and palmetto scrub lands with scattered hammocks and woodlands that are maintained using prescribed burns. While the center portion of the park is heavily influenced by Mosquito Lagoon and is mainly comprised of a mix of Red and Black Mangroves. For perspective, the land mass of the park encompasses approximately 7,081 hectares (17,498 ac) while Mosquito Lagoon alone covers over 12,438 hectares (30,735 ac), additionally, approximately 3,183 hectares (7,865 ac) of the Atlantic Ocean lie within the park boundaries.

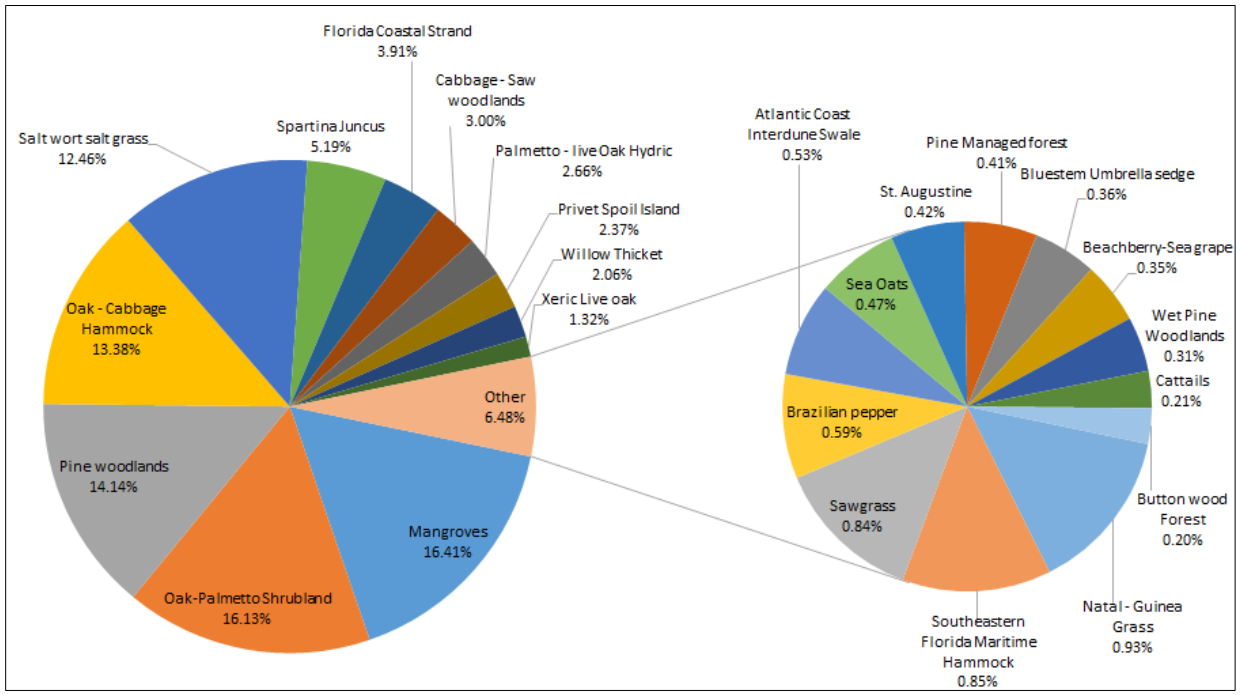


Figure 6. Park vegetation classes organized by relative size. Six classes' each with areas made up less than 0.2% of the vegetated cover were excluded from this chart.

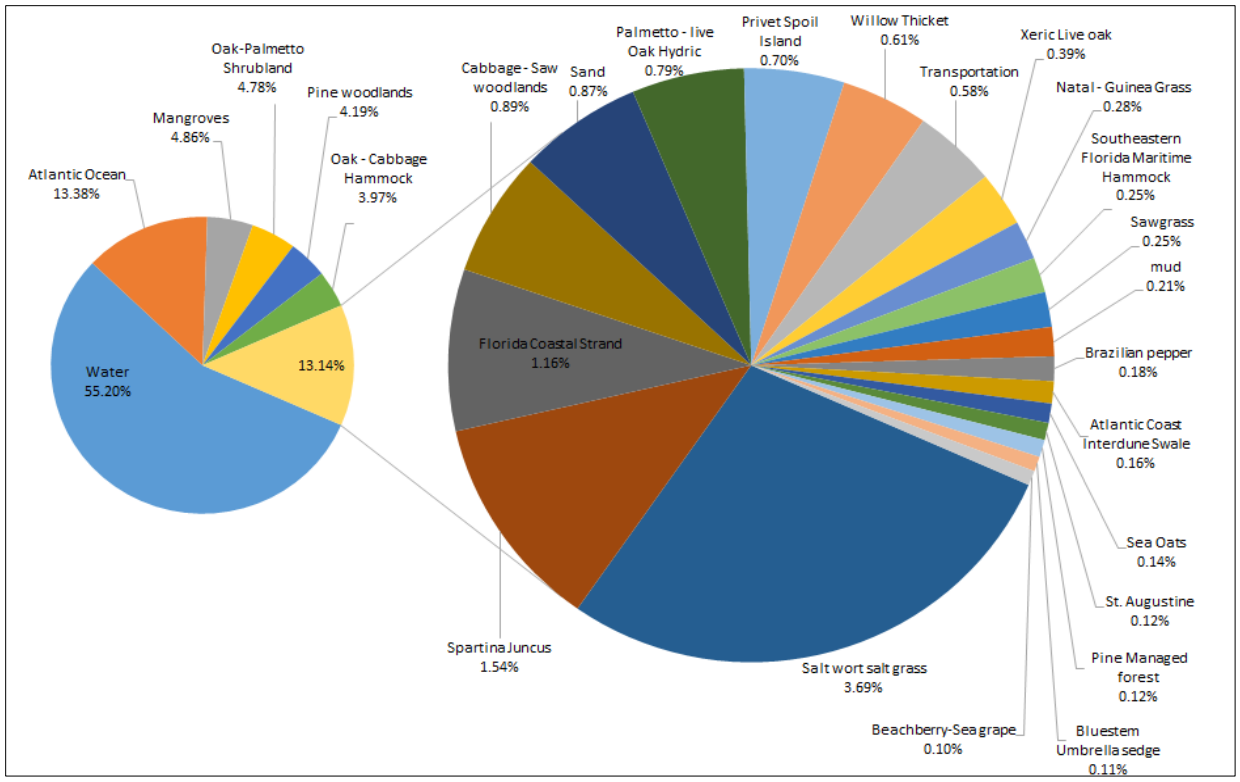


Figure 7. All park classes organized by relative size. Eleven classes' each with areas made up less than 0.1% of the park were excluded from this chart.

Table 8. Community element global code (CEGL) classes, frequency of occurrence, mean area, total area, and percentage of total area within the park boundary of Canaveral NS.

CEGL	Description	Frequency	Mean Area (ha)	Total Area (ha)	Percentage of Vegetated Area	Percentage of Total Area
21013*	Mangroves	1782	0.6	1157.3	16.41	4.86
23006*	Oak-Palmetto Shrubland	187	6.1	1137.9	16.13	4.78
22003*	Pine woodlands	60	16.6	997.7	14.14	4.19
21007*	Oak - Cabbage Hammock	104	9.1	944.1	13.38	3.97
24018*	Saltwort - Saltgrass	651	1.4	879.1	12.46	3.69
24020*	Spartina - Juncus	157	2.3	366	5.19	1.54
23010*	Florida Coastal Strand	50	5.5	275.5	3.91	1.16
22006*	Cabbage - Saw Woodlands	118	1.8	211.6	3.00	0.89
99997†	Sand	145	1.4	206.9	n/a	0.87

* Not an NVCS Code. This value is a combination of two or more NVCS codes.

† Not an NVCS Code.

Table 8 (continued). Community element global code (CEGL) classes, frequency of occurrence, mean area, total area, and percentage of total area within the park boundary of Canaveral NS.

CEGL	Description	Frequency	Mean Area (ha)	Total Area (ha)	Percentage of Vegetated Area	Percentage of Total Area
7040	Palmetto - Live Oak Hydric Hammock	41	4.6	187.6	2.66	0.79
4237	Florida Swamp Privet Spoil Island	294	0.6	167.3	2.37	0.70
4423	Central Florida Willow Thicket	41	3.5	145.1	2.06	0.61
99994†	Transportation	39	3.6	138.8	n/a	0.58
7028	Xeric Live Oak Hammock	16	5.8	93	1.32	0.39
24002*	Natal - Guinea Grass	32	2.1	65.7	0.93	0.28
3940	Central Florida Sawgrass Marsh	27	2.2	59.5	0.84	0.25
7020	Southeastern Florida Maritime Hammock	24	2.5	59.6	0.85	0.25
99992†	Mud	130	0.4	49.7	n/a	0.21
3799	Brazilian-pepper Seasonally Flooded Shrubland	50	0.8	41.8	0.59	0.18
3839	Atlantic Coast Interdune Swale	19	2	37.6	0.53	0.16
4001	Southeast Florida Beach Dune	19	1.7	33	0.47	0.14
4883	St. Augustine Grass Herbaceous Vegetation	37	0.8	29.5	0.42	0.12
7171	Mid-Late Successional Slash Pine Managed Forest	8	3.7	29.3	0.41	0.12
4235	Short-spike Bluestem-Southern Umbrella-sedge–Longleaf Three-awn Herbaceous Vegetation	34	0.7	25.4	0.36	0.11
3781	Beachberry-Sea grape/Sea-oats Shrubland	13	1.9	24.7	0.35	0.10
22004*	Wet Pine Woodlands	7	3.1	21.9	0.31	0.09
99993†	Development Spoil	55	0.3	18.9	n/a	0.08
3960	Elephantgrass Herbaceous Vegetation	6	2.2	13.2	0.19	0.06
21012*	Buttonwood Forest	13	1.1	14.2	0.20	0.06
24010*	Cattails	19	0.8	14.8	0.21	0.06

* Not an NVCS Code. This value is a combination of two or more NVCS codes.

† Not an NVCS Code.

Table 8 (continued). Community element global code (CEGL) classes, frequency of occurrence, mean area, total area, and percentage of total area within the park boundary of Canaveral NS.

CEGL	Description	Frequency	Mean Area (ha)	Total Area (ha)	Percentage of Vegetated Area	Percentage of Total Area
99998†	Building	6	1.4	8.4	n/a	0.04
3525	South Atlantic Coastal Shell Midden Woodland	7	1	6.7	0.09	0.03
7021	Sand Laurel Oak / Greenbrier species Forest	2	4	7.9	0.11	0.03
4475	Chainfern Small Depression Pond	13	0.2	3.1	0.04	0.01
4527	Watershield Pond	3	0.7	2.1	0.03	0.01
4830	Brazilian Beefwood Forest	6	0.3	1.9	0.03	0.01
99995†	Atlantic Ocean	1	3183.8	3183.8	n/a	13.38
99999†	Water	931	14.1	13138	n/a	55.20
Total	Vegetated	3840	–	7054.1	100.0	n/a
Total	All	5147	–	23798.53	n/a	100.00

* Not an NVCS Code. This value is a combination of two or more NVCS codes.

† Not an NVCS Code.

Within the buffer region of Canaveral NS, just like the main part of the park, water is the dominate class (Table 9; Figure 8). The Atlantic Ocean comprises 43% of the 500-meter (1,640-ft) buffer area with general water making up another 11% of the classes within the buffer. Mixed Upland Hardwood Forests dominate the landscape, encompassing over 13% of the total (non-Atlantic Ocean) buffer area. The Atlantic Ocean was excluded from these buffer calculations because approximately 2,080 hectares (5,140 ac) of the buffer lie in the Ocean while approximately 2,803 hectares (6,926 ac) lie in non-Ocean areas. Oak Scrub and Oak-Cabbage Palm are the second and third most common classes with 11% and 10% of the non-Atlantic Ocean area, respectively. Residential areas with greater than five units per acre (0.4 ha), Cordgrass/Needle Rush, and Mangroves were the only other classes with more than 5% of the buffer, made up 8%, 6%, and 5%, respectively.

Table 9. Land use/land cover code, description, frequency of occurrence, mean area, total area, percentage of area (ha) not including the Atlantic Ocean, and percentage of total area (ha) within the buffer area of Canaveral National Seashore.

Code	Description	Frequency	Mean Area (ha)	Total Area (ha)	Percentage non-Ocean	Percentage of all Area
1112	Mixed Upland Hardwood	22	16.65	366.3	13.07	7.50
1211	Oak Scrub	36	8.78	316.25	11.28	6.48
1126	Oak - Cabbage Palm	13	19.92	258.96	9.24	5.30
17222	Residential >5 Per Acre	25	8.59	214.65	7.66	4.40
5242	Cordgrass/Needle Rush	16	10.56	168.96	6.03	3.46
5251	Mangrove	64	2.22	142.05	5.07	2.91
1220	Upland Mixed Woodland	9	14.66	131.9	4.70	2.70
17221	Residential 2-5 Per Acre	6	18.57	111.44	3.97	2.28
1733	Tree Plantations	7	9.85	68.96	2.46	1.41
5241	Short Salt Grass	18	3.72	66.91	2.39	1.37
17213	Grass	32	1.92	61.46	2.19	1.26
1740	Transportation	12	4.49	53.87	1.92	1.10
1120	Mesic Hammock	9	4.91	44.18	1.58	0.90
2232	Hydric Hammock	2	19.72	39.44	1.41	0.81
1210	Scrub	2	16.53	33.06	1.18	0.68
5331	Spoil Island	41	0.73	29.75	1.06	0.61
17211	Open Land	5	5.71	28.57	1.02	0.58
17223	Commercial and Services	6	4.7	28.19	1.01	0.58
1730	Agriculture	4	6.41	25.65	0.91	0.53
2130	Fresh Water Taller Marsh	4	5.31	21.24	0.76	0.43
1124	Pine - Mesic Oak	1	18.27	18.27	0.65	0.37
1125	Cabbage Palm	7	1.77	12.38	0.44	0.25
1711	Vegetative Berm	4	2.56	10.23	0.37	0.21
17225	Institutional	2	3.31	6.61	0.24	0.14
1570	Sand	2	2.09	4.17	0.15	0.09
1214	Coastal Scrub	1	1.84	1.84	0.07	0.04
17212	Residential <1 Per Acre	2	0.84	1.68	0.06	0.03
1230	Upland Pine	1	0.51	0.51	0.02	0.01
99999	Water	59	9.09	536.17	19.12	10.98

Table 9 (continued). Land use/land cover code, description, frequency of occurrence, mean area, total area, percentage of area (ha) not including the Atlantic Ocean, and percentage of total area (ha) within the buffer area of Canaveral National Seashore.

Code	Description	Frequency	Mean Area (ha)	Total Area (ha)	Percentage non-Ocean	Percentage of all Area
99995	Atlantic Ocean	1	2080.18	2080.18	n/a	42.59
Total (Non-Ocean)	–	412	–	2803.63	100	n/a
Total	–	413	–	4882.81	n/a	100

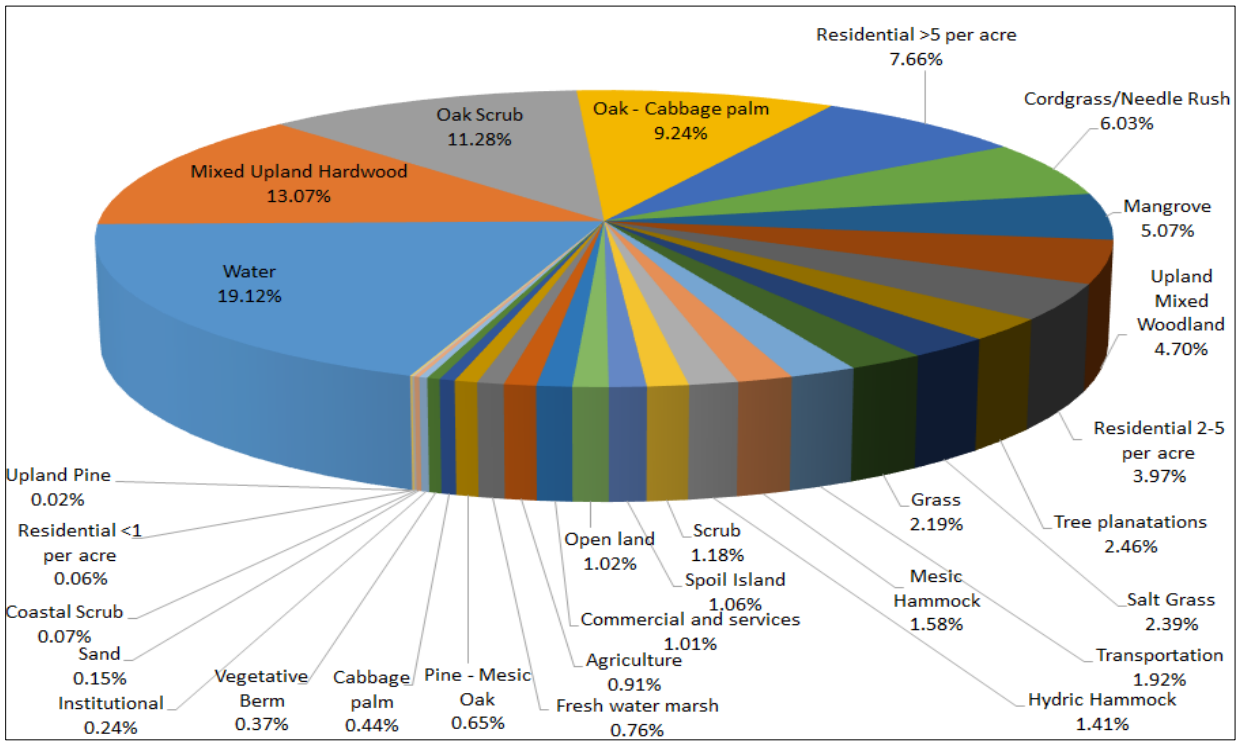


Figure 8. Buffer classes, excluding the Atlantic Ocean, organized by relative size found in Canaveral National Seashore.

Modifiers were utilized throughout the park region to further enhance the classification system, Table 10. The modifier system was based on vegetation height and human influences. These modifiers can include LULC, or impervious surface coverage based on a scaling system. Where used, the scaling system is based on percent coverage of the specific modifier, with 1 for less than 25%, 2 for greater than 25% but less than 75%, and 3 for coverage greater than 75%. The two most used modifiers were to distinguish areas of dwarf shrublands (ds), such as areas where mangroves were dominant but not enough to be classified as a forest, and burn regions.

Table 10. Modifiers used throughout the park and buffer areas, including code, description, frequency of occurrence, mean area, and total area.

Code	Description	Frequency	Mean Area (ha)	Total Area (ha)
ag	Agriculture	1	3.63	3.63
Bay	Mosquito Lagoon	1	12,438	12,438
burn	Burned Vegetation	163	4.45	725.22
ds	Dwarf or shorter than CEGL derived vegetation	789	0.82	645.27
hi	Human Influence	30	2.70	80.96
inland	Inland spoil regions	34	1.25	42.56
IS1	Impervious surface — Less than 25 percent	1	0.25	0.25
IS2	Impervious surface — 25 to 75 percent	5	1.19	5.94
IS3	Impervious surface — Greater than 75 percent	6	9.18	55.07
mangrove	Contains at least 25% mangroves	5	0.81	4.03
sand	Sand	35	6.77	236.87
treated	Chemically treated vegetation	5	0.81	4.04
water	Water — Greater than 75 percent	71	0.67	47.49
Total	–	1146	–	14289.38

Accuracy Assessment

Point Selection

As a part of the total mapping effort, a separate accuracy analysis of the thematic contents of the vegetation maps is required. Only classes with CEGL codes assigned and only polygons that fall within the prescribed park boundary are evaluated. To accomplish this, a set of points is selected to represent the distribution and rarity of the mapped vegetation classes. The number of accuracy assessment (AA) sample points per class depends on the total area (in ha) of the particular vegetation class within the map area, according to the rule set established by the NPS for this purpose (Lea and Curtis 2010):

- Classes with < 8.33 ha
    - 5 points per class
- Classes with ≥ 8.33 AND < 50 ha
    - number of points is 0.6 × the area in ha
- Classes with ≥ 50 ha
    - 30 points per class

Protocol dictates that the points be randomly distributed and stratified by class. For example, if 30 points are required for a particular class, those 30 points should be randomly distributed within all of the polygons of that particular class. The distribution of classes, the number of polygons, and the areas of each class was given in Table 8.

Point Acquisition

The accuracy assessment points were collected October 3 – 5, 12 – 21, 24 – 28, 31, and November 1 – 2, 2016 by I. Weber, J. Armstrong, J. Mansuetti, and N. Panico. Figure 9 shows the locations of these points and Appendix C has the detailed information gathered at each of the 582, half a hectare (1.2 ac) accuracy assessment plot locations.

Accuracy of Vegetation Map

Once the accuracy assessment plot data were received, they were overlaid on top of the draft vegetation maps to determine the accuracy of the map. This process entailed determining whether predicted vegetation classes matched observed accuracy assessment plots. To ensure the most accurate assessment was made, numerous factors had to be considered to determine if the accuracy assessment plots were placed in locations representative of their polygons. Plots deemed unrepresentative of the polygons in question were removed from the final analysis.

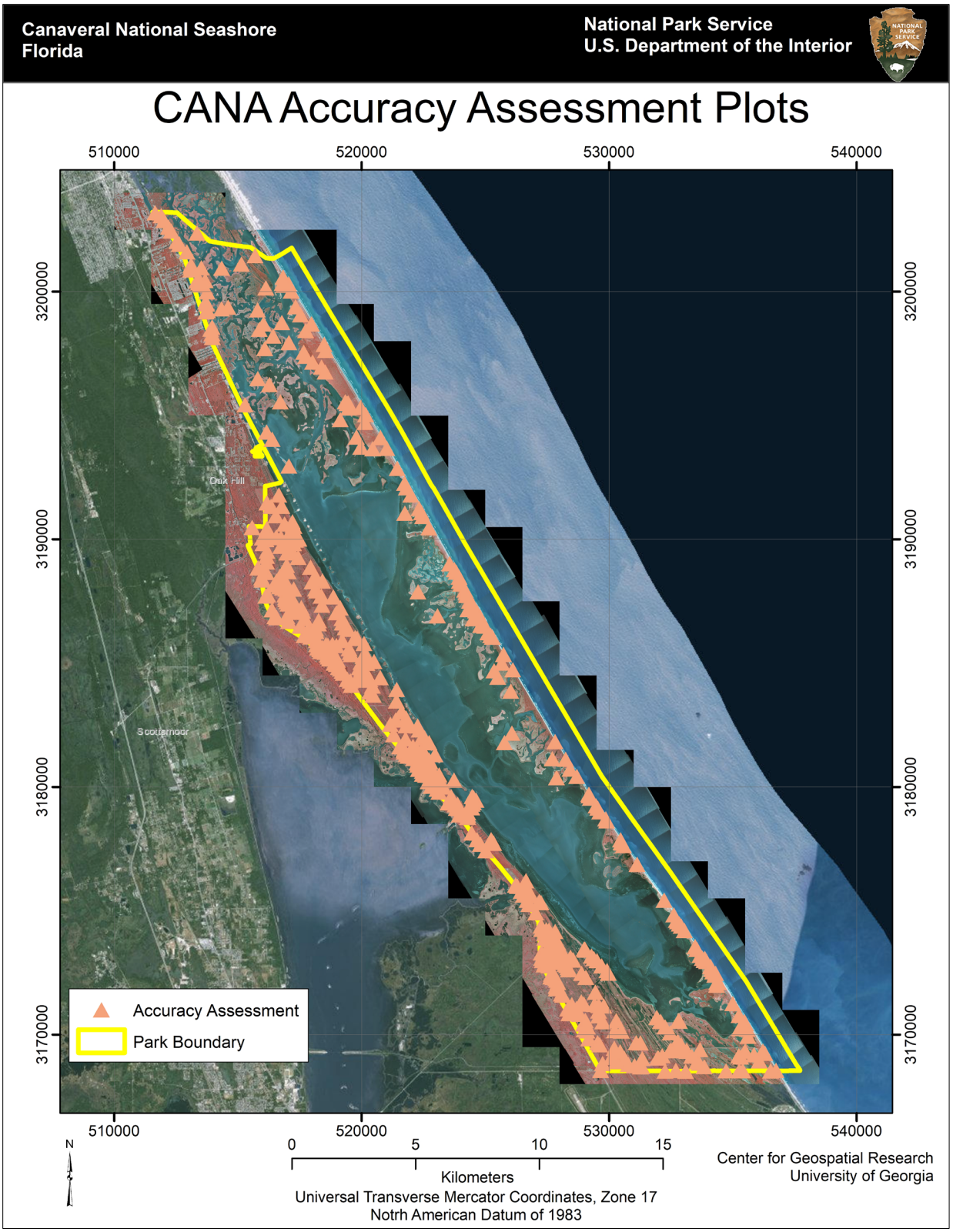


Figure 9. Accuracy assessment plot locations for Canaveral NS

Quality Assurance of AA Plots

The AA plots were divided into 17 categories to better understand issues regarding representativeness of accuracy assessment plot locations within Canaveral NS (Table 11). For instance: “perfect match” (M1, M1a-c) was assigned if AA plots were assigned the same CEGL code as the polygon that they fell in. Each point was given a Primary CEGL Code, an optional Secondary CEGL Code, and an optional description CEGL Code created by the Weber et al. team. The University of Georgia Center for Geospatial Research team created a Vegetation Code and an optional Alternate Vegetation Code. Not all points had a Secondary CEGL Code or Alternate Vegetation Code. Other categories were created if the AA plot was in highly disturbed areas (M2a-d), if there were key discrepancies between the imagery and AA plot (M3), spatial errors (S1a, S1b, and S1e), and if the AA plot used a NatureServe plot that did not occur within the park (N1).

Table 11. Classes based on Community element global code (CEGL), frequency of occurrence, mean area, total area, and percentage total area for Canaveral NS.

Type	Code	Number	Status for Final Analysis
Perfect match – primary codes matched	M1	111	Retained
Alternate/Secondary Code match	M1a	11	Retained
Matched description - polygon matched with AA plot description	M1b	8	Retained
Moved point - plot coordinates located outside of actual location	M1c	80	Retained
Highly disturbed - anthropogenic	M2a	18	Kicked Out
Highly disturbed - Burn	M2b	16	Kicked Out
Highly disturbed - Hurricane	M2c	11	Kicked Out
Highly disturbed - Agriculture	M2d	2	Kicked Out
Key discrepancies – disagreements between AA and imagery	M3	39	Retained
Key discrepancies – disagreements between AA and NatureServe	M3a	10	Kicked Out
CEGL code selection by CGR inaccurate	M5	127	Retained
Change polygon	M6	37	Retained (9 polygons changed)
Temporal errors – changes since images were acquired	T1	14	Retained
Spatial error - MMU	S1a	32	Kicked Out
Spatial error can’t locate AA plot	S1b	29	Kicked Out
Spatial error ecotone	S1e	25	Kicked Out
No NatureServe plot with listed CEGL code	N1	12	Kicked Out
Total	–	582	427 used for analysis

The AA plot locations were randomly selected within a given polygon, therefore, there was no guarantee that they landed in a location representative of either the polygon or of the plant associations included within the polygon's map unit. For example, an AA plot could easily land in a small gully, an inclusion that is too small to map, i.e. less than the MMU (0.5 hectare [1.2 ac]), or an ecotone where trees are invading a shrub land. To account for these situations, field observers were tasked with determining not only the vegetation within the AA sample area, but the surrounding area as well. An AA plot would be deemed a poor fit in cases where the assigned AA location was not easily classified by one of the designated vegetation classes. These instances included AA plots that fell inside of an ecotone or inclusion, or in an anomalous situation such as in a gully or sandy area (McManamay et al. 2012).

One-hundred fifty-five plots were removed from consideration with forty-seven of those being removed due to their proximity to highly disturbed areas. Eighteen plots were listed as highly disturbed due to anthropogenic surroundings (M2a), such as parking areas, trails, or roads and sixteen plots were removed because they existed in burned locations (M2b). Eleven other highly disturbed plots were removed due to effects of Hurricane Matthew (M2c), these included AA plots 332–334 which were located on the dunes along the Atlantic Ocean, some of which were completely removed due to the hurricane. The last group of highly disturbed classes involved agriculture (M2d) where the two AA plots were located in old agricultural field and were therefore too disturbed to properly key.

Ten plots were removed due to their close proximity to a NatureServe plot (M3a) that was labeled with a different CEGL code. Overall 86 points were removed for spatial errors such as polygons that were less than the MMU (S1a with thirty-two plots). Additionally, there were twenty-nine plots that could not be located because the AA plot was taken outside of the polygon being identified and there was inadequate information provided to locate the desired vegetation/polygon in question (S1b with 29 plots). Other spatial errors included plots located in ecotones, i.e. in a plot that was located in multiple polygons when the 20m buffer was applied (S1e with twenty-five plots). Twelve plots were also removed because the AA plots used CEGL codes that did not exist in the original NatureServe survey (N1).

All available data was used to create a final vegetation classification for Canaveral NS and the confusion matrix for the park is shown in Table 12a–b. Overall 155 plots were removed (M2a, M2b, M2c, M2d, M3a, S1a, S1b, S1e, N1) based on the plots lying in locations that were deemed unrepresentative of the polygon or imagery from 2012. This left 427 AA plots that were used to assess the map based on the 2012 imagery. The overall assessment showed a 70% accuracy and a kappa rating of 67% using the 427 AA plots.

Potential Improvements

During the analysis of this park a few key issues were identified that could increase the efficiency and effectiveness of this process. These issues, which will be described in more detail below, involve supplying the AA companies with more data, including the imagery used for photointerpretation, polygon boundaries, and NatureServe plots.

The largest errors associated with the AA plots in Canaveral NS were based on spatial discrepancies. One-hundred-eight plots were offset from the desired vegetation, as described by the AA contractor. Twenty-nine of the 108 offset plots were lacking vector information (distance and direction) or their desired location was unable to be located, therefore the plots were unable to be used for assessment (S1b). Many parks have areas that are inaccessible but if vector information is provided with the plots that lie outside of the desired vegetation polygon the AA plots could still be used for assessment.

Finally, if AA companies were provided digital copies of the aerial photographs in GeoPDF form then they could see the vegetation over from an aerial perspective, thus providing a broader context of the area in question. Using the GeoPDF, blank polygon files could be provided to reduce errors caused by AA points that are within 20 meters (65.6 ft), or many times even less, to a polygon boundary. These areas are very difficult to classify and typically represent a very gradual change between vegetation classes that could span 10s of meters. This also highlights the number of plots that classified areas smaller than the MMU and the difficultly to accurately assign a classification to them. By utilizing this technique even more errors can be reduced: 86 of 582 (S1a, S1b, and S1e) for Canaveral NS were attributed to these errors.

Accuracy assessors should have access to the NatureServe Plot locations and information, so they can better understand the system the photo interpretation was based upon. There were a few instances that have a NatureServe and AA point within 100 meters (328 ft) of each other that assign conflicting classes. There were 12 points removed due to the AA plots disagreeing with nearby, less than 100 meters (328 ft), vegetation plots (N1) or containing features that were nonexistent in the aerial imagery.

Overall using these simple additions up to 129 (81%) more plots could have been used in the accuracy assessment of the park..

Table 12a. Confusion matrix for the accuracy assessment. The rows are the expected vegetation class as predicted by the photo interpretation conducted by the UGA Center for Geospatial Research, and the columns are the observed vegetation class at the AA point.

Class	3525	3527	3781	3799	3825	3839	3940	3960	4001	4235	4237	4423	4475	4827	4830	4883	7020	7028	7040	7171	21007	21012	21013	22003	22004	22006	23003	23006	23010	24002	24010	24018	24020	99994	Total
3525	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5
3527	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3781	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	2	0	0	0	1	0	6
3799	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
3825	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3839	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0	0	0	1	0	0	0	0	0	6
3940	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	17
3960	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	7
4001	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	9
4235	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	9
4237	1	0	0	0	0	0	0	0	0	0	16	0	0	1	0	0	0	0	3	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	24
4423	0	0	0	0	0	0	1	0	0	0	0	10	0	0	0	0	2	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	15
4475	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
4827	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
4883	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
7020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	11	0	0	0	0	3	0	1	0	0	0	0	0	0	18
7028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	16
7040	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	1	5	0	1	0	0	0	0	2	0	0	0	0	0	0	0	12
7171	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	5	2	0	0	0	0	0	0	0	15
21007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	24	0	0	0	0	2	0	0	0	0	0	0	0	27
21012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	3
21013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	25	0	0	1	0	0	0	0	0	0	0	0	29
22003	0	0	0	0	1	0	5	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	10	6	1	1	1	0	0	0	0	1	0	27
22004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	1	0	0	0	0	0	0	0	0	10
22006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	22	0	0	2	0	0	0	0	0	25
23003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	3	1	0	4	1	3	22	4	8	0	16	14	2	1	4	3	4	5	14	8	56	14	26	10	21	37	1	22	46	13	2	35	27	0	427

Table 12b. Accuracy and error for the confusion matrix. Overall accuracy is 70. Kappa is 67.

Accuracy/error type	3525	3527	3781	3799	3825	3839	3940	3960	4001	4235	4237	4423	4475	4827	4830	4883	7020	7028	7040	7171	21007	21012	21013	22003	22004	22006	23003	23006	23010	24002	24010	24018	24020	99994
Producer Accuracy	67[b]	0[b]	0[b]	100[a]	0[b]	33[b]	59[b]	100[a]	100[a]	0[b]	100[a]	71[a]	100[a]	0[b]	100[a]	100[a]	25[b]	20[b]	36[b]	100[a]	43[b]	7[b]	96[a]	100[a]	43[b]	59[b]	0[b]	91[a]	85[a]	100[a]	100[a]	91[a]	56[b]	0[b]
Omission Error	33	100	0	0	100	67	41	0	0	0	0	29	0	100	0	0	75	80	64	0	57	93	4	0	57	41	100	9	15	0	0	9	44	0
User Accuracy	40[b]	0b	0[b]	100[a]	0[b]	17[b]	76[a]	57[b]	89[a]	0[b]	67[b]	67[b]	100[a]	0[b]	100[a]	100[a]	6[b]	6[b]	42[b]	53[b]	89[a]	33[b]	86[a]	37[b]	90[a]	88[a]	0[b]	83[a]	87[a]	93[a]	100[a]	100[a]	100[a]	0[b]
Commission Error	60	0	100	0	0	83	24	43	11	100	33	33	0	0	0	0	94	94	58	47	11	67	14	63	10	12	0	17	13	7	0	0	0	100

[a] represents accuracy greater than or equal to 70%

[b] represents accuracy less than 70%

Conclusion

Canaveral National Seashore (CANA) averaged around 1,000,000 visitors per year from 2006–2013 with 2014 and 2015 showing an increase in visitors to about 1,500,000 visitors per year (NPS Stats 2019). The park is located on the eastern coast of Florida making up 24 miles (38.6 km) of its border with the Atlantic Ocean. The boundary of the park encompasses approximately 23,798 hectares (58,807 ac) and was originally part of land set aside by the United States government for the aerospace program.

The most visible feature within the park is Mosquito Lagoon, with its many spoil islands, which reaches from the farthest northern extents of the park to within a just few hundred meters of the southern border. The western region of the park also contains a portion of the Intracoastal Waterway which follows Indian River south through the park for approximately 16 miles (25.7 km) before exiting the park.

Because of the extensive coverage of the park and the wide range of vegetation classes from saltwater marshes to upland forests to freshwater wetlands including fire managed areas, using the National Vegetation Classification System (NVCS) to the association level was challenging. Determining community element global (CEGL) codes was particularly difficult because NVCS was designed for ground based classification. Some classes were indistinguishable from each other when using aerial photos and other areas contained classes that changed from the time NatureServe did their vegetation surveys to the time aerial images were acquired and some locations had changed classes again by the time we were able to perform our ground truthing. Because of these difficulties some classes were grouped together that were indistinguishable from aerial photos. Through the use of NatureServe vegetation plots, aerial photos, and data collected in the field, vegetation communities were delineated and assigned attributes. Using dominant vegetation classes and modifiers to describe the diversity of species, detailed vegetation maps were created for Canaveral NS, both inside the park and within a 500-meter (1,640-ft) buffer. The buffer polygons and attributes were created on a broader scale using a system based on the Anderson Level II classification scheme and the Florida Land Cover Classification System (FLDCS), which includes anthropogenic and land use/land cover (LULC) classes. Within the seashore, the more detailed CEGL codes were used.

