National Park Service
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Natural Resource Stewardship and Science

Vegetation Classification and Mapping

Gulf Islands National Seashore

Natural Resource Report NPS/GUIS/NRR—2023/2519





ON THIS PAGE
Horn Island
(CSU/Tom Baldvins)

ON THE COVER
Petit Bois Island
(CSU/Tom Baldvins)

Vegetation Classification and Mapping

Gulf Islands National Seashore

Natural Resource Report NPS/GUIS/NRR—2023/2519

Matt Ley,[1] Tom Baldvins,[2] David Jones1,[1] Hannah Pilkington,[1] and Kelly Anderson[2]

[1] Center for Environmental Management of Military Lands
Warner College of Natural Resources
Colorado State University
Fort Collins, Colorado

[2] Colorado Natural Heritage Program
Warner College of Natural Resources
Colorado State University
Fort Collins, Colorado

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Executive Summary

The Gulf Islands National Seashore (GUIS) vegetation inventory project classified and mapped vegetation on park-owned lands within the administrative boundary and estimated thematic map accuracy quantitatively. The project began in June 2016.

National Park Service (NPS) Vegetation Mapping Inventory Program provided technical guidance. The overall process included initial planning and scoping, imagery procurement, field data collection, data analysis, imagery interpretation/classification, accuracy assessment (AA), and report writing and database development. Initial planning and scoping meetings took place during May, 2016 in Ocean Springs, Mississippi where representatives gathered from GUIS, the NPS Gulf Coast Inventory and Monitoring Network, and Colorado State University.

Primary imagery used for interpretation was 4-band (RGB and CIR) orthoimages from 2014 and 2016 with resolutions of 15 centimeters (cm) (Florida only) and 30 cm. Supplemental imagery with varying coverage across the study area included National Aerial Imagery Program 50 cm imagery for Mississippi (2016) and Florida (2017), 15 and 30 cm true color Digital Earth Model imagery for Mississippi (2016 and 2017), and current and historical true-color Google Earth and Bing Map imagery. National Oceanic Atmospheric Administration National Geodetic Survey 30 cm true color imagery from 2017 (post Hurricane Nate) supported remapping the Mississippi barrier islands after Hurricane Nate.

The preliminary vegetation classification included 59 United States National Vegetation Classification (USNVC) associations. Existing vegetation and mapping data combined with vegetation plot data contributed to the final vegetation classification. Quantitative classification using hierarchical clustering and professional expertise was supported by vegetation data collected from 250 plots in 2016 and 29 plots in 2017 and 2018, as well as other observational data. The final vegetation classification includes 39 USNVC associations and 5 park special types; 18 forest and woodland, 7 shrubland, 17 herbaceous, and 2 sparse vegetation types were identified.

The final GUIS map consists of 38 map classes. Land cover classes include four types: non-vegetated barren land / borrow pit, developed open space, developed low – high intensity, and water/ocean. Of the 34 vegetation map classes, 26 represent a single USNVC association/park special, six map classes contain two USNVC associations/park specials, and two map classes contain three USNVC associations/park specials. Forest and woodland associations had an abundance of sand pine (*Pinus clausa*), slash pine (*Pinus elliottii*), sand live oak (*Quercus geminata*), yaupon (*Ilex vomitoria*), wax myrtle (*Morella cerifera*), and saw palmetto (*Serenoa repens*). Shrubland associations supported dominant species such as eastern baccharis (*Baccharis halimifolia*), yaupon (*Ilex vomitoria*), wax myrtle (*Morella cerifera*), saw palmetto (*Serenoa repens*), and sand live oak (*Quercus geminata*). Herbaceous associations commonly included camphorweed (*Heterotheca subaxillaris*), needlegrass rush (*Juncus roemerianus*), bitter seabeach grass (*Panicum amarum* var. *amarum*), gulf bluestem (*Schizachyrium maritimum*), saltmeadow cordgrass (*Spartina patens*), and sea oats (*Uniola paniculata*).

The final GUIS vegetation map consists of 1,268 polygons totaling 35,769.0 hectares (ha) or 88,387.2 acres (ac). Mean polygon size excluding water is 3.6 ha (8.9 ac). The most abundant land cover class is open water/ocean which accounts for approximately 31,437.7 ha (77,684.2 ac) or 87.9% of the total mapped area. Natural and ruderal vegetation consists of 4,176.8 ha (10,321.1 ac) or 11.6% of the total area. Within the natural and ruderal vegetation types, herbaceous types are the most extensive with 1945.1 ha (4,806.4 ac) or 46.5%, followed by forest and woodland types with 804.9 ha (1,989.0 ac) or 19.3%, sparse vegetation types with 726.9 ha (1,796.1 ac) or 17.4%, and shrubland types with 699.9 ha (1,729.5 ac) or 16.8%. Developed open space, which can include a matrix of roads, parking lots, park-like areas and campgrounds account for 153.8 ha (380.0 ac) or 0.43% of the total mapped area. Artificially non-vegetated barren land is rare and only accounts for 0.74 ha (1.82 ac) or 0.002% of the total area.

We collected 701 AA samples to evaluate the thematic accuracy of the vegetation map. Final thematic accuracy, as a simple proportion of correct versus incorrect field calls, is 93.0%. Overall weighted map class accuracy is 93.6%, where the area of each map class was weighted in proportion to the percentage of total park area. This method provides more weight to larger map classes in the park. Each map class had an individual thematic accuracy goal of at least 80%. The hurricane impact area map class was the only class that fell below this target with an accuracy of 73.5%. The vegetation communities impacted by the hurricane are highly dynamic and regenerated quickly following the disturbance event, contributing to map class disagreement during the accuracy assessment phase. No other map classes fell below the 80% accuracy threshold.

In addition to the vegetation polygon database and map, several products to support park resource management are provided including the vegetation classification, field key to the associations, local association descriptions, photographic database, project geodatabase, ArcGIS .mxd files for map posters, and aerial imagery acquired for the project. The project geodatabase links the spatial vegetation data layer to vegetation classification, plot photos, project boundary extent, AA points, and the PLOTS database. The geodatabase includes USNVC hierarchy tables allowing for spatial queries of data associated with a vegetation polygon or sample point. All geospatial products are projected using North American Datum 1983 (NAD83) in Universal Transverse Mercator (UTM) Zone 16 N. The final report includes methods and results, contingency tables showing AA results, field forms, species list, and a guide to imagery interpretation. These products provide useful information to assist with management of park resources and inform future management decisions.

Use of standard national vegetation classification and mapping protocols facilitates effective resource stewardship by ensuring the compatibility and widespread use throughout the NPS as well as other federal and state agencies. Products support a wide variety of resource assessments, park management and planning needs. Associated information provides a structure for framing and answering critical scientific questions about vegetation communities and their relationship to environmental processes across the landscape.

Acknowledgments

The success of this project would not have been possible without the contributions of various organizations and individuals. We thank NPS staff at Gulf Islands National Seashore, Gulf Coast Inventory and Monitoring Network, and Karl Brown and Tammy Cook at the Vegetation Mapping Inventory Program. Additional thanks goes to the University of Southern Mississippi Gulf Coast Research Laboratory for providing support and lodging.

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Introduction

NPS Vegetation Mapping Inventory Program

Since 1994, the National Park Service (NPS) Vegetation Mapping Inventory (VMI) Program has led an effort to classify, describe, and map existing vegetation of national park units for the NPS Inventory and Monitoring (I&M) Division. The VMI program aims to classify and map vegetation at over 270 national park units across the United States and territories, and provides baseline ecological data for park resource managers, creates data in a regional and national context, and provides opportunities for future inventory, monitoring, and research activities (FGDC 1997, Grossman et al. 1998). The VMI program brings botanists, imagery interpreters, cartographers, and ecologists together during a multi-year project to describe and map existing vegetation types within park boundaries. The preliminary map product is then statistically evaluated to assess the map accuracy before releasing a final comprehensive classification and map.

The NPS I&M program has developed general guidelines for the development and delivery of vegetation map products. The guidelines are detailed in the "12-Step Guidance for NPS Vegetation Inventories" (NPS 2013) and include the following:

1) Review existing data and "best practices" to develop a brief proposal.
2) Plan and scope to gather the detailed information needed to develop the study plan.
3) Develop and submit a detailed study plan for approval of funding.
4) Collect field plot data (for the ecological classification).
5) Develop vegetation classification, vegetation type descriptions, and field key.
6) Develop mapping model (calibration).
7) Acquire and prepare imagery.
8) Analyze and classify imagery.
9) Prepare GIS project.
10) Validate thematic accuracy of map products.
11) Conduct formal accuracy assessment (AA).
12) Deliver final reports, GIS database, and required products.

A technical brief (steps 1-3) was prepared for the Gulf Islands National Seashore (GUIS) vegetation inventory project by Colorado State University (CSU) in 2015. This project supports the remaining steps. All final products are consistent with the following VMI Program standards and guidance:

- National Vegetation Classification Standard (FGDC 1997, FGDC 2008)
- Spatial Data Transfer Standard (FGDC 1998a)
- Content Standard for Digital Geospatial Metadata (FGDC 1998b)
- United States National Map Accuracy Standards (USGS 1999)
- Integrated Taxonomic Information System

- Program-defined standards for map attribute accuracy and minimum mapping unit (MMU)
- Vegetation Mapping Inventory Program 12-Step Guidance

The products derived from these efforts include special data and vegetation information.

Spatial Data:

- Map classification data
- Spatial database of vegetation communities
- Field plot data from the classification and AA phases from over 950 locations
- Metadata for spatial databases,
- Map files to produce maps at various scales/sizes and levels of thematic detail
- Quantitative AA of spatial data

Vegetation Information:

- Vegetation classification: list of communities present
- Dichotomous field key of vegetation classes
- Formal description for each vegetation class
- Ground photos of vegetation classes
- Field data in database format

NPS vegetation inventory projects classify and map park vegetation using a combination of plot and observation point data, legacy plot data and imagery, field reconnaissance, and interpretation of remotely-sensed imagery. The protocols and standards developed for large parks were used and are described in NPS Biological Resources Division program documents (TNC and ESRI 1994, NPS 2013).

Planning and Scoping

For the initial planning and scoping meetings, CSU staff traveled to Gulf Breeze, Florida and met with NPS GUIS and GULN staff, and NPS VMI program managers, as well as other interested agencies and subject matter experts. A scoping meeting with park staff and other stakeholders took place on May 5, 2016, followed by a field tour on May 6, 2016. The participants of the scoping meeting included the following: by name and affiliation.

David Jones: CSU, CEMML

Joe Stevens: CSU, CNHP

Tom Baldvins: CSU, CNHP

Tammy Cook: NPS I&M

Martha Segura: NPS, Gulf Islands Network

Cassity Bromely: NPS, GUIS Chief of Resources

Mark Nicholas: NPS, Biologist

Gary Hopkins: NPS, Biologist

Jolene Williams: NPS, Environmental Protection Specialist

Group discussion at the scoping meetings included defining the project area boundary, evaluating existing sources of vegetation data and availability of existing imagery/maps, and discussing logistical issues such as work schedule, land access, stakeholders, and opportunities for in-kind park support.

The group agreed that only NPS-owned portions would be mapped under this project with the exclusion of Fort Barrancas. Total mapped project area is 35,769.0 ha (88,387.2 ac) of which the majority is water/ocean with 4,455.5 ha (11,009.7 ac) of land area.

The United States National Vegetation Classification (USNVC) and National Vegetation Classification Standard (NVCS)

Use of the U.S. National Vegetation Classification (USNVC) (USNVC 2020) is central to supporting the NPS mapping program. The USNVC:

- Is based upon current vegetation.
- Uses a systematic approach to classify a continuum.
- Emphasizes natural and existing vegetation.
- Uses a combined physiognomic-floristic hierarchy.
- Identifies vegetation units based on both qualitative and quantitative data.
- Is appropriate for mapping at multiple scales.

Use of a standardized national vegetation classification and mapping protocol facilitates effective resource stewardship by ensuring compatibility and widespread use of the information throughout the NPS, as well as by other federal and state agencies. Vegetation data and associated information support a wide variety of resource assessment, park management, planning needs, and provide a structure for framing and answering critical scientific questions about vegetation communities and their relationship to environmental processes across the landscape.

The USNVC was largely developed and implemented by The Nature Conservancy (TNC) and NatureServe in conjunction with the network of Natural Heritage Programs from 1980 to 2000. The USNVC is currently maintained and updated by the joint efforts of NatureServe, the Federal Geographic Data Committee (FGDC), and the Ecological Society of America (http://usnvc.org/). These organizations participate in ongoing classification refinements that are reviewed both locally and nationally.

The FGDC released Version 2 of the National Vegetation Classification Standard (NVCS) in 2008, representing a major revision (FGDC 2008). This project uses Version 2 as its classification standard, which treats natural/ruderal vegetation and cultural vegetation as two separate hierarchies. Classification criteria utilized by the USNVC system include three upper levels that emphasize physiognomy of natural and ruderal (i.e., semi-natural or nonnative) communities, three middle levels that integrate biogeography and floristics, and two lowest levels based solely on floristics (Figure 1) (USNVC 2020).

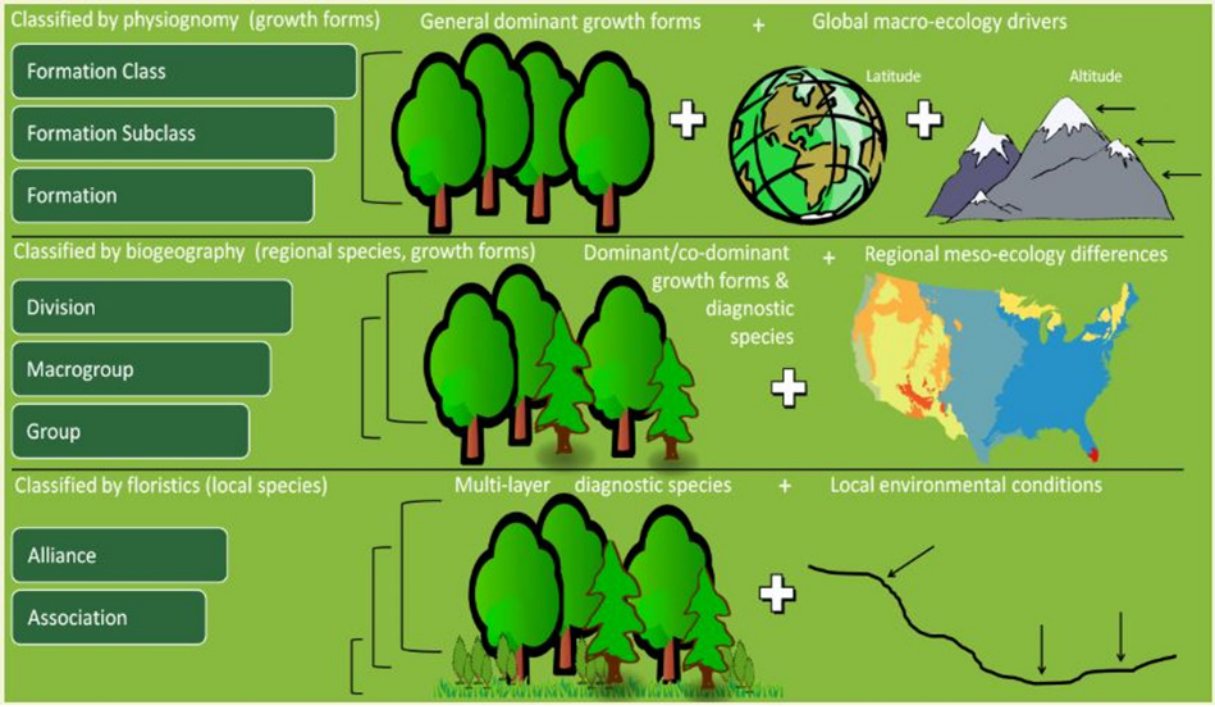


Figure 1. USNVC hierarchy and classification criteria (USNVC 2020).

Alliances and associations are based on species dominance in the uppermost vegetation layer and indicator species consistently found in some types but absent in others. Alliance names are generally based on the dominant/diagnostic species in the uppermost stratum of the vegetation with up to four diagnostic species. Associations are grouped under alliances and are the most specific classification unit. Associations define a distinct plant composition that repeats across the landscape. Alliances typically include numerous associations while associations only occur under one alliance. Table 1 provides criteria and examples of vegetation classification using the 2008 hierarchy for natural vegetation.

Table 1. USNVC (2020) hierarchy criteria and examples of classified types.

Level (level criteria)	Hierarchy for Natural Vegetation	Vegetation Classification Criteria	Ecological Context	Scientific Name	Colloquial Name
Upper Levels (predominantly physiognomy)	1) Formation Class	Broad combinations of general dominant growth forms.	Basic temperature (energy budget), moisture, and substrate/aquatic conditions.	1: Mesomorphic Tree Vegetation Class	Forest & Woodland
	2) Formation Subclass	Combinations of general dominant and diagnostic growth forms.	Global macroclimatic factors driven primarily by latitude and continental position, or overriding substrate/aquatic conditions.	1.B: Temperate & Boreal Forest & Woodland Subclass	Temperate & Boreal Forest & Woodland
	3) Formation	Combinations of dominant and diagnostic growth forms.	Global macroclimatic factors as modified by altitude, seasonality of precipitation, substrates, and hydrologic conditions.	1.B.1: Warm Temperate Forest & Woodland Formation	Warm Temperate Forest & Woodland Formation
Middle Levels (physiognomy, biogeography, and floristics)	4) Division	Combinations of dominant and diagnostic growth forms and a broad set of diagnostic plant species that reflect biogeographic differences.	Continental differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes.	1.B.1.Na: Southeastern North American Forest & Woodland	Southeastern North American Forest & Woodland
	5) Macrogroup	Combinations of moderate sets of diagnostic plant species and diagnostic growth forms that reflect biogeographic differences.	Sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes.	M007: *Pinus palustris* / *Aristida stricta* Woodland	Longleaf Pine Woodland
	6) Group	Combinations of relatively narrow sets of diagnostic plant species, including dominants and co-dominants, broadly similar composition, and diagnostic growth forms.	Regional mesoclimate, geology, substrates, hydrology and disturbance regimes.	G008: *Pinus clausa* / *Quercus geminata* – *Quercus myrtifolia* Scrub Forest & Woodland Group	Sand Pine Scrub Forest & Open Woodland

Table 1 (continued). USNVC (2020) hierarchy criteria and examples of classified types.

Level (level criteria)	**Hierarchy for Natural Vegetation**	**Vegetation Classification Criteria**	**Ecological Context**	**Scientific Name**	**Colloquial Name**
Lower Levels (predominantly floristics)	7) Alliance	Diagnostic species, including some from the dominant growth form or layer, and moderately similar composition.	Regional to subregional climate, substrates, hydrology, moisture/ nutrient factors, and disturbance regimes.	A3117: *Pinus clausa* Scrub Woodland Alliance	Sand Pine Scrub Woodland
	8) Association	Diagnostic species, usually from multiple growth forms or layers, and more narrowly similar composition.	Topo-edaphic climate, substrates, hydrology, and disturbance regimes	CEGL003554: *Pinus clausa* / *Quercus geminata* – *Quercus myrtifolia* – *Conradina canescens* Woodland	Panhandle Sand Pine Dune Scrub

Associations are named using uppermost stratum-dominant vegetation species, lower strata-dominant species, or a diagnostic species of any stratum. The species nomenclature for all alliances and associations follows that of Kartesz (1999). For more information on the USNVC, see Grossman et al. (1998). Documentation from NatureServe (2006) describes the naming and syntax for all USNVC names:

- A hyphen ("-") separates names of species occurring in the same stratum.
- A slash ("/") separates names of species occurring in different strata.
- Species that occur in the uppermost stratum are listed first, followed successively by those in lower strata.
- Order of species names generally reflects decreasing levels of dominance, constancy, or indicator value.
- Parentheses around a species name indicates the species is less consistently found either in all associations of an alliance, or in all occurrences of an association.
- Association names include the dominant species of the significant strata, followed by the class in which they are classified (e.g., "Forest," "Woodland," or "Herbaceous" vegetation).
- Alliance names also include the class in which they are classified (e.g., "Forest," "Woodland," "Herbaceous"), but are followed by the word "Alliance" to distinguish them from associations.

Additional information is available at the National Vegetation Classification Standard website http://usnvc.org/, the FGDC (Federal Geographic Data Committee) website http://www.fgdc.gov/standards/projects/FGDC-standards-projects/vegetation, and the NatureServe Explorer website http://explorer.natureserve.org/classeco.htm.

Gulf Islands National Seashore Vegetation Inventory and Mapping Project

Vegetation inventory and mapping is one of the 12 basic inventories mandated by the 1992 NPS Natural Resources I&M Guidelines.

In 2016, the NPS awarded a cooperative agreement to CSU's Center for Environmental Management of Military Lands (CEMML) and Colorado Natural Heritage Program (CNHP) to implement the vegetation inventory. Expertise provided by CNHP, CEMML, NPS staff at Gulf Island National Seashore, Gulf Coast I&M Network (GULN), and NPS VMI Program ultimately contributed to the successful completion of the project.

CNHP was primarily responsible for collecting standardized field data, classifying data into vegetation types through analysis and expert opinion, writing dichotomous vegetation keys, managing plot data, performing the AA, and report writing. CEMML was responsible for acquiring imagery of the park, collaborating with CNHP staff on classification issues, developing a mapping model based on limitations of the imagery and interpretation, classifying and delineating vegetation polygons from imagery, developing an imagery interpretation guide, performing informal map validation prior to AA, report writing and database development. Staff from GUIS, GULN, and the

VMI Program provided logistical and technical support, helped coordinate field work, and reviewed draft data and reports.

Location and Administrative Setting

GUIS stretches approximately 254 kilometers (km) (158 miles (mi)) along the northern coast of the Gulf of Mexico from Cat Island in Mississippi to the Okaloosa Area near Destin, Florida (Figure 2). The GUIS administrative boundary does not include any areas within the State of Alabama. The park administrative boundary consists of 52,750.0 ha (130,348.1 ac). Fort Barrancas was excluded from the mapping effort as only park-owned properties were mapped by this project. The total mapped project area is 35,769.0 ha (88,387.2 ac) of which a majority is water/ocean; 4,455.5 ha (11,009.7 ac) is land area.

The National Seashore preserves the natural environment of Gulf Coast environments including scrub shrub, fresh and saltwater marshes, oak hammocks, dune communities, and maritime forests (Hatt et al. 2016). In addition to preserving a variety of natural habitats, GUIS contains several historic buildings including Fort Pickens, Fort Barrancas, Fort McRee, and Fort Massachusetts (Hatt et al. 2016). In 1939, Santa Rosa Island was established as a National Monument; this included Fort Pickens, Opal Beach, and Okaloosa Beach (Hatt et al. 2016). The Mississippi district includes a small mainland area called Davis Bayou and six barrier islands: Petit Bois, Sand, Horn, East and West Ship, and Cat Islands (Hatt et al. 2016).

Although GUIS has remained largely undeveloped, there is a history of military use along the barrier islands. Naval Live Oaks Reservation was the first area to be acquired by the government in 1828 to provide timber for ship building, as its name implies (Hatt et al. 2016). The War Department built Fort Pickens on Santa Rosa Island and Fort McRee on Perdido Key in 1842 to protect the Pensacola Bay area (Tidball 1996, Looney et al. 1993). Fort Massachusetts was constructed around the same time to defend the natural deep-water harbor on the north side of West Ship Island (Hatt et al. 2016).

At the beginning of the Civil War, Fort Pickens played a pivotal role in preventing the Confederacy from controlling Pensacola Bay (Tidball 1996). The Confederacy managed to capture both Fort McRee and Fort Barrancas, but they would be unable to hold Pensacola Bay without Fort Pickens. In 1861, Union troops in Fort Pickens managed to hold the fort while besieged from the other two forts across the bay. Eventually reinforcements arrived and, shortly thereafter, the Confederacy was forced to abandon Pensacola and retreat further inland (Tidball 1996). Without the defense of Fort Pickens, the Confederacy would have controlled this important harbor. Until 1943, the government continued to modify and improve these forts and batteries by building new structures and planting vegetation to camouflage the existing batteries (Looney et al. 1993).

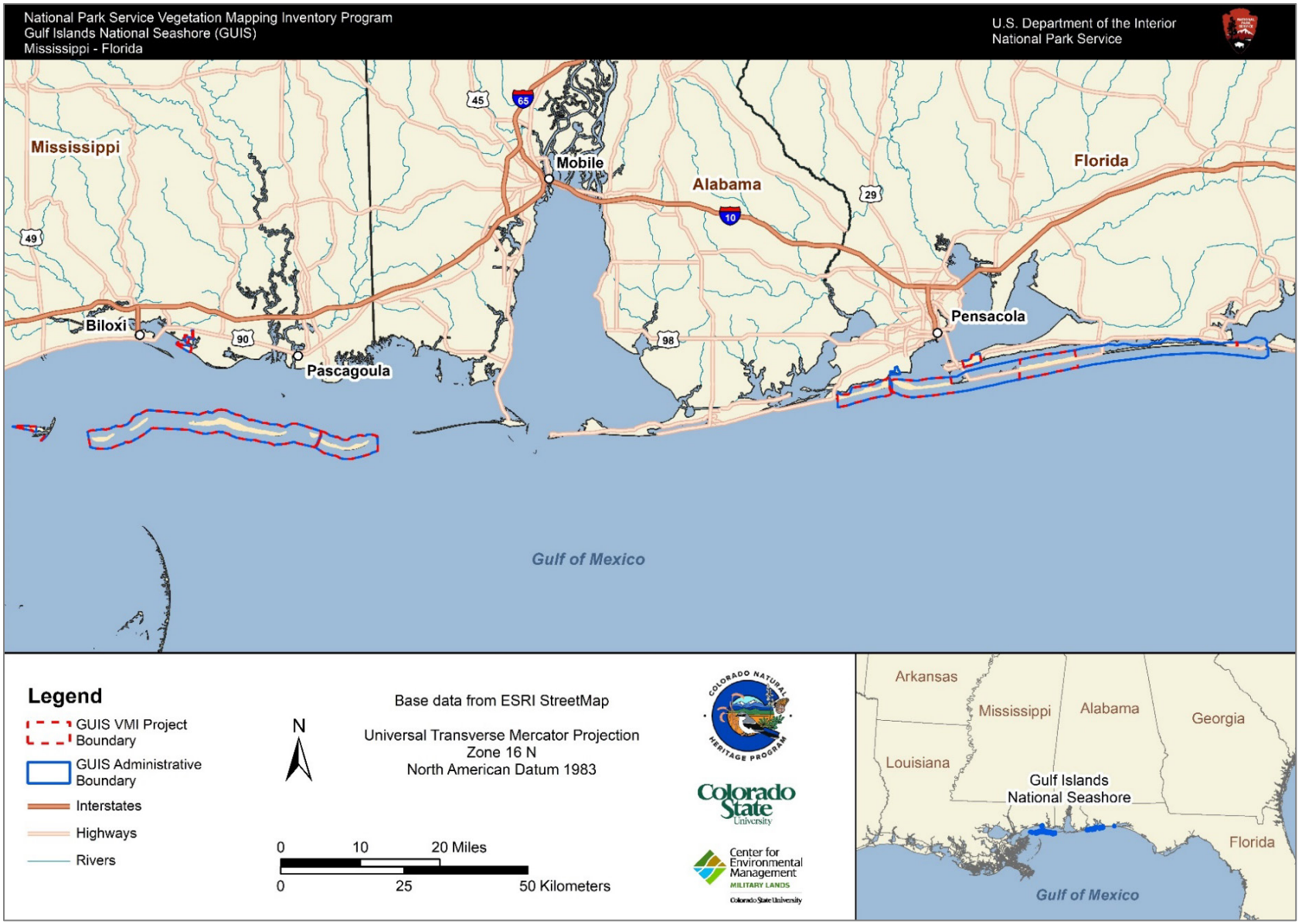


Figure 2. Administrative boundary of GUIS and the mapping project boundary. Background data from ESRI Streetmap.



Old batteries of Fort Pickens at GUIS (CSU Photo).

Physiographic Setting

GUIS consists of two management districts; one headquartered in Gulf Breeze, Florida, and the other in Ocean Springs, Mississippi. A majority of the area within the park administrative boundary is water/ocean. Land areas within the administrative boundary of the National Seashore consist of two mainland (Naval Live Oaks Reservation and Fort Barrancas) and four barrier island (Perdido Key, Fort Pickens, Santa Rosa Island, and Okaloosa Beach) areas in Florida and another mainland section (Davis Bayou) and six barrier islands (Petit Bois, Sand, Horn, East Ship, West Ship, and Cat Islands) in Mississippi (NPS 2014). The barrier islands in the Florida district are relatively near shore while the Mississippi barrier islands lie 13 to 20 km (8 to 12 mi) offshore.

GUIS is within the Southern Coastal Plain Level III ecoregion (USEPA 2013) (Figure 3):

> *The Southern Coastal Plain consists of mostly flat plains, but it is a heterogeneous region containing barrier islands, coastal lagoons, marshes, and swampy lowlands along the Gulf and Atlantic coasts. In Florida, an area of discontinuous highlands contains numerous lakes. This ecoregion is lower in elevation with less relief and wetter soils than the Southeastern Plains. It is warmer, more heterogeneous, and has a longer growing season and coarser textured soils than the Middle Atlantic Coastal Plain. Once covered by a variety of forest communities that included trees of longleaf pine, slash pine, pond pine, beech, sweetgum, southern magnolia, white oak, and laurel oak, land cover in the region is now mostly slash and loblolly pine with oak-gum-cypress forest in some low lying areas, citrus groves in Florida, pasture for beef cattle, and urban.*

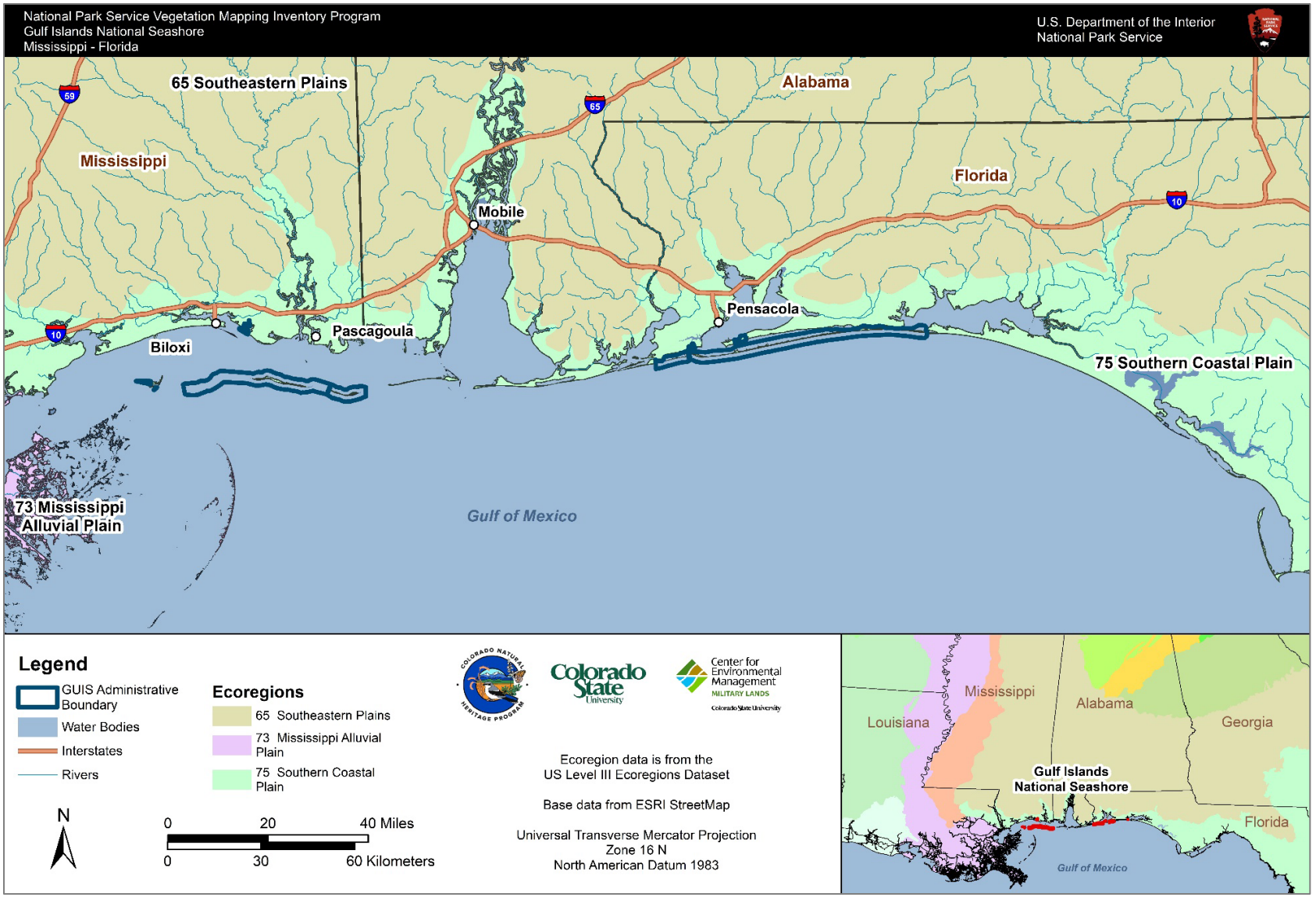


Figure 3. GUIS is located within the Southern Coastal Plain Level III ecoregions (USEPA 2013). (Background data from ESRI Streetmap)

Climate

The climate at GUIS is humid subtropical with mostly mild winters and hot, humid summers. Occasionally, temperatures fall below freezing for brief periods during the winter (Davey et al. 2007). The El Niño Southern Oscillation (ENSO) has a large impact on the climate at GUIS (Davey et al. 2007). During El Niño years, lower temperatures and increased precipitation are common in winter while La Niña years typically bring warmer, drought conditions during the winter (Davey et al. 2007). GUIS receives over 160 cm (63 inches) of rainfall annually (Davey et al. 2007).

GUIS has average annual temperatures ranging from approximately 18.1 degree Celsius (˚C) to 20˚C (64.5 degree Fahrenheit (°F) to 68°F) (Davey et al. 2007). July is typically the warmest month with a mean high temperature of 31.0 ˚C (87.8 °F). January is typically the coldest month with a mean low temperature of 5.0 ˚C (41 °F) (Davey et al. 2007).

Hurricane Disturbance and Ecological Response

Tropical storms and hurricanes occur regularly along the Gulf Coast and are important drivers of many natural processes at the National Seashore (NPS 2014). These storms have reshaped the islands at GUIS for centuries and the flora and fauna are well adapted to their impact. Often, following sediment deposition on the islands by hurricanes, early colonizers such as saltmeadow cordgrass (*Spartina patens*) and sea oats (*Uniola paniculata*) stabilize the sediments and lead to dune creation (Wolner et al. 2013). Once dunes are stabilized, woody species such as slash pine (*Pinus elliottii*), sand live oak (*Quercus geminata*) and other woody shrubs begin to colonize.

The frequency and intensity of tropical storms and hurricanes may be increasing (Bahr et al. 1983, Saunders and Lea 2008, Knutson et al. 2010, Klotzbach and Landsea 2015). In 2017, three hurricanes made landfall in the continental United States for the first time since 2008; Hurricanes Harvey, Irma, and Nate caused over $250 billion in damages (Blake and Zelinsky 2018, Cangialosi et al. 2018, Pasch et al. 2018). In 2017, and for the first time, two Category 4 hurricanes (Hurricanes Harvey and Irma), made landfall in the continental United States during the same year (Klotzbach and Bell 2017).

Barrier islands are incredibly dynamic systems that are constantly reworked through erosion and accretion by storm events, long-term currents, waves, sea level change, and available sediment supply (McBride et al. 1995, Bracewell 2018). Generally, barrier islands at GUIS have moved laterally from east to west due to longshore currents and southeasterly winds (Morton 2008). These islands are relatively small; most of them are <1 km (0.62 mi) wide with dunes ranging from 2 m to 3 m high (6.6 ft to 9.8 ft) (Stockdon et al. 2010). Large-scale developments along the shoreline and dredging and maintenance of shipping channels has greatly diminished available sediment supplies to the islands and accelerated their diminution (Feagin 2015, Ford 2014). In the past 150 years, the Mississippi islands have rotated counterclockwise and lost a considerable portion of their land area (e.g., Petit Bois Island lost 50%, Horn Island lost 20%, Ship Island lost 60%, and Cat Island lost 40% of their land area, respectively) (Morton 2008). Since 2018, the GULN monitors the geomorphology of these barrier islands along elevation transects and shoreline surveys (Bracewell 2018).

Storm surge is the most intensive aspect of tropical storms and hurricanes, undermining barrier islands' structure and vegetation through erosion, accretion, formation of overwash, and redistribution of estuarine sediments (Hayes 1978, Fahrig et al. 1993). Hurricanes and tropical storms often weaken barrier islands' protective dune fields potentially contributing to future island impacts. Without barrier islands, hurricane storm surge to the mainland could increase by ~1.3 m (4.1 ft) (Ford 2014). Because barrier islands play an important role in hurricane mitigation, the degradation of barrier islands over time may lead to increased mainland damage from future hurricanes and tropical storms (Ford 2014).

Hydrology and Water Resources

The watersheds of GUIS drain into the Gulf of Mexico, including four major hydrologic units: the Mississippi Coastal Sound, Perdido Bay, Pensacola Bay, and Choctawhatchee Bay. Pascagoula and Mobile Bay near GUIS play a significant role in sediment supply, pollution, and freshwater influx (Hatt et al. 2016). Water quality at GUIS is threatened by pollution associated with shipping lanes, commercial fishing, and oil refineries, and is influenced by circulating currents in the Gulf of Mexico. One stretch of water along the northern shore of the Naval Live Oaks area is listed as an impaired waterbody due to elevated mercury concentrations, organic enrichment due to depleted oxygen, and microorganism contamination (Hatt et al. 2016, Florida Department of Environmental Protection 2020).

Flora and Fauna

Habitats at GUIS include myriad marine and terrestrial habitats that house a variety of unique species. The flora along the barrier islands is richer and has a broader array of dominant growth forms than either the Pacific or Atlantic coasts (Barbour et al. 1985). GUIS contains a variety of rare and endangered species including shore birds, fish, sea turtles, gopher tortoises, and beach mice.

Four species of sea turtles are present at GUIS: the green sea turtle (*Chelonia mydas*), loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*), and Kemp's ridley (*Lepidochelys kempii*) (Hatt et al. 2016). The loggerhead sea turtle nests along Pensacola Beach from mid May to early August (Ogurcak and Berry 2000). More than 320 species of birds currently occur at GUIS. Beaches serve as important nesting grounds for many of these species such as the snowy plover (*Charadrius nivosus*), piping plover (*Charadrius melodus*) and least tern (*Sternula antillarum*) (Himes et al. 2006, Hatt et al. 2016).

Perdido Key and Santa Rosa Island provide the only known habitat for two endemic mice species: Perdido Key beach mouse (*Peromyscus polionotus* ssp. *trissyllepsis*) and Santa Rosa beach mouse (*Peromyscus polionotus* ssp. *leucocephalus*) (Hatt et al. 2016, Gore and Greene 2011). Perdido Key beach mouse historically ranged from Alabama to the Florida panhandle, but in 1982 hurricane impacts along the coast of Alabama destroyed valuable dune habitat and wiped out the local population there (Holler et al. 1989). Biologists reintroduced captive beach mice in the 1990s, but in 1995 Hurricane Opal decimated the population once again (Gore and Greene 2011). Compounding other stressors, hurricanes pose a serious threat for the future of these endemic mice species and may lead to the eventual extinction of both species (Oli et al. 2001).

Over 270 species of fishes are present at GUIS (Wilborn and Bennett 2006), including the threatened gulf sturgeon (*Acipenser oxyrinchus* ssp. *desotoi*). The expansion of non-native and invasive lionfish (*Pterois volitans* and *Pterois miles*) in the GUIS area could harm native marine wildlife populations in the future (Hatt et al. 2016). At GUIS, marine species rely extensively on seagrass beds for habitat, food, and nurseries (Carter et al. 2011). Five dominant species make up the seagrass beds: shoal grass (*Halodule wrightii*), star grass (*Halophila engelmannii*), widgeon grass (*Ruppia maritima*), manatee grass (*Syringodium filiforme*), and turtle grass (*Thalassia testudinum*) (Meiman and Segura 2019). A variety of anthropogenic disturbances such as changes in sediment loading and availability, commercial fishing, and shipping lanes (Meiman and Segura 2019) can cause seagrass beds to decline rapidly, often requiring a disturbance-free, multiple year period for full recovery (Fourqurean et al. 2003). The Mississippi Sound experienced a 63% decline of seagrass beds between 1940 and 1970 (Pham 2017).

Many vegetation communities along the Gulf Coast are highly dynamic and resilient to hurricane and tropical storm disturbance. Sea oats (*Uniola paniculata*) grasslands, slash pine (*Pinus elliottii*) communities, and dune vegetation communities (Eleuterius 1971, Stoneburner 1978, Gornish and Miller 2010, Anderson 2015) regenerate quickly following mild hurricane and tropical storm events. However, major hurricanes such as Hurricane Katrina (2005) can permanently alter vegetation communities on the barrier islands. East Ship Island is the most vulnerable barrier island along the Mississippi Sound. East and West Ship Island were once connected but Hurricane Camille (1969) split Ship Island in two (Schmid 2003, Otvos and Carter 2008). The storm surge from Hurricane Katrina (2005) severely eroded East Ship Island, leaving the island only 1.5 km (0.93 mi) long and 400 m (437 yards) wide (Fritz et. al. 2007, Hughes 2008, Otvos and Carter 2008). The hurricane's overwash killed roughly 100% and 80% of *Pinus* spp. on East Ship Horn Island, respectively (Otvos and Carter 2008). To date, little pine regeneration has occurred on East Ship Island and the island's once mature pine forests are unlikely to return without a significant restoration effort or a long recovery period. Since tropical storm frequency and intensity is expected to increase over the next century, the resiliency of these communities may decrease, resulting in lower species diversity and an overall decline in the extent of barrier island vegetation communities (Gornish and Miller 2010, Knutson et al. 2010).

Naval Live Oaks Reservation contains several longleaf pine (*Pinus palustris*) savannahs, which historically covered an extensive portion of Southeastern U.S. coastal plain (Blaustein 2008). These communities are known for exceptional amounts of diversity with many areas containing over 150 vascular plant species per hectare and an equivalent diversity of fauna, including the federally-listed gopher tortoise (*Gopherus polyphemus*) (Blaustein 2008, Hatt et al. 2016). Longleaf pine stands at Naval Live Oaks have undergone extensive fire suppression that has led to increased understory shrub density and reduced longleaf pine regeneration (Ruth 2003). The recent reintroduction of prescribed fire to the Naval Live Oaks area has improved habitat conditions enabling the return of many longleaf-obligate species (Ruth 2003).

Many areas of GUIS are impacted by non-native and invasive plant species that threaten to out compete native species and reduce biodiversity (Hatt et al. 2016). Non-native invasive plant species

that are of particular concern include cogongrass (*Imperata cylindrica*), Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), common reed (*Phragmites australis*), and Chinese tallow (*Triadica sebifera*). Cogongrass contributes to hotter and more intense fires that can kill native species and prohibit the use of prescribed burns. Park staff works to manage cogongrass and has successfully reduced the population at GUIS (Hatt et al. 2016). Arguably the worst non-native invasive species at GUIS is torpedo grass (*Panicum repens*), which outcompetes native species across a wide varieties of habitats. Torpedo grass has invaded many areas along the Mississippi barrier islands and requires repeated and aggressive treatments for effective control.

GUIS provides habitat for a number of rare plant species listed as imperiled and vulnerable at the global/state level. Table 2 lists 48 Florida Track List species of conservation concern from the Florida areas of GUIS (FNAI 2019). Mississippi Natural Heritage Program (2018) data from Harrison and Jackson Counties provided a Track List of 39 species of conservation concern for GUIS (Table 3) (MNHP 2018). Urbatsch et al. (2007) identified 18 state listed rare vascular plant species at GUIS, eight of which were listed as S1. They include chalky bluestem (*Andropogon virginicus* var. *glaucus*), Wright's rosete grass (*Dichanthelium wrightianum*), coastal sand frostweed (*Helianthemum arenicola*), Carolina desert-thorn (*Lycium carolinianum*), slenderleaf clammyweed (*Polanisia tenuifolia*), spreading pogonia (*Cleistes divaricata*), and dwarf live oak (*Quercus minima*). Rare plant species at the park are periodically surveyed by FNAI (FNAI 2019).

Table 2. Florida Track List species of conservation concern for Escambia and Santa Rosa Counties (FNAI 2019).

Scientific Name	Common Name	Global Rank	State Rank	State Status
Agalinis georgiana	Pine Barren False-foxglove	G1	S1	Endangered
Agrimonia incisa	Incised Groove-bur	G3	S2	Threatened
Andropogon arctatus	Pine-woods Bluestem	G3	S3	Threatened
Baptisia calycosa var. villosa	Hairy Wild Indigo	G3T3	S3	Threatened
Botrychium lunarioides	Winter Grape-fern	G4	S3	Not Listed
Calamovilfa curtissii	Curtiss' Sandgrass	G3	S3	Threatened
Calycanthus floridus	Sweet-shrub	G5	S2	Endangered
Carex baltzellii	Baltzell's Sedge	G3	S3	Threatened
Carex tenax	Sandhill Sedge	G5	S3	Not Listed
Chrysopsis godfreyi	Godfrey's Goldenaster	G2	S2	Endangered
Chrysopsis gossypina	Cruise's Goldenaster	G5T2	S2	Endangered
Cladium mariscoides	Pond Rush	G5	S1	Not Listed
Coelorachis tuberculosa	Piedmont Jointgrass	G3	S3	Threatened

Table 2 (continued). Florida Track List species of conservation concern for Escambia and Santa Rosa Counties (FNAI 2019).

Scientific Name	Common Name	Global Rank	State Rank	State Status
Eleocharis rostellata	Beaked Spikerush	G5	S1	Endangered
Epigaea repens	Trailing Arbutus	G5	S2	Endangered
Fothergilla gardenii	Dwarf Witch-alder	G3G4	S1	Endangered
Hexastylis arifolia	Heartleaf	G5	S3	Threatened
Ilex amelanchier	Serviceberry Holly	G4	S2	Threatened
Juncus gymnocarpus	Coville's Rush	G4	S2	Endangered
Kalmia gymnocarpus	Mountain Laurel	G5	S3	Threatened
Kalmia latifolia	Mountain Laurel	G5	S3	Threatened
Lachnocaulon digynum	Bog Button	G3	S3	Threatened
Lepuropetalon spathulatum	Little-People	G4G5	S1	Endangered
Lilium iridollae	Panhandle Lily	G2	S2	Endangered
Lilium superbum	Turk's Cap Lily	G5	S1	Endangered
Lindera subcoriacea	Bog Spicebush	G2G3	S1	Endangered
Lobelia boykinii	Boykin's Lobelia	G2G3	S1	Endangered
Macranthera flammea	Hummingbird Flower	G3	S2	Endangered
Magnolia ashei	Ashe's Magnolia	G2	S2	Endangered
Magnolia pyramidata	Pyramid Magnolia	G4	S3	Endangered
Malaxis unifolia	Green Adder's-mouth Orchid	G5	S3	Endangered
Myriophyllum laxum	Piedmont Water Milfoil	G3	S3	Not Listed
Najas filifolia	Narrowleaf Naiad	G1	S1	Threatened
Nuphar advena spp. Ulvacea	West Florida Cowlily	G5T2	S2	Not Listed
Pinguicula primuliflora	Primrose-flowered Butterwort	G3G4	S3	Endangered
Platanthera clavellata	Little Club-spur Orchid	G5	S1	Endangered
Platanthera integra	Yellow Fringeless Orchid	G3G4	S3	Endangered
Polygonella macrophylla	Large-leaved Jointweed	G3	S3	Threatened
Pteroglossaspis ecristata	Giant Orchid	G2G3	S2	Threatened
Quercus arkansana	Arkansas Oak	G3	S3	Threatened
Rhexia parviflora	Small-flowered Meadowbeauty	G2	S2	Endangered

Table 2 (continued). Florida Track List species of conservation concern for Escambia and Santa Rosa Counties (FNAI 2019).

Scientific Name	Common Name	Global Rank	State Rank	State Status
Rhododendron austrinum	Florida Flame Azalea	G3	S3	Endangered
Sarracenia rubra	Sweet Pitcherplant	G4	S3	Threatened
Schwalbea americana	American Chaffseed	G2	S1	Endangered
Sideroxylon thornei	Thorne's Buckthorn	G2	S1	Endangered
Stewartia malacodendron	Silky Camellia	G4	S3	Endangered
Tephrosia mohrii	Pineland Hoary-pea	G3	S3	Threatened
Xyris scabrifolia	Harper's Yellow-eyed Grass	G3	S3	Threatened
Xyris stricta var. obscura	Kral's Yellow-eyed Grass	G3T3	S1	Not Listed

Table 3. Mississippi Track List for species of conservation concern in Harrison and Jackson County (MNHP 2018).

Scientific Name	Common Name	Global Rank	State Rank
Aristida simpliciflora	Southern Three-awned Grass	G3G4	S1S2
Aristida spiciformis	Pine Barren Three-awned Grass	G4	S1
Calopogon multiflorus	Many-flower Grass-pink	G2G3	S1
Canna flaccida	Bandana-of-the-Everglades	G4?	S1
Carex verrucosa	Warty Sedge	G4	S1S2
Chamaecrista deeringiana	Florida Senna	G2G4Q	S1
Chasmanthium ornithorhynchum	Bird-bill Spikegrass	G4	S1S2
Coreopsis nudata	Georgia Tickseed	G3?	S1S2
Cyperus lecontei	Le Conte's Flatsedge	G4?	S1
Dichanthelium wrightianum	Wright's Witchgrass	G4	S1S2
Eryngium aquaticum	Marsh Rattlesnake-master	G4	S1
Fuirena longa	Coastal-plain Umbrella-sedge	G3G4	S1
Helianthemum arenicola	Coastal-sand Frostweed	G3	S1S2
Hibiscus coccineus	Brilliant Hibiscus	G4?	S1S2
Ipomoea macrorhiza	Large-stem Morning-glory	G3G5	S1

Table 3 (continued). Mississippi Track List for species of conservation concern in Harrison and Jackson County (MNHP 2018).

Scientific Name	Common Name	Global Rank	State Rank
Isoetes louisianensis	Louisiana Quillwort	G2G3	S2
Linum macrocarpum	Spring Hill Flax	G2	S2
Lobelia boykinii	Boykin's Lobelia	G2G3	S1
Lycium carolinianum	Carolina Wolf-berry	G4	S1
Myriophyllum laxum	Loose Water-milfoil	G3	S1
Paronychia erecta	Beach Sand-squares	G3G4	S1S2
Pieris phillyreifolia	Climbing Fetter-bush	G3	S1
Pinguicula pumila	Dwarf Butterwort	G4	S1
Pinus clausa	Sand Pine	G4	S1
Rhynchospora breviseta	Short-bristle Baldrush	G3G4	S1
Rhynchospora crinipes	Hairy-peduncled Beak-rush	G2G3	S1
Rhynchospora curtissii	Curtiss's Beakrush	G4	S1
Rhynchospora pleiantha	Brown Beakrush	G2G3	S1
Rhynchospora stenophylla	Chapman's Beakrush	G4	S1S2
Rhynchospora tracyi	Tracy's Beakrush	G4	S1
Sagittaria kurziana	Spring-tape Arrowhead	G4	S1
Scleria reticularis	Reticulated Nutrush	G4	S1
Spiranthes eatonii	Eaton's Ladies'-tresses	G2G4	S1
Spiranthes floridana	Florida Ladies'-tresses	G1	S1S2
Stylisma aquatica	Water Southern Morning-glory	G4	S1
Syringodium filiforme	Manatee-grass	G4	S1
Utricularia olivacea	Piedmont Bladderwort	G4	S1
Xyris flabelliformis	Fan-shaped Yellow-eyed Grass	G4	S1
Xyris serotina	Acid-swamp Yellow-eyed-grass	G3G4	S1

Vegetation Inventory and Classification

Methods

Vegetation community classification followed methodology by Lea (2011).

Legacy Data

Legacy data sources related to vegetation communities at GUIS were identified to support the project and evaluated using the TNC and NPS (2009) evaluation framework (Table 4, Table 5).

Table 4. Summary of legacy data evaluation using TNC and NPS (2009) criteria.

Category	Description
I	Data are adequate for classification and mapping (i.e., the data are geo-referenced, represent existing vegetation, and contain sufficient structural, compositional and site information to place the sample within the standard classification framework).
II	Data are adequate to assist in photo interpretation, photographic signature key development, or map accuracy assessment (i.e., the vegetation and site information are of lower quality, but the samples represent existing vegetation and are geo-referenced with reasonable confidence).
III	Data can be used for vegetation classification and characterization of a vegetation type within the park, but not for mapping or analysis because the sample is not adequately georeferenced, contains inadequate detail in the vegetation information, and/or may not represent existing vegetation at the sample location.
IV	Dat were assessed and found to be not useful at any level.
V	Data were not available for assessment.