Over 68% of Canaveral National Seashore's area is open-water, with the Atlantic Ocean making up 13.4% of that open-water area. The most common vegetation class found in the park is Mangroves (21013), covering approximately 5% of total park area, and 16% of the vegetated area in the park. The second most common class, Oak—Palmetto Shrubland (23006), was nearly equal, representing15% of vegetated area within the park. Pine woodlands (7750 and 4658), Oak—Cabbage Hammock (7032 and 7033), and Salt wort—Salt grass (3956, 2278, 3824, 7694 7663, and 4114) are the only other classes representing greater than 10% of the total vegetative cover (14%, 13%, and 13%, respectively). While a total of thirty-eight individual vegetation classes were identified; the five above mentioned, dominant classes represent more than 70% of vegetation cover at Canaveral NS. A rigorous accuracy assessment was conducted on the map classes identified within the boundary of the park representing floristic types within the National Vegetation Classification System. This accuracy

assessment determined a 70% accuracy and a kappa rating of 67% using the 427 different accuracy assessment plots.

Literature Cited

Anderson, J. R., E. E. Hardy, J. T. Roach, and R. E. Witmer. 1976. A land use and land cover classification system for use with remote sensor data. Geological Survey Professional Paper 964. U.S. Government Printing Office, Washington, D.C.

Anderson, M., P. Bourgeron, M. Bryer, R. Crawford, L. Engelking, D. Faber-Langendoen, M. Gallyoun, K. Goodin, D. Grossman, and S. Landaal. 1998. International classification of ecological communities: Terrestrial vegetation of the United States. Volume II. The National Vegetation Classification System: List of types. The Nature Conservancy, Arlington, Virginia.

Canaveral National Seashore (CANA). 2000. History of Canaveral National Seashore. Press Release January 20, 2000. http://www.nbbd.com/godo/cns/PressReleases/000120.html

Fancy, S. G., J. E. Gross, and S. L. Carter. 2009. Monitoring the condition of natural resources in US national parks. Environmental Monitoring and Assessment 151:161–174.

Grossman, D. H., D. Faber-Langendoen, A. S. Weakley, M. Anderson, P. Bourgeron, Crawford, K. Goodin, S. Landaal, K. Metzler, K. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. International classification of ecological communities: Terrestrial vegetation of the United States. Volume I. The National Vegetation Classification System: Development, status, and applications. The Nature Conservancy, Arlington, Virginia.

Grossman, D. H., K. L. Goodin, and C. L. Reuss, editors. 1994. Rare plant communities of the conterminous United States: An initial survey. The Nature Conservancy, Arlington, Virginia.

Jennings, M. D., D. Faber-Langendoen, O. L. Loucks, R. K. Peet, and D. Roberts. 2009. Standards for associations and alliances of the U.S. National Vegetation Classification. Ecological Monographs 79(2):173–199.

Kawula, R. 2009. Florida Land Cover Classification System. Final Report, December 31, 2009, State Wildlife Grant: SWG T-13 (FWRI Grant#6325).

Lea, C., and A. C. Curtis. 2010. Thematic accuracy assessment procedures: National Park Service Vegetation Inventory, version 2.0. Natural Resource Report NPS/2010/NRR—2010/204. Available at: https://www1.usgs.gov/vip/standards/NPSVI_Accuracy_Assessment_Guidelines_ver2.pdf (last accessed November 2019).

McManamay, R. H., S. L. Corbett, and A. C. Curtis. 2019. Field procedures for vegetation mapping accuracy assessment: Cape Lookout National Seashore and Cape Hatteras National Seashore—Version 1.0. Standard Operating Procedure. NPS/SECN/SOP—1.4.17. Southeast Coast Inventory and Monitoring Network, National Park Service, Athens, Georgia. Available at: https://irma.nps.gov/DataStore/Reference/Profile/2266071 (last accessed October 2019).

NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Associations and Alliances of Canaveral National Seashore. NatureServe, Arlington, Virginia.

National Park Service (NPS). 2019a. Vegetation inventory. NPS Inventory and Monitoring. Available at: https://www.nps.gov/im/vegetation-inventory.htm (last accessed October 2019).

National Park Service (NPS). 2019b. NPS Inventory and Monitoring. Available at: https://www.nps.gov/im/about.htm (last accessed October 2019).

National Park Service (NPS). 2019c. NPS Southeast Coast Inventory & Monitoring Network. Available at: https://www.nps.gov/im/secn/index.htm (last accessed October 2019).

National Park Service Visitor Use Statistics (NPS Stats) 2019. Available at: https://irma.nps.gov/Stats/ (last accessed October 2019).

Parker, S. 2008. Canaveral National Seashore Historic Resource Study. Available at: http://www.nps.gov/parkhistory/online_books/cana/cana_hrs.pdf (last accessed October 2019).

Pardue, J. 2008. The GeoPDF File; a new solution for the digital publication, distribution, and collaboration of geospatial data. 30 pages. U. S. Geological Survey, Reston, Virginia.

Schmoldt, D. L., D. L. Peterson, and D. G. Silsbee. 1994. Developing inventory and monitoring programs based on multiple objectives. Environmental Management 18(5):707–727.

UNESCO. 1973. International Classification and Mapping of Vegetation. Series 6. Ecology and conservation. United Nations Educational, Scientific, and Cultural Organization, Paris, France.

Wuthrich, D. 2006. Data sharing with GeoPDFs. Geospatial Solutions 16:34–35.

Appendix A. Flight Line

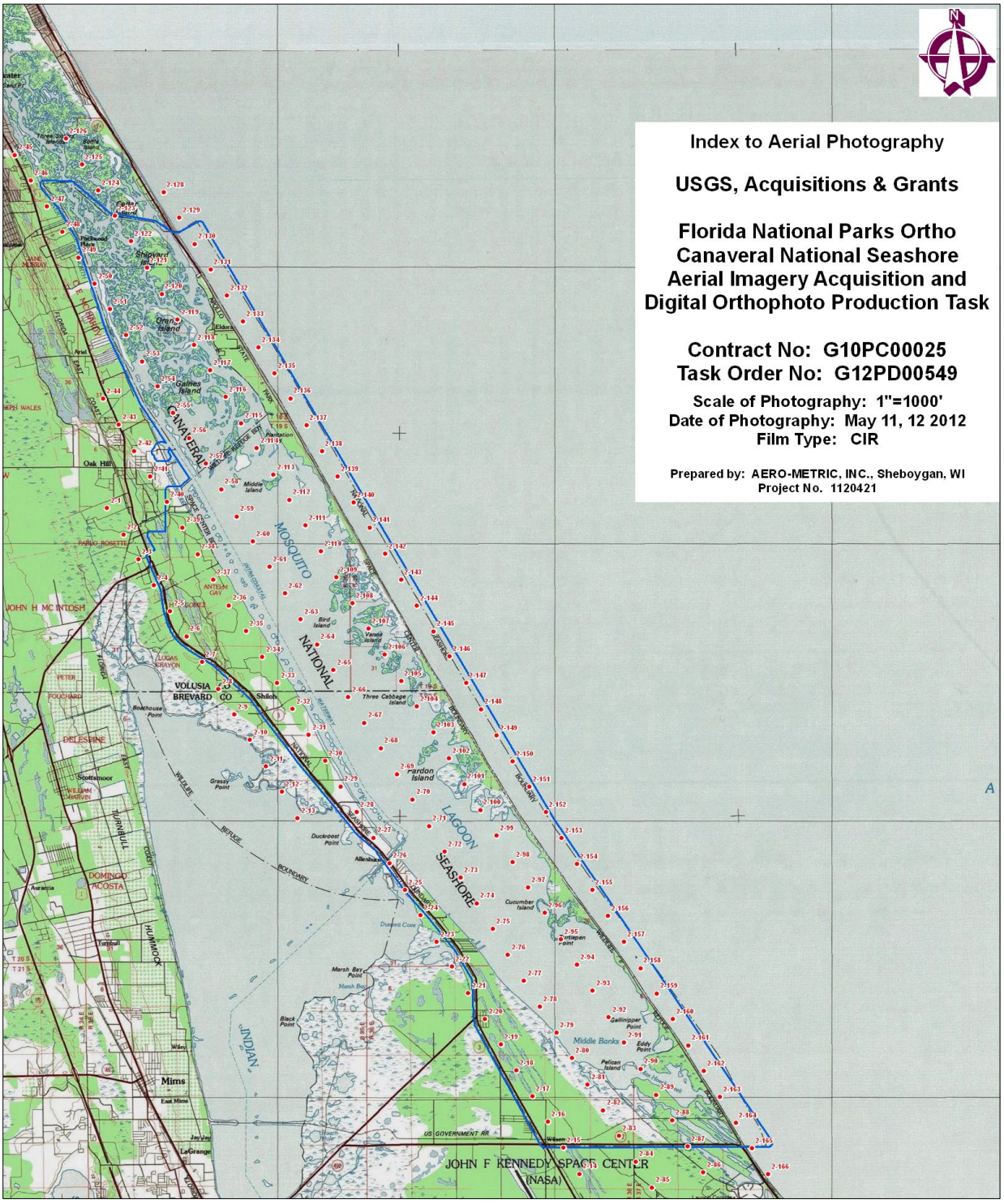


Figure A-1. Index to Aerial Photography.

Appendix B. NatureServe Plot Locations

Table B-1. NatureServe plots with coordinates, surveyor names, and classifications.

Plot Code	Provisional	Latitude	Longitude	Surveyors	Cowardin	Leaf Pheno	Leaf Type	Physio Class	CEGL
CANA.001	maritime hammock	28.9084	-80.8147	G. Schultz, M. Pyne, R. White, JW	Upland	Evergreen	Broad-leaved	Forest	7032
CANA.002	coastal strand	28.911	-80.8118	G. Schultz, M. Pyne, R. White	Upland	Evergreen	Broad-leaved	Shrubland	3812
CANA.003	tidal marsh	28.5005	-80.4546	G. Schultz	Estuarine	Evergreen	Microphyllous	Shrubland	3956
CANA.004	beach dune	28.4922	-80.4514	G. Schultz	Upland	Perennial herb	Graminoid	Herbaceous vegetation	4001
CANA.005	coastal grassland	28.4922	-80.4516	G. Schultz	Upland	Perennial herb	Graminoid	Herbaceous vegetation	4883
CANA.006	coast interdune swale	28.4921	-80.4516	G. Schultz	Upland	Perennial herb	Graminoid	Herbaceous vegetation	0
CANA.007	hydric hammock	28.5106	-80.4949	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	7040
CANA.008	mesic hammock	28.5005	-80.4912	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	7032
CANA.009	mesic hammock	28.5023	-80.4928	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	7032
CANA.010	scrub	28.5033	-80.4941	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	7020
CANA.011	scrub	28.5034	-80.4941	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	7020
CANA.012	coastal strand	28.4247	-80.4035	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	3811
CANA.013	beach dune	28.4228	-80.4018	G. Schultz	Estuarine	Evergreen	Broad-leaved	Shrubland	0
CANA.014	tidal marsh	28.3907	-80.4006	G. Schultz	Estuarine	Perennial herb	Graminoid	Herbaceous vegetation	4114
CANA.015	tidal marsh	28.3905	-80.4006	G. Schultz	Estuarine	Evergreen	Mixed	Shrubland	2278

Plot Code	Provisional	Latitude	Longitude	Surveyors	Cowardin	Leaf Pheno	Leaf Type	Physio Class	CEGL
CANA.016	tidal swamp	28.4059	-80.3912	G. Schultz	Estuarine	Evergreen	Broad-leaved	Shrubland	0
CANA.017	mesic flatwoods	28.4028	-80.4256	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	7750
CANA.018	basin marsh	28.4003	-80.4227	G. Schultz	Palustrine	Cold-deciduous	Broad-leaved	Shrubland	4423
CANA.019	mesic hammock	28.394	-80.4226	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	7032
CANA.020	scrub	28.4145	-80.43	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	3821
CANA.021	mesic flatwoods	28.4649	-80.4739	G. Schultz	Upland	Evergreen	Mixed	Woodland	7750
CANA.022	mesic flatwoods	28.4627	-80.47	G. Schultz	Upland	Evergreen	Mixed	Woodland	7750
CANA.023	scrub	28.4639	-80.4713	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	3821
CANA.024	scrub	28.5118	-80.5005	G. Schultz	Upland	Evergreen	Broad-leaved	Woodland	3821
CANA.025	ruderal	28.5105	-80.4956	G. Schultz	Upland	Evergreen	Mixed	Woodland	7654
CANA.026	tidal marsh	28.5132	-80.4707	G. Schultz	Estuarine	Evergreen	Graminoid	Herbaceous vegetation	7694
CANA.027	maritime hammock	28.5221	-80.4735	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	7033
CANA.028	maritime hammock	28.5211	-80.4728	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	3525
CANA.029	shell mound	28.5203	-80.4723	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	3525
CANA.030	shell mound	28.5341	-80.483	G. Schultz	Upland	Evergreen	Broad-leaved	Woodland	3525
CANA.031	shell mound	28.5551	-80.4938	G. Schultz	Upland	Evergreen	Broad-leaved	Woodland	3525
CANA.032	maritime hammock	28.4632	-80.4329	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	7033
CANA.033	tidal marsh	28.481	-80.4431	G. Schultz	Estuarine	Evergreen	Graminoid	Herbaceous vegetation	4186
CANA.034	beach dune	28.4812	-80.443	G. Schultz	Upland	Evergreen	Graminoid	Herbaceous vegetation	4001
CANA.035	mesic flatwoods	28.5427	-80.4905	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	4658

Plot Code	Provisional	Latitude	Longitude	Surveyors	Cowardin	Leaf Pheno	Leaf Type	Physio Class	CEGL
CANA.036	mesic flatwoods	28.5412	-80.4851	G. Schultz	Upland	Evergreen	Mixed	Forest	4658
CANA.037	mesic hammock	28.5414	-80.4829	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	7033
CANA.038	coastal strand	28.5438	-80.4843	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	3812
CANA.039	wet flatwoods	28.4942	-80.5018	G. Schultz	Upland	Evergreen	Mixed	Forest	7040
CANA.040	scrub	28.4702	-80.4727	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	3821
CANA.041	ruderal	28.4708	-80.4732	G. Schultz	Upland	Evergreen	Graminoid	Herbaceous vegetation	7653
CANA.042	coastal strand	28.3949	-80.3817	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	3811
CANA.043	tidal marsh	28.4046	-80.3903	G. Schultz	Estuarine	Evergreen	Graminoid	Herbaceous vegetation	7694
CANA.044	tidal swamp	28.4042	-80.3902	G. Schultz	Estuarine	Evergreen	Broad-leaved	Shrubland	7600
CANA.045	tidal swamp	28.4011	-80.3835	G. Schultz	Estuarine	Evergreen	Broad-leaved	Shrubland	7600
CANA.046	mesic flatwoods	28.3852	-80.4048	G. Schultz	Upland	Evergreen	Broad-leaved	Woodland	7750
CANA.047	scrubby flatwoods	28.3929	-80.4126	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	7750
CANA.048	ruderal	28.3931	-80.4145	G. Schultz	Upland	Evergreen	Graminoid	Herbaceous vegetation	7653
CANA.049	hydric hammock	28.3908	-80.4149	G. Schultz	Palustrine	Mixed evergreen - cold-deciduous	Broad-leaved	Forest	3527
CANA.050	hydric hammock	28.3908	-80.4151	G. Schultz	Palustrine	Evergreen	Broad-leaved	Woodland	3527
CANA.051	other	28.3941	-80.4131	G. Schultz	Palustrine	Evergreen	Graminoid	Herbaceous vegetation	4235
CANA.052	beach dune	28.405	-80.3901	G. Schultz	Upland	Evergreen	Broad-leaved herbaceous	Herbaceous vegetation	4406
CANA.053	beach dune	28.4136	-80.3938	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	3781
CANA.054	wet flatwoods	28.3924	-80.4146	G. Schultz	Upland	Evergreen	Broad-leaved	Woodland	3796

Plot Code	Provisional	Latitude	Longitude	Surveyors	Cowardin	Leaf Pheno	Leaf Type	Physio Class	CEGL
CANA.055	–	28.4002	-80.4142	G. Schultz	Palustrine	Evergreen	Pteridophyte	Herbaceous vegetation	4475
CANA.056	wet flatwoods	28.4956	-80.5018	G. Schultz	Upland	Evergreen	Broad-leaved	Woodland	4791
CANA.057	mesic flatwoods	28.4955	-80.5018	G. Schultz	Upland	Evergreen	Mixed	Woodland	4791
CANA.058	basin marsh	28.4955	-80.5013	G. Schultz	Palustrine	Cold-deciduous	Mixed	Forest	3940
CANA.059	basin marsh	28.4955	-80.5015	G. Schultz	Palustrine	Evergreen	Mixed	Herbaceous vegetation	4511
CANA.060	dome swamp	28.4932	-80.5004	G. Schultz	Palustrine	Cold-deciduous	Mixed	Woodland	4457
CANA.061	basin marsh	28.4922	-80.4953	G. Schultz	Palustrine	Evergreen	Mixed	Herbaceous vegetation	4527
CANA.062	basin marsh	28.4926	-80.4951	G. Schultz	Palustrine	Evergreen	Graminoid	Herbaceous vegetation	3940
CANA.063	ruderal	28.5003	-80.5004	G. Schultz	Palustrine	Evergreen	Mixed	Herbaceous vegetation	4462
CANA.064	basin marsh	28.5023	-80.5006	G. Schultz	Palustrine	Evergreen	Mixed	Herbaceous vegetation	3940
CANA.065	scrub	28.4953	-80.5001	G. Schultz	Upland	Evergreen	Mixed	Woodland	3821
CANA.066	dome swamp	28.4954	-80.5004	G. Schultz	Palustrine	Cold-deciduous	Mixed	Forest	4457
CANA.067	mesic flatwoods	28.4943	-80.5004	G. Schultz	Upland	Evergreen	Mixed	Woodland	7750
CANA.068	hydric hammock	28.4832	-80.4934	G. Schultz	Upland	Mixed evergreen - cold-deciduous	Mixed	Forest	3643
CANA.069	wet flatwoods	28.4829	-80.4932	G. Schultz	Upland	Evergreen	Mixed	Forest	3643
CANA.070	ruderal	28.4754	-80.4847	G. Schultz	Upland	Evergreen	Mixed	Forest	7171
CANA.071	mesic flatwoods	28.4828	-80.4848	G. Schultz	Upland	Evergreen	Mixed	Forest	7750
CANA.072	xeric hammock	28.4827	-80.485	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	7020

Plot Code	Provisional	Latitude	Longitude	Surveyors	Cowardin	Leaf Pheno	Leaf Type	Physio Class	CEGL
CANA.073	mesic hammock	28.4721	-80.4812	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	7021
CANA.074	ruderal	28.4714	-80.4747	G. Schultz	Upland	Evergreen	Mixed	Shrubland	0
CANA.075	maritime hammock	28.4727	-80.4718	G. Schultz	Upland	Evergreen	Mixed	Forest	7032
CANA.076	ruderal	28.4426	-80.4458	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	4237
CANA.077	maritime hammock	28.4423	-80.4459	G. Schultz	Upland	Evergreen	Broad-leaved	Woodland	7020
CANA.078	ruderal	28.4433	-80.4452	G. Schultz	Upland	Evergreen	Mixed	Forest	4830
CANA.079	scrubby flatwoods	28.4322	-80.4422	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	3821
CANA.080	tidal marsh	28.4217	-80.4321	G. Schultz	Estuarine	Evergreen	Mixed	Herbaceous vegetation	4194
CANA.081	hydric hammock	28.4206	-80.4314	G. Schultz	Palustrine	Evergreen	Mixed	Forest	7040
CANA.082	mesic hammock	28.4207	-80.4316	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	7028
CANA.083	wet flatwoods	28.4147	-80.4314	G. Schultz	Upland	Evergreen	Mixed	Forest	3643
CANA.084	maritime hammock	28.4519	-80.4559	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	7032
CANA.085	ruderal	28.4728	-80.4811	G. Schultz	Upland	Evergreen	Graminoid	Herbaceous vegetation	3960
CANA.086	mesic flatwoods	28.4743	-80.473	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	4241
CANA.087	tidal marsh	28.4739	-80.4726	G. Schultz	Estuarine	Evergreen	Graminoid	Herbaceous vegetation	7663
CANA.088	mesic hammock	28.473	-80.4721	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	7028
CANA.089	hydric hammock	28.4731	-80.4721	G. Schultz	Palustrine	Evergreen	Broad-leaved	Forest	3527
CANA.090	ruderal	28.4707	-80.4746	G. Schultz	Upland	Evergreen	Mixed	Woodland	0
CANA.091	tidal marsh	28.4052	-80.4215	G. Schultz	Estuarine	Evergreen	Graminoid	Herbaceous vegetation	7663

Plot Code	Provisional	Latitude	Longitude	Surveyors	Cowardin	Leaf Pheno	Leaf Type	Physio Class	CEGL
CANA.092	tidal marsh	28.4055	-80.4218	G. Schultz	Estuarine	Evergreen	Graminoid	Herbaceous vegetation	7663
CANA.093	tidal marsh	28.4051	-80.4215	G. Schultz	Estuarine	Evergreen	Graminoid	Herbaceous vegetation	4194
CANA.094	–	28.4046	-80.4217	G. Schultz	Palustrine	Perennial herb	Graminoid	Herbaceous vegetation	4511
CANA.095	mesic flatwoods	28.4047	-80.4218	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	3796
CANA.096	hydric hammock	28.6640	-80.6602	G. Schultz	Estuarine	Evergreen	Broad-leaved	Shrubland	3799
CANA.097	maritime hammock	28.6617	-80.6534	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	3525
CANA.098	estuarine tidal swamp	28.6632	-80.6575	G. Schultz	Estuarine	Evergreen	Broad-leaved	Shrubland	4827
CANA.099	tidal marsh	28.6607	-80.6701	G. Schultz	Estuarine	Perennial herb	Mixed herbaceous	Herbaceous vegetation	7694
CANA.100	tidal marsh	28.6606	-80.6689	G. Schultz	Estuarine	Evergreen	Broad-leaved	Shrubland	3924
CANA.101	beach dune	28.6518	-80.6294	G. Schultz	Upland	Perennial herb	Mixed herbaceous	Herbaceous vegetation	3811
CANA.102	mesic hammock	28.9328	-80.8383	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	7028
CANA.103	tidal marsh	28.9300	-80.8402	G. Schultz	Estuarine	Perennial herb	Mixed herbaceous	Herbaceous vegetation	7694
CANA.104	tidal marsh	28.9228	-80.8395	G. Schultz	Estuarine	Evergreen	Mixed broad-leaved	Dwarf shrubland	3956
CANA.105	maritime hammock	28.9152	-80.8334	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	7033
CANA.106	tidal marsh	28.9272	-80.8349	G. Schultz	Estuarine	Perennial herb	Mixed herbaceous	Herbaceous vegetation	2278
CANA.107	maritime hammock	28.9268	-80.8357	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	7033
CANA.108	ruderal spoil island	28.6685	-80.6679	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	4237

Plot Code	Provisional	Latitude	Longitude	Surveyors	Cowardin	Leaf Pheno	Leaf Type	Physio Class	CEGL
CANA.109	tidal swamp	28.6693	-80.6674	G. Schultz	Estuarine	Evergreen	Broad-leaved	Shrubland	4827
CANA.110	maritime hammock/ruderal spoil island	28.9015	-80.8212	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	4237
CANA.111	tidal marsh	28.8803	-80.7977	G. Schultz	Estuarine	Perennial herb	Graminoid	Herbaceous vegetation	4186
CANA.112	shell mound	28.8804	-80.7983	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	3525
CANA.113	beach dune	28.9352	-80.8281	G. Schultz	Upland	Perennial herb	Graminoid	Herbaceous vegetation	4001
CANA.114	coastal strand	28.8647	-80.7809	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	3811
CANA.115	ruderal - borrow pond	28.6853	-80.6999	G. Schultz	Estuarine	Perennial herb	Broad-leaved herbaceous	Herbaceous vegetation	3988
CANA.116	tidal swamp	28.6757	-80.6475	G. Schultz	Estuarine	Evergreen	Broad-leaved	Shrubland	7600
CANA.117	tidal swamp	28.6884	-80.6576	G. Schultz	Estuarine	Evergreen	Broad-leaved	Shrubland	7600
CANA.118	hydric hammock	28.8001	-80.7957	G. Schultz	Palustrine	Evergreen	Broad-leaved	Forest	7040
CANA.119	wet flatwoods	28.8027	-80.7978	G. Schultz	Upland	–	–	–	4791
CANA.120	scrubby flatwoods	28.8021	-80.7990	G. Schultz	Upland	Mixed evergreen - cold-deciduous	Broad-leaved	Shrubland	3821
CANA.121	beach dune	28.7237	-80.6848	G. Schultz	Upland	Perennial herb	Broad-leaved herbaceous	Herbaceous vegetation	4406
CANA.122	maritime hammock	28.7751	-80.7262	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	7033
CANA.123	coastal strand	28.7911	-80.7334	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	3811
CANA.124	beach dune	28.7451	-80.7017	G. Schultz	Upland	Perennial herb	Graminoid	Herbaceous vegetation	4001
CANA.125	beach dune	28.7427	-80.6997	G. Schultz	Upland	Perennial herb	Mixed herbaceous	Herbaceous vegetation	4001

Plot Code	Provisional	Latitude	Longitude	Surveyors	Cowardin	Leaf Pheno	Leaf Type	Physio Class	CEGL
CANA.126	–	28.9005	-80.8506	G. Schultz	Upland	Evergreen	Broad-leaved	Forest	7032
CANA.127	tidal swamp	28.918	-80.8558	G. Schultz	Estuarine	Evergreen	Broad-leaved	Shrubland	4764
CANA.128	tidal swamp	28.9427	-80.8663	G. Schultz	Estuarine	Evergreen	Broad-leaved	Shrubland	4764
CANA.129	tidal swamp	28.9432	-80.8650	G. Schultz	Estuarine	Evergreen	Broad-leaved	Shrubland	4827
CANA.130	ruderal spoil island	28.9452	-80.8695	G. Schultz	Upland	Perennial herb	Mixed herbaceous	Herbaceous vegetation	4237
CANA.131	coastal strand	28.6447	-80.6247	G. Schultz	Upland	Evergreen	Broad-leaved	Shrubland	3811
CANA.132	tidal marsh	28.6442	-80.6526	G. Schultz	Estuarine	Perennial herb	Graminoid	Herbaceous vegetation	4186
CANA.133	depression marsh	28.6442	-80.6748	G. Schultz	Palustrine	Perennial herb	Graminoid	Herbaceous vegetation	4475

Appendix C. Accuracy Assessment Plot Notes

Table C-1. The Accuracy Assessment points were collected by I. Weber, J. Armstrong, J. Mansuetti, and N. Panico on behalf of Amec-Foster-Wheeler Environmental & Infrastructure, Inc. on October 3–5, 12–21, 24–28, 31, and November 1–2, 2016.

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_000100	10/27/2016 0:00	Jarrod Armstrong	CEGL007750	–	–	–
CANA_AA_000200	10/27/2016 0:00	Irene Weber	CEGL007040	–	–	–
CANA_AA_000400	10/21/2016 0:00	Joe Mansuetti	CEGL007033	–	–	Maritime live oak hammock
CANA_AA_000500	10/21/2016 0:00	Joe Mansuetti	CEGL004241	–	–	palmetto live oak hydric hammock
CANA_AA_000600	10/27/2016 0:00	Irene Weber	CEGL007033	–	–	–
CANA_AA_000700	10/21/2016 0:00	Joe Mansuetti	CEGL007033	–	–	palmetto live oak hydric hammock
CANA_AA_000800	10/27/2016 0:00	Irene Weber	CEGL004511	CEGL003527	–	–
CANA_AA_000900	10/27/2016 0:00	Irene Weber	CEGL003796	–	–	no sabal, only quercus
CANA_AA_001000	10/27/2016 0:00	Irene Weber	CEGL003527	CEGL004511	–	–
CANA_AA_001100	10/27/2016 0:00	Irene Weber	CEGL003796	CEGL004511	–	–
CANA_AA_001200	10/21/2016 0:00	Joe Mansuetti	CEGL007033	–	–	Maritime live oak hammock
CANA_AA_001300	10/27/2016 0:00	Irene Weber	CEGL003796	–	–	no sabal
CANA_AA_001400	10/21/2016 0:00	Joe Mansuetti	CEGL007033	–	–	FL Atlantic coastal tropical temperate maritime hammock
CANA_AA_001500	10/21/2016 0:00	Joe Mansuetti	CEGL004241	–	–	xeric love oak hammock
CANA_AA_001600	10/18/2016 0:00	Joe Mansuetti	CEGL007033	–	–	maritime live oak hammock with white mangrove in a small ditch
CANA_AA_001700	10/18/2016 0:00	Joe Mansuetti	CEGL004241	–	–	xeric live oak hammock

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_001800	10/18/2016 0:00	Joe Mansuetti	CEGL004241	–	–	xeric live oak hammock
CANA_AA_001900	10/21/2016 0:00	Joe Mansuetti	CEGL007028	–	–	xeric live oak hammock
CANA_AA_002000	10/18/2016 0:00	Joe Mansuetti	CEGL007033	–	–	FL Atlantic coastal tropical/temperate maritime hammock
CANA_AA_002200	10/12/2016 0:00	Irene Weber	CEGL007040	–	–	–
CANA_AA_002300	10/13/2016 0:00	Nichole Panico	CEGL007033	–	–	ardisia and psychotria not present, quercus laurifolia present not Q. Virginiana
CANA_AA_002400	10/12/2016 0:00	Irene Weber	CEGL004827	–	–	–
CANA_AA_002500	12/18/2016 0:00	Irene Weber	CEGL007032	–	–	Fair
CANA_AA_002600	10/4/2016 0:00	Irene Weber	CEGL007033	–	–	–
CANA_AA_002700	10/4/2016 0:00	Nichole Panico	CEGL003796	–	ground cover primarily leaf litter	plant composition matches key
CANA_AA_002800	10/4/2016 0:00	Irene Weber	CEGL007033	–	–	–
CANA_AA_003000	10/25/2016 0:00	Joe Mansuetti	CEGL007020	–	–	–
CANA_AA_003100	10/5/2016 0:00	Nichole Panico	CEGL007032	–	–	canopy cover less than 60%
CANA_AA_003200	10/5/2016 0:00	Nichole Panico	CEGL007032	–	–	–
CANA_AA_003300	10/5/2016 0:00	Nichole Panico	CEGL007032	–	–	woodland, not forest
CANA_AA_003500	10/21/2016 0:00	Jarrod Armstrong	CEGL007033	CEGL003525	–	–
CANA_AA_003700	10/21/2016 0:00	Jarrod Armstrong	CEGL007033	CEGL003799	–	edge
CANA_AA_004200	10/14/2016 0:00	Joe Mansuetti	CEGL004827	–	–	–
CANA_AA_004300	10/18/2016 0:00	Joe Mansuetti	CEGL004827	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_004400	10/18/2016 0:00	Joe Mansuetti	CEGL004827	–	–	–
CANA_AA_004500	10/14/2016 0:00	Joe Mansuetti	CEGL004827	–	–	–
CANA_AA_004700	10/18/2016 0:00	Joe Mansuetti	CEGL004827	–	–	–
CANA_AA_004800	10/18/2016 0:00	Joe Mansuetti	CEGL004827	–	–	–
CANA_AA_004900	10/19/2016 0:00	Jarrod Armstrong	CEGL003956	–	–	–
CANA_AA_005000	10/19/2016 0:00	Joe Mansuetti	CEGL007600	–	–	–
CANA_AA_005100	10/19/2016 0:00	Joe Mansuetti	CEGL004827	–	–	–
CANA_AA_005300	10/19/2016 0:00	Joe Mansuetti	CEGL004827	–	–	–
CANA_AA_005400	10/19/2016 0:00	Joe Mansuetti	CEGL004827	–	–	–
CANA_AA_005500	10/20/2016 0:00	Irene Weber	CEGL007600	–	–	–
CANA_AA_005600	10/31/2016 0:00	Irene Weber	CEGL004827	CEGL007600	–	–
CANA_AA_006000	11/2/2016 0:00	Irene Weber	CEGL004827	CEGL007600	–	–
CANA_AA_006100	11/2/2016 0:00	Irene Weber	CEGL003956	CEGL007600	–	–
CANA_AA_006400	11/2/2016 0:00	Irene Weber	CEGL007600	–	–	–
CANA_AA_006700	10/17/2016 0:00	Irene Weber	CEGL004827	–	–	–
CANA_AA_006800	10/17/2016 0:00	Irene Weber	CEGL007600	CEGL003956	offset due to marsh	–
CANA_AA_006900	10/17/2016 0:00	Irene Weber	CEGL007600	CEGL003956	–	–
CANA_AA_007000	10/5/2016 0:00	Nichole Panico	CEGL003643	CEGL007032	–	–
CANA_AA_007100	10/5/2016 0:00	Nichole Panico	CEGL007750	–	–	–
CANA_AA_007200	10/27/2016 0:00	Irene Weber	CEGL007033	CEGL007040	–	–
CANA_AA_007300	10/27/2016 0:00	Irene Weber	CEGL007020	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_007400	10/26/2016 0:00	Irene Weber	CEGL003825	–	–	–
CANA_AA_007500	10/27/2016 0:00	Jarrod Armstrong	CEGL003643	–	–	pinus elliotti
CANA_AA_007600	10/27/2016 0:00	Jarrod Armstrong	CEGL003822	CEGL003825	–	also has lyonia; recent burn area short scrub
CANA_AA_007700	10/27/2016 0:00	Irene Weber	CEGL004241	CEGL007028	–	–
CANA_AA_007800	10/26/2016 0:00	Irene Weber	CEGL003825	–	–	–
CANA_AA_007900	10/27/2016 0:00	Jarrod Armstrong	CEGL007020	CEGL003643	–	–
CANA_AA_008000	10/26/2016 0:00	Jarrod Armstrong	CEGL003821	CEGL003825	–	–
CANA_AA_008100	10/26/2016 0:00	Jarrod Armstrong	CEGL003822	CEGL003643	–	–
CANA_AA_008200	10/28/2016 0:00	Joe Mansuetti	CEGL004511	–	–	–
CANA_AA_008300	10/26/2016 0:00	Joe Mansuetti	CEGL007020	–	–	Northeast Florida coastal shrub
CANA_AA_008400	10/26/2016 0:00	Jarrod Armstrong	CEGL003643	–	–	–
CANA_AA_008500	10/26/2016 0:00	Joe Mansuetti	CEGL007020	–	–	–
CANA_AA_008600	10/14/2016 0:00	Joe Mansuetti	CEGL003643	–	–	ilex not present
CANA_AA_008700	10/14/2016 0:00	Nichole Panico	CEGL003825	–	–	–
CANA_AA_008800	10/14/2016 0:00	Nichole Panico	CEGL003825	–	–	–
CANA_AA_008900	10/14/2016 0:00	Nichole Panico	CEGL007750	–	–	–
CANA_AA_009000	10/14/2016 0:00	Nichole Panico	CEGL007750	–	–	aristida not present, panicum present
CANA_AA_009100	10/14/2016 0:00	Nichole Panico	CEGL003643	CEGL003825	–	ilex glabra not present

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_009200	10/17/2016 0:00	Joe Mansuetti	CEGL003527	–	–	with saw palm also
CANA_AA_009300	10/13/2016 0:00	Nichole Panico	CEGL003822	CEGL007750	–	sideroxylon not dominant, xeminia not present
CANA_AA_009400	10/13/2016 0:00	Nichole Panico	CEGL003643	CEGL003825	–	–
CANA_AA_009500	10/13/2016 0:00	Nichole Panico	CEGL007171	CEGL003796	–	pinus present
CANA_AA_009600	10/13/2016 0:00	Nichole Panico	CEGL003796	CEGL007040	–	–
CANA_AA_009700	10/13/2016 0:00	Nichole Panico	CEGL003796	–	–	–
CANA_AA_009800	10/13/2016 0:00	Nichole Panico	CEGL003821	–	–	persea not present
CANA_AA_009900	10/31/2016 0:00	Irene Weber	CEGL003825	–	–	–
CANA_AA_010000	10/28/2016 0:00	Joe Mansuetti	CEGL007020	–	–	xeric oak scrubland
CANA_AA_010100	10/13/2016 0:00	Nichole Panico	CEGL003796	CEGL003527	–	ilex cassine not present, other species also present and dominant that are not listed in classification
CANA_AA_010200	10/19/2016 0:00	Irene Weber	CEGL003821	CEGL003822	–	–
CANA_AA_010300	10/19/2016 0:00	Irene Weber	CEGL003527	–	–	no sabal
CANA_AA_010400	10/19/2016 0:00	Irene Weber	CEGL004241	–	–	little QV
CANA_AA_010500	10/19/2016 0:00	Irene Weber	CEGL003821	–	–	–
CANA_AA_010600	10/19/2016 0:00	Irene Weber	CEGL003821	–	–	–
CANA_AA_010700	10/19/2016 0:00	Irene Weber	CEGL003821	–	–	–
CANA_AA_010800	10/24/2016 0:00	Nichole Panico	CEGL003796	CEGL003643	–	–
CANA_AA_010900	10/18/2016 0:00	Jarrod Armstrong	CEGL003796	–	–	barbonia is dominant no sereno repens
CANA_AA_011000	10/18/2016 0:00	Jarrod Armstrong	CEGL004791	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_011100	10/18/2016 0:00	Jarrod Armstrong	CEGL003796	CEGL003525	–	edge
CANA_AA_011200	10/24/2016 0:00	Jarrod Armstrong	CEGL003643	CEGL003796	–	edge of two veg types
CANA_AA_011300	10/24/2016 0:00	Jarrod Armstrong	CEGL003643	–	–	–
CANA_AA_011400	10/18/2016 0:00	Jarrod Armstrong	CEGL003796	CEGL003643	–	missing glabra
CANA_AA_011500	10/18/2016 0:00	Jarrod Armstrong	CEGL003812	–	–	–
CANA_AA_011600	10/18/2016 0:00	Jarrod Armstrong	CEGL003643	–	–	–
CANA_AA_011700	10/18/2016 0:00	Jarrod Armstrong	CEGL003796	–	–	–
CANA_AA_011800	10/18/2016 0:00	Jarrod Armstrong	CEGL003796	–	–	missing sereno repens
CANA_AA_011900	10/24/2016 0:00	Jarrod Armstrong	CEGL003643	–	–	–
CANA_AA_012000	10/18/2016 0:00	Jarrod Armstrong	CEGL003812	CEGL003799	–	depressional arwa
CANA_AA_012100	10/24/2016 0:00	Jarrod Armstrong	CEGL003643	–	–	–
CANA_AA_012200	10/18/2016 0:00	Jarrod Armstrong	CEGL003796	–	–	–
CANA_AA_012300	10/18/2016 0:00	Jarrod Armstrong	CEGL003796	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_012400	10/24/2016 0:00	Jarrod Armstrong	CEGL003643	–	–	–
CANA_AA_012600	10/18/2016 0:00	Jarrod Armstrong	CEGL003527	CEGL003525	–	edge of two classifications
CANA_AA_012700	10/18/2016 0:00	Jarrod Armstrong	CEGL003796	–	–	sereno repens not dominant
CANA_AA_012800	10/24/2016 0:00	Jarrod Armstrong	CEGL003643	–	–	–
CANA_AA_012900	10/24/2016 0:00	Jarrod Armstrong	CEGL003643	–	–	–
CANA_AA_013000	10/27/2016 0:00	Jarrod Armstrong	CEGL004511	–	some small maples in center of marsh	–
CANA_AA_013100	10/28/2016 0:00	Joe Mansuetti	CEGL003527	–	–	–
CANA_AA_013200	10/27/2016 0:00	Joe Mansuetti	CEGL004423	–	–	–
CANA_AA_013300	10/26/2016 0:00	Irene Weber	CEGL003527	CEGL003527	–	–
CANA_AA_013400	10/14/2016 0:00	Nichole Panico	CEGL003527	–	–	ilex and morella not present. Shrub layer not very dense. Dense herbaceous layer
CANA_AA_013500	10/14/2016 0:00	Nichole Panico	CEGL003527	–	–	ilex not present, quercus not present. Andropgon present.
CANA_AA_013600	10/18/2016 0:00	Irene Weber	CEGL003527	–	–	–
CANA_AA_013700	11/1/2016 0:00	Irene Weber	CEGL003796	CEGL004511	–	–
CANA_AA_013800	11/1/2016 0:00	Irene Weber	CEGL003527	CEGL004475	–	–
CANA_AA_013900	11/1/2016 0:00	Irene Weber	CEGL003527	–	–	–
CANA_AA_014000	11/1/2016 0:00	Irene Weber	CEGL003527	–	–	–
CANA_AA_014100	11/1/2016 0:00	Irene Weber	CEGL003527	CEGL004475	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_014200	11/1/2016 0:00	Irene Weber	CEGL003527	–	–	–
CANA_AA_014400	10/24/2016 0:00	Joe Mansuetti	CEGL003799	–	–	Brazilian pepper seasonally flooded shrubland
CANA_AA_014500	10/4/2016 0:00	Irene Weber	CEGL007663	–	not in key	–
CANA_AA_014600	10/4/2016 0:00	Irene Weber	CEGL007653	–	–	Urochloa maxima Herbaceous Alliance
CANA_AA_015000	10/3/2016 0:00	Morgan Edwards	CEGL003527	–	Brazilian pepper also present	–
CANA_AA_015500	10/17/2016 0:00	Irene Weber	CEGL007040	–	–	–
CANA_AA_015800	10/17/2016 0:00	Irene Weber	CEGL004674	–	Best fit Sabal palmetto - Quercus laurifolia - Quercus virginiana - Magnolia virginiana - Ulmus	–
CANA_AA_016000	10/28/2016 0:00	Irene Weber	CEGL003812	–	–	–
CANA_AA_016100	10/27/2016 0:00	Irene Weber	CEGL004423	CEGL003527	–	–
CANA_AA_016200	10/27/2016 0:00	Irene Weber	CEGL004423	–	–	acer swamp
CANA_AA_016300	10/28/2016 0:00	Joe Mansuetti	CEGL003822	–	–	–
CANA_AA_016400	10/26/2016 0:00	Joe Mansuetti	CEGL007020	–	–	northeastern Florida coastal scrub. Not near dune area
CANA_AA_016500	10/28/2016 0:00	Joe Mansuetti	CEGL003821	–	–	xeric scrub oak
CANA_AA_016600	10/21/2016 0:00	Joe Mansuetti	CEGL004241	–	–	live oak saw palmetto shrubland
CANA_AA_016700	10/21/2016 0:00	Joe Mansuetti	CEGL007028	–	–	live oak saw palmetto shrubland
CANA_AA_016800	10/13/2016 0:00	Nichole Panico	CEGL003825	–	–	–
CANA_AA_016900	10/31/2016 0:00	Irene Weber	CEGL003825	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_017000	10/24/2016 0:00	Jarrod Armstrong	CEGL004241	–	–	highly disturbed area
CANA_AA_017100	10/24/2016 0:00	Joe Mansuetti	CEGL003796	CEGL004241	–	mixed veg types
CANA_AA_017200	10/4/2016 0:00	Nichole Panico	CEGL007020	–	ground cover half bare sand and half leaf litter	expected veg present
CANA_AA_017300	10/4/2016 0:00	Nichole Panico	CEGL004241	CEGL003796	–	area dominated by serenoa repens, sparse cabbage palm on outskirts
CANA_AA_017400	10/4/2016 0:00	Nichole Panico	CEGL007020	–	ground cover primarily leaf litter	correct species present
CANA_AA_017500	10/25/2016 0:00	Joe Mansuetti	CEGL003811	–	–	Florida coastal' strand
CANA_AA_017600	10/4/2016 0:00	Nichole Panico	CEGL004241	–	ground cover primarily leaf litter	ilex vomitoria not present
CANA_AA_017700	10/4/2016 0:00	Irene Weber	CEGL003812	–	–	recently burned. Tall quercus dead
CANA_AA_017800	10/4/2016 0:00	Nichole Panico	CEGL003825	–	–	–
CANA_AA_017900	10/4/2016 0:00	Irene Weber	CEGL003812	–	–	–
CANA_AA_018000	10/4/2016 0:00	Irene Weber	CEGL003825	–	–	–
CANA_AA_018100	10/4/2016 0:00	Irene Weber	CEGL003825	–	–	–
CANA_AA_018200	10/4/2016 0:00	Irene Weber	CEGL003825	–	–	–
CANA_AA_018300	10/4/2016 0:00	Irene Weber	CEGL003825	–	–	–
CANA_AA_018400	10/4/2016 0:00	Irene Weber	CEGL003812	–	–	glabr
CANA_AA_018500	10/3/2016 0:00	Irene Weber	CEGL003825	–	–	–
CANA_AA_018600	10/17/2016 0:00	Irene Weber	CEGL003825	–	–	–
CANA_AA_018700	10/3/2016 0:00	Irene Weber	CEGL003825	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_018900	10/21/2016 0:00	Jarrod Armstrong	CEGL004511	CEGL004186	–	–
CANA_AA_019000	10/21/2016 0:00	Joe Mansuetti	CEGL003811	–	–	–
CANA_AA_019100	10/21/2016 0:00	Joe Mansuetti	CEGL003811	–	–	–
CANA_AA_019200	10/21/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (tpt)
CANA_AA_019300	10/21/2016 0:00	Joe Mansuetti	CEGL003812	–	–	FL coastal strand (tpt)
CANA_AA_019400	10/21/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (satt)
CANA_AA_019500	10/21/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (satt)
CANA_AA_019600	10/21/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (tpt)
CANA_AA_019700	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	(tpt)	FL coastal strand (tpt)
CANA_AA_019800	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (tpt)
CANA_AA_019900	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (tpt)
CANA_AA_020000	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (tpt)
CANA_AA_020100	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (tpt)
CANA_AA_020200	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (tpt)
CANA_AA_020300	10/20/2016 0:00	Joe Mansuetti	CEGL007600	–	–	–
CANA_AA_020400	10/19/2016 0:00	Jarrod Armstrong	CEGL004827	–	–	–
CANA_AA_020500	10/19/2016 0:00	Jarrod Armstrong	CEGL003812	–	–	–
CANA_AA_020600	10/20/2016 0:00	Irene Weber	CEGL007600	–	–	–
CANA_AA_020700	10/20/2016 0:00	Irene Weber	CEGL003811	–	–	–
CANA_AA_020800	10/20/2016 0:00	Irene Weber	CEGL003811	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_021300	10/20/2016 0:00	Irene Weber	CEGL003811	–	–	–
CANA_AA_021400	10/20/2016 0:00	Irene Weber	CEGL003811	–	–	–
CANA_AA_021500	10/19/2016 0:00	Joe Mansuetti	CEGL007600	–	–	–
CANA_AA_021600	10/21/2016 0:00	Jarrod Armstrong	CEGL007600	–	–	–
CANA_AA_021700	10/21/2016 0:00	Jarrod Armstrong	CEGL003811	–	–	–
CANA_AA_021800	10/16/2016 0:00	Irene Weber	CEGL003811	–	–	–
CANA_AA_021900	10/16/2016 0:00	Irene Weber	CEGL003811	CEGL007600	–	–
CANA_AA_022000	10/27/2016 0:00	Joe Mansuetti	CEGL004423	–	–	–
CANA_AA_022100	10/5/2016 0:00	Nichole Panico	CEGL004241	–	–	ilex not present
CANA_AA_022200	10/5/2016 0:00	Nichole Panico	CEGL004241	–	–	ilex not present
CANA_AA_022300	10/5/2016 0:00	Nichole Panico	CEGL003940	–	–	other species present, but cladium dominant
CANA_AA_022400	10/27/2016 0:00	Jarrod Armstrong	CEGL004511	–	–	–
CANA_AA_022500	10/5/2016 0:00	Nichole Panico	CEGL004423	–	–	–
CANA_AA_022600	10/5/2016 0:00	Nichole Panico	CEGL004423	CEGL004658	–	–
CANA_AA_022700	10/27/2016 0:00	Jarrod Armstrong	CEGL004511	–	–	–
CANA_AA_022800	10/27/2016 0:00	Jarrod Armstrong	CEGL004511	–	–	–
CANA_AA_022900	10/27/2016 0:00	Joe Mansuetti	CEGL004423	–	–	–
CANA_AA_023000	10/26/2016 0:00	Irene Weber	CEGL004511	CEGL004462	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_023100	10/26/2016 0:00	Irene Weber	CEGL003940	–	–	–
CANA_AA_023200	10/19/2016 0:00	Irene Weber	CEGL004511	–	–	–
CANA_AA_023300	10/14/2016 0:00	Nichole Panico	CEGL003796	CEGL003825	–	other oak species present, not live oak
CANA_AA_023400	10/14/2016 0:00	Nichole Panico	CEGL003527	–	–	herbaceous species dominant, ilex and morella not present
CANA_AA_023500	10/14/2016 0:00	Nichole Panico	CEGL007040	–	(CEGL007653) Guinea Grass Herbaceous Vegetation	–
CANA_AA_023600	10/12/2016 0:00	Irene Weber	CEGL003796	CEGL003527	–	–
CANA_AA_023700	10/12/2016 0:00	Irene Weber	CEGL003796	–	(CEGL007653) Guinea Grass Herbaceous Vegetation Urochloa maxima Herbaceous Vegetation	old plantation
CANA_AA_023800	10/12/2016 0:00	Irene Weber	CEGL003796	–	–	possibly artificial
CANA_AA_023900	10/12/2016 0:00	Irene Weber	CEGL007653	CEGL004235	(CEGL007653) Guinea Grass Herbaceous Vegetation	–
CANA_AA_024000	10/12/2016 0:00	Irene Weber	CEGL007653	CEGL007694	–	no match

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_024100	10/12/2016 0:00	Irene Weber	CEGL007653	CEGL007654	Urochloa maxima Herbaceous Vegetation (CEGL007653) Guinea Grass Herbaceous Vegetation. (CEGL007654) Natal Grass Herbaceous Vegetation	–
CANA_AA_024200	10/12/2016 0:00	Irene Weber	CEGL004235	–	(CEGL007653) Guinea Grass Herbaceous Vegetation	–
CANA_AA_024300	10/12/2016 0:00	Irene Weber	CEGL004235	–	(CEGL007653) Guinea Grass Herbaceous Vegetation	–
CANA_AA_024400	10/12/2016 0:00	Irene Weber	CEGL004235	–	–	–
CANA_AA_024500	10/12/2016 0:00	Irene Weber	CEGL007653	–	(CEGL007653) Guinea Grass Herbaceous Vegetation	–
CANA_AA_024600	10/12/2016 0:00	Irene Weber	CEGL007653	CEGL003527	(CEGL007653) Guinea Grass Herbaceous Vegetation	–
CANA_AA_024700	10/12/2016 0:00	Irene Weber	CEGL007653	–	(CEGL007653) Guinea Grass Herbaceous Vegetation	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_024800	10/12/2016 0:00	Irene Weber	CEGL007653	CEGL003812	–	no fit
CANA_AA_024900	10/12/2016 0:00	Irene Weber	CEGL007653	–	(CEGL007653) Guinea Grass Herbaceous Vegetation	–
CANA_AA_025000	10/26/2016 0:00	Irene Weber	CEGL003940	CEGL004511	–	mix of the 2
CANA_AA_025100	10/26/2016 0:00	Irene Weber	CEGL003940	–	–	–
CANA_AA_025200	10/26/2016 0:00	Irene Weber	CEGL003940	–	–	–
CANA_AA_025300	10/26/2016 0:00	Irene Weber	CEGL003940	–	–	–
CANA_AA_025400	10/26/2016 0:00	Irene Weber	CEGL003940	CEGL004511	–	–
CANA_AA_025500	10/26/2016 0:00	Irene Weber	CEGL003940	–	–	–
CANA_AA_025600	10/18/2016 0:00	Joe Mansuetti	CEGL004241	–	–	xeric live oak hammock
CANA_AA_025700	10/25/2016 0:00	Joe Mansuetti	CEGL004511	CEGL003940	–	–
CANA_AA_025800	10/25/2016 0:00	Joe Mansuetti	CEGL004511	CEGL003940	–	–
CANA_AA_025900	10/14/2016 0:00	Irene Weber	CEGL003956	–	–	–
CANA_AA_026000	10/14/2016 0:00	Irene Weber	CEGL004827	–	–	–
CANA_AA_026100	10/13/2016 0:00	Joe Mansuetti	CEGL003956	–	–	saltwort and Spartina sp.
CANA_AA_026200	10/14/2016 0:00	Irene Weber	CEGL003956	–	veg based on not flooded fringe	–
CANA_AA_026300	10/14/2016 0:00	Joe Mansuetti	CEGL003956	–	–	–
CANA_AA_026400	10/18/2016 0:00	Joe Mansuetti	CEGL003956	–	–	–
CANA_AA_026500	10/14/2016 0:00	Joe Mansuetti	CEGL003956	–	–	–
CANA_AA_026600	10/18/2016 0:00	Joe Mansuetti	CEGL003956	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_026700	10/13/2016 0:00	Joe Mansuetti	CEGL003956	–	–	salicornia more dom with black mangrove
CANA_AA_026800	10/15/2016 0:00	Joe Mansuetti	CEGL003956	–	–	–
CANA_AA_026900	10/13/2016 0:00	Joe Mansuetti	CEGL003956	CEGL002278	–	–
CANA_AA_027000	10/14/2016 0:00	Joe Mansuetti	CEGL003956	–	–	–
CANA_AA_027100	10/14/2016 0:00	Joe Mansuetti	CEGL003956	–	–	–
CANA_AA_027200	10/14/2016 0:00	Joe Mansuetti	CEGL002278	–	–	Salicornia sp. Instead of sarcocornia sp.
CANA_AA_027300	10/19/2016 0:00	Jarrod Armstrong	CEGL004827	CEGL003956	–	mixed batis and avicennia
CANA_AA_027400	10/19/2016 0:00	Joe Mansuetti	CEGL003956	–	–	–
CANA_AA_027500	10/19/2016 0:00	Joe Mansuetti	CEGL007694	–	–	–
CANA_AA_027600	10/19/2016 0:00	Joe Mansuetti	CEGL003956	–	–	–
CANA_AA_027700	10/19/2016 0:00	Joe Mansuetti	CEGL002278	–	–	salicornoa bogelovii
CANA_AA_028100	10/21/2016 0:00	Jarrod Armstrong	CEGL007600	–	–	–
CANA_AA_028200	10/16/2016 0:00	Irene Weber	CEGL007694	–	–	–
CANA_AA_028300	10/16/2016 0:00	Irene Weber	CEGL007694	–	–	–
CANA_AA_028400	11/2/2016 0:00	Irene Weber	CEGL007694	–	–	–
CANA_AA_028500	10/15/2016 0:00	Irene Weber	CEGL007694	–	–	–
CANA_AA_028600	11/2/2016 0:00	Irene Weber	CEGL003956	–	–	–
CANA_AA_028700	10/21/2016 0:00	Jarrod Armstrong	CEGL003956	–	–	–
CANA_AA_028800	10/21/2016 0:00	Jarrod Armstrong	CEGL003956	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_028900	10/5/2016 0:00	Joe Mansuetti	CEGL003940	–	–	Key goes through freshwater marsh instead of brackish. After two steps, mentions intertidal dune and gets back on track.
CANA_AA_029000	10/5/2016 0:00	Joe Mansuetti	CEGL004186	–	–	–
CANA_AA_029100	10/5/2016 0:00	Joe Mansuetti	CEGL004186	–	–	–
CANA_AA_029300	10/19/2016 0:00	Jarrod Armstrong	CEGL003956	–	–	–
CANA_AA_029400	10/24/2016 0:00	Joe Mansuetti	CEGL004511	–	–	–
CANA_AA_029500	10/18/2016 0:00	Jarrod Armstrong	CEGL007694	–	–	–
CANA_AA_029600	10/25/2016 0:00	Irene Weber	CEGL007694	CEGL004194	see note for 297	–
CANA_AA_029700	10/25/2016 0:00	Irene Weber	CEGL007694	CEGL004194	marsh is inaccessible by foot, kayak or park boat. This area is a mosaic of primarily distichlis and spartina herb veh with small pockets of short mangrove	–
CANA_AA_029800	10/25/2016 0:00	Irene Weber	CEGL007694	CEGL004194	see note for 297	–
CANA_AA_029900	10/25/2016 0:00	Joe Mansuetti	CEGL004511	–	–	–
CANA_AA_030300	11/2/2016 0:00	Irene Weber	CEGL007694	CEGL007663	–	–
CANA_AA_030400	11/2/2016 0:00	Irene Weber	CEGL003956	–	–	–
CANA_AA_030600	11/2/2016 0:00	Irene Weber	CEGL002278	–	–	–
CANA_AA_030700	10/17/2016 0:00	Irene Weber	CEGL004511	CEGL004186	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_030900	10/31/2016 0:00	Irene Weber	CEGL004827	–	–	–
CANA_AA_031000	10/17/2016 0:00	Irene Weber	CEGL004186	CEGL004511	–	–
CANA_AA_031100	10/21/2016 0:00	Jarrod Armstrong	CEGL004511	–	–	–
CANA_AA_031200	10/21/2016 0:00	Jarrod Armstrong	CEGL004511	–	–	–
CANA_AA_031300	10/17/2016 0:00	Irene Weber	CEGL004186	CEGL004194	–	–
CANA_AA_031500	10/17/2016 0:00	Irene Weber	CEGL004511	CEGL003839	–	–
CANA_AA_031600	10/17/2016 0:00	Irene Weber	CEGL004194	CEGL003839	–	patens marsh
CANA_AA_031700	10/17/2016 0:00	Irene Weber	CEGL003839	CEGL004511	–	all patens herbaceous
CANA_AA_031800	10/17/2016 0:00	Irene Weber	CEGL004827	–	–	–
CANA_AA_031900	10/13/2016 0:00	Joe Mansuetti	CEGL003839	CEGL003796	–	morella and celtis but no spartina
CANA_AA_032000	10/13/2016 0:00	Joe Mansuetti	CEGL003839	CEGL003527	–	–
CANA_AA_032100	10/14/2016 0:00	Joe Mansuetti	CEGL007040	–	–	–
CANA_AA_032200	10/14/2016 0:00	Joe Mansuetti	CEGL003839	CEGL007033	–	–
CANA_AA_032300	10/13/2016 0:00	Joe Mansuetti	CEGL007033	–	–	–
CANA_AA_032400	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (satt)
CANA_AA_032500	10/20/2016 0:00	Irene Weber	CEGL003811	–	–	–
CANA_AA_032600	10/20/2016 0:00	Irene Weber	CEGL003811	CEGL004511	–	–
CANA_AA_032700	10/16/2016 0:00	Irene Weber	CEGL003811	–	–	–
CANA_AA_032800	10/16/2016 0:00	Irene Weber	CEGL003811	–	–	–
CANA_AA_032900	10/16/2016 0:00	Irene Weber	CEGL007600	CEGL003811	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_033000	10/16/2016 0:00	Irene Weber	CEGL007600	CEGL003811	–	–
CANA_AA_033100	10/16/2016 0:00	Irene Weber	CEGL003811	–	–	–
CANA_AA_033200	10/16/2016 0:00	Irene Weber	CEGL003811	–	–	–
CANA_AA_033300	10/16/2016 0:00	Irene Weber	CEGL003811	–	–	–
CANA_AA_033400	10/16/2016 0:00	Irene Weber	CEGL004001	–	–	–
CANA_AA_033500	10/16/2016 0:00	Irene Weber	CEGL004511	CEGL003811	–	–
CANA_AA_033600	10/16/2016 0:00	Irene Weber	CEGL007600	–	–	–
CANA_AA_033700	10/16/2016 0:00	Irene Weber	CEGL007600	CEGL003811	–	–
CANA_AA_033800	10/16/2016 0:00	Irene Weber	CEGL007600	CEGL004883	edge of parking lot	–
CANA_AA_034000	10/18/2016 0:00	Joe Mansuetti	CEGL007600	–	–	southern seablite shrubland
CANA_AA_034100	10/13/2016 0:00	Joe Mansuetti	CEGL007033	–	–	–
CANA_AA_034300	10/24/2016 0:00	Jarrod Armstrong	CEGL003940	–	–	Spartina alternifolia
CANA_AA_034400	10/25/2016 0:00	Irene Weber	CEGL003527	CEGL003799	–	–
CANA_AA_034500	10/25/2016 0:00	Irene Weber	CEGL003799	CEGL003527	lots of dead morella due to hurricane flooding	–
CANA_AA_034600	10/25/2016 0:00	Irene Weber	CEGL004827	CEGL003799	–	–
CANA_AA_034700	10/25/2016 0:00	Irene Weber	CEGL003527	CEGL003799	–	–
CANA_AA_034800	10/25/2016 0:00	Irene Weber	CEGL004827	CEGL003799	–	–
CANA_AA_034900	11/2/2016 0:00	Irene Weber	CEGL003799	–	dead schinus	–
CANA_AA_035100	11/2/2016 0:00	Irene Weber	CEGL007032	–	live oak appear to have lost leaves	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_036100	11/2/2016 0:00	Irene Weber	CEGL007694	CEGL007663	–	–
CANA_AA_036200	10/17/2016 0:00	Irene Weber	CEGL003956	CEGL007694	–	–
CANA_AA_036300	10/17/2016 0:00	Irene Weber	CEGL007600	CEGL003839	–	–
CANA_AA_036400	10/20/2016 0:00	Irene Weber	CEGL007020	–	–	–
CANA_AA_036500	10/19/2016 0:00	Jarrod Armstrong	CEGL007040	–	–	–
CANA_AA_036600	10/20/2016 0:00	Joe Mansuetti	CEGL007600	–	–	–
CANA_AA_036700	10/20/2016 0:00	Joe Mansuetti	CEGL004241	–	–	–
CANA_AA_036800	10/20/2016 0:00	Joe Mansuetti	CEGL003811	CEGL003812	–	FL coastal strand (tpt)
CANA_AA_036900	10/20/2016 0:00	Irene Weber	CEGL007600	–	–	–
CANA_AA_037800	10/21/2016 0:00	Jarrod Armstrong	CEGL007600	CEGL003811	–	–
CANA_AA_037900	10/16/2016 0:00	Irene Weber	CEGL003811	–	–	–
CANA_AA_038000	10/16/2016 0:00	Irene Weber	CEGL007600	–	–	Conocarpus erectus - (Laguncularia racemosa) / Batis maritima - Borrichia frutescens / Sesuvium portulacastrum - Suaeda linearis Shrubland
CANA_AA_038100	10/16/2016 0:00	Irene Weber	CEGL003811	–	–	–
CANA_AA_038200	10/16/2016 0:00	Irene Weber	CEGL007600	CEGL003811	–	–
CANA_AA_038300	10/16/2016 0:00	Irene Weber	CEGL003811	–	–	–
CANA_AA_038400	11/2/2016 0:00	Irene Weber	CEGL004827	CEGL007600	–	–
CANA_AA_038500	10/16/2016 0:00	Irene Weber	CEGL007600	CEGL003811	–	–
CANA_AA_038600	10/16/2016 0:00	Irene Weber	CEGL003811	–	–	–
CANA_AA_038700	10/28/2016 0:00	Joe Mansuetti	CEGL003940	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_038800	10/26/2016 0:00	Irene Weber	CEGL003940	–	–	–
CANA_AA_038900	10/26/2016 0:00	Irene Weber	CEGL003940	CEGL004511	–	–
CANA_AA_039000	10/26/2016 0:00	Irene Weber	CEGL003940	CEGL004511	–	–
CANA_AA_039100	10/26/2016 0:00	Irene Weber	CEGL004511	–	–	–
CANA_AA_039200	10/26/2016 0:00	Irene Weber	CEGL004235	CEGL004511	–	–
CANA_AA_039300	10/18/2016 0:00	Jarrod Armstrong	CEGL007694	–	–	–
CANA_AA_039400	10/25/2016 0:00	Irene Weber	CEGL004511	–	–	–
CANA_AA_039500	10/25/2016 0:00	Irene Weber	CEGL003940	–	–	–
CANA_AA_039600	10/25/2016 0:00	Irene Weber	CEGL003940	CEGL004511	–	–
CANA_AA_039700	10/25/2016 0:00	Irene Weber	CEGL003940	CEGL004511	–	–
CANA_AA_039800	10/18/2016 0:00	Jarrod Armstrong	CEGL004511	–	Spartina bakeri - Woodwardia virginica - Saccharum giganteum Herbaceous Vegetation (CEGL007713)	–
CANA_AA_039900	10/24/2016 0:00	Jarrod Armstrong	CEGL003940	–	–	–
CANA_AA_040000	10/25/2016 0:00	Irene Weber	CEGL004511	–	–	–
CANA_AA_040100	10/25/2016 0:00	Irene Weber	CEGL003940	CEGL004511	–	–
CANA_AA_040300	10/25/2016 0:00	Irene Weber	CEGL003940	–	–	–
CANA_AA_040500	10/25/2016 0:00	Irene Weber	CEGL003940	–	–	–
CANA_AA_040800	11/1/2016 0:00	Irene Weber	CEGL004511	CEGL004423	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_041100	11/1/2016 0:00	Irene Weber	CEGL004511	–	–	–
CANA_AA_041200	11/1/2016 0:00	Irene Weber	CEGL004511	–	–	–
CANA_AA_041300	10/25/2016 0:00	Joe Mansuetti	CEGL004511	–	–	–
CANA_AA_041400	10/25/2016 0:00	Joe Mansuetti	CEGL004511	–	–	–
CANA_AA_041500	11/2/2016 0:00	Irene Weber	CEGL007600	–	–	–
CANA_AA_041700	10/24/2016 0:00	Jarrod Armstrong	CEGL007033	–	(CEGL007653) Guinea Grass Herbaceous Vegetation	roadside veg with large grape arbor
CANA_AA_041800	10/24/2016 0:00	Nichole Panico	CEGL007033	–	(CEGL007653) Guinea Grass Herbaceous Vegetation	–
CANA_AA_041900	10/24/2016 0:00	Jarrod Armstrong	CEGL007033	–	–	highly disturbed area
CANA_AA_042000	10/24/2016 0:00	Nichole Panico	CEGL003796	CEGL007033	–	species not listed in classification present
CANA_AA_042100	10/24/2016 0:00	Nichole Panico	CEGL003796	CEGL007033	–	other species not listed in classification present
CANA_AA_042200	10/24/2016 0:00	Jarrod Armstrong	CEGL007033	–	–	highly disturbed
CANA_AA_042300	10/24/2016 0:00	Jarrod Armstrong	CEGL007033	–	–	highly disturbed
CANA_AA_042400	10/18/2016 0:00	Joe Mansuetti	CEGL003799	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_042500	10/21/2016 0:00	Joe Mansuetti	CEGL004001	CEGL003811	(CEGL004001) Dune Marsh-elder / Sea-oats - Beach Sunflower Herbaceous Vegetation	southeast Florida dune in narrow strip due to storm. Within 10m FL coastal strand
CANA_AA_042600	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (tpt)
CANA_AA_042700	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (satt)
CANA_AA_042800	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (satt)
CANA_AA_042900	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (satt)
CANA_AA_043000	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL Coastal Strand (SATT)
CANA_AA_043100	10/20/2016 0:00	Joe Mansuetti	CEGL003811	CEGL007694	–	–
CANA_AA_043200	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand
CANA_AA_043300	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand
CANA_AA_043400	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	Florida coastal strand
CANA_AA_043500	10/20/2016 0:00	Joe Mansuetti	CEGL004001	CEGL003811	–	–
CANA_AA_043600	10/20/2016 0:00	Irene Weber	CEGL004194	CEGL003924	–	–
CANA_AA_043700	10/20/2016 0:00	Irene Weber	CEGL003811	–	–	–
CANA_AA_043800	10/20/2016 0:00	Irene Weber	CEGL004001	CEGL004406	–	–
CANA_AA_043900	10/20/2016 0:00	Irene Weber	CEGL004001	CEGL007600	–	–
CANA_AA_044000	10/20/2016 0:00	Irene Weber	CEGL004001	CEGL003811	–	–
CANA_AA_044100	10/20/2016 0:00	Irene Weber	CEGL003924	CEGL003811	–	–
CANA_AA_044200	10/21/2016 0:00	Jarrod Armstrong	CEGL003811	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_044300	11/2/2016 0:00	Irene Weber	CEGL004827	CEGL007600	–	–
CANA_AA_044400	10/17/2016 0:00	Irene Weber	CEGL003811	–	–	–
CANA_AA_044500	10/5/2016 0:00	Nichole Panico	CEGL003940	–	–	cladium was dominant but other species were also present
CANA_AA_044600	10/27/2016 0:00	Jarrod Armstrong	CEGL004511	–	–	edge of two veg types
CANA_AA_044700	10/27/2016 0:00	Jarrod Armstrong	CEGL004511	–	–	–
CANA_AA_044800	10/26/2016 0:00	Irene Weber	CEGL003940	–	–	–
CANA_AA_044900	10/26/2016 0:00	Irene Weber	CEGL003940	CEGL004511	–	–
CANA_AA_045000	10/26/2016 0:00	Irene Weber	CEGL003940	CEGL004511	–	–
CANA_AA_045100	10/26/2016 0:00	Irene Weber	CEGL003940	–	–	–
CANA_AA_045200	10/26/2016 0:00	Irene Weber	CEGL003940	CEGL004511	–	–
CANA_AA_045300	10/26/2016 0:00	Irene Weber	CEGL004511	–	–	–
CANA_AA_045400	10/26/2016 0:00	Irene Weber	CEGL004511	–	–	–
CANA_AA_045500	10/26/2016 0:00	Irene Weber	CEGL004511	–	–	–
CANA_AA_045600	10/26/2016 0:00	Irene Weber	CEGL004511	CEGL004235	–	–
CANA_AA_045700	10/26/2016 0:00	Irene Weber	CEGL003940	–	–	–
CANA_AA_045800	10/26/2016 0:00	Irene Weber	CEGL003940	–	–	–
CANA_AA_045900	10/26/2016 0:00	Irene Weber	CEGL004511	–	–	–
CANA_AA_046000	10/13/2016 0:00	Irene Weber	CEGL003527	–	–	–
CANA_AA_046100	10/13/2016 0:00	Irene Weber	CEGL003527	–	–	–
CANA_AA_046200	10/13/2016 0:00	Joe Mansuetti	CEGL003527	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_046300	10/13/2016 0:00	Irene Weber	CEGL003527	–	–	–
CANA_AA_046400	10/14/2016 0:00	Joe Mansuetti	CEGL007020	–	Florida swamp privet spoil island. (CEGL004237) Florida Swamp Privet - Wax-myrtle - Cabbage Palmetto / Camphor Goldenaster Shrubland	no swamp privet and more woodland like. Larger juniperus
CANA_AA_046500	10/14/2016 0:00	Joe Mansuetti	CEGL003525	CEGL003525	Quercus virginiana - Juniperus virginiana - (Sabal palmetto) Woodland Alliance	–
CANA_AA_046600	10/14/2016 0:00	Joe Mansuetti	CEGL007032	–	–	not exact sp. Composition
CANA_AA_046700	10/14/2016 0:00	Joe Mansuetti	CEGL007033	–	–	–
CANA_AA_046800	10/15/2016 0:00	Joe Mansuetti	CEGL003839	CEGL003525	–	Morella and juniperus sp.
CANA_AA_046900	10/18/2016 0:00	Joe Mansuetti	CEGL003525	–	–	S. Atlantic shell midden woodland
CANA_AA_047000	10/15/2016 0:00	Joe Mansuetti	CEGL003525	–	(CEGL003525) Coastal Red-cedar - Toothache-tree - Live Oak - (Cabbage Palmetto) / Small-flower Mock Buckthorn (Tough Bumelia) Woodland	juniperus and sable palm shell midden
CANA_AA_047100	10/18/2016 0:00	Joe Mansuetti	CEGL007033	–	–	maritime live oak hammock
CANA_AA_047200	10/18/2016 0:00	Joe Mansuetti	CEGL003525	–	–	S. Atlantic coastal shell midden woodland
CANA_AA_047300	10/17/2016 0:00	Joe Mansuetti	CEGL007040	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_047400	10/17/2016 0:00	Joe Mansuetti	CEGL007040	–	–	–
CANA_AA_047500	10/17/2016 0:00	Joe Mansuetti	CEGL003525	–	–	S. Atlantic shell midden woodland
CANA_AA_047700	10/17/2016 0:00	Joe Mansuetti	CEGL003525	–	–	s Atlantic shell midden woodlands
CANA_AA_047800	10/17/2016 0:00	Joe Mansuetti	CEGL003525	–	–	S. Atlantic shell midden woodland
CANA_AA_047900	10/17/2016 0:00	Joe Mansuetti	CEGL007033	–	–	maritime live oak hammock
CANA_AA_048000	10/17/2016 0:00	Joe Mansuetti	CEGL003525	–	–	s Atlantic shell midden woodland
CANA_AA_048100	10/17/2016 0:00	Joe Mansuetti	CEGL003525	–	–	–
CANA_AA_048200	10/12/2016 0:00	Irene Weber	CEGL003252	CEGL003527	(CEGL003525) Coastal Red-cedar - Toothache-tree - Live Oak - (Cabbage Palmetto) / Small-flower Mock Buckthorn (Tough Bumelia) Woodland	no match
CANA_AA_048300	10/17/2016 0:00	Joe Mansuetti	CEGL003525	–	–	–
CANA_AA_048400	10/17/2016 0:00	Joe Mansuetti	CEGL003525	–	–	S. Atlantic shell midden woodland
CANA_AA_048500	10/17/2016 0:00	Joe Mansuetti	CEGL003525	CEGL003799	–	S. Atlantic coastal shell midden woodland
CANA_AA_048600	10/17/2016 0:00	Joe Mansuetti	CEGL003525	–	–	S. Atlantic coastal shell midden woodland
CANA_AA_048700	10/17/2016 0:00	Joe Mansuetti	CEGL003527	CEGL004827	–	small area with higher elevation that includes palms. Remainder consists of black mangroves
CANA_AA_048800	10/17/2016 0:00	Joe Mansuetti	CEGL007040	CEGL003525	–	–
CANA_AA_048900	10/17/2016 0:00	Joe Mansuetti	CEGL004827	CEGL003799	–	–
CANA_AA_049000	10/28/2016 0:00	Irene Weber	CEGL004423	CEGL007032	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_049100	10/27/2016 0:00	Irene Weber	CEGL004423	–	–	–
CANA_AA_049200	10/28/2016 0:00	Joe Mansuetti	CEGL004511	–	–	red maple wetland forest
CANA_AA_049500	10/27/2016 0:00	Irene Weber	CEGL004423	–	–	–
CANA_AA_049600	10/5/2016 0:00	Joe Mansuetti	CEGL007020	–	–	–
CANA_AA_049700	10/5/2016 0:00	Joe Mansuetti	CEGL007028	–	–	no Ilex vomitoria and m. grandiflora and c. glabra in subcanopy
CANA_AA_049800	10/27/2016 0:00	Irene Weber	CEGL004423	–	–	–
CANA_AA_049900	10/5/2016 0:00	Joe Mansuetti	CEGL007033	–	–	Sabal included but not codominant some understory trees but no tropical shrub layer
CANA_AA_050000	10/5/2016 0:00	Joe Mansuetti	CEGL007020	–	–	–
CANA_AA_050100	10/27/2016 0:00	Irene Weber	CEGL004423	–	–	–
CANA_AA_050200	10/5/2016 0:00	Joe Mansuetti	CEGL004241	–	–	–
CANA_AA_050300	10/26/2016 0:00	Irene Weber	CEGL003940	–	–	–
CANA_AA_050400	10/26/2016 0:00	Irene Weber	CEGL004423	–	–	–
CANA_AA_050500	10/18/2016 0:00	Jarrod Armstrong	CEGL003839	CEGL003812	–	morella and serenoa repens no spartina patens
CANA_AA_050600	10/18/2016 0:00	Jarrod Armstrong	CEGL004423	–	–	Salix caroliniana / Decodon verticillatus / Typha latifolia Forest
CANA_AA_050700	10/24/2016 0:00	Jarrod Armstrong	CEGL003940	CEGL004186	–	–
CANA_AA_050900	11/1/2016 0:00	Irene Weber	CEGL004511	–	–	–
CANA_AA_051000	11/1/2016 0:00	Irene Weber	CEGL004511	–	–	–
CANA_AA_051200	11/1/2016 0:00	Irene Weber	CEGL004511	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_051400	10/25/2016 0:00	Joe Mansuetti	CEGL003527	–	–	–
CANA_AA_051500	10/25/2016 0:00	Joe Mansuetti	CEGL004194	–	–	–
CANA_AA_051700	10/24/2016 0:00	Joe Mansuetti	CEGL004511	–	–	sandcord grass interdune swale
CANA_AA_051800	10/17/2016 0:00	Irene Weber	CEGL007750	–	–	–
CANA_AA_051900	10/17/2016 0:00	Irene Weber	CEGL003799	–	–	–
CANA_AA_052000	10/26/2016 0:00	Irene Weber	CEGL004235	–	–	–
CANA_AA_052100	10/26/2016 0:00	Irene Weber	CEGL003940	CEGL004511	–	–
CANA_AA_052400	10/4/2016 0:00	Nichole Panico	CEGL003812	CEGL004475	–	other ferns and shrubs present, no moss observed
CANA_AA_052500	10/4/2016 0:00	Nichole Panico	CEGL003799	–	–	area dominated by Brazilian pepper
CANA_AA_052600	10/17/2016 0:00	Irene Weber	CEGL007694	–	–	–
CANA_AA_052900	10/17/2016 0:00	Joe Mansuetti	CEGL004830	–	Brazilian beefwood forest not on drop down (CEGL004830) (Cunningham Beefwood, Australian-pine, Brazilian Beefwood) Forest	–
CANA_AA_053000	10/17/2016 0:00	Joe Mansuetti	CEGL004827	–	–	–
CANA_AA_053100	10/12/2016 0:00	Joe Mansuetti	CEGL004830	–	(CEGL004830) (Cunningham Beefwood, Australian-pine, Brazilian Beefwood) Forest	–
CANA_AA_053200	10/14/2016 0:00	Nichole Panico	CEGL004511	CEGL004511	point is located in paved parking area	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_053300	10/12/2016 0:00	Irene Weber	CEGL003796	CEGL007033	–	–
CANA_AA_053400	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (satt)
CANA_AA_053500	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (satt)
CANA_AA_053600	10/12/2016 0:00	Irene Weber	CEGL007654	–	(CEGL007654) Natal Grass Herbaceous Vegetation	–
CANA_AA_053700	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (satt)
CANA_AA_053800	10/24/2016 0:00	Nichole Panico	CEGL007653	–	(CEGL007653) Guinea Grass Herbaceous Vegetation	roadside grasses, no classification that fits
CANA_AA_053900	10/24/2016 0:00	Nichole Panico	CEGL004235	–	–	roadside grasses, no classification that fits
CANA_AA_054000	10/24/2016 0:00	Nichole Panico	CEGL007653	–	(CEGL007653) Guinea Grass Herbaceous Vegetation	roadside grasses, no classification that fits
CANA_AA_054100	10/24/2016 0:00	Nichole Panico	CEGL007653	CEGL004235	(CEGL007653) Guinea Grass Herbaceous Vegetation	roadside grasses, no classification that fits.
CANA_AA_054200	10/24/2016 0:00	Jarrod Armstrong	CEGL007653	–	(CEGL007653) Guinea Grass Herbaceous Vegetation	–
CANA_AA_054300	10/24/2016 0:00	Nichole Panico	CEGL004235	CEGL004235	–	roadside grasses, no classification that fits
CANA_AA_054400	10/18/2016 0:00	Jarrod Armstrong	CEGL004883	–	–	mowed ROW
CANA_AA_054500	10/24/2016 0:00	Joe Mansuetti	CEGL004114	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_054600	10/25/2016 0:00	Joe Mansuetti	CEGL004114	CEGL004114	–	mowed area in right away near intersection
CANA_AA_054700	10/17/2016 0:00	Irene Weber	CEGL004114	–	–	planted turf
CANA_AA_054800	10/20/2016 0:00	Joe Mansuetti	CEGL003811	–	–	FL coastal strand (satt)
CANA_AA_054900	10/17/2016 0:00	Irene Weber	CEGL004827	–	–	–
CANA_AA_055000	10/17/2016 0:00	Irene Weber	CEGL003956	–	–	–
CANA_AA_055100	10/16/2016 0:00	Irene Weber	CEGL004114	–	–	artificial retention pond/building
CANA_AA_055200	10/13/2016 0:00	Irene Weber	CEGL004827	–	–	–
CANA_AA_055300	10/13/2016 0:00	Joe Mansuetti	CEGL003796	–	–	–
CANA_AA_055400	10/13/2016 0:00	Irene Weber	CEGL003527	–	–	–
CANA_AA_055500	10/13/2016 0:00	Irene Weber	CEGL003527	–	–	–
CANA_AA_055600	10/13/2016 0:00	Joe Mansuetti	CEGL007033	–	–	–
CANA_AA_055700	10/13/2016 0:00	Joe Mansuetti	CEGL007028	–	–	–
CANA_AA_055800	10/13/2016 0:00	Joe Mansuetti	CEGL003527	–	–	–
CANA_AA_055900	10/13/2016 0:00	Joe Mansuetti	CEGL003527	CEGL007033	–	–
CANA_AA_056000	10/18/2016 0:00	Joe Mansuetti	CEGL007033	CEGL003525	–	maritime live oak hammock w/o live oak
CANA_AA_056100	10/18/2016 0:00	Joe Mansuetti	CEGL007033	CEGL003525	–	maritime live oak hammock
CANA_AA_056200	10/18/2016 0:00	Joe Mansuetti	CEGL007033	–	–	maritime live oak hammock
CANA_AA_056300	10/18/2016 0:00	Joe Mansuetti	CEGL007033	CEGL003525	–	maritime live oak hammock description except for live oaks are absent
CANA_AA_056400	10/14/2016 0:00	Joe Mansuetti	CEGL007033	–	–	–
CANA_AA_056500	10/14/2016 0:00	Joe Mansuetti	CEGL007028	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_056600	10/14/2016 0:00	Joe Mansuetti	CEGL007033	–	–	–
CANA_AA_056700	10/14/2016 0:00	Joe Mansuetti	CEGL007033	–	–	south Atlantic shell midden woodlands
CANA_AA_056800	10/14/2016 0:00	Joe Mansuetti	CEGL007033	–	–	–
CANA_AA_057100	10/26/2016 0:00	Irene Weber	CEGL007033	CEGL007032	–	–
CANA_AA_057200	10/26/2016 0:00	Irene Weber	CEGL007033	CEGL004241	–	–
CANA_AA_057300	10/13/2016 0:00	Nichole Panico	CEGL003527	–	–	ilex cassine not present
CANA_AA_057400	10/13/2016 0:00	Nichole Panico	CEGL003527	CEGL003525	–	ilex cassine not present
CANA_AA_057500	10/12/2016 0:00	Joe Mansuetti	CEGL004241	–	–	–
CANA_AA_057600	10/12/2016 0:00	Joe Mansuetti	CEGL004241	CEGL003812	–	sand live oak instead of live oak
CANA_AA_057700	10/12/2016 0:00	Joe Mansuetti	CEGL007033	–	–	–
CANA_AA_057800	10/12/2016 0:00		CEGL007033	–	–	–
CANA_AA_057900	10/12/2016 0:00	Joe Mansuetti	CEGL007033	–	–	–
CANA_AA_058000	10/4/2016 0:00	Nichole Panico	CEGL007033	–	–	no cabbage palm, canopy of live oak greater than 60%, Brazilian pepper present
CANA_AA_058100	10/24/2016 0:00	Joe Mansuetti	CEGL004241	–	–	xeric live oak hammock
CANA_AA_058200	10/19/2016 0:00	Irene Weber	CEGL003527	CEGL004423	–	acer swamp
CANA_AA_058300	10/19/2016 0:00	Irene Weber	CEGL003527	CEGL003527	–	no fit
CANA_AA_058400	10/19/2016 0:00	Irene Weber	CEGL007033	–	–	–
CANA_AA_058500	10/19/2016 0:00	Irene Weber	CEGL007033	–	–	–
CANA_AA_058600	10/19/2016 0:00	Irene Weber	CEGL007032	–	–	–
CANA_AA_058700	10/25/2016 0:00	Irene Weber	CEGL007032	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_058800	10/25/2016 0:00	Irene Weber	CEGL007032	–	–	–
CANA_AA_058900	10/25/2016 0:00	Irene Weber	CEGL007032	–	–	–
CANA_AA_059000	10/25/2016 0:00	Irene Weber	CEGL004194	CEGL003527	–	–
CANA_AA_059100	10/14/2016 0:00	Nichole Panico	CEGL007032	CEGL007750	–	woodland not forest
CANA_AA_059200	10/14/2016 0:00	Nichole Panico	CEGL007032	–	–	some species in classification not present. Woodland, not forest.
CANA_AA_059300	10/14/2016 0:00	Nichole Panico	CEGL003796	CEGL003643	–	–
CANA_AA_059400	10/14/2016 0:00	Nichole Panico	CEGL007032	CEGL003643	–	woodland, not forest
CANA_AA_059500	10/14/2016 0:00	Nichole Panico	CEGL007032	CEGL003643	–	woodland, not forest
CANA_AA_059700	10/28/2016 0:00	Irene Weber	CEGL003940	CEGL004423	–	–
CANA_AA_059800	10/28/2016 0:00	Irene Weber	CEGL004423	CEGL003940	–	acer marsh
CANA_AA_059900	10/28/2016 0:00	Irene Weber	CEGL004194	CEGL007040	–	acer swamp
CANA_AA_060000	10/14/2016 0:00	Nichole Panico	CEGL007040	–	–	–
CANA_AA_060100	10/28/2016 0:00	Irene Weber	CEGL007033	–	–	–
CANA_AA_060200	10/14/2016 0:00	Nichole Panico	CEGL007040	–	–	–
CANA_AA_060300	10/28/2016 0:00	Irene Weber	CEGL007033	–	–	–
CANA_AA_060400	10/28/2016 0:00	Irene Weber	CEGL004241	CEGL007032	–	–
CANA_AA_060500	10/28/2016 0:00	Irene Weber	CEGL007032	–	–	–
CANA_AA_060600	10/28/2016 0:00	Irene Weber	CEGL004241	CEGL007033	–	–
CANA_AA_060700	10/28/2016 0:00	Irene Weber	CEGL003796	CEGL007033	–	–
CANA_AA_060800	10/28/2016 0:00	Irene Weber	CEGL007040	–	–	–
CANA_AA_060900	10/28/2016 0:00	Irene Weber	CEGL007040	–	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_061000	10/14/2016 0:00	Nichole Panico	CEGL003796	–	–	sabal palmetto not present
CANA_AA_061100	10/17/2016 0:00	Joe Mansuetti	CEGL007033	–	–	–
CANA_AA_061200	10/31/2016 0:00	Irene Weber	CEGL004423	–	sandy clay loam	–
CANA_AA_061300	10/12/2016 0:00	Irene Weber	CEGL007033	–	canopy lost due to hurricane	–
CANA_AA_061400	10/12/2016 0:00	Irene Weber	CEGL007033	–	–	–
CANA_AA_061500	10/12/2016 0:00	Irene Weber	CEGL007033	–	–	much of canopy lost due to hurricane?
CANA_AA_061600	10/12/2016 0:00	Irene Weber	CEGL007033	–	–	–
CANA_AA_061800	10/12/2016 0:00	Irene Weber	CEGL007040	–	–	–
CANA_AA_061900	10/19/2016 0:00	Irene Weber	CEGL007033	–	–	–
CANA_AA_062000	10/19/2016 0:00	Irene Weber	CEGL007032	CEGL007033	–	–
CANA_AA_062100	10/19/2016 0:00	Irene Weber	CEGL007033	–	–	–
CANA_AA_062200	10/19/2016 0:00	Irene Weber	CEGL007033	–	–	–
CANA_AA_062300	10/19/2016 0:00	Irene Weber	CEGL007033	–	–	–
CANA_AA_062400	10/25/2016 0:00	Irene Weber	CEGL007033	–	–	young
CANA_AA_062500	10/25/2016 0:00	Irene Weber	CEGL003825	–	–	–
CANA_AA_062600	10/5/2016 0:00	Joe Mansuetti	CEGL003825	–	–	–
CANA_AA_062700	10/5/2016 0:00	Joe Mansuetti	CEGL007040	–	–	–
CANA_AA_062800	10/5/2016 0:00	Joe Mansuetti	CEGL003811	–	–	closest descrip. Recently burn
CANA_AA_062900	10/28/2016 0:00	Joe Mansuetti	CEGL007028	–	–	palmetto live oak hydric hammock
CANA_AA_063000	10/26/2016 0:00	Jarrod Armstrong	CEGL007033	–	–	understory dominated by serenoa repens and morella cerifera