Table 5. Legacy data sources and ratings for use in classification and mapping.

Data Source Citation	Description	Legacy Data Category
Urbatsch et al. (2007)	GUIS vascular plant inventory	III
FNAI [Florida Natural Areas Inventory] (2010)	Map and guide to the FNAI natural community classification system	IV
Snyder and Maisel (2008)	Pre and Post Hurricane Ivan Assessment of Barrier Island Plant Community Dynamics at GUIS	III
Laine and Ramsey (1998)	Landcover Classification for Padre Island National Seashore	IV

Legacy data had limited value for classification and mapping (Table 5), but provided qualitative information to support classification.

Sample Design

Sample Size

Based on the number of types identified by the preliminary classification, it was estimated that approximately 180 vegetation classification plots would be needed to represent approximately 60 vegetation types. Additional data from 100 to 200 observation points were targeted to support the mapping process.

Sampling Strata

Accessibility and Safety Layer

Areas with deep water or the presence of dangerous species (e.g., alligators) were considered inaccessible or too hazardous for field work. Several wetland areas on the Mississippi barrier islands bordered large freshwater ponds. These ponds make an excellent habitat for alligators and field crews avoided the wetlands near these large ponds.

Plot Allocation

Opportunistic plot sampling was the primary form of data collection. Initially, crews located representative examples of each vegetation community from the list of preliminary community types. Crews also sampled any recurring unique habitats that were not represented on the preliminary community type list. Sites were sampled using either the vegetation plot or observation point method. To aid field crews in capturing the diversity of vegetation communities, target destinations were selected using aerial imagery prior to field work.

Vegetation Data Collection

Vegetation classification plots were sampled in the summer of 2016 by two 2-person crews and a crew leader. Crews were housed in a private rental house in Gulf Breeze, Florida, and in dormitories at the University of Southern Mississippi Gulf Coast Research Laboratory. Data were collected using a combination of Collector for ArcGIS and paper data forms. Field sampling locations were accessed from roads using four-wheel drive vehicles and from boats with the assistance of GUIS staff.

The goal of vegetation classification sampling was to survey a minimum of three plots per vegetation association and to document as many vegetation types as possible within the park. Crews used project area maps with target locations and a list of 60 potential vegetation types to guide field work. Since GUIS is diverse with many remote islands, crews were hired for their ability to work in variable outdoor conditions, to hike long distances, and to make careful and effective choices to optimize route efficiency.

Crew members were provided with a field manual describing the field forms and plot sampling methodology, backcountry safety, plant species lists, and accepted plant species codes. Crews were provided with tablets and GPS units loaded with random and subjective plot locations to help disperse the effort across ecological types and gradients.

Field forms documented the plot location, environmental attributes, vegetation attributes, and comments/notes (Table 6).

Table 6. Specific attributes recorded on the vegetation plot form.

Section	Attributes
Location Information	Plot code, plot type, survey date, surveyors, provisional community name, UTM zone and coordinates, GPS accuracy, comments, plot shape, plot dimensions, camera number, photo numbers, representativeness of the vegetation to the provisional association, and representativeness of the plot within the stand.
Environmental Attributes	Slope, aspect, topographic position, landform, surficial geology, Cowardin class, hydrology, soil texture, soil drainage, percent ground cover, and environmental comments.
Vegetation Attributes	Leaf phenology, leaf type, physiognomic class, height class, cover class, dominant species by strata, vegetation comments, species list for all species in the plot indicating stratum and cover class, and any additional species outside the plot.

Plot locations were all located in front-country less than approximately 3 hours travel time from vehicle to accessible points. Many sites were accessed via boat. During the classification phase, GUIS staff provided boat support to and from the Mississippi barrier islands. The CSU team chartered fishing vessels for island access during subsequent island trips after the classification phase.

Overview of the Data Collection and Plot Sampling Process

Efficient sampling required careful planning and consideration of the proximity of sampling plots to roads, trails, topography, and vegetation. Crews planned routes to collect the most plots in the most different potential vegetation types while minimizing travel time.

Crews navigated to plots via motor vehicle, boat, or foot travel using a compass and GPS-enabled tablets running Collector for ArcGIS software. After arriving at a selected site, crews examined the habitat to understand plot vegetative characteristics, determine if the plot was representative of the vegetation, and determine if the plot met the 0.5 ha (1.2 ac) minimum mapping unit size.

If the plot was too heterogeneous or too close to an ecotone, crews moved further to the patch interior (within the standards of project methodology) to a position having more homogeneous structure and/or composition. If the plot was opportunistic, crews determined whether the plot represented a provisional community type still needing to be sampled, and if so, sampled it using either a classification plot or an observation point. Observation points document vegetation structure, dominant species, and environmental attributes using the same forms and instructions as for full vegetation plots, but the information gathered is less detailed. Observation points are very useful for the photo interpreters as training/reference sites.

While navigating to and from selected plots, crew members paid attention to the vegetation types they were passing through. If they observed a new or different undocumented vegetation type, they established a vegetation plot.

At each sampling location, plot layout and data collection followed NPS VMI Program protocols (Lea 2011). Due to the ephemeral nature of barrier islands field crews did not leave permanent plot

markers. Crews recorded the GPS UTM coordinates for the plot center, then laid out the plot using measuring tapes and flagging according to the size and shape specified in the field manual for that vegetation type; most plots were 400 m^2 and square. Plots consisting of forest, woodland, and shrubland were typically 20 x 20 m^2 with plot shape adapted to best fit the existing vegetation. Circular plots with an 11.3 m radius were used in areas with dwarf shrub and herbaceous vegetation, and more linear 10 x 40 m plots were used in narrow riparian areas.

Following plot setup crews analyzed the vegetation structure by visually dividing vegetation into vertical strata and recorded dominant species and percent cover in each stratum. Crews developed a comprehensive plot species list by recording the species name and canopy cover class for each stratum. Cover values were assessed using cover ranges from a twelve-category scale (Table 7). Crews selected the cover class that best represented the actual cover of the species in the stratum. The midpoint of the cover range is used for quantitative analysis.

Table 7. Canopy cover classes used for plot sampling.

Cover Class	Cover Range	Midpoint
Trace	0–1	0.5
Present	1–5	3.0
1	5–15	10.0
2	15–25	20.0
3	25–35	30.0
4	35–45	40.0
5	45–55	50.0
6	55–65	60.0
7	65–75	70.0
8	75–85	80.0
9	85–95	90.0
10	>= 95	97.5

Recorded data included a relative measure of how well plot vegetation represented the surrounding vegetation as well as site environmental characteristics such as slope, aspect, topographic position, landform, soil texture, and percent ground cover.

All data were collected using iPad Pro tablets, Collector for ArcGIS, and paper field forms. Plot photos were taken with iPad cameras and linked to Collector points according to cardinal directions (north, east, south, and west). If crews were unable to take cardinal direction photos due to thick vegetation, a single representative photograph of the overall plot was taken.

Before removing plot markers, crews assigned one of the preliminary vegetation types to the plot. If the plot did not fit into a known vegetation type, the crew assigned a type based on the dominant species in the top two strata. When the plot information was complete, crews navigated to the next nearest plot. Plant species recorded during plot sampling are listed in Appendix C.

Classification

Data Management

Field forms were reviewed for accuracy and completeness and data were entered into NPS PLOTS database version 4.0 (CNHP 2015). Corrections were recorded in red with the reviewer's initials and the date. Data entered into the PLOTS database were subject to a quality control process that involved examining, sorting, and querying data to locate missing or erroneous information such as misspellings, duplicate entries, or typographical errors. Plant nomenclature followed the USDA NRCS PLANTS Database (2019) approved names and plant codes. Recorded species lists for each plot were compared to assigned vegetation type to ensure agreement.

Each plot or observation point was labeled with the provisional classification name assigned by the crew in the field. The provisional classification is a subjective classification based on the plot composition and vegetation structure.

Photos collected at vegetation and observation plots were uploaded to the GUIS vegetation inventory folder and renamed using a convention indicating the park name, plot number and cardinal direction of the photo.

Vegetation Classification

Vegetation plot data were classified to plant community using a combination of quantitative multivariate analysis and expert opinion. The quantitative analysis used data from the 223 vegetation classification plots that passed quality control and were entered into the PLOTS 4.0 database. Prior to being analyzed, observation point data that did not include detailed species and cover values were removed from the classification dataset.

A list of species and their associated cover data for the 223 vegetation classification plots was exported from the PLOTS 4.0 database. The mid-point of each cover class range was used as a discrete canopy cover value for analysis and descriptive purposes. Since most species tend to dominate in a single stratum for a given plot, each species' cover values for all strata were summed (with a maximum combined cover of 100% per species). Canopy cover values for all strata combined were organized into a plot-by-species matrix within a spreadsheet. Text files were then imported into the multivariate statistics software package PC-ORD version 6.0 (McCune and Mefford 2011).

A *priori* breaks in the dataset were based on physiognomy of the dominant species in the uppermost strata of the plots (e.g., wooded, shrubland, herbaceous). The divisions simplified the analysis to prevent ecologically unrelated community types from being compared or combined. Plots that had only one or two strongly dominant species and that did not relate to other plots (e.g., cattail marsh with 90% *Typha domingensis*) were separated out for analysis using qualitative expert review.

Each of the groups was analyzed using hierarchical cluster analysis applying the Sorenson (Bray-Curtis) distance measure method and group average linkage method (McCune and Grace 2002). The output of the analysis suggested natural groupings of plots for comparison with the concepts of the USNVC associations in the preliminary classification. Decisions on how to refine the dendrograph were first based on natural groupings followed by additional examination of the plot groupings. This analysis considered environmental characteristics of the plot and species composition, as well as the field crew provisional plot community name. When association-level classification was necessary, further group division involved examining plot data such as species composition, environmental data, and plot notes using Microsoft Access and Microsoft Excel. Using these combined data, plots were assigned to existing USNVC associations or given provisional names. Classification of observation points data to USNVC types was also based on this approach. Provisional associations, or "park specials," were created to represent associations when we were unable to confidently assign an existing USNVC type. Park special types are not currently part of the USNVC.

Field reconnaissance visits to verify map classes during the mapping phase of the project also identified existing USNVC associations that were not captured during the classification collection phase. These associations were documented and added to the list of associations classified in the park.

Association Descriptions

Vegetation descriptions of each association found at GUIS were developed from the plot data and are referred to as "local descriptions." Included in each local description is the USNVC hierarchy placement, typical environmental setting, plots of occurrence, and vegetation composition, structure, stratum, and dominance. In comparison, the published global descriptions incorporate all known plot data across the type's entire range. Typical global types occur across a wide geographic range resulting in broader characteristic descriptions. These global environmental and vegetation descriptions were compiled for the GUIS project. Local and global descriptions for GUIS associations are provided in Appendix A.

Field Key to the Community Types

A dichotomous field key to communities was developed (Appendix B). The key is stratified by physiognomy (sub-keys) and written to be nominally redundant for those types with confusing physiognomy and classification. Built-in redundancy enables the same association to be identified from multiple sub-keys. For instances, a type that occurs both as a shrubland or a woodland can be found in both sub-keys for each respective physiognomic group.

Results

A total of 44 distinct GUIS vegetation communities including USNVC associations and park specials were identified. Of these associations, herbaceous communities are the most abundant at GUIS.

Vegetation Data Collection

Prior to field sampling, the 2016 preliminary classification included 60 USNVC vegetation types. This list of preliminary communities was created before visiting GUIS based on range maps of communities in Florida and Mississippi. Field crews noted that the preliminary classification focused

on mainland types rather than barrier island types, so more preliminary associations were included on the list than were found at GUIS. Additionally, a majority of the USNVC barrier island communities were absent from the preliminary classification. Field crews provisionally assigned 9 preliminary USNVC types and 29 USNVC types that were not listed in the preliminary classification.

Over the course of the field season a total of 250 vegetation plots and observation points were established within the GUIS project area (Figures 4 and 5). Of these, 223 were full vegetation plots and 27 were observation points.

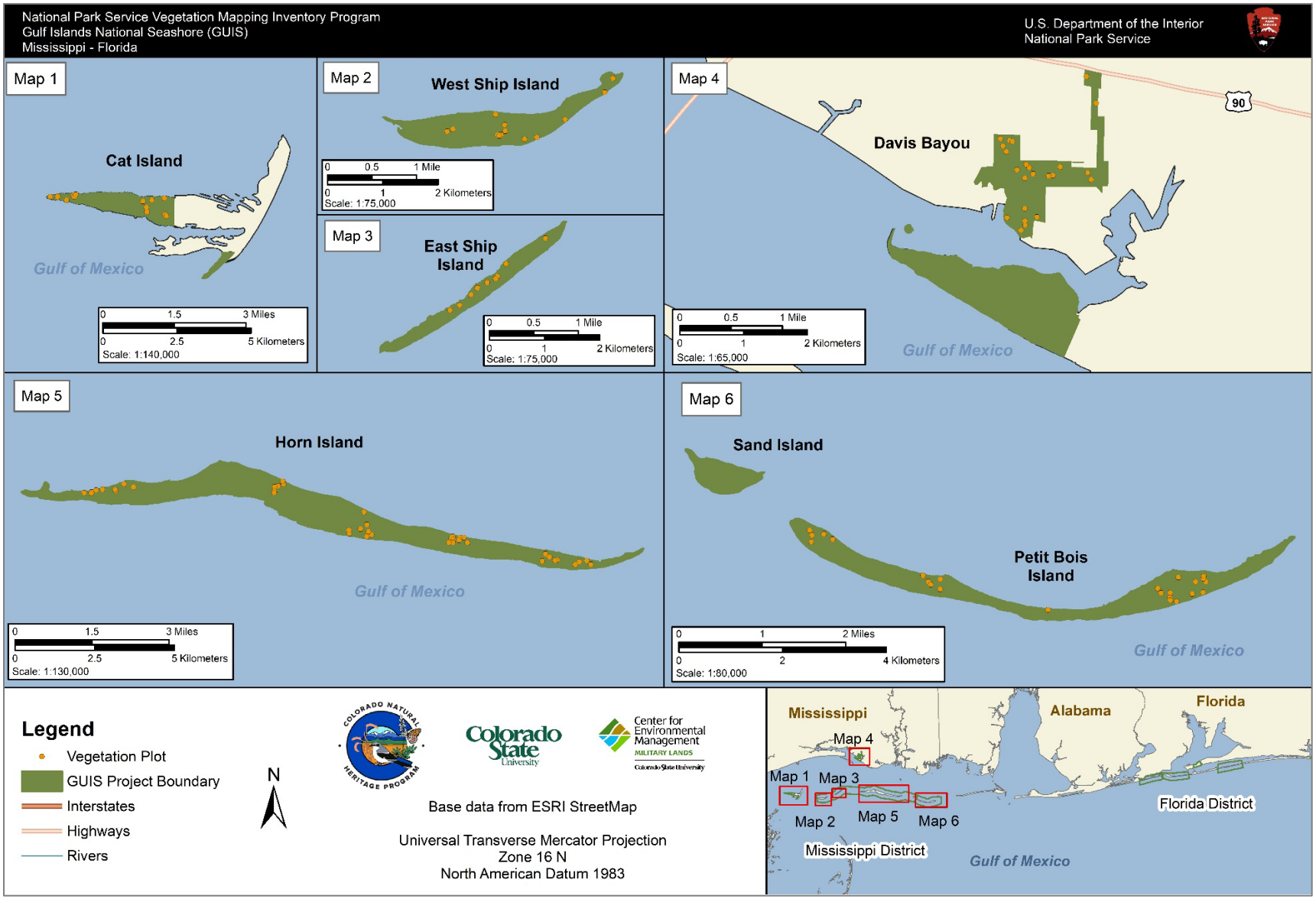


Figure 4. Location of vegetation plots and observation points within the Mississippi District at GUIS. (Background data from ESRI Streetmap)

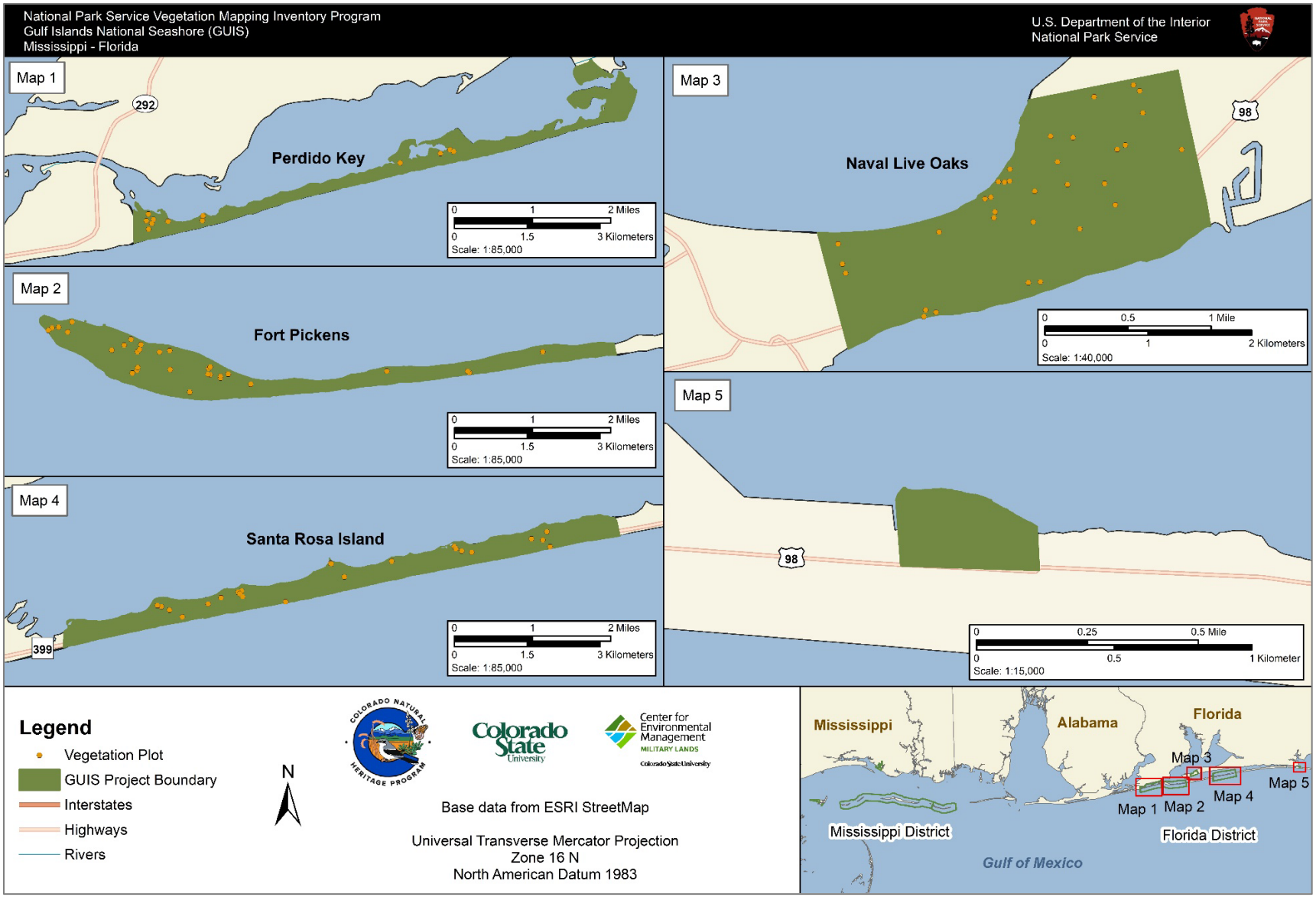


Figure 5. Location of vegetation plots and observation points within the Florida District at GUIS. (Background data from ESRI Streetmap)

A total of 372 plant species were encountered at GUIS. The most common species were *Baccharis halimifolia*, *Ilex vomitoria*, *Juncus roemerianus*, *Morella cerifera*, *Pinus elliottii*, *Quercus geminata*, *Schizachyrium maritimum*, *Serenoa repens*, and *Spartina patens.*

Vegetation Classification

The vegetation classification at GUIS consists of 44 associations or park specials: 18 forest or woodland, 7 shrubland, 17 herbaceous, and 2 sparse vegetation types. Five types are park specials not contained in the USNVC. Of the 250 classification plots and points, 63 are forest or woodland types, 60 shrublands, 114 herbaceous types, and 13 sparse vegetation types. A complete list of vegetation classification plots and observation points and their classified vegetation community type is included in Appendix D. Appendix A contains descriptions for all GUIS vegetation types.

The vegetation classification field inventory did not account for a number of preliminary or expected vegetation classification types. After the initial field inventory and during the mapping reconnaissance and validation phase of the project, an additional six associations were added. Many of these types were rare and only assigned to a few points. Type determinations from one or more location per type were based on plot data.

Forest and woodland types at GUIS were dominated by *Ilex vomitoria*, *Morella cerifera*, *Pinus clausa, Pinus elliottii*, *Serenoa repens*, and *Quercus geminata* (Table 8).

Table 8. Forest and woodland types documented at GUIS.

ELCODE	Association Name
CEGL003554	*Pinus clausa* / *Quercus geminata – Quercus myrtifolia – Conradina canescens* Woodland
CEGL003638	*Pinus elliottii / Cliftonia monophylla – Cyrilla racemiflora* Swamp Forest
CEGL003673	*Pinus elliottii* var. *elliottii – (Pinus serotina) / Aristida beyrichiana – Rhynchospora oligantha – Sarracenia* spp. Woodland
CEGL004680	*Pinus elliottii* var. *elliottii / Serenoa repens – Ilex glabra – Morella cerifera – Ilex vomitoria* Woodland
CEGL004958	*Pinus elliottii* var. *elliottii / Spartina patens – Juncus roemerianus – (Panicum virgatum)* Tidal Woodland
CEGL004658	*Pinus elliottii* var. *elliottii – (Pinus palustris) / Ilex vomitoria – Serenoa repens – Morella cerifera* Woodland
CEGL003656	*Pinus palustris – (Pinus elliottii* var. *elliottii) / Ilex coriacea – Cyrilla racemiflora* Woodland
NPSGUIS005	*Pinus elliottii – Quercus myrtifolia – Quercus geminata* Scrub Woodland
CEGL007019	*Quercus geminata / Serenoa repens – Ilex vomitoria – (Sideroxylon lanuginosum) Forest*
CEGL007020	*Quercus geminata – (Quercus virginiana) / Serenoa repens – Lyonia fruticosa* Forest
CEGL007028	*Quercus virginiana / Vaccinium arboreum – Ilex vomitoria* Forest

Table 8 (continued). Forest and woodland types documented at GUIS.

ELCODE	Association Name
CEGL007032	*Quercus virginiana – (Pinus elliottii* var. *elliottii, Sabal palmetto) / Persea borbonia – Callicarpa americana* Forest
CEGL007156	*Nyssa biflora – Magnolia virginiana – (Pinus elliottii* var. *elliottii) / Morella (caroliniensis, inodora)* Swamp Forest
CEGL008477	*Nyssa biflora – Liquidambar styraciflua / Magnolia virginiana / Hamamelis virginiana – Viburnum nudum* Swamp Forest
CEGL002419	*Nyssa aquatica* Swamp Forest
CEGL004638	*Quercus nigra* Ruderal Forest
CEGL007225	*Quercus alba – Carya glabra – Carya alba / Aesculus pavia* Forest
CEGL004965	*Fagus grandifolia – Magnolia grandiflora – Quercus michauxii – Quercus nigra / Rhododendron canescens* Forest

Shrubland dominant species included *Baccharis halimifolia*, *Ilex vomitoria*, *Morella cerifera*, *Serenoa repens*, and/or *Quercus geminata* (Table 9).

Table 9. Shrubland types documented at GUIS.

ELCODE	Association Name
CEGL003813	*Ilex vomitoria – Quercus (geminata, virginiana) – Morella cerifera – Serenoa repens* Shrubland
CEGL003824	*Quercus myrtifolia – Quercus geminata – Ceratiola ericoides – Conradina canescens* Shrubland
CEGL003920	*Baccharis halimifolia – Iva frutescens – Morella cerifera – (Ilex vomitoria)* Saline Shrubland
CEGL003839	*Morella cerifera / Spartina patens* Wet Shrubland
CEGL003844	*Cyrilla racemiflora – Lyonia lucida* Wet Shrubland
CEGL003864	*Ceratiola ericoides – (Chrysoma pauciflosculosa) / Polygonella polygama / Cladonia leporina* Shrubland
CEGL003947	*Chrysoma pauciflosculosa – Paronychia erecta* Dwarf Shrubland

Herbaceous types were highly variable and included salt marsh, dune, and disturbed communities (Table 10). The dominant species included *Heterotheca subaxillaris*, *Juncus roemerianus*, *Panicum amarum*, *Schizachyrium maritimum*, *Spartina patens*, and *Uniola paniculata*.

Sparse vegetation communities consist of bare sand occurring on beaches and areas disturbed by Hurricane Nate (Table 11). The extent and composition of these communities are highly variable and subject to change from ongoing and periodic disturbance.

Table 10. Herbaceous types documented at GUIS.

ELCODE	Association Name
NPSGUIS001	*Panicum repens* Ruderal Grassland
CEGL004041	*Uniola paniculata – Panicum amarum* var. *amarum – Iva imbricata* Grassland
NPSGUIS002	*Uniola paniculata* Grassland
CEGL004001	*Iva imbricata / Uniola paniculata – Helianthus debilis* spp. *debilis* Grassland
CEGL004057	*Schizachyrium maritimum – (Heterotheca subaxillaris)* Grassland
CEGL004234	*Smilax auriculata / Heterotheca subaxillaris – Strophostyles helvola – (Uniola paniculata)* Grassland
CEGL004953	*Fuirena scirpoidea – Panicum tenerum – Dichanthelium wrightianum – Andropogon capillipes* Grassland
CEGL004186	*Juncus roemerianus* Salt Marsh
CEGL008456	*Typha domingensis* Salt Marsh
CEGL004178	*Cladium mariscus* ssp. *jamaicense* Tidal Salt Marsh
CEGL004187	*Phragmites australis s*sp. *australis* Tidal Ruderal Marsh
CEGL004962	*Panicum virgatum – (Cladium mariscus* ssp. *jamaicense, Juncus roemerianus)* Salt Marsh
CEGL004755	*Spartina patens – Schoenoplectus (americanus, pungens) – (Distichlis spicata)* Salt Marsh
CEGL004190	*Spartina alterniflora – Juncus roemerianus – Distichlis spicata* Louisianan Zone Tidal Salt Marsh
CEGL004110	*Fimbristylis castanea – Paspalum distichum* Marsh
CEGL007718	*Carex striata* var. *striata – Xyris fimbriata – Lachnanthes caroliniana* Marsh
CEGL002386	*Nuphar advena – Nymphaea odorata* Aquatic Vegetation

Table 11. Sparse vegetation types documented at GUIS.

ELCODE	Association Name
NPSGUIS003	Beach Bare Sand
NPSGUIS004	Hurricane Impact Area

Non-native Plant Species of Concern

Of the non-native plant species present at GUIS, only two had patches large enough to warrant their own communities. *Panicum repens* and *Phragmites australis* were classified and mapped as NPSGUIS001 and CEGL004187, respectively. The largest patches of these communities occurred on the Mississippi barrier islands, although smaller patches occurred throughout GUIS. Other exotic species of concern were less common and formed minor components of other communities. For example, Chinese tallow (*Triadica sebifera*) occurred as a tree and shrub within many of the mesic

forest and woodland communities at Davis Bayou, Naval Live Oaks Reservation, and along the western end of Perdido Key with cover typically less than 10%. Communities impacted by Chinese tallow at GUIS include: *Nyssa biflora - Liquidambar styraciflua* / *Magnolia virginiana* / *Hamamelis virginiana - Viburnum nudum* Swamp Forest (CEGL008477); *Pinus elliottii* / *Serenoa repens - Ilex glabra - Morella cerifera - Ilex vomitoria* Woodland (CEGL004680); *Pinus elliottii* / *Spartina patens - Juncus* roemerianus - (*Panicum virgatum*) Tidal Woodland (CEGL004958); *Nyssa aquatica* Swamp Forest (CEGL002419), *Quercus nigra* Ruderal Forest (CEGL004638); *Quercus virginiana* - (*Pinus elliottii*, *Sabal palmetto*) / *Persea borbonia - Callicarpa americana* Forest (CEGL007032); and *Nyssa biflora - Magnolia virginiana* - (*Pinus elliottii*) / *Morella* (*caroliniensis*, *inodora*) Swamp Forest (CEGL007156).

Another invasive plant, cogongrass (*Imperata cylindrica*), has been successfully managed at GUIS and is largely eradicated from Davis Bayou. Several small pockets occur on the Mississippi barrier islands including Horn and Petit Bois. Cogongrass typically occurred within the *Schizachyrium maritimum* – (*Heterotheca subaxillaris*) Grassland (CEGL004057) and may also be invading other dune herbaceous communities such as the *Uniola paniculata – Panicum amarum* var. *amarulum – Iva imbricata* Grassland (CEGL004041) and the *Uniola paniculata* Grassland (NPSGUIS002).

Japanese privet (Ligustrum japonicum) was found in the Davis Bayou area in the Fagus grandifolia - Magnolia grandiflora - Quercus michauxii - Quercus nigra / Rhododendron canescens Forest (CEGL004965) and Nyssa biflora - Liquidambar styraciflua / Magnolia virginiana / Hamamelis virginiana - Viburnum nudum Swamp Forest (CEGL008477) communities. Overall cover appeared low compared to other Japanese privet-invaded stands around the southeastern United States.

Beach vitex (*Vitex rotundifolia*), a coastal species with very high invasive potential, was found along the southern shore of Naval Live Oaks Reservation in the *Uniola paniculata - Panicum amarum* var. *amarulum - Iva imbricata* Grassland (CEGL004041). Additional monitoring is needed to help manage this species.

Rare Plant Species of Concern

Vegetation communities at GUIS contain a number of rare plant species of concern. Within the longleaf pine (*Pinus palustris*) savannahs of Naval Live Oaks, the *Pinus elliottii* – (*Pinus serotina*) / *Aristida beyrichiana – Rhynchospora oligantha - Sarracenia* spp. Woodland (CEGL003673) contains the threatened grass *Calamovilfa curtissii*. This community occurred within small moist depressions just north of Gulf Breeze Parkway. Although not found during our surveys, the endangered forb *Schwalbea americana* may occur within the *Pinus elliottii* – (*Pinus palustris*) / *Ilex vomitoria – Serenoa repens – Morella cerifera* Woodland (CEGL004658) in Naval Live Oaks.

Within dune complexes of both the Florida and Mississippi districts, the endangered forbs *Chrysopsis godfreyi* and *Chrysopsis gossypina* were relatively abundant in the *Schizachyrium maritimum* – (*Heterotheca subaxillaris*) Grassland (CEGL004057), *Uniola paniculata – Panicum amarum* var. *amarulum – Iva imbricata* Grassland (CEGL004041), *Smilax auriculata* / *Heterotheca subaxillaris – Strophostyles helvola* – (*Uniola paniculata*) Grassland (CEGL004234), *Chrysoma pauciflosculosa – Paronychia erecta* Dwarf Shrubland (CEGL003947), *Ilex vomitoria – Quercus*

(*geminata*, *virginiana*) – *Morella cerifera – Serenoa repens* Shrubland (CEGL003813), and *Quercus myrtifolia – Quercus geminata – Ceratiola ericoides – Conradina canescens* Shrubland (CEGL003824) communities.

Photographic Database

A total of 989 vegetation plot photos were collected during the vegetation classification field sampling effort. During the accuracy assessment (AA) phase four photos were taken per plot for an additional 2,706 AA point photos. The photo database contains a total of 3,695 photos. Vegetation plot photos were collected over the summer of 2016, winter 2017, and spring 2018. AA point photos were collected over the summer of 2018.

Each photo is georeferenced and can be accurately projected in ArcGIS, Google Earth, or another program capable of mapping features with georeferenced coordinates. The photos for this project have also been incorporated into a photo viewer database accessible through ArcMap. This allows the user to access photos and other plot data when viewing each point in ArcMap. The photo viewer database is included in the project deliverables.

Vegetation Mapping

The mapping phase of the project included image acquisition, examination of legacy data, mapping model development that accommodates existing vegetation types within interpretable map classes, field reconnaissance, polygon classification and delineation, field verification, and database development.

Methods

Map Specifications

Map specification product details are described below.

Map extent: Mapped regions included all NPS-owned areas inside the GUIS boundary. Polygons outside this area were not mapped, visited, or sampled.

Minimum Mapping Unit (MMU): The image interpreter used a minimum mapping unit/polygon size of 0.5 ha (1.24 ac). Polygons smaller that the minimum mapping unit were assigned the map class of the predominant adjacent map class. A few polygons in Davis Bayou were retained below the MMU as these communities were part of a larger community that extended outside of the GUIS boundary.

Thematic Accuracy: The desired minimum map class thematic user accuracy across all vegetation classes is 80%.

Imagery Acquisition and Data Management

Remote-sensing imagery provides the foundation for mapping vegetation types and other land cover classes. New imagery was purchased from Hexagon Imagery Program (HxIP) for the GUIS mapping project. This imagery was delivered as 4-band (RGB and CIR) high-resolution orthoimages with 2016 15 cm resolution for Florida and 2014 30 cm resolution for Mississippi. The 15 cm imagery has a positional accuracy of ≤0.5 m while the 30 cm imagery has a positional accuracy of ≤1.2 m.

Specifications for the HxIP imagery included the following:

- Total area for new acquisition of 446 km^2 (173 mi^2)
- Cloud cover <3% for 15 cm imagery and <10% for 30 cm imagery
- Allowable Ground Sample Distance: 0.2 m for 15 cm imagery and 0.4 m for 30 cm imagery

A variety of other existing imagery sources also supported mapping (Table 12). Additional imagery included Farm Service Agency (FSA) 50 cm 2016 (Mississippi) and 2017 (Florida) National Aerial Imagery Program (NAIP), Mississippi Digital Earth Model (MDEM) 2016 and 2017 15 and 30 cm true color imagery, as well as current and historical true-color Google Earth and Bing Maps imagery. In addition, National Oceanic Atmospheric Administration (NOAA) National Geodetic Survey (NGS) 2017 15 cm true color post-Hurricane Nate imagery assisted with remapping the Mississippi barrier islands following Hurricane Nate.

Table 12. Specifications for imagery used for the GUIS vegetation mapping project.

Product	Data Source	Year	Resolution	Bands
2017 NOAA NGS Post Hurricane Nate (MS only	NOAA NGS	2017	15 cm	RGB
2017 Florida NAIP	USDA-FSA	2017	50 cm	RGB
2017 MDEM (Jackson County MS)	MDEM	2017	15 and 30 cm	RGB
2016 MDEM (Harrison County MS)	MDEM	2016	15 and 30 cm	RGB
2016 Mississippi NAIP	USDA-FSA	2016	50 cm	RGB
2016 HxIP (Florida and Davis Bayou)	HxIP	2016	15 cm	RGB, CIR
2015 Florida NAIP	USDA-FSA	2015	100 cm	RGB
2014 HxIP (Mississippi Islands)	HxIP	2014	30 cm	RGB, CIR
2014 Mississippi NAIP	USDA-FSA	2014	100 cm	RGB

In addition to using aerial and satellite imagery, 2016 Topographic/Bathymetric Light Detection and Ranging (LiDAR) data available from the Unites States Army Corps of Engineers (USACE) National Coastal Mapping Program (NCMP) was used to analyze vegetation structure, density, and height. . LiDAR data were collected with an average point spacing of 0.55 m for all coastal areas at GUIS. Digital Height Models (DHM) and Digital Elevation Models (DEM) were created to further refine breaks between different vegetation communities (e.g., forest to shrubland transition). The use of this publicly available product drastically improved the GUIS vegetation map.

Legacy Data

Prior to field work CSU worked with NPS staff to identify a variety of legacy datasets and spatial data that could support vegetation classification and mapping at GUIS. Legacy data were evaluated using the TNC and NPS (2009) evaluation framework (see section 2.1.1). Overall, no legacy datasets supported the mapping ffort.

Map Classes and Mapping Model

The conceptual mapping model takes into account mapping classes and the natural/ruderal USNVC vegetation associations. Choosing an appropriate mapping model has important implications for the utility and accuracy of the final map. An optimized mapping model provides the highest thematic detail while meeting required standards of accuracy. The ideal model would have the most detailed desired level of the USNVC (e.g., association or alliance) represented by a single map class.

To initiate mapping model development, an understanding of each vegetation community's type concept and type complexities was necessary. A careful review of the preliminary vegetation classification and consideration of ruderal/semi-natural vegetation and other non-vegetated land use types was performed. Preliminary vegetation classification provided a starting point for identifying potential map classes and formed the foundation for mapping model development. The 2017 vegetation community's classification used 2016 quantitative vegetation plot inventory data and

produced a near complete list of GUIS community types. Numerous collaborative meetings between CEMML and CNHP aided mapping reconnaissance, refining map classification, and documenting vegetation communities not documented during the vegetation classification phase.

The mapping model reflects interpretation limitations given the available data, imagery, time, and other resources available for field reconnaissance and verification. It incorporates challenges related to distinguishing vegetation communities and other land cover classes. Some of these challenges include the following:

- Impacts from Hurricane Nate in 2017 required a complete remapping across a majority of the Mississippi barrier islands.
- Interpreting thresholds between non-vegetated and sparse vegetation types. For instance, dune communities and beach communities with abundant sand and bare ground sometimes "washes out" the vegetation photo signature making these communities difficult to distinguish from sparse vegetation or bare sand areas.
- Interpreting structural component thresholds between communities such as the difference between herbaceous and herbaceous shrubland communities.
- Interpreting understory differences in non-herbaceous communities such as the understory components of *Pinus* or *Quercus* forest and woodlands. The use of LiDAR drastically improved our ability to map these areas accurately.
- Vegetation classification field identification errors and inconsistencies such as classifying an herbaceous shrubland as a grassland and not a shrubland.

Additional challenges influencing map class development are discussed in Section 3.1.7 - *Interpretation Challenges*. As part of the accuracy assessment (AA) analysis, the AA confusion matrix contingency table supported discussions to evaluate possible modifications to the mapping model due to low accuracies and confusion among types. This aggregation process is discussed in detail in Chapter 4 - *Accuracy Assessment*. Final map classes and the representative vegetation types are discussed in Section 3.2 - *Results*.

Imagery Interpretation

Classification and delineation of polygons was an iterative process involving the development of preliminary map classes, field reconnaissance, and review of classified plot results. The process included the classification of preliminary polygon line work, additional field reconnaissance, map refinement, final line work and mapping model, field validation, and finalization of the map layer. This process began by initially mapping the vegetation physiognomy showing areas dominated by trees, shrubs, herbaceous vegetation, sparse vegetation, and open water. Field reconnaissance served as the primary means to refine the physiognomic map. Unique vegetation photo-signatures for each map class were identified using vegetation inventory plot data and photos. Photo signatures supported classifying and delineating polygons at a finer level until a balance between map robustness and required thematic accuracy was achieved. Prior to AA field work, map development field reconnaissance occurred in the fall of 2016, spring and fall of 2017, and spring of 2018. Reconnaissance allowed mappers to become familiar with the area's flora and ecology, and begin to

understand subtle landscape patterns and other environmental site factors influencing vegetation. To aid in the identification of communities with evident affinities for certain habitats or repeating landscape patterns, a variety of characteristics were considered including soil, geology, landform, elevation, aspect, and slope.

Manual digitizing was used to delineate polygons given the moderate size of the park, classification intricacies, and the ability to distinguish classes visually. Table 12 shows imagery products used for interpretation including 15 cm and 30 cm 4-band HxIP imagery. Vegetation class boundaries were distinguished using differences in the imagery pattern, color, texture, and tone. Map unit classification and digitized polygon labels incorporated vegetation plot and observation point data. A minimum mapping unit of 0.5 ha was used for all map classes. Two-dimensional and three-dimensional visualization using USACE NCMP LiDAR data and Google Earth were used to better see vegetation structure and composition. Different combinations of imagery bands were occasionally used to differentiate types. Appendix F summarizes interpretation notes for GUIS map classes.

Validation of Map Thematic Accuracy

Whereas AA is a considerable investment in time and effort, validation is a process of more limited sampling designed to to determine whether a final draft map is accurate enough to justify field-based thematic AA of individual map classes. The results of validation primarily address the immediate needs of the map production team and project oversight team to evaluate the overall product before conducting a formal quantitative AA. Map thematic validation is important to ensure that errors in the map, the association field key, and the classification are corrected before the AA phase of the project begins.

The NPS (2013) 12-Step Guidance document recommends independent third party validation of the map and key prior to the AA. Map thematic validation is completed by image analysts and ecologists visiting the site together and briefly testing the map and key in the field. While some projects plan a quantitative, third-party validation, this was not done for the GUIS project. The imagery interpretation team conducted several validation trips to GUIS to examine certain map classes and polygons—one in fall of 2016, one in spring of 2017, two in fall of 2017, and three in the spring of 2018. The field validation effort was not quantitative and did not involve random sampling across all map classes, but rather focused on those classes considered to have the lowest accuracy by interpreters. Field data collected resulted in some modifications to individual polygon boundaries, additional refinements to the map classification, and a higher level of confidence in certain classes and the map as a whole. These efforts met the intent of the guidance, and the decision was then made within the CSU team to proceed with the AA phase.

Interpretation Challenges

Impacts from Hurricane Nate

In 2017, Hurricane Nate, a Category 1 hurricane, made a secondary landfall near Biloxi, Mississippi, on October 8th, 2017, with maximum winds near 85.0 mph and a maximum storm surge of 2.7 m (8.9 ft) (Beven II and Berg 2018). High winds, salt spray, and the storm surge dramatically altered vegetation patterns and structure on the Mississippi barrier islands. Prior to the hurricane, CSU had

developed a preliminary vegetation map of GUIS effectively creating a pre-hurricane record of vegetation communities. The pre-hurricane map had not undergone a formal validation assessment or AA, so accuracy of the product is unknown. Nonetheless, using this pre-hurricane map, we were able to examine how some vegetation communities changed due to Hurricane Nate.

A decrease of 31.5 ha (77.9 ac) in land area or 1.60% of the total mapped land area in the Mississippi barrier islands was observed between pre-hurricane mapping and post-hurricane mapping. Decreases in land area were greatest at Petit Bois and Sand Islands where a decline of 3.5% (12.7 ha, 31.3 ac) and 6.5% (4.6 ha, 11.4 ac), respectively, of the total island land area were observed after the hurricane. Horn Island and East Ship Island decreased by 1.0% (12.7 ha, 31.4 ac) and 1.83% (1.8 ha, 4.5 ac), respectively, while West Ship Island gained 0.07% (0.14 ha, 0.35 ac) of land area.

Of the total land area of post-hurricane East Ship, West Ship, Horn, Sand, and Petit Bois Islands, 367.4 ha (907.9 ac) or 18.8% was mapped as Hurricane Disturbance Area based on 2017 post-hurricane NOAA imagery and subsequent validation trips in late 2017 to early 2018. This totaled 8.5% of the total GUIS land area (including Florida) and represents the second largest map class present at GUIS. Three communities form the majority of the area impacted by the hurricane: *Fimbristylis castanea-Paspalum distichum* Marsh, *Uniola paniculata-Panicum amarum-Iva imbricata* Grassland, and *Schizachyrium maritimum*-(*Heterotheca subaxillaris*) Grassland (Table 13). *Schizachyrium maritimum* and *Panicum amarum* were the first observed species to recolonize after Hurricane Nate (Figure 6). *Uniola paniculata* appeared delayed compared to other species.

Hurricane Nate primarily affected two areas of GUIS, the western tip of East Ship Island and the eastern tip of Horn Island. Both areas contained large *Fimbristylis castanea-Paspalum distichum* marshes that were filled in by overwash after the storm (Figure 7). On East Ship Island, marshes were reduced by 39% of their pre-hurricane size. In most cases, all that was left of the marsh communities were the tops of dead plants sticking through the sand (Figure 7). *Uniola paniculata-Panicum amarum-Iva imbricata* Grassland had the greatest loss in total area on these islands. The grassland community was reduced from 465.0 ha (1,149.0 ac) to 262.0 ha (647.4 ac) with a majority of the loss occurring on Horn Island (138.0 ha (341.0 ac) were lost). This loss occurred primarily along the south side of the island and within approximately 150 m (492.1 ft) of the southern shore. Petit Bois suffered the greatest loss of the *Schizachyrium maritimum*-(*Heterotheca subaxillaris*) Grassland community, which was reduced from 77 ha (190.3 ac) to 56 ha (138.4 ac).

Table 13. Changes in the extent of vegetation communities following Hurricane Nate in 2017.

Map Class	Change in Area (ha)					Total Change in Hectares	% Change
	East Ship	West Ship	Horn Island	Petit Bois	Sand Island		
Fimbristylis castanea - *Paspalum distichum* Marsh	-23.62	-3.47	-44.21	-18.23	-1.28	-90.81	-67%
Uniola paniculata - *Panicum amarum* - *Iva imbricata* Grassland	-11.36	-9.84	-138.26	-37.98	-5.27	-202.70	-44%
Panicum virgatum - (*Cladium mariscus*, *Juncus roemerianus*) Salt Marsh	–	–	-2.45	–	–	-2.46	-31%
Beach Bare Sand	5.29	-2.86	-28.67	-22.41	-7.00	-55.64	-25%
Schizachyrium maritimum - (*Heterotheca subaxillaris*) Grassland	–	-1.56	0.55	-20.77	-1.94	-23.72	-19%
Spartina patens - *Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh	-1.02	-6.55	-5.88	-1.76	-1.86	-17.07	-11%
Ceratiola ericoides - *Chrysoma pauciflosculosa* Shrubland	–	–	-1.63	-1.73	–	-3.36	-7%
Phragmites australis Tidal Ruderal Marsh	–	0.12	-0.63	-0.21	–	-0.71	-6%
Panicum repens Ruderal Grassland	–	0.52	-3.18	-0.73	0.03	-3.35	-5%
Ilex vomitoria - *Quercus* (*geminata*, *virginiana*) - *Morella cerifera* - *Serenoa repens* Shrubland	-2.61	–	0.28	-2.08	–	-4.41	-5%
Baccharis halimifolia - *Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland	1.09	-2.15	-1.29	-0.38	-0.38	-3.11	-1%
Pinus elliottii / *Serenoa repens* - *Ilex vomitoria* Woodland	–	–	2.82	–	–	2.82	2%
Juncus roemerianus Salt Marsh	0.09	–	3.01	0.01	–	3.11	2%
Quercus geminata - *Quercus virginiana* / *Serenoa repens* - *Ilex vomitoria* Forest	–	–	0.14	–	–	0.14	9%

Table 13 (continued). Changes in the extent of vegetation communities following Hurricane Nate in 2017.

Map Class	Change in Area (ha)					Total Change in Hectares	% Change
	East Ship	West Ship	Horn Island	Petit Bois	Sand Island		
Typha domingensis Tidal Marsh	–	3.78	-0.39	0.07	–	3.47	17%
Smilax auriculata / *Heterotheca subaxillaris* - *Strophostyles helvola* - (*Uniola paniculata*) Grassland	–	-0.01	-	1.22	–	1.21	37%
Fuirena scirpoidea - *Panicum tenerum* - *Dichanthelium wrightianum* - *Andropogon capillipes* Grassland	–	4.92	0.64	1.42	0.50	7.48	56%
Spartina alterniflora - *Juncus roemerianus* - (*Distichlis spicata*) Salt Marsh	–	–	2.02	–	–	2.02	339%
Hurricane Impacted Area	31.37	17.34	210.43	91.15	15.06	365.4	N/A

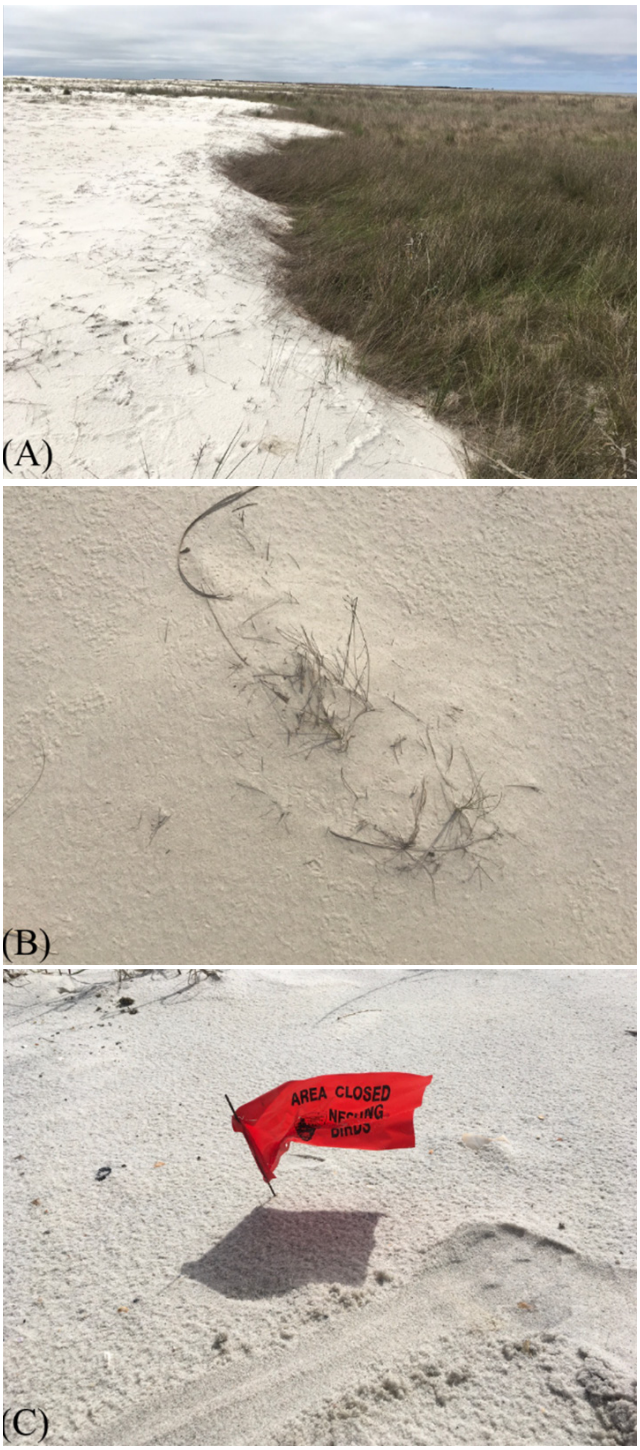


Figure 6. Evidence of hurricane-impacted areas. From top to bottom: (A) overwash into marsh (Petit Bois Island 2/26/2018). (B) Buried vegetation (Horn Island 7/27/2018). (C) Flag buried showing depth of overwash (Petit Bois Island 2/26/2018). (CSU photos)

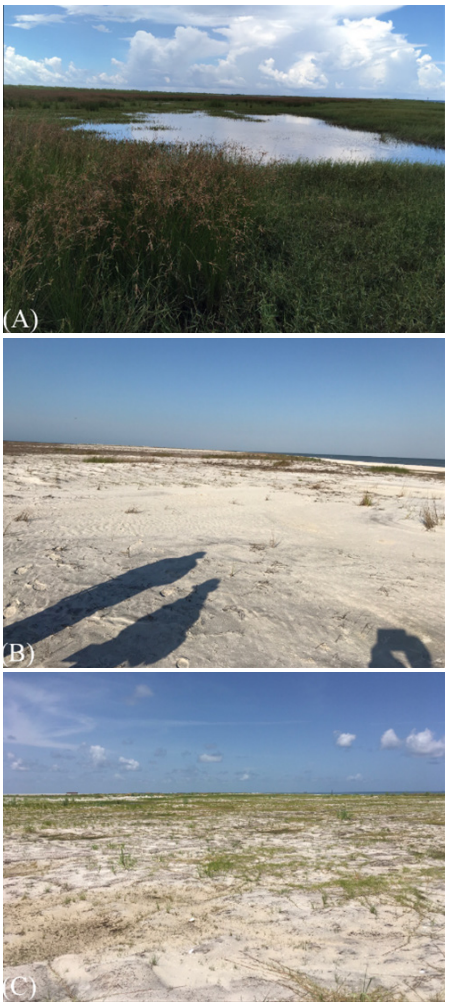


Figure 7. *Fimbristylis castanea* marshes on East Ship Island were greatly reduced in size from Hurricane Nate. A: before Hurricane Nate (8/20/2016); B: after Hurricane Nate (5/2/2018); C: the growing season after the hurricane (7/9/2018). Photos (A) and (B) were taken from the same spot, and photo (C) was taken in the same polygon.

Results

Map Classes

The project aimed to map vegetation communities to the association level of the USNVC (i.e., the highest level of floristic detail), where possible. In some cases, consistent interpretation to the association level was not possible and the interpreter was obliged to include more than one association in a map class. The initial map classification going into the AA phase consisted of 34 natural and ruderal vegetated map classes, representing 44 USNVC associations or other unpublished communities defined by the project as “park specials”.