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_063100	10/26/2016 0:00	Jarrod Armstrong	CEGL003940	–	–	acer rubrum and saw grass
CANA_AA_063200	10/26/2016 0:00	Joe Mansuetti	CEGL004423	CEGL004423	–	Swamp dogwood wetland
CANA_AA_063300	10/17/2016 0:00	Joe Mansuetti	CEGL007028	–	–	sabal palm hydric hammock
CANA_AA_063400	10/17/2016 0:00	Joe Mansuetti	CEGL007033	–	–	Maritime live oak hammock
CANA_AA_063500	10/17/2016 0:00	Joe Mansuetti	CEGL007033	–	–	maritime live oak hammock
CANA_AA_063600	10/12/2016 0:00	Irene Weber	CEGL007033	–	–	–
CANA_AA_063700	10/19/2016 0:00	Jarrod Armstrong	CEGL003527	CEGL003799	–	ilex vomitoria
CANA_AA_063800	10/17/2016 0:00	Joe Mansuetti	CEGL007040	–	–	palmetto live oak hydric hammock
CANA_AA_064100	10/24/2016 0:00	Irene Weber	CEGL004423	CEGL007033	–	–
CANA_AA_064200	10/24/2016 0:00	Irene Weber	CEGL004423	CEGL007033	–	–
CANA_AA_064300	10/24/2016 0:00	Joe Mansuetti	CEGL004423	–	–	Central Florida willow thicket
CANA_AA_064400	10/24/2016 0:00	Joe Mansuetti	CEGL007033	–	–	Maritime live oak hammock
CANA_AA_064500	10/24/2016 0:00	Joe Mansuetti	CEGL007040	–	–	palmetto live oak hydric hammock
CANA_AA_064600	10/24/2016 0:00	Joe Mansuetti	CEGL004423	CEGL004423	–	no description for habitat close to salix habitat w/o salix
CANA_AA_064700	10/25/2016 0:00	Irene Weber	CEGL003527	CEGL004827	inaccessible	–
CANA_AA_064800	10/4/2016 0:00	Nichole Panico	CEGL003796	CEGL007040	–	tree cover made of live oak and sabal palm about 50%, saw palmetto is dominant shrub
CANA_AA_064900	10/4/2016 0:00	Nichole Panico	CEGL003796	–	ground cover primarily leaf litter	plants are of expected concertation and species
CANA_AA_065000	10/25/2016 0:00	Irene Weber	CEGL003956	CEGL002278	–	–

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_065600	10/19/2016 0:00	Irene Weber	CEGL007171	CEGL004658	–	Maybe previously managed forest
CANA_AA_065700	10/19/2016 0:00	Irene Weber	CEGL004658	CEGL003643	–	–
CANA_AA_065800	10/19/2016 0:00	Irene Weber	CEGL007171	CEGL004658	–	–
CANA_AA_065900	10/19/2016 0:00	Irene Weber	CEGL007171	CEGL004658	–	–
CANA_AA_066000	10/19/2016 0:00	Irene Weber	CEGL007171	CEGL004658	–	–
CANA_AA_066100	10/19/2016 0:00	Irene Weber	CEGL007171	CEGL004658	–	–
CANA_AA_066200	10/19/2016 0:00	Irene Weber	CEGL007171	CEGL004658	–	–
CANA_AA_066300	10/19/2016 0:00	Irene Weber	CEGL007171	CEGL004658	–	–
CANA_AA_066400	10/26/2016 0:00	Joe Mansuetti	CEGL003643	–	–	Slash pine flatwoods
CANA_AA_066500	10/26/2016 0:00	Joe Mansuetti	CEGL003643	–	–	slash pine flatwoods
CANA_AA_066600	10/26/2016 0:00	Joe Mansuetti	CEGL003643	–	(CEGL007653) Guinea Grass Herbaceous Vegetation	slash pine flatwoods
CANA_AA_066700	10/26/2016 0:00	Joe Mansuetti	CEGL003643	–	–	Slash pine flatwoods
CANA_AA_066800	10/13/2016 0:00	Nichole Panico	CEGL004658	–	–	serenoa and morella present but not dominant
CANA_AA_066900	10/13/2016 0:00	Nichole Panico	CEGL007032	CEGL003796	–	Q. Virginiana not present, Q. Laurifolia present. Woodland, not forest.
CANA_AA_067000	10/13/2016 0:00	Nichole Panico	CEGL007171	–	–	woodland, not forest. Not sure if managed.
CANA_AA_067100	10/13/2016 0:00	Nichole Panico	CEGL003643	–	–	ilex not present, other species present not 'listed in classification
CANA_AA_067200	10/13/2016 0:00	Nichole Panico	CEGL003796	CEGL007040	–	other species present not listed in classification

AA_Event	Event Date	Surveyors	Primary Co	Secondary Code	General_Co	Represen_1
CANA_AA_067300	10/13/2016 0:00	Nichole Panico	CEGL003527	CEGL007040	–	ilex vomitoria present, not cassine. Other species present not listed in classification
CANA_AA_067400	10/12/2016 0:00	Joe Mansuetti	CEGL004830	–	Brazilian beefwood forest is not in the drop menu (CEGL004830) (Cunningham Beefwood, Australian-pine, Brazilian Beefwood) Forest	–
CANA_AA_067500	10/12/2016 0:00	Joe Mansuetti	CEGL004830	–	Brazilian beefwood forest not on drop down (CEGL004830) (Cunningham Beefwood, Australian-pine, Brazilian Beefwood) Forest	–
CANA_AA_067600	10/4/2016 0:00	Nichole Panico	CEGL003799	–	–	area dominated by schinus terebinthifolius

Appendix D. Photointerpretation Key

The photointerpretation key describes the attributes of the color infrared (CIR) images used to delineate the vegetation association CEGL based codes found within the park. For each code, a CIR image chip from within the park is included. For most codes, we also included a ground based digital photo of the vegetation, taken within the park. The standard visual cues to interpret and distinguish vegetation are described, including color, tone, texture, and pattern. When applicable, we also include comments on location within the park, topographic position, or why CEGL classes were grouped together. If there were other vegetation associations within the park that appeared similar on the CIR photographs, traits used to distinguish between similar vegetation associations are described.

The Vegetation Description for the CEGL within the park was copied directly from NatureServe (2009) to provide plot level information on species composition, dominance, characteristic species, and percent estimate of vegetation cover in understory, midstory, and/or canopy. It also includes the Global Description and geographic distribution. A separate literature cited section of the references from NatureServe (2009) text that was directly copied into the photointerpretation key is included at the end of this appendix.

South Atlantic Coastal Shell Midden Woodland

Attributes, descriptions, a photo and a map are shown in Table D-1, and Figures D-1 and D-2.

Table D-1. Attributes and descriptions of South Atlantic Coastal Shell Midden Woodland.

Attribute	Description
CEGL Code	3525
Community Name	South Atlantic Coastal Shell Midden Woodland
Color	Red with gray
Tone	Light to dark
Texture	Coarse
Pattern	Moderate to Dense Canopy
Height	Tall
Shape	Random
Size	Uncommon class; small average size with large variations possible.
Location	Found near the Lagoon, sometimes near cultural sites and transportation.
Association	21007
Comments	Similar to 21007 but with less cabbage palm



Figure D-1. Example of South Atlantic Coastal Shell Midden Woodland.



Figure D-2. Map showing South Atlantic Coastal Shell Midden Woodland (3525).

Summary

Canaveral National Seashore Vegetation

The sparse to moderate (10–60% cover) tree canopy, 5–20 meters (16.4–65.6 ft) tall, is dominated by *Quercus virginiana* (live oak), *Celtis laevigata* (sugarberry), *Juniperus virginiana var. silicicola* (southern redcedar), and *Pinus elliottii* (slash pine). The moderate (0–60%) subcanopy (5–10 meters [16.4–32.8 ft]), when present, includes *Myrcianthes fragrans* (twinberry). The moderate to dense (40–90%) tall-shrub layer (2–5 meters [6.6–16.4 ft]), when present, is dominated by *Erythrina herbacea* (redcardinal) and *Forestiera segregate* (Floridaswampprivet) along with *Amyris elemifera* (sea torchwood), *Ardisia escallonoides* (island marlberry), *Capparis flexuosa* (falseteeth), *Chiococca alba* (West Indian milkberry), *Erythrina herbacea* (redcardinal), *Forestiera segregata* (Florida

swampprivet), *Sageretia minutiflora* (smallflower mock buckthorn), and *Zanthoxylum fagara* (lime pricklyash). The sparse to moderate (10–60%) short-shrub layer (0.5–2 meters [1.6–6.6 ft]), when present, includes tall-shrub species as well as small amounts of *Agave decipiens* (false sisal), *Harrisia simpsonii* (Simpson's applecactus) (globally and state-imperiled), and *Psychotria nervosa* (Seminole balsamo). The sparse herbaceous layer (5–40%) includes *Atriplex cristata* (crested saltbush), *Euphorbia cyathophora* (fire on the mountain), *Mentzelia floridana* (poorman's patch), *Pavonia spinifex* (gingerbush), *Plumbago scandens* (doctorbush) (dominant), and *Verbesina virginica* (white crownbeard). Seven exotic species were recorded from the six sampled plots. *Pavonia spinifex* (gingerbush) (state imperiled) and *Hymenocallis latifolia* (perfumed spiderlily) (state-vulnerable) also occur here. Vine cover can be high (up to 70%) and includes *Cissus trifoliata* (sorrelvine), *Ipomoea alba* (tropical white morning-glory), *Ipomoea batatas* (sweetpotato), and *Parthenocissus quinquefolia* (Virginia creeper).

Global Vegetation

The canopy of this calciphilic community consists of *Juniperus virginiana var. silicicola* (southern redcedar), *Sabal palmetto* (cabbage palmetto), *Celtis laevigata var. laevigata* (sugarberry), *Zanthoxylum clava-herculis* (Hercules' club), *Quercus virginiana* (live oak), *Osmanthus americanus* (devilwood), and other species. Shrubs are prominent and may include *Ilex vomitoria* (yaupon), *Yucca aloifolia* (aloe yucca), *Sageretia minutiflora* (smallflower mock buckthorn), *Forestiera segregata* (Florida swampprivet), *Frangula caroliniana* (Carolina buckthorn), *Opuntia humifusa var. austrina* (devil's-tongue), and others. Composition is very variable from site to site, depending on environmental conditions and accidents of establishment and persistence.

Beachberry—Sea-grape/Sea-oats Shrubland

Attributes, descriptions, a photo and a map are shown in Table D-2, and Figures D-3 and D-4.

Table D-2. Attributes and descriptions of Beachberry—Sea-grape/Sea-oats Shrubland.

Attribute	Description
CEGL Code	3781
Community Name	Beachberry - Sea-grape/Sea-oats Shrubland
Color	Grey with red components
Tone	Medium to dark
Texture	Coarse
Pattern	Moderate to dense canopy
Height	Short to moderate
Shape	Elongated
Size	Not a common class; small average size with some variation possible.
Location	Sand dunes along the Atlantic Coast

Table D-2 (continued). Attributes and descriptions of Beachberry—Sea-grape/Sea-oats Shrubland.

Attribute	Description
Association	4001
Comments	Similar to 4001 but contains more beachberry and cabbage palm, so more red than grey



Figure D-3. Example of Beachberry—Sea-grape/Sea-oats Shrubland.

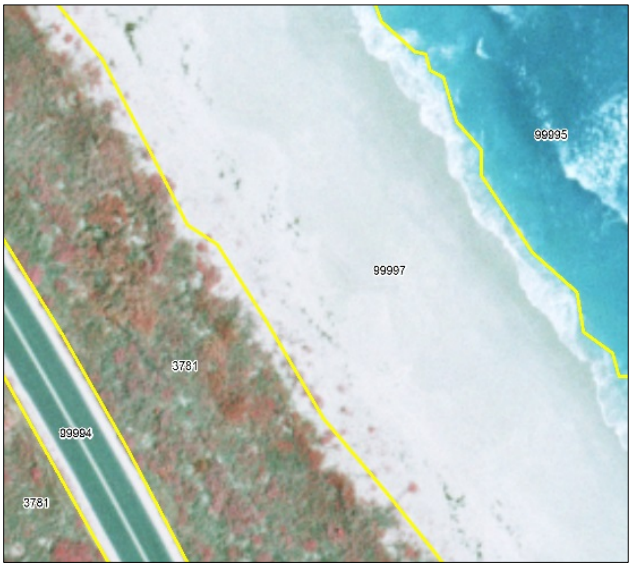


Figure D-4. Map showing Beachberry—Sea-grape/Sea-oats Shrubland. (3781).

Summary

Canaveral National Seashore Vegetation

The sparse tall-shrub layer includes *Sabal palmetto* (cabbage palmetto) and *Serenoa repens* (saw palmetto). The short-shrub layer is dominated by *Iva imbricata* (seacoast marshelder; 10% cover) with lesser amounts of *Coccoloba uvifera* (seagrape), *Forestiera segregata* (Florida swampprivet),

Lantana depressa (depressed shrubverbena), *Opuntia stricta* (erect pricklypear), *Scaevola plumieri* (gullfeed), *Sideroxylon tenax* (tough bully), and *Yucca aloifolia* (aloe yucca). The herbaceous layer is dominated by *Uniola paniculata* (seaoats; 60%) with lesser amounts of *Helianthus debilis* (cucumberleaf sunflower), *Spartina patens* (saltmeadow cordgrass), *Sporobolus virginicus* (seashore dropseed), and *Vigna luteola* (hairypod cowpea). This community supports several rare species, including the globally and state-imperiled *Lantana depressa* (depressed shrubverbena), the globally and state-vulnerable *Glandularia maritima* (coastal mock vervain), and the state-vulnerable *Physalis walteri* (Walter's groundcherry).

Global Vegetation

Stands are dominated by the shrubs *Scaevola plumieri* and *Coccoloba uvifera* (seagrape), with *Uniola paniculata* (seaoats) present in the herb layer. Other characteristic species include *Chamaesyce mesembrianthemifolia* (coastal beach sandmat), *Coccoloba uvifera* (seagrape), *Iva imbricata* (seacoast marshelder), *Panicum amarum var. amarulum* (bitter panicgrass), *Paspalum distichum* (knotgrass), *Cenchrus longispinus* (mat sandbur), *Helianthus debilis* (cucumberleaf sunflower), *Remirea maritima* (beachstar), and *Alternanthera maritima* (seaside joyweed).

Brazilian-pepper Seasonally Flooded Shrubland

Attributes, descriptions, a photo and a map are shown in Table D-3, and Figures D-5 and D-6.

Table D-3. Attributes and descriptions of Brazilian-pepper Seasonally Flooded Shrubland.

Attribute	Description
CEGL Code	3799
Community Name	Brazilian-pepper Seasonally Flooded Shrubland
Color	Grey with red components
Tone	Light to Medium
Texture	Coarse
Pattern	Moderate to dense canopy
Height	Tall
Shape	Random
Size	Common class; small average size with some variation possible.
Location	Near human influenced areas surrounding the Lagoon
Association	7040
Comments	Similar to 7040 but with more grey components from containing more cedars and Brazilian pepper



Figure D-5. Example of Brazilian-pepper Seasonally Flooded Shrubland.

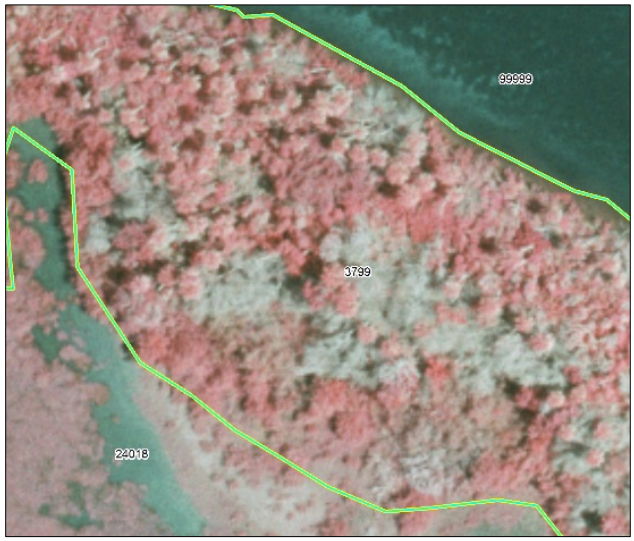


Figure D-6. Map showing Brazilian-pepper Seasonally Flooded Shrubland. (3799).

Summary

Canaveral National Seashore Vegetation

The stand of this association is nearly an exclusive monoculture of the invasive exotic *Schinus terebinthifolius* (Brazilian peppertree) in a canopy layer with 100% cover and 5–10 meters (16.4–32.8 ft) tall. The only other species recorded for the one sampled plot are *Sabal palmetto* (cabbage palmetto), *Eugenia axillaris* (white stopper), and *Acrostichum danaeifolium* (inland leatherfern).

Global Vegetation

These shrublands dominated by the exotic *Schinus terebinthifolius* (Brazilian peppertree) and are generally essentially monospecific. Sometimes *Psidium guajava* (guava), *Baccharis halimifolia* (eastern baccharis), *Ficus aurea* (Florida strangler fig), or *Salix caroliniana* (coastal plain willow) can codominate, under varying circumstances.

Atlantic Coast Interdune Swale

Attributes, descriptions, a photo and a map are shown in Table D-4, and Figures D-7 and D-8.

Table D-4. Attributes and descriptions of Atlantic Coast Interdune Swale.

Attribute	Description
CEGL Code	3839
Community Name	Atlantic Coast Interdune Swale
Color	Red with some grey
Tone	Medium to Dark
Texture	Rough
Pattern	Dense Canopy
Height	Medium to tall
Shape	Elongated
Size	Common class, moderate average size with moderate variation
Location	Along the Atlantic Coast separated from the Ocean by 4001 and/or 3781
Association	4001, 3781
Comments	Closer to the Lagoon than 4001 and 3781 and with less grey



Figure D-7. Example of Atlantic Coast Interdune Swale.