The final GUIS map classification consists of 38 map classes representing 44 USNVC associations, park specials and land cover types (Table 14). Of these 44 types, 32 are natural vegetation associations within the USNVC, three are ruderal associations within the USNVC, five are

unpublished park specials, and four are National Land Cover Dataset (NLCD) Level II land cover classes (Water/Ocean; Barren; Developed, Open Space; and Developed, Low-High Intensity).

Of the 34 vegetated map classes, 26 represent a single USNVC association or park special, six represent two USNVC associations, and two represent three USNVC associations or park specials. Where a map class represents a single USNVC type, the map class name is the same as the USNVC name. Where the map class represents more than one USNVC type, the map class name reflects the types included within it, and is weighted toward the type occupying the largest acreage. Type descriptions for USNVC associations and alliances and park specials are presented in Appendix A.

Table 14. List of GUIS map classes and their USNVC associations and/or park specials, organized by dominant vegetation physiognomy.

Dominant Vegetation Physiogomy	GUS Map Class	USNVC Association or Park Special class
Herbaceous Vegetation	GUIS MC101 *Panicum repens* Ruderal Grassland	NPSGUIS001: *Panicum repens* Ruderal Grassland
	GUIS MC102 *Uniola paniculata* – *Panicum amarum* var. *amarulum* – *Iva imbricata* Grassland	CEGL004041: *Uniola paniculata* – *Panicum amarum* var. *amarulum* – *Iva imbricata* Grassland
	GUIS MC102 *Uniola paniculata* – *Panicum amarum* var. *amarulum* – *Iva imbricata* Grassland	NPSGUIS002: *Uniola paniculata* Grassland
	GUIS MC102 *Uniola paniculata* – *Panicum amarum* var. *amarulum* – *Iva imbricata* Grassland	CEGL004001: *Iva imbricata* / *Uniola paniculata* – *Helianthus debilis* ssp. *debilis* Grassland
	GUIS MC103 *Schizachyrium maritimum* – (*Heterotheca subaxillaris*) Grassland	CEGL004057: *Schizachyrium maritimum* – (*Heterotheca subaxillaris*) Grassland
	GUIS MC104 *Smilax auriculata* / *Heterotheca subaxillaris* – *Strophostyles helvola* – (*Uniola paniculata*) Grassland	CEGL004234: *Smilax auriculata* / *Heterotheca subaxillaris* – *Strophostyles helvola* – (*Uniola paniculata*) Grassland
	GUIS MC105 *Fuirena scirpoidea* – *Panicum tenerum* – *Dichanthelium wrightianum* – *Andropogon capillipes* Grassland	CEGL004953: *Fuirena scirpoidea* – *Panicum tenerum* – *Dichanthelium wrightianum* – *Andropogon capillipes* Grassland
	GUIS MC106 *Juncus roemerianus* Salt Marsh	CEGL004186: *Juncus roemerianus* Salt Marsh
	GUIS MC107 *Typha domingensis* Tidal Marsh	CEGL008456: *Typha domingensis* Salt Marsh
	GUIS MC108 *Cladium mariscus* Tidal Salt Marsh	CEGL004178: *Cladium mariscus* Tidal Salt Marsh
	GUIS MC109 *Phragmites australis* ssp. *australis* Tidal Ruderal Marsh	CEGL004187: *Phragmites australis* ssp. *australis* Tidal Ruderal Marsh
	GUIS MC110 *Panicum virgatum* – (*Cladium mariscus*, *Juncus roemerianus*) Salt Marsh	CEGL004962: *Panicum virgatum* – (*Cladium mariscus*, *Juncus roemerianus*) Salt Marsh
	GUIS MC111 *Spartina patens* – *Schoenoplectus* (*americanus*, *pungens*) – (*Distichlis spicata*) Salt Marsh	CEGL004755: *Spartina patens* – *Schoenoplectus* (*americanus*, *pungens*) – (*Distichlis spicata*) Salt Marsh

Table 14 (continued). List of GUIS map classes and their USNVC associations and/or park specials, organized by dominant vegetation physiognomy.

Dominant Vegetation Physiogomy	GUS Map Class	USNVC Association or Park Special class
Herbaceous Vegetation (continued)	GUIS MC112 *Spartina alterniflora – Juncus roemerianus – Distichlis spicata* Tidal Salt Marsh	CEGL004190: *Spartina alterniflora – Juncus roemerianus – Distichlis spicata* Louisianian Zone Tidal Salt Marsh
	GUIS MC113 *Fimbristylis castanea – Paspalum distichum* Marsh	CEGL004110: *Fimbristylis castanea – Paspalum distichum* Marsh
	GUIS MC114 *Carex striata* var. *striata – Xyris fimbriata – Lachnanthes caroliniana* Marsh	CEGL00007718: *Carex* var. *striata – Xyris fimbriata – Lachnanthes caroliniana* Marsh
	GUIS MC115 *Nuphar advena – Nymphaea odorata* Aquatic Vegetation	CEGL002386: *Nuphar advena – Nymphaea odorata* Aquatic Vegetation
Shrublands	GUIS MC201 *Ilex vomitoria – Quercus* (*geminata*, *virginiana*) *– Morella cerifera – Serenoa repens* Shrubland	CEGL003813: *Ilex vomitoria – Quercus* (*geminata*, *virginiana*) *– Morella cerifera – Serenoa repens* Shrubland
	GUIS MC202 *Quercus myrtifolia – Quercus geminata – Ceratiola ericoides – Conradina canescens* Shrubland	CEGL003824: *Quercus myrtifolia – Quercus geminata – Ceratiola ericoides – Conradina canescens* Shrubland
	GUIS MC203 *Baccharis halimifolia – Morella cerifera –* (*Ilex vomitoria*) Saline Shrubland	CEGL003920: *Baccharis halimifolia – Iva frutescens – Morella cerifera –* (*Ilex vomitoria*) Saline Shrubland
	GUIS MC204 *Cyrilla racemiflora – Lyonia lucida* Wet Shrubland	CEGL003844: *Cyrilla racemiflora – Lyonia lucida* Wet Shrubland
	GUIS MC205 *Ceratiola ericoides – Chrysoma pauciflosculosa* Shrubland	CEGL003864: *Ceratiola ericoides –* (*Chrysoma pauciflosculosa*) / *Polygonella polygama* / *Cladonia leporina* Shrubland
	GUIS MC205 *Ceratiola ericoides – Chrysoma pauciflosculosa* Shrubland	CEGL003947: *Chrysoma pauciflosculosa – Paronychia erect* Dwarf Shrubland
Woodland and Forest	GUIS MC301 *Pinus clausa* / *Quercus geminata – Quercus myrtifolia – Conradina canescens* Woodland	CEGL003554: *Pinus clausa* / *Quercus geminata – Quercus myrtifolia – Conradina canescens* Woodland
	GUIS MC302 *Pinus elliottii* / *Cliftonia monophylla – Cyrilla racemiflora* Swamp Woodland	CEGL003638: *Pinus elliottii* / *Cliftonia monophylla – Cyrilla racemiflora* Swamp Woodland

Table 14 (continued). List of GUIS map classes and their USNVC associations and/or park specials, organized by dominant vegetation physiognomy.

Dominant Vegetation Physiogomy	GUS Map Class	USNVC Association or Park Special class
Woodland and Forest (continued)	GUIS MC302 *Pinus elliottii* / *Cliftonia monophylla* – *Cyrilla racemiflora* Swamp Woodland	CEGL003673: *Pinus elliottii* – (*Pinus serotina*) / *Aristida beyrichiana* – *Rhynchospora oligantha* – *Sarracenia* ssp. Woodland
	GUIS MC303 *Pinus elliottii* / *Serenoa repens* – *Ilex vomitoria* Woodland	CEGL004680: *Pinus elliottii* / *Serenoa repens* – *Ilex glabra* – *Morella cerifera* – *Ilex vomitoria* Woodland
	GUIS MC303 *Pinus elliottii* / *Serenoa repens* – *Ilex vomitoria* Woodland	CEGL004958: *Pinus elliottii* / *Spartina patens* – *Juncus roemerianus* – (*Panicum virgatum*) Tidal Woodland
	GUIS MC304 *Pinus elliottii* – (*Pinus palustris*) / *Ilex vomitoria* – *Serenoa repens* – *Morella cerifera* Woodland	CEGL004658: *Pinus elliottii* – (*Pinus palustris*) / *Ilex vomitoria* – *Serenoa repens* – *Morella cerifera* Woodland
	GUIS MC304 *Pinus elliottii* – (*Pinus palustris*) / *Ilex vomitoria* – *Serenoa repens* – *Morella cerifera* Woodland	CEGL003656: *Pinus palustris* – *(Pinus elliottii*) / *Ilex coriacea* – *Cyrilla racemiflora* Woodland
	GUIS MC305 *Pinus elliottii* – (*Quercus myrtifolia*) – *Quercus geminata* Scrub Woodland	NPSGUIS005: *Pinus elliottii* – *Quercus myrtifolia* – *Quercus geminata* Scrub Woodland
	GUIS MC306 *Quercus geminata* – *Quercus virginiana* / *Serenoa repens* – *Ilex vomitoria* Forest	CEGL007019: *Quercus geminata* / *Serenoa repens* – *Ilex vomitoria* – (*Sideroxylon lanuginosum*) Forest
	GUIS MC306 *Quercus geminata* – *Quercus virginiana* / *Serenoa repens* – *Ilex vomitoria* Forest	CEGL007020: *Quercus geminata* – (*Quercus virginiana*) / *Serenoa repens* – *Lyonia fruticosa* Forest
	GUIS MC306 *Quercus geminata* – *Quercus virginiana* / *Serenoa repens* – *Ilex vomitoria* Forest	CEGL007028: *Quercus virginiana* / *Vaccinium arboreum* – *Ilex vomitoria* Forest
	GUIS MC307 *Quercus virginiana* – (*Pinus elliottii*, *Sabal palmetto*) / *Persea borbonia* – *Callicarpa americana* Forest	CEGL007032: *Quercus virginiana* – (*Pinus elliottii*, *Sabal palmetto*) / *Persea borbonia* – *Callicarpa americana* Forest
	GUIS MC308 *Nyssa biflora* – *Magnolia virginiana* – (*Pinus elliottii*) / *Morella* (*caroliniensis*, *inodora*) Swamp Forest	CEGL007156: *Nyssa biflora* – *Magnolia virginiana* – (*Pinus elliottii*) / *Morella* (*caroliniensis*, *inodora*) Swamp Forest

Table 14 (continued). List of GUIS map classes and their USNVC associations and/or park specials, organized by dominant vegetation physiognomy.

Dominant Vegetation Physiogomy	GUS Map Class	USNVC Association or Park Special class
Woodland and Forest (continued)	GUIS MC308 *Nyssa biflora* – *Magnolia virginiana* – (*Pinus elliottii*) / *Morella* (*caroliniensis*, *inodora*) Swamp Forest	CEGL008477: *Nyssa biflora* – *Liquidambar styraciflua* / *Magnolia virginiana* – *Viburnum nudum* Swamp Forest
	GUIS MC309 *Nyssa aquatica* Swamp Forest	CEGL002419: *Nyssa aquatica* Swamp Forest
	GUIS MC310 *Quercus nigra* Ruderal Forest	CEGL004638: *Quercus nigra* Ruderal Forest
	GUIS MC311 *Quercus alba* – *Carya glabra* – *Carya tomentosa* / *Aesculus pavia* Forest	CEGL007225: *Quercus alba* – *Carya glabra* – *Carya alba* / *Aesculus pavia* Forest
	GUIS MC312 *Fagus grandifolia* – *Magnolia grandiflora* – *Quercus michauxii* – *Quercus nigra* / *Rhododendron canescens* Forest	CEGL004965: *Fagus grandifolia* – *Magnolia grandiflora* – *Quercus michauxii* – *Quercus nigra* / *Rhododendron canescens* Forest
Sparse Vegetation	GUIS MC401 Beach Bare Sand	NPSGUIS003: Beach Bare Sand
	GUIS MC402 Hurricane Impact Area	NPSGUIS004: Hurricane Impact Area
Land Cover	LC001 Non-vegetated / Barren Land, Borrow Pit, Cut Bank	–
	LC002 Developed, Open Space	–
	LC003 Developed, (Low, Medium, High) Intensity	–
	LC004 Water / Ocean	–

Summary Statistics

The final GUIS vegetation map consists of 1,268 polygons totaling 35,769.0 ha (88,387.2 ac). Mean polygon size is 28.2 ha (69.7 ac). Mean polygon size, excluding water, is 3.6 ha (8.9 ac). Of the total area, 4,176.8 ha (10,321.1 ac) or 11.6% represent natural or ruderal vegetation. Artificially non-vegetated barren land is rare and only accounts for 0.74 ha (1.82 ac) or 0.002% of the total area. Developed open space such as roads, parking lots, and campgrounds comprises 153.8 ha (380.0 ac) or 0.43% of the total. Open water (including ocean) is the most widespread land cover class with an area of approximately 31,437.7 ha (77,684.2 ac) or 87.9% of the total area mapped within the administrative boundary (Figure 8). Statistics for the Florida and Mississippi districts are shown in Table 15.

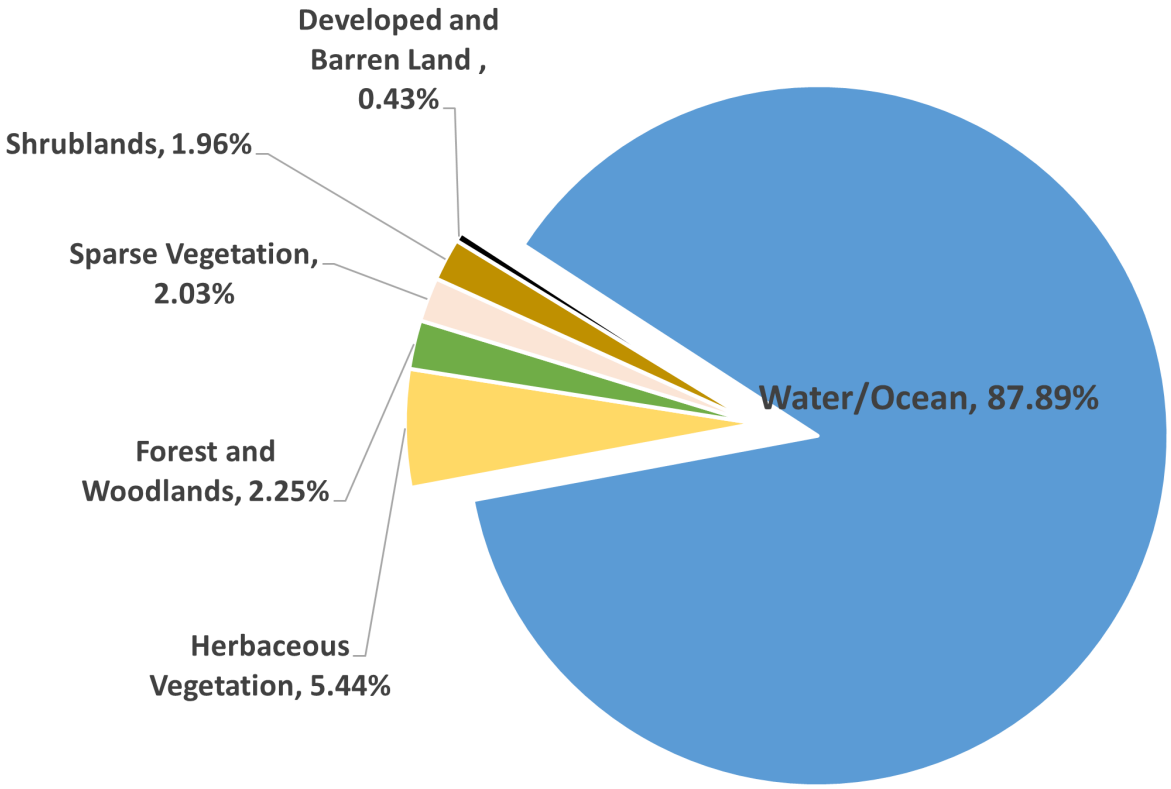


Figure 8. Proportionsof mapped land cover types at GUIS.

Within the total area occupied by natural or ruderal vegetation, herbaceous types were the most extensive (1,945.1 ha (4,806.4 ac) or 46.6%), followed by forest and woodland types (804.9 ha (1,989.0 ac) or 19.3%), sparse vegetation types (726.9 ha (1,796.1 ac) or 17.4%), and shrubland types (699.9 ha (1,729.5 ac) or 16.8%).

Table 15. Map statistics by district

Parameter	Florida District	Mississippi District
Number of Polygons	545	723
Polygon Area	12,072.8 ha (29,832.5 ac)	23,696.2 ha (58,554.7 ac)
Polygon Mean Area	22.2 ha (54.7 ac)	32.8 ha (81.0 ac)
Natural or Ruderal Vegetation	1,825.9 ha (4,511.9 ac)	2,350.9 ha (5,809.3 ac)
Developed (Open space, Low – High Intensity)	123.4 ha (305.0 ac)	30.4 ha (75.1 ac)
Open Water	10,122,8 ha (25,013.9 ac)	21,314.9 ha (52,670.3 ac)
Herbaceous Vegetation	902.7 ha (2,230.7 ac)	1,042, 4 ha (2,575.8 ac)
Woodlands and Forests	477.3 ha (1,179.4 ac)	327.6 ha (809.6 ac)
Sparse Vegetation	186.2 ha (460.1 ac)	540.7 ha (1,336 ac)
Shrublands	259.7 ha (641.7 ac)	440.2 ha (1,087.9 ac)

Herbaceous Vegetation

Herbaceous vegetation map classes occupied 5.4% (1,945.1 ha; 4,806.4 ac) of the park area and accounted for 39.4% (499 polygons) of the mapped polygons. The *Uniola paniculata – Panicum amarum* var. *amarulum – Iva imbricata* Grassland (MC102) represented the largest component of herbaceous vegetation at GUIS occupying 941.6 ha (2,326.9 ac) or 2.63% of the GUIS area. This map class included two USNVC associations and one park special including CEGL004041: *Uniola paniculata – Panicum amarum* var. *amarulum – Iva imbricata* Grassland, NPSGUIS002: *Uniola paniculata* Grassland, and CEGL004001: *Iva imbricata / Uniola paniculata – Helianthus debilis* ssp. *debilis* Grassland.

The second most abundant herbaceous vegetation type was the *Juncus roemerianus* Salt Marsh (MC106). This type occupied 341.4 ha (843.5 ac) and represented 0.95% of the GUIS area. The next most common herbaceous vegetation types at GUIS (i.e., MC111 *Spartina patens – Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh, MC103 *Schizachyrium maritimum –* (*Heterotheca subaxillaris*) Grassland, MC105 *Fuirena scirpoidea* - *Panicum tenerum* - *Dichanthelium wrightianum* - *Andropogon capillipes* Grassland) occupied 0.41% (145.7 ha; 360.1 ac), 0.38% (136.4 ha; 337.0 ac), and 0.31% (109.5 ha; 270.5 ac) of the park, respectively (Table 16).

Table 16. Map statistics by map class for the Gulf Islands National Seashore vegetation map.

Dominant Vegetation Physiogomy	Map Class Code	Map Class Name	Number of Polygons	Minimum size (ha)	Maximum size (ha)	Mean size (ha)	Total area (ha)
Herbaceous Vegetation	MC101	*Panicum repens* Ruderal Grassland	23	0.50	17.90	2.75	63.30
	MC102	*Uniola paniculata* – *Panicum amarum* var. *amarulum* – *Iva imbricata* Grassland	95	0.50	136.44	9.91	941.65
	MC103	*Schizachyrium maritimum* – (*Heterotheca subaxillaris*) Grassland	50	0.50	30.03	2.73	136.38
	MC104	*Smilax auriculata* / *Heterotheca subaxillaris* – *Strophostyles helvola* – (*Uniola paniculata*) Grassland	26	0.50	4.31	0.99	25.85
	MC105	*Fuirena scirpoidea* – *Panicum tenerum* – *Dichanthelium wrightianum* – *Andropogon capillipes* Grassland	52	0.50	13.53	2.10	109.46
	MC106	*Juncus roemerianus* Salt Marsh	100	0.23	78.73	3.41	341.36
	MC107	*Typha domingensis* Tidal Marsh	20	0.50	9.91	1.77	35.33
	MC108	*Cladium mariscus* Tidal Salt Marsh	21	0.50	2.94	1.07	22.52
	MC109	*Phragmites australis* ssp. *australis* Tidal Ruderal Marsh	13	0.57	3.69	1.15	15.00
	MC110	*Panicum virgatum* – (*Cladium mariscus*, *Juncus roemerianus*) Salt Marsh	3	0.84	3.12	1.82	5.46
	MC111	*Spartina patens* – *Schoenoplectus* (*americanus, pungens*) – (*Distichlis spicata*) Salt Marsh	67	0.51	18.56	2.18	145.74
	MC112	*Spartina alterniflora* – *Juncus roemerianus* – *Distichlis spicata* Tidal Salt Marsh	10	0.42	47.88	5.67	56.66
	MC113	*Fimbristylis castanea* – *Paspalum distichum* Marsh	17	0.50	12.75	2.66	45.18
	MC114	*Carex striata* var. *striata* – *Xyris fimbriata* – *Lachnanthes caroliniana* Marsh	1	0.72	0.72	0.72	0.72
	MC115	*Nuphar advena* – *Nymphaea odorata* Aquatic Vegetation	1	0.50	0.5	0.50	0.50

Table 16 (continued). Map statistics by map class for the Gulf Islands National Seashore vegetation map.

Dominant Vegetation Physiogomy	Map Class Code	Map Class Name	Number of Polygons	Minimum size (ha)	Maximum size (ha)	Mean size (ha)	Total area (ha)
Shrublands	MC201	*Ilex vomitoria* – *Quercus* (*geminata, virginiana*) – *Morella cerifera* – *Serenoa repens* Shrubland	86	0.50	6.43	1.72	147.97
	MC202	*Quercus myrtifolia* – *Quercus geminata* – *Ceratiola ericoides* – *Conradina canescens*	41	0.50	13.34	2.50	102.30
	MC203	*Baccharis halimifolia* – *Morella cerifera* – (*Ilex vomitoria*) Saline Shrubland	178	0.50	28.55	1.96	348.66
	MC204	*Cyrilla racemiflora* – *Lyonia lucida* Wet Shrubland	1	0.58	0.58	0.58	0.58
	MC205	*Ceratiola ericoides* – *Chrysoma pauciflosculosa* Shrubland	57	0.51	13.96	1.76	100.41
Woodland and Forest	MC301	*Pinus clausa* / *Quercus geminata* – *Quercus myrtifolia* – *Conradina canescens* Woodland	31	0.52	54.77	5.86	181.76
	MC302	*Pinus elliottii* / *Cliftonia monophylla* – *Cyrilla racemiflora* Swamp Woodland	4	0.82	1.08	0.92	3.68
	MC303	*Pinus elliottii* / *Serenoa repens* – *Ilex vomitoria* Woodland	55	0.50	65.71	5.05	277.51
	MC304	*Pinus elliottii* – (*Pinus palustris*) / *Ilex vomitoria* – *Serenoa repens* – *Morella cerifera* Woodland	37	0.50	28.66	3.99	147.61
	MC305	*Pinus elliottii* – (*Quercus myrtifolia*) – *Quercus geminata* Scrub Woodland	15	0.51	12.66	2.19	32.80
	MC306	*Quercus geminata* – *Quercus virginiana* / *Serenoa repens* – *Ilex vomitoria* Forest	29	0.51	30.01	3.61	104.67
	MC307	*Quercus virginiana* – (*Pinus elliottii*, *Sabal palmetto*) / *Persea borbonia* – *Callicarpa americana* Forest	13	0.60	1.93	1.07	13.97
	MC308	*Nyssa biflora* – *Magnolia virginiana* – (*Pinus elliottii*) / *Morella* (*caroliniensis, inodora*) Swamp	13	0.50	7.47	1.66	21.60

Table 16 (continued). Map statistics by map class for the Gulf Islands National Seashore vegetation map.

Dominant Vegetation Physiogomy	Map Class Code	Map Class Name	Number of Polygons	Minimum size (ha)	Maximum size (ha)	Mean size (ha)	Total area (ha)
Woodland and Forest (continued)	MC309	*Nyssa aquatica* Swamp Forest	2	0.50	1.12	0.81	1.62
	MC310	*Quercus nigra* Ruderal Forest	6	1.44	4.41	2.65	15.90
	MC311	*Quercus alba – Carya glabra – Carya tomentosa* / *Aesculus pavia* Forest	1	1.17	1.17	1.17	1.17
	MC312	*Fagus grandifolia – Magnolia grandiflora – Quercus michauxii – Quercus nigra* / *Rhododendron canescens* Forest	1	2.66	2.66	2.66	2.66
Sparse Vegetation	MC401	Beach Bare Sand	52	0.53	54.44	6.91	359.35
	MC402	Hurricane Impact Area	51	0.53	80.90	7.21	367.52
Land Cover	LC001	Non-vegetated / Barren Land, Borrow Pit, Cut Bank	1	0.74	0.74	0.74	0.74
	LC002	Developed, Open Space	24	0.50	7.56	2.47	59.19
	LC003	Developed, Low – High Intensity	6	3.02	26.89	15.76	94.59
	LC004	Water / Ocean	65	0.51	16,683.74	483.66	31,437.70
Totals	–	–	**1,268**	–	–	–	**35,769.02**

Shrublands

Five shrubland map classes at GUIS account for 1.96% (699.9 ha; 1,729.5 ac) of the park area and 28.6% (363) of the mapped polygons. The most common type, the *Baccharis halimifolia – Morella cerifera* – (*Ilex vomitoria*) Saline Shrubland (MC203) accounts for 348.7 ha (861.6 ac) or 0.95% of the park area. The second most abundant shrubland type was the *Ilex vomitoria – Quercus* (*geminata, virginiana*) *– Morella cerifera – Serenoa repens* Shrubland map class (MC201). This type occupied 148.0 ha (365.7 ac) and represented 0.41% of the GUIS area. The other three map classes (MC202 *Quercus myrtifolia – Quercus geminata – Ceratiola ericoides – Conradina canescens* Shrubland; MC204 *Cyrilla racemiflora – Lyonia lucida* Wet Shrubland, and MC205 *Ceratiola ericoides – Chrysoma pauciflosculosa* Shrubland) occupied 0.29% (102.3 ha; 252.8 ac), 0.28% (100.4 ha; 248.1 ac), and 0.002% (0.58 ha; 1.4 ac) of the park, respectively (Table 16).



Example of a *Ceratiola ericoides – Chrysoma pauciflosculosa* Shrubland (MC205) at GUIS in the fall (CSU Photo).

Woodland and Forest

Twelve forest and woodland vegetation map classes at GUIS occupy 2.3% (804.9 ha; 1,989.0 ac) of the park area and account for 16.3% (207) of the mapped polygons. The most abundant type was *Pinus elliottii* / *Serenoa repens* - *Ilex vomitoria* Woodland Total (MC303) which represented 277.5 ha (685.7 ac) or 0.78% of the park. The next most common types (MC301 *Pinus clausa* / *Quercus geminata – Quercus myrtifolia – Conradina canescens* Woodland, MC304 *Pinus elliottii* – (*Pinus palustris*) / *Ilex vomitoria – Serenoa repens – Morella cerifera* Woodland, and MC306 *Quercus geminata – Quercus virginiana* / *Serenoa repens – Ilex vomitoria* Forest) occupied 0.51% (181.8 ha;

449.1 ac), 0.41% (147.6 ha; 364.8 ac), and 0.29% (104.7 ha; 258.6 ac) of the park, respectively (Table 16).

Sparse Vegetation

Sparse vegetation map classes comprise 2.0% (726.9 ha; 1,796.1 ac) of the GUIS park area. Beach Bare Sand (MC401) represents 359.3 ha (888.0 ac) or 1.0%, and Hurricane Impact Area (MC402) represents 367.5 ha (908.2 ac) or 1.0% of the park area (Table 16).

Map Class Layer Development

Following the AA, several fields were added to the feature class layer attribute table to facilitate basic query and display for the map data. Attribute fields in the vegetation polygon layer table include the following:

- map class code (map_class_code)
- map class name (map_class_name)
- map class translated name (map_class_translated)
- preliminary map class name (prelim_map_class_name)
- vegetation physiognomy (physiognomy)
- polygon size (ha)
- polygon size (ac)
- notes (for some polygons)
- polygon perimeter in m (shape_length)
- polygon area in m^2 (shape_area)

The geodatabase links the vegetation layer to other feature classes, such as vegetation classification and AA plots and associated sampling data from the PLOTS database, plot photos, and project boundary extent. Database tables document the USNVC hierarchy and allow for spatial queries for a multitude of data associated with a vegetation polygon or sample point. All geospatial products are projected using NAD83 in UTM Zone 16N.

Accuracy Assessment

Introduction

Accuracy Assessment (AA) is a statistical analysis of the thematic accuracy of the vegetation map. It does not evaluate the spatial accuracy of map polygon boundaries. The AA measures the degree of confusion or error between map classes presented on the map and the vegetation as sampled on the ground. It tests the ability of the map to accurately identify the patterns of the map classes on the landscape. The AA provides map users with information on the limitations of the map and its suitability for particular applications and informs map producers of potential sources of error and how to improve the mapping procedure (Lea and Curtis 2010). The results provide measures of overall accuracy and an estimate of the users' and producers' accuracy for each map class. Users' accuracy is the probability that map polygons correctly classify the vegetation communities as they occur on the ground. Producers' accuracy is the probability that a vegetation community is correctly identified on the map.

To produce a quantitative estimate of accuracy, random sample points stratified by map class area and frequency are distributed over the map surface. Vegetation at each of these survey points is classified in the field and assigned a USNVC-recognized vegetation type or other local type (i.e., park special) by a field crew using the dichotomous key to plant associations of GUIS. The field classifications are then compared to the associated map class designation for each location. These data are analyzed to estimate overall accuracy and the users' and producers' accuracy of the map. Together, these identify the "confidence" of the map for the user.

When vegetation types with lower accuracy represent types of management interest, park staff may recommend aggregating types that have similar management concerns or needs. These aggregations can improve per-class accuracy, although some valuable detail can be lost in the process. The sample design, field methods, and methods of analysis were conducted in accordance with *Thematic Accuracy Assessment Procedures* (Lea and Curtis 2010).

Methods

Sample Design

A stratified random sampling approach was used to determine AA sampling locations. The area of inference was developed by applying several constraints to the map layer. Excluded classes, buffers applied and other allocation adjustments are described below.

Map Classes Included/Excluded. All developed land uses, cultural vegetation, and non-vegetated classes, including water, were excluded from the plot allocation.

Accessibility and Safety Cost Surface Layer. Areas having steep terrain and cliffs were considered inaccessible or too hazardous for field work. A cost surface using a threshold of 40+ degrees or 89 percent slope was developed using a 10 m DEM data layer.

Buffers to Avoid Road Shoulders and Associated Disturbance. Paved and unpaved park roads were buffered 25 m from the centerline and clipped from the allocation layer to avoid allocation of samples in disturbed roadside areas.

Buffers to Promote Homogeneity within Samples. Transitional or otherwise atypical vegetation is problematic for thematic AA analysis. Polygon boundaries form discrete boundaries that in the real world often consist of transitional zones (i.e., ecotones) between distinct vegetation types. A 5-45 m buffer was applied to polygon edges, depending on community type, to avoid ecotone boundaries.

Buffers to Maintain Independence Among Observations. A minimum buffer between AA plots equivalent to 80 m, or twice the radius of a circular area of observation, or 0.5 ha MMU was applied. However, these buffers may not always have been practicable due to limited allocation on narrow islands.

Sample sizes for each evaluated map class were selected using guidance from Lea and Curtis (2010) (Table 17). Most map classes were allocated 30 points using a simple random allocation. After the plots were allocated to each map class, the points were combined into a single data layer that tracked the mapped class for each point. A total of 649 AA points and an additional 240 alternate points were allocated among the vegetated map classes (Figures 9 and 10). In the event that a primary sample point was inaccessible and/or not visible, alternate points were sampled, chosen from a sequential list of alternate points for the same map class type. Spatial coordinates for all AA points were downloaded to GPS tablets for field sampling.

Table 17. Standard sample size allocations for a thematic accuracy assessment, based on map class area (from Lea and Curtis 2010).

Map Class Abundance	Map Class Total Area*	Number of Observations per Map Class**
Abundant	> 50 hectares	30
Relatively Abundant	8.33 to 50 hectares	0.6 per hectare
Relatively Rare	< 8.33 hectares	5

* - as measured before buffering for cost surface (access buffer) or for map class boundary buffer.

** - or as many spatially independent (non-overlapping) observation sites as map class area, MMU size, and other considerations will allow.

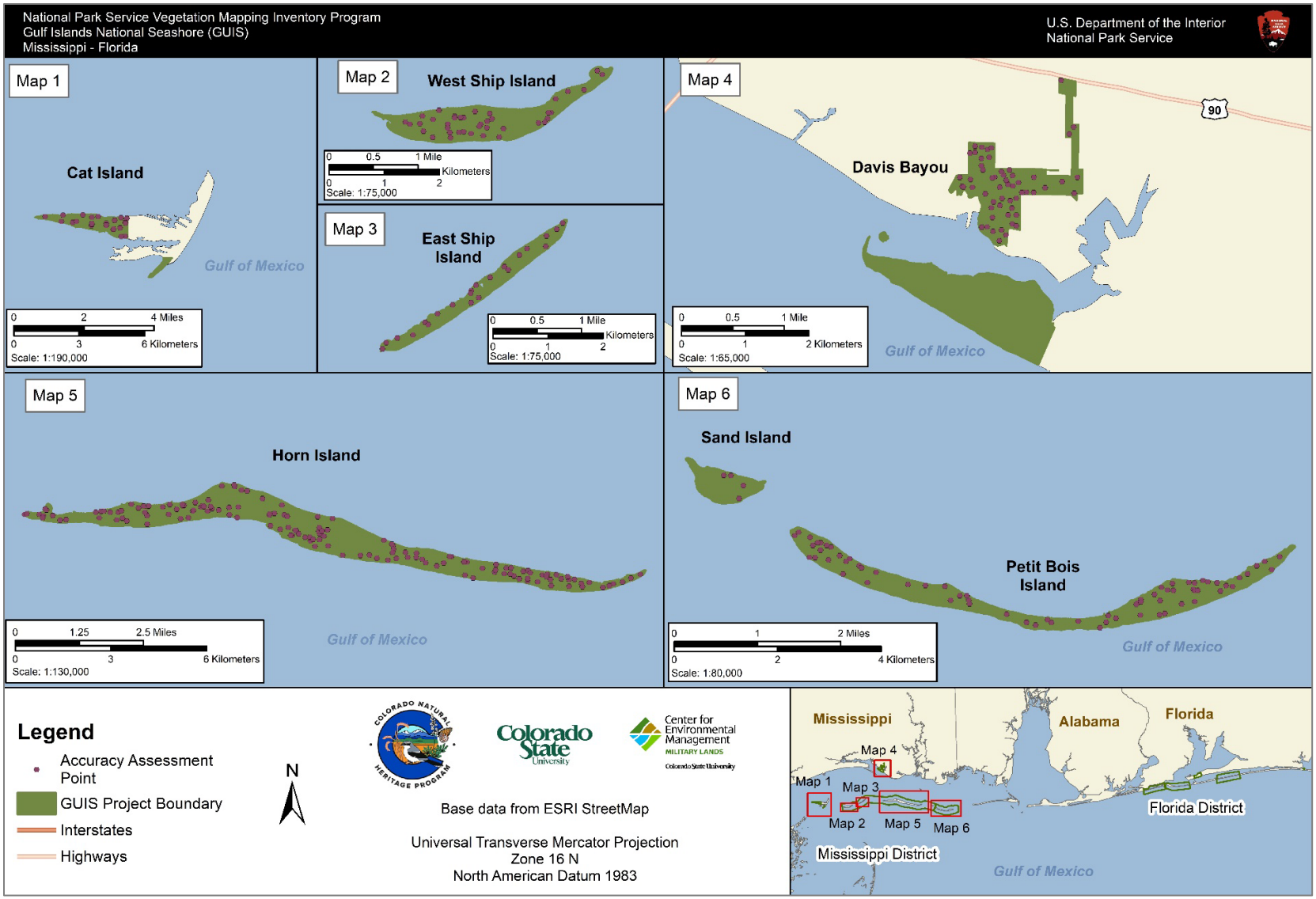


Figure 9. GUIS AA sample points for the Mississippi District visited during summer of 2018. Background data from ESRI Streetmap.

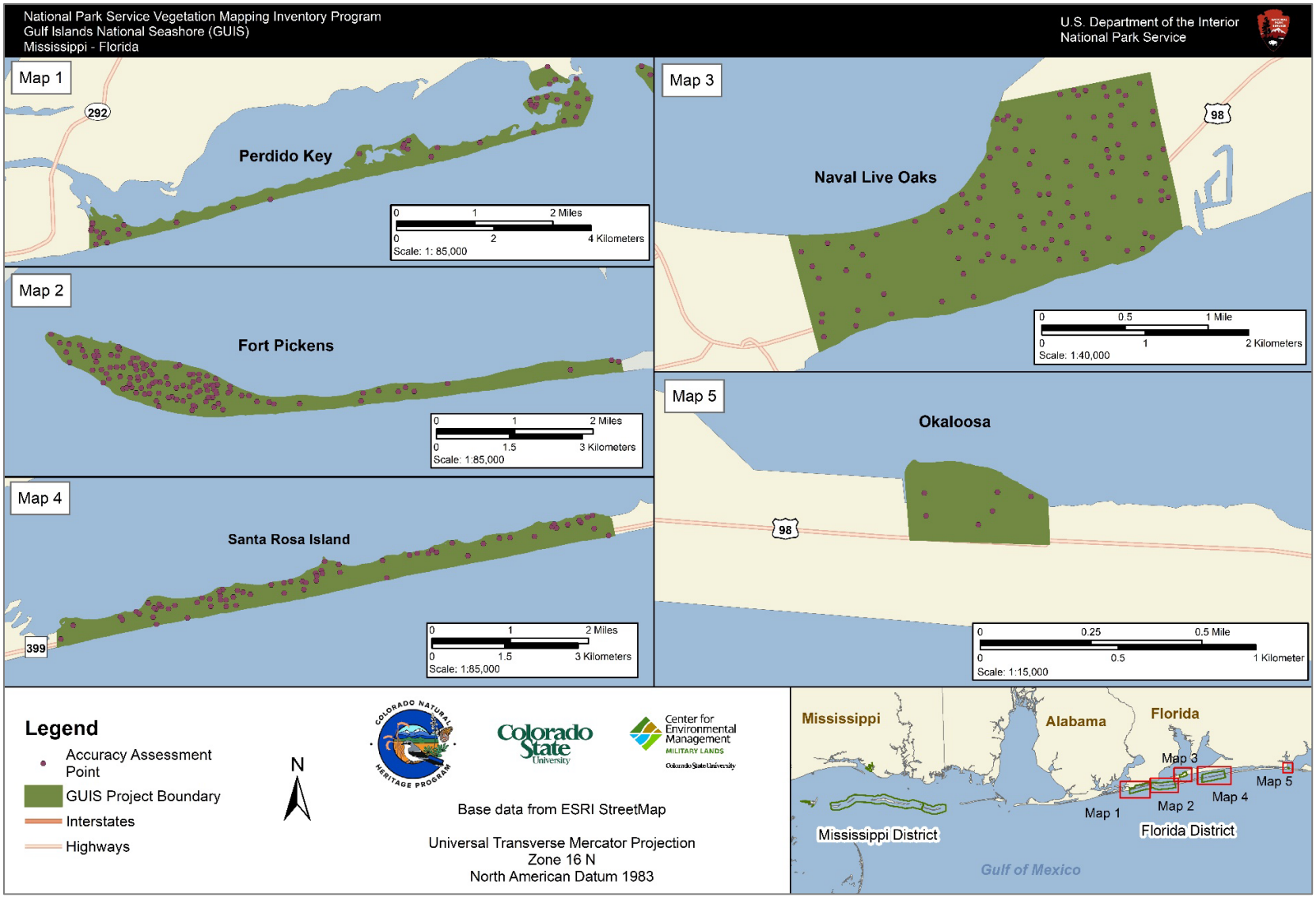


Figure 10. GUIS AA sample points for the Florida District visited during summer of 2018. Background data from ESRI Streetmap.

Field AA Data Collection

Field staff for AA data collection consisted of two 2-person crews and a crew leader that worked from June 5th through August 3rd of 2018. To limit biases, all crew members had backgrounds in botany and ecology sampling techniques, but were previously unfamiliar with the vegetation present at GUIS. Before field sampling began, all crew members were trained in species identification, field methods and protocols, and use of the vegetation classification keyFor the AA, field crews used Collector for ArcGIS to collect points and record data. Field crews used Apple iPad Pro tablets with Bad Elf Bluetooth GPS units. When finished with field work, the data was exported from ArcGIS online to local servers for analysis.

Primary and alternate AA points were uploaded to ArcGIS online. These points were added to a map along with the digital data sheet, park boundary, and road layers. Each map viewable on the data collection device included locations of primary and alternate points with topographical lines overlaid on satellite imagery to aid in navigation. To avoid biasing field determinations, no information on the map class or classified association of polygons was revealed to the crews.

As with the vegetation classification plots, AA point locations were accessed using a combination of travel on roads, boat travel (supported by NPS and charter vessels), and foot travel, typically completed during day-trips. Once a crew successfully navigated to an AA point, they evaluated the site relative to the AA criteria. The standard observational area of each point was a 0.5 ha (1.24 ac) inference area, which is equivalent to the MMU for each map class. If the point was notably affected by some disturbance, such as a developed site or a road, the crew attempted to move or reshape the point. If the point could not be moved or reshaped appropriately, it was rejected and replaced with an alternate point selected sequentially from the alternate point list. If the point appeared to encompass more than one distinct vegetation type (not considered an inclusion), the point would be moved or reshaped. Moving and reshaping of points followed modified guidance from Lea and Curtis (2010). When a point was moved, the crew recorded the GPS coordinates of the new point center on the field form. Points that were inaccessible or deemed unsafe due to water (>1m deep) or the presence of alligators were rejected and replaced with alternate points.

Once an AA point was determined to meet the selection criteria, the crew used the *Field Key to Community Associations/Types* (Appendix B) to assign a vegetation type. A primary or "best fit" assignment was recorded as well as a secondary or "next best" assignment. The vegetation types were either recognized USNVC types or park specials. The vegetation types were equivalent to, or nested uniquely within, a single map class. There could be many types within a single map class, but only one map class for each type. Thus, identifying the sample point vegetation type ultimately determines whether the correct map class has been applied. This method avoids the need to generate a separate map class key and provides the user with more information on map class composition.

In addition to assigning a vegetation type to each AA point, the crew also recorded the crew member names, date, dominant species of each stratum and their respective cover classes, cover class of each stratum, ground cover, leaf phenology of dominant stratum, whether the point was a good representation of the inference area, and whether the designated type was a good fit for the vegetation observed at the site. The crew also recorded the UTM coordinates of the field point center, which

was especially crucial when points were moved or reshaped or the error in the GPS unit was high. They also noted any special conditions that could affect the classification of the point (e.g., recent disturbance, potential species misidentification, etc.) and took a picture from point center in each of the cardinal directions (beginning with north, and followed by east, south, and then west). These digital photos were archived according to point number, and were referenced during data analysis in the event of a disagreement between the mapped class and the field-assigned class.

Data Quality Control

These data underwent quality control (QC) procedures prior to and following data entry before any analyses were performed. The first QC step was review and verification of field form data. Data on the field forms were checked for completeness and to ensure that values were appropriate for the given parameter. Following entry of the data into the PLOTS database, routine QC checks of the data were completed to eliminate possible transcription errors. These checks included searching for null values, as well as checking for out of range, nonsensical, or otherwise erroneous values. After making necessary corrections, data were imported into ArcGIS as a layer file and a data QC check was completed to ensure that the geocoding was correct for all points.

Accuracy Assessment Data Analysis

To analyze the GUIS AA data, a table was created from the pertinent data fields in the PLOTS database and imported into ArcGIS. The data fields included Plot ID, Primary Association, Secondary Association, Primary Map Class, Secondary Map Class, Plot XY Coordinates, and Field XY Coordinates. The imported data were converted to a shapefile and spatially joined to the vegetation map layer. This spatial join produced a list of all sampled points, the map class of the Primary and Secondary Association identified by the field crew, and the map class of the vegetation map polygon where the point was sampled. The attribute table of the spatial join was exported from ArcGIS as a table and imported to MS Excel for further evaluation (Appendix E).

The data table imported to MS Excel was evaluated to identify point records where the field map class (field call) did not agree with the map class of the vegetation map (map call). Records where the primary field call was correct were considered correct and removed from the analysis. Records for which the primary field call disagreed with the mapped class but the crew had made a secondary call were then evaluated. Records for which the secondary call was correct were considered correct. The remaining records were considered incorrect and retained for further evaluation to determine the source of the disagreement and potential need for reconciliation. The analysis of this dataset provided an initial (raw) accuracy measure.

The remaining records where neither the primary nor secondary field call agreed with the map call were individually evaluated by reviewing all available data for the sample point and the map polygon. The purpose of the review was to identify the source of the disagreement between the field call and the map call, and verify whether the error was attributable to the map call or some other factor. Verifying the source of error allows one to reconcile errors that in reality have very little to do with the accuracy of the map polygons, and provides a truer measure of the map accuracy. The analysis of this dataset provided a reconciled accuracy measure. The reconciled accuracy measure

remains unbiased by correcting only errors that can objectively be attributed to an erroneous field call or a change in land use or land cover.

Three potential sources of disagreement were identified prior to verifying the sources. These included cases where the disagreement was due to an erroneous map call (MC), an erroneous field call (FC), or due to recent changes in the land use or land cover (RC) (i.e., changes occurring after the imagery date). Erroneous field calls were further classified as due to a species or association identification (ID) error (FC1), a cover or density estimate error (FC2), a minimum map unit (MMU) estimate error (FC3), or a simple recording error (FC4). Any disagreement that could not objectively be attributed to something other than a map call were classified as an erroneous map call (MC). All disagreements classified as MC were retained as errors. All disagreements classified as FC1-FC4 or RC1 were considered to be valid and were upheld.

The review of all disagreements included reviewing the point species lists, the sample point photos, the map polygons, and imagery of the area. Prior to starting the review, additional columns were added to the evaluation spreadsheet for "Error Classification," "Comments/Justification," and "Reconciled Field Call." Error Classification is one of six codes listed above (FC1-FC4, MC1 or RC1), Comments/Justification provides a short description of what the specific issue was, and Reconciled Field Call is the post-reconciliation value assigned to the point (may remain the same or change).

Following the reconciliation, the data were arrayed in MS Excel to create an error matrix as well as a list of all map classes and associated areas. Map class names were categorized by the physiognomy of the type to ensure that similar types were positioned near one another in the matrix. To do this, we added a digit to the map class name to designate the physiognomy. The matrix and list were then copied and pasted into the NPS Contingency Table workbook (NPS 2018). For more information on the NPS Contingency Table Spreadsheet see Lea and Curtis (2010). The contingency table workbook for GUIS is included in the deliverable package.

Users' accuracy is based on the mapped classes (rows in the contingency table), and is defined as the probability that a location mapped as class x is in fact class x on the ground. Users' accuracy is more important to map users because they are most interested in knowing how well the map represents the types on the ground (Lea and Curtis 2010). The producers' accuracy is based on the true vegetation class in the field (columns in the contingency table), and is defined as the probability that a location of vegetation class x in the field is correctly mapped as class x. The producers' accuracy provides the map producer with an indication of how accurately a class may be detected wherever it occurs within the mapped area (inference area) (Lea and Curtis 2010).

Map Class Aggregation

Map classes with low individual class accuracy were evaluated for aggregation into the class(es) with which they were confused. The class errors were evaluated to determine the specific classes to combine to improve the accuracy. Aggregating map classes decreases the thematic resolution of the aggregated classes. Therefore, the objective is to maximize the individual class accuracies while minimizing the loss of thematic resolution of map classes. This requires identifying the correct map

classes to combine and not combining more classes than is absolutely necessary to improve the accuracy to an acceptable level, consistent with park staff input. We consulted with GUIS staff, and based on our judgement and needs of the park, no aggregation was needed for the GUIS vegetation inventory project.

Results

Accuracy Assessment Field Data Collection

The field crews collected data at 638 primary points and 63 alternate points, for a total of 701 AA points (Figures 9 and 10). The total inference area within the 35,769.0 ha (88,387.2 ac) of GUIS is 4,176.8 ha (10,321.1 ac), or 11.6%. Open water/ocean comprises most of the area for GUIS at 31,437.7 ha (77,684.2 ac) or 87.9% of the area. Open water and land use areas (roads, urban, etc.) are not included in the inference area. The inference area in each map class and the count of sample points collected across them are shown in Table 18.

Table 18. Count of AA sample points and inference area for each map class.

Map Class Code	Map Class Inference Area (hectares)	Number of AA Sample Points[a]
MC101	66	30
MC102	938	35
MC103	137	32
MC104	26	17
MC105	106	38
MC106	227	31
MC107	36	23
MC108	23	17
MC109	15	10
MC110	5	5
MC111	143	31
MC112	5	5
MC113	51	31
MC114	1	1 [a]
MC115	1	1 [a]
MC201	149	32
MC202	102	31
MC203	344	32

[a] polygon validated in addition to AA plot.

Table 18 (continued). Count of AA sample points and inference area for each map class.

Map Class Code	Map Class Inference Area (hectares)	Number of AA Sample Points[a]
MC204	1	1[a]
MC205	100	34
MC301	180	31
MC302	4	5
MC303	278	32
MC304	148	32
MC305	34	22
MC306	102	30
MC307	14	12
MC308	24	18
MC309	2	2[a]
MC310	16	12
MC311	1	1[a]
MC312	3	1[a]
MC401	361	31
MC402	367	34

[a] polygon validated in addition to AA plot.

Accuracy Assessment Data Analysis

Field crews collected data from a total of 701 AA sample points. Prior to examining individual disagreements, 613 samples agreed with the map classification and 88 disagreed with the map classification. As a simple plot count proportion, the overall accuracy before reconciliation was 87.4%. When the accuracy for each map class is weighted relative to the area it occupies within the park (i.e., as a proportion of the population), the initial overall accuracy was 87.8% with a Kappa coefficient of 86.9%. When each AA sample that disagreed with the mapped class was evaluated for potential errors, a number of the disagreements were overturned, resulting in revised accuracies. A total of 39 AA records disagreed due to erroneous field calls, and 49 disagreed due to a true map classification error. The 39 records with initial disagreement due to an erroneous field call were overturned and considered correct (to agree) for the purpose of the AA.

Table 19 summarizes the outcome of the error reconciliation. As a simple point count proportion, the reconciled overall accuracy was 93.0%. The overall accuracy, accuracy with the Kappa coefficient applied, and upper and lower 90% confidence intervals for the initial (raw) AA data and reconciled AA data (as a spatially weighted population proportion) are provide in Table 20. Users' and

producers' final accuracies for each map class and the estimated extent of each class are shown in Table 21.

Table 19. Accuracy assessment error reconciliation summary for GUIS based on simple point count proportions.

Accuracy Type	Category	Metric	Count	Percent
Initial (raw) Accuracy	Map Class Agreement	–	613	87%
	Map Class Disagreement	–	88	13%
Concise (reconciled) Accuracy	Map Class Agreement	–	652	93%
	Map Class Disagreement	–	49	7%
Evaluation Criteria	Initial Agreement	Match	613	87%
Map Call Errors	Classification Error	MC1	49	–
	Spatial Error	MC2	0	–
	Total Call Errors	–	49	7%
Field Call Errors	Species/Type ID Error	FC1	5	0.7%
	Cover Estimation Error	FC2	25	3.6%
	MMU Estimation Error	FC3	4	0.6%
	Data Recording Error	FC4	5	0.7%
	Total Field Call Errors	–	39	6%
Vegetation Change Errors	–	–	0	0%

Table 20. Initial and reconciled overall map accuracy, spatially weighted results.

Accuracy Type	Metric	Initial (raw) Accuracy Percent	Reconciled Accuracy Percent
General Accuracy:	Lower Limit, 90% Confidence Interval	85.4%	91.8%
	Upper Limit, 90% Confidence Interval	90.2%	95.3%
	Overall Accuracy	87.8%	93.6%
Kappa Accuracy:	Lower Limit, 90% Confidence Interval, K	84.8%	91.1%
	Upper Limit, 90% Confidence Interval, K	89.1%	94.4%
	Weighted Kappa Accuracy	86.9%	92.7%

Table 21. Users' and producers' final accuracies for each map class, spatially weighted.