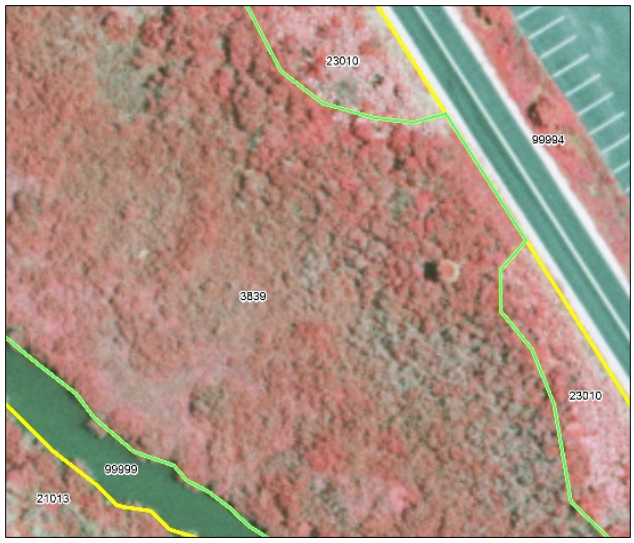


Figure D-8. Map showing Atlantic Coast Interdune Swale (3839).

Summary

Canaveral National Seashore Vegetation

This association was not documented at Canaveral NS, although it is possible that it does occur at the park. It is documented from the adjoining Cape Canaveral Air Force Station.

Global Vegetation

This vegetation is characterized by a moderately open to densely closed canopy of *Morella cerifera* (wax myrtle). Other canopy associates include *Baccharis halimifolia* (eastern baccharis), *Morella pensylvanica* (northern bayberry) (from northern North Carolina northward), *Juniperus virginiana var. silicicola* (southern redcedar) (from North Carolina and possibly southern Virginia southward), and *Rhus copallinum* (flameleaf sumac). The herbaceous layer is characterized by *Spartina patens* (saltmeadow cordgrass). Other ground flora associates include *Toxicodendron radicans* (eastern poison ivy), *Panicum virgatum* (switchgrass), *Andropogon virginicus* (broomsedge bluestem), *Juncus dichotomus* (forked rush), *Solidago sempervirens* (seaside goldenrod), *Smilax* (greenbrier) spp., *Parthenocissus quinquefolia* (Virginia creeper), *Vitis* (grape) spp., and *Schoenoplectus pungens* (common threesquare). Small openings may have wetland graminoids, such as *Juncus roemerianus* (needlegrass rush), *Spartina patens* (saltmeadow cordgrass), *Fimbristylis castanea* (marsh fimbry), *Andropogon glomeratus var. pumilus* (bushy bluestem), *Muhlenbergia filipes* (gulfhairawn muhly), etc., and forbs, such as *Hydrocotyle bonariensis* (largeleaf pennywort), *Sabatia stellaris* (rose of Plymouth), *Polygonum hydropiperoides* (swamp smartweed), *Eleocharis* (spikerush) spp., etc. In other cases, few herbs are present, because of the dense, thicket-like shrub layer.

Central Florida Sawgrass Marsh

Attributes, descriptions, a photo and a map are shown in Table D-5, and Figures D-9 and D-10.

Table D-5. Attributes and descriptions of Central Florida Sawgrass Marsh.

Attribute	Description
CEGL Code	3940
Community Name	Central Florida Sawgrass Marsh
Color	Pink to black
Tone	Light to Dark
Texture	Rough
Pattern	Spotty canopy
Height	Short
Shape	Elongated to circular
Size	Common class, moderate average size with moderate variation
Location	Low lying fresh water areas, very often in burned regions
Association	4423
Comments	Shorter and less homogenous than 4423



Figure D-9. Example of Central Florida Sawgrass Marsh.



Figure D-10. Map showing Central Florida Sawgrass Marsh (3940).

Summary

Canaveral National Seashore Vegetation

The overall appearance of this community is that of a tall grassland with 100% cover in the herbaceous layer. However, there may be a moderate (50% cover) emergent (10–20 meters [32.8–65.6 ft] tall) tree layer that includes *Acer rubrum* (red maple), *Nyssa biflora* (swamp tupelo), and *Ulmus americana* (American elm), and a sparse (10–40% cover; 1–5 meters [3.3–16.4 ft] tall) shrub layer that includes *Cephalanthus occidentalis* (common buttonbush), *Morella cerifera* (wax myrtle), and *Salix caroliniana* (coastal plain willow). The herbaceous layer is dominated by a near-monoculture of the grass *Cladium mariscus ssp. jamaicense* (Jamaica swamp sawgrass); additional species may include *Ludwigia repens* (creeping primrose-willow), *Panicum hemitomon* (maidencane), *Polygonum hydropiperoides* (swamp smartweed), *Pontederia cordata* (pickerelweed), *Rhynchospora inundata* (narrowfruit horned beaksedge), *Sagittaria graminea* (grassy arrowhead), *Sagittaria lancifolia* (bulltongue arrowhead), *Utricularia foliosa* (leafy bladderwort), and *Woodwardia virginica* (Virginia chainfern).

Global Vegetation

More information is needed on the species composition of this type, especially as it compares with related sawgrass marsh of tropical Florida. It is presumed that due to the more northerly occurrence, this type has some floristic indicators either lacking or rare in the tropical community. Both types are generally described as being "dense" sawgrass communities (Kushlan 1990). Although the St. Johns region was beyond their study area, Hilsenbeck et al. (1979) noted that sawgrass marshes vary in a north-south pattern, with denser types (those with more robust individual plants) found in more northern areas.

Elephantgrass Herbaceous Vegetation

Attributes, descriptions, a photo and a map are shown in Table D-6, and Figures D-11 and D-12.

Table D-6. Attributes and descriptions of Elephantgrass Herbaceous Vegetation.

Attribute	Description
CEGL Code	3960
Community Name	Elephantgrass Herbaceous Vegetation
Color	Red with some grey
Tone	Light to Medium
Texture	Rough
Pattern	Sparse Canopy
Height	Short to medium
Shape	Oblong
Size	Very uncommon class, moderate average size with some variation
Location	Near human influenced areas on the western side of the park
Association	3940
Comments	Typically xeric and more sparse than 3940



Figure D-11. Example of Elephantgrass Herbaceous Vegetation.

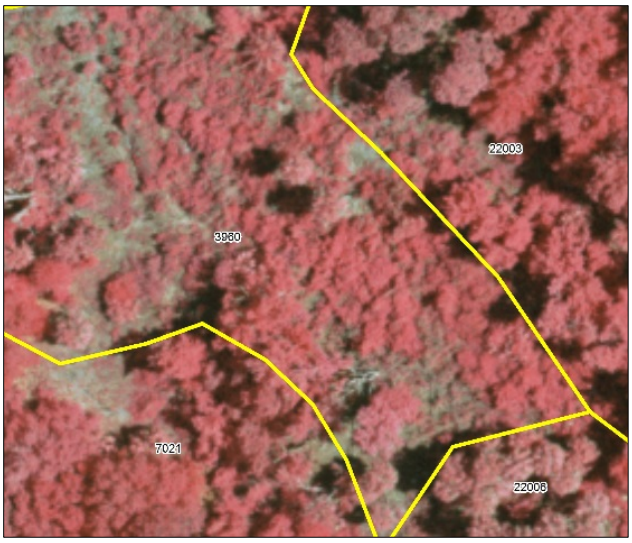


Figure D-12. Map showing Elephantgrass Herbaceous Vegetation (3960).

Summary

Canaveral National Seashore Vegetation

Stands of this association are nearly exclusive monocultures of the exotic grass *Pennisetum purpureum* (elephant grass) in an herbaceous layer with 100% cover. Other species reported from the single sampled plot include the vines *Smilax auriculata* (earleaf greenbrier) and *Vitis rotundifolia* (muscadine) and the exotic tree *Melia azedarach* (Chinaberrytree).

Global Vegetation

Areas dominated by *Pennisetum purpureum* (native of Africa), extensive in southern Florida and elsewhere in the tropics, where *Pennisetum purpureum* invades abandoned farmland and other disturbed areas. Once established, this can be a long-persistent vegetation type.

Southeast Florida Beach Dune

Attributes, descriptions, a photo and a map are shown in Table D-7, and Figures D-13 and D-14.

Table D-7. Attributes and descriptions of Southeast Florida Beach Dune.

Attribute	Description
CEGL Code	4001
Community Name	Southeast Florida Beach Dune
Color	Grey
Tone	Light
Texture	Coarse
Pattern	Sparse to moderate canopy
Height	Short

Table D-7 (continued). Attributes and descriptions of Southeast Florida Beach Dune.

Attribute	Description
Shape	Elongated
Size	Moderately uncommon class; small average size with some variation possible.
Location	Sand dunes along the Atlantic Coast
Association	3781
Comments	Similar to 3781 but mainly grey because lacking saw palmetto and beach berry



Figure D-13. Example of Southeast Florida Beach Dune.

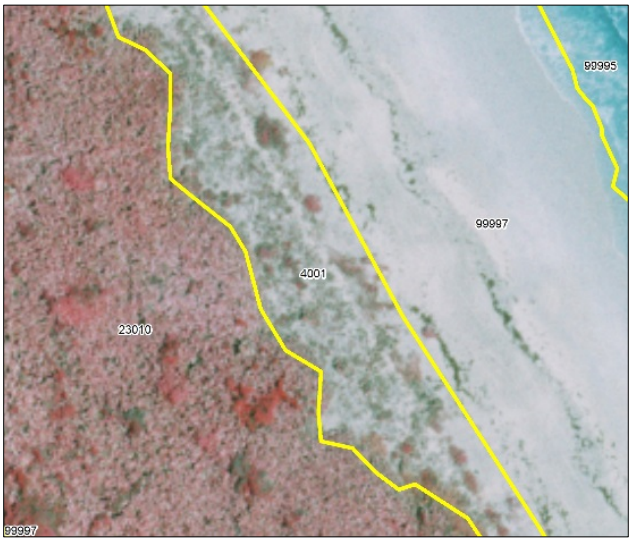


Figure D-14. Map showing Southeast Florida Beach Dune (4001).

Summary

Canaveral National Seashore Vegetation

The dense to total-cover (90–100%) herbaceous layer dominates this community. However, there is a moderate (10–20%) short-shrub layer (0.5–1 meters [1.6–3.3 ft]) that is dominated by *Iva imbricata* (seacoast marshelder); additional species may include *Coccoloba uvifera* (seagrape), *Lantana depressa* (depressed shrubverbena), *Opuntia stricta* (erect pricklypear), and *Serenoa repens* (saw

palmetto). The herbaceous layer is dominated by *Uniola paniculata* (seaoats) and *Spartina patens* (saltmeadow cordgrass) and may include lesser amounts of *Canavalia rosea* (baybean), *Helianthus debilis* (cucumberleaf sunflower), *Heterotheca subaxillaris* (camphorweed), *Panicum amarum* (bitter panicgrass), *Sesuvium portulacastrum* (shoreline seapurslane), *Sporobolus virginicus* (seashore dropseed), and *Stenotaphrum secundatum* (St. Augustine grass). Vines include *Smilax auriculata* (earleaf greenbrier). In addition, this community supports several rare species, including the globally and state-imperiled *Chamaesyce cumulicola* (coastal dune sandmat) and *Lantana depressa* (depressed shrubverbena), the globally and state-vulnerable *Glandularia maritima* (coastal mock vervain), and the state-vulnerable *Physalis walteri* (Walter's groundcherry).

Global Vegetation

Examples are dominated by *Iva imbricata* (seacoast marshelder) and *Uniola paniculata* (seaoats). Other common species include *Panicum amarum var. amarulum* (bitter panicgrass), *Ipomoea pes-caprae* (bayhops), *Spartina patens* (saltmeadow cordgrass), *Paspalum distichum* (knotgrass), *Sesuvium portulacastrum* (shoreline seapurslane), and *Heterotheca subaxillaris* (camphorweed). Scattered shrubs such as *Coccoloba uvifera* (seagrape), *Lantana depressa* (depressed shrubverbena), and *Sabal palmetto* (cabbage palmetto) may occur at low cover. Johnson et al. (1990) provide a species list for this community with abundance values for all taxa.

Short-Spike Bluestem—Southern Umbrella-sedge—Longleaf Three-awn Herbaceous Vegetation

Attributes, descriptions, a photo and a map are shown in Table D-8, and Figures D-15 and D-16.

Table D-8. Attributes and descriptions of Short-Spike Bluestem—Southern Umbrella-sedge—Longleaf Three-awn Herbaceous Vegetation.

Attribute	Description
CEGL Code	4235
Community Name	Short-Spike Bluestem—Southern Umbrella-sedge—Longleaf Three-awn Herbaceous Vegetation
Color	Grey
Tone	Light
Texture	Moderately coarse
Pattern	Moderate to dense canopy
Height	Short
Shape	Elongated to circular
Size	Not a common class; small average size with some variation possible.
Location	Western part of the park in low lying fresh water areas typically surrounded by 23006 and sometimes surrounding fresh water ponds

Table D-8 (continued). Attributes and descriptions of Short-Spike Bluestem—Southern Umbrella-sedge—Longleaf Three-awn Herbaceous Vegetation.

Attribute	Description
Association	23006
Comments	Typically surrounded by scrub oak and palmetto 23006 in low lying areas that are wet most of the year.



Figure D-15. Example of Short-Spike Bluestem—Southern Umbrella-sedge—Longleaf Three-awn Herbaceous Vegetation.

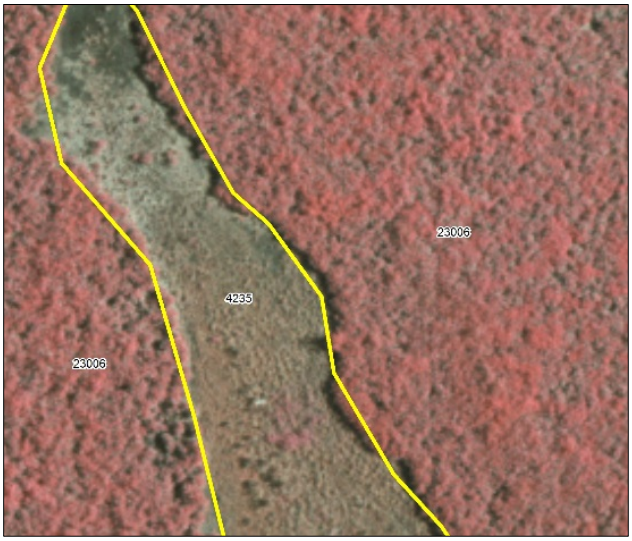


Figure D-16. Map showing Short-Spike Bluestem—Southern Umbrella-sedge—Longleaf Three-awn Herbaceous Vegetation (4235).

Summary

Canaveral National Seashore Vegetation

Stands of this community are composed of a dense herbaceous layer (100%) of grasses and graminoids. *Andropogon brachystachyus* (shortspike bluestem) and *Fuirena scirpoidea* (southern umbrella-sedge) are strongly dominant, with *Aristida palustris* (longleaf threeawn) and *Aristida*

spiciformis (bottlebrush threeawn) found at lower cover. A sparse (5%) short-shrub layer of *Lyonia lucida* (fetterbush lyonia) and *Hypericum cistifolium* (roundpod St. Johnswort) is also present.

Global Vegetation

This association is dominated by *Andropogon brachystachyus* (shortspike bluestem) and *Fuirena scirpoidea* (southern umbrella-sedge), with other wetland herbaceous species at low cover, including *Aristida palustris* (longleaf threeawn), *Aristida spiciformis* (bottlebrush threeawn), *Lyonia lucida* (fetterbush lyonia), and *Hypericum cistifolium* (roundpod St. Johnswort).

Florida Swamp Privet Spoil Island

Attributes, descriptions, a photo and a map are shown in Table D-9, and Figures D-17 and D-18.

Table D-9. Attributes and descriptions of Florida Swamp Privet Spoil Island.

Attribute	Description
CEGL Code	4237
Community Name	Florida Swamp Privet Spoil Island
Color	White with grey and red components
Tone	Light
Texture	Coarse
Pattern	Sparse to moderate canopy
Height	Short to moderate
Shape	Circular
Size	Moderate common class; small average size with small variation possible.
Location	Islands in the Lagoon
Association	21013
Comments	Found in the inner most portions of islands in the Lagoon, usually surrounded by mangroves (21013)



Figure D-17. Example of Florida Swamp Privet Spoil Island.



Figure D-18. Map showing Florida Swamp Privet Spoil Island (4237).

Summary

Canaveral National Seashore Vegetation

While the dominant strata on these spoil islands is the shrub layer, there may be a sparse (5-10% cover) canopy of *Juniperus virginiana var. silicicola* (southern redcedar) and/or *Sabal palmetto* (cabbage palmetto). The sparse to moderate (10–70%) tall-shrub layer (2–10 meters [6.6–32.8 ft] tall) may be dominated by *Borrichia frutescens* (bushy seaside tansy), *Forestiera segregata* (Florida swampprivet), and/or *Morella cerifera* (wax myrtle) but may also include *Ilex vomitoria* (yaupon) and *Sabal palmetto* (cabbage palmetto). The sparse to moderate (10–60%) short-shrub layer (0.5–1 meters [1.6–3.3 ft]) may include *Forestiera segregate* (Florida swampprivet), *Borrichia frutescens* (bushy seaside tansy), *Opuntia stricta* (erect pricklypear), *Chiococca alba* (West Indian milkberry), and *Lantana depressa* (depressed shrubverbena). The sparse herbaceous layer (5–30%) is dominated by *Heterotheca ubaxillaris* (camphorweed) or *Heliotropium angiospermum* with lesser amounts of *Schizachyrium scoparium* (little bluestem), *Trichostema dichotomum* (forked bluecurls), *Triplasis purpurea* (purple sandgrass), and *Ipomopsis rubra* (standing-cypress). Other species at low cover may include *Iva frutescens* (Jesuit's bark), *Chiococca alba* (West Indian milkberry), *Atriplex cristata* (crested saltbush), *Conocarpus erectus* (button mangrove), and *Avicennia germinans* (black mangrove).

Global Vegetation

This spoil island vegetation is dominated by *Forestiera segregata* (Florida swampprivet), *Juniperus virginiana var. silicicola* (southern redcedar), *Morella cerifera* (wax myrtle), and *Heterotheca subaxillaris* (camphorweed).

Central Florida Willow Thicket

Attributes, descriptions, a photo and a map are shown in Table D-10, and Figures D-19 and D-20.

Table D-10. Attributes and descriptions of Central Florida Willow Thicket.

Attribute	Description
CEGL Code	4423
Community Name	Central Florida Willow Thicket
Color	Pink with red components
Tone	Light
Texture	Coarse
Pattern	Moderate to dense canopy
Height	Moderate to Tall
Shape	Random
Size	Moderate common class; large average size with large variation possible.
Location	Low lying areas in the western part of the park
Association	22006
Comments	Usually found near roads in wet areas surrounded by oak and cabbage scrub (22006).



Figure D-19. Example of Central Florida Willow Thicket.

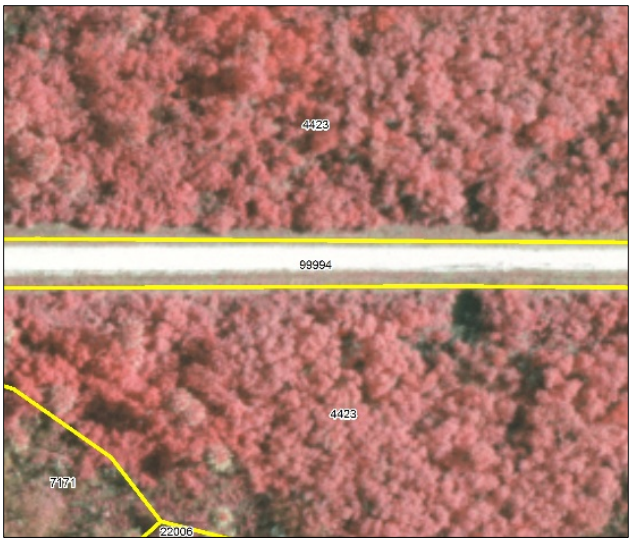


Figure D-20. Map showing Central Florida Willow Thicket (4423).

Summary

Canaveral National Seashore Vegetation

The dense (90% cover) tree canopy, 5–10 meters [16.4–32.8 ft] tall, is dominated by *Salix caroliniana* (coastal plain willow) with lesser amounts of *Diospyros virginiana* (common persimmon) and *Ulmus americana* (American elm). The moderate (40%) tall-shrub layer (2–5 meters [6.6–16.4 ft]) is also dominated by *Salix caroliniana* (coastal plain willow). The sparse herbaceous layer (30%) includes *Acrostichum danaeifolium* (inland leatherfern), *Cladium mariscus ssp. jamaicense* (Jamaica swamp sawgrass), *Ludwigia repens* (creeping primrose-willow), *Panicum virgatum* (switchgrass), *Sagittaria lancifolia* (bulltongue arrowhead), *Spartina bakeri* (sand cordgrass), and *Thelypteris interrupta* (Willdenow's maiden fern). Vines include *Ampelopsis arborea* (peppervine). Epiphyte *Tillandsia usneoides* (Spanish moss) is also present.

Global Vegetation

An example of this community at Canaveral National Seashore occurs along the edge of a larger, linear marsh and is dominated by *Salix caroliniana* (coastal plain willow) in both the canopy and tall-shrub layers, with a sparse herb layer of *Cladium mariscus ssp. jamaicense* (Jamaica swamp sawgrass), *Sagittaria lancifolia* (bulltongue arrowhead), and *Acrostichum danaeifolium* (inland leatherfern).

Chainfern Small Depression Pond

Attributes, descriptions, a photo and a map are shown in Table D-11, and Figures D-21 and D-22.

Table D-11. Attributes and descriptions of Chainfern Small Depression Pond.

Attribute	Description
CEGL Code	4475
Community Name	Chainfern Small Depression Pond
Color	Red
Tone	Medium
Texture	Smooth to moderate
Pattern	Dense canopy
Height	Short
Shape	Circular
Size	Not a common class; small average size with little variation possible.
Location	Low lying areas in the western part of the park, sometimes surrounding fresh water ponds
Association	24020, 23006
Comments	In low lying areas surrounded by oak and cabbage scrub (23006) sometimes with an inner ring of Spartina (24020).



Figure D-21. Example of Chainfern Small Depression Pond.

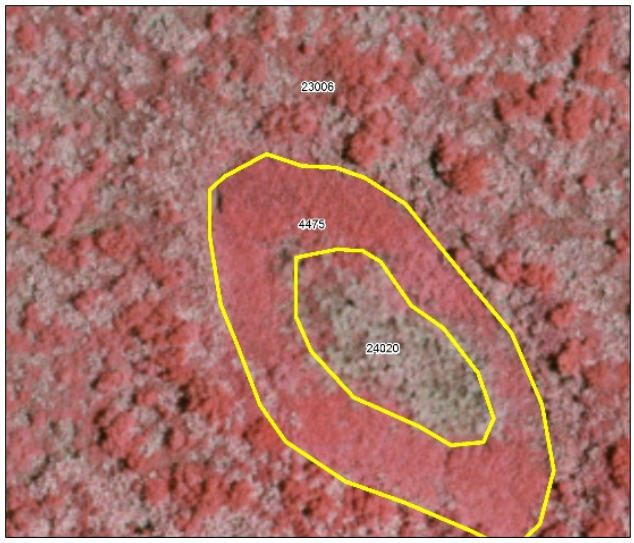


Figure D-22. Map showing Chainfern Small Depression Pond (4475).

Summary

Canaveral National Seashore Vegetation

This herbaceous community, with 100% cover, is dominated by *Woodwardia virginica* (Virginia chainfern), with *Spartina bakeri* present at relatively high cover in one of the plots. Additional herbs include *Blechnum serrulatum* (toothed midsorus fern), *Lachnanthes caroliana* (Carolina redroot), *Osmunda cinnamomea* (cinnamon fern), *Panicum hemitomon* (maidencane), and *Sagittaria lancifolia* (bulltongue arrowhead). There may also be a sparse (20–30%) shrub layer that may include *Lyonia lucida* (fetterbush lyonia) and *Morella cerifera* (wax myrtle). The ground surface is covered (80%) by *Sphagnum* (sphagnum) spp.

Global Vegetation

Stands of this generally defined association are often strongly dominated by *Woodwardia virginica* (Virginia chainfern). The vegetation may be tall, reaching up to 1.5 meters (4.9 ft) in height. Additional associates include *Triadenum virginicum* (Virginia marsh St. Johnswort), *Carex striata* (Walter's sedge), *Hypericum mutilum* (dwarf St. Johnswort), and *Decodon verticillatus* (swamp loosestrife). Woody associates typically occur at the periphery of the pond or depression and may include scattered and stunted individuals of *Acer rubrum* (red maple), *Pinus taeda* (loblolly pine), *Liquidambar styraciflua* (sweetgum), *Clethra alnifolia* (coastal sweetpepperbush), *rhododendron viscosum* (swamp azalea), or *Vaccinium corymbosum* (highbush blueberry). In addition, *Sphagnum* (sphagnum) mosses (e.g., *Sphagnum cuspidatum* (toothed sphagnum), *Sphagnum palustre* (prairie sphagnum)) are also typical components. More information is needed on this vegetation type.

Watershield Pond

Attributes, descriptions, a photo and a map are shown in Table D-12, and Figures D-23 and D-24.

Table D-12. Attributes and descriptions of Watershield Pond.

Attribute	Description
CEGL Code	4527
Community Name	Watershield Pond
Color	Pink
Tone	Light
Texture	Smooth
Pattern	Moderate to dense canopy
Height	Extremely Short
Shape	Circular to oblong
Size	Second most uncommon class; small average size with little variation possible.
Location	Year round fresh water bodies on the western part of the park
Association	24010, 24018
Comments	Cattails (24010) can be found on outer edges of ponds but they are grey; Can be confused with 24018 but watershield are found in fresh water rather than brackish and float on the water.



Figure D-23. Example of Watershield Pond.

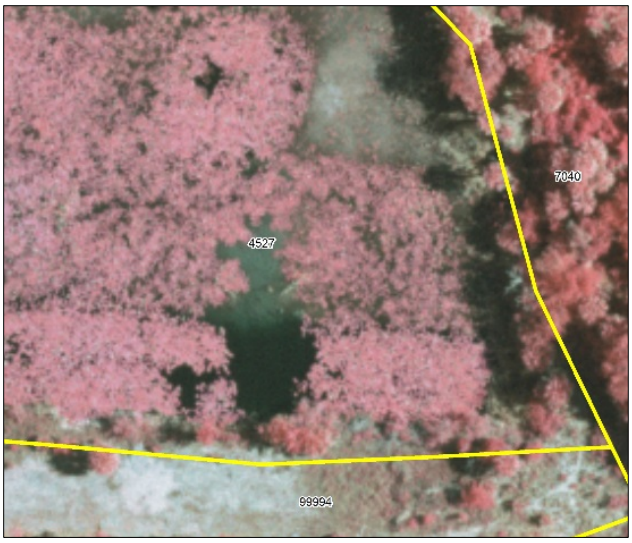


Figure D-24. Map showing Watershield Pond (4527).

Summary

Canaveral National Seashore Vegetation

This aquatic community is dominated by *Brasenia schreberi* (watershield) (60% cover) and may include lesser amounts of *Fuirena scirpoidea* (southern umbrella-sedge), *Panicum hemitomon* (maidencane), *Sagittaria lancifolia* (bulltongue arrowhead), *Spartina bakeri* (sand cordgrass), and *Woodwardia virginica* (Virginia chainfern). In addition, a sparse (5% cover) shrub layer (0.5–1 meters [1.6–3.3 ft] tall) of *Cephalanthus occidentalis* (common buttonbush) may occur.

Global Vegetation

Brasenia schreberi (watershield), a floating aquatic native to Florida that has become naturalized throughout much of the eastern and western U.S. and Canada, is the dominant plant species; other species may include *Leersia oryzoides* (rice cutgrass), *Lemna valdiviana* (valdivia duckweed), *Juncus effusus* (common rush), *Stuckenia pectinata* (sago pondweed), *Nymphaea odorata* (American white waterlily), and *Spirodela polyrrhiza* (common duckmeat). Other floating aquatics present include *Nelumbo lutea* (American lotus), *Nymphaea odorata* (American white waterlily), *Nymphaea mexicana* (yellow waterlily), and *Utricularia* (bladderwort) spp., along with submersed aquatics such as *Cabomba caroliniana* (Carolina fanwort) and *Ceratophyllum demersum* (coon's tail) and rooted aquatics such as *Pontederia cordata* (pickerelweed) and *Zizaniopsis miliacea* (giant cutgrass).

Brazilian Beefwood Forest

Attributes, descriptions, a photo and a map are shown in Table D-13, and Figures D-25 and D-26.

Table D-13. Attributes and descriptions of Brazilian Beefwood Forest.

Attribute	Description
CEGL Code	4830
Community Name	Brazilian Beefwood Forest
Color	Red
Tone	Medium
Texture	Coarse
Pattern	Dense canopy
Height	Very tall
Shape	Elongated
Size	Most uncommon class; small average size with little variation possible.
Location	Along Intracoastal Waterway where it exits the park on the western side.
Association	21007
Comments	Similar to Oak Cabbage Hammock (21007) but lacking cabbage and is taller and more coarse than oak.



Figure D-25. Example of Brazilian Beefwood Forest.



Figure D-26. Map showing Brazilian Beefwood Forest (4830).

Summary

Canaveral National Seashore Vegetation

The closed (100% cover) tree canopy, 10–15 meters [32.8–49.2 ft] tall, is dominated exclusively by the exotic *Casuarina glauca* (gray sheoak), which also makes up the sparse (10%) tall-shrub layer (2–5 meters [6.6–16.4 ft]). *Forestiera segregata* (Florida swampprivet) comprises a very sparse short-shrub layer (0.5–1 meters [1.6–3.3 ft]).

Global Vegetation

This forest us dominated by *Casuarina equisetifolia* (beach sheoak). Lower vegetation strata are typically very depauperate, owing to dense accumulations of *Casuarina* (sheoak) litter, but can sometimes consist of dense clonal growths of (often exotic) species, such as *Sansevieria hyacinthoides* (iguanatail) or *Kalanchoe* (widow's-thrill) spp.

St. Augustine Grass Herbaceous Vegetation

Attributes, descriptions, a photo and a map are shown in Table D-14, and Figures D-27 and D-28.

Table D-14. Attributes and descriptions of St. Augustine Grass Herbaceous Vegetation.

Attribute	Description
CEGL Code	4883
Community Name	St. Augustine Grass Herbaceous Vegetation
Color	Pink to light red
Tone	Light
Texture	Smooth to medium
Pattern	Moderate to dense canopy

Table D-14 (continued). Attributes and descriptions of St. Augustine Grass Herbaceous Vegetation.

Attribute	Description
Height	Short
Shape	Elongated
Size	Uncommon class; small average size with very little variation possible.
Location	Along roadsides in the park, most common along the roads in the western part of the park.
Association	23006
Comments	Found between 23006 and roadways



Figure D-27. Example of St. Augustine Grass Herbaceous Vegetation.



Figure D-28. Map showing St. Augustine Grass Herbaceous Vegetation (4883).

Summary

Canaveral National Seashore Vegetation

The dense to total-cover (90–100%) herbaceous layer of *Stenotaphrum secundatum* (St. Augustine grass) dominates this community. However, in this example there is a moderate (20%) short-shrub layer (0.5–1 meters [1.6–3.3 ft]) that contains *Borrichia frutescens* (bushy seaside tansy), *Iva*

imbricata (seacoast marshelder), *Opuntia stricta* (erect pricklypear), and *Sabal palmetto* (cabbage palmetto). Additional herbs at much lower cover include *Spartina patens* (saltmeadow cordgrass), *Fimbristylis caroliniana* (Carolina fimbry), and *Cyperus planifolius*.

Global Vegetation

This association consists of planted or semi-natural grasslands dominated by *Stenotaphrum secundatum* with varying degrees of native composition remaining, on a wide variety of soils and sites occurring in the Bahamas, Puerto Rico, Florida and possibly in other states and ecoregions.

Sand Live Oak—(Live Oak)/Saw Palmetto—Rusty Fetterbush Forest

Attributes, descriptions, a photo and a map are shown in Table D-15, and Figures D-29 and D-30.

Table D-15. Attributes and descriptions of Sand Live Oak—(Live Oak)/Saw Palmetto—Rusty Fetterbush Forest.

Attribute	Description
CEGL Code	7020
Community Name	Sand Live Oak—(Live Oak)/Saw Palmetto—Rusty Fetterbush Forest
Color	Red with pink and grey components
Tone	Medium
Texture	Coarse
Pattern	Moderate to dense canopy
Height	Moderate to tall
Shape	Mainly circular but can be oblong
Size	Common class; moderate average size with some variation possible.
Location	Inner part of islands in the Lagoon and on the western part of the park
Association	4237
Comments	Similar to 4237 but contains more oaks than cedars and has much denser canopy coverage



Figure D-29. Example of Sand Live Oak—(Live Oak)/Saw Palmetto—Rusty Fetterbush Forest.



Figure D-30. Map showing Sand Live Oak—(Live Oak)/Saw Palmetto—Rusty Fetterbush Forest (7020).

Summary

Canaveral National Seashore Vegetation

The sparse to total (10–100% cover) tree canopy, 5–20 meters [16.4–65.6 ft] tall, is dominated by *Quercus geminata* (sand live oak) and may contain lesser amounts of *Juniperus virginiana var. silicicola* (southern redcedar) and *Pinus elliottii* (slash pine). The sparse to moderate (0–60%) tall-shrub layer (2–5 meters [6.6–16.4 ft]), when present, includes *Carya floridana* (scrub hickory), *Forestiera segregata* (Florida swampprivet), *Juniperus virginiana var. silicicola* (southern redcedar), *Lyonia ferruginea* (rusty staggerbush), *Morella cerifera* (wax myrtle), *Quercus myrtifolia* (myrtle oak), *Sabal palmetto* (cabbage palmetto), and/or *Serenoa repens* (saw palmetto). The dense (0–80%) short-shrub layer (0.5–2 meters [1.6–6.6 ft]), when present, includes *Ilex ambigua* (Carolina holly), *Ilex glabra* (inkberry), *Ilex vomitoria* (yaupon), *Persea borbonia* (redbay), *Persea humilis* (silk bay), *Serenoa repens* (saw palmetto), *Vaccinium myrsinites* (shiny blueberry), and *Vaccinium stamineum* (deerberry). The sparse herbaceous layer (0–5%) includes *Galactia elliottii* (Elliott's milkpea), *Galactia erecta* (erect milkpea), *Pteridium aquilinum* (western brackenfern), *Rhynchospora megalocarpa* (sandyfield beaksedge), and *Scleria triglomerata* (whip nutrush). Epiphytes *Tillandsia recurvata* (small ballmoss) and *Tillandsia usneoides* (Spanish moss) may also be present.

Global Vegetation

This association represents xeric maritime hammocks of the central eastern coast of Florida and adjacent areas in southern Georgia. The overstory is dominated by *Quercus geminata*; *Quercus virginiana* may also be present, along with *Quercus myrtifolia*. The dense shrub layer includes *Serenoa repens*, *Lyonia fruticosa*, *Lyonia ferruginea*, *Osmanthus americanus* var. *americanus*, *Persea borbonia*, and *Morella cerifera*. An understory of *Sabal palmetto* may also be present. In northeastern Florida, at the Timucuan Ecological and Historic Preserve, dead and dying *Persea borbonia* indicate that these maritime hammocks are being affected by laurel wilt, which is caused by a vascular wilt fungus that is transmitted to species in the Lauraceae family via the non-native redbay ambrosia beetle (*Xyleborus glabratus*)

Sand Laurel Oak/Greenbrier species Forest

Attributes, descriptions, a photo and a map are shown in Table D-16, and Figures D-31 and D-32.

Table D-16. Attributes and descriptions of Sand Laurel Oak/Greenbrier species Forest.

Attribute	Description
CEGL Code	7021
Community Name	Sand Laurel Oak/Greenbrier species Forest
Color	Red with pink components
Tone	Light
Texture	Coarse
Pattern	Moderate to dense canopy
Height	Tall
Shape	Elongated
Size	Very uncommon class; large average size with some variation possible.
Location	Western most part of the park
Association	7020, 7028, 22003
Comments	Similar to 7020 and 7028 but lacking cedar component. Found near areas where 22003 can also be found



Figure D-31. Example of Sand Laurel Oak/Greenbrier species Forest.