Map Class Code	Users' Accuracy %	Lower Limit, 90% CI	Upper Limit, 90% CI	Producers' Accuracy %	Lower Limit, 90% CI	Upper Limit, 90% CI	Est. True MC Area (ha)
MC101	83.3%	70.5%	96.2%	92.8%	92.6%	93.0%	59.43
MC102	100.0%	98.6%	100.0%	95.5%	95.3%	95.7%	982.09
MC103	93.8%	85.1%	100.0%	84.2%	83.9%	84.5%	152.50
MC104	94.1%	81.8%	100.0%	85.1%	85.0%	85.1%	28.64
MC105	100.0%	98.7%	100.0%	92.0%	92.0%	92.0%	115.10
MC106	93.8%	85.1%	100.0%	98.6%	98.1%	99.2%	323.12
MC107	95.7%	86.5%	100.0%	100.0%	99.9%	100.0%	34.58
MC108	100.0%	97.1%	100.0%	100.0%	100.0%	100.0%	22.52
MC109	100.0%	95.0%	100.0%	57.9%	57.9%	57.9%	25.90
MC110	80.0%	40.6%	100.0%	17.1%	16.8%	17.3%	25.62
MC111	93.5%	84.7%	100.0%	82.4%	82.1%	82.6%	162.36
MC112	80.0%	40.6%	100.0%	100.0%	99.6%	100.0%	45.33
MC113	87.1%	75.6%	98.6%	67.1%	67.0%	67.3%	65.78
MC114	100.0%	50.0%	100.0%	100.0%	100.0%	100.0%	0.72
MC115	100.0%	50.0%	100.0%	100.0%	100.0%	100.0%	0.50
MC201	93.8%	85.1%	100.0%	86.4%	86.1%	86.7%	160.69
MC202	90.3%	80.0%	100.0%	91.0%	90.8%	91.2%	102.64
MC203	93.8%	85.1%	100.0%	92.0%	91.4%	92.6%	355.36
MC204	100.0%	50.0%	100.0%	27.3%	27.3%	27.3%	2.12
MC205	97.1%	90.8%	100.0%	95.3%	95.1%	95.4%	99.36
MC301	100.0%	98.4%	100.0%	94.1%	94.1%	94.1%	191.05
MC302	100.0%	90.0%	100.0%	100.0%	100.0%	100.0%	3.68
MC303	96.9%	90.3%	100.0%	98.9%	98.5%	99.2%	281.35
MC304	90.6%	80.6%	100.0%	100.0%	99.7%	100.0%	133.78
MC305	86.4%	72.1%	100.0%	100.0%	99.9%	100.0%	29.30
MC306	100.0%	98.3%	100.0%	96.2%	96.2%	96.2%	99.21
MC307	91.7%	74.4%	100.0%	100.0%	100.0%	100.0%	12.78
MC308	83.3%	66.1%	100.0%	81.5%	81.4%	81.6%	24.88

Table 21 (continued). Users' and producers' final accuracies for each map class, spatially weighted.

Map Class Code	Users' Accuracy %	Lower Limit, 90% CI	Upper Limit, 90% CI	Producers' Accuracy %	Lower Limit, 90% CI	Upper Limit, 90% CI	Est. True MC Area (ha)
MC309	100.0%	75.0%	100.0%	100.0%	100.0%	100.0%	1.62
MC310	100.0%	95.8%	100.0%	73.4%	73.4%	73.4%	21.67
MC311	100.0%	50.0%	100.0%	100.0%	100.0%	100.0%	1.17
MC312	100.0%	50.0%	100.0%	100.0%	100.0%	100.0%	2.66
MC401	93.5%	84.7%	100.0%	100.0%	99.4%	100.0%	337.51
MC402	73.5%	59.6%	87.4%	99.4%	98.4%	100.4%	271.85

Following review of the individual class accuracies, the classification team met with the interpretation team to discuss the results. Possible aggregation of preliminary map classes considered contingency table results illustrating the distribution of disagreements/confusion among types, nuances of the communities, and the locations and extents of types.

One map class with users' accuracy of 73.5% (MC402 Hurricane Impact Area) was retained, after consulting with GUIS staff, because its accuracy was reasonably close to the 80% threshold and the disturbed polygons within this class may support park management. Therefore there was no post-AA aggregation of map classes.

The 90% confidence interval for a total of ten map classes extended below 80%. The classes with broader confidence intervals generally had sample sizes below 10, driven by relatively small class acreages. The overall spatially-weighted accuracy of the GUIS map is 93.6% with a Kappa accuracy of 92.7% (Table 22). User' accuracy for each map class is shown in Figure 11.

Table 22. Overall accuracy and Kappa accuracy for the final GUIS vegetation map.

Accuracy Type	Metric	Percent
Overall:	Lower Limit, 90% Confidence Interval	91.4
	Upper Limit, 90% Confidence Interval	94.8
	Overall Accuracy	93.6
Kappa:	Lower Limit, 90% Confidence Interval, K	91.1
	Upper Limit, 90% Confidence Interval, K	94.4
	Kappa Accuracy	92.7

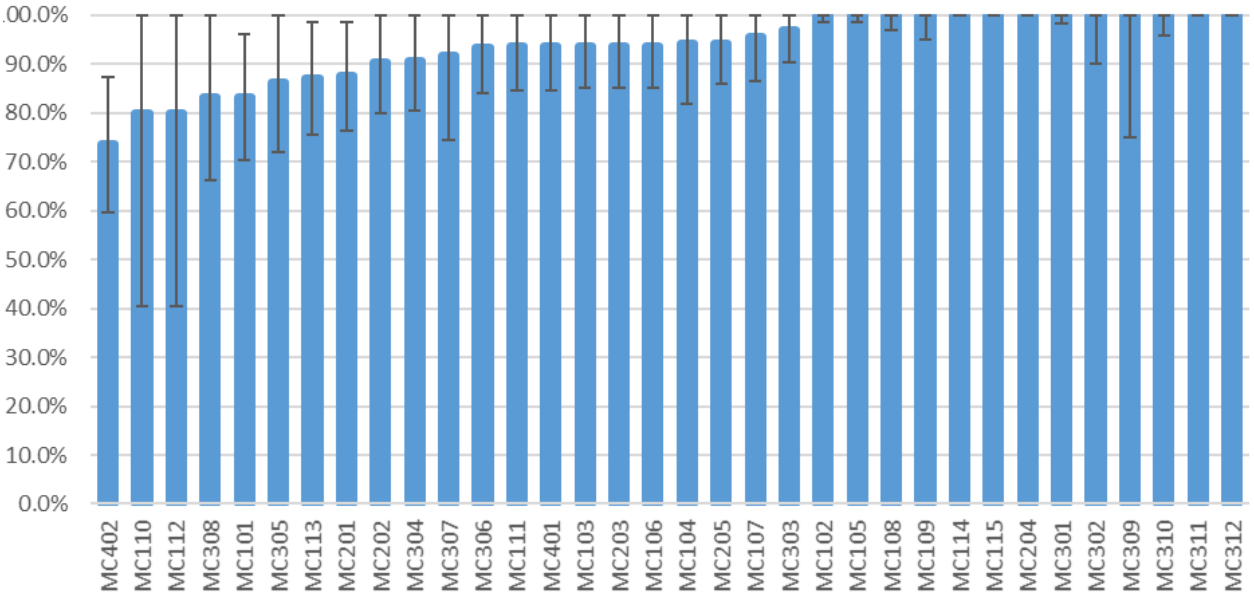


Figure 11. Users' accuracy and 90% confidence intervals for GUIS vegetation map classes.

Conclusions

The vegetation inventory project at GUIS classified and mapped vegetation in the park-managed area. The project was conducted over a five-year period from 2016 to 2020.The accuracy of the final map is 93.6%, In addition to this technical report and an associated geospatial vegetation map database, the project also developed other products valuable for park resource management. They include the vegetation classification, field key to the associations, local association descriptions, and a photo viewer database. Together with the vegetation data layer, these products provide the park with an array of tools to assist in managing park resources and making informed resource management decisions.

The GUIS vegetation classification and map will be helpful in managing myriad park resources. The geospatial database, map, and other products directly support managing and monitoring plant and animal habitats, examining the effects of land uses and environmental changes on vegetation over time, and evaluating the long-term effects of management activities on plant communities within the park.

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Appendix A. Plant Community Descriptions

Local descriptions are based on plot data collected for this project. Global descriptions are from the U.S. National Vegetation Classification (USNVC) website (http://usnvc.org/). Full citations for short citations provided in the global descriptions are also available at the USNVC website. Within each local description, the number of plots meeting various environmental criteria are shown in parentheses.

The Florida Natural Areas Inventory (FNAI) developed a standard classification system and guide for 81 natural communities represented in Florida. Last published in 2010, the *Guide to the Natural Communities of Florida* includes community descriptions, species lists, synonyms, and cross-walks to other classification systems (Guide download and descriptions available at https://www.fnai.org/). The FNAI types do not directly correspond to the USNVC. In this appendix, the FNAI type that most closely corresponds to a type within the USNVC hierarchy is listed under the "Florida Natural Areas Inventory" heading within each community description. The crosswalk from FNAI communities to the USNVC typically occurs at the group or macrogroup level of the USNVC, and may emphasize localized factors more than the USNVC description. Listing the corresponding FNAI types enables FNAI practitioners to translate USNVC associations into FNAI types used by federal and Florida agencies and others.

Lists of Plant Communities

Herbaceous Vegetation Types

- NPSGUIS001 *Panicum repens* Ruderal Grassland
- NPSGUIS002 *Uniola paniculata* Grassland
- CEGL004041 *Uniola paniculata* - *Panicum amarum* var. *amarulum* - *Iva imbricata* Grassland
- CEGL004057 *Schizachyrium maritimum* - (*Heterotheca subaxillaris*) Grassland
- CEGL004234 *Smilax auriculata* / *Heterotheca subaxillaris* - *Strophostyles helvula* - (*Uniola paniculata*) Grassland
- CEGL004001 *Iva imbricata* / *Uniola paniculata* - *Helianthus* ssp. *debilis* Grassland
- CEGL004953 *Fuirena scirpoidea* - *Panicum tenerum* - *Dichanthelium wrightianum* - *Andropogon capillipes* Grassland
- CEGL004186 *Juncus roemerianus* Salt Marsh
- CEGL008456 *Typha domingensis* Salt Marsh
- CEGL004178 *Cladium mariscus* Tidal Salt Marsh
- CEGL004187 *Phragmites australis* ssp. *australis* Tidal Ruderal Marsh
- CEGL004962 *Panicum virgatum* - (*Cladium mariscus*, *Juncus roemerianus*) Salt Marsh
- CEGL004755 *Spartina patens* - *Schoenoplectus* (*americanus, pungens*) - (*Distichlis spicata*) Salt Marsh

- CEGL004190 *Spartina alterniflora* - *Juncus roemerianus* - *Distichlis spicata* Louisianian Zone Tidal Salt Marsh
- CEGL004110 *Fimbristylis castanea* - *Paspalum distichum* Marsh
- CEGL007718 *Carex striata* var. *striata* - *Xyris fimbriata* - *Lachnanthes caroliana* Marsh
- CEGL002386 *Nuphar advena* - *Nymphaea odorata* Aquatic Vegetation

Forest and Woodland Types

- CEGL003554 Pinus clausa / Quercus geminata - Quercus myrtifolia - Conradina canescens Woodland
- CEGL004680 Pinus elliottii / Serenoa repens - Ilex glabra - Morella cerifera - Ilex vomitoria Woodland
- CEGL004658 Pinus elliottii - (Pinus palustris) / Ilex vomitoria - Serenoa repens - Morella cerifera Woodland
- CEGL003656 Pinus palustris - (Pinus elliottii) / Ilex coriacea - Cyrilla racemiflora Woodland
- CEGL004958 Pinus elliottii / Spartina patens - Juncus roemerianus - (Panicum virgatum) Tidal Woodland
- CEGL003638 Pinus elliottii / Cliftonia monophylla - Cyrilla racemiflora Swamp Woodland
- CEGL003673 Pinus elliottii - (Pinus serotina) / Aristida beyrichiana - Rhynchospora oligantha - Sarracenia spp. Woodland
- NPSGUIS005 Pinus elliottii - Quercus myrtifolia - Quercus geminata Scrub Woodland
- CEGL007019 Quercus geminata / Serenoa repens - Ilex vomitoria - (Sideroxylon lanuginosum) Forest
- CEGL007020 Quercus geminata – (Quercus virginiana) / Serenoa repens – Lyonia fruticosa Forest
- CEGL007028 Quercus virginiana / Vaccinium arboreum - Ilex vomitoria Forest
- CEGL007032 Quercus virginiana - (Pinus elliottii, Sabal palmetto) / Persea borbonia - Callicarpa americana Forest
- CEGL007156 Nyssa biflora - Magnolia virginiana - (Pinus elliottii) / Morella (carolinensis, inodora) Swamp Forest
- CEGL002419 Nyssa aquatica Swamp Forest
- CEGL008477 Nyssa biflora - Liquidambar styraciflua / Magnolia virginiana / Hamamelis virginiana - Viburnum nudum Swamp Forest
- CEGL004638 Quercus nigra Ruderal Forest
- CEGL007225 Quercus alba - Carya alba / Aesculus pavia Forest
- CEGL004965 Fagus grandifolia - Magnolia grandiflora - Quercus michauxii - Quercus nigra / Rhododendron canescens Forest

Shrubland Types

- CEGL003813 Ilex vomitoria - Quercus (geminata, virginiana) - Morella cerifera - Serenoa repens Shrubland
- CEGL003824 Quercus myrtifolia - Quercus geminata - Ceratiola ericoides - Conradina canescens Shrubland
- CEGL003920 Baccharis halimifolia - Iva frutescens - Morella cerifera - (Ilex vomitoria) Saline Shrubland
- CEGL003839 Morella cerifera / Spartina patens Wet Shrubland
- CEGL003844 Cyrilla racemiflora - Lyonia lucida Wet Shrubland
- CEGL003864 Ceratiola ericoides - (Chrysoma paucifloculosa) / Polygonella polygama / Cladonia leporina Shrubland
- CEGL003947 Chrysoma paucifloculosa - Paronychia erecta Dwarf-Shrubland

Sparse Types

- NPSGUIS003 Beach Bare Sand
- NPSGUIS004 Hurricane Disturbed Area

Mapped Herbaceous Vegetation Types

NPSGUIS001 Panicum repens Ruderal Grassland

USNVC: Park Special NPSGUIS001

Field Plots: 1047, 2070, 2084, 1049, 1065, 2072

Map Class: GUIS MC101

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 2.67 ft (range 0 ft to 9 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean Flat (range Flat)

Macro Topography: Swale Interdunal Depression (6)

Soil Texture: Sand (1), Loamy Sand (2), Sandy Loam (2), Muck (1)

Environment: Six plots were sampled within this community. This community was found in interdunal depressions. Litter tended to dominate the ground cover with values between 25% and 85%. There were a few areas where water dominated the plot with cover between 30% and 70%.

Local Vegetation Description
Structure: Tall Shrub (0%-40%), Short Shrub (0%-20%), Herbaceous (80%-100%)

Vegetation Floristics: This ruderal community has been invaded by *Panicum repens*. *Panicum repens* typically has cover >70%. This community is often invading other herbaceous communities, so other common graminoids may be present include *Spartina patens, Juncus roemerianus*, and *Panicum virgatum*.

Dynamics: N/A

Conservation Status Rank
Global: N/A

State: N/A

Global Environmental Description
N/A

Global Vegetation Description
N/A

Florida Natural Areas Inventory
N/A

Example Photograph
Figure A1 below shows an example of NPSGUIS001 *Panicum repens* Ruderal Grassland.



Figure A1. *Panicum repens* Ruderal Grassland (CSU).

NPSGUIS002 Uniola paniculata Grassland
USNVC: Park Special NPSGUIS002

Field Plots: 2050, 2080, 2081, 1113

Map Class: GUIS MC102

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 22.75 ft (range 0 ft - 52 ft)

Aspect: Mean 57.5˚ (range 0˚ to 230˚)

Slope: Mean 2.5˚ (range 0˚ to 10˚)

Macro Topography: Upland (2), Primary Dune Backslope (1), Dune Field Complex (1)

Soil Texture: Sand (4)

Environment: Four plots were sampled within this community. This community was typically found on primary dune slopes and dune complexes. Litter dominated the ground cover with cover usually >75%. There is also a component of bare soil with cover typically between 5% and 15%.

Local Vegetation Description
Structure: Dwarf Shrub (0%-10%), Herbaceous (80%-90%)

Vegetation Floristics: This community is heavily vegetated by *Uniola paniculata*. *Uniola paniculata* typically has cover >70%. Other common species include *Panicum amarum, Heterotheca subaxillaris, Hydrocotyle bonariensis*, and *Schizachyrium maritimum*.

Dynamics: N/A

Conservation Status Rank
Global: N/A

State: N/A

Global Environmental Description
N/A

Global Vegetation Description
N/A

Florida Natural Areas Inventory
N/A

Example Photograph

Figure A2 below shows an example of NPSGUIS002 *Uniola paniculata* Grassland.



Figure A2. *Uniola paniculata* Grassland (CSU.).

CEGL004041 Uniola paniculata - Panicum amarum var. amarulum - Iva imbricata Grassland

Table A1 below shows the USNVC Hierarchy for CEGL004041 *Uniola paniculata – Panicum amarum* var. *amarulum – Iva imbricata* Grassland.

Table A1. USNVC hierarchy for CEGL004041 *Uniola paniculata – Panicum amarum* var. *amarulum – Iva imbricata* Grassland.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.B Temperate & Boreal Grassland & Shrubland
Formation	2.B.4 Temperate to Polar Scrub & Herb Coastal Vegetation
Division	2.B.4.Na Eastern North American Coastal Scrub & Herb Vegetation
Macrogroup	2.B.4.Na Eastern North American Coastal Dune & Grassland

Table A1 (continued). USNVC hierarchy for CEGL004041 *Uniola paniculata – Panicum amarum* var. *amarulum – Iva imbricata* Grassland.

Category	Description
Group	2.B.4.Na South Atlantic & Gulf Coastal Dune & Grassland
Alliance	A1199 Uniola paniculata - Panicum amarum Dune Grassland Alliance
Association	2.B.4.Na Uniola paniculata - Panicum amarum var. amarulum - Iva imbricata Grassland (CEGL004041)

Field Plots: 1009, 1012, 2032, 1015, 1021, 2016, 2019, 2017, 1062, 1064, 2065, 2087, 2028, 1082, 1005, 1017, 2011, 3006, 3007, 2078, 1078, 1006

Map Class: GUIS MC102

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 8.64 ft (range 0 ft to 32 ft)

Aspect: Mean 33.32˚ (range 0˚ to 320˚)

Slope: Mean 1.82˚ (range 0˚ to 12˚)

Macro Topography: Bayshore (2), Dune Field Complex (9), Primary Dune (5), Primary Dune Backslope (2), Shoreline Beach (4)

Soil Texture: Sand (22)

Environment: Twenty-two plots were sampled within this community. This community primarily occurred on shoreline beaches, dune complexes, and primary dunes. Bare soil dominated the ground cover with values between 10% and 99%. When bare soil did not dominate the ground cover, litter was the primary component with values between 0% and 70%.

Local Vegetation Description
Structure: Dwarf Shrub (0%-30%), Herbaceous (10%-80%)

Vegetation Floristics: This community is usually dominated by a sparse herbaceous stratum of *Uniola paniculata, Panicum amarum, Iva imbricata,* and *Heterotheca subaxillaris*. *Uniola paniculata* tends to be the most dominant species with cover usually <50%; however, *Panicum amarum* may have greater cover. Occasionally, *Panicum amarum* reaches cover >80% cover when occurring on areas protected from the wind and waves such as Naval Live Oaks.

Dynamics: This community persists as long as it continues to be exposed to sand burial. Within 2-6 years after a dune ridge is protected, *Schizachyrium maritimum* becomes dominant and replaces both *Uniola paniculata* and *Panicum amarum* (var. *amarulum*).

Conservation Status Rank
Global: G2

State (Florida): S2

Global Environmental Description
Bare sand averages 79% in this community, somewhat more than related dune vegetation of the region (Johnson 1997).

Global Vegetation Description
According to Johnson (1997) this fore dune beach community is dominated by *Uniola paniculata* and *Panicum amarum* (var. *amarulum*), with *Schizachyrium maritimum* and *Iva imbricata* as frequent associates. The species composition changes as a dune is protected from sand burial; *Schizachyrium maritimum* will replace both *Uniola paniculata* and *Panicum amarum*.

Florida Natural Area Inventory
Beach Dune

Example Photograph
Figure A3 below shows an example of CEGL004041 *Uniola paniculata – Panicum amarum – Iva imbricata* Grassland.



Figure A3. *Uniola paniculata - Panicum amarum - Iva imbricata* Grassland (CSU).

Short Citation: Johnson, 1997.

CEGL004057 Schizachyrium maritimum - (Heterotheca subaxillaris) Grassland

Table A2 below shows the USNVC Hierarchy for CEGL004057 *Schizachyrium maritimum* – (*Heterotheca subaxillaris*) Grassland.

Table A2. USNVC hierarchy for CEGL004057 *Schizachyrium maritimum* – (*Heterotheca subaxillaris*) Grassland.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.B Temperate & Boreal Grassland & Shrubland
Formation	2.B.4 Temperate to Polar Scrub & Herb Coastal Vegetation
Division	2.B.4.Na Eastern North American Coastal Scrub & Herb Vegetation
Macrogroup	2.B.4.Na Eastern North American Coastal Dune & Grassland
Group	2.B.4.Na South Atlantic & Gulf Coastal Dune & Grassland
Alliance	A1222 *Schizachyrium maritimum - Heterotheca subaxillaris* Dune Grassland Alliance
Association	2.B.4.Na *Schizachyrium maritimum* - (*Heterotheca subaxillaris*) Grassland (CEGL004057)

Field Plots: 1044, 1051, 2062, 2015, 2069, 1013, 2048, 1022, 1019, 1046, 1048, 1052

Map Class: GUIS MC103

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 11 ft (range 0 ft to 50 ft)

Aspect: Mean 104.42˚ (range 0˚ to 332˚)

Slope: Mean 2.42˚ (range 0˚ to 9˚)

Macro Topography: Bayshore (2), Dune Field Complex (4), Primary Dune Backslope (6)

Soil Texture: Sand (12)

Environment: Twelve plots were sampled within this community. This community primarily occurred on primary dune backslopes and dune field complexes. Bare soil dominated the ground cover with values ranging from 13% to 98%. When there are more plants present, litter may dominate ground cover with values ranging from 10% to 85%.

Local Vegetation Description
Structure: Dwarf Shrub (0%-30%), Herbaceous (0%-70%)

Vegetation Floristics: This community is dominated by *Schizachyrium scoparium* and *Heterotheca subaxillaris* with herbaceous cover values typically <40%. Other common beach species may be present such as *Uniola paniculata* and *Panicum amarum*, but these species do not have greater cover than either *Heterotheca subaxillaris* or *Schizachyrium scoparium*. A variety of forbs tends to be within this community as well, such as *Balduina angustifolia*, *Ipomoea imperati*, *Chamaecrista fasciculata*, *Diodia teres*, and others.

Dynamics: This association occurs on dunes that have been protected from active sand burial for approximately 2-6 years (Johnson 1997); more active sand burial favors *Uniola* and *Panicum amarum* [see *Uniola paniculata* - *Panicum amarum* var. *amarulum* - *Iva imbricata* Grassland (CEGL004041)]. With longer periods of protection, this vegetation will succeed to *Chrysoma pauciflosculosa* - *Paronychia erecta* Dwarf-shrubland (CEGL003947).

Conservation Status Rank
Global: G2

State (Florida): S2

Global Environmental Description
This is a dune grassland community. It occurs on dunes that have been protected from active sand burial for approximately 2-6 years (Johnson 1997).

Global Vegetation Description

This grassland community is dominated by *Schizachyrium maritimum* but may also have less amounts of *Panicum amarum* var. *amarulum* (= *Panicum amarulum*) and/or *Uniola paniculata*. There is some variation in the expression of this association from west to east. Examples from the western panhandle of Florida and southern Alabama more regularly contain *Paronychia erecta*, *Chrysopsis godfreyi*, *Balduina angustifolia*, *Galactia microphylla*, *Chrysopsis gossypina* ssp. *cruiseana*, and *Chrysoma pauciflosculosa*. Examples from the eastern panhandle of Florida are usually codominated by *Schizachyrium maritimum* and *Heterotheca subaxillaris*, and lack *Paronychia erecta*, *Chrysopsis godfreyi*, *Balduina angustifolia*, *Galactia microphylla*, *Chrysopsis gossypina* ssp. *cruiseana*, and *Chrysoma pauciflosculosa*. *Heterotheca subaxillaris* is a weedy species which cannot tolerate sand burial, and thus may be a temporary member of this community; it vanished from many areas of Florida after Hurricane Opal (A. Johnson pers. comm.)

Florida Natural Areas Inventory

Beach Dune

Example Photograph

Figure A4 below shows an example of CEGL004057 *Schizachyrium maritimum* – (*Heterotheca subaxillaris*) Grassland.



Figure A4. *Schizachyrium maritimum* - (*Heterotheca subaxillaris*) Grassland (CSU).

Short Citation: Johnson, 1997.

CEGL004234 Smilax auriculata / Heterotheca subaxillaris - Strophostyles helvula - (Uniola paniculata) Grassland

Table A3 below shows the USNVC Hierarchy for CEGL004234 *Smilax auriculata* / *Heterotheca subaxillaris – Strophostyles helvula –* (*Uniola paniculata*) Grassland.

Table A3. USNVC hierarchy for CEGL004234 *Smilax auriculata* / *Heterotheca subaxillaris – Strophostyles helvula* – (*Uniola paniculata*) Grassland.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.B Temperate & Boreal Grassland & Shrubland
Formation	2.B.4 Temperate to Polar Scrub & Herb Coastal Vegetation
Division	2.B.4.Na Eastern North American Coastal Scrub & Herb Vegetation
Macrogroup	2.B.4.Na Eastern North American Coastal Dune & Grassland
Group	2.B.4.Na South Atlantic & Gulf Coastal Dune & Grassland
Alliance	A1199 *Uniola paniculata - Panicum amarum* Dune Grassland Alliance
Association	2.B.4.Na *Smilax auriculata / Heterotheca subaxillaris - Strophostyles helvula* - (*Uniola paniculata*) Grassland (CEGL004234)

Field Plots: 2024, 2027, 1027, 1109

Map Class: GUIS MC104

Local Environmental Description

Plot/Sample Data Environmental Summary

Elevation: Mean 0 ft (range 0 ft)

Aspect: Mean 58˚ (range 0˚ to 232˚)

Slope: Mean 2˚ (range 0˚ to 8˚)

Macro Topography: Bayshore (1), Dune Field Complex (2), Upland (1)

Soil Texture: Sand (3), Loamy Sand (1)

Environment: Four plots were sampled within this community. These communities generally occurred on drier areas on the sound side of the barrier islands. Litter typically dominates the ground cover with values between 33% and 90%. Bare soil is also prominent with cover values between 8% and 60%.

Local Vegetation Description
Structure: Canopy (0%-10%), Short Shrub (0%-20%), Dwarf Shrub (0%-40%), Herbaceous (0%-40%), Vine (30%-80%)

Vegetation Floristics: These communities are characterized by a high abundance of *Smilax* spp., either *Smilax auriculata* or *Smilax bona-nox*, and generally occurred on backdunes near the sound. *Smilax* sp. cover ranges between 10% and 60%. Graminoids tend to have greater abundance than forbs with the most abundant including *Uniola paniculata* and *Distichlis spicata*. Common forbs may include *Hydrocotyle bonariensis*, *Opuntia erecta*, and *Sabatia grandiflora*.

Dynamics: N/A

Conservation Status Rank
Global: G2G3

State (Florida): S2

Global Environmental Description
This coastal grassland community occurs in northeastern Florida, ranging from Volusia County, Florida, northwards to North Carolina. In Florida, this community occurs "primarily on the broader barrier islands such as Amelia, Little Talbot, and Anastasia islands" (Johnson and Muller 1993b), and "only on prograding coasts" (Johnson and Muller 1993b).

Global Vegetation Description
This community is dominated by woody vines and forbs, including *Smilax auriculata*, *Heterotheca subaxillaris*, *Opuntia pusilla*, *Opuntia stricta*, *Sideroxylon tenax*, *Forestiera segregata*, *Morella cerifera*, and *Ipomoea imperati*.

Florida Natural Areas Inventory
Beach Dune

Example Photograph
Figure A5 below shows an example of CEGL004234 *Smilax auriculata* / *Heterotheca subaxillaris* – *Strophostyles helvula* – (*Uniola paniculata*) Grassland.



Figure A5. *Smilax auriculata / Heterotheca subaxillaris - Strophostyles helvula* - (*Uniola paniculata*) Grassland (CSU)

Short Citation: Johnson and Muller, 1993b.

CEGL004001 Iva imbricata / Uniola paniculata - Helianthus debilis ssp. debilis Grassland

Table A4 below shows the USNVC Hierarchy for CEGL004001 *Iva imbricata* / *Uniola paniculata* – *Helianthus* ssp. *debilis* Grassland.

Table A4. USNVC hierarchy for CEGL004001 *Iva imbricata* / *Uniola paniculata* – *Helianthus debilis* ssp. *debilis* Grassland.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.B Temperate & Boreal Grassland & Shrubland
Formation	2.B.4 Temperate to Polar Scrub & Herb Coastal Vegetation
Division	2.B.4.Na Eastern North American Coastal Scrub & Herb Vegetation
Macrogroup	2.B.4.Na Eastern North American Coastal Dune & Grassland
Group	2.B.4.Na South Atlantic & Gulf Coastal Dune & Grassland

Table A4 (continued). USNVC hierarchy for CEGL004001 *Iva imbricata* / *Uniola paniculata* – *Helianthus debilis* ssp. *debilis* Grassland.

Category	Description
Alliance	A3693 *Uniola paniculata - Muhlenbergia filipes - Ernodea littoralis* Subtropical Dune Grassland Alliance
Association	2.B.4.Na *Iva imbricata / Uniola paniculata - Helianthus debilis* ssp. *debilis* Grassland (CEGL004001)

Field Plots: 2018

Map Class: GUIS MC102

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 0 ft (range 0 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Shoreline Beach

Soil Texture: Sand (1)

Environment: One plot was sampled within this community. This community occurred along the shoreline beach. Bare soil dominated with almost 100% cover.

Local Vegetation Description
Structure: Herbaceous (30%)

Vegetation Floristics: Vegetation is very sparse with *Iva imbricata* dominating the community with cover of ~30%. Other plants present include *Uniola paniculata* and *Panicum amarum*.

Dynamics: N/A

Conservation Status Rank
Global: G2G3

State (Florida): S2

Global Environmental Description
N/A

Global Vegetation Description

Examples are dominated by *Iva imbricata* and *Uniola paniculata*. Other common species include *Panicum amarum* var. *amarulum*, *Ipomoea pes-caprae*, *Spartina patens*, *Paspalum distichum*, *Sesuvium portulacastrum*, and *Heterotheca subaxillaris*. Scattered shrubs such as *Coccoloba uvifera*, *Lantana depressa*, and *Sabal palmetto* may occur at low cover. Johnson et al. (1990b) provide a species list for this community with abundance values for all taxa.

Florida Natural Areas Inventory

Beach Dune

Example Photograph

Figure A6 below shows an example of CEGL004001 *Iva imbricata* / *Uniola paniculata – Helianthus debilis* ssp. *debilis* Grassland.



Figure A6. *Iva imbricata / Uniola paniculata - Helianthus debilis* ssp. *debilis* Grassland (CSU).

Short Citation: Johnson et al., 1990b.

CEGL004953 Fuirena scirpoidea - Panicum tenerum - Dichanthelium wrightianum - Andropogon capillipes Grassland

Table A5 below shows the USNVC Hierarchy for CEGL004953 *Fuirena scirpoidea – Panicum tenerum – Dichanthelium wrightianum – Andropogon capillipes* Grassland.

Table A5. USNVC hierarchy for CEGL004953 *Fuirena scirpoidea – Panicum tenerum – Dichanthelium wrightianum – Andropogon capillipes* Grassland.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.B Temperate & Boreal Grassland & Shrubland
Formation	2.B.4 Temperate to Polar Scrub & Herb Coastal Vegetation
Division	2.B.4.Na Eastern North American Coastal Scrub & Herb Vegetation
Macrogroup	2.B.4.Na Eastern North American Coastal Dune & Grassland
Group	2.B.4.Na South Atlantic & Gulf Coastal Dune & Grassland
Alliance	A3687 *Andropogon capillipes - Panicum tenerum - Dichanthelium wrightianum* Wet Grassland Alliance
Association	2.B.4.Na *Fuirena scirpoidea - Panicum tenerum - Dichanthelium wrightianum - Andropogon capillipes* Grassland (CEGL004953)

Field Plots: 1016, 1107, 2013, 1108, 1106, 1105, 2022

Map Class: GUIS MC105

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 1.71 ft (range 0 ft to 8 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Bayshore (1), Dune Field Complex (1), Swale Interdunal Depression (5)

Soil Texture: Sand (7)

Environment: Seven plots were sampled within this community. These communities typically occurred within interdunal swales and dune field complexes. This intermittently flooded community has ground cover dominated by bare soil, water, or litter. Bare soil can range from 0%-95%, water can range from 0% to 60%, and litter can range from 0%-85%.

Local Vegetation Description
Structure: Herbaceous (60%-100%)

Vegetation Floristics: This community is mainly dominated by mesic graminoids and occurs within interdunal depressions. The herbaceous stratum is often very dense with covers ranging between 60% and 100%. *Fuirena scirpoidea* is diagnostic of this community even though it may not be the most dominant species. Other common graminoids include *Rhynchospora* spp., *Panicum repens*, and

Juncus roemerianus. *Xyris jupicai* is often present but in small abundances. Common forbs in this community include *Centella asiatica* and *Hydrocotyle bonariensis*.

Dynamics: N/A

Conservation Status Rank
Global: G2

State (Florida): S2

Global Environmental Description
This association occurs in seasonally flooded (but shallow and relatively short duration) interdune swales.

Global Vegetation Description
Characteristic species observed in southern Alabama include *Fuirena scirpoidea*, *Panicum tenerum*, *Dichanthelium wrightianum,* and *Andropogon capillipes* (M. Pyne pers. obs., A. Weakley pers. obs.). Some Mississippi data include *Fuirena scirpoidea*, *Dichanthelium sabulorum,* and *Euthamia leptocephala* as components of the "Barrier Island Mesic/Dry Meadow" (Wieland 2000b), which seems to be apparently related. For the time being, this is accommodated in this community.

Florida Natural Areas Inventory
Beach Dune

Example Photograph
Figure A7 below shows an example of CEGL004953 *Fuirena scirpoidea – Panicum tenerum – Dichanthelium wrightianum – Andropogon capillipes* Grassland.



Figure A7. *Fuirena scirpoidea-Panicum tenerum-Dichanthelium wrightianum-Andropogon capillipes* Grassland (CSU).

Short Citation: Wieland, 2000b.

CEGL004186 Juncus roemerianus Salt Marsh

Table A6 below shows the USNVC Hierarchy for CEGL004186 *Juncus roemerianus* Salt Marsh.

Table A6. USNVC hierarchy for CEGL004186 *Juncus roemerianus* Salt Marsh.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.C Shrub & Herb Wetland
Formation	2.C.5 Salt Marsh
Division	2.C.5.Nb North American Atlantic & Gulf Coastal Salt Marsh
Macrogroup	2.C.5.Nb North American Atlantic & Gulf Coastal Salt Marsh
Group	2.C.5.Nb Atlantic & Gulf Coastal High Salt Marsh
Alliance	A4020 *Juncus roemerianus* Salt Marsh Alliance
Association	2.C.5.Nb *Juncus roemerianus* Salt Marsh (CEGL004186)

Field Plots: 1028, 1031, 2053, 1060, 1090, 2094, 1068, 2068, 1014, 1055, 1080, 2012, 2034, 2073, 2106

Map Class: GUIS MC106

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 5.4 ft (range 0 ft to 31 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Bayshore (1), Floodplain Active Channel (1), Swale Interdunal Depression (6), Tidal Lagoon (7)

Soil Texture: Sand (7), Loamy Sand (3), Sandy Loam (1), Silt (2), Muck (2)

Environment: Fifteen plots were sampled within this community. These communities occurred in tidal lagoons and interdunal swales. Water dominated the ground cover with values ranging from 20% to 80%. When present, litter could reach cover values up to 60%.

Local Vegetation Description
Structure: Herbaceous (80%-100%)

Vegetation Floristics: This community is dominated by dense *Juncus roemerianus* with cover >50%. Often this community forms a monoculture, but other common species may include *Panicum repens, Spartina patens*, and *Fimbristylis castanea*.

Dynamics: Lynch (1941) described three types of fires: cover burns, root burns, and peat burns. Net primary productivity increased in a *Juncus roemerianus* marsh after a winter burn in Mississippi, but after repeated burns vigor and growth of *Juncus roemerianus* declined and other species began to replace it. Hackney and de la Cruz (1981) also pointed out that monospecific *Juncus roemerianus* marshes are more difficult to burn on such a frequent basis and may resist changes to community structure that may occur in more mixed *Juncus roemerianus* marshes.

Conservation Status Rank
Global: G5

State: N/A

Global Environmental Description
Large expanses of this community are found in northwest Florida, where approximately 60% of the salt marshes consist of monospecific stands of this community. These stands extend nearly to the water's edge and may be considered low marsh (Montague and Wiegert 1990). In other regions of Florida, including northeast Florida, Indian River (central Atlantic coast), and south Florida, *Juncus*

roemerianus occurs in smaller discrete patches of high marsh (Montague and Wiegert 1990). Presumably, this community also occurs primarily as high salt marsh along the Atlantic coast as well (Hackney and de la Cruz 1982). In Mississippi *Juncus roemerianus* marsh was inundated less than 5.4% of the time that any portion of the marsh was flooded (Eleuterius and Eleuterius 1979). Due to longer and more frequent periods of exposure and resulting evaporation, interstitial water salinity may be higher than more frequently inundated zones. In addition, the interstitial water salinity was generally higher and more stable than flood water (Hackney and de la Cruz 1982). A range of soil conditions may be present in this broadly defined association, but soils are generally poorly to very poorly drained. In some areas, including tall-growth zones, soils were highly organic and peaty (averaging 15 cm in depth), while shorter zones occurred on sandy soils underlain by clay (Eleuterius and Caldwell 1984). In general, *Juncus roemerianus* occurs on sandy substrates (Penfound 1952). pH at the Mississippi site was 6.2 (Hackney and de la Cruz 1982).

Global Vegetation Description

The very dense vegetation is typically exclusively codominated by *Juncus roemerianus* and *Spartina alterniflora*. 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 may occur at low cover include *Borrichia frutescens*, *Baccharis halimifolia*, *Spartina alterniflora*, *Distichlis spicata*, *Schoenoplectus robustus* (= *Scirpus robustus*), *Limonium carolinianum*, *Symphyotrichum tenuifolium* (= *Aster tenuifolius*), *Symphyotrichum subulatum* (= *Aster subulatus*), and (in more southern occurrences) *Ipomoea sagittata*.

Florida Natural Areas Inventory

Salt Marsh

Example Photograph

Figure A8 below shows an example of CEGL004186 *Juncus roemerianus* Salt Marsh.



Figure A8. *Juncus roemerianus* Salt Marsh (CSU).

Short Citation:

- Eleuterius and Eleuterius, 1979
- Eleuterius and Caldwell, 1984
- Hackney and La Cruz, 1981
- Kruczynski et al., 1978
- Lynch, 1941
- Montague and Wiegert, 1990
- Penfound, 1952
- Stout, 1984.

CEGL008456 Typha domingensis Salt Marsh

Table A7 below shows the USNVC Hierarchy for CEGL008456 *Typha domingensis* Salt Marsh.

Table A7. USNVC Hierarchy for CEGL008456 *Typha domingensis* Salt Marsh.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.C Shrub & Herb Wetland
Formation	2.C.4 Temperate to Polar Freshwater Marsh, Wet Meadow & Shrubland
Division	2.C.4.Ne Atlantic & Gulf Coastal Marsh, Wet Meadow & Shrubland
Macrogroup	2.C.4.Ne Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh
Group	2.C.4.Ne Atlantic & Gulf Coastal Fresh-Oligohaline Tidal Marsh
Alliance	A4015 *Typha domingensis - Eleocharis rostellata* Gulf Coastal Plain Oligohaline Tidal Marsh Alliance
Association	2.C.4.Ne *Typha domingensis* Tidal Marsh (CEGL008456)

Field Plots: 1026, 2023, 2026, 1053, 2082, 2089, 3001, 2046

Map Class: GUIS MC107

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 9.63 ft (range 0 ft to 29 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Swale Interdunal Depression (5), Tidal Lagoon (3)

Soil Texture: Sand (3), Muck (5)

Environment: Eight plots were sampled within this community. This community occurred in either tidal lagoons or interdunal depressions. Water primarily dominated the ground cover among these sites with cover values ranging from 35% to 90%. Occasionally, there is a large portion of litter, which when present has cover values between 10% and 50%.

Local Vegetation Description
Structure: Herbaceous (70%-100%)

Vegetation Floristics: *Typha domingensis* dominates this community with cover >70%. This community tends to form dense monocultures.

Dynamics: N/A

Conservation Status Rank
Global: N/A

State: N/A

Global Environmental Description
This association occurs in deeply flooded tidal waters, on protected estuarine shores.

Global Vegetation Description
Typically, this association consists of pure stands of *Typha domingensis* (NatureServe Ecology - Southeastern U.S. unpubl. data 1999, 2000).

Florida Natural Areas Inventory
Slough Marsh

Example Photograph
Figure A9 below shows an example of CEGL008456 *Typha domingensis* Salt Marsh.



Figure A9. *Typha domingensis* Salt Marsh (CSU).

Short Citation: NatureServe Ecology – Southeastern U.S. unpubl. Data 1999, 2000.

CEGL004178 Cladium mariscus Tidal Salt Marsh

Table A8 below shows the USNVC Hierarchy for CEGL004178 *Cladium mariscus* Tidal Salt Marsh.

Table A8. USNVC hierarchy for CEGL004178 *Cladium mariscus* Tidal Salt Marsh.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.C Shrub & Herb Wetland
Formation	2.C.5 Salt Marsh
Division	2.C.5.Nb North American Atlantic & Gulf Coastal Salt Marsh
Macrogroup	2.C.5.Nb North American Atlantic & Gulf Coastal Salt Marsh
Group	2.C.5.Nb Atlantic & Gulf Coastal Brackish Salt Marsh
Alliance	A4013 *Spartina alterniflora - Spartina cynosuroides* Brackish Tidal Marsh Alliance
Association	2.C.5.Nb *Cladium mariscus* Tidal Salt Marsh (CEGL004178)

Field Plots: 1011, 2008, 1023, 1114

Map Class: GUIS MC108

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 21 ft (range 0 ft to 41 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Bayshore (1), Swale Interdunal Depression (1), Tidal Lagoon (2)

Soil Texture: Sand (2), Muck (2)

Environment: Four plots were sampled within this community. This community occurred in flooded or saturated tidal lagoons or interdunal depressions. Water usually dominated the ground cover with values between 50%-86%.

Local Vegetation Description
Structure: Herbaceous (90%-100%)

Vegetation Floristics: The community is dominated by *Cladium mariscus* and *Typha domingensis*. *Cladium mariscus* has cover ranging between 50% and 100%; when present, *Typha domingensis* has cover values ~50%. *Juncus roemerianus* typically occurs within these communities as well. Other common species included *Kosteletzkya virginica, Ipomoea sagittata,* and *Cynanchum angustifolium*.

Dynamics: N/A

Conservation Status Rank
Global: G4?

State: N/A

Global Environmental Description
In Florida this association occurs along the Gulf of Mexico and the Atlantic Coast in tidally influenced, upper reaches of river mouths where estuarine (salt) marshes blend with freshwater marshes (FNAI 1990). At this juncture, salinity levels are greatly diminished, allowing *Cladium mariscus* ssp. *jamaicense* (which is relatively salt intolerant) to form dense stands.

Global Vegetation Description
Stands are typically dominated by a very dense herbaceous layer of *Cladium mariscus* ssp. *jamaicense*. Additional species may include *Juncus roemerianus*, *Osmunda regalis*, *Polygonum hydropiperoides*, *Spartina alterniflora*, *Spartina bakeri*, *Typha domingensis*, *Amaranthus australis*, *Amaranthus cannabinus*, *Hibiscus* sp., *Solidago sempervirens* var. *mexicana*, and *Woodwardia virginica*, among others. In addition, there may be a sparse tree layer (10-15 m tall) of *Acer rubrum*, *Juniperus virginiana* var. *silicicola*, and *Sabal palmetto*. There may also be a very sparse to moderate shrub layer (2-5 m) of *Acer rubrum*, *Baccharis angustifolia*, *Morella cerifera*, and *Salix caroliniana*, among others. In addition, the noxious exotic *Triadica sebifera* could be present.

Florida Natural Areas Inventory
Slough Marsh

Example Photograph
Figure A10 below shows an example of CEGL004178 *Cladium mariscus* Tidal Salt Marsh.



Figure A10. *Cladium mariscus* Tidal Salt Marsh (CSU).

Short Citation: FNAI, 1990.

CEGL004187 Phragmites australis ssp. australis Tidal Ruderal Marsh

Table A9 below shows the USNVC Hierarchy for CEGL004187 *Phragmites australis* ssp. *australis* Tidal Ruderal Marsh.

Table A9. USNVC hierarchy for CEGL004187 *Phragmites australis* ssp. *australis* Tidal Ruderal Marsh.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.C Shrub & Herb Wetland
Formation	2.C.4 Temperate to Polar Freshwater Marsh, Wet Meadow & Shrubland
Division	2.C.4.Nd Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
Macrogroup	2.C.4.Nd Eastern-Southeastern North American Ruderal Marsh, Wet Meadow & Shrubland
Group	2.C.4.Nd Eastern Ruderal Wet Meadow & Marsh
Alliance	A1431 *Phragmites australis* ssp. *australis* Ruderal Marsh Alliance
Association	2.C.4.Nd *Phragmites australis* ssp. *australis* Tidal Ruderal Marsh (CEGL004187)

Field Plots: 1112, 2055, 2049

Map Class: GUIS MC109

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 16.33 ft (range 8 ft to 23 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Dune Field Complex (1), Swale Interdunal Depression (2)

Soil Texture: Sand (2), Muck (1)

Environment: Three plots were sampled within this community. This community occurred mainly in interdunal swales. Litter typically dominates the ground cover with values ranging from 35% to 90%. Water can range ranging from 10% to 45%.

Local Vegetation Description
Structure: Herbaceous (90%)

Vegetation Floristics: This community is dominated by *Phragmites australis* with cover between 60% and 90%. *Phragmites australis* typically forms monocultures; however, other common species include *Ipomoea sagittaria*, *Spartina patens*, and *Hydrocotyle bonariensis*.

Dynamics: N/A

Conservation Status Rank
Global: N/A

State: N/A

Global Environmental Description
This community is a dense tall grassland indicative of disturbance. It occurs in a range of tidal wetland habitats from fresh to brackish in salinity.

Global Vegetation Description
This community is a broadly defined reed grass marsh. It is characterized by dense stands of *Phragmites australis* ssp. *australis*, an exotic taxon which tends to grow in colonies of tall, stout, leafy plants often to the exclusion of all other vascular plant species. Associated species are highly variable, depending on the community that has been invaded. Spreading in large colonies, *Phragmites* eventually dominates disturbed areas at coverage up to 100%. More typically, though, scattered individuals of other species may occur, such as sparse *Morella cerifera (= Myrica cerifera)* shrubs, *Kosteletzkya virginica, Calystegia sepium, Boehmeria cylindrica, Typha*

angustifolia, Apocynum cannabinum, Rosa palustris, Polygonum sp., and *Mikania scandens*. Vines of *Toxicodendron radicans* are also frequent but typically occur at low cover.

Florida Natural Areas Inventory
Floodplain Marsh

Example Photograph
Figure A11 below shows an example of CEGL004187 *Phragmites australis* ssp. *australis* Tidal Ruderal Marsh.



Figure A11. *Phragmites australis* ssp. *australis* Tidal Ruderal Marsh (CSU).

CEGL004962 Panicum virgatum - (Cladium mariscus, Juncus roemerianus) Salt Marsh

Table A10 below shows the USNVC Hierarchy for CEGL004962 *Panicum virgatum* – (*Cladium mariscus*, *Juncus roemerianus*) Salt Marsh.

Table A10. USNVC hierarchy for CEGL004962 *Panicum virgatum* – (*Cladium mariscus*, *Juncus roemerianus*) Salt Marsh.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.C Shrub & Herb Wetland
Formation	2.C.5 Salt Marsh
Division	2.C.5.Nb North American Atlantic & Gulf Coastal Salt Marsh
Macrogroup	2.C.5.Nb North American Atlantic & Gulf Coastal Salt Marsh
Group	2.C.5.Nb Atlantic & Gulf Coastal High Salt Marsh
Alliance	A4020 *Juncus roemerianus* Salt Marsh Alliance
Association	2.C.5.Nb *Panicum virgatum* - (*Cladium mariscus, Juncus roemerianus*) Salt Marsh (CEGL004962)

Field Plots: 2007, 2031, 2064

Map Class: GUIS MC110

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 3 ft (range 0 ft to 9 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Bayshore (1), Swale Interdunal Depression (2)

Soil Texture: Sand (2), Muck (1)

Environment: Three plots were sampled within this community. This community occurred in mesic areas such as interdunal swales and bayshores. Water dominates the ground cover with values ranging from 70% to 85%.

Local Vegetation Description
Structure: Herbaceous (90%-100%)

Vegetation Floristics: Graminoids dominate the herbaceous stratum with cover values ranging from 90% to 100%. An abundance of *Panicum virgatum* separates this community from other mesic graminoid communities. *Panicum virgatum* cover is typically ~30%. Other abundant graminoids include *Juncus roemerianus*, *Spartina patens*, and *Cladium mariscus*. Forbs tend to be fairly sparse but may include *Xyris jupicai, Kosteletzkya virginica*, and *Ipomoea sagittata*.

Dynamics: N/A

Conservation Status Rank
Global: G3

State: N/A

Global Environmental Description
N/A

Global Vegetation Description
This southern switchgrass tidal grassland of the Gulf Coast is dominated by *Panicum virgatum*. Other characteristic species may include *Juncus roemerianus, Cladium mariscus ssp. jamaicense, Sagittaria lancifolia*, and *Spartina cynosuroides*. This association occurs in brackish to nearly freshwater tidal marshes, usually slightly upslope from *Juncus roemerianus* marshes, and often adjacent to nearby upland (or saturated non-tidal) forests. Sometimes it occurs on higher ground on the edges of tidal creeks.

Florida Natural Areas Inventory
Basin Marsh

Example Photograph
Figure A12 below shows an example of CEGL004962 *Panicum virgatum* – (*Cladium mariscus*, *Juncus roemerianus*) Salt Marsh.



Figure A12. *Panicum virgatum* - (*Cladium mariscus, Juncus roemerianus*) Salt Marsh (CSU).

CEGL004755 Spartina patens - Schoenoplectus (americanus, pungens) - (Distichlis spicata) Salt Marsh

Table A11 below shows the USNVC Hierarchy for CEGL004755 *Spartina patens – Schoenoplectus* (*americanus*, *pungens*) – (*Distichlis spicata*) Salt Marsh.

Table A11. USNVC hierarchy for CEGL004755 *Spartina patens – Schoenoplectus* (*americanus*, *pungens*) – (*Distichlis spicata*) Salt Marsh.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.C Shrub & Herb Wetland
Formation	2.C.5 Salt Marsh
Division	2.C.5.Nb North American Atlantic & Gulf Coastal Salt Marsh
Macrogroup	2.C.5.Nb North American Atlantic & Gulf Coastal Salt Marsh
Group	2.C.5.Nb Atlantic & Gulf Coastal High Salt Marsh
Alliance	A1481 *Spartina patens* High Salt Marsh Alliance
Association	2.C.5.Nb *Spartina patens - Schoenoplectus* (*americanus, pungens*) - (*Distichlis spicata*) Salt Marsh (CEGL004755)

Field Plots: 1045, 2093, 2076, 1077, 1059, 2044, 2058, 2086, 2059, 2052, 2079, 1071, 2088, 2045, 2074

Map Class: GUIS MC111

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 7.2 ft (range 0 ft to 41 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Dune Field Complex (2), Swale Interdunal Depression (11), Tidal Lagoon (2)

Soil Texture: Loamy Sand (1), Sandy Loam (1), Muck (4), Silty Clay Loam (1), Sand (8)

Environment: Fifteen plots were sampled within this community. This community occurred in interdunal swales, tidal lagoons, and occasionally dune field complexes. Litter or water dominated the plots; in drier areas, litter dominated with values >50%, but this community may be partially submerged with water ground cover >50%.

Local Vegetation Description
Structure: Tall Shrub (0%-50%), Herbaceous (50%-100%)

Vegetation Floristics: *Spartina patens* dominates this community generally with cover >50%. Occasionally other species may codominate with *Panicum repens* or *Juncus roemerianus*. *Baccharis halimifolia* and *Iva frutescens* are the common shrubs and usually have cover ~20%.