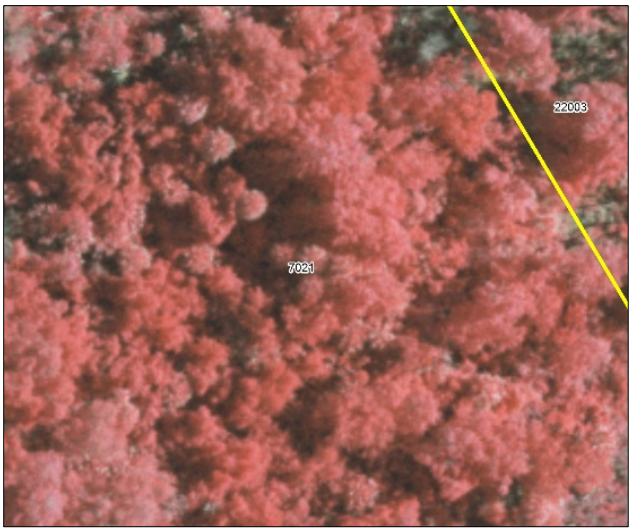


Figure D-32. Map showing Sand Laurel Oak/Greenbrier species Forest (7021).

Summary

Canaveral National Seashore Vegetation

The dense (80% cover) tree canopy, 20–35 meters (65.6–114.8 ft) tall, is dominated exclusively by *Quercus hemisphaerica* (Darlington oak). The sparse (20%) subcanopy contains *Prunus caroliniana* (Carolina laurelcherry) and *Sabal palmetto* (cabbage palmetto). The moderate (60%) short-shrub layer is dominated by *Prunus caroliniana* (Carolina laurelcherry). The sparse herbaceous layer (20%) is dominated by the exotic *Nephrolepis cordifolia* (narrow swordfern) with lesser amounts of *Galactia volubilis* (downy milkpea) and *tenotaphrum secundatum* (St. Augustine grass). Vines include *Abrus precatorius* (rosarypea), *Smilax auriculata* (earleaf greenbrier) and *Vitis rotundifolia* (muscadine). Epiphytes *Tillandsia recurvata* (small ballmoss) and *landsia usneoides* (Spanish moss) may also be present.

Global Vegetation

This association represents fire-suppressed successional stands of *Quercus hemisphaerica*, often nearly monospecific. These communities have been referred to as high hammocks or pioneer hammocks. The extent of this community is increasing as fire suppression increases and old fields succeed to vegetation of this type.

Live Oak/Farkleberry—Yaupon forest

Attributes, descriptions, a photo and a map are shown in Table D-17, and Figures D-33 and D-34.

Table D-17. Attributes and descriptions of Live Oak/Farkleberry—Yaupon forest.

Attribute	Description
CEGL Code	7028
Community Name	Live Oak/Farkleberry—Yaupon forest
Color	Red with pink and few grey components are possible

Table D-17 (continued). Attributes and descriptions of Live Oak/Farkleberry—Yaupon forest.

Attribute	Description
Tone	Light to medium
Texture	Coarse
Pattern	Moderate to dense canopy
Height	Tall
Shape	Expansive
Size	A common class; large average size with moderate variation possible.
Location	Western edge of the park in xeric areas
Association	7020, 7021
Comments	Similar to 7020 but more greater canopy coverage and similar to 7021 but with cedar



Figure D-33. Example of Live Oak/Farkleberry—Yaupon forest.

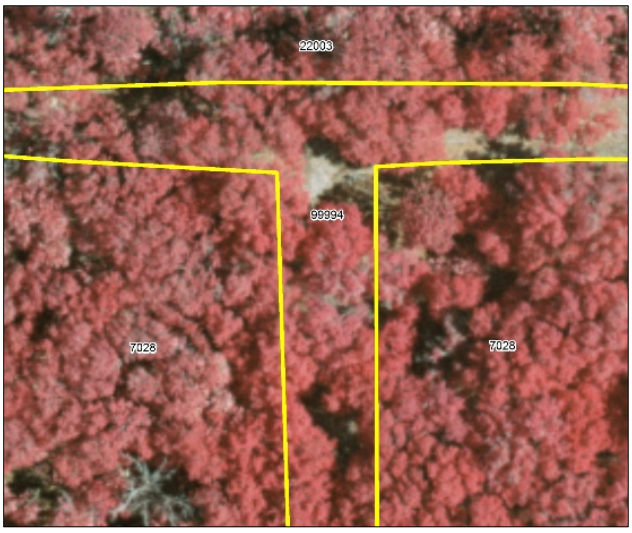


Figure D-34. Map showing Live Oak/Farkleberry—Yaupon forest (7028).

Summary

Canaveral National Seashore Vegetation

The dense to total (90–100% cover) tree canopy, 5–20 meters (16.4–65.6 ft) tall, is dominated by *Quercus virginiana* (live oak). The very sparse (0–10%) subcanopy (5–10 meters [16.4–32.8 ft]) includes *Juniperus virginiana var. silicicola* (southern redcedar) and *Persea borbonia* (redbay). The total (100%) tall-shrub layer (1–2 meters [3.3–6.6 ft]) is dominated by *Serenoa repens* (saw palmetto) with lesser amounts of *Ilex vomitoria* (yaupon). The sparse herbaceous layer (0–5%) includes *Blechnum serrulatum* (toothed midsorus fern), *Galactia elliottii* (Elliott's milkpea), and *Encyclia tampensis* (Tampa butterfly orchid). *Smilax auriculata* (earleaf greenbrier) is the dominant vine. Common epiphytes include *Pleopeltis polypodioides* (resurrection fern), *Tillandsia recurvata* (small ballmoss), and *Tillandsia usneoides* (Spanish moss). Species diversity in this community is significantly lower than other maritime hammock communities.

Global Vegetation

Stands are dominated by *Quercus virginiana* (live oak), sometimes with *Juniperus virginiana var. silicicola* (southern redcedar) present in the canopy. *Ilex vomitoria* (yaupon) and *Vaccinium arboreum* (farkleberry) are present in the shrub layer. Frequently small *Cladina/Cladonia*-dominated openings are present. Other characteristic species include *Scleria triglomerata* (whip nutrush), *Paronychia baldwinii* (Baldwin's nailwort), *Cladina evansii* (Evans' reindeer lichen), *Stipulicida setacea* (pineland scalypink), and *Hypericum hypericoides* (St. Andrew's cross).

Palmetto—Live Oak Hydric Hammock

Attributes, descriptions, a photo and a map are shown in Table D-18, and Figures D-35 and D-36.

Table D-18. Attributes and descriptions of Palmetto—Live Oak Hydric Hammock.

Attribute	Description
CEGL Code	7040
Community Name	Palmetto—Live Oak Hydric Hammock
Color	Red with grey components
Tone	Medium to dark
Texture	Coarse
Pattern	Moderate to dense canopy
Height	Moderate to tall
Shape	Expansive
Size	Very common class; large average size with large variation possible.
Location	Hydric areas found in the western part of the park
Association	7028
Comments	Similar to 7028 but contains cabbage palm, and a more open canopy



Figure D-35. Example of Palmetto—Live Oak Hydric Hammock.

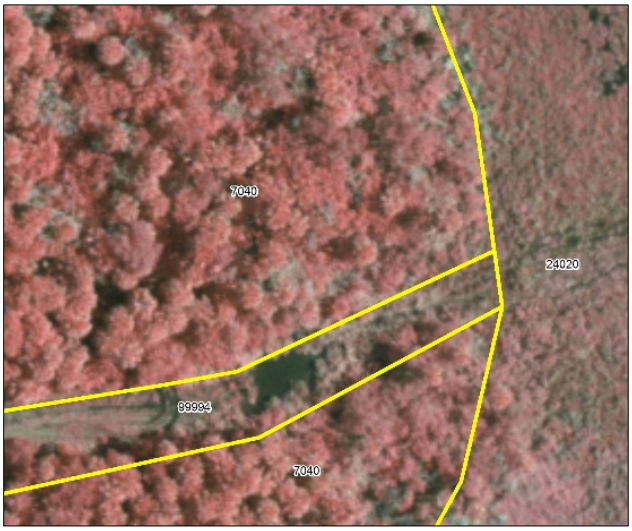


Figure D-36. Map showing Palmetto—Live Oak Hydric Hammock (7040).

Summary

Canaveral National Seashore Vegetation:

The moderate to dense (50–90% cover) tree canopy, 10–35 meters (32.8–114.8 ft) tall, is dominated by *Quercus virginiana* (live oak) and may include *Juniperus virginiana var. silicicola* (southern redcedar), *Pinus elliottii* (slash pine), and *Sabal palmetto* (cabbage palmetto). The very sparse to moderate (5–60%) subcanopy (5–10 meters [16.4–32.8 ft]) is dominated by *Sabal palmetto* (cabbage palmetto), as is the very sparse to moderate (5–50%) tall-shrub layer (2–5 meters [6.6–16.4 ft]), which may also include *Ilex cassine* (dahoon) and *Serenoa repens* (saw palmetto). The sparse (5–20%) short-shrub layer (0.5–2 meters [1.6–6.6 ft]) includes *Ilex vomitoria* (yaupon) and *Morella cerifera* (wax myrtle). The variable herbaceous layer (5–90%) includes *Acrostichum danaeifolium* (inland leatherfern), *Amphicarpum muehlenbergianum* (Muhlenberg maidencane), *Bidens alba* (romerillo), *Blechnum serrulatum* (toothed midsorus fern), *Hydrocotyle prolifera* (whorled marshpennywort), *Mikania cordifolia* (Florida Keys hempvine), and the invasive exotic *Schinus terebinthifolius* (Brazilian peppertree). Vines include *Parthenocissus quinquefolia* (Virginia creeper), *Smilax auriculata* (earleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy), *Vitis aestivalis* (summer grape), and *Vitis rotundifolia* (muscadine). Epiphytes include *Phlebodium aureum* (golden polypody), *Pleopeltis polypodioides* (resurrection fern), and *Vittaria lineata* (shoestring fern).

Global Vegetation:
Sabal palmetto (cabbage palmetto) and *Quercus virginiana* (live oak) generally share canopy dominance, and few other trees except *Juniperus virginiana var. silicicola* (southern redcedar) are commonly encountered. *Sabal palmetto* (cabbage palmetto) or the other two primary canopy species (*Quercus virginiana* (live oak) or *Juniperus virginiana var. silicicola* (southern redcedar)) may strongly dominate local patches. *Morella cerifera* (wax myrtle) is a typical shrub or small tree. *Sapindus saponaria* (wingleaf soapberry) can be a shrub and subcanopy codominant on limestone in the Florida peninsula. An example attributed to this type on Ocala National Forest (Rocky Point) was dominated by *Quercus virginiana* (live oak) and *Sabal palmetto* (cabbage palmetto) with some *Carya aquatica* (water hickory) and *Celtis laevigata* (sugarberry) (NatureServe Ecology unpubl. data). *Sabal palmetto* (cabbage palmetto) and *Sapindus saponaria* (wingleaf soapberry) are important in the subcanopy and shrub strata; other shrubs present are *Sabal minor* (dwarf palmetto), *Morus rubra* (red mulberry), *Callicarpa americana* (American beautyberry), *Sageretia minutiflora* (smallflower mock buckthorn), *Sideroxylon reclinatum* (Florida bully), *Juniperus virginiana var. silicicola* (southern redcedar), and *Persea palustris* (swamp bay). Herbs are dominated by *Oplismenus hirtellus ssp. setarius* (bristle basketgrass). Vines are common, including *Campsis radicans* (trumpet creeper), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax bona-nox* (saw greenbrier), *Toxicodendron radicans* (eastern poison ivy), *Smilax auriculata* (earleaf greenbrier), *Cocculus carolinus* (Carolina coralbead), *Matelea gonocarpos* (angularfruit milkvine), and *Gelsemium sempervirens* (evening trumpetflower). Epiphytes are dominated by *Tillandsia usneoides* (Spanish moss), with *Tillandsia recurvata* (small ballmoss) and *Pleopeltis polypodioides ssp. michauxiana* (resurrection fern).

Mid- to Late-Successional Slash Pine Managed Forest

Attributes, descriptions, a photo and a map are shown in Table D-19, and Figures D-37 and D-38.

Table D-19. Attributes and descriptions of Mid- to Late-Successional Slash Pine Managed Forest.

Attribute	Description
CEGL Code	7171
Community Name	Mid- to Late-Successional Slash Pine Managed Forest
Color	Light pink to grey
Tone	Light to medium
Texture	Moderate to coarse
Pattern	Moderate to dense canopy
Height	Tall
Shape	Random
Size	Moderately uncommon class; moderate average size with large variation possible.
Location	Western part of the park

Table D-19 (continued). Attributes and descriptions of Mid- to Late-Successional Slash Pine Managed Forest.

Attribute	Description
Association	22003, 22004
Comments	Similar to 22003 and 22004 but typically more dense with all the trees having the same age



Figure D-37. Example of Mid- to Late-Successional Slash Pine Managed Forest.

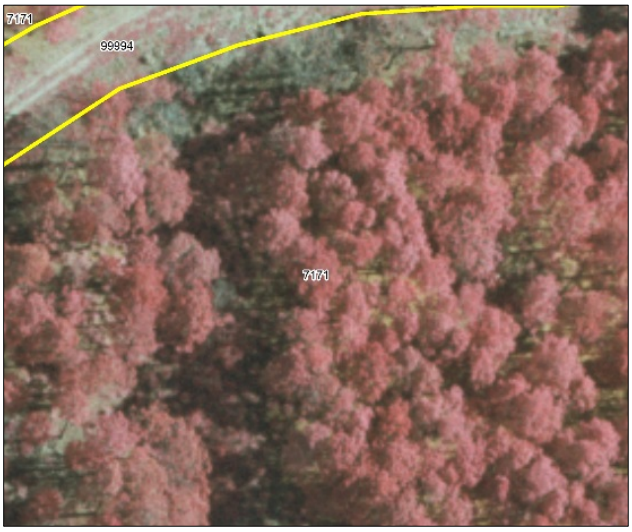


Figure D-38. Map showing Mid- to Late-Successional Slash Pine Managed Forest (7171).

Summary

Canaveral National Seashore Vegetation

The dense (90% cover) tree canopy, 15–20 meters [49.2–65.6 ft] tall, is dominated exclusively by *Pinus elliottii* (slash pine); the sparse (10%) subcanopy (5–10 meters [16.4–32.8 ft]) by *Sabal palmetto* (cabbage palmetto). The very sparse (5%) tall-shrub layer (2–5 meters [6.6–16.4 ft]) includes *Sabal palmetto* (cabbage palmetto) and the invasive exotic *Schinus terebinthifolius* (Brazilian peppertree). The very sparse (5%) short-shrub layer (0.5–1 meters [1.6–3.3 ft]) includes trace amounts of *Lantana camara* (lantana), *Quercus myrtifolia* (myrtle oak), *Rhus copallinum* (flameleaf sumac), and *Serenoa repens* (saw palmetto). The herbaceous layer (100%) is dominated

by the exotic *Urochloa maxima* (guineagrass; 95%) with traces of many other species including other exotic species such as *Hyptis mutabilis* (tropical bushmint), *Urena lobata* (Caesarweed), and *Paspalum notatum* (bahiagrass) and native species *Physalis walteri* (Walter's groundcherry) (state-vulnerable). Vines include *Smilax auriculata* (earleaf greenbrier) and *Vitis rotundifolia* (muscadine).

Global Vegetation

This broadly conceived association accommodates flatwoods and a variety of other mesic Coastal Plain environments which are dominated by mixtures of *Pinus palustris* (longleaf pine) and *Pinus elliottii var. elliottii* (Honduras pine). This includes a variety of situations. In the West Gulf Coastal Plain, which is outside the natural range of *Pinus elliottii* (slash pine), the understory and herbaceous strata vary depending on management, site conditions, and canopy coverage; the tall-shrub stratum ranges from fairly dense to sparse and may be patchy. The herbaceous layer also varies; in younger stands, the canopy may often be too dense for the herbaceous layer to become well-developed. However, *Schizachyrium scoparium* (little bluestem)-dominated ground cover may be extensive in older stands (60 years or greater in age) that have been burned and thinned. On some dry to xeric former *Pinus palustris* (longleaf pine) sites, this vegetation is expressed as a fairly open forest dominated by *Pinus elliottii* (slash pine) ranging from 60–80% cover. Ingrowths of *Pinus echinata* (shortleaf pine), *Pinus taeda* (loblolly pine), and *Pinus palustris* (longleaf pine) may occur here, and there is a patchy subcanopy of scrubby *Quercus incana* (bluejack oak) and/or *Quercus margarettiae* (runner oak); the shrub and herbaceous strata are sparse. In the Inner Coastal Plain of South Carolina (Savannah River Site), mature upland plantations placed here tend to develop an understory including *Nyssa sylvatica* (blackgum) and an herbaceous stratum dominated by *Rubus argutus* (sawtooth blackberry). In contrast, burned examples tend to have *Prunus serotina var. serotina* (black cherry) in the understory and *Andropogon virginicus* (broomsedge bluestem) in the herbaceous layer. At Canaveral National Seashore, the exotic *Urochloa maxima* (guineagrass) may dominate the herbaceous layer, with traces of many other species, including other exotics such as *Hyptis mutabilis* (tropical bushmint), *Urena lobata* (Caesarweed), and *Paspalum notatum* (bahiagrass) and native species *Physalis walteri* (Walter's groundcherry) (state-vulnerable). Vines may include *Smilax auriculata* (earleaf greenbrier) and *Vitis rotundifolia* (muscadine).

Oak—Cabbage Hammock and Maritime Live Oak Hammock and Florida Atlantic Coastal Tropical/Temperate Maritime Hammock

Attributes, descriptions, a photo and a map are shown in Table D-20, and Figures D-39 and D-40.

Table D-20. Attributes and descriptions of Oak—Cabbage Hammock and Maritime Live Oak Hammock and Florida Atlantic Coastal Tropical/Temperate Maritime Hammock.

Attribute	Description
Code	21007—7032 and 7033
Community Name	Oak—Cabbage Hammock Maritime Live Oak Hammock and Florida Atlantic Coastal Tropical/Temperate Maritime Hammock
Color	Red with Grey components

Table D-20 (continued). Attributes and descriptions of Oak—Cabbage Hammock and Maritime Live Oak Hammock and Florida Atlantic Coastal Tropical/Temperate Maritime Hammock.

Attribute	Description
Tone	Medium to dark
Texture	Smooth to coarse
Pattern	Moderate to dense canopy
Height	Tall
Shape	Expansive
Size	Very common class; Very large average size with large variation possible.
Location	Either side of the park
Association	7020, 7040
Comments	Could not distinguish 7032 and 7033 from each other using photo interpretation techniques so their classes were combined, their main differences occur below canopy based on tropical versus temperate species.



Figure D-39. Example of Oak—Cabbage Hammock and Maritime Live Oak Hammock and Florida Atlantic Coastal Tropical/Temperate Maritime Hammock.

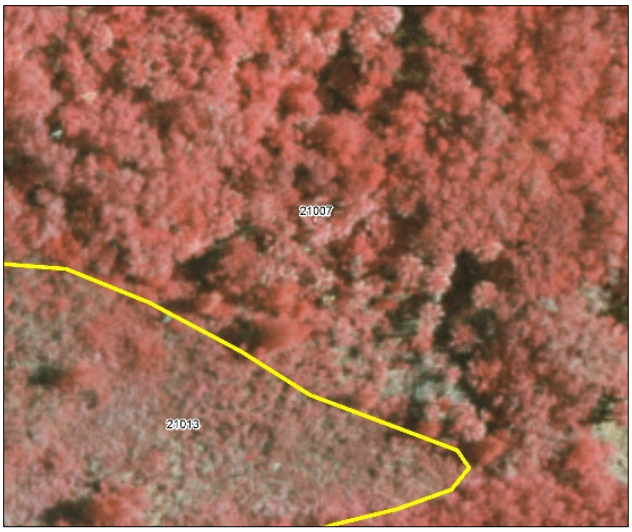


Figure D-40. Map showing Oak—Cabbage Hammock and Maritime Live Oak Hammock and Florida Atlantic Coastal Tropical/Temperate Maritime Hammock (21007).

Summary

7032

Canaveral National Seashore Vegetation

The moderate to total (60–100% cover) tree canopy, 10–35 meters (32.8–114.8 ft) tall, is dominated by *Quercus virginiana* (live oak) and *Sabal palmetto* (cabbage palmetto) and may contain lesser amounts of *Carya glabra* (pignut hickory), *Juniperus virginiana var. silicicola* (southern redcedar), and *Quercus hemisphaerica* (Darlington oak). The very sparse to moderate (5–40%) subcanopy (5–15 meters [16.4–49.2 ft]) may include *Magnolia grandiflora* (southern magnolia). The moderate to total (40–100%) tallshrub layer (1–5 meters [3.3–16.4 ft]) is dominated by *Ilex vomitoria* (yaupon), *Myrcianthes fragrans* (twinberry), *Sabal palmetto* (cabbage palmetto), and *Serenoa repens* (saw palmetto). The sparse (5–30%) short-shrub layer (1–2 meters [3.3–6.6 ft]) includes tall-shrub species as well as *Morella cerifera* (wax myrtle), *Psychotria nervosa* (Seminole balsamo), and *Psychotria tenuifolia* (shortleaf wild coffee). While some tropical species are present, they occur at relatively low cover, and it is possible that the more inland location of these communities (along the western edge of Mosquito Lagoon) prevents these tropical species from gaining dominance. The variable herbaceous layer (5–80%) includes *Chasmanthium sessiliflorum* (longleaf woodoats), *Cyperus tetragonus* (fourangle flatsedge), *Oplismenus hirtellus* (bristle basketgrass), and *Solidago sempervirens* (seaside goldenrod). *Vitis rotundifolia* (muscadine) is the dominant vines; others include *Cynanchum scoparium* (leafless swallow-wort), *Ipomoea alba* (tropical white morning-glory), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax bona-nox* (saw greenbrier), and *Vitis aestivalis* (summer grape). Epiphytes *Pleopeltis polypodioides* (resurrection fern), *Tillandsia recurvata* (small ballmoss), and *Tillandsia usneoides* (Spanish moss) may also be present. Several exotic species were recorded in the sampled plots, including the invasive shrub *Schinus terebinthifolius* (Brazilian peppertree).

Global Vegetation

This forest has a low to moderately high tree canopy, often stunted and pruned by salt spray into streamlined shapes. The canopy is mostly closed with well-developed subcanopy and shrub layers and a sparse herb layer. The canopy along the seaward edge of this community tends to be quite low in stature with shrub species grading smoothly into the dominant canopy species. Vines are often an important component of this community. Species that may be found in the canopy, subcanopy or shrub layers include *Quercus virginiana* (live oak), *Sabal palmetto* (cabbage palmetto), *Pinus elliottii var. elliottii* (Honduras pine), *Pinus taeda* (loblolly pine), *Magnolia grandiflora* (southern magnolia), *Persea borbonia* (redbay), *Quercus hemisphaerica* (Darlington oak), *Quercus nigra* (water oak), *Quercus phellos* (willow oak), *Magnolia virginiana* (sweetbay), *Acer rubrum var. drummondii* (Drummond's maple), *Liquidambar styraciflua* (sweetgum), *Juniperus virginiana var. silicicola* (southern redcedar), *Celtis laevigata* (sugarberry), *Morella cerifera* (wax myrtle), *Ilex vomitoria* (yaupon), *Osmanthus americanus var. americanus* (devilwood), *Sabal minor* (dwarf palmetto), *Serenoa repens* (saw palmetto), *Ilex opaca var. opaca* (American holly), *Carpinus caroliniana ssp. caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), *Prunus caroliniana* (Carolina laurelcherry), *Zanthoxylum clava-herculis* (Hercules' club), *Callicarpa americana* (American beautyberry), *Baccharis halimifolia* (eastern baccharis), *Baccharis angustifolia* (saltwater false willow), *Lyonia lucida* (fetterbush lyonia), *Sageretia minutiflora* (smallflower mock buckthorn), *Sideroxylon tenax* (tough bully), *Vaccinium arboreum* (farkleberry), *Forestiera segregata* (Florida swampprivet), and *Opuntia humifusa var. humifusa* (devil's-tongue). Typical vines and herbaceous species include *Toxicodendron radicans* (eastern poison ivy), *Smilax* (greenbrier) spp., *Vitis rotundifolia* (muscadine), *Parthenocissus quinquefolia* (Virginia creeper), *Houstonia procumbens* (roundleaf bluet), *Bignonia capreolata* (crossvine), *Mitchella repens* (partridgeberry), *Berchemia scandens* (Alabama supplejack), *Ampelopsis arborea* (peppervine), *Oplismenus hirtellus ssp. setarius* (bristle basketgrass), *Boehmeria cylindrica* (smallspike false nettle), *Galium pilosum* (hairy bedstraw), *Dichanthelium commutatum* (variable panicgrass), *Elephantopus nudatus* (smooth elephantsfoot), *Passiflora incarnata* (purple passionflower), *Passiflora lutea* (yellow passionflower), *Scleria triglomerata* (whipnutrush), *Piptochaetium avenaceum* (blackseed speargrass), *Panicum* (panicgrass) spp., *Chasmanthium laxum* (slender woodoats), *Juncus* (rush) spp., *Asplenium platyneuron var. bacculum-rubrum* (ebony spleenwort), *Osmunda cinnamomea* (cinnamon fern), and *Woodwardia virginica* (Virginia chainfern). In general, from Cape Fear, North Carolina, south to mid-South Carolina, the canopy is dominated by *Quercus virginiana* (live oak) and *Pinus taeda* (loblolly pine) occurring with *Sabal palmetto* (cabbage palmetto). Farther south, *Pinus elliottii var. elliottii* (Honduras pine) replaces *Pinus taeda* (loblolly pine), and *Sabal palmetto* (cabbage palmetto) becomes more prominent. Some floristic elements of the Georgia islands, such as *Lyonia ferruginea* (rusty staggerbush) and

Forestiera segregata (Florida swampprivet), are completely absent from barrier islands in the Carolinas. *Serenoa repens* (saw palmetto) does not occur on the North Carolina barrier islands. In mid-Florida, tropical species begin to dominate the understory while temperate species retain canopy dominance. South of Martin County, Florida, tropical species such as *Bursera simaruba* (gumbo limbo), *Sideroxylon foetidissimum* (false mastic), and *Ficus aurea* (Florida strangler fig) begin to dominate the forest canopy and mark the northern limits of the Tropical Barrier Island Forest

community. At the northern limit of the range of this type, *Persea palustris* (swamp bay) may replace *Persea borbonia* (redbay).

7033

Canaveral National Seashore Vegetation

The moderate to dense (70–90% cover) tree canopy, 5–15 meters (16.4–49.2 ft) tall, is dominated by *Quercus virginiana* (live oak) and *Sabal palmetto* (cabbage palmetto) may contain lesser amounts of *Juniperus virginiana var. silicicola* (southern redcedar) and *Persea borbonia* (redbay). The sparse (10–20%) subcanopy (5–10 meters [16.4–32.8 ft]) is dominated by *Myrcianthes fragrans* (twinberry), *Persea borbonia* (redbay), and *Sabal palmetto* (cabbage palmetto) and may include *Celtis laevigata* (sugarberry) and *Myrsine floridana* (Guianese colicwood). The moderate to total (40–100%) tall-shrub layer (2–5 meters [6.6–16.4 ft]) is dominated by *Ardisia escallonoides* (island marlberry), *Eugenia axillaris* (white stopper), *Ilex vomitoria* (yaupon), *Myrcianthes fragrans* (twinberry), *Myrsine floridana* (Guianese colicwood), *Persea borbonia* (redbay), *Sabal palmetto* (cabbage palmetto), and/or *Serenoa repens* (saw palmetto). The sparse to moderate (20–50%) short-shrub layer (0.5–2 meters [1.6–6.6 ft]) includes *Psychotria nervosa* (Seminole balsamo). The dominance of tropical species may be associated with the proximity to the ocean and distinguishes this community from other maritime hammocks on Canaveral. The sparse herbaceous layer (5%) includes *Cyperus tetragonus* (fourangle flatsedge), *Mikania cordifolia* (Florida Keys hempvine), and *Oplismenus hirtellus* (bristle basketgrass). Vines (5%) include *Smilax auriculata* (earleaf greenbrier), *Vitis rotundifolia* (muscadine), and *Vitis rotundifolia* (muscadine). The state-imperiled *Pavonia spinifex* (gingerbush) was recorded from one of the sampled plots.

Global Vegetation

Characteristic species include *Quercus virginiana* (live oak), *Sabal palmetto* (cabbage palmetto), *Persea borbonia* (redbay), *Myrcianthes fragrans* (twinberry), *Ardisia escallonoides* (island marlberry), and *Psychotria nervosa* (Seminole balsamo).

Buttonwood/bush Forest and Central Florida Buttonbush Pond and Buttonwood Forest

Attributes, descriptions, a photo and a map are shown in Table D-21, and Figures D-41 and D-42.

Table D-21. Attributes and descriptions of Buttonwood/bush Forest and Central Florida Buttonbush Pond and Buttonwood Forest.

Attribute	Description
Code	21012—4457 and 7600
Community Name	Buttonwood/bush Forest Central Florida Buttonbush Pond and Buttonwood Forest
Color	Red and pink
Tone	Light
Texture	Smooth to moderate

Table D-21 (continued). Attributes and descriptions of Buttonwood/bush Forest and Central Florida Buttonbush Pond and Buttonwood Forest.

Attribute	Description
Pattern	Moderate to dense canopy
Height	Moderate to tall
Shape	Random
Size	Uncommon class; Moderate average size with some variation possible.
Location	Mainly the west side of the park in low-lying wet areas
Association	–
Comments	Could not distinguish 4457 and 7600 from each other using photo interpretation techniques so their classes were combined.



Figure D-41. Example of Buttonwood/bush Forest and Central Florida Buttonbush Pond and Buttonwood Forest.

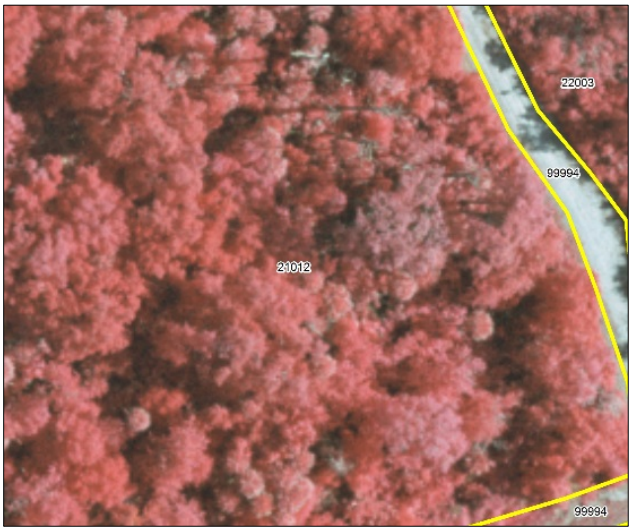


Figure D-42. Map showing Buttonwood/bush Forest and Central Florida Buttonbush Pond and Buttonwood Forest (21012).

Summary

4457

Canaveral National Seashore Vegetation

The overall appearance of this community is that of a dense shrubland. However, there may be a sparse (30–40% cover) emergent (15–35 meters [49.2–114.8 ft] tall) tree canopy of *Acer rubrum* (red maple) and *Nyssa biflora* (swamp tupelo) and very sparse (5–10%) subcanopy (5–10 meters [16.4–32.8 ft]) of *Sabal palmetto* (cabbage palmetto) and *Ilex cassine* (dahoon). The moderate to dense (70–90%) tall-shrub layer (2–5 meters [6.6–16.4 ft]) is dominated by *Cephalanthus occidentalis* (common buttonbush) along with lesser amounts of *Morella cerifera* (wax myrtle) and *Salix caroliniana* (coastal plain willow). The dense to total-cover herbaceous layer (80–100%) is clearly dominated by *Limnobium spongia* (American spongeplant) and may include lesser amounts of *Cladium mariscus ssp. jamaicense* (Jamaica swamp sawgrass), *Boehmeria cylindrica* (smallspike false nettle), *Ludwigia repens* (creeping primrose-willow), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), *Panicum hemitomon* (maidencane), *Polygonum hydropiperoides* (swamp smartweed), *Pontederia cordata* (pickerelweed), *Rhynchospora inundata* (narrowfruit horned beaksedge), *Sagittaria lancifolia* (bulltongue arrowhead), and *Woodwardia virginica* (Virginia chainfern). Epiphytes include *Pleopeltis polypodioides* (resurrection fern), *Tillandsia recurvata* (small ballmoss), and *Tillandsia usneoides* (Spanish moss).

Global Vegetation

This community occurs in isolated wetland basins in central Florida surrounded by uplands. *Cephalanthus occidentalis* dominates (often monospecifically). Few or no rooted herbs are present. Floating aquatics include *Salvinia minima*, *Limnobium spongia*, and *Lemna* spp. Although the floristic differences between this community and river floodplain buttonbush swamps are slight, this community is recognized because of its very different topographic setting, dynamics, and fauna.

7600

Canaveral National Seashore Vegetation

The stands of this association are nearly exclusive monocultures of *Conocarpus erectus* (button mangrove) in a canopy layer with 100% cover and 2–5 meters (6.6–16.4 ft) tall; *Laguncularia racemosa* (white mangrove) may also be present. The variable (10–60%) short-shrub layer (1–2 meters [3.3–6.6 ft]) is dominated by *Batis maritima* (turtleweed) and *Borrichia frutescens* (bushy seaside tansy). The sparse herbaceous layer (0–5%) includes *Acrostichum danaeifolium* (inland leatherfern).

Global Vegetation

These tidal swamps are dominated by *Conocarpus erectus* (button mangrove), typically at high cover. Other common species occurring at lower cover include *Acrostichum aureum* (golden leatherfern), *Acrostichum danaeifolium* (inland leatherfern), *Cladium mariscus ssp. jamaicense* (Jamaica swamp sawgrass), *Baccharis halimifolia* (eastern baccharis), *Laguncularia racemosa* (white mangrove), *Batis maritima* (turtleweed), and *Borrichia frutescens* (bushy seaside tansy).

Mangroves and Black Mangrove Forest and Red Mangrove Fringe Forest

Attributes, descriptions, a photo and a map are shown in Table D-22, and Figures D-43 and D-44.

Table D-22. Attributes and descriptions of Mangroves and Black Mangrove Forest and Red Mangrove Fringe Forest.

Attribute	Description
Code	21013—4827 and 4764
Community Name	Mangroves Black Mangrove Forest and Red Mangrove Fringe Forest
Color	Red and pink
Tone	Light
Texture	Smooth to moderate
Pattern	Sparse to dense canopy
Height	Short
Shape	Elongated for dense canopies, oblong for sparse canopies
Size	Most common class; small average size with some variation possible.
Location	On islands in the Lagoon or on the fringes of the Lagoon
Association	24018
Comments	Could not distinguish 4827 and 4764 from each other using photo interpretation techniques so their classes were combined. Field surveys even showed that most plots contained both types of Mangroves, if there were monospecific plots they were smaller than the MMU. This class had the largest use of a modifier, ds, because many areas were dominated by mangroves but did not meet the 100% canopy coverage required by the NatureServe classification system. Therefore ds, dwarf shrub, was used to designate the polygons that were dominated by mangroves but only covering 25%-75% of the canopy. Found with 24018 most frequently, specifically when the Mangrove class was sparse the remaining areas contained 24018. This class was distinguished from 24018 because of the tall structure of the vegetation.



Figure D-43. Example of Mangroves and Black Mangrove Forest and Red Mangrove Fringe Forest.