Dynamics: Dominance patterns are likely related to gradients in salinity and hydrology and are poorly understood.

Conservation Status Rank
Global: G4

State: N/A

Global Environmental Description
This community is found in irregularly flooded high marsh zones. This zone grades down into vegetation dominated by *Juncus roemerianus* or *Spartina alterniflora*, and up into shrub-dominated zones or saline prairie.

Global Vegetation Description
This association is dominated by *Spartina patens*. Other species that may be present in variable amounts include *Distichlis spicata*, *Juncus roemerianus*, *Vigna luteola*, *Typha* spp., *Phragmites australis*, *Spartina alterniflora*, *Lythrum lineare*, *Lythrum alatum* var. *lanceolatum*, *Cyperus*

articulatus, *Kosteletzkya virginica*, *Spartina cynosuroides* (within its range), *Paspalum vaginatum*, *Borrichia frutescens*, *Baccharis halimifolia*, *Schoenoplectus americanus* (= *Scirpus americanus*), *Schoenoplectus pungens* (= *Scirpus pungens*), *Schoenoplectus robustus*, *Ipomoea sagittata,* and *Eleocharis parvula*. In coastal Louisiana and Texas, this is a common, very brackish marsh community, often interspersed with ~*Spartina alterniflora - Distichlis spicata - Spartina patens* Mesohaline Salt Marsh (CEGL002230). In the Deltaic Plain, the community is clearly dominated by *Spartina patens* with *Schoenoplectus americanus* (= *Scirpus olneyi*) as the most common associate, while in the Chenier Plain of Louisiana, the two species are characteristically codominant. Species richness in the community is low.

Florida Natural Areas Inventory
Salt Marsh

Example Photograph
Figure A13 below shows an example of CEGL004755 *Spartina patens – Schoenoplectus* (*americanus*, *pungens*) – (*Distichlis spicata*) Salt Marsh.



Figure A13. *Spartina patens - Schoenoplectus* (*americanus, pungens*) - (*Distichlis spicata*) Salt Marsh (CSU).

CEGL004190 Spartina alterniflora - Juncus roemerianus - Distichlis spicata Louisianian Zone Tidal Salt Marsh

Table A12 below shows the USNVC Hierarchy for CEGL004190 *Spartina alterniflora – Juncus roemerianus – Distichlis spicata* Louisianian Zone Tidal Salt Marsh.

Table A12. USNVC hierarchy for CEGL004190 *Spartina alterniflora – Juncus roemerianus – Distichlis spicata* Louisianian Zone Tidal Salt Marsh.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.C Shrub & Herb Wetland
Formation	2.C.5 Salt Marsh
Division	2.C.5.Nb North American Atlantic & Gulf Coastal Salt Marsh
Macrogroup	2.C.5.Nb North American Atlantic & Gulf Coastal Salt Marsh
Group	2.C.5.Nb Atlantic & Gulf Coastal Low Salt Marsh
Alliance	A1471 *Spartina alterniflora* Low Salt Marsh Alliance
Association	2.C.5.Nb *Spartina alterniflora - Juncus roemerianus - Distichlis spicata* Louisianian Zone Tidal Salt Marsh (CEGL004190)

Field Plots: 1084, 1061

Map Class: GUIS MC112

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 22 ft (range 0 ft to 44 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Shoreline Beach (1), Tidal Lagoon (1)

Soil Texture: Sand (1), Silt (1)

Environment: Two plots were sampled within this community. These communities occurred along the shoreline beach or tidal lagoon. Bare soil typically had high ground cover with values between 55%-94%. Basal area can also have high cover with values up to ~45%.

Local Vegetation Description
Structure: Herbaceous (30%-80%)

Vegetation Floristics: These communities were dominated by graminoids mainly either *Distichlis spicata* or *Spartina alterniflora*. One site was completely dominated by *Spartina alterniflora* with cover up to 80%. The other site had a mix of graminoids but dominated by *Distichlis spicata* ~30%. Other common graminoids include *Juncus roemerianus*, *Fimbristylis castanea*, *Cyperus filicinus*, and *Paspalum* spp. Forbs tended to be sparse but included *Hydrocotyle bonariensis*, *Physalis angustifolium*, and *Bacopa monnieri*.

Dynamics: N/A

Conservation Status Rank
Global: G5

State: N/A

Global Environmental Description
This salt marsh community occurs along the Gulf Coast from Florida to Texas. It is the major salt marsh community of coastal Louisiana, occurring in Gulf-fringing areas, mostly flanking large bays. It is mainly found in the Deltaic Plain but is also present in the Chenier Plain, principally as a narrow band of marsh behind coastal dunes. This range is consistent with the "Louisianian Province" of Cowardin et al. (1979).

Global Vegetation Description
This marsh is usually strongly dominated by *Spartina alterniflora*. Species richness is characteristically quite low. In the Deltaic Plain of Louisiana, *Juncus roemerianus* may be present as a component or in localized monospecific patches of a marsh otherwise dominated by *Spartina alterniflora*. In the Chenier Plain of Louisiana, the community is codominated by *Distichlis spicata* and *Spartina alterniflora*. In the central and upper coast of Texas, this marsh is usually limited in extent to the bay side of barrier islands and narrow bands along mainland shores and tidal guts. Other common species include *Spartina patens*, *Vigna luteola*, *Schoenoplectus americanus* (= *Scirpus americanus*), *Phragmites australis*, *Sagittaria platyphylla*, *Polygonum* spp., *Batis maritima*, *Baccharis halimifolia*, and *Cyperus* spp. *Schoenoplectus robustus* (= *Scirpus robustus*) sometimes occurs as a local, patchy or zonal dominant and codominant.

Florida Natural Areas Inventory
Salt Marsh

Example Photograph
Figure A14 below shows an example of *Spartina alterniflora – Juncus roemerianus – Distichlis spicata* Louisianian Zone Tidal Salt Marsh.



Figure A14. *Spartina alterniflora - Juncus roemerianus - Distichlis spicata Louisianian* Zone Tidal Salt Marsh (CSU).

Short Citation: Cowardin et al., 1979.

CEGL004110 Fimbristylis castanea - Paspalum distichum Marsh

Table A13 below shows the USNVC Hierarchy for CEGL004110 *Fimbristylis castanea – Paspalum distichum* Marsh.

Table A13. USNVC hierarchy for CEGL004110 *Fimbristylis castanea – Paspalum distichum* Marsh.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.C Shrub & Herb Wetland
Formation	2.C.4 Temperate to Polar Freshwater Marsh, Wet Meadow & Shrubland
Division	2.C.4.Ne Atlantic & Gulf Coastal Marsh, Wet Meadow & Shrubland
Macrogroup	2.C.4.Ne Atlantic & Gulf Coastal Plain Wet Prairie & Marsh
Group	2.C.4.Ne Atlantic & Gulf Coastal Interdunal Marsh & Prairie
Alliance	A1372 *Fimbristylis castanea - Schoenoplectus pungens* Coastal Marsh Alliance
Association	2.C.4.Ne *Fimbristylis castanea - Paspalum distichum* Marsh (CEGL004110)

Field Plots: 2077, 1083, 2014, 1075, 1076, 2009

Map Class: GUIS MC113

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 3.17 ft (range 0 ft to 10 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Bayshore (1), Swale Interdunal Depression (5)

Soil Texture: Sand (5), Loamy Sand (1)

Environment: Six plots were sampled within this community. This community usually occurred in intermittently flooded interdunal swales. Water usually dominates with cover ~50%, but on drier sites, either litter or bare soil dominate with covers ~75%.

Local Vegetation Description
Structure: Herbaceous (70%-100%)

Vegetation Floristics: This community is usually codominated by graminoids and forbs. *Fimbristylis castanea* is the most abundant graminoid with cover ranging from 20% to 80%. Other common graminoids include *Paspalum vaginatum*, *Fuirena scirpoidea*, and *Spartina patens*. When present, *Sesuvium portulacastrum* dominates the forb layer with cover ranging from 40% to 70%. Other common forbs include *Chamaesyce bombensis*, *Centella asiatica*, and *Hydrocotyle umbellata*.

Dynamics: This dune swale community is maintained by periodic incursion of seawater. The dominant species apparently rapidly colonize bare sand patches. The formation of a seaward dune ridge that cuts off seawater inflow will lead to successional replacement of this community by an *Eragrostis elliottii* community within 4-7 years (Johnson 1997).

Conservation Status Rank
Global: G3

State (Florida): S2

Global Environmental Description
This community occurs in early-successional brackish interdune swales and backdune flats.

Global Vegetation Description
This community is dominated by halophytic species, including *Fimbristylis castanea*, *Paspalum distichum*, *Panicum amarum* var. *amarulum* (= *Panicum amarulum*), and/or *Iva imbricata* (Johnson 1997).

Florida Natural Areas Inventory
Coastal Interdunal Swale

Example Photograph
Figure A15 below shows an example of CEGL004110 *Fimbristylis castanea – Paspalum distichum* Marsh.



Figure A15. *Fimbristylis castanea - Paspalum distichum* Marsh (CSU).

Short Citation: Johnson, 1997.

CEGL007718 Carex striata var. striata - Xyris fimbriata - Lachnanthes caroliana Marsh

Table A14 below shows the USNVC Hierarchy for CEGL007718 *Carex striata* var. *striata – Xyris fimbriata – Lachnanthes caroliniana* Marsh.

Table A14. USNVC hierarchy for CEGL007718 *Carex striata* var. *striata – Xyris fimbriata – Lachnanthes caroliniana* Marsh.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.C Shrub & Herb Wetland
Formation	2.C.4 Temperate to Polar Freshwater Marsh, Wet Meadow & Shrubland
Division	2.C.4.Ne Atlantic & Gulf Coastal Marsh, Wet Meadow & Shrubland
Macrogroup	2.C.4.Ne Atlantic & Gulf Coastal Plain Wet Prairie & Marsh
Group	2.C.4.Ne Atlantic & Gulf Coastal Plain Pondshore & Wet Prairie
Alliance	A1383 *Rhynchospora careyana - Rhynchospora inundata* Pondshore Marsh Alliance
Association	2.C.4.Ne *Carex striata* var. *striata - Xyris fimbriata - Lachnanthes caroliana* Marsh (CEGL007718)

Field Plots: 2004

Map Class: GUIS MC114

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 11 ft (range 11 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Hillslope Base

Soil Texture: Muck

Environment: One plot was sampled within this community. The community was saturated and typically flooded. Water covers most of the ground typically with cover >70%. Litter was the other common ground cover with cover generally 5-30% depending on season.

Local Vegetation Description
Structure: Herbaceous (70%-100%)

Vegetation Floristics: Area is almost exclusively dominated by *Xyris fimbriata*. Other common species may include *Triadenum virginicum* and/or sparse *Nyssa aquatica*. This community forms within a flooded depression caused by the blocking of a small stream.

Dynamics: N/A

Conservation Status Rank
Global: N/A

State: N/A

Global Environmental Description
N/A

Global Vegetation Description
Stands of this association are dominated or codominated by *Carex striata* var. *striata*. Some areas are codominated by *Xyris fimbriata* and/or *Lachnanthes caroliana*. Other species present may include *Dulichium arundinaceum, Rhynchospora inundata, Rhynchospora cephalantha, Rhynchospora fascicularis, Syngonanthus flavidulus, Eleocharis microcarpa, Sarracenia minor, Xyris smalliana, Drosera intermedia*, and *Lipocarpha micrantha*. Some stands may have scattered woody plants associated with them (e.g., *Taxodium ascendens, Pinus serotina, Nyssa biflora*), possibly leading to ambiguous assignments of stands to wooded classes.

Florida Natural Areas Inventory
Clastic Upland Lake

Example Photograph
Figure A16 below shows an example of CEGL007718 *Carex striata* var. *striata – Xyris fimbriata – Lachnanthes caroliana* Marsh.



Figure A16. *Carex striata var. striata - Xyris fimbriata - Lachnanthes caroliana* Marsh (CSU).

CEGL002386 Nuphar advena - Nymphaea odorata Aquatic Vegetation

Table A15 below shows the USNVC Hierarchy for CEGL002386 *Nuphar advena – Nymphaea odorata* Aquatic Vegetation.

Table A15. USNVC hierarchy for CEGL002386 *Nuphar advena – Nymphaea odorata* Aquatic Vegetation.

Category	Description
Class	5 Aquatic Vegetation
Subclass	5.B Freshwater Aquatic Vegetation
Formation	5.B.2 Temperate & Boreal Freshwater Aquatic Vegetation
Division	5.B.2.Na North American Freshwater Aquatic Vegetation
Macrogroup	5.B.2.Na Eastern North American Freshwater Aquatic Vegetation
Group	5.B.2.Na Eastern North American Freshwater Aquatic Vegetation
Alliance	A4064 *Nymphaea odorata - Nuphar* spp. - *Brasenia schreberi* Aquatic Vegetation Alliance
Association	5.B.2.Na *Nuphar advena - Nymphaea odorata* Aquatic Vegetation (CEGL002386)

Field Plots: 3003

Map Class: GUIS MC115

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 0 ft (range 0 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Tidal Lagoon (1)

Soil Texture: Sandy Loam (1)

Environment: One plot was sampled within this community. Water covered 99% of the area.

Local Vegetation Description
Structure: Herbaceous (70%-100%)

Vegetation Floristics: *Nymphaea odorata* dominates this community and is usually the sole vegetation present in the water. *Cyrilla racemiflora* and *Nyssa aquatica* tend to occur along the edges of the pond.

Dynamics: N/A

Conservation Status Rank
Global: G4G5

State: N/A

Global Environmental Description
This community occupies shallow-water depressions, oxbow ponds, sluggish streams, and backwater sloughs of river floodplains, ponds (natural and artificial), and small lakes. In pools and slow-flowing stretches of river, at Obed River (TN), *Nuphar advena* is rooted in sandy substrate (Schmalzer and DeSelm 1982).

Global Vegetation Description
This community is dominated by rooted, floating-leaved aquatic species, with both submergent and emergent aquatics also present. *Nuphar advena* (= *Nuphar lutea* ssp. *advena*) and *Nymphaea odorata* are dominants, either in combination together, or each singly. Other species present include *Brasenia schreberi*, various *Potamogeton* and *Stuckenia* spp., *Eleocharis robbinsii* and other *Eleocharis* spp., *Polygonum amphibium*, *Polygonum amphibium var. emersum* (= *Polygonum coccineum*), *Sparganium americanum*, *Lemna* spp., *Spirodela polyrrhiza*, *Typha latifolia*, and *Saururus cernuus* (Anderson 1982, G. Fleming pers. comm.). Submerged aquatic species more common in the southern part of the range include *Cabomba caroliniana*, *Ceratophyllum demersum*,

and *Heteranthera dubia*. This broadly conceived community may include ponds, or zones of ponds, dominated by *Nymphaea odorata*, with or without *Nuphar advena*.

Florida Natural Areas Inventory
Spring-run Stream

Example Photograph
Figure A17 below shows an example of CEGL002386 *Nuphar advena – Nymphaea odorata* Aquatic Vegetation.



Figure A17. *Nuphar advena - Nymphaea odorata* Aquatic Vegetation (CSU).

Short Citation:

- Schmalzer and DeSelm, 1982
- Anderson, 1982.

Mapped Forest and Woodland Types

CEGL003554 Pinus clausa / Quercus geminata - Quercus myrtifolia - Conradina canescens Woodland

Table A16 below shows the USNVC Hierarchy for CEGL003554 *Pinus clausa* / *Quercus geminata – Quercus myrtifolia – Conradina canescens* Woodland.

Table A16. USNVC Hierarchy for CEGL003554 *Pinus clausa* / *Quercus geminata* – *Quercus myrtifolia* – *Conradina canescens* Woodland.

Category	Description
Class	1 Forest & Woodland
Subclass	1.B Temperate & Boreal Forest & Woodland
Formation	1.B.1 Warm Temperate Forest & Woodland
Division	1.B.1.Na Southeastern North American Forest & Woodland
Macrogroup	1.B.1.Na Longleaf Pine Woodland
Group	1.B.1.Na Sand Pine Scrub Forest & Open Woodland
Alliance	A3117 *Pinus clausa* Scrub Woodland Alliance
Association	1.B.1.Na *Pinus clausa / Quercus geminata - Quercus myrtifolia - Conradina canescens* Woodland (CEGL003554)

Field Plots: 1101, 2000, 1034, 1100, 2006, 1099

Map Class: GUIS MC301

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 47.67 ft (range 11 ft to 75 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Upland (6)

Soil Texture: Sand (5), Sandy Loam (1)

Environment: Six plots were sampled within this community. Litter ranged from 91% to 96%, wood ranged from 1% to 4%, and bare soil ranged from 0% to 3%.

Local Vegetation Description
Structure: Canopy (10%-70%), Subcanopy (0%-20%), Tall Shrub (0%-40%), Short Shrub (10%-60%), Herbaceous (0%-20%)

Vegetation Floristics: *Pinus clausa* or *Pinus echinata* dominates the canopy for cover between 10% and 70%. Shrubby oaks such as *Quercus geminata, Quercus laevis*, and *Quercus myrtifolia* usually occur in the subcanopy or tall shrub layer with covers between 20% and 30%. Other shrubs that may be present include *Ilex vomitoria, Serenoa repens, Ceratiola ericoides, Licania michauxii*, and

Conradina canescens; cover typically does not exceed 50%. Herbaceous layer is typically sparse with *Dichanthelium* spp., *Smilax* spp., *Euphorbia floridana*, etc.

Dynamics: N/A

Conservation Status Rank
Global: N/A

State: N/A

Global Environmental Description
This association occurs on near-coastal dune ridges.

Global Vegetation Description
Pinus clausa (= var. *immuginata*) dominates the canopy stratum, which can vary from very open to closed. Scrub oaks, in particular *Quercus geminata* and *Quercus myrtifolia*, dominate a short subcanopy stratum. Other oaks may be present as well, in particular *Quercus virginiana*. The shrub stratum includes a mixture of coastal indicators, such as *Conradina canescens*, *Clinopodium coccineum* (= *Calamintha coccinea*), and *Chrysoma pauciflosculosa*, and more widespread Coastal Plain shrubs, such as *Licania michauxii*, *Ceratiola ericoides*, and *Polygonella polygama* (= var. *polygama*). Herbs include *Stipulicida setacea*, *Polygonella gracilis*, *Aristida* sp., *Opuntia humifusa*, *Schizachyrium maritimum*, *Balduina angustifolia*, and *Heterotheca subaxillaris*. Lichens (*Cladina* spp., *Cladonia* spp.) are abundant. Many vascular plant species present in the several peninsular Florida sand pine scrub communities are lacking from this association, such as *Ilex opaca* var. *arenicola*, *Sabal etonia*, *Quercus inopina*, *Osmanthus americanus* var. *megacarpus*, *Persea humilis*, and many more.

Florida Natural Areas Inventory
Scrub

Example Photograph
Figure A18 below shows an example of CEGL003554 *Pinus clausa* / *Quercus geminata – Quercus myrtifolia – Conradina canescens* Woodland.



Figure A18. CEGL003554 *Pinus clausa / Quercus geminata - Quercus myrtifolia - Conradina canescens* Woodland (CSU).

CEGL004680 Pinus elliottii / Serenoa repens - Ilex glabra - Morella cerifera - Ilex vomitoria Woodland

Table A17 below shows the USNVC Hierarchy for CEGL004680 *Pinus elliottii* / *Serenoa repens – Ilex glabra – Morella cerifera – Ilex vomitoria* Woodland.

Table A17. USNVC Hierarchy for CEGL004680 *Pinus elliottii* / *Serenoa repens – Ilex glabra – Morella cerifera – Ilex vomitoria* Woodland.

Category	Description
Class	1 Forest & Woodland
Subclass	1.B Temperate & Boreal Forest & Woodland
Formation	1.B.1 Warm Temperate Forest & Woodland
Division	1.B.1.Na Southeastern North American Forest & Woodland
Macrogroup	1.B.1.Na Longleaf Pine Woodland
Group	1.B.1.Na Mesic Longleaf Pine Flatwoods - Spodosol Woodland

Table A17 (continued). USNVC Hierarchy for CEGL004680 *Pinus elliottii* / *Serenoa repens – Ilex glabra – Morella cerifera – Ilex vomitoria* Woodland.

Category	Description
Alliance	A3160 *Pinus palustris / Serenoa repens / Aristida beyrichiana* Woodland Alliance
Association	1.B.1.Na *Pinus elliottii / Serenoa repens - Ilex glabra - Morella cerifera - Ilex vomitoria* Woodland (CEGL004680)

Field Plots: 1092, 1036, 1070, 1039, 1067, 1069, 2096, 2102, 1087, 1091, 2001, 3008, 1074

Map Class: GUIS MC303

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 17.46 ft (range 0 ft to 57 ft)

Aspect: Mean 32.92˚ (range 0˚ to 288˚)

Slope: Mean 1.77˚ (range 0˚ to 12˚)

Macro Topography: Hillslope (1), Primary Dune (1), Shoreline Beach (1), Swale Interdunal Depression (2), Upland (8)

Soil Texture: Sand (9), Loamy Sand (2), Sandy Loam (2)

Environment: Thirteen plots were sampled within this community. This community occurred in a variety of different landforms such as upland, interdunal swales, shoreline beach, and primary dunes. Litter typically dominated the ground cover with values between 46% and 97%. Bare soil may make up a decent portion of ground cover with values between 0% and 50%.

Local Vegetation Description
Structure: Canopy (10%-60%), Tall Shrub (0%-70%), Short Shrub (0%-80%), Dwarf Shrub (0%-70%), Herbaceous (0%-80%)

Vegetation Floristics: *Pinus elliottii* dominates the canopy with cover ranging from 10% to ~60%. Other hardwoods may be present to codominating and include *Quercus nigra*, *Quercus laurifolia, Quercus virginiana, Liquidambar styraciflua*, and *Magnolia grandiflora*. Usually, there is a moderate to dense shrub layer with cover typically >40%. The most common shrubs include *Ilex vomitoria, Morella cerifera*, *Quercus geminata*, and *Serenoa repens*; other shrubs may include *Vaccinium stamineum* and *Baccharis halimifolia*. The herbaceous layer is typically sparse, but there tends to be a variety of vines including *Smilax auriculata, Toxicodendron radicans, Ipomoea sagittata*, and *Rubus trivialis*.

Dynamics: Storms may be a more frequent disturbance than fire affecting the renewal of this community.

Conservation Status Rank
Global: G3

State (Florida): S2?

Global Environmental Description
This association is found in dune swales and interdune flats on older, well-stabilized portions of barrier islands of the Gulf and south Atlantic coasts.

Global Vegetation Description
Pinus elliottii var. *elliottii* dominates the open to closed canopy. The dense shrub stratum consists of *Ilex glabra*, *Ilex vomitoria*, *Serenoa repens*, *Persea palustris*, *Vaccinium myrsinites*, *Ilex cassine*, *Quercus geminata*, and *Lyonia lucida*, which are often tangled together with *Smilax auriculata* (NatureServe Ecology unpubl. data 1999).

Florida Natural Areas Inventory
Scrubby Flatwoods

Example Photograph
Figure A19 below shows an example of CEGL004680 *Pinus elliottii* / *Serenoa repens – Ilex glabra – Morella cerifera – Ilex vomitoria* Woodland.



Figure A19. *Pinus elliottii* / *Serenoa repens - Ilex glabra - Morella cerifera - Ilex vomitoria* Woodland (CSU).

Short Citation: NatureServe Ecology, 1999.

CEGL004658 Pinus elliottii - (Pinus palustris) / Ilex vomitoria - Serenoa repens - Morella cerifera Woodland

Table A8 below shows the USNVC Hierarchy for CEGL004658 *Pinus elliottii* – (*Pinus palustris*) / *Ilex vomitoria – Serenoa repens – Morella cerifera* Woodland.

Table A18. USNVC hierarchy for CEGL004658 *Pinus elliottii* – (*Pinus palustris*) / *Ilex vomitoria – Serenoa repens – Morella cerifera* Woodland.

Category	Description
Class	1 Forest & Woodland
Subclass	1.B Temperate & Boreal Forest & Woodland
Formation	1.B.1 Warm Temperate Forest & Woodland
Division	1.B.1.Na Southeastern North American Forest & Woodland
Macrogroup	1.B.1.Na Longleaf Pine Woodland

Table A18 (continued). USNVC hierarchy for CEGL004658 *Pinus elliottii* – (*Pinus palustris*) / *Ilex vomitoria* – *Serenoa repens* – *Morella cerifera* Woodland.

Category	Description
Group	1.B.1.Na Mesic Longleaf Pine Flatwoods - Spodosol Woodland
Alliance	A3160 *Pinus palustris / Serenoa repens / Aristida beyrichiana* Woodland Alliance
Association	1.B.1.Na *Pinus elliottii* - (*Pinus palustris*) / *Ilex vomitoria - Serenoa repens - Morella cerifera* Woodland (CEGL004658)

Field Plots: 1102, 1103, 1104

Map Class: GUIS MC304

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 30 ft (range 11 ft to 46 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Upland (3)

Soil Texture: Sand (2), Sandy Loam (1)

Environment: Three plots were sampled within this community. This community occurred on dry upland areas. Litter dominated the ground cover with values between 91% and 96%.

Local Vegetation Description
Structure: Canopy (10%-40%), Short Shrub (50%-70%), Herbaceous (20%-50%)

Vegetation Floristics: *Pinus palustris* dominates the canopy with cover between 10% and 40%. *Pinus elliottii* may be present, but *Pinus palustris* tends to dominate. The understory is dominated by shrubs with shrub cover between 50% and 70%. The most abundant shrubs include *Serenoa repens, Quercus geminata, Ilex glabra,* and *Licania michauxii*. The herbaceous layer is dominated by graminoids with cover between 20% and 50%. Common graminoids include *Panicum* sp., *Andropogon glomeratus*, and *Rhynchospora* sp.

Dynamics: 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*).

Conservation Status Rank
Global: G2G3

State (Florida): S2?

Global Environmental Description
This maritime upland woodland occurs on stabilized upland dunes on barrier islands and near-coastal mainland areas on the East Gulf Coastal Plain and adjacent South Atlantic region.

Global Vegetation Description
Pinus elliottii var. *elliottii* dominates, sometimes with an admixture of *Pinus palustris*. In the past, canopy structure in natural stands was open, but now it varies to a more closed structure. At Cumberland Island National Seashore, a barrier island in southeastern Georgia, even-aged old-growth *Pinus palustris* is the exclusive canopy species. 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 (= Myrica 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*.

Florida Natural Areas Inventory
Scrubby Flatwoods

Example Photograph
Figure A20 below shows an example of CEGL004658 *Pinus elliottii* – (*Pinus palustris*) / *Ilex vomitoria – Serenoa repens – Morella cerifera* Woodland.



Figure A20. *Pinus elliottii* - (*Pinus palustris*) / *Ilex vomitoria - Serenoa repens - Morella cerifera* Woodland (CSU).

CEGL003656 Pinus palustris - (Pinus elliottii) / Ilex coriacea - Cyrilla racemiflora Woodland

Table A19 below shows the USNVC Hierarchy for CEGL003656 *Pinus palustris* – (*Pinus elliottii*) / *Ilex coriacea – Cyrilla racemiflora* Woodland.

Table A19. USNVC hierarchy for CEGL003656 *Pinus palustris* – (*Pinus elliottii*) / *Ilex coriacea – Cyrilla racemiflora* Woodland.

Category	Description
Class	1 Forest & Woodland
Subclass	1.B Temperate & Boreal Forest & Woodland
Formation	1.B.1 Warm Temperate Forest & Woodland
Division	1.B.1.Na Southeastern North American Forest & Woodland
Macrogroup	1.B.1.Na Longleaf Pine Woodland
Group	1.B.1.Na Mesic Longleaf Pine Flatwoods - Spodosol Woodland
Alliance	A3160 *Pinus palustris / Serenoa repens / Aristida beyrichiana* Woodland Alliance
Association	1.B.1.Na *Pinus palustris* - (*Pinus elliottii*) / *Ilex coriacea - Cyrilla racemiflora* Woodland (CEGL003656)

Field Plots: 2036, 2038, 2039, 2040, 2041, 2042, 3009, 3010

Map Class: GUIS MC304

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 39.13 ft (range 0 ft to 83 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Flatlands (2), Upland (6)

Soil Texture: Sandy Loam (6), Loamy Sand (1), Muck (1)

Environment: Eight plots were sampled within this community. Litter dominates the ground cover with cover values ranging from 71% to 96%. When present, wood comprises only 1% or 2% of ground cover. One plot contained water-filled pits comprising 25% of the cover.

Local Vegetation Description
Structure: Canopy (30%-70%), Subcanopy (0%-50%), Tall Shrub (0%-50%), Short Shrub (0%-80%), Herbaceous (0%-40%)

Vegetation Floristics: The canopy is dominated by *Pinus elliottii* with cover ranging between 30% to 60%. Occasionally *Pinus palustris* codominates in the canopy. Other trees present in the canopy or subcanopy may include *Nyssa aquatica, Magnolia virginiana, Acer rubrum*, and *Quercus nigra*. There is often a moderately dense layer with *Ilex coriacea* and *Cyrilla racemiflora* as the most common shrubs. Other less abundant shrubs include *Symplocos tinctoria, Persea borbonia, Ilex vomitoria,* and *Vaccinium corymbosum*.

Dynamics: The herbaceous and shrub components of this community occur in a mosaic fashion, and relative dominance varies with fire regime.

Conservation Status Rank
Global: G3G4

State (Florida): S2?

Global Environmental Description
This association occurs in saturated mineral soils in broad flats near the coast of the East Gulf Coastal Plain, and in shallow, flat basins associated with creek drainages further inland. *Pinus elliottii* is likely more dominant today than historically due to past logging of *Pinus palustris* (longleaf pine) and fire exclusion. The herbaceous and shrub components of this community occur in a mosaic fashion, and relative dominance varies with fire regime.

Global Vegetation Description

The canopy of this association is primarily *Pinus palustris*, with less *Pinus elliottii* var. *elliottii*. The canopy and/or subcanopy also contains *Acer rubrum*, *Liriodendron tulipifera*, *Nyssa biflora*, *Magnolia virginiana*, and *Liquidambar styraciflua*. The ground layer is shrub-dominated, with *Ilex coriacea*, *Nyssa biflora*, *Cliftonia monophylla*, and *Cyrilla racemiflora* generally the most abundant shrubs; other tall shrubs include *Morella cerifera* (= *Myrica cerifera*), *Morella caroliniensis* (= *Myrica heterophylla*), *Ilex vomitoria*, *Ilex glabra*, *Persea borbonia*, *Photinia pyrifolia* (= *Aronia arbutifolia*), *Osmanthus americanus* var. *americanus* (rarely), and *Arundinaria gigantea*. Low shrubs include *Gaylussacia mosieri*, *Lyonia lucida*, *Rhododendron viscosum* (= *Rhododendron serrulatum*), and *Hypericum brachyphyllum*. Herbs include *Andropogon* spp., *Aristida purpurascens* var. *virgata*, *Aristida purpurascens* var. *tenuispica*, *Carphephorus odoratissimus*, *Solidago rugosa*, and *Osmunda cinnamomea*; *Sphagnum* spp. may also be present. *Pinus elliottii* is likely more dominant today than historically due to past logging of *Pinus palustris* and fire exclusion.

Florida Natural Areas Inventory

Scrubby Flatwoods

Example Photograph

Figure A21 below shows an example of CEGL003656 *Pinus palustris* – (*Pinus elliottii*) / *Ilex coriacea* – *Cyrilla racemiflora* Woodland.



Figure A21. *Pinus palustris* - (*Pinus elliottii*) / *Ilex coriacea* - *Cyrilla racemiflora* Woodland (CSU).

CEGL004958 Pinus elliottii / Spartina patens - Juncus roemerianus - (Panicum virgatum) Tidal Woodland

Table A20 below shows the USNVC Hierarchy for CEGL004958 *Pinus elliottii* / *Spartina patens* – *Juncus roemerianus* – (*Panicum virgatum*) Tidal Woodland.

Table A20. USNVC hierarchy for CEGL004958 *Pinus elliottii* / *Spartina patens* – *Juncus roemerianus* – (*Panicum virgatum*) Tidal Woodland.

Category	Description
Class	1 Forest & Woodland
Subclass	1.B Temperate & Boreal Forest & Woodland
Formation	1.B.3 Temperate Flooded & Swamp Forest
Division	1.B.3.Nb Southeastern North American Flooded & Swamp Forest
Macrogroup	1.B.3.Nb Southern Coastal Plain Floodplain Forest
Group	1.B.3.Nb Bald-cypress - Tupelo Floodplain Forest
Alliance	A3595 *Taxodium distichum - Nyssa biflora* Tidal Swamp Forest Alliance
Association	1.B.3.Nb *Pinus elliottii / Spartina patens - Juncus roemerianus* - (*Panicum virgatum*) Tidal Woodland (CEGL004958)

Field Plots: 1001, 1024, 2035, 2095, 1110

Map Class: GUIS MC303

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 6.2 ft (range 0 ft to 23ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Swale Interdunal Depression (1), Upland (4)

Soil Texture: Sand (2), Loamy Sand (1), Sandy Loam (1), Peat (1)

Environment: Five plots were sampled within this community. This community occurred on upland areas. Litter usually dominates ground cover with values ranging from 20% to 94%.

Local Vegetation Description
Structure: Canopy (10%-50%), Tall Shrub (0%-30%), Short Shrub (0%-40%), Herbaceous (50%-80%)

Vegetation Floristics: *Pinus elliottii* dominates the canopy with cover ranging from 10% to 50%. There is often a sparse shrub layer with cover values between 10% and 40%. Common shrubs include *Cyrilla racemiflora*, *Baccharis halimifolia*, *Ilex vomitoria*, and *Morella cerifera*. Herbaceous layer is often dominated by graminoids with cover generally ~60%. Typical graminoids include *Spartina patens, Juncus roemerianus,* and *Rhynchospora fascicularis*.

Dynamics: This association has a high water table maintained by its occurrence on flat shores very slightly above sea level. It is not inundated by normal lunar tides, but receives inundation in storm and hurricane events.

Conservation Status Rank
Global: G3

State: N/A

Global Environmental Description
N/A

Global Vegetation Description
The canopy is dominated by *Pinus elliottii* var. *elliottii*. The subcanopy is generally poorly developed; the shrub stratum may be well- or poorly developed, with species such as *Morella cerifera* (= *Myrica cerifera*), *Serenoa repens*, *Ilex glabra*, *Baccharis halimifolia*, *Persea palustris*,

Iva frutescens, and scattered *Sabal minor* present. The herbaceous stratum is dense and typically consists of *Spartina patens*, *Juncus roemerianus*, *Rhynchospora* sp., and *Panicum virgatum*.

Florida Natural Areas Inventory
Bottomland Forest

Example Photograph
Figure A22 below shows an example of CEGL004958 *Pinus elliottii* / *Spartina patens – Juncus roemerianus* – (*Panicum virgatum*) Tidal Woodland.

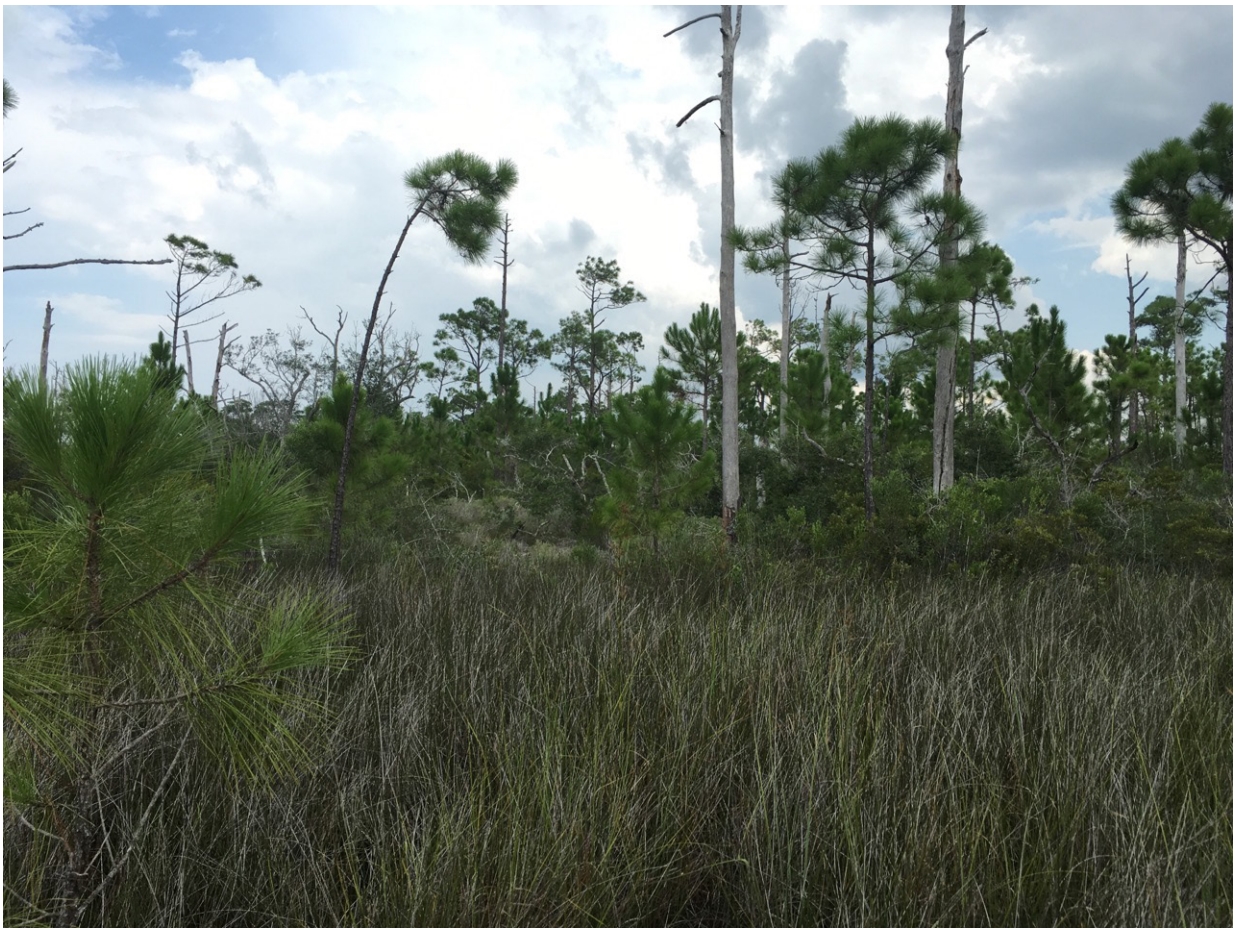


Figure A22. *Pinus elliottii* / *Spartina patens* - *Juncus roemerianus* - (*Panicum virgatum*) Tidal Woodland (CSU).

CEGL003638 Pinus elliottii / Cliftonia monophylla - Cyrilla racemiflora Swamp Woodland
Table A21 below shows the USNVC Hierarchy for CEGL003638 *Pinus elliottii* / *Cliftonia monophylla – Cyrilla racemiflora* Swamp Woodland.

Table A21. USNVC hierarchy for CEGL003638 *Pinus elliottii* / *Cliftonia monophylla – Cyrilla racemiflora* Swamp Woodland.

Category	Description
Class	1 Forest & Woodland
Subclass	1.B Temperate & Boreal Forest & Woodland
Formation	1.B.3 Temperate Flooded & Swamp Forest
Division	1.B.3.Nb Southeastern North American Flooded & Swamp Forest
Macrogroup	1.B.3.Nb Southern Coastal Plain Evergreen Hardwood - Conifer Swamp
Group	1.B.3.Nb Coastal Plain Mixed Evergreen Swamp
Alliance	A0058 *Cliftonia monophylla* Baygall Swamp Forest Alliance
Association	1.B.3.Nb *Pinus elliottii / Cliftonia monophylla - Cyrilla racemiflora* Swamp Woodland (CEGL003638)

Field Plots: 1001

Map Class: GUIS MC302

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 0 ft (range 0 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Upland (1)

Soil Texture: Sand (1)

Environment: One plot was sampled within this community. This community occurred on upland areas. Water dominated the ground cover with ~40% cover followed by basal area and litter at 35% and 20% respectively.

Local Vegetation Description
Structure: Canopy (0%-50%), Tall Shrub (0%-30%), Short Shrub (0%-40%), Herbaceous (50%-80%)

Vegetation Floristics: *Pinus elliottii* dominates the canopy with cover ranging of ~10% to 30%. There is often a moderate shrub layer with cover values of ~40%. The most common shrubs include *Cyrilla racemiflora* and *Ilex coriacea* with some *Lyonia lucida* on the edges of the community.

Herbaceous layer is often dominated by graminoids with cover generally ~80%. Typical graminoids include *Fuirena scirpoidea* and *Rhynchospora fascicularis*.

Dynamics: This association is not subject to frequent, low-intensity fire typical of longleaf flatwoods. The lack of herbaceous vegetation and presence of a high water table makes it difficult for fires to ignite except under drought conditions. If and when fires do occur, they are likely to be intense crown fires that may also burn into the peaty soils. Fire history may explain the physiognomy of this and related acid swamps. Clewell (1981) suggests that examples with emergent overstory and/or taller shrub layers are subject to less frequent fire or at least have not been subject to destructive fire as recently as shorter forms. Intense crown fires may eliminate or heavily reduce the pine overstory, creating a transition to ~ *Cyrilla racemiflora* - *Cliftonia monophylla* Wet Scrub (CEGL003847).

Conservation Status Rank
Global: G2G3

State: N/A

Global Environmental Description
These swamps may occur on strongly acidic, infertile, often peaty soils which are either shallowly inundated or waterlogged during wet seasons (Clewell 1981). They may be associated with blackwater areas (A. Weakley pers. comm.) and are usually isolated from more fire-prone flatwoods. In contrast to examples with a strong component of *Pinus serotina*, this association may inhabit deeper portions of acidic swamps (Clewell 1981).

Global Vegetation Description
This association presumably represents swamps of the East Gulf Coastal Plain of Florida (and possibly Mississippi and Alabama) with overstory canopy dominated by *Pinus elliottii* var. *elliottii*. In addition, *Pinus serotina* may be present but not abundant. These swamps may occur on strongly acidic, infertile, often peaty soils which are either shallowly inundated or waterlogged during wet seasons. They may be associated with blackwater areas and are usually isolated from more fire-prone flatwoods. In contrast to examples with a strong component of *Pinus serotina*, this association may inhabit deeper portions of acidic swamps. The midstory is strongly dominated by *Cliftonia monophylla* and *Cyrilla racemiflora* which tend to exclude invasion of other species, and which strongly suppress herbaceous understory species. Other evergreen species, such as *Lyonia lucida* and *Ilex coriacea*, may be common. Overall, species richness is quite low.

Florida Natural Areas Inventory
Baygall

Example Photograph
Figure A23 below shows an example of CEGL003638 *Pinus elliottii* / *Cliftonia monophylla – Cyrilla racemiflora* Swamp Woodland.



Figure A23. *Pinus elliottii* / *Cliftonia monophylla* - *Cyrilla racemiflora* Swamp Woodland (CSU).

Short Citation: Clewell, 1981.

CEGL003673 Pinus elliottii - (Pinus serotina) / Aristida beyrichiana - Rhynchospora oligantha - Sarracenia spp. Woodland

Table A22 below shows the USNVC Hierarchy for CEGL003673 *Pinus elliottii* – (*Pinus serotina*) / *Aristida beyrichiana – Rhynchospora oligantha – Sarracenia* spp. Woodland.

Table A22. USNVC hierarchy for CEGL003673 *Pinus elliottii* – (*Pinus serotina*) / *Aristida beyrichiana – Rhynchospora oligantha – Sarracenia* spp. Woodland.

Category	Description
Class	1 Forest & Woodland
Subclass	1.B Temperate & Boreal Forest & Woodland
Formation	1.B.1 Warm Temperate Forest & Woodland
Division	1.B.1.Na Southeastern North American Forest & Woodland
Macrogroup	1.B.1.Na Longleaf Pine Woodland
Group	1.B.1.Na Wet-Mesic Longleaf Pine Open Woodland

Table A22 (continued). USNVC hierarchy for CEGL003673 *Pinus elliottii* – (*Pinus serotina*) / *Aristida beyrichiana* – *Rhynchospora oligantha* – *Sarracenia* spp. Woodland.

Category	Description
Alliance	A4104 *Pinus palustris - Pinus elliottii* East Gulf Coastal Plain Wet Open Woodland Alliance
Association	1.B.1.Na *Pinus elliottii-* (*Pinus serotina*) / *Aristida beyrichiana - Rhynchospora oligantha - Sarracenia* spp. Woodland (CEGL003673)

Field Plots: 4011, 4015

Map Class: GUIS MC302

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 27 ft (range 19 ft to 35 ft

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Flatlands (2)

Soil Texture: Sandy loam (2)

Environment: Two plots were surveyed within this community. This community occurs on wet flatlands among the upland areas of Naval Live Oaks. Litter is the dominant ground cover, with values between 80% and 87%. Wood sometimes occurs but is often sparse with a ground cover of ~3%. Basal area can range from moderate to dense with covers between 8% and 18%.

Local Vegetation Description
Structure: Canopy (~30%), Tall Shrub (~10%), Short Shrub (~30%), Herbaceous (~60%)

Vegetation Floristics: This community usually occurs in wet swales of a larger *Pinus palustris* woodland. *Pinus elliottii* tends to dominate the canopy of this community with a fairly sparse cover of ~25%. *Ilex glabra* usually occurs in the short or dwarf shrub layer with moderate cover of ~30%. Herbaceous cover can be quite dense with cover values generally around 60%. Graminoids dominate and usually include *Calamovilfa curtissii*, *Schizachyrium scoparium*, and *Eleocharis* sp.

Dynamics: N/A

Conservation Status Rank
Global: G2?

State: N/A

Global Environmental Description
N/A

Global Vegetation Description
Stands of this flatwoods association have open canopies dominated by *Pinus elliottii* var. *elliottii*, sometimes with *Pinus serotina*. The shrub stratum is open and consists of *Ilex glabra*, *Cliftonia monophylla*, *Smilax laurifolia*, *Gaylussacia mosieri*, *Nyssa biflora*, and *Ilex myrtifolia*. The diverse and dense herb stratum is dominated by *Aristida beyrichiana* and *Rhynchospora oligantha*, and includes *Sarracenia* spp. (any of *Sarracenia flava*, *Sarracenia minor*, and/or *Sarracenia psittacina*), *Aletris lutea*, *Pogonia ophioglossoides*, *Eriocaulon decangulare*, *Ctenium aromaticum*, *Eurybia chapmanii* (= *Aster chapmanii*), *Aristida palustris*, *Rhynchospora latifolia*, *Lophiola aurea* (= *Lophiola americana*), *Rhexia alifanus*, *Polygala lutea*, *Chaptalia tomentosa*, and *Sabatia macrophylla*.

Florida Natural Areas Inventory
Wet Flatwoods

Example Photograph
Figure A24 below shows an example of CEGL003673 *Pinus elliottii* – (*Pinus serotina*) / *Aristida beyrichiana – Rhynchospora oligantha – Sarracenia* spp. Woodland.



Figure A24. *Pinus elliottii* - (*Pinus serotina*) / *Aristida beyrichiana - Rhynchospora oligantha - Sarracenia* spp. Woodland (CSU).

NPSGUIS005 Pinus elliottii - Quercus myrtifolia - Quercus geminata Scrub Woodland
USNVC: Park Special NPSGUIS005

Field Plots: 1111, 2100

Map Class: GUIS MC305

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 0 ft (range 0 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Relic Dune (2)

Soil Texture: Sand (2)

Environment: Two plots were sampled within this community. This community occurred on relict dunes and short ridges along the barrier islands of Florida and Mississippi. Bare soil usually dominated the ground cover with values ranging between 30% and 87%. Litter occurred in large quantities as well with covers between 10% and 58%.

Local Vegetation Description
Structure: Tall Shrub (30%-70%), Short Shrub (10%-50%), Dwarf Shrub (0-10%)

Vegetation Floristics: Tall shrubs reaching up to ~20 ft typically form a moderate to dense area with covers between 30% - 70%. Sparse to dense shrub *Pinus elliottii* occur here with variable cover. Shrubby oaks such as *Quercus myrtifolia* and *Quercus geminata* typically dominate with cover <50%. Other dwarf shrubs occur here as well including *Ceratiola ericoides*, *Conradina canescens*, and *Polygonella polygama*.

Dynamics: N/A

Conservation Status Rank
Global: N/A

State: N/A

Global Environmental Description
N/A

Global Vegetation Description
N/A

Florida Natural Areas Inventory
N/A

Example Photograph
Figure A25 below shows an example of NPSGUIS005 *Pinus elliottii – Quercus myrtifolia – Quercus geminata* Scrub Woodland.



Figure A25. *Pinus elliottii - Quercus myrtifolia - Quercus geminata* Scrub Woodland (CSU).

CEGL007019 Quercus geminata / Serenoa repens - Ilex vomitoria - (Sideroxylon lanuginosum) Forest

Table A23 below shows the USNVC Hierarchy for CEGL007019 *Quercus geminata* / *Serenoa repens – Ilex vomitoria –* (*Sideroxylon lanuginosum*) Forest.

Table A23. USNVC hierarchy for CEGL007019 *Quercus geminata* / *Serenoa repens – Ilex vomitoria –* (*Sideroxylon lanuginosum*) Forest.

Category	Description
Class	1 Forest & Woodland
Subclass	1.B Temperate & Boreal Forest & Woodland
Formation	1.B.1 Warm Temperate Forest & Woodland
Division	1.B.1.Na Southeastern North American Forest & Woodland
Macrogroup	1.B.1.Na Southeastern Coastal Plain Evergreen Oak - Mixed Hardwood Forest
Group	1.B.1.Na Southern Evergreen Oak Forest
Alliance	A0052 *Quercus geminata - Serenoa repens* Dry Sclerophyll Forest Alliance
Association	1.B.1.Na *Quercus geminata / Serenoa repens - Ilex vomitoria* - (*Sideroxylon lanuginosum*) Forest (CEGL007019)

Field Plots: 1095, 2002

Map Class: GUIS MC306

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 12.5 ft (range 9 ft to 14 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Upland (2)

Soil Texture: Sand (2)

Environment: Two plots were sampled within this community. This community occurred on upland flats. Litter dominates the ground cover with values ranging from 90%-96%.

Local Vegetation Description
Structure: Canopy (40%-50%), Tall Shrub (10%-50%), Short Shrub (0%-30%), Herbaceous (0%-10%)

Vegetation Floristics: The canopy is dominated by mature *Quercus geminata* with cover ~20%. Other canopy codominates include *Carya glabra* and *Magnolia grandiflora*. There is a shrub layer often with cover ranging from 20% to 50%. Common shrubs include *Magnolia virginiana, Serenoa repens,* and *Quercus laurifolia*. Herbaceous layer is sparse with common species including *Rhynchospora baldwinii*, *Smilax pumila*, and *Smilax bona-nox*.

Dynamics: N/A

Conservation Status Rank
Global: G2

State (Florida): S3

Global Environmental Description
N/A

Global Vegetation Description
Xeric maritime hammocks of the panhandle of Florida and possibly adjacent Alabama.

Florida Natural Areas Inventory
Mesic Hammock

Example Photograph

Figure A26 below shows an example of CEGL007019 *Quercus geminata* / *Serenoa repens – Ilex vomitoria* – (*Sideroxylon lanuginosum*) Forest.



Figure A26. *Quercus geminata* / *Serenoa repens* - *Ilex vomitoria* - (*Sideroxylon lanuginosum*) Forest (CSU).

CEGL007020 Quercus geminata – (Quercus virginiana) / Serenoa repens – Lyonia fruticosa Forest

Table A24 below shows the USNVC Hierarchy for CEGL007020 *Quercus geminata* – (*Quercus virginiana*) / *Serenoa repens – Lyonia fruticosa* Forest.

Table A24. USNVC hierarchy for CEGL007020 *Quercus geminata* – (*Quercus virginiana*) / *Serenoa repens – Lyonia fruticosa* Forest.

Category	Description
Class	1 Forest & Woodland
Subclass	1.B Temperate & Boreal Forest & Woodland
Formation	1.B.1 Warm Temperate Forest & Woodland

Table A24 (continued). USNVC hierarchy for CEGL007020 *Quercus geminata* – (*Quercus virginiana*) / *Serenoa repens* – *Lyonia fruticosa* Forest.

Category	Description
Division	1.B.1.Na Southeastern North American Forest & Woodland
Macrogroup	1.B.1.Na Southeastern Coastal Plain Evergreen Oak - Mixed Hardwood Forest
Group	1.B.1.Na Southern Evergreen Oak Forest
Alliance	A0052 *Quercus geminata - Serenoa repens* Dry Sclerophyll Forest Alliance
Association	1.B.1.Na *Quercus geminata* – (*Quercus virginiana*) / *Serenoa repens* – *Lyonia fruticosa* Forest (CEGL007020)

Field Plots: Field Reconnaissance

Map Class: GUIS MC306

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 5 ft (range 2 ft to 8 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Upland

Soil Texture: Sand

Environment: This community usually occurred behind established dunes in upland settings. Ground cover was mainly dominated by bare ground with values reaching up to ~75%. Litter may also occur here with cover values <20%.