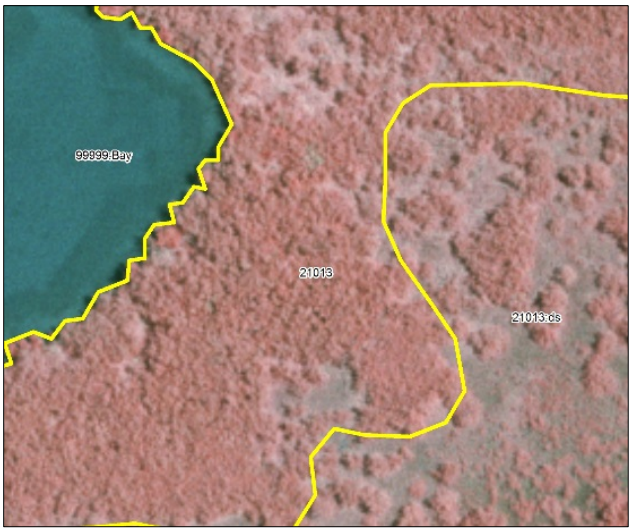


Figure D-44. Map showing Mangroves and Black Mangrove Forest & Red Mangrove Fringe Forest (21013).

Summary

4827

Canaveral National Seashore Vegetation

The stands of this association are nearly exclusive monocultures of *Avicennia germinans* (black mangrove) in a canopy layer with 100% cover and 2–10 meters (6.6–32.8 ft) tall. The variable (5–70%) short-shrub layer (0.5–2 meters [1.6–6.6 ft]) is dominated by *Batis maritima* (turtleweed) and may include lesser amounts of *Borrichia frutescens* (bushy seaside tansy), *Sarcocornia perennis* (chickenclaws), and *Salicornia bigelovii* (dwarf saltwort). The sparse herbaceous layer (0–5%) includes *Sesuvium portulacastrum* (shoreline seapurslane) and *Suaeda linearis* (annual seepweed).

Global Vegetation

Subtropical and tropical tidal swamps dominated by *Avicennia germinans*. *Batis maritima* is usually a common accompanying species. Others may include *Baccharis halimifolia*, *Iva cheiranthifolia, Sarcocornia perennis*, *Heliotropium curassavicum*, *Distichlis spicata*. *Avicennia*-dominated communities remain stressed by cold weather and may never attain the stature of forests.

4764

Canaveral National Seashore Vegetation

Stands of this association are exclusive monocultures of *Rhizophora mangle* (American mangrove) in a canopy layer with 100% cover and 2–5 meters (6.6–16.4 ft) tall. No other species were recorded from sampled plots.

Global Vegetation

Stands are typically dominated by *Rhizophora mangle* (American mangrove) (and are usually monospecific, though *Avicennia germinans* (black mangrove) and *Laguncularia racemosa* (white mangrove) can also occur).

Pine Woodlands and Peninsular Florida Scrubby Flatwoods and Maritime Slash Pine Upland Flatwoods

Attributes, descriptions, a photo and a map are shown in Table D-23, and Figures D-45 and D-46.

Table D-23. Attributes and descriptions of Pine Woodlands Peninsular Florida Scrubby Flatwoods and Maritime Slash Pine Upland Flatwoods.

Attribute	Description
Code	22003—7750 and 4658
Community Name	Pine Woodlands Peninsular Florida Scrubby Flatwoods & Maritime Slash Pine Upland Flatwoods
Color	Red and pink with light purple/grey components
Tone	Light
Texture	Coarse
Pattern	Sparse canopy
Height	Tall
Shape	Elongated
Size	Third most common class; largest average size with large variations possible.
Location	Western part of the park
Association	23006, 22004
Comments	Could not distinguish 7750 and 4658 from each other using photo interpretation techniques so their classes were combined. Similar to 23006 but contains pine. Similar to 22004 but is not as wet.



Figure D-45. Example of Pine Woodlands Peninsular Florida Scrubby Flatwoods and Maritime Slash Pine Upland Flatwoods.

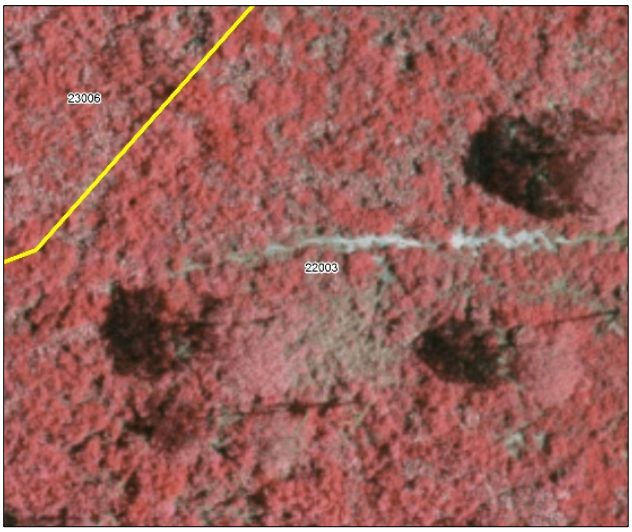


Figure D-46. Map showing Pine Woodlands Peninsular Florida Scrubby Flatwoods and Maritime Slash Pine Upland Flatwoods (22003).

Summary

7750

Canaveral National Seashore Vegetation

The sparse to moderate (10–70% cover) tree canopy, 10–20 meters (32.8–65.6 ft) tall, is dominated exclusively by *Pinus elliottii* (slash pine), sometimes with *Quercus geminata* (sand live oak) in the very sparse (5%) subcanopy (5–10 meters [16.4–32.8 ft]). The very sparse to moderate (5–40%) tall-shrub layer (2–5 meters [6.6–16.4 ft]) is dominated by *Serenoa repens* (saw palmetto) and may include *Lyonia lucida* (fetterbush lyonia), *Quercus chapmanii* (Chapman oak), *Quercus geminata* (sand live oak), and *Quercus myrtifolia* (myrtle oak). The moderate (40–60%) short-shrub layer (0.5–1 meters [1.6–3.3 ft]) is dominated by *Serenoa repens* (saw palmetto) and includes tallshrub species as well as *Ilex glabra* (inkberry), *Lyonia fruticosa* (coastalplain staggerbush), *Morella cerifera* (wax myrtle), *Piloblephis rigida* (wild pennyroyal), *Quercus minima* (dwarf live oak), *Vaccinium myrsinites* (shiny blueberry), and *Ximenia americana* (tallow wood). The herbaceous layer (20–80%) is dominated by *Aristida beyrichiana* (Beyrich threeawn) and may include *Andropogon floridanus* (Florida bluestem), *Andropogon virginicus* (broomsedge bluestem), *Centrosema virginianum* (spurred butterfly pea), *Chamaecrista fasciculata* (sleepingplant), *Clitoria mariana* (Atlantic pigeonwings), *Pteridium aquilinum* (western brackenfern), and *Schizachyrium sanguineum* (crimson bluestem). The dominant vine is *Smilax auriculata* (earleaf greenbrier). The state-vulnerable *Asimina obovata* (bigflower pawpaw) was found in one of the sampled plots.

Global Vegetation

The canopy of stands can contain predominantly *Pinus palustris* (longleaf pine), *Pinus elliottii var. elliottii* (Honduras pine), or a variable combination of both. According to Huffman and Judd (1998), who documented this type at Myakka River State Park (in both Manatee and Sarasota counties, Florida), other shrubs and woody vines include *Amorpha herbacea var. herbacea* (clusterspike false indigo), *Licania michauxii* (gopher apple), *Lyonia fruticosa* (coastalplain staggerbush), *Palafoxia*

integrifolia (coastalplain palafox), *Pinus clausa* (sand pine), *Quercus geminata* (sand live oak), *Quercus incana* (bluejack oak), *Quercus laevis* (turkey oak), *Quercus minima* (dwarf live oak), *Sideroxylon reclinatum* (Florida bully), *Smilax glauca* (cat greenbrier), *Smilax pumila* (sarsparilla vine), *Vaccinium arboreum* (farkleberry), *Ximenia americana* (tallow wood), and *Yucca filamentosa* (Adam's needle), and other herbaceous species include *Asclepias feayi* (Florida milkweed), *Aureolaria pectinata* (combleaf yellow false foxglove), *Balduina angustifolia* (coastalplain honeycombhead), *Coelorachis cylindrica* (cylinder jointtail grass), *Cyperus lupulinus* (Great Plains flatsedge), *Dalea adenopoda* (Tampa prairie clover), *Helianthemum corymbosum* (pinebarren frostweed), *Lechea divaricata* (drysand pinweed), *Liatris tenuifolia* (shortleaf blazing star), *Lygodesmia aphylla* (rose rush), *Opuntia humifusa var. humifusa* (devil's-tongue), *Phoebanthus grandiflorus* (Florida false sunflower), *Rhynchosia michauxii* (Michaux's snoutbean), *Rhynchospora megalocarpa* (sandyfield beaksedge), *Rhynchospora plumosa* (plumed beaksedge), *Seymeria pectinata* (piedmont blacksenna), *Sporobolus junceus* (pineywoods dropseed), *Tillandsia recurvata* (small ballmoss), and *Tillandsia utriculata* (spreading airplant).

4658

Canaveral National Seashore Vegetation

The moderate (50% cover) tree canopy, 15–35 meters (49.2–114.8 ft) tall, is dominated exclusively by *Pinus elliottii* (slash pine). The sparse to moderate (30–70%) subcanopy (5–20 meters [16.4–65.6 ft]) is dominated by *Quercus virginiana* (live oak) with lesser amounts of *Juniperus virginiana var. silicicola* (southern redcedar), *Magnolia grandiflora* (southern magnolia), *Quercus hemisphaerica* (Darlington oak), and *Sabal palmetto* (cabbage palmetto). The total cover (100%) of the tall-shrub layer (2–5 meters [6.6–16.4 ft]) is dominated by *Serenoa repens* (saw palmetto) and may also include *Ilex vomitoria* (yaupon), *Morella cerifera* (wax myrtle), *Osmanthus americanus* (devilwood), and *Sabal palmetto* (cabbage palmetto). The sparse short-shrub layer (0.5–1 meters [1.6–3.3 ft]) includes *Psychotria nervosa* (Seminole balsamo). The sparse herbaceous layer (0–5%) includes trace amounts of *Galactia volubilis* (downy milkpea), *Mikania cordifolia* (Florida Keys hempvine), *Pteridium aquilinum* (western brackenfern), and *Tridens flavus* (purpletop tridens). Common vines include *Smilax auriculata* (earleaf greenbrier) and *Vitis rotundifolia* (muscadine). Epiphytes include *Phlebodium aureum* (golden polypody), *Pleopeltis polypodioides* (resurrection fern), *Tillandsia usneoides* (Spanish moss), and *Vittaria lineata* (shoestring fern).

Global Vegetation

This maritime-influenced, upland *Pinus elliottii* var. *elliottii* woodland occurs on barrier islands and near-coastal areas of the East Gulf Coastal Plain and adjacent South Atlantic region. In addition to Pinus elliottii var. elliottii, stands sometimes contain an admixture of *Pinus palustris*. In the past, canopy structure in natural stands was open, but now it varies to a more closed structure. A subcanopy is sometimes present and can include *Quercus virginiana*, *Quercus geminata*, *Quercus hemisphaerica*, and *Magnolia grandiflora*. Typical understory species include *Ilex vomitoria*, *Serenoa repens*, and *Morella cerifera*. Other common shrubs and woody vines are *Smilax bona-nox*, *Smilax auriculata*, *Smilax laurifolia*, *Rhus copallinum* var. *leucantha*, *Vitis rotundifolia*, *Vaccinium arboreum*, and *Persea borbonia*. The herb stratum is typically poorly developed but may include *Solidago odora* var. *odora* and *Tragia urens*. On a southern Georgia barrier island, at the

Cumberland Island National Seashore, the sparse herb layer contains occasional species expected from more open longleaf pine uplands, including *Aristida lanosa*, *Liatris* sp., and *Sorghastrum secundum*. In northeastern Florida, at the Timucuan Ecological and Historic Preserve, dead and dying *Persea borbonia* indicate that these maritime flatwoods are being affected by laurel wilt, which is caused by a vascular wilt fungus that is transmitted to species in the Lauraceae family via the non-native redbay ambrosia beetle (*Xyleborus glabratus*).

Wet Pine Woodlands and Wet Longleaf—Pond Pine Flatwoods and Slash Pine Flatwoods

Attributes, descriptions, a photo and a map are shown in Table D-24, and Figures D-47 and D-48.

Table D-24. Attributes and descriptions of Wet Pine Woodlands and Wet Longleaf—Pond Pine Flatwoods and Slash Pine Flatwoods.

Attribute	Description
Code	22004—4791 and 3643
Community Name	Wet Pine Woodlands Wet Longleaf—Pond Pine Flatwoods and Slash Pine Flatwoods
Color	Red and pink with light purple/grey components
Tone	Light
Texture	Coarse
Pattern	Sparse canopy
Height	Tall
Shape	Random
Size	Common class; large average size with moderate variation possible.
Location	Western part of the park
Association	23006, 22003
Comments	Could not distinguish 4791 and 3643 from each other using photo interpretation techniques so their classes were combined. Similar to 23006 but contains pine. Similar to 22003 but is not as dry. These classes were burned frequently and there were also a lot of pines missing from the date the images were taken and the NatureServe field data were collected.



Figure D-47. Example of Wet Pine Woodlands and Wet Longleaf—Pond Pine Flatwoods and Slash Pine Flatwoods.



Figure D-48. Map showing Wet Pine Woodlands and Wet Longleaf—Pond Pine Flatwoods and Slash Pine Flatwoods (22004).

Summary

4791

Canaveral National Seashore Vegetation

The dominant stratum in stands of this association is the shrub layer. However, there may be a sparse (0–20% cover) emergent tree canopy, 5–20 meters (16.4–65.6 ft) tall, of *Pinus elliottii* (slash pine) and/or *Pinus serotina* (pond pine). The sparse to total-cover (10–100%) tall-shrub layer (1–5 meters [3.3–16.4 ft]) is dominated by *Serenoa repens* (saw palmetto) and may include *Ilex glabra* (inkberry), *Lyonia lucida* (fetterbush lyonia), *Morella cerifera* (wax myrtle), and *Rhus copallinum* (flameleaf sumac). The very sparse to dense (5–80%) short-shrub layer (0.5–2 meters [1.6–6.6 ft]) has the same make up as the tall-shrub layer in addition to *Vaccinium myrsinites* (shiny blueberry). Dominants in the herbaceous layer (5–50%) include graminoids *Andropogon glomeratus* (bushy bluestem) and *Aristida beyrichiana* (Beyrich threeawn) and ferns *Osmunda cinnamomea* (cinnamon fern), *Pteridium aquilinum* (western brackenfern), and *Woodwardia virginica* (Virginia chainfern). Vines include *Vitis rotundifolia* (muscadine).

Global Vegetation

Stands are dominated by *Pinus palustris* (longleaf pine) and *Pinus serotina* (pond pine). In central Florida, *Pinus elliottii* (slash pine) can be codominant with *Pinus serotina* (pond pine). *Serenoa repens* (saw palmetto) is also important in central Florida. The shrub layer is characterized by the presence or partial dominance of *Ilex glabra* (inkberry) and *Lyonia lucida* (fetterbush lyonia). Other characteristic species are *Morella cerifera* (wax myrtle), *Morella caroliniensis* (southern bayberry), *Persea palustris* (swamp bay), *Magnolia virginiana* (sweetbay), *Ilex coriacea* (large gallberry), *Serenoa repens* (saw palmetto) (in southern portions), and *Gordonia lasianthus* (loblolly bay). *Smilax laurifolia* (laurel greenbrier) is a common vine. Two plots from central Florida (Ocala National Forest) were dominated by sparse *Pinus elliottii* (slash pine) with *Pinus serotina* (pond pine) on sites which may have had *Pinus palustris* (longleaf pine) in the past. The dominant shrubs were *Serenoa repens* (saw palmetto), *Ilex glabra* (inkberry), and *Lyonia lucida* (fetterbush lyonia). Other important shrubs were *Quercus pumila* (running oak), *Quercus minima* (dwarf live oak), *Befaria racemosa* (tarflower), and *Vaccinium myrsinites* (shiny blueberry). Additional shrubs were *Lyonia fruticosa* (coastalplain staggerbush), *Gaylussacia dumosa* (dwarf huckleberry), *Morella cerifera* (wax myrtle), *Hypericum brachyphyllum* (coastalplain St. Johnswort), *Kalmia hirsuta* (hairy laurel), *Asimina pygmea* (dwarf pawpaw), and *Persea palustris* (swamp bay). The herbaceous component was generally patchy to sparse and included *Aristida beyrichiana* (Beyrich threeawn), *Aristida spiciformis* (bottlebrush threeawn), *Pityopsis graminifolia* (narrowleaf silkgrass), *Pterocaulon pycnostachyum* (wand blackroot), *Sabatia brevifolia* (shortleaf rose gentian), *Galactia elliottii* (Elliott's milkpea), *Lachnocaulon anceps* (whitehead bogbutton), *Xyris caroliniana* (Carolina yelloweyed grass), *Polygala nana* (candyroot), *Bulbostylis ciliatifolia* (capillary hairsedge), *Andropogon* (bluestem) spp., and *Scleria* (nutrush) sp. The wiregrass in stands of this association would be *Aristida beyrichiana* (Beyrich threeawn; *sensu* Peet 1993), not *Aristida stricta* (pineland threeawn).

3643

Canaveral National Seashore Vegetation

The dense (70–80% cover) tree canopy, 20–35 meters (65.6–114.8 ft) tall, is dominated exclusively by *Pinus elliottii* (slash pine). The sparse to moderate (20–50%) subcanopy (5–15 meters [16.4–49.2 ft]) is dominated by *Sabal palmetto* (cabbage palmetto) and may include lesser amounts of *Acer rubrum* (red maple), *Ilex cassine* (dahoon), *Juniperus virginiana var. silicicola* (southern redcedar), and/or *Persea palustris* (swamp bay). The sparse shrub layer includes *Morella cerifera* (wax myrtle), *Sabal palmetto* (cabbage palmetto), and *Serenoa repens* (saw palmetto). The herbaceous layer is dominated by graminoids, including *Cladium mariscus ssp. jamaicense* (Jamaica swamp sawgrass) (up to 60% in one plot), *Andropogon glomeratus* (bushy bluestem), *Dichanthelium dichotomum var. ensifolium* (cypress panicgrass), *Panicum rigidulum* (redtop panicgrass), and *Saccharum giganteum* (sugarcane plumegrass). *Woodwardia virginica* (Virginia chainfern) is a common fern.

Global Vegetation

Pinus elliottii var. elliottii (Honduras pine) dominates the generally open canopy. *Pinus palustris* (longleaf pine) or *Gordonia lasianthus* (loblolly bay) and *Pinus serotina* (pond pine) can be present, even codominant. The dense shrub stratum consists primarily of *Ilex glabra* (inkberry) and *Serenoa*

repens (saw palmetto). Other common shrubs include *Persea palustris* (swamp bay), *Gaylussacia nana* (Confederate huckleberry), *Gaylussacia dumosa* (dwarf huckleberry), *Gaylussacia tomentosa* (hairytwig huckleberry), *Photinia pyrifolia* (red chokeberry), *Quercus minima* (dwarf live oak), *Ilex coriacea* (large gallberry), *Vaccinium elliottii* (Elliott's blueberry), *Acer rubrum* (red maple), *Vaccinium formosum* (southern blueberry), *Befaria racemose* (tarflower), *Lyonia ferruginea* (rusty staggerbush), *Lyonia fruticosa* (coastalplain staggerbush), *Morella cerifera* (wax myrtle), *Kalmia hirsuta* (hairy laurel), *Vaccinium myrsinites* (shiny blueberry), and *Lyonia lucida* (fetterbush lyonia) (NatureServe Ecology unpubl. data). The most common vine is *Smilax laurifolia* (laurel greenbrier); other vines are *Smilax auriculata* (earleaf greenbrier), *Smilax glauca* (cat greenbrier), and *Vitis rotundifolia* (muscadine). The herbaceous flora is generally sparse or patchy, including *Aristida beyrichiana* (Beyrich threeawn), *Aristida spiciformis* (bottlebrush threeawn), *Woodwardia virginica* (Virginia chainfern), *Pteridium aquilinum* (western brackenfern), *Andropogon glomeratus* (bushy bluestem), *Andropogon capillipes* (chalky bluestem), *Andropogon virginicus* (broomsedge bluestem), *Sporobolus curtissii* (Curtis' dropseed), *Sporobolus floridanus* (Florida dropseed), *Schizachyrium scoparium* (little bluestem), *Dichanthelium* (rosette grass) spp., *Gratiola hispida* (rough hedgehyssop), *Pityopsis graminifolia* (narrowleaf silkgrass), and *Xyris* (yelloweyed grass) spp.

Cabbage—Saw Woodlands and Cabbage Palmetto Hydric Hammock and Cabbage/Saw Palmetto Woodland

Attributes, descriptions, a photo and a map are shown in Table D-25, and Figures D-49 and D-50.

Table D-25. Attributes and descriptions of Cabbage—Saw Woodlands and Cabbage Palmetto Hydric Hammock Cabbage/Saw Palmetto Woodland.

Attribute	Description
Code	22006—3527 and 3796
Community Name	Cabbage—Saw Woodlands Cabbage Palmetto Hydric Hammock and Cabbage Palmetto/Saw Palmetto Woodland
Color	Red and pink with light purple/grey components
Tone	Light
Texture	Coarse
Pattern	Sparse canopy
Height	Tall
Shape	Random
Size	Common class; moderate average size with some variation possible.
Location	Western part of the park, hydric areas
Association	23006, 22003
Comments	Could not distinguish 3527 and 3796 from each other using photo interpretation techniques so their classes were combined. Similar to 23006 but contains taller cabbage. Similar to 22003 but missing major pine component. These classes were burned frequently.



Figure D-49. Example of Cabbage—Saw Woodlands and Cabbage Palmetto Hydric Hammock Cabbage/Saw Palmetto Woodland.



Figure D-50. Map showing Cabbage—Saw Woodlands and Cabbage Palmetto Hydric Hammock Cabbage/Saw Palmetto Woodland (22006).

Summary

3527

Canaveral National Seashore Vegetation

The sparse to dense (20–80% cover) tree canopy, 10–35 meters (32.8–114.8 ft) tall, is dominated by *Quercus virginiana* (live oak) and *Sabal palmetto* (cabbage palmetto); one stand is dominated by *Acer rubrum* (red maple) (80%). The sparse to moderate (30–50%) subcanopy (5–15 meters [16.4–49.2 ft]) includes *Sabal palmetto* (cabbage palmetto). The sparse to dense (20–80%) tall-shrub layer (2–5 meters [6.6–16.4 ft]) is dominated by *Morella cerifera* (wax myrtle), *Sabal palmetto* (cabbage palmetto), or *Serenoa repens* (saw palmetto) and may include *Baccharis glomeruliflora* (silverling) and the invasive exotic *Schinus terebinthifolius* (Brazilian peppertree). The herbaceous layer is generally very sparse (0–5%), but one plot has 80% cover by the fern *Blechnum serrulatum* (toothed midsorus fern). Vines include *Smilax auriculata* (earleaf greenbrier), *Vitis cinerea* (graybark grape), and *Vitis rotundifolia* (muscadine).

Global Vegetation

This vegetation type is dominated by a combination of *Sabal palmetto* (cabbage palmetto), *Quercus virginiana* (live oak), *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), and *Quercus nigra* (water oak). *Sabal palmetto* (cabbage palmetto) is prominent in the upper woody strata. The canopy contains *Sabal palmetto* (cabbage palmetto), *Pinus elliottii* (slash pine), *Pinus taeda* (loblolly pine), and *Quercus nigra* (water oak). The subcanopy contains *Sabal palmetto* (cabbage palmetto), *Acer rubrumvar. trilobum* (red maple), *Juniperus virginiana* (eastern redcedar), *Liquidambar styraciflua* (sweetgum), and *Quercus nigra* (water oak). Shrubs include *Ilex cassine* (dahoon), *Morella cerifera* (wax myrtle), *Ilex glabra* (inkberry), *Persea palustris* (swamp bay), *Cornus foemina* (stiff dogwood), *Diospyros virginiana* (common persimmon), and *Vaccinium corymbosum* (highbush blueberry). Woody vines include *Berchemia scandens* (Alabama supplejack), *Smilax auriculata* (earleaf greenbrier), *Smilax bona-nox* (saw greenbrier), *Toxicodendron radicans* (eastern poison ivy), *Vitis rotundifolia* (muscadine), and *Smilax glauca* (cat greenbrier). Herbs include *Galactia elliottii* (Elliott's milkpea), *Cladium mariscus ssp. jamaicense* (Jamaica swamp sawgrass), *Osmunda cinnamomea* (cinnamon fern), *Woodwardia virginica* (Virginia chainfern), *Blechnum serrulatum* (toothed midsorus fern), and the epiphyte *Phlebodium aureum* (golden polypody).

3796

Canaveral National Seashore Vegetation

The sparse (5–20% cover) tree canopy, 10–20 meters (32.8–65.6 ft) tall, is dominated by *Quercus virginiana* (live oak) and *Sabal palmetto* (cabbage palmetto). The dense to total (80–100%) tall-shrub layer (1–5 meters [3.3–16.4 ft]) is clearly dominated by *Serenoa repens* (saw palmetto) and may include lesser amounts of *Baccharis halimifolia* (eastern baccharis), *Befaria racemose* (tarflower), *Ilex glabra* (inkberry), *Morella cerifera* (wax myrtle), and *Rhus copallinum* (flameleaf sumac). The sparse (0–30%) shortshrub layer (0.5–1 meters [1.6–3.3 ft]), when present, includes *Callicarpa americana* (American beautyberry) and *Vaccinium myrsinites* (shiny blueberry). The sparse herbaceous layer (0-5%) includes *Galactia elliottii* (Elliott's milkpea) and *Solidago stricta* (wand goldenrod). *Vitis rotundifolia* (muscadine) is the dominant vine. Epiphytes *Phlebodium aureum* (golden polypody) and *Tillandsia usneoides* (Spanish moss) may also be present.

Global Vegetation

This community occurs on similar sites to *Pinus elliottii* var. *densa* communities but with more frequent fire (2- to 3-year return time) favoring *Sabal* and *Serenoa*.

Oak-Palmetto Shrubland and Live Oak-Saw Palmetto—(Yaupon) Shrubland and Northeast Florida Coastal Scrub

Attributes, descriptions, a photo and a map are shown in Table D-26, and Figures D-51 and D-52.

Table D-26. Attributes and descriptions of Oak-Palmetto Shrubland and Live Oak-Saw Palmetto—(Yaupon) Shrubland and Northeast Florida Coastal Scrub.

Attribute	Description
Code	23006—4241 and 3821
Community Name	Oak-Palmetto Shrubland Live Oak-Saw Palmetto—(Yaupon) Shrubland and Northeast Florida Coastal Scrub
Color	Red and pink
Tone	Light
Texture	Coarse
Pattern	Dense canopy
Height	Short
Shape	Elongated
Size	Second most common class; large average size with large variation possible.
Location	Western part of the park
Association	22006, 22003, 23010
Comments	Could not distinguish 4241 and 3821 from each other using photo interpretation techniques so their classes were combined. Similar to 22006 but lacking taller cabbage. Similar to 22003 but missing major pine component. Very similar to 23010 but found on the western side of the park and containing less pink than 23010. These classes were burned frequently.



Figure D-51. Example of Oak-Palmetto Shrubland and Live Oak-Saw Palmetto—(Yaupon) Shrubland and Northeast Florida Coastal Scrub.

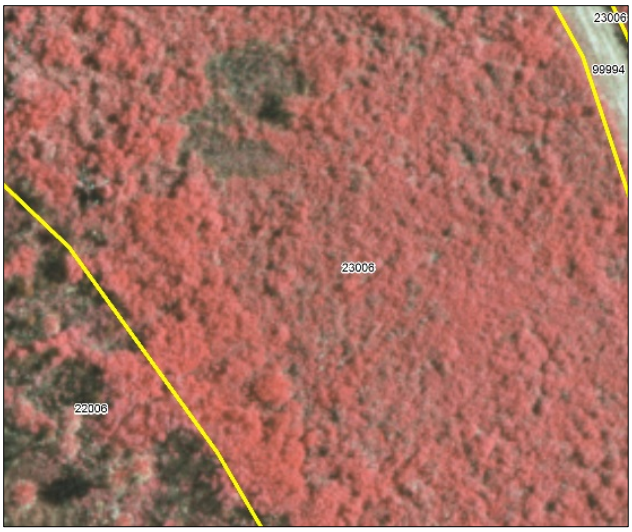


Figure D-52. Map showing Oak-Palmetto Shrubland and Live Oak-Saw Palmetto—(Yaupon) Shrubland and Northeast Florida Coastal Scrub (23006).

Summary

4241

Canaveral National Seashore Vegetation

While the dominant stratum in this association is the short-shrub layer, a sparse canopy of *Pinus elliottii* (slash pine) may occur. The moderate tall-shrub layer is dominated by *Quercus virginiana* (live oak), with a small amount of *Juniperus virginiana var. silicicola* (southern redcedar). The dense short-shrub layer is dominated by *Serenoa repens* (saw palmetto) and *Ilex vomitoria* (yaupon), and the sparse herb layer is dominated by *Dichanthelium dichotomum var. ensifolium* (cypress panicgrass). Other species include *Quercus myrtifolia* (myrtle oak), *Erythrina herbacea* (redcardinal), *Callicarpa americana* (American beautyberry), *Scleria triglomerata* (whip nutrush), *Ximenia americana* (tallow wood), and *Smilax auriculata* (earleaf greenbrier).

Global Vegetation

This maritime shrubland association represents a more southern version of *Quercus virginiana* - (*Ilex vomitoria*) Shrubland (CEGL003833) found in the Southern Atlantic Coastal Plain and dominated by *Serenoa repens*. It is described from a single plot at Canaveral National Seashore, and thus, its status is provisional until additional data are acquired.

3821

Canaveral National Seashore Vegetation

The overall appearance of this community is that of a dense shrubland. However, there may be a sparse (5–20% cover) emergent (5–20 meters [16.4–65.6 ft] tall) tree canopy of *Pinus clausa* (sand pine), *Pinus elliottii* (slash pine), *Carya floridana* (scrub hickory), and/or *Quercus geminata* (sand live oak). The very sparse to dense (5–80%) tall-shrub layer (2–10 meters [6.6–32.8 ft]) (generally inversely proportional to the short-shrub layer) is dominated by *Quercus geminata* (sand live oak) along with *Quercus chapmanii* (Chapman oak), *Quercus myrtifolia* (myrtle oak), and *Ximenia*

americana (tallow wood). The dense to total-cover (80–100%) short-shrub layer (0.5–2 meters [1.6–6.6 ft]) is dominated by *Serenoa repens* (saw palmetto) and includes the above-listed *Quercus* (oak) spp., as well as *Lyonia fruticosa* (coastalplain staggerbush), *Morella cerifera* (wax myrtle), *Vaccinium myrsinites* (shiny blueberry), and *Ximenia americana* (tallow wood). The sparse herbaceous layer (0–10%) includes *Andropogon floridanus* (Florida bluestem), *Aristida beyrichiana* (Beyrich threeawn), *Chamaecrista fasciculata* (sleepingplant), *Galactia elliottii* (Elliott's milkpea), *Pityopsis graminifolia* (narrowleaf silkgrass), and *Pteridium aquilinum* (western brackenfern). Vines (5–10%) are dominated by *Smilax auriculata* (earleaf greenbrier), and *Vitis rotundifolia* (muscadine). The state-vulnerable *Asimina obovata* (bigflower pawpaw) was recorded in one of the sampled plots.

Global Vegetation

This "coastal scrub" community occurs in northeastern Florida, from Duval County south to Cape Canaveral in northern Brevard County. This community occurs in a narrow strip near the coast on acidic sands. *Quercus geminata*, *Quercus myrtifolia*, *Serenoa repens*, and *Persea borbonia* dominate. Other characteristic species include *Morella cerifera*, *Quercus chapmanii*, *Osmanthus americanus*, *Lyonia ferruginea*, *Erythrina herbacea*, *Juniperus virginiana* var. *silicicola*, and *Ilex vomitoria*. Stands in northern Volusia County and on Cape Canaveral have dwarfed *Quercus virginiana* present along with the usual scrub oaks. Salt spray blown off the Atlantic Ocean by the prevailing easterly winds probably prevents the formation of a *Pinus clausa* canopy characteristic of more inland scrubs.

Florida Coastal Strand and Florida Coastal Strand (Southern Atlantic Temperate Type) and Florida Coastal Strand (Temperate Palmetto Type)

Attributes, descriptions, a photo and a map are shown in Table D-27, and Figures D-53 and D-54.

Table D-27. Attributes and descriptions of Florida Coastal Strand and Florida Coastal Strand (Southern Atlantic Temperate Type) and Florida Coastal Strand (Temperate Palmetto Type).

Attribute	Description
Code	23010—3811 and 3812
Community Name	Florida Coastal Strand Florida Coastal Strand (Southern Atlantic Temperate Type) and Florida Coastal Strand (Temperate Palmetto Type)
Color	Pink and red
Tone	Light
Texture	Smooth
Pattern	Dense canopy
Height	Short
Shape	Elongated
Size	Very common class; large average size with large variation possible.
Location	Eastern part of the park

Table D-27 (continued). Attributes and descriptions of Florida Coastal Strand and Florida Coastal Strand (Southern Atlantic Temperate Type) and Florida Coastal Strand (Temperate Palmetto Type).

Attribute	Description
Association	23006, 3781, 4001
Comments	Could not distinguish 3811 and 3812 from each other using photo interpretation techniques because many of the distinguishing species were not resolvable from the air photos, so their classes were combined. Very similar to 23006 but found on the eastern side of the park and containing more pink than 23006. Similar to 3781 and 4001 but missing the grey components.



Figure D-53. Example of Florida Coastal Strand and Florida Coastal Strand (Southern Atlantic Temperate Type) and Florida Coastal Strand (Temperate Palmetto Type).

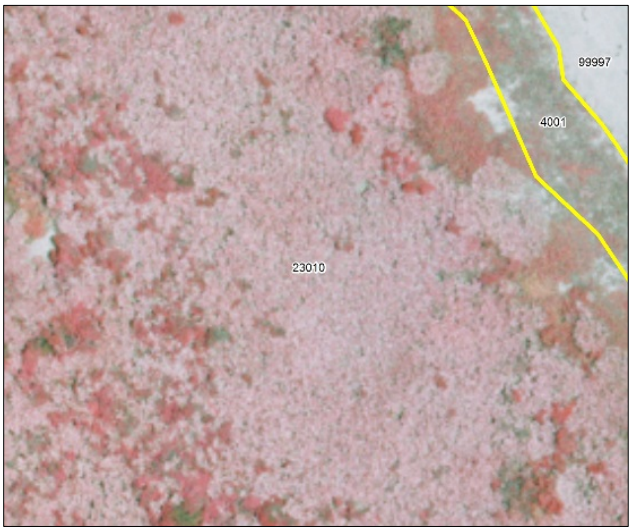


Figure D-54. Map showing Florida Coastal Strand and Florida Coastal Strand (Southern Atlantic Temperate Type) and Florida Coastal Strand (Temperate Palmetto Type; 23010).

Summary

3811

Canaveral National Seashore Vegetation

The sparse to total-cover (10–100%) tall-shrub layer (2–5 meters [6.6–16.4 ft]) is dominated by *Coccoloba uvifera* (seagrape) and may have lesser amounts of *Forestiera segregata* (Florida swampprivet), *Myrsine floridana* (Guianese colicwood), *Serenoa repens* (saw palmetto), and/or *Sideroxylon tenax* (tough bully). The sparse to total-cover (10–100%) short-shrub layer (0.5–2 meters [1.6–6.6 ft]) is dominated by *Serenoa repens* (saw palmetto) and *Coccoloba uvifera* (seagrape) and may include other tall-shrub species along with *Chiococca alba* (West Indian milkberry), *Erythrina herbacea* (redcardinal), and *Iva imbricata* (seacoast marshelder). The herbaceous layer (5–50%) is dominated by *Uniola paniculata* (seaoats); other species include *Ambrosia hispida* (coastal ragweed), *Spartina patens* (saltmeadow cordgrass), and *Stenotaphrum secundatum* (St. Augustine grass). The community supports many rare species: the globally and state-critically imperiled *Tephrosia angustissima var. curtissii* (Curtiss' hoarypea), the globally and state-imperiled *Lantana depressa* (depressed shrubverbena), the globally and state-vulnerable *Glandularia maritima* (coastal mock vervain), and the state-vulnerable *Ambrosia hispida* (coastal ragweed), *Hymenocallis latifolia* (perfumed spiderlily), and *Physalis walteri* (Walter's groundcherry). Vines include *Smilax auriculata* (earleaf greenbrier).