Local Vegetation Description
Structure: Canopy (20%-30%), Tall Shrub (0%-20%), Short Shrub (0%-30%), Herbaceous (0%-20%)

Vegetation Floristics: This community occurs on maritime hammocks dominated by tree-sized *Quercus geminata*. *Quercus virginiana* is rarely present within the area. The understory is dominated by shrubs and ranges from sparse to moderate cover with values typically <30%. Common shrubs include *Serenoa repens* and *Lyonia fruticosa*.

Dynamics: N/A

Conservation Status Rank
Global: G2?

State (Florida): N/A

Global Environmental Description
This association represents xeric maritime hammocks of the central eastern coast of Florida and adjacent areas of southern Georgia, occurring on deep, sandy soils.

Global Vegetation Description
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* (= *Myrica cerifera*). An understory of *Sabal palmetto* may also be present.

Florida Natural Areas Inventory
Mesic Hammock

Example Photograph
Figure A27 below shows an example of CEGL007020 *Quercus geminata* – (*Quercus virginiana*) / *Serenoa repens – Lyonia fruticosa* Forest.



Figure A27. *Quercus geminata* – (*Quercus virginiana*) / *Serenoa repens – Lyonia fruticosa* Forest (CSU).

CEGL007028 Quercus virginiana / Vaccinium arboreum - Ilex vomitoria Forest

Table A25 below shows the USNVC Hierarchy for CEGL007028 *Quercus virginiana* / *Vaccinium arboreum – Ilex vomitoria* Forest.

Table A25. USNVC hierarchy for CEGL007028 *Quercus virginiana* / *Vaccinium arboreum – Ilex vomitoria* Forest.

Category	Description
Class	1 Forest & Woodland
Subclass	1.B Temperate & Boreal Forest & Woodland
Formation	1.B.1 Warm Temperate Forest & Woodland
Division	1.B.1.Na Southeastern North American Forest & Woodland
Macrogroup	1.B.1.Na Southeastern Coastal Plain Evergreen Oak - Mixed Hardwood Forest
Group	1.B.1.Na Southern Evergreen Oak Forest
Alliance	A0052 *Quercus geminata - Serenoa repens* Dry Sclerophyll Forest Alliance
Association	1.B.1.Na *Quercus virginiana / Vaccinium arboreum - Ilex vomitoria* Forest (CEGL007028)

Field Plot: 2005, 1093, 1096, 1032

Map Class: GUIS MC306

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 35.67 ft (range 0 ft to 57 ft)

Aspect: Mean 46.5˚ (range 0˚ to 104˚)

Slope: Mean 3˚ (range 0˚ to 8˚)

Macro Topography: Hillslope (1), Upland (3)

Soil Texture: Sand (3), Sandy Loam (1)

Environment: Four plots were sampled within this community. All of these plots occurred on upland areas. Litter dominated the ground cover with values between 70%-98%.

Local Vegetation Description
Structure: Canopy (50%-80%), Tall Shrub (10%-60%), Short Shrub (0%-20%), Dwarf Shrub (0%-10%)

Vegetation Floristics: Canopy is dominated by mature *Quercus virginiana* or *Quercus geminata* with cover >30%. Other codominates may include *Carya glabra, Magnolia grandiflora,* and *Pinus*

echinata. There is a vigorous shrub layer with *Vaccinium arboreum* as a prominent species; however, other common species may include *Ilex coriacea, Ilex vomitoria, Serenoa repens,* and *Quercus myrtifolia*. Herbaceous stratum is sparse and may contain *Mitchella repens, Smilax pumila,* and *Cladonia evansii*.

Dynamics: N/A

Conservation Status Rank
Global: G2G3

State (Florida): S3

Global Environmental Description
N/A

Global Vegetation Description
Stands are dominated by *Quercus virginiana*, sometimes with *Juniperus virginiana* var. *silicicola* present in the canopy. *Ilex vomitoria* and *Vaccinium arboreum* are present in the shrub layer. Frequently small *Cladina*/*Cladonia*-dominated openings are present. Other characteristic species include *Scleria triglomerata, Paronychia baldwinii, Cladina evansii, Stipulicida setacea*, and *Hypericum hypericoides*.

Florida Natural Areas Inventory
Mesic Hammock

Example Photograph
Figure A28 below shows an example of CEGL007028 *Quercus virginiana* / *Vaccinium arboreum – Ilex vomitoria* Forest.



Figure A28. *Quercus virginiana* / *Vaccinium arboreum - Ilex vomitoria* Forest (CSU).

CEGL007032 Quercus virginiana - (Pinus elliottii, Sabal palmetto) / Persea borbonia - Callicarpa americana Forest

Table A26 below shows the USNVC Hierarchy for CEGL007032 *Quercus virginiana* – (*Pinus elliottii*, *Sabal palmetto*) / *Persea borbonia – Callicarpa americana* Forest.

Table A26. USNVC hierarchy for CEGL007032 *Quercus virginiana* – (*Pinus elliottii*, *Sabal palmetto*) / *Persea borbonia – Callicarpa americana* Forest.

Category	Description
Class	1 Forest & Woodland
Subclass	1.B Temperate & Boreal Forest & Woodland
Formation	1.B.1 Warm Temperate Forest & Woodland
Division	1.B.1.Na Southeastern North American Forest & Woodland
Macrogroup	1.B.1.Na Southeastern Coastal Plain Evergreen Oak - Mixed Hardwood Forest
Group	1.B.1.Na Coastal Live Oak - Hickory - Palmetto Forest

Table A26 (continued). USNVC hierarchy for CEGL007032 *Quercus virginiana* – (*Pinus elliottii*, *Sabal palmetto*) / *Persea borbonia* – *Callicarpa americana* Forest.

Category	Description
Alliance	A3192 *Quercus virginiana - Sabal palmetto* Coastal Evergreen Forest Alliance
Association	1.B.1.Na *Quercus virginiana* - (*Pinus elliottii, Sabal palmetto*) / *Persea borbonia - Callicarpa americana* Forest (CEGL007032)

Field Plots: 1007, 1035, 1008

Map Class: GUIS MC307

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 46 ft (range 34 ft to 61 ft)

Aspect: Mean 3˚ (range 0˚ to 8˚)

Slope: Mean 6˚ (range 0˚ to 10˚)

Macro Topography: Floodplain Ridge and Swale (1), Hillslope (1), Upland (1)

Soil Texture: Sand (1), Loamy Sand (2)

Environment: Three plots were sampled within this community. This community occurred on the sound side of Naval Live Oaks. Litter dominates the ground cover with values ranging from 93% to 96%.

Local Vegetation Description
Structure: Canopy (30%-70%), Subcanopy (0%-50%), Tall Shrub (0%-30%), Short Shrub (0%-40%), Dwarf Shrub (0%-10%), Herbaceous (0%-30%)

Vegetation Floristics: This community is dominated by a dense canopy of *Quercus virginiana* and *Quercus laurifolia*. Their combined cover values reach up to 80%. Other species that may occur in the canopy include *Pinus echinata, Magnolia grandiflora,* and *Carya glabra*. There is often a shrub layer with cover values <30%. Common species include *Quercus myrtifolia*, *Ilex vomitoria,* and *Serenoa repens*. A sparse herbaceous layer may be present and includes *Mitchella repens*, *Smilax pumila*, and *Callicarpa americana*. This is distinct from CEGL007028 due to lack of *Vaccinium arboreum*.

Dynamics: In maritime forests in the Sea Islands region (USFS 232Ce, EPA Ecoregion 75j, Keys et al. 1995, EPA 2204), a successional pathway may exist from which new islands of sand or shell are first colonized by *Juniperus virginiana* var. *silicicola* and *Sabal palmetto* (with salt shrub species as well). This would include *Sabal palmetto* - (*Juniperus virginiana* var. *silicicola*) Woodland (CEGL003526) and *Juniperus virginiana* var. *silicicola* - (*Quercus virginiana, Sabal*

palmetto) Forest (CEGL007813). These associations represent an early stage in this process. This could be considered an important stage in the stabilization and maintenance of hammock and barrier islands. In the absence of disturbance, this sere in time will give way to *Quercus virginiana* - (*Pinus elliottii* var. *elliottii*, *Sabal palmetto*) / *Persea borbonia - Callicarpa americana* Forest (CEGL007032) with red-cedar, palmetto, yaupon and wax-myrtle as components. Ultimately as the soils become more nutrient-rich and in the absence of major disturbance events, *Quercus hemisphaerica, Magnolia grandiflora,* and *Quercus nigra* become more dominant, for example, as in *Quercus virginiana - Quercus hemisphaerica - Pinus taeda / Persea palustris - Ilex vomitoria* Forest (CEGL007027). Of course tropical storms, flood tides and other wind events may alter this succession. This general pattern also may be reflected on larger maritime islands when one goes from the salt marsh to the island interior. Composition varies with the presence of shell or spoil in the soil. Some variants, such as *Quercus geminata* - (*Quercus virginiana*) / *Serenoa repens - Lyonia fruticosa* Forest (CEGL007020) (from the coast of Florida, Georgia and at least one location in South Carolina), do not fit perfectly into this scheme, but in South Carolina they are more anomalies than the norm.

Conservation Status Rank
Global: G2

State (Florida): S2

Global Environmental Description
This community is found on xeric to mesic sites from the Carolinas to Alabama, often occurring as linear strands behind frontal dunes. The seaward edge of this vegetation is generally found on the leeward side of dune complexes which are capable of providing shelter from excessive salt spray and overwash. The interior of this community occurs on top of relict dune ridges and other areas with xeric to mesic hydrology. The soils of these forests are generally poorly developed, sandy soils, low in natural fertility and organic matter content. In the northern portion of this community's range, siliceous sands dominate with little in the way of carbonate sands present. Further south, the carbonate fraction increases. In the deep south, and especially along the coast of Florida, carbonate sands begin to dominate. In terms of nutrients, siliceous sands are quite poor while carbonate sands are somewhat richer. Barrier island soils are derived from material carried onto the island by water and wave action and not from weathering of rock. The major input of nutrients to the terrestrial vegetation is from salt spray and precipitation (Godfrey 1976).

Global Vegetation Description
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*, *Sabal palmetto*, *Pinus elliottii* var. *elliottii*, *Pinus taeda*, *Magnolia grandiflora*, *Persea borbonia*, *Quercus hemisphaerica*, *Quercus nigra*, *Quercus phellos*, *Magnolia virginiana*, *Acer rubrum* var. *drummondii*, *Liquidambar styraciflua*, *Juniperus virginiana*

var. *silicicola*, *Celtis laevigata*, *Morella cerifera* (= *Myrica cerifera*), *Ilex vomitoria*, *Osmanthus americanus* var. *americanus*, *Sabal minor*, *Serenoa repens*, *Ilex opaca* var. *opaca*, *Carpinus caroliniana* ssp. *caroliniana*, *Cornus florida*, *Prunus caroliniana*, *Zanthoxylum clava-herculis*, *Callicarpa americana*, *Baccharis halimifolia*, *Baccharis angustifolia*, *Lyonia lucida*, *Sageretia minutiflora*, *Sideroxylon tenax*, *Vaccinium arboreum*, *Forestiera segregata*, and *Opuntia humifusa* var. *humifusa*. Typical vines and herbaceous species include *Toxicodendron radicans*, *Smilax* spp., *Vitis rotundifolia*, *Parthenocissus quinquefolia*, *Houstonia procumbens*, *Bignonia capreolata*, *Mitchella repens*, *Berchemia scandens*, *Ampelopsis arborea*, *Oplismenus hirtellus* ssp. *setarius* (= *Oplismenus setarius*), *Boehmeria cylindrica*, *Galium pilosum*, *Dichanthelium commutatum*, *Elephantopus nudatus*, *Passiflora incarnata*, *Passiflora lutea*, *Scleria triglomerata*, *Piptochaetium avenaceum*, *Panicum* spp., *Chasmanthium laxum*, *Juncus* spp., *Asplenium platyneuron var. bacculum-rubrum*, *Osmunda cinnamomea*, and *Woodwardia virginica*. In general, from Cape Fear, North Carolina, south to mid-South Carolina, the canopy is dominated by *Quercus virginiana* and *Pinus taeda* occurring with *Sabal palmetto*. Farther south, *Pinus elliottii var. elliottii* replaces *Pinus taeda*, and *Sabal palmetto* becomes more prominent. Some floristic elements of the Georgia islands, such as *Lyonia ferruginea* and *Forestiera segregata*, are completely absent from barrier islands in the Carolinas. *Serenoa repens* does not occur on the North Carolina barrier islands but is important on Georgia 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, Sideroxylon foetidissimum*, and *Ficus aurea* 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 community, *Persea palustris* may replace *Persea borbonia*. Rare species reported from this community include *Agrimonia incisa, Sageretia minutiflora, Cynanchum scoparium*, and *Cyperus tetragonus*. The exotic *Triadica sebifera* (= *Sapium sebiferum*) has successfully established in many occurrences of this community.

Florida Natural Areas Inventory
Mesic Hammock

Example Photograph
Figure A29 below shows an example of CEGL007032 *Quercus virginiana* – (*Pinus elliottii*, *Sabal palmetto*) / *Persea borbonia – Callicarpa americana* Forest.



Figure A29. *Quercus virginiana* - (*Pinus elliottii*, *Sabal palmetto*) / *Persea borbonia - Callicarpa americana* Forest (CSU).

Short Citation:

- Godfrey, 1976
- Keys et al., 1995.

CEGL007156 Nyssa biflora - Magnolia virginiana - (Pinus elliottii) / Morella (carolinensis, inodora) Swamp Forest

Table A27 below shows the USNVC Hierarchy for CEGL007156 *Nyssa biflora – Magnolia virginiana* – (*Pinus elliottii*) / *Morella* (*carolinensis*, *inodora*) Swamp Forest.

Table A27. USNVC hierarchy for CEGL007156 *Nyssa biflora – Magnolia virginiana* – (*Pinus elliottii*) / *Morella* (*carolinensis*, *inodora*) Swamp Forest.

Category	Description
Class	1 Forest & Woodland
Subclass	1.B Temperate & Boreal Forest & Woodland
Formation	1.B.3 Temperate Flooded & Swamp Forest

Table A27 (continued). USNVC hierarchy for CEGL007156 *Nyssa biflora – Magnolia virginiana –* (*Pinus elliottii*) / *Morella* (*carolinensis*, *inodora*) Swamp Forest.

Category	Description
Division	1.B.3.Nb Southeastern North American Flooded & Swamp Forest
Macrogroup	1.B.3.Nb Southern Coastal Plain Evergreen Hardwood - Conifer Swamp
Group	1.B.3.Nb Coastal Plain Mixed Evergreen Swamp
Alliance	A0378 *Magnolia virginiana - Nyssa biflora - Quercus laurifolia* Swamp Forest Alliance
Association	1.B.3.Nb *Nyssa biflora - Magnolia virginiana -* (*Pinus elliottii*) / *Morella* (*caroliniensis, inodora*) Swamp Forest (CEGL007156)

Field Plots: 1098

Map Class: GUIS MC308

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 21 ft (range 21 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Upland (1)

Soil Texture:

Environment: One plot was sampled within this community. This occurred in an upland area. Litter dominates the ground cover with a value of 92%.

Local Vegetation Description
Structure: Canopy (30%), Subcanopy (10%), Tall Shrub (90%)

Vegetation Floristics: This community is dominated by *Nyssa aquatica* and *Magnolia virginiana* with cover values of ~30% and ~10% respectively. There is a very dense shrub layer with cover ~90%. Common shrubs included *Lyonia lucida*, *Morella cerifera*, and *Ilex coriacea*.

Dynamics: This association is subject to heavy flooding following hurricanes.

Conservation Status Rank
Global: G4

State: N/A

Global Environmental Description

This is a saturated forest receiving input from groundwater seepage as well as from rainfall events. It often contains small, braided seepage-fed streams, and extends along shallow, fairly narrow drainages; it only occasionally forms broad swamps. The highly organic sandy soils are topped with a thick peat layer. During drought periods, no water may be visible in the headwaters. This forest is typically extremely dense; the proportion of *Nyssa biflora* increases with the volume of water carried by the creek. Soils on which this association is found include poorly drained silt loams (Bibb and Trebloc) as well as very poorly drained 'mucky' organics (Pamlico-Dorovan association).

Global Vegetation Description

This mixed canopy "bay forest" is dominated by species such as *Nyssa biflora* and *Magnolia virginiana*, with *Pinus elliottii* var. *elliottii* present in many examples. This forest is typically extremely dense; the proportion of *Nyssa biflora* increases with the volume of water carried by the creek. *Pinus elliottii* may be a prominent feature of the community, rising above the canopy as large emergents, or it may have been removed by logging. The canopy may also contain *Acer rubrum* var. *trilobum, Liquidambar styraciflua*, *Liriodendron tulipifera*, *Gordonia lasianthus*, *Taxodium ascendens*, and *Pinus taeda*. Along with *Morella inodora* and *Morella caroliniensis*, shrubs include *Lyonia lucida*, *Cyrilla racemiflora*, *Viburnum nudum*, *Itea virginica*, *Persea palustris*, *Leucothoe racemosa*, *Ilex glabra*, *Ilex opaca*, and *Clethra alnifolia*. Vines are mainly *Smilax laurifolia*. *Smilax walteri*, *Toxicodendron radicans*, and *Vitis rotundifolia* can also be present. Examples from northeast Florida lack *Morella inodora*, and *Morella cerifera* can have low cover values. The very scattered herbaceous layer contains *Osmunda regalis* var. *spectabilis* and *Woodwardia areolata*. Other herbaceous species may include *Woodwardia virginica*, *Osmunda cinnamomea*, *Mayaca fluviatilis*, *Viola* x *primulifolia*, *Carex glaucescens*, *Triadenum virginicum*, *Carex leptalea* ssp. *harperi*, *Rhynchospora gracilenta*, *Rhynchospora capitellata* (= *Rhynchospora leptocarpa*), and *Saururus cernuus*. In southern Mississippi, *Eriocaulon decangulare* var. *latifolium* and *Pinguicula primuliflora* are characteristic, and examples may contain *Melanthium virginicum*, *Isoetes louisianensis*, *Peltandra sagittifolia*, and *Macranthera flammea*. *Sphagnum* is more common near the edges where the degree of light penetration is higher.

Florida Natural Areas Inventory

Baygall

Example Photograph

Figure A30 below shows an example of CEGL007156 *Nyssa biflora – Magnolia virginiana –* (*Pinus elliottii*) / *Morella* (*carolinensis*, *inodora*) Swamp Forest.



Figure A30. *Nyssa biflora - Magnolia virginiana* - (*Pinus elliottii*) / *Morella* (*carolinensis*, *inodora*) Swamp Forest (CSU).

CEGL002419 Nyssa aquatica Swamp Forest

Table A28 below shows the USNVC Hierarchy for CEGL002419 *Nyssa aquatica* Swamp Forest.

Table A28. USNVC hierarchy for CEGL002419 *Nyssa aquatica* Swamp Forest.

Category	Description
Class	1 Forest & Woodland
Subclass	1.B Temperate & Boreal Forest & Woodland
Formation	1.B.3 Temperate Flooded & Swamp Forest
Division	1.B.3.Nb Southeastern North American Flooded & Swamp Forest
Macrogroup	1.B.3.Nb Southern Coastal Plain Floodplain Forest
Group	1.B.3.Nb Bald-cypress - Tupelo Floodplain Forest
Alliance	A0345 *Nyssa aquatica* Swamp Forest Alliance
Association	1.B.3.Nb *Nyssa aquatica* Swamp Forest (CEGL002419)

Field Plots: 2003

Map Class: GUIS MC309

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 0 ft (range 0 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Hillslope Seepage Area (1)

Soil Texture: Muck (1)

Environment: One plot was sampled within this community. Water comprises 50% of the ground cover and 47% is litter.

Local Vegetation Description
Structure: Canopy (70%), Herbaceous (10%)

Vegetation Floristics: This community is heavily dominated by *Nyssa aquatica* with cover ~70%. There is a sparse shrub layer present composed of *Ilex myrtifolia*, *Itea virginica*, *Magnolia virginiana, Morella cerifera,* and *Persea* sp. Herbaceous layer is usually sparse and contains *Eleocharis elongata, Dichanthelium sabulorum, Juncus acuminatus,* and *Xyris fimbriata*.

Dynamics: This is a climax wetland community. Flooding frequency is approximately 100% of years, and flooding duration is approximately 100% of the growing season. Seasonal (spring and fall) flood pulses contribute to channel scouring and deposition of organic matter (where slackwater and pooling of floodwaters occur). Flooding also provides water which persists during dry periods, although dewatering during summer months is not uncommon. Seasonal flooding and permanent water require special adaptations by vegetation to exist in this extremely dynamic ecosystem. Many plants have highly specialized methods to facilitate acquisition and transport of oxygen during periods of prolonged inundation. Neither bald-cypress nor water tupelo are able to germinate in water and require dry periods to produce seedlings. Seedlings are unable to survive complete submergence, and prolonged flooding with excessive water levels can kill even mature trees. Subcanopy and herbaceous components of this community are very dynamic, and densities fluctuate with availability of substrate.

Nyssa aquatica swamps occur most commonly in riparian zones subject to seasonal hydrologic pulses. Inundation is usually more than 6 months of the year and is greatest during spring and fall. Timing, duration, depth, and extent of flooding greatly affect community composition. Deeper, more permanent flooding conditions seem to select for bald-cypress. Prolonged drought can create conditions favorable for tupelo recruitment. In addition, *Nyssa aquatica* may replace *Taxodium*

distichum in some sites because bald-cypress has minimal sprouting ability, erratic reproduction, and slower growth (Wharton et al. 1982). Prolonged flooding can increase senescence of seedlings and saplings, removing all but older mature timber. These open areas, while quickly colonized during subsequent dry years, are very dynamic until the hydrology stabilizes sufficiently long to select for a specific species.

Conservation Status Rank
Global: G4G5

State: N/A

Global Environmental Description
Stands of this association occur on permanently saturated soils on low, wet flats and sloughs, swales and backswamps. The association is more common on floodplains of brownwater, rather than blackwater, rivers. Both organic and mineral soils may be present. Soil moisture is abundant and fairly permanent, often with a shallow impermeable clay layer which creates a shallow, perched water table. Anaerobic conditions are prevalent, with considerable gleying due to reduction of iron and manganese. Root zones often exhibit iron mottling and concretions. Soils are generally acidic (4.0-6.0 pH), with low nutrient availability. Historically, periods of flooding and drought have determined community dominance. Sediment deposition also modifies swamp forest communities by decreasing water depth. Excessive sedimentation can speed the natural transition of wetlands as they evolve to a drier condition. Bedrock is deeply buried Paleozoic rock, exhibiting little or no effect on community structure or composition. Unconsolidated alluvial sediments need further characterization.

Global Vegetation Description
The vegetation is dominated by dense, and occasionally pure, stands of *Nyssa aquatica* but often in association with *Taxodium distichum* (never very abundant in this community), *Liquidambar styraciflua, Planera aquatica, Nyssa biflora, Gleditsia aquatica, Fraxinus profunda*, and *Cephalanthus occidentalis*. The herbaceous layer is conspicuously sparse, and density is wholly dependent upon the extent and duration of flooding. Where water is permanent, herbaceous plants rely on substrates found on rotting logs, stumps, terraces, and buttresses of trees. Some herbs which may be present at low densities on these elevated places include *Phanopyrum gymnocarpon, Pluchea camphorata, Boehmeria cylindrica, Rudbeckia laciniata, Sagittaria latifolia, Onoclea sensibilis, Triadenum walteri, Carex joorii, Carex glaucescens, Asclepias perennis, Saururus cernuus, Justicia ovata, Leersia lenticularis*, and others. The exotic plant species *Eichhornia crassipes* may a problem. Subcanopy density and forest tree recruitment are poor due to fluctuating water levels (TNC 1995a).

Florida Natural Areas Inventory
Bottomland Forest

Example Photograph
Figure A31 below shows an example of CEGL002419 *Nyssa aquatica* Swamp Forest.

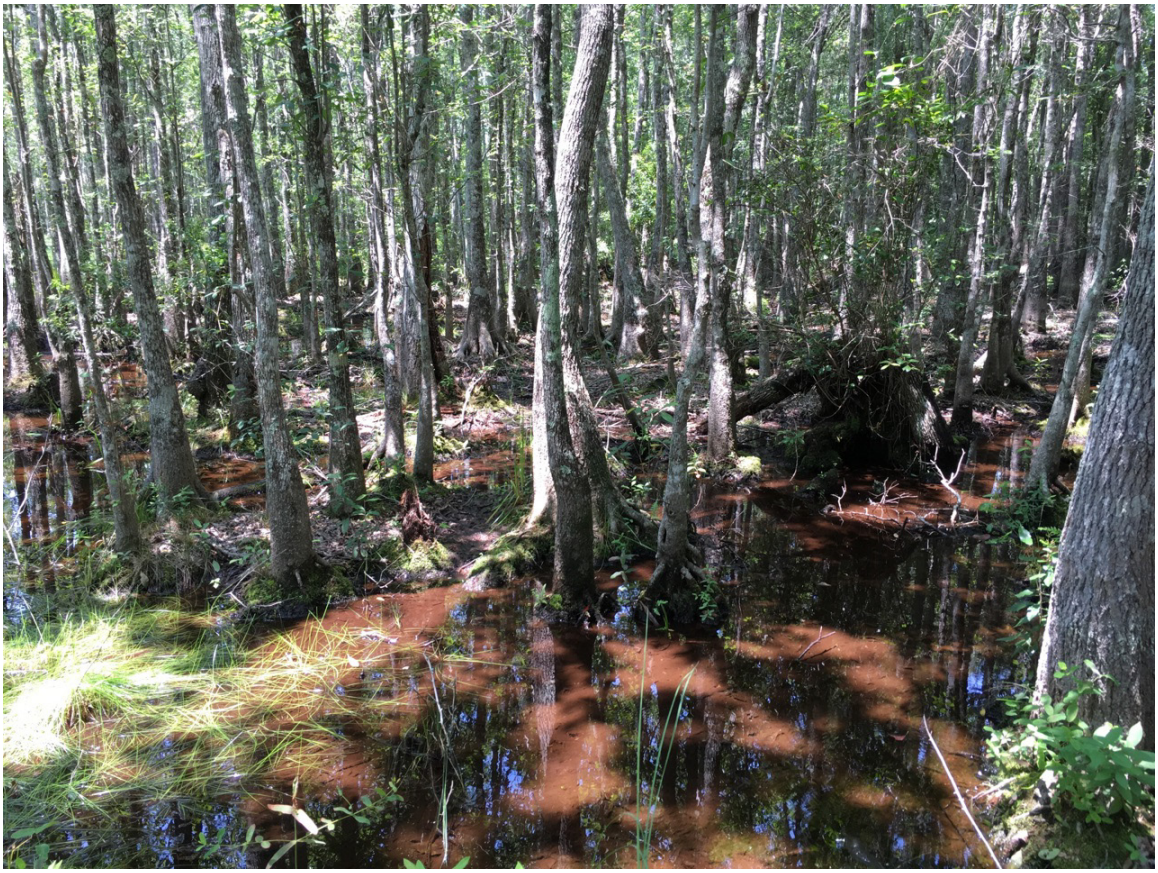


Figure A31. *Nyssa aquatica* Swamp Forest (CSU).

Short Citation:

- Wharton et al., 1982
- TNC, 1995a.

CEGL008477 Nyssa biflora - Liquidambar styraciflua / Magnolia virginiana / Hamamelis virginiana - Viburnum nudum Swamp Forest

Table A29 below shows the USNVC Hierarchy for CEGL008477 *Nyssa biflora – Liquidambar styraciflua* / *Magnolia virginiana* / *Hamamelis virginiana – Viburnum nudum* Swamp Forest.

Table A29. USNVC hierarchy for CEGL008477 *Nyssa biflora – Liquidambar styraciflua* / *Magnolia virginiana* / *Hamamelis virginiana – Viburnum nudum* Swamp Forest.

Category	Description
Class	1 Forest & Woodland
Subclass	1.B Temperate & Boreal Forest & Woodland
Formation	1.B.3 Temperate Flooded & Swamp Forest
Division	1.B.3.Nb Southeastern North American Flooded & Swamp Forest

Table A29 (continued). USNVC hierarchy for CEGL008477 *Nyssa biflora – Liquidambar styraciflua* / *Magnolia virginiana* / *Hamamelis virginiana – Viburnum nudum* Swamp Forest.

Category	Description
Macrogroup	1.B.3.Nb Southern Coastal Plain Evergreen Hardwood - Conifer Swamp
Group	1.B.3.Nb Coastal Plain Mixed Evergreen Swamp
Alliance	A0378 *Magnolia virginiana - Nyssa biflora - Quercus laurifolia* Swamp Forest Alliance
Association	1.B.3.Nb *Nyssa biflora - Liquidambar styraciflua / Magnolia virginiana / Hamamelis virginiana - Viburnum nudum* Swamp Forest (CEGL008477)

Field Plots: 1037, 2107, 2104, 1043

Map Class: GUIS MC308

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 31 ft (range 16 ft to 43 ft)

Aspect: Mean 161.25˚ (range 0˚ to 235˚)

Slope: Mean 4.5˚ (range 0˚ to 10˚)

Macro Topography: Hillslope (1), Upland (1), Upland Swales (2)

Soil Texture: Sandy Loam (2), Sandy Loam (2)

Environment: Four plots were sampled within this community. This community was generally found in upland swales. Litter dominates the ground cover with values from 80% to 95%. Wood is sometimes present with values between 2% and 4%.

Local Vegetation Description
Structure: Canopy (20%-50%), Subcanopy (0%-60%), Tall Shrub (0%-20%), Herbaceous (40%-70%)

Vegetation Floristics: The canopy is dominated by a mix of *Quercus nigra* and *Nyssa aquatica*. The canopy cover ranges from 20% to 60%. Other tree species may include *Acer rubrum, Liquidambar styraciflua,* and *Magnolia virginiana*. Shrubs may be sparse to absent with common species including *Morella cerifera, Ilex vomitoria,* and *Viburnum nudum*. There is a vigorous herbaceous stratum that is mainly dominated by ferns. Fern cover may reach up to 70%; common ferns include *Osmunda cinnamomea* and *Woodwardia areolata*.

Dynamics: N/A

Conservation Status Rank
Global: G2G3

State: N/A

Global Environmental Description
N/A

Global Vegetation Description
The open tree canopy of stands is typically dominated by *Nyssa biflora*, with some combination of *Liquidambar styraciflua* and *Acer rubrum* (NatureServe Ecology unpubl. data). In addition, *Pinus taeda* may be present in some stands. The subcanopy (and possibly the canopy in some examples) contains substantial *Magnolia virginiana*; this stratum may also contain *Ilex opaca* var. *opaca* and *Cornus foemina*. Canopy cover in these seeps is not complete, and the shrub and herbaceous layers may be well-developed. The shrub stratum contains *Ilex opaca* var. *opaca, Viburnum nudum* var. *nudum, Hamamelis virginiana*, and *Itea virginica*, which may be dominant. Other shrubs present include *Viburnum dentatum, Ilex decidua, Cornus foemina, Arundinaria gigantea* ssp. *tecta*, and others. The herbaceous layer includes *Osmunda regalis* var. *spectabilis, Osmunda cinnamomea, Woodwardia areolata, Solidago patula* var. *strictula, Sagittaria latifolia, Penthorum sedoides, Mikania scandens, Juncus effusus, Chelone glabra, Dichanthelium* spp., *Carex crinita, Carex frankii, Carex intumescens, Carex leptalea, Mitchella repens, Sphagnum* spp., and others. Several of these herbs may be locally dominant in patches. Woody vines are common; some typical species are *Smilax laurifolia, Smilax rotundifolia, Toxicodendron radicans, Berchemia scandens*, and others. This association lacks some of the species characteristic of related vegetation communities from further south, such as *Morella caroliniensis* (= *Myrica heterophylla*)*, Toxicodendron vernix, Ilex coriacea, Clethra alnifolia*, and *Persea palustris*.

Florida Natural Areas Inventory
Baygall

Example Photograph
Figure A32 below shows an example of CEGL008477 *Nyssa biflora – Liquidambar styraciflua* / *Magnolia virginiana* / *Hamamelis virginiana – Viburnum nudum* Swamp Forest.



Figure A32. *Nyssa biflora - Liquidambar styraciflua* / *Magnolia virginiana* / *Hamamelis virginiana - Viburnum nudum* Swamp Forest (CSU).

CEGL004638 Quercus nigra Ruderal Forest

Table A30 below shows the USNVC Hierarchy for CEGL004638 *Quercus nigra* Ruderal Forest.

Table A30. USNVC hierarchy for CEGL004638 *Quercus nigra* Ruderal Forest.

Category	Description
Class	1 Forest & Woodland
Subclass	1.B Temperate & Boreal Forest & Woodland
Formation	1.B.1 Warm Temperate Forest & Woodland
Division	1.B.1.Na Southeastern North American Forest & Woodland
Macrogroup	1.B.1.Na Southeastern North American Ruderal Forest
Group	1.B.1.Na Southeastern Native Ruderal Forest
Alliance	A3232 *Liquidambar styraciflua - Celtis laevigata - Quercus nigra* Ruderal Forest Alliance
Association	1.B.1.Na *Quercus nigra* Ruderal Forest (CEGL004638)

Field Plots: 1041, 2108, 2109, 2103, 1040

Map Class: GUIS MC310

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 60.8 ft (range 34 ft to 110 ft)

Aspect: Mean 64˚ (range 0˚ to 320˚)

Slope: Mean 2.4˚ (range 0˚ to 12˚)

Macro Topography: Hillslope (1), Upland (4)

Soil Texture: Sand (1), Sandy Loam (1), Loamy Sand (1), Sandy Clay Loam (2)

Environment: Five plots were sampled within this community. These communities only occurred in upland areas in Davis Bayou. Litter dominated the ground cover with values ranging from 87% to 95%. When present, bare soil covered only 2% to 5%.

Local Vegetation Description
Structure: Canopy (60%-70%), Subcanopy (0%-10%), Tall Shrub (10%-40%), Short Shrub (0%-10%), Dwarf Shrub (0%-30%), Herbaceous (0%-10%)

Vegetation Floristics: The canopy is usually dominated by *Quercus nigra* with cover ranging between 30% and 70%. Other trees occur in the canopy and subcanopy as well, but do not typically reach codominance. Other tree species include *Liquidambar styraciflua*, *Acer rubrum*, and *Magnolia grandiflora*. A moderate shrub layer is generally present with cover <50%. Common shrubs include *Vaccinium stamineum*, *Ilex vomitoria*, and *Morella cerifera*. The herbaceous layer tends to be sparse with cover usually <20%.

Dynamics: This community occurs as a successional community following either degradation of pinelands or recovery from agricultural disturbance of old fields in fairly sandy soils, as well as other forms of soil disturbance in the southern coastal plains and adjacent Piedmont. In the Piedmont area of South Carolina, this is reported to occur on areas formerly codominated by *Quercus oglethorpensis*. In these areas, the *Quercus oglethorpensis* still survives, making this modified community of more conservation value in those areas. This manifestation may be an altered version of a natural association, and not strictly "ruderal."

Conservation Status Rank
Global: N/A

State: N/A

Global Environmental Description

This community is a result of disturbance and/or fire suppression of upland pinelands of the southeastern Coastal Plain and adjacent Piedmont. South of the range of southern yellow pines, this community is found on highly disturbed upland sites, spoil banks, artificial levees, and other anthropogenic landforms in a marsh and swamp landscape context. It occurs on mesic or dry-mesic sites, especially on loamy or other fine-textured soils. In the Piedmont transition of South Carolina, it may have grown out of areas that were heavily farmed or cut over in the past but which did not grow up into *Pinus taeda* forests.

Global Vegetation Description

The canopy of this association is dominated by *Quercus nigra*. Other oaks may be intermixed, especially *Quercus phellos*, as well as *Quercus falcata*, *Quercus hemisphaerica*, *Liquidambar styraciflua*, remnant *Pinus palustris*, weedy *Pinus elliottii* var. *elliottii*, *Carya* spp., or *Pinus taeda*. In the Upper Gulf Coastal Plain of Georgia, some examples may contain *Fagus grandifolia*, *Liriodendron tulipifera*, *Carya alba*, and *Cornus florida* in the subcanopy.

Florida Natural Areas Inventory

Mesic Hammock

Example Photograph

Figure A33 below shows an example of CEGL004638 *Quercus nigra* Ruderal Forest.



Figure A33. *Quercus nigra* Ruderal Forest (CNHP).

CEGL007225 Quercus alba - Carya alba / Aesculus pavia Forest

Table A31 below shows the USNVC Hierarchy for CEGL007225 *Quercus alba – Carya alba* / *Aesculus pavia* Forest.

Table A31. USNVC hierarchy for CEGL007225 *Quercus alba – Carya alba* / *Aesculus pavia* Forest.

Category	Description
Class	1 Forest & Woodland
Subclass	1.B Temperate & Boreal Forest & Woodland
Formation	1.B.1 Warm Temperate Forest & Woodland
Division	1.B.1.Na Southeastern North American Forest & Woodland
Macrogroup	1.B.1.Na Southern Mesic Mixed Broadleaf Forest
Group	1.B.1.Na Southern Mesic Beech - Oak - Mixed Deciduous Forest
Alliance	A3234 *Quercus alba - Carya alba* Mesic Coastal Plain Forest Alliance
Association	1.B.1.Na *Quercus alba - Carya glabra - Carya alba / Aesculus pavia* Forest (CEGL007225)

Field Plots: 2105

Map Class: GUIS MC311

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 13 ft (range 13 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Upland (1)

Soil Texture: Loamy Sand (1)

Environment: One plot was sampled within this community. This community occurred in an upland area. Litter dominated the ground cover with a value of ~92%, and wood contained ~4% cover.

Local Vegetation Description
Structure: Canopy (40%), Subcanopy (10%), Tall Shrub (50%)

Vegetation Floristics: Canopy is dominated by a variety of hardwoods mainly composed of *Quercus laurifolia*, *Quercus falcata*, *Liquidambar styraciflua*, *Quercus nigra*, *Magnolia grandifolia*, and *Carya tomentosa*. Canopy cover was ~40%. There was a vigorous shrub layer with cover ~50%. *Morella cerifera* was the most common shrub, but other common ones included *Hamamelis virginiana* and *Vaccinium arboreum*. There was not much present in the herbaceous stratum.

Dynamics: N/A

Conservation Status Rank
Global: N/A

State: N/A

Global Environmental Description
More information is needed on the detailed range, environment, and floristics of this association. Conceptually, it would be a coastal plain oak-hickory forest found on circumneutral substrates (e.g., on soils with a shell fraction in the profile).

Global Vegetation Description
Stands are typically dominated by *Quercus alba* and *Carya* spp. (most frequently *Carya glabra*, possibly *Carya cordiformis* in more mesic examples, and *Carya pallida* in drier ones). *Aesculus pavia* is characteristically present in the understory and shrub layer. Some other canopy components include *Quercus nigra*, *Fraxinus americana*, *Liriodendron tulipifera*, and *Liquidambar styraciflua*. The subcanopy may contain *Liquidambar styraciflua*, *Cornus florida*, *Nyssa sylvatica*, *Morus rubra*,

Celtis occidentalis, *Ostrya virginiana*, *Acer rubrum*, *Diospyros virginiana*, *Prunus serotina*, *Ulmus alata*, and/or *Quercus velutina*. Some other possible shrubs include *Arundinaria gigantea*, *Asimina parviflora*, *Callicarpa americana*, *Quercus alba*, *Quercus velutina*, *Vaccinium elliottii*, *Rubus argutus*, and *Vaccinium fuscatum*. Typical vines include *Vitis rotundifolia*, *Parthenocissus quinquefolia*, *Cocculus carolinus*, *Smilax bona-nox*, *Smilax glauca*, *Berchemia scandens*, and *Toxicodendron radicans*.

Vegetation from Fort Benning, Georgia, which appears to be compatible with this concept contains *Quercus alba*, *Quercus nigra*, *Carya pallida*, *Carya alba*, and *Fraxinus americana* in the canopy, *Cornus florida* and *Liriodendron tulipifera* in the subcanopy as well as *Aesculus pavia*, *Vitis rotundifolia*, *Callicarpa americana*, *Aralia spinosa*, *Polygonatum biflorum*, *Hexastylis arifolia*, *Aristolochia serpentaria*, *Elephantopus tomentosus*, *Matelea* sp., and *Passiflora lutea*. This stand would not be on a completely calcareous soil, being found in a more sandy landscape (some sands have a calcareous shell fraction). The concept of this community may be somewhat expanded to accommodate these data. See also stand data from plot TALO.35, Five Mile Branch, Talladega-Oakmulgee National Forest. This example differs from the stand at Fort Benning, but is probably also compatible with the concept of this community. This stand is dominated by *Quercus alba*, *Liriodendron tulipifera*, and *Liquidambar styraciflua*. Other oak species are not in the canopy and have negligible cover in the subcanopy. The subcanopy contains *Liquidambar styraciflua*, *Cornus florida*, *Nyssa sylvatica*, *Morus rubra*, *Prunus serotina*, *Ulmus alata*, and *Quercus velutina*. The hickories *Carya alba* and *Carya glabra* (nominals in this association), as well as *Aesculus pavia*, are present in the shrub layer. Other small trees and shrubs include *Arundinaria gigantea*, *Diospyros virginiana*, *Asimina parviflora*, *Callicarpa americana*, *Acer rubrum*, *Quercus alba*, *Quercus velutina*, *Celtis occidentalis*, *Ostrya virginiana*, *Nyssa sylvatica*, *Vaccinium elliottii*, *Rubus argutus*, and *Vaccinium fuscatum*. Typical vines include *Vitis rotundifolia*, *Parthenocissus quinquefolia*, *Cocculus carolinus*, *Smilax bona-nox*, *Smilax glauca*, *Berchemia scandens*, and *Toxicodendron radicans*. Herbs in this particular stand include *Acalypha gracilens*, *Aristolochia serpentaria*, *Chamaelirium luteum*, *Chasmanthium sessiliflorum* (most frequent here), *Desmodium* sp., *Dichanthelium* sp., *Dioscorea quaternata*, *Euphorbia pubentissima*, *Hexastylis arifolia*, *Mitchella repens*, *Ruellia caroliniensis*, *Smilax hugeri*, *Viola* spp., and *Athyrium filix-femina* ssp. *asplenioides* (NatureServe Ecology unpubl. data).

Florida Natural Areas Inventory
Slope Forest

Example Photograph
Figure A34 below shows an example of CEGL007225 *Quercus alba – Carya alba* / *Aesculus pavia* Forest.



Figure A34. *Quercus alba - Carya alba* / *Aesculus pavia* Forest (CSU).

CEGL004965 Fagus grandifolia - Magnolia grandiflora - Quercus michauxii - Quercus nigra / Rhododendron canescens Forest

Table A32 below shows the USNVC Hierarchy for CEGL004965 *Fagus grandifolia – Magnolia grandiflora – Quercus michauxii – Quercus nigra* / *Rhododendron canescens* Forest.

Table A32. USNVC Hierarchy for CEGL004965 *Fagus grandifolia – Magnolia grandiflora – Quercus michauxii – Quercus nigra* / *Rhododendron canescens* Forest.

Category	Description
Class	1 Forest & Woodland
Subclass	1.B Temperate & Boreal Forest & Woodland
Formation	1.B.1 Warm Temperate Forest & Woodland
Division	1.B.1.Na Southeastern North American Forest & Woodland
Macrogroup	1.B.1.Na Southern Mesic Mixed Broadleaf Forest
Group	1.B.1.Na Southern Mesic Beech - Magnolia - Oak Forest

Table A32 (continued). USNVC Hierarchy for CEGL004965 *Fagus grandifolia – Magnolia grandiflora – Quercus michauxii – Quercus nigra* / *Rhododendron canescens* Forest.

Category	Description
Alliance	A0369 *Fagus grandifolia - Magnolia grandiflora* Forest Alliance
Association	1.B.1.Na *Fagus grandifolia - Magnolia grandiflora - Quercus michauxii - Quercus nigra / Rhododendron canescens* Forest (CEGL004965)

Field Plots: 1042

Map Class: GUIS MC312

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 39 ft (range 39 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Upland (1)

Soil Texture: Sandy Loam (1)

Environment: One plot was sampled within this community. This community occurred on a ridge in a ridge and swale system. Litter dominated here with cover of ~97%.

Local Vegetation Description
Structure: Canopy (60%), Tall Shrub (20%), Short Shrub (20%)

Vegetation Floristics: Canopy is mainly dominated by *Fagus grandifolia*, but *Carya glabra, Liquidambar styraciflua,* and *Quercus nigra* may codominate as well. Canopy cover tends to be ~70%. There is also a shrub layer with cover ~20%. Common shrubs include *Hamamelis virginiana, Ilex vomitoria, Magnolia grandiflora,* and *Morella cerifera*. The herbaceous stratum tends to be sparse with cover <10%. Common forbs include *Mitchella repens* and *Rubus argutus*.

Dynamics: N/A

Conservation Status Rank
Global: G2G3

State: N/A

Global Environmental Description
This community comprises forests of small perennial stream bottoms, found on knolls and broad flats over acidic silt/sand loams in floodplains of small streams, where examples are subject to regular but

brief flooding events (typically 1-5 floods each year, lasting from 1-3 days each). These floods usually result from late-winter and early-spring rains. It is described from the central and eastern Florida parishes of Louisiana, within the range of *Pinus palustris*.

Global Vegetation Description

Stands of this community are structurally and compositionally very much like ~*Fagus grandifolia* - *Magnolia grandiflora* - *Pinus glabra* - (*Magnolia macrophylla*) / (*Illicium floridanum*) Forest (CEGL007460) (as modified by L.M. Smith 11-97), but typically with a significantly greater prevalence of species such as *Quercus nigra*, *Quercus michauxii*, *Quercus laurifolia*, *Liquidambar styraciflua*, *Liriodendron tulipifera*, *Acer rubrum*, *Carpinus caroliniana*, *Symplocos tinctoria*, *Halesia diptera*, *Viburnum dentatum*, *Persea borbonia*, *Vitis rotundifolia,* and *Berchemia scandens*. The forest usually lacks some species occasionally present in CEGL007460, such as *Pinus echinata*, *Quercus velutina*, *Euphorbia corollata* (and others). Species common here that are rare to uncommon in CEGL007460 include *Rhododendron canescens* and *Itea virginica* (others). Some stands (e.g., Crain's Creek TNC Preserve) may contain *Magnolia macrophylla* and *Kalmia latifolia*.

Florida Natural Areas Inventory

Slope Forest

Example Photograph

Figure A35 below shows an example of CEGL004965 *Fagus grandifolia – Magnolia grandiflora – Quercus michauxii – Quercus nigra* / *Rhododendron canescens* Forest.



Figure A35. *Fagus grandifolia - Magnolia grandiflora - Quercus michauxii - Quercus nigra / Rhododendron canescens* Forest (CSU).

Mapped Shrubland Types

CEGL003813 Ilex vomitoria - Quercus (geminata, virginiana) - Morella cerifera - Serenoa repens Shrubland

Table A33 below shows the USNVC Hierarchy for CEGL003813 *Ilex vomitoria – Quercus* (*geminata*, *virginiana*) *– Morella cerifera – Serenoa repens* Shrubland.

Table A33. USNVC hierarchy for CEGL003813 *Ilex vomitoria – Quercus* (*geminata*, *virginiana*) *– Morella cerifera – Serenoa repens* Shrubland.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.B Temperate & Boreal Grassland & Shrubland
Formation	2.B.4 Temperate to Polar Scrub & Herb Coastal Vegetation
Division	2.B.4.Na Eastern North American Coastal Scrub & Herb Vegetation
Macrogroup	2.B.4.Na Eastern North American Coastal Dune & Grassland

Table A33 (continued). USNVC hierarchy for CEGL003813 *Ilex vomitoria* – *Quercus* (*geminata*, *virginiana*) – *Morella cerifera* – *Serenoa repens* Shrubland.

Category	Description
Group	2.B.4.Na South Atlantic & Gulf Coastal Dune & Grassland
Alliance	A3690 *Quercus virginiana - Ilex vomitoria - Morella cerifera* Shrubland Alliance
Association	2.B.4.Na *Ilex vomitoria - Quercus* (*geminata, virginiana*) *- Morella cerifera - Serenoa repens* Shrubland (CEGL003813)

Field Plots: 1056, 1058, 2033, 2054, 1057, 2057, 1088, 1018, 1029, 3004, 2029, 2010, 1086, 1010, 1085, 1089, 2092

Map Class: GUIS MC201

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 9.76 ft (range 0 ft to 88 ft)

Aspect: Mean 90˚ (range 0˚ to 340˚)

Slope: Mean 3.41˚ (range 0˚ to 12˚)

Macro Topography: Bayshore (2), Dune Field Complex (3), Relic Dune (7), Upland (5)

Soil Texture: Sand (14), Loamy Sand (2), Sandy Loam (1)

Environment: Seventeen plots were sampled within this community. This community was found mainly in dune complexes or on relic dunes. Bare soil usually dominates with cover ranging from 3% to 97%, but occasionally litter may dominate with cover ranging from 1% to 90%.

Local Vegetation Description
Structure: Canopy (0%-20%), Tall Shrub (20%-90%), Short Shrub (10%-90%), Dwarf Shrub (0%-30%), Herbaceous (0%-40%)

Vegetation Floristics: This shrub community was dominated by a mix of *Quercus geminata*, *Ilex vomitoria, Morella cerifera*, and *Baccharis halimifolia*. The shrub cover typically ranges from 20% to 90%. Herbaceous stratum usually was sparse with cover <30% and variable. Common species may include *Uniola paniculata*, *Schizachyrium maritimum*, *Chamaecrista fasciculata*, *Oenothera humifusa*, and *Heterotheca subaxillaris*.

Dynamics: These require high water tables and flooding, but generally do not experience scouring floods, which allows for the graminoid understory to develop.

Conservation Status Rank
Global: G2G3

State (Florida): S2

Global Environmental Description
N/A

Global Vegetation Description
This association consists of upland shrub thickets dominated by variable mixtures of *Ilex vomitoria*, *Quercus virginiana, Quercus geminata, Morella cerifera* (= *Myrica cerifera*), *Serenoa repens*, and *Baccharis halimifolia*. It occurs on rises in *Juncus roemerianus* marshes, and in other upland but extreme situations on barrier islands and barrier spits. It is likely maintained by edaphic conditions, as well as by periodic catastrophic disturbance of storm flooding and salt kill. Occasional low stature *Pinus elliottii* may be present.

Florida Natural Areas Inventory
Beach Dune

Example Photograph
Figure A36 below shows an example of CEGL003813 *Ilex vomitoria – Quercus* (*geminata*, *virginiana*) *– Morella cerifera – Serenoa repens* Shrubland.



Figure A36. *Ilex vomitoria - Quercus* (*geminata*, *virginiana*) *- Morella cerifera - Serenoa repens* Shrubland (CNHP).

CEGL003824 Quercus myrtifolia - Quercus geminata - Ceratiola ericoides - Conradina canescens Shrubland

Table A34 below shows the USNVC Hierarchy for CEGL003824 *Quercus myrtifolia – Quercus geminata – Ceratiola ericoides – Conradina canescens* Shrubland.

Table A34. USNVC hierarchy for CEGL003824 *Quercus myrtifolia – Quercus geminata – Ceratiola ericoides – Conradina canescens* Shrubland.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.B Temperate & Boreal Grassland & Shrubland
Formation	2.B.4 Temperate to Polar Scrub & Herb Coastal Vegetation
Division	2.B.4.Na Eastern North American Coastal Scrub & Herb Vegetation
Macrogroup	2.B.4.Na Eastern North American Coastal Dune & Grassland
Group	2.B.4.Na South Atlantic & Gulf Coastal Dune & Grassland
Alliance	A3689 *Quercus geminata - Quercus myrtifolia* Dune Shrubland Alliance
Association	2.B.4.Na *Quercus myrtifolia - Quercus geminata - Ceratiola ericoides - Conradina canescens* Shrubland (CEGL003824)

Field Plots: 1002, 1033, 1004, 1097, 1003, 3005, 2101, 2021, 2025, 3002

Map Class: GUIS MC202

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 6.08 ft (range 0 ft to 35 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Dune Field Complex (1), Hillslope (1), Relic Dune (5), Upland (5)

Soil Texture: Sand (11), Loamy Sand (1)

Environment: Twelve plots were sampled within this community. This community occurred on upland areas and on relic dunes. Litter typically dominated these plots with cover ranging from 5% to 95%. Occasionally bare soil dominates with cover ranging from 1% to 94%.