Global Vegetation

The community is characterized by dense structure and an even, salt-spray-pruned canopy, slanting upward with increasing distance from the coast. The tropical shrub/small tree *Myrcianthes fragrans* (twinberry) is characteristic of this type and is not found in coastal strands farther north or south. Unlike many other tropical species, *Myrcianthes fragrans* (twinberry) is unaffected by the occasional freezes along this coastal segment, probably due to the high concentration of aromatic compounds in its leaves (A. Johnson pers. comm.). Nearest the coast, *Serenoa repens* (saw palmetto) and *Coccoloba uvifera* (seagrape) dominate, with dwarfed trees of *Sabal palmetto* (cabbage palmetto) extending above the low 1- to 2-foot high canopy. Further inland is found a mixed dominance of temperate (*Sideroxylon tenax* (tough bully), *Persea borbonia* (redbay), *Quercus virginiana* (live oak)) and tropical (*Myrcianthes fragrans* (twinberry), *Myrsine floridana* (Guianese colicwood)) shrubs or salt-spray-dwarfed trees, often grading gradually upward in height to maritime hammock at increasing distance inland. Other characteristic species include *Forestiera segregata* (Florida swampprivet), *Morella cerifera* (wax myrtle), *Schinus terebinthifolius* (Brazilian peppertree) (exotic), *Lantana involucrata* (buttonsage), and *Zanthoxylum clava-herculis* (Hercules' club).

3812

Canaveral National Seashore Vegetation

The sparse to moderate (30–50% cover) tall-shrub layer (2–5 meters [6.6–16.4 ft] tall) contains *Ilex vomitoria* (yaupon), *Serenoa repens* (saw palmetto), and *Sideroxylon tenax* (tough bully). The moderate (40–70%) short-shrub layer (0.5–2 meters [1.6–6.6 ft]) includes *Serenoa repens* (saw palmetto), *Licania michauxii* (gopher apple), and *Myrcianthes fragrans* (twinberry). The herbaceous layer (0–30%) includes *Schizachyrium scoparium* (little bluestem), *Helianthus debilis* (cucumberleaf

sunflower), and *Heterotheca subaxillaris* (camphorweed). *Vitis rotundifolia* (muscadine) is a common vine.

Global Vegetation

The most abundant species in this strand community are *Serenoa repens* (saw palmetto) and *Ilex vomitoria* (yaupon), followed by occasional dwarfed individuals of *Sabal palmetto* (cabbage palmetto) and *Sideroxylon tenax* (tough bully) (Johnson and Muller 1993). Other species include *Persea borbonia* (redbay), *Magnolia grandiflora* (southern magnolia) (dwarfed), *Zanthoxylum clava-herculis* (Hercules' club), *Smilax auriculata* (earleaf greenbrier), *Monarda punctata* (spotted beebalm), *Erythrina herbacea* (redcardinal), and, less frequently, *Juniperus virginiana var. silicicola* (southern redcedar). The presence of *Sideroxylon tenax* (tough bully) and *Serenoa repens* (saw palmetto) and the absence of vines differentiate it from the dune "shrub/vine" thickets on barrier islands of North and South Carolina (Sandifer et al. 1980, p. 119). This strand type is distinguished from more southerly ranging types by the frequent presence of *Ilex vomitoria* (yaupon) (Johnson and Muller 1993).

Natal—Guinea Grass and Natal Grass Herbaceous Vegetation and Guinea Grass Herbaceous Vegetation

Attributes, descriptions, a photo and a map are shown in Table D-28, and Figures D-55 and D-56.

Table D-28. Attributes and descriptions of Natal—Guinea Grass and Natal Grass Herbaceous Vegetation and Guinea Grass Herbaceous Vegetation.

Attribute	Description
Code	24002—7654 and 7653
Community Name	Natal – Guinea Grass Natal Grass Herbaceous Vegetation and Guinea Grass Herbaceous Vegetation
Color	Grey and red
Tone	Medium
Texture	Coarse
Pattern	Sparse canopy
Height	Short to moderate
Shape	Random
Size	Moderately common class; moderate average size with some variation possible.
Location	Western part of the park
Association	3940, 4883
Comments	Could not distinguish 7654 and 7653 from each other using photo interpretation techniques, so their classes were combined. Similar to 3940 but sparser canopy and more sand visible. Similar to 4883 but less dense canopy and more sand visible.



Figure D-55. Example of Natal—Guinea Grass and Natal Grass Herbaceous Vegetation and Guinea Grass Herbaceous Vegetation.

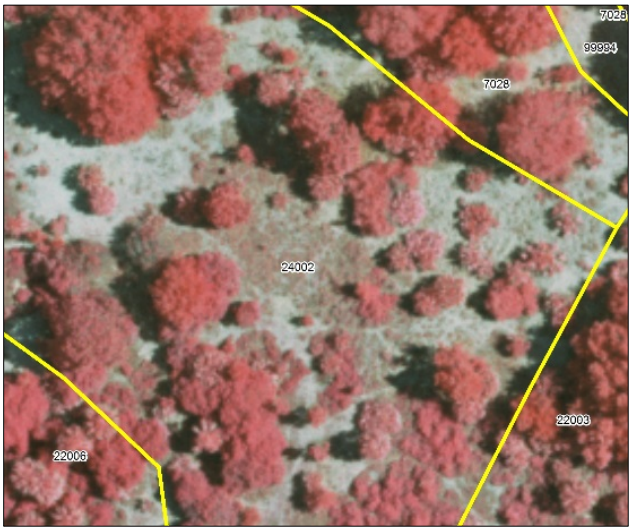


Figure D-56. Map showing Natal—Guinea Grass and Natal Grass Herbaceous Vegetation and Guinea Grass Herbaceous Vegetation (24002).

Summary

7654

Canaveral National Seashore Vegetation

At Canaveral National Seashore, the herbaceous layer is dominated by the exotic grass *Melinis repens* (rose Natal grass); additional species may include *Bidens alba* (romerillo), *Hyptis mutabilis* (tropical bushmint), *Iresine diffusa* (Juba's bush), *Monarda punctata* (spotted beebalm), *Sorghastrum elliottii* (slender Indiangrass), *Urochloa maxima* (guineagrass), and *Verbesina virginica* (white crownbeard), among others. Vines may include *Ampelopsis arborea* (peppervine), *Smilax auriculata* (earleaf greenbrier), and *Vitis rotundifolia* (muscadine). There may be a sparse emergent tree layer of *Sabal palmetto* (cabbage palmetto), *Quercus virginiana* (live oak), and/or *Zanthoxylum clava-herculis* (Hercules' club). The very sparse short-shrub layer includes *Callicarpa americana* (American beautyberry), *Lantana camara* (lantana), and *Sabal palmetto* (cabbage palmetto).

Global Vegetation

This semi-natural association encompasses disturbed areas, such as old fields, vacant lots, and roadsides dominated by the exotic *Melinis repens* (= *Rhynchelytrum repens*). It occurs in Florida, the Bahamas, Cuba and Puerto Rico.

7653

Canaveral National Seashore Vegetation

The overall appearance of this community is that of a grassland with 100% cover in the herbaceous layer. However, there may be a sparse (15–20% cover) emergent (5–10 meters [16.4–32.8 ft] tall) tree layer that includes *Sabal palmetto* (cabbage palmetto), *Citrus sinensis* (sweet orange), and/or *Schinus terebinthifolius* (Brazilian peppertree). The very sparse (5%) shortshrub layer (0.5–1 meters [1.6–6.6 ft]) includes *Baccharis halimifolia* (eastern baccharis) and *Sabal palmetto* (cabbage palmetto). The herbaceous layer is dominated by a near-monoculture of the exotic grass *Urochloa maxima* (guineagrass); additional species may include *Bidens alba* (romerillo) and *Vigna luteola* (hairypod cowpea). Vines (5%) include *Vitis shuttleworthii* (calloose grape). This highly disturbed community contains several additional exotic species.

Global Vegetation

Stands of this vegetation are usually strongly dominated by *Urochloa maxima* (guineagrass). A sparse emergent tree layer may be present that could include *Sabal palmetto* (cabbage palmetto), *Citrus sinensis* (sweet orange), and/or *Schinus terebinthifolius* (Brazilian peppertree). Additional species that may be present include *Bidens alba* (romerillo) and *Vigna luteola* (hairypod cowpea). Vines may include *Vitis shuttleworthii* (calloose grape). This highly disturbed community also may contain several additional exotic species.

Cattails and South Florida Cattail Marsh and Broadleaf Cattail—Pickerelweed Herbaceous Vegetation

Attributes, descriptions, a photo and a map are shown in Table D-29, and Figures D-57 and D-58.

Table D-29. Attributes and descriptions of Cattails and South Florida Cattail Marsh and Broadleaf Cattail—Pickerelweed Herbaceous Vegetation.

Attribute	Description
Code	24010—3988 and 4462
Community Name	Cattails South Florida Cattail Marsh & Broadleaf Cattail - Pickerelweed Herbaceous Vegetation
Color	Grey possibly some red components
Tone	Light
Texture	Moderate to Coarse
Pattern	Dense canopy
Height	Short to moderate

Table D-29 (continued). Attributes and descriptions of Cattails and South Florida Cattail Marsh and Broadleaf Cattail—Pickerelweed Herbaceous Vegetation.

Attribute	Description
Shape	Circular
Size	Moderately common class; moderate average size with some variation possible.
Location	Western part of the park found in and around yearlong ponds
Association	4001
Comments	Could not distinguish 3988 and 4462 from each other using photo interpretation techniques, so their classes were combined. Similar to 4001 but denser canopy, coarser texture, and found in or around ponds.



Figure D-57. Example of Cattails and South Florida Cattail Marsh and Broadleaf Cattail—Pickerelweed Herbaceous Vegetation.

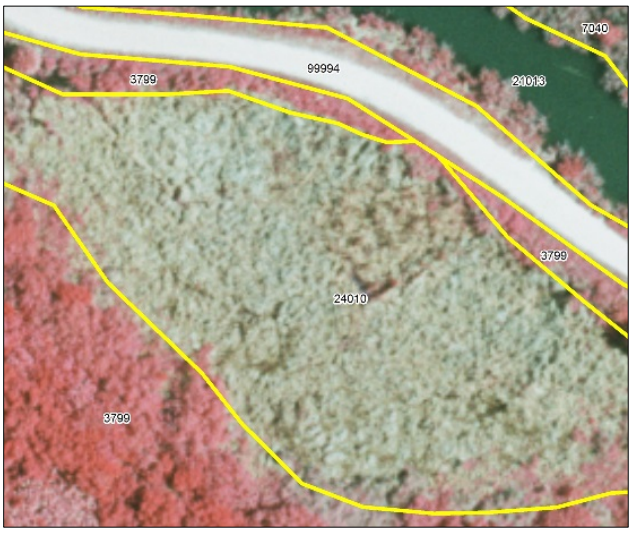


Figure D-58. Map showing Cattails and South Florida Cattail Marsh and Broadleaf Cattail—Pickerelweed Herbaceous Vegetation (24010).

Summary

3988

Canaveral National Seashore Vegetation

This community is comprised of a monoculture of 2–5 meters (6.6–16.4 ft) tall *Typha domingensis* (southern cattail) with 80% cover.

Global Vegetation

According to Hilsenbeck et al. (1979) and Kushlan (1990), relatively few other species are associated with this community. These include *Pontederia cordata* (pickerelweed), *Eleocharis cellulosa* (Gulf Coast spikerush), *Cladium mariscus ssp. jamaicense* (Jamaica swamp sawgrass), *Utricularia gibba* (humped bladderwort), and *Sagittaria lancifolia* (bulltongue arrowhead).

4462

Canaveral National Seashore Vegetation

The sparse herbaceous layer, with 100% cover, is dominated by *Pontederia cordata* (pickerelweed) and *Typha latifolia* (broadleaf cattail). Additional species may include *Brasenia schreberi* (watershield), *Panicum hemitomon* (maidencane), *Woodwardia virginica* (Virginia chainfern), and the tall-shrub (2–5 meters [6.6–16.4 ft]) *Salix caroliniana* (coastal plain willow; 10% cover).

Global Vegetation

This freshwater marsh association is dominated almost exclusively by *Typha latifolia* (broadleaf cattail) and *Pontederia cordata* (pickerelweed).

Saltwort/Saltgrass and Saltwort—Woody Glasswort Dwarf-shrubland and Salt Flat (Woody Glasswort Type) and Seaside Oxeye Tidal Shrub Flat and Saltgrass—(Saltmarsh Dropseed) Herbaceous Vegetation and Saltmarsh Dropseed—Saltgrass Herbaceous Vegetation and Crowngrass Interdune Swale

Attributes, descriptions, a photo and a map are shown in Table D-30, and Figures D-59 and D-60.

Table D-30. Attributes and descriptions of Saltwort/Saltgrass and Saltwort—Woody Glasswort Dwarf-shrubland and Salt Flat (Woody Glasswort Type) and Seaside Oxeye Tidal Shrub Flat and Saltgrass—(Saltmarsh Dropseed) Herbaceous Vegetation and Saltmarsh Dropseed—Saltgrass Herbaceous Vegetation and Crowngrass Interdune Swale.

Attribute	Description
Code	24018—3956 and 2278 and 3924 and 7694 and 7663 and 4114
Community Name	Saltwort/Saltgrass Saltwort—Woody Glasswort Dwarf-shrubland and Salt Flat (Woody Glasswort Type) and Seaside Oxeye Tidal Shrub Flat and Saltgrass—(Saltmarsh Dropseed) Herbaceous Vegetation and Saltmarsh Dropseed—Saltgrass Herbaceous Vegetation and Crowngrass Interdune Swale
Color	Grey, pink, light green with some red possible
Tone	Light

Table D-30 (continued). Attributes and descriptions of Saltwort/Saltgrass and Saltwort—Woody Glasswort Dwarf-shrubland and Salt Flat (Woody Glasswort Type) and Seaside Oxeye Tidal Shrub Flat and Saltgrass—(Saltmarsh Dropseed) Herbaceous Vegetation and Saltmarsh Dropseed—Saltgrass Herbaceous Vegetation and Crowngrass Interdune Swale.

Attribute	Description
Texture	Smooth
Pattern	Dense canopy
Height	Very short
Shape	Random
Size	Very common class; moderate average size with some variation possible.
Location	Found all around the park but mainly in and around the Lagoon
Association	21013
Comments	Could not distinguish 3956, 2278, 3924, 7694, 7663, and 4114 from each other using photo interpretation techniques, so their classes were combined. Certain locations could be dominated by one CEGL class but were typically less than the MMU. Additionally, many locations dominated by one CEGL class in the air photos or NatureServe vegetation plots but were completely different once we visited them during our field work. Thus the dynamic nature of this vegetation added to our reasoning of grouping these classes together. Usually found with 21013 but smoother texture, and shorter vegetation.



Figure D-59. Example of Saltwort/Saltgrass and Saltwort—Woody Glasswort Dwarf-shrubland and Salt Flat (Woody Glasswort Type) and Seaside Oxeye Tidal Shrub Flat and Saltgrass—(Saltmarsh Dropseed) Herbaceous Vegetation and Saltmarsh Dropseed—Saltgrass Herbaceous Vegetation and Crowngrass Interdune Swale.

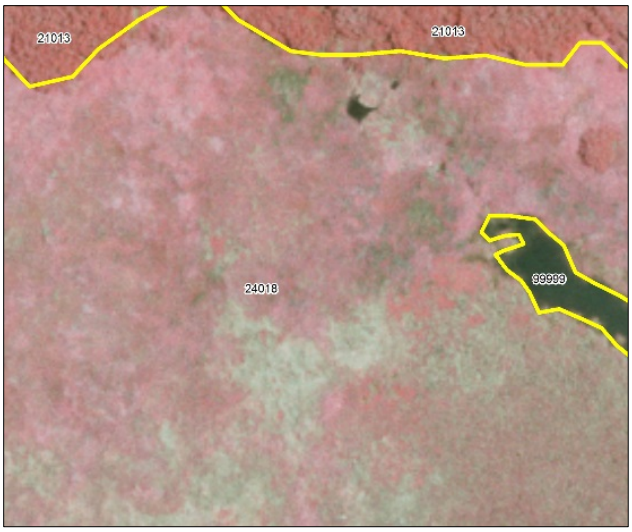


Figure D-60. Map showing Saltwort/Saltgrass and Saltwort—Woody Glasswort Dwarf-shrubland and Salt Flat (Woody Glasswort Type) and Seaside Oxeye Tidal Shrub Flat and Saltgrass—(Saltmarsh Dropseed) Herbaceous Vegetation and Saltmarsh Dropseed—Saltgrass Herbaceous Vegetation and Crowngrass Interdune Swale (24018).

Summary

3956

Canaveral National Seashore Vegetation

The short-shrub layer (0.5–1 meters [1.6–3.3 ft] tall) has total cover (100%) and is dominated by *Batis maritima* (turtleweed) and *Sarcocornia perennis* (chickenclaws). Other short shrubs in lesser amounts may include *Laguncularia racemosa* (white mangrove) and *Salicornia virginica* (Virginia glasswort). The sparse herbaceous layer (5%) includes *Distichlis spicata* (inland saltgrass) and *Monanthochloe littoralis* (shoregrass).

Global Vegetation

This community is dominated by *Batis maritima* (turtleweed) sometimes in association with *Sarcocornia perennis* (chickenclaws), *Sporobolus virginicus* (seashore dropseed), *Borrichia frutescens* (bushy seaside tansy), *Suaeda linearis* (annual seepweed), *Suaeda conferta* (beach seepweed) (in southern Texas), *Lycium carolinianum* (Carolina desert-thorn), *Spartina spartinae* (gulf cordgrass), *Sesuvium portulacastrum* (shoreline seapurslane), and *Blutaparon vermiculare* (silverhead). Algal mats of blue-green and sometimes green algae are characteristically present, visible even in densely vegetated pannes.

2278

Canaveral National Seashore Vegetation

The very dense (90%) short-shrub layer (0.5–1 meters [1.6–3.3 ft]) is clearly dominated by *Sarcocornia perennis* (chickenclaws); other short shrubs may include *Batis maritima* (turtleweed), *Borrichia arborescens* (tree seaside tansy), *Iva frutescens* (Jesuit's bark), and *Laguncularia racemosa* (white mangrove). The moderate herbaceous layer (30–40%) includes *Acrostichum danaeifolium*

(inland leatherfern), *Bacopa monnieri* (herb of grace), *Distichlis spicata* (inland saltgrass), and *Spartina alterniflora* (smooth cordgrass).

Global Vegetation

This community is dominated by the halophytic, succulent dwarf-shrub *Sarcocornia perennis* (chickenclaws) and other halophytes, including *Salicornia bigelovii* (dwarf saltwort), *Distichlis spicata* (inland saltgrass), and sometimes stunted *Spartina alterniflora* (smooth cordgrass). Other typical species can include *Suaeda* (seepweed) spp., *Sporobolus virginicus* (seashore dropseed), *Sesuvium portulacastrum* (shoreline seapurslane), and *Limonium carolinianum* (Carolina sealavender). Algal mats are characteristically present, visible even in densely vegetated pannes. Blue-green algae may contribute significantly more biomass than vascular species. Texas examples, of alternately wet and dry saline soils along the Gulf Coast, may contain *Monanthochloe littoralis* (shoregrass), *Rayjacksonia phyllocephala* (camphor daisy), *Borrichia frutescens* (bushy seaside tansy), *Maytenus phyllanthoides* (Florida mayten), *Suaeda* (seepweed) spp., *Sesuvium portulacastrum* (shoreline seapurslane), and *Sporobolus virginicus* (seashore dropseed).

3924

Canaveral National Seashore Vegetation

The moderately dense (70%) short-shrub layer (0.5–1 meters [1.6–3.3 ft]) of *Borrichia frutescens* (bushy seaside tansy) dominates this community. Additional short shrubs include *Batis maritima* (turtleweed) and *Sarcocornia perennis* (chickenclaws). The very sparse herbaceous layer (5%) includes *Distichlis spicata* (inland saltgrass).

Global Vegetation

This community is strongly dominated by *Borrichia frutescens* (bushy seaside tansy). Other characteristic species may include *Spartina patens* (saltmeadow cordgrass), *Iva frutescens* (Jesuit's bark), *Distichlis spicata* (inland saltgrass), *Schoenoplectus robustus* (sturdy bulrush), *Sporobolus virginicus* (seashore dropseed), *Monanthochloe littoralis* (shoregrass), *Sarcocornia perennis* (chickenclaws), *Limonium carolinianum* (Carolina sealavender), *Lycium carolinianum var. quadrifidum* (Carolina desert-thorn), *Rayjacksonia phyllocephala* (camphor daisy), and *Batis maritima* (turtleweed). In Texas, *Spartina patens* (saltmeadow cordgrass) is a less important component of this community, but it often forms a fringe along the upper margin.

7694

Canaveral National Seashore Vegetation

The dense to total-cover (90–100%) herbaceous layer is dominated almost exclusively by *Distichlis spicata* (inland saltgrass). In addition, there may be a very sparse (5%) tall-shrub layer (1–5 meters [3.3–16.4 ft] tall) and/or very sparse to dense (5–80%) short-shrub layer (0.5–1 meters [1.6–3.3 ft]) present. *Sarcocornia perennis* (chickenclaws) is the dominant shrub; additional species may include *Avicennia germinans* (black mangrove), *Batis maritima* (turtleweed), *Borrichia frutescens* (bushy seaside tansy), *Laguncularia racemosa* (white mangrove), and *Lycium carolinianum* (Carolina desert-thorn).

Global Vegetation

This association is dominated by *Distichlis spicata* (inland saltgrass), often mixed with other halophytic grasses and succulents such as *Sporobolus virginicus* (seashore dropseed), *Sarcocornia perennis* (chickenclaws), *Batis maritima* (turtleweed), *Lycium carolinianum* (Carolina desert-thorn), *Heliotropium curassavicum* (salt heliotrope), and others. In some Florida high marshes this type may occur in distinct monotypic zones with *Paspalum vaginatum* (seashore paspalum), *Batis maritima* (turtleweed), and *Salicornia* (pickleweed) spp., and in other cases these species intermingle (Montague and Wiegert 1990).

7663

Canaveral National Seashore Vegetation

The total-cover (90–100%) herbaceous layer is dominated almost exclusively by *Sporobolus virginicus* (seashore dropseed); other common species include *Juncus roemerianus* (needlegrass rush), *Sesuvium portulacastrum* (shoreline seapurslane), and *Spartina bakeri* (sand cordgrass). In addition, there may be a very sparse (0–5%) tallshrub layer (1–5 meters [3.3–16.4 ft] tall) or sparse (5–10%) short-shrub layer (0.5–1 meters [1.6–3.3 ft]) present that may include *Lycium carolinianum* (Carolina desert-thorn), *Batis maritima* (turtleweed), *Borrichia frutescens* (bushy seaside tansy), *Laguncularia racemosa* (white mangrove), and *Sarcocornia perennis* (chickenclaws).

Global Vegetation

This association accommodates coastal tidally flooded grasslands of Florida, south Texas, and Cuba dominated by *Sporobolus virginicus*. This association also accommodates areas codominated by *Sporobolus virginicus* and *Distichlis spicata*. *Distichlis spicata* may dominate some examples in south Texas. Other species that may be present include *Eustachys petraea*, *Limonium carolinianum*, and *Sesuvium portulacastrum*. In addition, there may be a very sparse emergent layer of *Juniperus virginiana* var. *silicicola*, *Ilex vomitoria*, and *Iva frutescens*.

4114

Canaveral National Seashore Vegetation

Stands of this association are nearly exclusive monocultures of *Paspalum vaginatum* (seashore paspalum) (85% cover). The only other species recorded in the one sampled plot is *Sesuvium portulacastrum* (shoreline seapurslane).

Global Vegetation

This vegetation is dominated by *Paspalum vaginatum* (seashore paspalum). In addition, *Sesuvium portulacastrum* (shoreline seapurslane) may be present.

Spartina—Juncus and Sand Cordgrass Interdune Swale and Needlerush High Marsh and Sand Cordgrass—Seashore Mallow Herbaceous Vegetation

Attributes, descriptions, a photo and a map are shown in Table D-31, and Figures D-61 and D-62.

Table D-31. Attributes and descriptions of Spartina—Juncus and Sand Cordgrass Interdune Swale and Needlerush High Marsh and Sand Cordgrass—Seashore Mallow Herbaceous Vegetation.

Attribute	Description
Code	24020—4511 and 4186 and 4194
Community Name	Spartina—Juncus Sand Cordgrass Interdune Swale and Needlerush High Marsh and Sand Cordgrass—Seashore Mallow Herbaceous Vegetation
Color	Grey with some red possible
Tone	Light
Texture	Moderate
Pattern	Dense canopy
Height	Short
Shape	Random
Size	Very common class; moderate average size with some variation possible.
Location	Found all around the park in wet areas
Association	3940
Comments	Could not distinguish 4511, 4186, and 4194 from each other using photo interpretation techniques, so their classes were combined. Additionally, many locations dominated by one CEGL class in the air photos or NatureServe vegetation plots were completely different once we visited them during our field work. Thus the dynamic nature of this vegetation added to our reasoning of grouping these classes together. Many of these are were also in burned regions so using air photos were also difficult. Similar to 3940 but denser coverage, 3940 would appear spotty in some locations.



Figure D-61. Example of Spartina—Juncus and Sand Cordgrass Interdune Swale and Needlerush High Marsh and Sand Cordgrass—Seashore Mallow Herbaceous Vegetation.

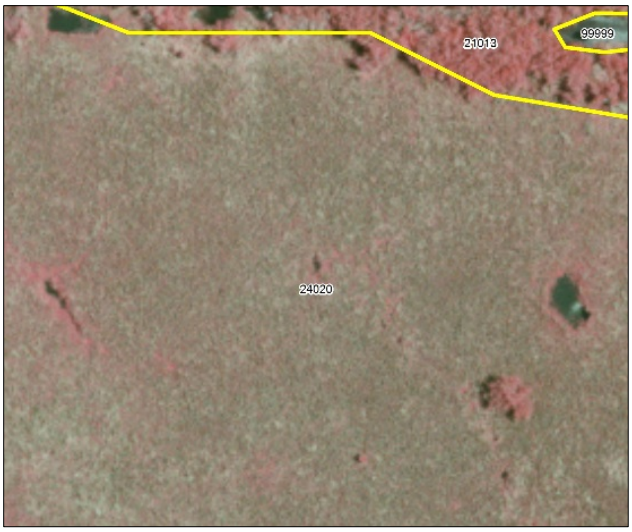


Figure D-62. Map showing Spartina—Juncus and Sand Cordgrass Interdune Swale and Needlerush High Marsh and Sand Cordgrass—Seashore Mallow Herbaceous Vegetation (24020).

Summary

4511

Canaveral National Seashore Vegetation

The overall appearance of this community is that of a grassland with 100% cover in the herbaceous layer. However, there may be a sparse (5–10% cover) emergent (2–10 meters [6.6–32.8 ft] tall) tree layer that includes *Acer rubrum* (red maple) and *Sabal palmetto* (cabbage palmetto) and a sparse (0–20%) tall-shrub layer (2–5 meters [6.6–16.4 ft]) of *Cephalanthus occidentalis* (common buttonbush), *Diospyros virginiana* (common persimmon), and *Morella cerifera* (wax myrtle). The herbaceous layer is dominated by *Spartina bakeri* (sand cordgrass) and *Cladium mariscus ssp. jamaicense* (Jamaica swamp sawgrass); additional species may include *Ipomoea sagittata* (saltmarsh morning-glory), *Proserpinaca pectinata* (combleaf mermaidweed), *Sagittaria lancifolia* (bulltongue arrowhead), and *Woodwardia virginica* (Virginia chainfern).

Global Vegetation

Stands of this type are dominated by *Spartina bakeri* (sand cordgrass), or at least with substantial cover of it. *Muhlenbergia filipes* (gulfhairawn muhly) may be codominant; *Andropogon glomeratus* (bushy bluestem) and *Aristida* (threeawn) sp. are occasionally present. A variety of wetland herbs are present in the wetter swales, including *Rhynchospora colorata* (starrush whitetop), *Sagittaria lancifolia* (bulltongue arrowhead), *Eupatorium mikanioides* (semaphore thoroughwort) (a Florida endemic), *Setaria magna* (giant bristlegrass), *Cladium mariscus ssp. jamaicense* (Jamaica swamp sawgrass), *Phyla nodiflora* (turkey tangle fogfruit), *Sabatia stellaris* (rose of Plymouth), and *Pluchea rosea* (rosy camphorweed). *Nostoc*, a cyanobacterium, forms a wet, slippery, dark green ground cover during wet periods and a thick, black crust during dry spells. An alga, *Chara* sp., is also present in pools in wet swales. Exotic species found in some swales include *Schinus terebinthifolius* (Brazilian peppertree) and *Catharanthus roseus* (Madagascar periwinkle). A stand assigned here in the Ocala National Forest (Farles Prairie) is strongly dominated by *Spartina bakeri* (sand cordgrass),

with *Ludwigia suffruticosa* (shrubby primrose-willow), *Amphicarpum muehlenbergianum* (Muhlenberg maidencane), *Dichanthelium* (rosette grass) sp., *Smilax pumila* (sarsparilla vine), *Centella erecta* (erect centella), *Rhexia mariana* (Maryland meadowbeauty), *Pluchea rosea* (rosy camphorweed), *Andropogon brachystachyus* (shortspike bluestem), *Andropogon capillipes* (chalky bluestem), and *Ludwigia repens* (creeping primrose-willow). The shrubs *Vaccinium darrowii* (Darrow's blueberry) and *Hypericum myrtifolium* (myrtleleaf St. Johnswort) are present here at low cover values.

4186

Canaveral National Seashore Vegetation

This herbaceous community is a nearly monotypic stand of *Juncus roemerianus* (needlegrass rush) in the dominant herbaceous layer (100% cover). Additional herbs include *Acrostichum danaeifolium* (inland leatherfern), *Amaranthus australis* (southern amaranth), *Bacopa monnieri* (herb of grace), *Eupatorium serotinum* (lateflowering thoroughwort), *Samolus ebracteatus* (limewater brookweed), and *Spartina bakeri* (sand cordgrass). In addition, there may be a very Vegetation of Canaveral National Seashore sparse to moderate (5–40%) shrub layer (0.5–2 meters [1.6–6.6 ft] tall) of *Sarcocornia perennis* (chickenclaws) along with *Batis maritima* (turtleweed) and *Borrichia frutescens* (bushy seaside tansy).

Global Vegetation

Tall and short growth-form zones have been noted in several areas (Kruczynski et al. 1978; Hackney and de la Cruz 1982; Stout 1984; Montague and Wiegert 1990). Associates that do occur at low cover may include *Borrichia frutescens* (bushy seaside tansy), *Baccharis halimifolia* (eastern baccharis), *Spartina alterniflora* (smooth cordgrass), *Distichlis spicata* (inland saltgrass), *Schoenoplectus robustus* (sturdy bulrush), *Limonium carolinianum* (Carolina sealavender), *Symphyotrichum tenuifolium* (perennial saltmarsh aster), *Symphyotrichum subulatum* (eastern annual saltmarsh aster), and (in more southern occurrences) *Ipomoea sagittata* (saltmarsh morning-glory).

4194

Canaveral National Seashore Vegetation:

This herbaceous tidal community is a nearly monotypic stand of *Spartina bakeri* (sand cordgrass) in the dominant herbaceous layer (100% cover). Additional herbs may include *Andropogon glomeratus* (bushy bluestem), *Blechnum serrulatum* (toothed midsorus fern), *Fimbristylis thermalis* (hot springs fimbry), *Hydrocotyle verticillata* (whorled marshpennywort), *Ipomoea sagittata* (saltmarsh morning-glory), *Juncus roemerianus* (needlegrass rush), *Mikania scandens* (climbing hempvine), *Pluchea foetida* (stinking camphorweed), *Setaria parviflora* (marsh bristlegrass), and *Sporobolus virginicus* (seashore dropseed). In addition, there may be a very sparse (5%) tree layer (5–10 meters [16.4–32.8 ft] tall) of *Sabal palmetto* (cabbage palmetto) and very sparse (5%) shrub layer (0.5–1 meters [1.6–3.3 ft] tall) of *Baccharis halimifolia* (eastern baccharis), *Kosteletzkya virginica* (Virginia saltmarsh mallow), and *Morella cerifera* (wax myrtle).

Global Vegetation

This tidal marsh association is dominated almost exclusively by *Spartina bakeri* (sand cordgrass). Other species that may occur include *Kosteletzkya virginica* (Virginia saltmarsh mallow), *Ipomoea sagittata* (saltmarsh morning-glory), *Vicia floridana* (Florida vetch), and *Mikania scandens* (climbing hempvine). Scattered shrubs are often present (in the absence of fire) and include *Baccharis halimifolia* (eastern baccharis), *Morella cerifera* (wax myrtle), *Acer rubrum* (red maple), *Salix caroliniana* (coastal plain willow), and *Fraxinus caroliniana* (Carolina ash).

Literature Cited

Hackney, C. T., and A. A. de la Cruz. 1982. The structure and function of brackish marshes in the north central Gulf of Mexico: A ten year case study. Pages 89-107 *in*: B. Gopal et al., editors. Wetlands ecology and management. National Institute of Ecology. International Science Publication, Jaipur, India.

Hilsenbeck, C. E., R. H. Hofstetter, and T. R. Alexander. 1979. Preliminary synopsis of major plant communities in the East Everglades area: Vegetation map supplement. Unpublished document. Metropolitan Dade County Planning Department, Miami, Florida.

Huffman, J. M., and W. S. Judd. 1998. Vascular flora of Myakka River State Park, Sarasota and Manatee counties, Florida. Castanea 63:25–50.

Johnson, A. F., and J. W. Muller. 1993. An assessment of Florida's remaining coastal upland natural communities: Final summary report. The Nature Conservancy, Florida Natural Areas Inventory, Tallahassee, Florida. 37 pp.

Johnson, A. F., J. W. Muller, and K. A. Bettinger. 1990. An assessment of Florida's remaining coastal upland natural communities: Southeast Florida. The Nature Conservancy, Florida Natural Areas Inventory, Tallahassee, Florida. 10 pp. plus appendices.

Kruczynski, W. L., C. B. Subrahmanyam, and S. H. Drake. 1978. Studies on the plant community of a north Florida salt marsh. Bulletin of Marine Science 28:707-715.

Kushlan, J. A. 1990. Freshwater marshes. Pages 324-363 *in*: R. L. Myers and J. J. Ewel, editors. Ecosystems of Florida. University of Central Florida Press, Orlando, Florida.

Montague, C. L., and R. G. Wiegert. 1990. Salt marshes. Pages 481-516 *in*: R. L. Myers and J. J. Ewel, editors. Ecosystems of Florida. University of Central Florida Press, Orlando, Florida.

Peet, R. K. 1993. A taxonomic study of *Aristida stricta* and *A. beyrichiana*. Rhodora 95:25–37.

Sandifer, P. A., J. V. Miglarese, D. R. Calder, J. J. Manzi, and L. A. Barclay, editors. 1980. Ecological characterization of the Sea Island coastal region of South Carolina and Georgia. Volume III. Biological features of the characterization area. USDI Fish & Wildlife Service, Office of Biological Service. FWS/OBS-79/42. Washington, D.C. 620 pp.

Stout, J. P. 1984. The ecology of irregularly flooded salt marshes of the northeastern Gulf of Mexico: A community profile. USDI Fish and Wildlife Service, Minerals Management Service. Biological Report 85(7.1). 98 pp.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 639/167042, February 2020



Natural Resource Stewardship and Science
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525