Local Vegetation Description
Structure: Canopy (0%-10%), Tall Shrub (10%-60%), Short Shrub (20%-90%), Dwarf Shrub (10%-40%), Herbaceous (10%-20%)

Vegetation Floristics: This shrub community was dominated by a combination of shrubs, mainly *Quercus geminata*, *Quercus myrtifolia*, *Ceratiola ericoides*, and *Serenoa repens*. Shrub cover generally ranges from 60% to 90%. Occasionally *Pinus echinata* may be present, but its cover does not exceed 5%. Herbaceous stratum is usually sparse with <10%; common species include *Rhynchospora* spp., *Cladonia evansii*, and *Cladonia leporina*.

Dynamics: N/A

Conservation Status Rank
Global: G2

State (Florida): S2

Global Environmental Description
N/A

Global Vegetation Description
This is a "coastal scrub" community of the Panhandle of Florida, from Escambia County west to Franklin County, and in Baldwin County, Alabama, especially on the mainland (non-barrier island) coast from Destin (Walton County) east to Panama City (Bay County). It differs from Florida Atlantic Coast oak scrubs by having such panhandle species as *Chrysoma pauciflosculosa*, *Polygonella macrophylla*, *Lupinus westianus*, *Chrysopsis gossypina* ssp. *cruiseana*, *Chrysopsis godfreyi*, and *Conradina canescens*. Characteristic lichens are *Cladina evansii*, *Cladonia prostrata*, and *Cladonia leporina*. Other characteristic species include *Pinus clausa* (dwarfed), *Serenoa repens, Ilex vomitoria*, *Osmanthus americanus*, *Polygonella gracilis*, *Polygonella polygama*, *Balduina angustifolia*, *Agalinis filifolia*, *Asclepias humistrata*, and *Licania michauxii*. This community differs from more inland panhandle scrubs in the absence of a closed *Pinus clausa* canopy and infrequency of *Lyonia ferruginea* in the shrub layer.

Florida Natural Areas Inventory
Beach Dune

Example Photograph
Figure A37 below shows an example of CEGL003824 *Quercus myrtifolia – Quercus geminata – Ceratiola ericoides – Conradina canescens* Shrubland.



Figure A37. *Quercus myrtifolia - Quercus geminata - Ceratiola ericoides - Conradina canescens* Shrubland (CSU).

CEGL003920 Baccharis halimifolia - Iva frutescens - Morella cerifera - (Ilex vomitoria) Saline Shrubland

Table A35 below shows the USNVC Hierarchy for CEGL003920 *Baccharis halimifolia – Iva frutescens – Morella cerifera –* (*Ilex vomitoria*) Saline Shrubland.

Table A35. USNVC Hierarchy for CEGL003920 *Baccharis halimifolia – Iva frutescens – Morella cerifera –* (*Ilex vomitoria*) Saline Shrubland.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.C Shrub & Herb Wetland
Formation	2.C.5 Salt Marsh
Division	2.C.5.Nb North American Atlantic & Gulf Coastal Salt Marsh
Macrogroup	2.C.5.Nb North American Atlantic & Gulf Coastal Salt Marsh
Group	2.C.5.Nb Atlantic & Gulf Coastal High Salt Marsh

Table A35 (continued). USNVC Hierarchy for CEGL003920 *Baccharis halimifolia – Iva frutescens – Morella cerifera* – (*Ilex vomitoria*) Saline Shrubland.

Category	Description
Alliance	A1023 *Iva frutescens* Tidal Shrub Salt Marsh Alliance
Association	2.C.5.Nb *Baccharis halimifolia - Iva frutescens - Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland (CEGL003920)

Field Plots: 1072, 1063, 2067, 1054, 1081, 1079, 2085, 1066, 1050, 2056, 2090, 2091, 2097, 2061, 2063, 2066

Map Class: GUIS MC203

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 9.63 ft (range 0 ft to 36 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Dune Field Complex (3), Swale Inderdunal Depression (10), Upland (3)

Soil Texture: Sand (5), Muck (5), Loamy Sand (2), Sandy Clay Loam (1), Sandy Loam (3)

Environment: Sixteen plots were sampled within this community. The community was found in dune complexes, interdunal swales, and upland areas. Litter usually dominated with cover from 60% to 92%. In one site, water dominated with cover of 70%.

Local Vegetation Description
Structure: Tall Shrub (0%-70%), Short Shrub (0%-30%), Herbaceous (50%-90%)

Vegetation Floristics: Shrubs typically form a sparse to moderate stratum with *Baccharis halimifolia, Iva frutescens,* and *Morella cerifera*. Other common shrubs include *Pinus elliottii* and *Ilex vomitoria*. There is also a vigorous herbaceous layer dominated with graminoids. Abundant graminoids in this community include *Panicum virgatum*, *Rhynchospora* spp., *Panicum repens*, and *Cyperus* spp.

Dynamics: N/A

Conservation Status Rank
Global: G4

State: N/A

Global Environmental Description

This shrubland occurs in slightly elevated areas within salt flats and salt marshes as well as in marsh edges throughout much of the East Gulf, South Atlantic, and Mid-Atlantic coastal plains. This community is usually best developed at the upper limit of non-storm tidal inundation, on natural levees deposited by above-normal tides.

Global Vegetation Description

The most common species are typically *Baccharis halimifolia*, *Morella cerifera* (= *Myrica cerifera*), *Iva frutescens* ssp. *frutescens*, *Yucca gloriosa*, *Juniperus virginiana* var. *silicicola*, *Lycium carolinianum*, *Baccharis angustifolia*, and *Ilex vomitoria*. Other species which may be present include *Borrichia frutescens*, *Fimbristylis castanea*, *Limonium carolinianum*, and *Solidago sempervirens*.

Florida Natural Areas Inventory

Salt Marsh

Example Photograph

Figure A38 below shows an example of CEGL003920 *Baccharis halimifolia – Iva frutescens – Morella cerifera –* (*Ilex vomitoria*) Saline Shrubland.



Figure A38. *Baccharis halimifolia - Iva frutescens - Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland (CSU).

CEGL003839 Morella cerifera / Spartina patens Wet Shrubland

Table A36 below shows the USNVC Hierarchy for CEGL003839 *Morella cerifera* / *Spartina patens* Wet Shrubland.

Table A36. USNVC hierarchy for CEGL003839 *Morella cerifera* / *Spartina patens* Wet Shrubland.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.C Shrub & Herb Wetland
Formation	2.C.4 Temperate to Polar Freshwater Marsh, Wet Meadow & Shrubland
Division	2.C.4.Ne Atlantic & Gulf Coastal Marsh, Wet Meadow & Shrubland
Macrogroup	2.C.4.Ne Atlantic & Gulf Coastal Plain Wet Prairie & Marsh
Group	2.C.4.Ne Northern & Mid-Atlantic Coastal Wetland
Alliance	A3649 *Morella cerifera* Coastal Wet Shrubland Alliance
Association	2.C.4.Ne *Morella cerifera / Spartina patens* Wet Shrubland (CEGL003839)

Field Plot: 2075, 2099, 2020, 2071

Map Class: GUIS MC203

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 5.25ft (range 0 ft to 13 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Relic Dune (1), Swale Interdunal Depression (3)

Soil Texture: Sand (2), Loamy Sand (2)

Environment: Four plots were sampled within this community. These usually occurred within interdunal swales, and one on a relic dune. Litter usually ranges between 88% and 25%. Some plots had 85% water and another had 60% bare soil.

Local Vegetation Description
Structure: Short Shrub (20%-70%), Herbaceous (50%-70%)

Vegetation Floristics: This community is dominated by a dense shrub layer of *Morella cerifera* and *Baccharis halimifolia* with covers between 20%-50%. Other common shrubs may include *Ilex vomitoria*, *Magnolia virginiana*, *Quercus myrtifolia*, *Quercus geminata*, and *Serenoa repens*. *Pinus*

elliottii may be present in the tall shrub or canopy strata, but its cover does not exceed 5%. Herbaceous stratum is typically dense with cover between 50% and 70%. Graminoids tend to dominate the herbaceous layer with common species such as *Fuirena scirpoidea*, *Panicum repens*, *Rhynchospora fascicularis*, *Spartina patens*, *Juncus roemerianus*, and *Panicum virgatum*.

Dynamics: N/A

Conservation Status Rank
Global: G3G4

State: N/A

Global Environmental Description
This association occurs on maritime barrier islands and spits, usually on more protected backdunes, barrier flats, islands within salt marshes, and interdunal swales. It is not tidally flooded and occurs beyond the reach of most storm tides, but it is impacted by salt spray. The substrate may be sand or loamy sand, sometimes with a thin layer of organic matter. The water table is often less than half a meter below the surface, and may be dry at the end of the growing season.

Global Vegetation Description
This vegetation is characterized by a moderately open to densely closed canopy of *Morella cerifera* (= *Myrica cerifera*). Other canopy associates include *Baccharis halimifolia*, *Morella pensylvanica* (from northern North Carolina northward), *Juniperus virginiana* var. *silicicola* (from North Carolina and possibly southern Virginia southward), *Sabal palmetto*, and *Rhus copallinum*. The herbaceous layer is characterized by *Spartina patens*. Other ground flora associates include *Toxicodendron radicans, Eupatorium capillifolium, Eupatorium hyssopifolium* var. *hyssopifolium, Panicum virgatum, Andropogon virginicus, Juncus dichotomus, Solidago sempervirens*, *Smilax* spp., *Parthenocissus quinquefolia*, *Vitis* spp., and *Schoenoplectus pungens* (= *Scirpus pungens*). Small openings may have wetland graminoids, such as *Juncus roemerianus*, *Spartina patens*, *Fimbristylis castanea*, *Andropogon glomeratus* var. *pumilus*, *Muhlenbergia filipes,* etc., and forbs, such as *Hydrocotyle bonariensis*, *Sabatia stellaris*, *Polygonum hydropiperoides, Phyla nodiflora*, *Eleocharis* spp., etc. In other cases, few herbs are present because of the dense, thicket-like shrub layer.

Florida Natural Areas Inventory
Coastal Interdunal Swale

Example Photograph
Figure A39 below shows an example of CEGL003839 *Morella cerifera* / *Spartina patens* Shrubland.



Figure A39. *Morella cerifera* / *Spartina patens* Wet Shrubland (CSU).

CEGL003844 Cyrilla racemiflora - Lyonia lucida Wet Shrubland

Table A37 below shows the USNVC Hierarchy for CEGL003844 *Cyrilla racemiflora – Lyonia lucida* Wet Shrubland.

Table A37. USNVC hierarchy for CEGL003844 *Cyrilla racemiflora – Lyonia lucida* Wet Shrubland.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.C Shrub & Herb Wetland
Formation	2.C.2 Temperate to Polar Bog & Fen
Division	2.C.2.Nb Atlantic & Gulf Coastal Plain Pocosin
Macrogroup	2.C.2.Nb Southeastern Coastal Bog & Fen
Group	2.C.2.Nb Southeastern Coastal Pocosin & Shrub Bog
Alliance	A0802 *Cyrilla racemiflora - Ilex coriacea* Wet Shrubland Alliance
Association	2.C.2.Nb *Cyrilla racemiflora - Lyonia lucida* Wet Shrubland (CEGL003844)

Field Plots: 1094

Map Class: GUIS MC204

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 36 ft (range 36 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Upland Swales (1)

Soil Texture: Loamy Sand (1)

Environment: One plot was sampled within this community. This occurred within an upland swale and was permanently flooded.

Local Vegetation Description
Structure: Tall Shrub (80%), Herbaceous (10%)

Vegetation Floristics: The community is dominated by a dense shrub layer mainly composed of *Cyrilla racemiflora* or *Morella cerifera* with short shrub layer of *Lyonia lucida* usually surrounding the area. An herbaceous layer of *Woodwardia virginica* is typically present as well.

Dynamics: N/A

Conservation Status Rank
Global: G3

State: N/A

Global Environmental Description
N/A

Global Vegetation Description
Cyrilla racemiflora and *Lyonia lucida* usually dominate this marginal zone of coastal plain ponds. An example at Fort Gordon, Georgia, contains the shrubs *Lyonia lucida*, *Morella cerifera* (= *Myrica cerifera*), and *Viburnum nudum* var. *nudum*, along with the herbs and low shrubs *Dulichium arundinaceum*, *Eupatorium* sp., *Hypericum* sp., *Triadenum* sp., *Ludwigia* sp., *Xyris* sp., and *Scirpus cyperinus*.

Florida Natural Areas Inventory
Wet Flatwoods

Example Photograph

Figure A40 below shows an example of CEGL003844 *Cyrilla racemiflora – Lyonia lucida* Wet Shrubland.



Figure A40. *Cyrilla racemiflora-Lyonia lucida* Wet Shrubland (CSU).

CEGL003864 Ceratiola ericoides - (Chrysoma pauciflosculosa) / Polygonella polygama / Cladonia leporina Shrubland

Table A38 below shows the USNVC Hierarchy for CEGL003864 *Ceratiola ericoides* – (*Chrysoma pauciflosculosa*) / *Polygonella polygama* / *Cladonia leporina* Shrubland.

Table A38. USNVC hierarchy for CEGL003864 *Ceratiola ericoides* – (*Chrysoma pauciflosculosa*) / *Polygonella polygama* / *Cladonia leporina* Shrubland.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.B Temperate & Boreal Grassland & Shrubland
Formation	2.B.2 Temperate Grassland & Shrubland
Division	2.B.2.Ne Southeastern North American Grassland & Shrubland

Table A38 (continued). USNVC hierarchy for CEGL003864 *Ceratiola ericoides* – (*Chrysoma pauciflosculosa*) / *Polygonella polygama* / *Cladonia leporina* Shrubland.

Category	Description
Macrogroup	2.B.2.Ne Florida Peninsula Scrub & Herb
Group	2.B.2.Ne Florida Xeric Scrub
Alliance	A0817 *Ceratiola ericoides - Chrysoma pauciflosculosa* Scrub Alliance
Association	2.B.2.Ne *Ceratiola ericoides* - (*Chrysoma pauciflosculosa*) / *Polygonella polygama / Cladonia leporina* Shrubland (CEGL003864)

Field Plots: 1025

Map Class: GUIS MC205

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 0 ft (range 0 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Upland Swales (1)

Soil Texture: Sand (1)

Environment: One plot was sampled within this community. This occurred along a ridge in a hummocky upland area. Bare soil dominates the ground cover with ~96% cover.

Local Vegetation Description
Structure: Dwarf Shrub (10%), Herbaceous (10%)

Vegetation Floristics: This is a dwarf shrubland occurring on old stabilized dunes of *Ceratiola ericoides*, *Chrysoma pauciflosculosa*, *Hypericum tenuifolium*, and *Polygonella polygama*. Short *Pinus elliottii* tend to occur in low abundance (~1%) along the edge of this community or sparsely within. If present, the herbaceous stratum is sparse with common species including *Schizachyrium maritimum, Polygonella macrophylla*, and *Lachnanthes caroliniana*.

Dynamics: Dune vegetation of the western panhandle of Florida transitions from herbaceous-dominated communities (after approximately 20-30 years) to *Chrysoma pauciflosculosa*-dominated stands, and eventually to this *Ceratiola ericoides*-dominated community in later stages. It is a relatively late-successional vegetation community of coastal dunes which have not been disturbed by sand burial for approximately 50-100 years (Johnson 1997).

Conservation Status Rank
Global: G2

State (Florida): S2

Global Environmental Description
N/A

Global Vegetation Description
Stands of this association are typically dominated by *Ceratiola ericoides*, and usually contain substantial *Chrysoma pauciflosculosa* and little or no *Serenoa repens*. Other characteristic species include *Conradina canescens*, *Quercus geminata*, *Quercus myrtifolia*, *Cladina evansii*, *Pinus elliottii* var. *elliottii*, *Smilax auriculata*, *Cladonia prostrata*, *Helianthemum arenicola* (Florida Panhandle only), *Lechea sessiliflora*, and *Paronychia erecta* (Florida Panhandle only). Other species present may include *Triplasis purpurea*, *Seymeria cassioides*, *Polygonella gracilis*, *Paronychia erecta*, *Ipomoea imperati*, and *Aristida* sp. Some stands of this association may have a scattered canopy of *Pinus elliottii* var. *elliottii*.

Florida Natural Areas Inventory
Scrub

Example Photograph
Figure A41 below shows an example of CEGL003864 *Ceratiola ericoides* – (*Chrysoma pauciflosculosa*) / *Polygonella polygama* / *Cladonia leporina* Shrubland.



Figure A41. *Ceratiola ericoides* - (*Chrysoma pauciflosculosa*) / *Polygonella polygama* / *Cladonia leporina* Shrubland (CSU).

Short Citation: Johnson, 1997.

CEGL003947 Chrysoma pauciflosculosa - Paronychia erecta Dwarf-Shrubland

Table A39 below shows the USNVC Hierarchy for CEGL003947 *Chrysoma pauciflosculosa – Paronychia erecta* Dwarf-Shrubland.

Table A39. USNVC hierarchy for CEGL003947 *Chrysoma pauciflosculosa – Paronychia erecta* Dwarf-Shrubland.

Category	Description
Class	2 Shrub & Herb Vegetation
Subclass	2.B Temperate & Boreal Grassland & Shrubland
Formation	2.B.4 Temperate to Polar Scrub & Herb Coastal Vegetation
Division	2.B.4.Na Eastern North American Coastal Scrub & Herb Vegetation
Macrogroup	2.B.4.Na Eastern North American Coastal Dune & Grassland
Group	2.B.4.Na South Atlantic & Gulf Coastal Dune & Grassland

Table A39 (continued). USNVC hierarchy for CEGL003947 *Chrysoma pauciflosculosa – Paronychia erecta* Dwarf-Shrubland.

Category	Description
Alliance	A1061 *Chrysoma pauciflosculosa - Schizachyrium* maritimum Dune Scrub Alliance
Association	2.B.4.Na *Chrysoma pauciflosculosa - Paronychia erecta* Dwarf-shrubland (CEGL003947)

Field Plots: 1073, 1020, 2047

Map Class: GUIS MC205

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 11.67 ft (range 0 ft to 21 ft)

Aspect: Mean 280˚ (range 200˚ to 320˚)

Slope: Mean 7.67˚ (range 3˚ to 10˚)

Macro Topography: Dune Field Complex (1), Primary Dune Backslope (1), Relic Dune (1)

Soil Texture: Sand (3)

Environment: Three plots were sampled within this community. These generally occurred on relic dunes, dune field complex, or primary dune backslope. Bare soil dominated with cover >90%.

Local Vegetation Description
Structure: Canopy (0%-10%), Short Shrub (0%-40%), Dwarf Shrub (0%-20%), Herbaceous (0%-40%)

Vegetation Floristics: This community is dominated by *Chrysoma pauciflosculosa* with cover between 10% and 40%. *Ceratiola ericoides* is often present as well but at lower abundances. Herbaceous layer is often sparse with cover typically <40%. Common herbaceous species include *Diodella teres, Paronychia erecta, Uniola paniculata,* and *Schizachyrium maritimum*. *Cladonia leporina* is often present as well with cover <30%.

Dynamics: N/A

Conservation Status Rank
Global: G1/G2

State (Florida): S2

Global Environmental Description

According to Johnson (1997) this community occupies dune ridges which have been protected from sand burial for 18-23 years. More chronically or recently disturbed dunes support communities dominated by some combination of *Uniola paniculata*, *Panicum amarum* var. *amarulum*, and *Schizachyrium maritimum*, while later successional dunes are dominated by *Ceratiola ericoides*.

Global Vegetation Description

Plant species found in this community include low amounts of *Uniola paniculata* and *Schizachyrium maritimum*, as well as *Smilax auriculata*, *Paronychia erecta*, and *Polygonella polygama* (Johnson 1997).

Florida Natural Areas Inventory

Beach Dune

Example Photograph

Figure A42 below shows an example of CEGL003947 *Chrysoma pauciflosculosa – Paronychia erecta* Dwarf-Shrubland.



Figure A42. *Chrysoma pauciflosculosa - Paronychia erecta* Dwarf-Shrubland (CSU).

Short Citation: Johnson, 1997.

Mapped Sparse Types

NPSGUIS003 Beach Bare Sand

USNVC: Park Special NPSGUIS003

Field Plots: Field Reconnaissance Observations

Map Class: GUIS MC401

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 2.5 ft (range 0 ft to 5 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Shoreline Beach

Soil Texture: Sand

Environment: Ground cover is typically ~95-100% bare sand. Shells, beach debris, and litter occasionally compose <5% of the ground cover.

Local Vegetation Description
Structure: N/A

Vegetation Floristics: Community typically lacks vegetation; however, some sparse beach vegetation may persist such as *Uniola paniculata*, *Schizachyrium maritimum*, *Panicum amarum*, *Cakile constricta*, and *Iva imbricata*. Their combined cover does not reach >10% and typically only amounts to ~1%.

Dynamics: N/A

Conservation Status Rank
Global: N/A

State: N/A

Global Environmental Description
N/A

Global Vegetation Description
N/A

Florida Natural Areas Inventory
N/A

Example Photograph
Figure A43 below shows an example of NPSGUIS003 Beach Bare Sand.



Figure A43. Beach Bare Sand (CSU).

NPSGUIS004 Hurricane Disturbed Area
USNVC: Park Special NPSGUIS004

Field Plots: 4001, 4002, 4003, 4004, 4005, 4006, 4007, 4008, 4009, 4010

Map Class: GUIS MC402

Local Environmental Description
Plot/Sample Data Environmental Summary

Elevation: Mean 11.6 ft (range 0 ft to 51 ft)

Aspect: Mean 0˚ (range 0˚)

Slope: Mean 0˚ (range 0˚)

Macro Topography: Shoreline Beach (10)

Soil Texture: Sand (10)

Environment: Ten plots were surveyed within this community. A thick wash of sand occurring on many ocean-side shoreline beaches were indicative of hurricane disturbance. Hurricane Nate deposited ~12" of sand over previous interdunal swales and buried nearby vegetation. Often ~5% of ground cover is composed of crushed shells.

Local Vegetation Description
Structure: N/A

Vegetation Floristics: Vegetation is typically sparse with total cover <10%. Most of the vegetation, if present, is buried in the sand. The most common species include *Fimbristylis castanea*, *Schizachyrium maritimum*, *Panicum amarum*, and *Uniola paniculata*.

Dynamics: N/A

Conservation Status Rank
Global: N/A
State: N/A

Global Environmental Description
N/A

Global Vegetation Description
N/A

Florida Natural Areas Inventory
N/A

Example Photograph
Figure A44 below shows an example of NPSGUIS004 Hurricane Disturbed Area.



Figure A44. Hurricane Disturbed Area (CSU).

Appendix B: Field Key to Community Associations/Types

Introduction

The vegetation classification and key of Gulf Islands National Seashore (GUIS) has been developed as part of the Vegetation Classification and Mapping project. The Gulf Coast Inventory and Monitoring Network managed this project under the guidance of the National Park Service's National Vegetation Inventory Program. The field key is one of the products produced as part of the classification phase of the project. It has been developed by using the compiled field data, which was analyzed to identify the vegetation types that occur within GUIS. The vegetation types identified during analysis have been classified according to the National Vegetation Classification (NVC) hierarchy (USNVC 2016).

This key has been written to assist users in identifying the major physiognomic units and the vegetation alliances within GUIS. The key also lists each alliance's respective vegetation associations that were sampled within the park. The alliances and associations are based on one or more dominant and/or diagnostic species and on environmental settings. The key is used to distinguish formal mapping units and to conduct the accuracy assessment of the vegetation maps for the park. This key can also be used to identify various vegetation communities for other projects within the park. The key is based on classification of new data collected by the Colorado Natural Heritage Program vegetation mapping field crew in 2016 and additional surveys in 2017.

The key may not denote all vegetation types that occur within the park, nor explain the full range of variation of vegetation types as they appear on the ground. Species interact in a continuum based on a complex set of habitat preferences, and they can intermix in wide or narrow zones within the landscape. While this key attempts to reflect this complexity, unusual or site specific assemblages of plants may exist in the landscape and may not be easily keyed.

The following paragraphs define the conventions for how those terms and concepts are used in the key. Be sure to consider these usage conventions as you work through the keys. If you are having trouble reaching a satisfactory conclusion, your interpretation of a term or concept may be different and leading you down the wrong path. If you feel you are not getting a satisfactory outcome, critically evaluate the specific terms used in each couplet and consider your interpretation of them and how that may be impacting your results. Remember, by design, vegetation classification is an attempt to place lines around things which in reality are not bounded by hard lines. As such, one must often accept "the preponderance of the evidence" in lieu of a "perfect fit".

Before using this key several terms and concepts need to be clearly defined:

Shrubs tend to be multi-stemmed plants less than 5 meters tall. Trees are generally single-stemmed and are greater than 5 meters tall. Some canopy trees such as *Quercus geminata* may straddle the line between tree and shrub; these plants can occupy both layers, and the decision between shrub and subcanopy should be based on average height of the species in the area.

Forest canopies typically have greater than 60% cover; woodland canopies have cover values between 60% and 25%. However, cover values tend to be variable and are not necessarily hard cutoffs. Forests may have cover ~55% if you happen to catch a gap in the canopy, and woodlands may have cover values of ~15% if the trees are exceptionally sparse. When deciding on whether or not an area is a forest or woodland, consider the surrounding area and whether or not the cover of the plot where you are is representative of the entire area.

Due to the dynamic nature of coastal systems, dune complexes and tidal marshes may drastically change from year to year. After storm events, herbaceous vegetation may be scoured away leaving only bare sand. At other times, previously sparse vegetation may become heavily vegetated. In other areas, sandbars may appear or disappear from year to year. Keep that dynamic characteristic in mind as you interpret an area and compare that interpretation with the couplets of the key.

Species abbreviations use the USDA PLANTS Database syntax in which each Latin binomial and trinomial is assigned a unique symbol. For a binomial, the symbol consists of the uppercase first two letters of the genus, plus the uppercase first two letters of the specific epithet. For example the symbol for *Uniola paniculata* is UNPA, and the symbol for *Iva imbricata* is IVIM. Different plants with the same 4-letter symbol are differentiated by adding a number as a tie-breaking suffix. For example the symbol for *Quercus geminata* is not QUGE, but QUGE2. Likewise, *Heterotheca subaxillaris* is not HESU, but HESU3. The symbol for a trinomial consists of the first two letters of the genus, plus the first two letters of the specific epithet, plus the first letter of the sub-specific or varietal epithet. For example the symbol for *Elymus elymoides* ssp. *elymoides* is ELELE. Tie-breaking numbers are used here for differentiating duplicative letter combinations.

USNVC community types have a 10-digit CEGL code (CEGL000658). Communities present at GUIS without an appropriate USNVC type are labeled as “Park Specials” and are recognized under a 10-digit code beginning with “NPSGUIS” followed by a sequential number (NPSGUIS001).

The syntax of the USNVC names use the symbols “/”, “-”, and “( )” to indicate the structure and composition of the community. The “/” symbol separating two species names indicates the species are in different strata. The species listed on the left of the “/” is in the stratum above the stratum containing the species on the right of the “/”. The “-” symbol separating two species names indicates the species separated by the dash are essentially codominant within the same stratum. Species names within parentheses [e.g. “( )”] indicate that species may or may not be present in the community.

Determining the correct vegetation associations and map units requires an awareness of the scale at which those are being defined. The scale, or minimum mapping unit (MMU), used in this project is 0.5 hectares (ha).

The area of the map includes everything within the park’s administrative boundary except Fort Barrancas. That means there are map classes for all of the vegetated areas, the non-vegetated areas such as open water and sand bars, as well as areas of land-use such as agricultural fields, roads, and developed vegetation such as maintained lawns. Each of these types is described in the following key and defined in the map class descriptions document.

The floristic structure of vegetation associations are broken down into 5 strata: Emergent, Canopy, Subcanopy, Shrub, and Herbaceous (Figure B1).

- Emergent. Emergent stratum is characterized by tall trees that are distinctly above a canopy. The most common tree to occur in this stratum is *Pinus palustris*. For there to be an emergent stratum, there must first be a canopy stratum.
- Canopy. A canopy is the main layer of trees formed by mature crowns. A canopy must be present in order for either an Emergent or Subcanopy layer to be present.
- Subcanopy. The subcanopy is a distinct layer of trees occurring beneath the canopy. There must be a canopy in order for there to be a subcanopy. Common subcanopy trees include *Magnolia virginiana* and *Acer rubrum*.
- Shrub. The shrub layer is often underneath the canopy/subcanopy, but it may occur without either. The shrub canopy is composed of shrubs between 0.5 m and 5 m in height. Common shrubs include *Morella cerifera, Ilex vomitoria,* and *Ceratiola ericoides*.
- Herbaceous. The herbaceous layer is composed of graminoids, forbs, ferns, and seedlings. At GUIS, graminoids and forbs are the most commn plants in the herbaceous layer.

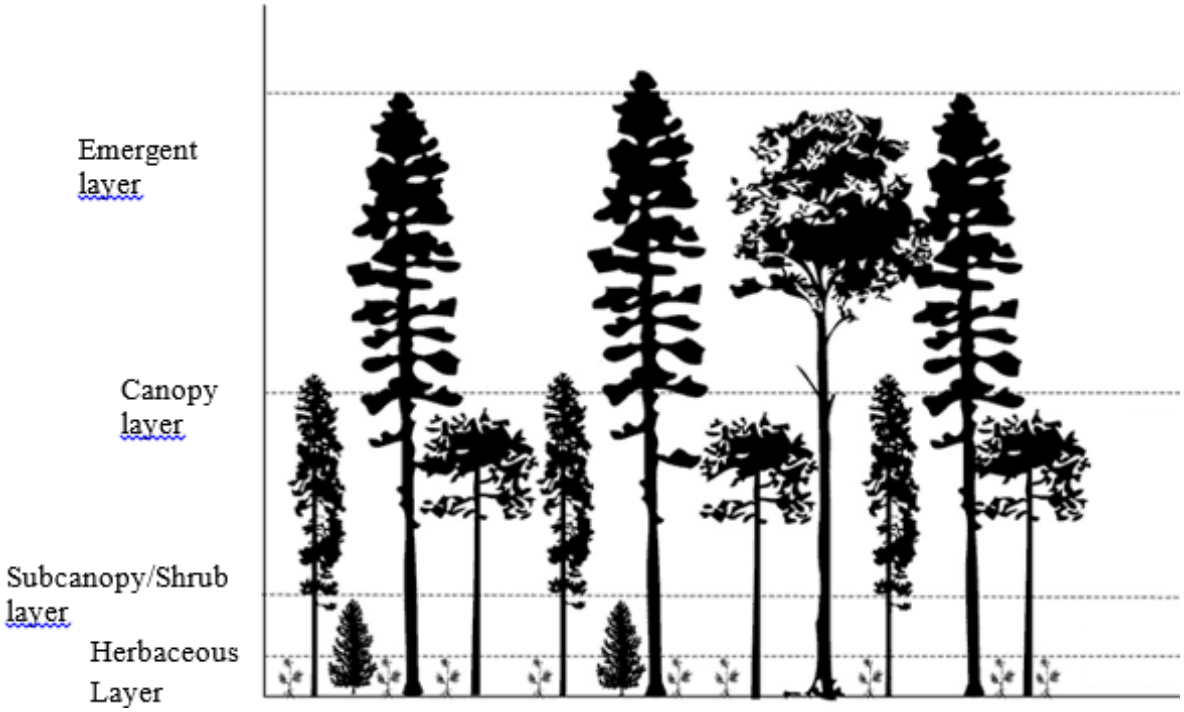


Figure B-1. The floristic structure of the associations used. Adapted from Warren and Lemmen 2014.

Land Use Classes

Adapted from USGS (2011) and Anderson et al. (2001).

The following land use classes are areas that are not included in the list of natural and semi-natural vegetation types. They are any area where the human use of the land dominates and dictates the

vegetation present, if any. These areas tend to be heavily developed such as agricultural croplands and pastures, and urban/commercial development such as roads, parking lots, houses, parks, etc. Additionally, open water is one of the land use classes.

Key to Land Use Classes

1a Area has been developed in some way; usually there are roads, campgrounds, or mowed areas .....(2a)

Area has low amounts of vegetation and does not look developed .....(3a)

2a Areas with a mixture of some constructed materials, but mostly vegetation in the form of turf grass. Impervious surfaces typically account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, campgrounds, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes ..... **LC002 Developed, Open Space**

2b All other developed areas. These areas typically include 20% to 100% impervious surfaces. These areas most commonly include urban/commercial development, roads, parking lots, etc. Areas such as the mowed margins of roadways are classified as developed, despite the presence of natural or semi-natural vegetation..... **LC003 Developed, Low- High Intensity**

3a Developed areas with typically 20% to 100% impervious surfaces. These areas most commonly include urban/commercial development, roads, parking lots, etc. Areas such as the mowed margins of roadways are classified as developed, despite the presence of natural or semi-natural vegetation..... **LC003 Developed, Low- High Intensity**

3b Not as above. Barren ground or open water .....(4a)

4a Areas of bare ground, strip mines, gravel pits, borrow pits, road cut banks and other areas that accumulate bare earthen material. Generally, vegetation accounts for <20% of total cover ..... **LC001 Non-vegetated/Barren Land, Borrow Pit, Cut Bank**

4b Areas of open water, generally with <25% cover of vegetation or exposed soil. These are usually areas of deep water such as inundated bays, lakes, or streams within a salt marsh. If natural vegetation is present such as *Nymphaea odorata*, *Spartina alterniflora*, *Spartina patens*, *Juncus roemerianus*, *Cladium mariscus*, *Typha domingensis*, or *Nyssa* spp. with cover >25%, the community should be run through the appropriate Forest/Woodland or Herbaceous key ..... **LC004 Open Water**

Key to Plant Associations

The following physiognomic classes separate the vegetation into groupings based on the growth habit and vegetation structure. The associations within each of these groupings are based on species and communities with similar diagnostic characteristics. However, because the definition and interpretation of those characteristics is highly variable, it is important to keep an open mind and remain flexible in how one interprets the terms and concepts used in the key. For example, if you are in an area that contains a patchy and variable cover of short shrubs set into a matrix of mixed grass, you may be inclined to call it a shrub association and work through the key from that perspective. Depending on the cover values, you may decide that it is a grassland with a low cover of shrubs and

attempt to key the types through the grasslands section. Either approach may be correct. We have tried to build flexibility into the key that will allow one to reach the same conclusion regardless of the starting point. However, if you start to key an area from one key Division but are failing to reach what feels like a suitable conclusion, try to start from an alternative Division.

Physiognomic Classes

Deciduous and/or coniferous tree species, or a combination of the two, form an open too dense canopy with cover generally >25% ..... **Division A – Tree associations**

Shrubs form the dominant stratum with cover typically >10%. If present, trees will generally have <10% cover. An herbaceous stratum is usually present and may have great abundance ....**Division B – Shrub associations**

Herbaceous plants dominate the site. Any woody species such as shrubs and trees typically have <10% cover. Total vegetation cover is typically >10%..... **Division C – Herbaceous associations**

Total vegetation cover on the site is <10% and the surface of the substrate is easily visible. Typically, located in dynamic settings where disturbance occurs regularly (e.g. sandbars) or where substrates are not favorable for plant growth (e.g. solid rock) ..... **Division D – Sparse associations**

Division A – Tree associations

Tree associations include types considered forests as well as woodlands. Woodlands have a tree canopy containing approximately 20-60% cover. For the most part, woodlands have an open canopy that allows a clear view of the sky throughout most of the area, although the crowns of trees in a woodland may occasionally touch or overlap.

Forests have a tree canopy containing approximately 60-100% cover. The crowns of trees in a forest are almost always touching and often overlap; for the most part they form a closed canopy that precludes a clear view of the sky in most areas.

While most forest and woodland types will have trees of different species occupying the different strata, the uppermost stratum with at least 10% cover is diagnostic of the community type. Likewise, different-aged individuals of the same species may be present in each stratum in the community. However, the dominant species of the uppermost stratum is always diagnostic of the overall community type, while dominant species in any substrata are diagnostic of the specific association within the overall type.

Trees and shrubs are classified by species. However, when using this key, height is usually considered more important when placing a species in a canopy layer. Woody species will fall into one of the shrub strata if they are <5 m tall; if a species is >5 m tall, it will be included in a canopy stratum. Some subcanopy trees such as *Juniperus virginiana* may straddle the line between tree and shrub; these plants can occupy both layers, and the decision between shrub and subcanopy will need to be finessed to get to the correct association.

1a The canopy is dominated by *Pinus* spp. such as *Pinus elliottii*, *Pinus palustris*, *Pinus taeda*, *Pinus clausa*, and/or *Pinus echinata*. Hardwoods may be present to codominant with the pines .....(2a)

1b The canopy is dominated by hardwood trees, pines may be present as a minor component of the forest or woodland.....(12a)

2a *Pinus clausa* and/or *Pinus echinata* occurs within the canopy with cover between 10% and 70%. Shrubby oaks such as *Quercus geminata*, *Quercus laevis*, and *Quercus myrtifolia* usually form a sparse to dense subcanopy or shrub layer with covers usually >20%. Other shrubs that may be present include *Ilex vomitoria*, *Serenoa repens*, *Ceratiola ericoides*, *Licania michauxii*, and *Conradina canescens*; short shrub and/or dwarf shrub cover typically does not exceed 50%. Herbaceous layer is typically sparse with *Dichanthelium* spp., *Smilax* spp., *Euphorbia floridana*, *Rhynchospora baldwinii*, and other herbaceous species. Lichens can include *Cladina evansii* and *Cladonia leporina*.....**CEGL003554 *Pinus clausa/Quercus geminata-Quercus myrtifolia-Conradina canescens* Woodland**

2b Not as above. *Pinus elliottii*, *Pinus taeda*, and/or *Pinus palustris* dominate the canopy. If *Pinus clausa* is present, it may be sparse to codominant with other pines in the area.....(3a)

3a This community is dominated by a sparse to dense canopy of *Quercus virginiana*, *Quercus geminata*, and/or *Quercus laurifolia*. Their combined cover values can reach up to 80%. Other species that may occur in the canopy include *Quercus nigra*, *Magnolia grandiflora*, and *Carya glabra*. *Pinus elliottii* and/or *Pinus palustris* often occur scattered throughout this community. *Sabal palmetto* may occur as either a shrub or tree. There is often a modest shrub layer with cover values <30%. Common species include *Quercus myrtifolia*, *Ilex vomitoria*, and *Serenoa repens*. A sparse herbaceous layer may be present and includes *Mitchella repens*, *Smilax pumila*, and *Callicarpa americana*. This is distinct from CEGL007028 due to the presence of *Pinus elliottii*.....**CEGL007032 *Quercus virginiana*-(*Pinus elliottii*, *Sabal palmetto*)/*Persea borbonia-Callicarpa americana* Forest**

3b Not as above. *Quercus virginiana* and/or *Quercus geminata* do not dominate the canopy with cover greater than pines .....(4a)

4a *Pinus palustris* is present within the general area. *Pinus elliottii* is usually in the area, and *Pinus taeda* and/or *Pinus clausa* may be present.....(5a)

4b *Pinus elliottii* and/or *Pinus taeda* are dominant without *Pinus palustris* present .....(8a)

5a *Pinus elliottii* and/or *Pinus palustris* dominate the canopy with cover between 10% and 60%. *Pinus taeda* and/or *Pinus clausa* may also be present. The understory is dominated by drier shrubs with cover between 50% and 70%. The most abundant shrubs include *Serenoa repens*, *Quercus geminata*, *Ilex glabra*, *Conradina canescens*, and *Licania michauxii*. The herbaceous layer is dominated by graminoids with cover between 20% and 50%. Common graminoids include *Panicum* sp., *Andropogon glomeratus*, *Schizachyrium littorale*, *Aristida* spp., and *Rhynchospora* sp **CEGL004658**

***Pinus elliottii* var. *elliottii-(Pinus palustris)/Ilex vomitoria-Serenoa repens-Morella cerifera* Woodland**

5b Not as above. Mesic trees and shrubs occur in the community including species such as *Magnolia virginiana*, *Acer rubrum*, *Nyssa aquatica*, *Quercus nigra*, *Cyrilla racemiflora, Symplocos tinctoria, Persea borbonia, Lyonia lucida, Ilex glabra,* and/or *Ilex coriacea* .....(6a)

6a The canopy is dominated by a mix of *Pinus palustris*, *Pinus elliottii* and/or *Pinus taeda* with cover ranging from 30% to 60%. Other canopy trees may include the more mesic species *Nyssa aquatica*, *Magnolia virginiana*, *Acer rubrum*, and *Quercus nigra*. There is often a moderately dense shrub layer with *Ilex coriacea* and *Cyrilla racemiflora* as the most common shrubs. Other less abundant shrubs include *Symplocos tinctoria*, *Persea borbonia*, *Ilex vomitoria*, and *Vaccinium corymbosum* .....**CEGL003656 *Pinus palustris-(Pinus elliottii* var. *elliottii)/Ilex coriacea-Cyrilla racemiflora* Woodland**

6b Not as above. Hardwood species do not occur in the canopy. Canopy is usually open and dominated only by pines .....(7a)

7a This community usually occurs in wet swales of a larger *Pinus palustris* woodland. *Pinus elliottii* dominates the canopy of this community with a fairly sparse cover of ~25%. *Ilex glabra* usually occurs in the short or dwarf shrub layer with moderate cover of ~30%. Herbaceous cover can be quite dense with cover values generally around 60%. Graminoids dominate and usually include *Calamovilfa curtissii*, *Schizachyrium scoparium*, and *Eleocharis* sp. Common forbs include *Fuirena scirpoidea*, *Xyris ambigua*, and *Lachnanthes caroliniana* .. **CEGL003673 *Pinus elliottii* var. *elliottii*-(*Pinus serotina*)/*Aristida beyrichiana-Rhynchospora oligantha-Sarracenia* spp. Woodland**

7b *Pinus elliottii* dominates the canopy with cover ranging from ~10% to 30%. There is often a moderate shrub layer with cover values of ~40%. The most common shrubs include *Cyrilla racemiflora*, *Ilex glabra*, and *Ilex coriacea* with some *Lyonia lucida* on the edges of the community. Herbaceous layer is often dominated by graminoids with cover generally ~80%. Typical graminoids include *Fuirena scirpoidea* and *Rhynchospora fascicularis.* This community is different from CEGL003656 due to the lack of mesic hardwoods within the canopy .....**CEGL003638 *Pinus elliottii* var. *elliottii/Cliftonia monophylla-Cyrilla racemiflora* Swamp Woodland**

8a The understory of the pine stands contains a moderate to dense layer of shrubs such as *Ilex vomitoria, Morella cerifera, Ceratiola ericoides, Quercus geminata,* and/or *Quercus myrtifolia* .....(9a)

8b Not as above. Shrub layer is either absent or dominated by mesic species such as *Baccharis halimifolia, Ilex glabra*, *Cyrilla racemiflora*, or *Persea borbonia* .....(10a)

9a Usually occurring on barriers, *Pinus elliottii* dominates the canopy with cover ranging from 10% to ~60%. Usually, there is a moderate to dense shrub layer with cover typically >40%. The most common shrubs include *Ilex vomitoria*, *Morella cerifera*, *Quercus geminata*, and *Serenoa repens*; other shrubs may include *Vaccinium stamineum* and *Baccharis halimifolia*.

The herbaceous layer is typically sparse with some graminoids such as *Schizachyrium littorale*, and there tends to be a variety of vines including *Smilax auriculata*, *Toxicodendron radicans*, *Ipomoea sagittata*, and *Rubus trivialis*. This type is less mesic than CEGL003656 above **CEGL004680**
***Pinus elliottii* var. *elliottii/Serenoa repens-Ilex glabra-Morella cerifera-Ilex vomitoria* Woodland**

9b A short tree canopy or tall shrub layer is composed of *Pinus elliottii, Quercus geminata,* and *Quercus myrtifolia* within this community. *Pinus clausa* may occur in this community as well. All of these species border the tree and shrub height category and usually reach heights of 6 m (20 ft). Dwarf shrubs occur here as well including *Ceratiola ericoides*, *Conradina canescens*, *Hypericum tenuifolium*, and *Polygonella polygama* **NPSGUIS005**
***Pinus elliottii-Quercus myrtifolia-Quercus geminata* Scrub Woodland**

10a This community usually occurs in wet swales of a larger *Pinus palustris* woodland. *Pinus elliottii* dominates the canopy of this community with a fairly sparse cover of ~25%. *Ilex glabra* usually occurs on the edges of this community in the short or dwarf shrub layer with moderate cover of ~30%. Herbaceous cover can be quite dense with cover values generally around 60%. Graminoids dominate and usually include *Calamovilfa curtissii*, *Schizachyrium scoparium*, *Fuirena scirpoidea*, and *Eleocharis* sp. Common forbs include *Lachnanthes caroliniana* and *Xyris ambigua* **CEGL003673**
***Pinus elliottii* var. *elliottii*-(*Pinus serotina*)/*Aristida beyrichiana*-*Rhynchospora oligantha*-*Sarracenia* spp. Woodland**

10b Not as above. Area contains *Cyrilla racemiflora* or *Baccharis halimifolia*.....(11a)

11a *Pinus elliottii* and/or *Pinus taeda* dominates with cover ranging from 30% to 60% occasionally with *Pinus palustris* present. Other trees present in the canopy or subcanopy may include *Nyssa aquatica*, *Magnolia virginiana*, *Acer rubrum*, and *Quercus nigra*. There is often a moderately dense shrub layer with *Ilex coriacea* and *Cyrilla racemiflora* as the most common shrubs. Other less abundant shrubs include *Symplocos tinctoria*, *Persea borbonia*, *Ilex vomitoria*, and *Vaccinium corymbosum*.....**CEGL003656**
***Pinus palustris*-(*Pinus elliottii* var. *elliottii)/Ilex coriacea-Cyrilla racemiflora* Woodland**

11b *Pinus elliottii* dominates the canopy with cover ranging from 10% to 50%. There is often a sparse to moderate shrub layer with cover values between 10% and 40%. Common shrubs include *Cyrilla racemiflora*, *Baccharis halimifolia*, *Ilex vomitoria*, and *Morella cerifera*. Herbaceous layer is often dominated by graminoids with cover generally ~60%. Typical graminoids include *Spartina patens*, *Juncus roemerianus*, *Cladium mariscus*, and *Rhynchospora fascicularis.* On the Florida panhandle herbaceous strata may differ slightly and include *Xyris jupicai*, *Fuirena scirpoidea*, and *Schizachyrium littorale*.....**CEGL004958**
***Pinus elliottii* var. *elliottii/Spartina patens-Juncus roemerianus-(Panicum virgatum)* Tidal Woodland**

12a Canopy is dominated by mesic trees such as *Nyssa aquatica*, *Nyssa biflora*, *Quercus nigra*, and/or *Magnolia virginiana*. *Pinus* spp. may occur as a minor component of the canopy or subcanopy.....(13a)

12b Canopy is dominated by other species such as *Quercus virginiana*, *Quercus geminata*, *Quercus alba*, *Carya* sp., *Fagus grandifolia*, and/or *Magnolia grandiflora*. *Pinus* spp. may occur as a minor component of the canopy or subcanopy. *Quercus nigra* can occur here in upland areas as well.....(17a)

13a Canopy is typically dominated by *Quercus nigra*.....(14a)

13b Canopy typically contains *Nyssa aquatica* or *Nyssa biflora*.....(15a)

14a The canopy is usually dominated by *Quercus nigra* with cover ranging between 30% and 70%. Other trees occur in the canopy and subcanopy as well, but do not typically reach codominance. Other tree species include *Liquidambar styraciflua*, *Acer rubrum*, *Magnolia grandiflora*, *Pinus spp.*, and *Quercus spp*. A moderate shrub layer is generally present with cover <50%. Common shrubs include *Vaccinium stamineum*, *Ilex vomitoria*, and *Morella cerifera*. The herbaceous layer tends to be sparse with cover usually <20%.....**CEGL004638 *Quercus nigra* Ruderal Forest**

14b The canopy is dominated by a mix of *Quercus nigra* and *Nyssa aquatica* or *Nyssa biflora*. The canopy cover ranges from 20% to 60%. Other common tree species may include *Morella cerifera*, *Ilex vomitoria*, and *Viburnum nudum*. Often there is a vigorous herbaceous stratum that is dominated by ferns. Fern cover may reach up to ~70%; common ferns include *Osmunda cinnamomea* and *Woodwardia areolata*.....**CEGL008477 *Nyssa biflora-Liquidambar styraciflua*/*Magnolia virginiana*/*Hamamelis virginiana-Viburnum nudum* Swamp Forest**

15a This community is dominated by *Nyssa aquatica* with cover ~40%. There may be a sparse shrub layer present composed of *Ilex myrtifolia*, *Itea virginica*, *Magnolia virginiana*, *Morella cerifera*, and *Persea* spp. Herbaceous layer is usually sparse, containing *Eleocharis elongata*, *Dichanthelium sabulorum*, *Juncus acuminatus*, and/or *Xyris fimbriata*.....C**EGL002419 *Nyssa aquatica* Swamp Forest**

15b Other trees such as *Nyssa biflora*, *Magnolia virginiana*, *Liriodendron tulipifera*, *Acer rubrum*, etc., dominate the canopy. *Nyssa aquatica* may be present in some stands as well .....(16a)

16a Canopy is dominated by *Nyssa aquatica, Nyssa biflora,* and/or *Magnolia virginiana* with canopy cover of ~40%. Occasionally, *Pinus clausa* occurs within this community as well. A distinct dense shrub layer separates this community from CEGL008477. The dense shrub layer usually has cover >70%, and common shrubs include *Lyonia lucida*, *Aralia spinosa*, *Morella cerifera*, *Cyrilla racemiflora*, and *Ilex coriacea*.....**CEGL007156 *Nyssa biflora-Magnolia virginiana*-(*Pinus elliottii* var. *elliottii*)/*Morella* (*caroliniensis*, *inodora*) Swamp Forest**

16b The canopy is dominated by a mix of *Nyssa aquatica, Nyssa biflora*, and *Quercus nigra*. The canopy cover ranges from 20% to 60%. Common shrub species may include *Morella cerifera*, *Ilex vomitoria*, and *Viburnum nudum*. Unlike CEGL007156, shrubs are sparse to absent from

this community, and often there is a vigorous herbaceous stratum that is mainly dominated by ferns. Fern cover may reach up to ~70%; common ferns include *Osmunda cinnamomea* and *Woodwardia areolata*.....**CEGL008477 *Nyssa biflora-Liquidambar styraciflua*/*Magnolia virginiana*/*Hamamelis virginiana-Viburnum nudum* Swamp Forest**

17a The canopy is dominated by *Quercus geminata*, *Quercus myrtifolia*, *Quercus laevis*, *Quercus chapmanii*, and or *Quercus virginiana*.....(18a)

17b The canopy is dominated by *Carya* spp., *Quercus alba*, *Quercus nigra*, *Liquidambar styraciflua*, *Fagus grandifolia*, and/or *Magnolia grandiflora*.....(21a)

18a *Pinus clausa* and/or *Pinus echinata* occurs within the canopy with cover between 10% and 70%. Shrubby oaks such as *Quercus geminata*, *Quercus laevis*, and *Quercus myrtifolia* usually form a sparse to dense subcanopy or shrub layer with cover usually >20%. Other shrubs that may be present include *Ilex vomitoria*, *Serenoa repens*, *Ceratiola ericoides*, *Licania michauxii*, and *Conradina canescens*; short shrub and/or dwarf shrub cover typically does not exceed 50%. Herbaceous layer is typically sparse with *Dichanthelium* spp., *Smilax* spp., *Euphorbia floridana*, lichens such as *Cladina evansii* and *Cladonia leporina*, *Rhynchospora baldwinii*, and other herbaceous species .....**CEGL003554 *Pinus clausa*/*Quercus geminata-Quercus myrtifolia-Conradina canescens* Woodland**

18b Not as above. *Pinus clausa* is not present.....(19a)

19a Canopy is dominated by mature *Quercus geminata* with cover of ~30%. Other canopy dominates may include *Carya glabra* and *Magnolia grandiflora*. There is a shrub layer with cover typically ranging between 20% and 50%. Common shrubs include *Magnolia virginiana*, *Morella cerifera*, *Serenoa repens*, *Quercus virginiana*, and *Quercus laurifolia*. Herbaceous layer is sparse with common species including *Rhynchospora baldwinii*, *Smilax pumila*, and *Smilax bona-nox*.....**CEGL007019 *Quercus geminata*/*Serenoa repens-Ilex vomitoria*-(*Sideroxylon lanuginosum*) Forest**

19b Canopy contains a greater abundance of *Quercus virginiana* than *Quercus geminata* with cover generally >20% .....(20a)

20a Canopy is dominated by mature *Quercus virginiana* or *Quercus geminata* with cover >30%. Other dominants may include *Carya glabra* and *Magnolia grandiflora*. Common species may include Vaccinium spp., *Ilex coriacea*, *Ilex vomitoria*, *Serenoa repens*, and *Quercus myrtifolia*. Herbaceous stratum is sparse and may contain *Callicarpa americana*, *Mitchella repens*, *Smilax pumila*, and *Cladonia evansii*. This community is distinct from CEGL007032 due to presence of *Vaccinium* spp. and absence of *Sabal palmetto* and/or *Pinus* spp .....
CEGL007028 *Quercus virginiana*/*Vaccinium arboreum-Ilex vomitoria* Forest

20b This community is dominated by a dense canopy of *Quercus virginiana*, *Quercus geminata*, and/or *Quercus laurifolia*. Their combined cover values can reach up to 80%. Other species that may occur in the canopy include *Quercus nigra*, *Magnolia grandiflora*, and *Carya glabra*. *Pinus elliottii* and/or *Pinus palustris* often occurs scattered throughout this community. *Sabal palmetto* may occur as either a shrub or tree. There is often a modest shrub layer with cover

values <30%. Common species include *Quercus myrtifolia*, *Ilex vomitoria*, and *Serenoa repens*. A sparse herbaceous layer may be present and includes *Mitchella repens*, *Smilax pumila*, and *Callicarpa americana*. This is distinct from CEGL007028 due to the presence of *Pinus elliottii* **CEGL007032**
***Quercus virginiana*-(*Pinus elliottii*, *Sabal palmetto*)/*Persea borbonia-Callicarpa americana* Forest**

21a The canopy is usually dominated by *Quercus nigra* with cover ranging between 30% and 70%. Other trees occur in the canopy and subcanopy as well, but do not typically reach codominance. Other tree species include *Liquidambar styraciflua*, *Acer rubrum*, *Magnolia grandiflora*, *Pinus* spp., and *Quercus* spp. A moderate shrub layer is generally present with cover <50%. Common shrubs include *Vaccinium stamineum*, *Ilex vomitoria*, and *Morella cerifera*. The herbaceous layer tends to be sparse with cover usually <20%.....**CEGL004638**
***Quercus nigra* Ruderal Forest**

21b Not as above. Community is not dominated by *Quercus nigra*. Other trees dominate the canopy such as *Carya* spp., *Fagus grandifolia*, *Quercus alba*, and/or *Magnolia grandifolia*..... .....(22a)

22a Canopy contains *Fagus grandifolia*, but *Carya glabra*, *Magnolia grandiflora*, *Liquidambar styraciflua*, and *Quercus nigra* often codominate as well. Canopy cover tends to be ~70%. The subcanopy and/or shrub layer tends to be fairly open with cover ~20%. Common shrubs include *Hamamelis virginiana*, *Ilex vomitoria*, *Magnolia grandiflora*, and *Morella cerifera*. The herbaceous stratum tends to be sparse with cover <10%. Common forbs include *Mitchella repens* and *Rubus argutus* **CEGL004965**
***Fagus grandifolia-Magnolia grandiflora-Quercus michauxii-Quercus nigra*/*Rhododendron canescens* Forest**

22b This community is characterized by a canopy composed of *Quercus alba*, *Carya tomentosa*, *Magnolia grandiflora*, and *Liquidambar styraciflua*. Canopy cover generally reaches up to ~40%. There is a vigorous shrub layer with cover ~50%. The most common shrubs include *Ilex vomitoria*, *Symplocos tinctoria*, *Morella cerifera*, and *Serenoa repens*. There was not much present in the herbaceous stratum **CEGL007225**
***Quercus alba-Carya glabra-Carya alba*/*Aesculus pavia* Forest**

Division B – Shrub associations

Shrublands here are mostly characterized as areas with <10% cover of trees and >10% shrub cover. Shrublands may occur as dense thickets in valleys or a sparse shrub cover occurring in a grassland. The minimum mapping unit for communities is ½ hectare; however due to the patchy nature of shrublands, several clusters of shrubs can equal a minimum mapping unit as long as each patch of shrubs are <30 m from each other. Shrubs are typically multi-stemmed plants <5 m in height.

Species that are always considered shrubs are *Morella cerifera*, *Baccharis halimifolia*, and *Ilex vomitoria*. Some species may be considered a tree or shrub such as *Sabal palmetto* or *Quercus geminata*. Generally, height is used to determine whether or not these species are shrubs (<5 m) or trees (>5 m).

1a Shrubland occurs within or adjacent to mesic areas and is dominated by more mesic shrubs *Baccharis halimifolia*, *Morella cerifera*, *Ilex vomitoria*, and/or *Cyrilla racemiflora* .....(2a)

1b Shrubland occurs on upland areas or sandy ridges and is usually dominated by *Chrysoma pauciflosculosa*, *Ceratiola ericoides*, *Pinus clausa*, *Pinus echinata*, *Pinus elliottii*, and/or scrub oaks such as *Quercus geminata* or *Quercus myrtifolia* .....(5a)

2a The community is dominated by a dense shrub layer mainly composed of *Cyrilla racemiflora* or *Morella cerifera* with short shrub layer of *Lyonia lucida* usually surrounding the area. An herbaceous layer of *Woodwardia virginica* is typically present as well.....**CEGL003844 *Cyrilla racemiflora-Lyonia lucida* Wet Shrubland**

2b Area is mainly dominated by either *Baccharis halimifolia*, *Ilex vomitoria*, and/or *Morella cerifera*.....(3a)

3a This community is dominated by a dense shrub layer of *Morella cerifera* and *Baccharis halimifolia* with covers between 20%-50%. Other common shrubs may include *Ilex vomitoria*, *Magnolia virginiana*, *Quercus myrtifolia*, *Quercus geminata*, and *Serenoa repens*; however, these are often only a few individuals and do not make up a significant amount of cover. *Pinus elliottii* may be present in the tall shrub or canopy strata, but its cover does not typically exceed 5%. Herbaceous stratum is typically dense with cover between 50% and 70%. Graminoids tend to dominate the herbaceous layer with common species such as *Spartina patens*, *Fuirena scirpoidea*, *Panicum repens*, *Rhynchospora fascicularis*, *Juncus roemerianus*, and *Panicum virgatum*.....**CEGL003839 *Morella cerifera/Spartina patens* Wet Shrubland**

3b Area is densely dominated by *Baccharis halimifolia*, *Ilex* spp., or *Quercus geminata*.....(1a)

4a Shrubs typically form a moderate to sparse stratum with *Baccharis halimifolia* and *Iva frutescens*. *Baccharis halimifolia* may occur around the grasslands or scattered throughout. Other common shrubs may include *Pinus elliottii* and *Ilex vomitoria*. *Morella cerifera* may be present, but it does not dominate the area, which differentiates it from CEGL003839. There is also a vigorous herbaceous layer dominated with graminoids. Abundant graminoids in this community include *Spartina patens*, *Panicum virgatum*, *Rhynchospora* spp., *Panicum repens*, and *Cyperus* spp.....**CEGL003920 *Baccharis halimifolia-Iva frutescens-Morella cerifera-(Ilex vomitoria)* Saline Shrubland**

4b This shrub community is dominated by a mix of *Ilex vomitoria*, *Quercus geminata*, *Morella cerifera*, and *Baccharis halimifolia*. The shrub cover typically ranges from 20%-90%. Herbaceous stratum is usually sparse with cover <30% and variable. Common species may include *Uniola paniculata*, *Schizachyrium maritimum*, *Chamaecrista fasciculata*, *Oenothera humifusa*, and *Heterotheca subaxillaris*.....**CEGL003813 *Ilex vomitoria-Quercus* (*geminata*, *virginiana*)-*Morella cerifera-Serenoa repens* Shrubland**

5a Area is dominated by *Ceratiola ericoides* and/or *Chrysoma pauciflosculosa*. *Pinus elliottii* and/or *Quercus geminata* may occur here as well, but they are very sparse with cover <20%.....(6a)

5b Not as above. Community is dominated by *Pinus elliottii*, *Pinus clausa*, *Pinus echinata*, *Ilex vomitoria*, or scrub oaks such as *Quercus geminata*, *Quercus virginiana*, and/or *Quercus*

myrtifolia.....(7a)

6a There is a dwarf shrubland of *Ceratiola ericoides*, *Chrysoma pauciflosculosa*, *Hypericum tenuifolium*, and *Polygonella polygama* occurring on old stabilized dunes. Short *Pinus elliottii* tend to occur in low abundance (~1%) along the edge of this community or sparsely within. If present, the herbaceous stratum is sparse with common species including *Schizachyrium maritimum*, *Polygonella macrophylla*, and *Lachnanthes caroliniana* .....**CEGL003864 *Ceratiola ericoides*-(*Chrysoma pauciflosculosa*)/*Polygonella polygama*/*Cladonia leporina* Shrubland**

6b This community usually occurs in dune complexes or on relict dunes. It is typically dominated by *Chrysoma pauciflosculosa* with cover between 10% and 40%. *Ceratiola ericoides* and *Conradina canescens* is often present as well but at lower abundances. Herbaceous layer is often moderate to sparse with cover typically <40%. Herbaceous cover may be very dense in swales. Common herbaceous species include *Diodella teres*, *Paronychia erecta*, *Uniola paniculata*, and *Schizachyrium maritimum*. *Cladonia leporina* is often present as well with cover <30%. This community is distinct from CEGL003864 due to the lack of dominance of *Ceratiola ericoide* ..... **CEGL003947 *Chrysoma pauciflosculosa-Paronychia erecta* Dwarf-Shrubland**

7a *Pinus clausa* and/or *Pinus echinata* occurs within the canopy with cover between 10% and 70%. Shrubby oaks such as *Quercus geminata*, *Quercus laevis*, and *Quercus myrtifolia* usually form a sparse to dense subcanopy or shrub layer with covers usually >20%. Other shrubs that may be present include *Ilex vomitoria*, *Serenoa repens*, *Ceratiola ericoides*, *Licania michauxii*, and *Conradina canescens*; short shrub and/or dwarf shrub cover typically does not exceed 50%. Herbaceous layer is typically sparse with *Dichanthelium* spp., *Smilax* spp., *Euphorbia floridana*, lichens such as *Cladina evansii* and *Cladonia leporina*, *Rhynchospora baldwinii*, and other herbaceous species.....**CEGL003554 *Pinus clausa*/*Quercus geminata-Quercus myrtifolia-Conradina canescens* Woodland**

7b Not as above. Community is not dominated by *Pinus clausa* and/or *Pinus echinata*. Area is dominated by *Pinus elliottii* and/or shrub oaks such as *Quercus geminata*, *Quercus myrtifolia*, and/or *Quercus laevis* .....(8a)

8a Sparse to dense shrub *Pinus elliottii* occur here with variable cover. *Pinus elliottii* may border tree height reaching up to ~20 ft. Shrubby oaks such as *Quercus myrtifolia* and *Quercus geminata* typically dominate with cover <50%. *Quercus myrtifolia* and *Quercus geminata* may reach tree height up to ~20 ft. Other dwarf shrubs occur here as well including *Ceratiola ericoides*, *Conradina canescens*, and *Polygonella polygama* .....**NPSGUIS005 *Pinus elliottii-Quercus myrtifolia-Quercus geminata* Scrub Woodland**

8b Shrubland contains <30% *Pinus elliottii* and is dominated by *Ilex vomitoria*, *Morella cerifera*, and/or scrub oaks such as *Quercus geminata* and/or *Quercus myrtifolia*.....(9a)

9a This shrub community is dominated by a mix of *Ilex vomitoria*, *Quercus geminata*, *Morella cerifera*, *Baccharis halimifolia*, and *Serenoa repens*. On relict dunes along Santa Rosa beach, *Magnolia grandiflora* may occur with cover ~20%. The shrub cover typically ranges from 20% to 90%. Herbaceous stratum usually is sparse with cover <30% and variable. Common species

may include *Uniola paniculata*, *Schizachyrium maritimum*, *Chamaecrista fasciculata*, *Oenothera humifusa*, and *Heterotheca subaxillaris.* This community is distinct from CEGL003824 due to dominance of *Ilex vomitoria* within this community.....**CEGL003813 *Ilex vomitoria-Quercus* (*geminata*, *virginiana*)-*Morella cerifera-Serenoa repens* Shrubland**

9b This shrub community is dominated by a combination of shrubs, mainly *Quercus geminata*, *Quercus myrtifolia*, *Ceratiola ericoides*, *Conradina canescens*, *Licania michauxii*, and *Serenoa repens*. Shrub cover generally ranges from 60% to 90%. Occasionally *Pinus echinata* or *Pinus clausa* are present, but their cover does not exceed 5%. Herbaceous stratum is usually sparse with <10%; common species include *Rhynchospora* spp., *Cladonia evansii*, and *Cladonia leporina*. This community is distinct from CEGL003813 due to lack of dominance of *Ilex vomitoria* ..... **CEGL003824 *Quercus myrtifolia-Quercus geminata-Ceratiola ericoides-Conradina canescens* Shrubland**

Division C – Herbaceous associations

Herbaceous associations are dominated by forbs and grasses or grass-like species. They may contain shrubs, and occasional trees at low cover levels. Typically, shrub or tree species present in a grassland will be widely scattered and have low cover values of less than 10 - 15%.

Herbaceous communities within the area of the park may be either riparian and wetland types, or upland types that occur away from areas of wet soils. Many of the herbaceous types exhibit a large amount of overlap in their species composition and can be difficult to classify in the field. This is particularly true of the wetland and riverine types that tend to form a mosaic of two to four species that range from complete monocultures to equally co-dominant across short distances the size of the minimum mapping unit or smaller. Issues of scale and pattern become very important considerations in discerning the most appropriate type to select.

1a Community is dominated by ruderal forbs or graminoids such as *Panicum repens* or *Phragmites australis* .....(2a)

1b Community is dominated by native forbs or graminoids .....(3a)

2a Community is dominated by *Phragmites australis* with cover between 60% and 90%. *Phragmites australis* typically forms monocultures; however, other common species include *Ipomoea sagittata*, *Spartina patens*, and *Hydrocotyle bonariensis*.....**CEGL004187 *Phragmites australis* spp. *australis* Tidal Ruderal Marsh**

2b This ruderal community is dominated by *Panicum repens*. *Panicum repens* typically has cover >70%. This community is often invading other herbaceous types, so cover needs to exceed 50% or another community should be considered. Due to overlapping nature of this type, other common mesic graminoids may be present such as *Spartina patens*, *Juncus roemerianus*, and *Panicum virgatum*. A low amount of shrubs such as *Baccharis halimifolia* and/or *Morella cerifera* may be present .....**NPSGUIS001 *Panicum repens* Ruderal Grassland**

3a Vegetation occurs within a moist low area or wetland, area that is regularly flooded, or experiences a high water table such as interdunal swales. Common species include *Juncus*

scirpoides, *Fuirena scirpoidea*, *Spartina patens*, *Juncus roemerianus*, *Cladium mariscus*, *Schoenoplectus* sp., and others .....(4a)

3b Vegetation occurs within drier areas of dune complexes, fore dunes or back dunes and typically is dominated by *Uniola paniculata*, *Schizachyrium maritimum*, *Iva imbricata*, and/or *Heterotheca subaxillaris*.....(20a)

4a Area is almost exclusively dominated by *Xyris fimbriata.* Other common species may include *Triadenum virginicum* and very sparse cover of *Nyssa aquatica.* Common herbaceous species besides *Xyris fimbriata* may include *Utricularia* sp., *Eleocharis cellulosa*, and *Nymphaea odorata*.....**CEGL007718 *Carex striata* var. *striata-Xyris fimbriata-Lachnanthes caroliniana* Marsh**

4b Not as above. *Xyris fimbriata* does not dominate the community.....(5a)

5a The majority of the area is generally flooded with water >6".....(6a)

5b The majority of the area occurs within a moist area or interdunal depression with water typically <6" .....(14a)

6a *Nymphaea odorata* occurs within a pond. It is usually the sole vegetation present in the water. Water levels can fluctuate within the area so there may be exposed herbaceous vegetation around the pond. Herbaceous vegetation may include *Eleocharis* sp., *Lachnanthes caroliniana*, *Polygonum hydropiperoides*, and *Cyperus* spp. *Cyrilla racemiflora* and *Nyssa aquatica* tend to occur along the edges of the pond .....**CEGL002386 *Nuphar advena-Nymphaea odorata* Aquatic Vegetation**

6b Not as above; community does not occur in a pond, and other herbaceous species dominate such as *Spartina* spp., *Typha domingensis*, *Juncus roemerianus*, *Cladium mariscus*, and/or *Phragmites australis* .....(7a)

7a Area is dominated by *Spartina* spp.....(8a)

7b Area is dominated by other species such as *Typha domingensis*, *Juncus roemerianus*, *Cladium mariscus*, *Panicum virgatum*, and/or *Phragmites australis*.....(9a)

8a Community is strongly dominated by graminoids such as *Spartina alterniflora* or *Distichlis spicata* with cover typically ~80%. Other common graminoids include *Juncus roemerianus*, *Fimbristylis castanea*, *Cyperus filicinus*, and *Paspalum* spp. Forbs tend to be sparse but include *Hydrocotyle bonariensis*, *Physalis angustifolium*, and *Bacopa monnieri*.....**CEGL004190 *Spartina alterniflora-Juncus roemerianus-Distichlis spicata* Louisianan Zone Tidal Salt Marsh**

8b *Spartina patens* dominates this community generally with cover >50%. Occasionally other species may codominate with *Panicum repens*, *Panicum amarum*, and/or *Juncus roemerianus*. *Baccharis halimifolia* and *Iva frutescens* are the common shrubs and usually have cover ~20% .... **CEGL004755 *Spartina patens-Schoenoplectus* (*americanus*, *pungens*)-(*Distichlis spicata*) Salt Marsh**

9a Community is dominated by *Typha domingensis* or *Phragmites australis*.....(10a)

9b Community is dominated by *Juncus roemerianus*, *Spartina alterniflora*, *Cladium mariscus*,

and/or *Panicum virgatum* .....(12a)

10a This community is dominated by *Phragmites australis* with cover between 60% and 90%. *Phragmites australis* typically forms monocultures; however, other common species may include *Ipomoea sagittata*, *Spartina patens*, and *Hydrocotyle bonariensis* .....**CEGL004187 *Phragmites australis* ssp. *australis* Tidal Ruderal Marsh**

10b Area is dominated by *Typha* sp. .....(11a)

11a *Typha* sp. dominates this community with cover >70%. This community tends to form very dense monocultures; however, *Cladium mariscus* occasionally occurs in small pockets or on the edges of this community. Around the margin of this community *Phragmites australis* usually occurs..... .....**CEGL008456 *Typha domingensis* Salt Marsh**

11b The community is dominated by *Cladium mariscus* and/or *Typha* sp. *Cladium mariscus* has cover ranging between 50% and 100%; when present, *Typha* sp. has cover values ~50%. *Juncus roemerianus* typically occurs within these communities as well. Other common species include *Kosteletzkya virginica*, *Ipomoea sagittata*, and *Cynanchum angustifolium* .....**CEGL004178 *Cladium mariscus* spp. *jamaicense* Tidal Salt Marsh**

12a This community is dominated by dense *Juncus roemerianus* with cover >50%. *Spartina alterniflora* may codominate with *Juncus roemerianus*. Often this community forms a monoculture but other common species may include *Panicum repens*, *Cladium mariscus*, *Spartina patens*, and *Fimbristylis castanea*. This association may grade into other communities, so there should be a dominance of *Juncus roemerianus* for it to fall into this association ....**CEGL004186 *Juncus roemerianus* Salt Marsh**

12b *Cladium mariscus* or *Panicum virgatum* dominate the community .....(13a)

13a The community is dominated by *Cladium mariscus* and/or *Typha* sp. *Cladium mariscus* has cover ranging between 50% and 100%; when present, *Typha* sp. has cover values ~50%. *Juncus roemerianus* typically occurs within these communities as well. Other common species includes *Kosteletzkya virginica*, *Ipomoea sagittata*, and *Cynanchum angustifolium* .....**CEGL004178 *Cladium mariscus* spp. *jamaicense* Tidal Salt Marsh**

13b Graminoids dominate the herbaceous stratum with cover values ranging from 90% to 100%. *Panicum virgatum* separates this community from other mesic graminoid communities. *Panicum virgatum* cover is typically ~20%. Other abundant graminoids include *Juncus roemerianus*, *Spartina patens*, and *Cladium mariscus*. Forbs tend to be fairly sparse but may include *Xyris jupicai*, *Kosteletzkya virginica*, and *Ipomoea sagittate* .....**CEGL004962 *Panicum virgatum*-(*Cladium mariscus* spp. *jamaicense*, *Juncus roemerianus*) Salt Marsh**

14a Area is dominated by *Spartina* spp. and/or *Schoenoplectus* spp. .....(15a)

14b Area is dominated by *Fuirena scirpoidea*, *Juncus scirpoides*, *Juncus roemerianus*, *Panicum tenerum*, *Fimbristylis castanea*, and/or *Paspalum distichum* .....(18a)

15a Graminoids dominate the herbaceous stratum with cover values ranging from 90% to 100%. *Panicum virgatum* separates this community from other mesic graminoid communities. *Panicum virgatum* cover is typically ~20%. Other abundant graminoids include *Juncus roemerianus*,

Spartina patens, and *Cladium mariscus*. Forbs tend to be fairly sparse but may include *Xyris jupicai*, *Kosteletzkya virginica*, and *Ipomoea sagittate* ..... **CEGL004962 *Panicum virgatum*-(*Cladium mariscus* spp. *jamaicense*, *Juncus roemerianus*) Salt Marsh**

15b Not as above. *Panicum virgatum* has cover <10% and *Spartina alterniflora*, *Spartina patens*, *Schoenoplectus* spp., and/or *Fuirena scirpoidea* dominates the herbaceous layer.....(16a)

16a These communities are strongly dominated by graminoids such as *Spartina alterniflora* or *Distichlis spicata*. Other common graminoids include *Juncus roemerianus*, *Fimbristylis castanea*, *Cyperus filicinus*, and *Paspalum* spp. Forbs tend to be sparse but include *Hydrocotyle bonariensis*, *Physalis angustifolium*, and *Bacopa monnieri*..... **CEGL004190 *Spartina alterniflora-Juncus roemerianus-Distichlis spicata* Louisianan Zone Tidal Salt Marsh**

16b Area is not as above and is dominated by *Spartina patens*, *Schoenoplectus* spp., and/or *Fuirena scirpoidea* .....(17a)

17a *Spartina patens* dominates this community generally with cover >50%. Occasionally other species codominate including *Schoenoplectus pungens*, *Panicum repens*, *Panicum amarum*, and/or *Juncus roemerianus*. If present, *Baccharis halimifolia* and *Iva frutescens* are the common shrubs and usually have cover ~20%. Occasionally, *Schoenoplectus robustus* strongly dominates large patches of the area with some *Spartina patens* occurring around the edges ..... **CEGL004755 *Spartina patens-Schoenoplectus* (*americanus*, *pungens*)-(*Distichlis spicata*) Salt Marsh**

17b The most dominant graminoids include *Fuirena scirpoidea*, *Juncus scirpoides*, *Juncus americanus*, *Rhynchospora* spp., *Panicum repens* (<50% cover)*, Dichanthelium wrightianum, Cladium mariscus, Spartina patens*, *Schoenoplectus pungens*, and *Juncus roemerianus*. *Xyris jupicai* is often present but in small abundances. These interdunal swales usually have a very dense herbaceous stratum with covers ranging between 60% and 100% cover. Common forbs in this community include *Centella asiatica* and *Hydrocotyle bonariensis.* Occasionally, a few individuals of *Baccharis halimifolia* may be scattered throughout the community. This community is mainly dominated by mesic graminoids and usually occurs in interdunal swales within dune complexes. Raised drier dunes are generally dominated by *Uniola paniculata*, *Schizachyrium maritimum*, *Chrysoma pauciflosculosa*, and *Heterotheca subaxillaris* .... **CEGL004953 *Fuirena scirpoidea-Panicum tenerum-Dichanthelium wrightianum-Andropogon capillipes* Grassland**

18a This community is dominated by dense *Juncus roemerianus* with cover >50%. Often this community forms a monoculture but other common species may include *Spartina alterniflora*, *Panicum repens*, *Spartina patens*, and *Fimbristylis castanea*. Occasionally, *Spartina alterniflora* may codominate with *Juncus roemerianus*. This association may grade into other communities, so there should be a dominance of *Juncus roemerianus* for it to fall into this association .... **CEGL004186 *Juncus roemerianus* Salt Marsh**

18b Not as above. Area is not dominated by *Juncus roemerianus*.....(19a)

19a *Fimbristylis castanea* is the most abundant graminoid with cover ranging from 20% to 80%. Other common graminoids include *Paspalum vaginatum*, *Fuirena scirpoidea*, and *Spartina*

patens. Occasionally there are small patches of *Juncus roemerianus*. When present, *Sesuvium portulacastrum* dominates the forb layer with cover ranging from 40% to 70%. Other common forbs include *Chamaesyce bombensis*, *Centella asiatica*, and *Hydrocotyle umbellata.* This association often occurs within shallow depressions that regularly flood.....**CEGL004110 *Fimbristylis castanea-Paspalum distichum* Marsh**

19b The most dominant graminoids include *Fuirena scirpoidea*, *Juncus scirpoides*, *Juncus americanus*, *Rhynchospora* spp., *Panicum repens* (<50% cover)*, Dichanthelium wrightianum, Cladium mariscus, Spartina patens*, *Schoenoplectus pungens*, and *Juncus roemerianus*. *Xyris jupicai* is often present but in small numbers. These interdunal swales usually have a very dense herbaceous stratum with covers ranging between 60% and 100% cover. Common forbs in this community include *Centella asiatica* and *Hydrocotyle bonariensis.* Occasionally, a few individuals of *Baccharis halimifolia* may be scattered throughout the community. This community is mainly dominated by mesic graminoids and usually occurs in interdunal swales within dune complexes. Raised drier dunes are generally dominated by *Uniola paniculata*, *Schizachyrium maritimum*, *Chrysoma pauciflosculosa*, and *Heterotheca subaxillaris* ..... **CEGL004953 *Fuirena scirpoidea-Panicum tenerum-Dichanthelium wrightianum-Andropogon capillipes* Grassland**

20a Area contains an abundance of *Uniola paniculata* and/or *Panicum amarum*; other species may be present, but usually not as much as *Uniola paniculata* .....(21a)

20b Area is dominated by other species such as *Iva imbricata*, *Schizachyrium maritimum*, *Heterotheca subaxillaris*, and/or *Smilax auriculata* .....(24a)

21a Vegetation is very sparse with the majority of the ground covered in bare sand. *Iva imbricata* dominates the community with cover of ~30%. Other plants present include *Uniola paniculata* and *Panicum amarum*; however, these plants never occur with cover >5% .....**CEGL004001 *Iva imbricata*/*Uniola paniculata-Helianthus debilis* spp. *debilis* Grassland**

21b Not as above. The community is dominated by *Uniola paniculata* and/or *Panicum amarum*..(22a)

22a This community is characterized by patches of dense *Smilax* spp. usually on the edges of the community. *Smilax* spp. cover ranges between 10% and 60%. Graminoids tend to have greater abundance than forbs with the most abundant including *Uniola paniculata* and *Distichlis spicata*. Common forbs may include *Hydrocotyle bonariensis*, *Opuntia erecta*, and *Sabatia grandiflora* ..... **CEGL004234 *Smilax auriculata*/*Heterotheca subaxillaris-Strophostyles helvula-*(*Uniola paniculata*) Grassland**

22b Not as above. Area is not covered by *Smilax* spp.....(23a)

23a Typically found on primary dune slopes, this community is heavily vegetated by *Uniola paniculata*. This is distinct from other *Uniola paniculata* types because *Uniola paniculata* typically has cover >70%. Other common species include *Panicum amarum*, *Heterotheca subaxillaris*, *Hydrocotyle bonariensis*, and *Schizachyrium maritimum* .....**NPSGUIS002 *Uniola paniculata* Grassland**

23b This community is usually dominated by a sparse herbaceous stratum of *Uniola paniculata*, *Panicum amarum*, *Iva imbricata*, and *Heterotheca subaxillaris*. This association occurs on

shoreline beaches, dune complexes, and primary dunes. *Uniola paniculata* tends to be the most dominant species with cover usually <50%; however, *Panicum amarum* may have greater cover. Occasionally, *Panicum amarum* reaches >80% cover when occurring on areas protected from the wind and waves such as Naval Live Oaks. This is distinct from CEGL004001 due to the abundance of *Uniola paniculata* and *Panicum amarum* within CEGL004041.....**CEGL004041 *Uniola paniculata-Panicum amarum* var. *amarulum-Iva imbricata* Grassland**

24a Vegetation is very sparse with the majority of the ground covered in bare sand. *Iva imbricata* dominates the community with cover of ~30%. Other plants present may include *Uniola paniculata* and *Panicum amarum;* however, these plants never occur with cover >5%..... .....**CEGL004001 *Iva imbricata*/*Uniola paniculata-Helianthus debilis* spp. *debilis* Grassland**

24b Not as above. Community is dominated by other species such as *Schizachyrium maritimum*, *Smilax* spp., and/or *Heterotheca subaxillaris* .....(25a)

25a This community is characterized by a high abundance of *Smilax* spp. either *Smilax auriculata* or *Smilax bona-nox*. *Smilax* spp. cover ranges between 10% and 60%. Graminoids tend to have greater abundance than forbs with the most abundant including *Uniola paniculata* and *Distichlis spicata*. Common forbs may include *Hydrocotyle bonariensis*, *Opuntia erecta*, and *Sabatia grandiflora*.....**CEGL004234 *Smilax auriculata*/*Heterotheca subaxillaris-Strophostyles helvula-*(*Uniola paniculata*) Grassland**

25b Not as above. Community lacks a large amount of *Smilax* spp.....(26a)

26a This community is dominated by *Schizachyrium maritimum* and/or *Heterotheca subaxillaris* with herbaceous cover values typically <40%. Other common beach species may be present such as *Uniola paniculata* and *Panicum amarum*, but these species do not have greater cover than either *Heterotheca subaxillaris* or *Schizachyrium maritimum* .....**CEGL004057 *Schizachyrium maritimum*-(*Heterotheca subaxillaris*) Grassland**

26b This community is usually dominated by a sparse herbaceous stratum of *Uniola paniculata*, *Panicum amarum*, *Iva imbricata*, and *Heterotheca subaxillaris*. This association occurs on shoreline beaches, dune complexes, and primary dunes. *Uniola paniculata* tends to be the most dominant species with cover usually <50%; however, *Panicum amarum* may have greater cover. Occasionally, *Panicum amarum* reaches cover >80% when occurring on areas protected from wind and waves such as Naval Live Oaks.....**CEGL004041 *Uniola paniculata-Panicum amarum* var. *amarulum-Iva imbricata* Grassland**

Division D – Sparse associations

Sparse associations generally have <10% vegetated cover and tend to occur on rock outcrops, beaches, or sandbars.

1a Area lacks vegetation.....(2a)

1b A small amount of vegetation is within the area .....(3a)

2a Area is just bare beach sand with <10% vegetation .....**NPSGUIS003 Beach Bare Sand**

2b Hurricane Nate has severely impacted this area. Typically there is a thick over-wash of sand burying most of the plants that were present. Vegetation is typically sparse with cover <10%, and some of the common species include Fimbristylis castanea, Schizachyrium maritimum, Panicum amarum, and Uniola paniculate ..... **NPSGUIS004 Hurricane Disturbed Area**

3a This community is usually dominated by a sparse herbaceous stratum of *Uniola paniculata*, *Panicum amarum*, *Iva imbricata*, and *Heterotheca subaxillaris*. This association occurs on shoreline beaches, dune complexes, and primary dunes. *Uniola paniculata* tends to be the most dominant species with cover usually <50%; however, *Panicum amarum* may have greater cover. Occasionally, *Panicum amarum* reaches cover >80% when occurring on areas protected from the wind and waves such as Naval Live Oaks.....**CEGL004041 *Uniola paniculata-Panicum amarum* var. *amarulum-Iva imbricata* Grassland**

3b Hurricane Nate has severely impacted this area. Typically there is a thick over-wash of sand burying most of the plants that were present. Vegetation is typically sparse with cover <10%, and some of the common species include *Fimbristylis castanea*, *Schizachyrium maritimum*, *Panicum amarum*, and *Uniola paniculate* ..... **NPSGUIS004 Hurricane Disturbed Area**

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Appendix C: List of Plant Species Documented During Plot Sampling at Gulf Islands National Seashore

Table C1. List of plant species at GUIS.

Plant Taxon Name	USDA Plants Taxon Code
Acalypha gracilens	ACGR2
Acer rubrum	ACRU
Aeschynomene indica	AEIN
Aeschynomene viscidula	AEVI
Aesculus pavia	AEPA
Agalinis filifolia	AGFI2
Ambrosia artemisiifolia	AMAR2
Andropogon capillipes	ANCA4
Andropogon glomeratus	ANGL2
Andropogon ternarius	ANTE2
Andropogon virginicus	ANVI2
Apocynaceae	APOCY
Apteria aphylla	APAP
Aralia spinosa	ARSP2
Aristida beyrichiana	ARBE7
Aristida oligantha	AROL
Aristida purpurascens	ARPU8
Aristida sp.	ARST
Aronia arbutifolia	ARAR7
Asclepias humistrata	ASHU3
Asimina triloba	ASTR
Asteraceae	ASTER
Baccharis halimifolia	BAHA
Bacopa monnieri	BAMO
Balduina angustifolia	BAAN3
Baptisia lanceolata	BALA3

Table C1 (continued). List of plant species at GUIS.

Plant Taxon Name	USDA Plants Taxon Code
Bidens alba	BIAL
Bignonia capreolata	BICA
Boehmeria cylindrica	BOCY
Bolboschoenus robustus	BORO5
Boltonia diffusa	BODI
Borrichia frutescens	BOFR
Bulbostylis ciliatifolia	BUCI
Bulbostylis sp.	BULBO
Cakile constricta	CACO25
Cakile lanceolata	CALA2
Calamovilfa curtissii	CACU
Callicarpa americana	CAAM2
Campsis radicans	CARA2
Carex sp.	CAREX
Carya glabra	CAGL8
Carya illinoinensis	CAIL2
Castanea dentata	CADE12
Cenchrus spinifex	CESP4
Centella asiatica	CEAS
Centrosema virginianum	CEVI2
Ceratiola ericoides	CEER3
Chamaecrista fasciculata	CHFAF
Chamaesyce blodgettii	CHBL2
Chamaesyce bombensis	CHBO7
Chamaesyce thymifolia	CHTH4
Chasmanthium sessiliflorum	CHSE2
Chenopodium album	CHAL7
Chrysoma pauciflosculosa	CHPA18
Chrysopsis godfreyi	CHGO2

Table C1 (continued). List of plant species at GUIS.

Plant Taxon Name	USDA Plants Taxon Code
Chrysopsis gossypina	CHGO
Chrysopsis graminifolia	CHGR2
Cladina evansii	CLEV
Cladium mariscus	CLMAJ
Cladonia leporina	CLLE4
Cladonia prostrata	CLPR3
Cladonia sp.	CLADO
Cliftonia monophylla	CLMO2
Clinopodium coccineum	CLCO10
Clitoria mariana	CLMA4
Cnidoscolus urens	CNURS
Cocculus carolinus	COCA
Commelina erecta	COER
Commelina virginica	COVI3
Conradina canescens	COCA19
Conyza canadensis	COCA5
Crataegus uniflora	CRUN
Crotalaria rotundifolia	CRRO5
Croton glandulosus	CRGL2
Croton punctatus	CRPU6
Cuscuta gronovii	CUGR
Cuscuta pentagona	CUPE3
Cynanchum angustifolium	CYAN5
Cynodon dactylon	CYDA
Cyperus erythrorhizos	CYER2
Cyperus filicinus	CYFI
Cyperus flavescens	CYFL
Cyperus haspan	CYHA
Cyperus lecontei	CYLE2

Table C1 (continued). List of plant species at GUIS.

Plant Taxon Name	USDA Plants Taxon Code
Cyperus odoratus	CYOD
Cyperus ovatus	CYOV3
Cyperus sp.	CYPER
Cyrilla racemiflora	CYRA
Desmodium ciliare	DECI
Dichanthelium aciculare	DIAC
Dichanthelium acuminatum	DIAC2
Dichanthelium chamaelonche	DICA
Dichanthelium commutatum	DICO2
Dichanthelium dichotomum	DIDIE
Dichanthelium ovale	DIOV
Dichanthelium sabulorum	DISAT
Dichanthelium sp.	DICHA
Dichanthelium sphaerocarpon	DISP2
Dichanthelium strigosum	DISTL
Diodia teres	DITE2
Diodia virginiana	DIVI3
Diospyros virginiana	DIVI5
Distichlis spicata	DISP
Ditrysinia fruticosa	DIFR6
Drosera intermedia	DRIN3
Drosera sp.	DROSE
Eleocharis cellulosa	ELCE
Eleocharis elongata	ELEL2
Eleocharis melanocarpa	ELME
Eleocharis montevidensis	ELMO2
Eleocharis sp.	ELEOC
Elephantopus elatus	ELEL3
Elymus virginicus	ELVI3

Table C1 (continued). List of plant species at GUIS.

Plant Taxon Name	USDA Plants Taxon Code
Eragrostis elliottii	EREL
Eragrostis lugens	ERLU
Erechtites hieraciifolius	ERHI12
Eremochloa ophiuroides	EROP
Eriocaulon compressum	ERCO7
Eriogonum tomentosum	ERTO2
Eryngium yuccifolium	ERYU
Erythrina herbacea	ERHE4
Eubotrys racemosus	EURA14
Eupatorium capillifolium	EUCA5
Eupatorium compositifolium	EUCO7
Euphorbia floridana	EUFL4
Eustachys glauca	EUGL5
Euthamia graminifolia	EUGR5
Fagus grandifolia	FAGR
Fimbristylis castanea	FICA4
Fimbristylis dichotoma	FIDI
Fimbristylis puberula	FIPU
Froelichia floridana	FRFL
Fuirena scirpoidea	FUSC
Galactia microphylla	GAMI3
Galactia regularis	GARE2
Galactia volubilis	GAVO
Galium hispidulum	GAHI
Gelsemium sempervirens	GESE
Hamamelis virginiana	HAVI4
Helianthemum arenicola	HEAR11
Heterotheca subaxillaris	HESU3
Hibiscus coccineus	HICO2

Table C1 (continued). List of plant species at GUIS.

Plant Taxon Name	USDA Plants Taxon Code
Hibiscus grandiflorus	HIGR4
Hydrocotyle bonariensis	HYBO
Hydrocotyle umbellata	HYUM
Hymenocallis sp.	HYMEN
Hypericum brachyphyllum	HYBR3
Hypericum cistifolium	HYCI
Hypericum gentianoides	HYGE
Hypericum hypericoides	HYHY
Hypericum sp.	HYPER
Hypericum tenuifolium	HYTE11
Hyptis mutabilis	HYMU2
Ilex attenuata	ILAT
Ilex cassine	ILCA
Ilex coriacea	ILCO
Ilex glabra	ILGL
Ilex myrtifolia	ILMY
Ilex opaca	ILOP
Ilex vomitoria	ILVO
Imperata cylindrica	IMCY
Indigofera caroliniana	INCA
Ipomoea imperati	IPIM
Ipomoea sagittata	IPSA
Ipomopsis rubra	IPRU2
Itea virginica	ITVI
Iva frutescens	IVFR
Iva imbricata	IVIM
Juncus acuminatus	JUAC
Juncus dichotomus	JUDI
Juncus elliottii	JUEL

Table C1 (continued). List of plant species at GUIS.

Plant Taxon Name	USDA Plants Taxon Code
Juncus roemerianus	JURO
Juncus scirpoides	JUSC
Juniperus virginiana	JUVI
Kalmia hirsuta	KAHI2
Kosteletzkya virginica	KOVI
Lachnanthes caroliniana	LACA5
Lantana camara	LACA2
Lechea sessiliflora	LESE7
Lepidium virginicum	LEVI3
Liatris chapmanii	LICH2
Liatris sp.	LIATR
Licania michauxii	LIMI5
Ligustrum japonicum	LIJA
Ligustrum sinense	LISI
Liquidambar styraciflua	LIST2
Liriodendron tulipifera	LITU
Lonicera sempervirens	LOSE
Ludwigia alata	LUAL
Ludwigia linearis	LULI
Ludwigia maritima	LUMA4
Lycopodiella appressa	LYAP4
Lycopodiella prostrata	LYPR3
Lygodium japonicum	LYJA
Lyonia lucida	LYLU3
Lythrum lineare	LYLI2
Magnolia acuminata	MAAC
Magnolia grandiflora	MAGR4
Magnolia virginiana	MAVI2
Mikania scandens	MISC

Table C1 (continued). List of plant species at GUIS.

Plant Taxon Name	USDA Plants Taxon Code
Mimosa sp.	MIMO
Mitchella repens	MIRE
Morella cerifera	MOCE2
Morus rubra	MORU2
Nekemias arborea	NEAR5
Nerium oleander	NEOL
Nymphaea odorata	NYOD
Nyssa aquatica	NYAQ2
Nyssa biflora	NYBI
Nyssa sylvatica	NYSY
Oenothera drummondii	OEDR
Oenothera humifusa	OEHU
Oenothera simulans	OESI
Opuntia humifusa	OPHU
Opuntia pusilla	OPPU2
Opuntia sp.	OPUNT
Osmanthus americanus	OSAM
Osmunda cinnamomea	OSCI
Osmunda regalis	OSRE
Panicum amarum	PAAM2
Panicum repens	PARE3
Panicum sp.	PANIC
Panicum virgatum	PAVI2
Paronychia erecta	PAER2
Parthenocissus quinquefolia	PAQU2
Paspalum distichum	PADI6
Paspalum floridanum	PAFL4
Paspalum laeve	PALA10
Paspalum notatum	PANO2

Table C1 (continued). List of plant species at GUIS.

Plant Taxon Name	USDA Plants Taxon Code
Paspalum urvillei	PAUR2
Paspalum vaginatum	PAVA
Passiflora lutea	PALU2
Persea borbonia	PEBO
Persea sp.	PERSE
Phragmites australis	PHAU7
Phyla nodiflora	PHNO2
Physalis angustifolia	PHAN8
Pinus clausa	PICL
Pinus echinata	PIEC2
Pinus elliottii	PIEL
Pinus palustris	PIPA2
Pinus sp.	PINUS
Pinus taeda	PITA
Pityopsis graminifolia	PIGR4
Pleopeltis polypodioides	PLPO2
Pluchea rosea	PLRO
Polygala balduinii	POBA4
Polygala cruciata	POCR
Polygala lutea	POLU
Polygonella macrophylla	POMA14
Polygonella polygama	POPO2
Polygonum hydropiperoides	POHY2
Polygonum punctatum	POPUP4
Polypremum procumbens	POPR4
Proserpinaca pectinata	PRPE
Prunus serotina	PRSE2
Pseudognaphalium obtusifolium	PSOB3
Pteridium aquilinum	PTAQ

Table C1 (continued). List of plant species at GUIS.

Plant Taxon Name	USDA Plants Taxon Code
Quercus alba	QUAL
Quercus chapmanii	QUCH
Quercus falcata	QUFA
Quercus geminata	QUGE2
Quercus laevis	QULA2
Quercus laurifolia	QULA3
Quercus marilandica	QUMA3
Quercus michauxii	QUMI
Quercus myrtifolia	QUMY
Quercus nigra	QUNI
Quercus phellos	QUPH
Quercus sp.	QUERC
Quercus stellata	QUST
Quercus velutina	QUVE
Quercus virginiana	QUVI
Rhexia alifanus	RHAL4
Rhus copallinum	RHCO
Rhynchospora baldwinii	RHBA
Rhynchospora colorata	RHCO7
Rhynchospora debilis	RHDE2
Rhynchospora decurrens	RHDE
Rhynchospora fascicularis	RHFA
Rhynchospora inundata	RHIN7
Rhynchospora megalocarpa	RHME
Rhynchospora microcarpa	RHMI7
Rhynchospora microcephala	RHMI8
Rhynchospora sp.	RHYNC
Rubus argutus	RUAR2
Rubus trivialis	RUTR

Table C1 (continued). List of plant species at GUIS.

Plant Taxon Name	USDA Plants Taxon Code
Sabal minor	SAMI8
Sabal palmetto	SAPA
Sabatia campanulata	SACA26
Sabatia grandiflora	SAGR8
Sabatia stellaris	SAST5
Sagittaria graminea	SAGR
Sagittaria lancifolia	SALA
Salix nigra	SANI
Sarracenia alata	SAAL4
Sarracenia sp.	SARRA
Sassafras albidum	SAAL5
Saururus cernuus	SACE
Schizachyrium littorale	SCLI11
Schizachyrium maritimum	SCMA3
Schizachyrium scoparium	SCSC
Schoenoplectus americanus	SCAM6
Schoenoplectus pungens	SCPU10
Scleria ciliata	SCCI
Scleria triglomerata	SCTR
Scleria verticillata	SCVE2
Scoparia dulcis	SCDU3
Serenoa repens	SERE2
Sesbania drummondii	SEDR
Sesuvium portulacastrum	SEPO2
Setaria parviflora	SEPA10
Setaria pumila	SEPUP2
Seymeria cassioides	SECA4
Seymeria pectinata	SEPE2
Smilax auriculata	SMAU

Table C1 (continued). List of plant species at GUIS.

Plant Taxon Name	USDA Plants Taxon Code
Smilax bona-nox	SMBO2
Smilax glauca	SMGL
Smilax laurifolia	SMLA
Smilax pumila	SMPU
Smilax rotundifolia	SMRO
Smilax sp.	SMILA
Smilax tamnoides	SMTA2
Smilax walteri	SMWA
Solidago odora	SOOD
Solidago sempervirens	SOSE
Sonchus asper	SOAS
Spartina alterniflora	SPAL
Spartina patens	SPPA
Sphagnum sp.	SPHAG
Sporobolus indicus	SPIN4
Sporobolus virginicus	SPVI3
Stipulicida setacea	STSE3
Stokesia laevis	STLA6
Strophostyles helvola	STHE9
Strophostyles leiosperma	STLE6
Symplocos tinctoria	SYTI
Syngonanthus flavidulus	SYFL
Tephrosia sp. 1004.1	1004.1
Tillandsia usneoides	TIUS
Toxicodendron pubescens	TOPU2
Toxicodendron radicans	TORA2
Tradescantia hirsutifolia	TRHI
Tradescantia ohiensis	TROH
Triadenum virginicum	TRVI

Table C1 (continued). List of plant species at GUIS.

Plant Taxon Name	USDA Plants Taxon Code
Triadica sebifera	TRSE6
Typha domingensis	TYDO
Typha sp.	TYPHA
Uniola paniculata	UNPA
Utricularia juncea	UTJU
Vaccinium arboreum	VAAR
Vaccinium corymbosum	VACO
Vaccinium elliottii	VAEL
Vaccinium myrsinites	VAMY3
Vaccinium sp.	VACCI
Vaccinium stamineum	VAST
Viburnum rufidulum	VIRU
Vigna luteola	VILU3
Viola sp.	VIOLA
Viburnum dentatum	VIDE
Viburnum nudum	VINU
Vitis rotundifolia	VIRO3
Woodwardia areolata	WOAR
Woodwardia virginica	WOVI
Xyris ambigua	XYAM
Xyris difformis	XYDI
Xyris elliottii	XYEL2
Xyris fimbriata	XYFI
Xyris jupicai	XYJU
Xyris platylepis	XYPL
Yucca filamentosa	YUFI
Yucca gloriosa	YUGL2

Appendix D: List of Plots and Classified Vegetation Associations

Table D1. List of plots and classified vegetation associations.

Plot Code	Classified code	Scientific name
1001	CEGL003638	*Pinus elliottii* / *Cliftonia monophylla - Cyrilla racemiflora* Swamp Woodland
1002	CEGL003824	*Quercus myrtifolia - Quercus geminata - Ceratiola ericoides - Conradina canescens* Shrubland
1003	CEGL003824	*Quercus myrtifolia - Quercus geminata - Ceratiola ericoides - Conradina canescens* Shrubland
1004	CEGL003824	*Quercus myrtifolia - Quercus geminata - Ceratiola ericoides - Conradina canescens* Shrubland
1005	CEGL004041	*Uniola paniculata - Panicum amarum* var. *amarulum - Iva imbricata* Grassland
1006	CEGL004041	*Uniola paniculata - Panicum amarum* var. *amarulum - Iva imbricata* Grassland
1007	CEGL007032	*Quercus virginiana* - (*Pinus elliottii*, *Sabal palmetto*) / *Persea borbonia - Callicarpa americana* Forest
1008	CEGL007032	*Quercus virginiana* - (*Pinus elliottii*, *Sabal palmetto*) / *Persea borbonia - Callicarpa americana* Forest
1009	CEGL004041	*Uniola paniculata - Panicum amarum* var. *amarulum - Iva imbricata* Grassland
1010	CEGL003813	*Ilex vomitoria - Quercus* (*geminata*, *virginiana*) - *Morella cerifera - Serenoa repens* Shrubland
1011	CEGL004178	*Cladium mariscus* Tidal Salt Marsh
1012	CEGL004041	*Uniola paniculata - Panicum amarum* var. *amarulum - Iva imbricata* Grassland
1013	CEGL004057	*Schizachyrium maritimum* - (*Heterotheca subaxillaris*) Grassland
1014	CEGL004186	*Juncus roemerianus* Salt Marsh
1015	CEGL004041	*Uniola paniculata - Panicum amarum* var. *amarulum - Iva imbricata* Grassland
1016	CEGL004953	*Fuirena scirpoides - Panicum tenerum - Dichanthelium wrightianum - Andropogon capillipes* Grassland
1017	CEGL004041	*Uniola paniculata - Panicum amarum* var. *amarulum - Iva imbricata* Grassland
1018	CEGL003813	*Ilex vomitoria - Quercus* (*geminata*, *virginiana*) - *Morella cerifera - Serenoa repens* Shrubland
1019	CEGL004057	*Schizachyrium maritimum* - (*Heterotheca subaxillaris*) Grassland
1020	CEGL003864	*Ceratiola ericoides* - (*Chrysoma pauciflosculosa*) / *Polygonella polygama* / *Cladonia leporina* Shrubland
1021	CEGL004041	*Uniola paniculata - Panicum amarum* var. *amarulum - Iva imbricata* Grassland

Table D1 (continued). List of plots and classified vegetation associations.

Plot Code	Classified code	Scientific name
1022	CEGL004057	*Schizachyrium maritimum* - (*Heterotheca subaxillaris*) Grassland
1023	CEGL004178	*Cladium mariscus* Tidal Salt Marsh
1024	CEGL004958	*Pinus elliottii* / *Spartina patens* - *Juncus roemerianus* - (*Panicum virgatum*) Tidal Woodland
1025	CEGL003947	*Chrysoma pauciflosculosa* - *Paronychia erecta* Dwarf Shrubland
1026	CEGL008456	*Typha domingensis* Salt Marsh
1027	CEGL004234	*Smilax auriculata* / *Heterotheca subaxillaris* - *Strophostyles helvola* - (*Uniola paniculata*) Grassland
1028	CEGL004186	*Juncus roemerianus* Salt Marsh
1029	CEGL003813	*Ilex vomitoria* - *Quercus* (*geminata*, *virginiana*) - *Morella cerifera* - *Serenoa repens* Shrubland
1030	CEGL003813	*Ilex vomitoria* - *Quercus* (*geminata*, *virginiana*) - *Morella cerifera* - *Serenoa repens* Shrubland
1031	CEGL004186	*Juncus roemerianus* Salt Marsh
1032	CEGL007028	*Quercus virginiana* / *Vaccinium arboreum* - *Ilex vomitoria* Forest
1033	CEGL003824	*Quercus myrtifolia* - *Quercus geminata* - *Ceratiola ericoides* - *Conradina canescens* Shrubland
1034	CEGL003554	*Pinus clausa* / *Quercus geminata* - *Quercus myrtifolia* - *Conradina canescens* Woodland
1035	CEGL007032	*Quercus virginiana* - (*Pinus elliottii*, *Sabal palmetto*) / *Persea borbonia* - *Callicarpa americana* Forest
1036	CEGL004680	*Pinus elliottii* / *Serenoa repens* - *Ilex glabra* - *Morella cerifera* - *Ilex vomitoria* Woodland
1037	CEGL008477	*Nyssa biflora* - *Liquidambar styraciflua* / *Magnolia virginiana* / *Hamamelis virginiana* - *Viburnum nudum* Swamp Forest
1038	CEGL003813	*Ilex vomitoria* - *Quercus* (*geminata*, *virginiana*) - *Morella cerifera* - *Serenoa repens* Shrubland
1039	CEGL004680	*Pinus elliottii* / *Serenoa repens* - *Ilex glabra* - *Morella cerifera* - *Ilex vomitoria* Woodland
1040	CEGL004638	*Quercus nigra* Ruderal Forest
1041	CEGL004638	*Quercus nigra* Ruderal Forest
1042	CEGL004965	*Fagus grandifolia* - *Magnolia grandiflora* - *Quercus michauxii* - *Quercus nigra* / *Rhododendron canescens* Forest

Table D1 (continued). List of plots and classified vegetation associations.

Plot Code	Classified code	Scientific name
1043	CEGL008477	*Nyssa biflora* - *Liquidambar styraciflua* / *Magnolia virginiana* / *Hamamelis virginiana* - *Viburnum nudum* Swamp Forest
1044	CEGL004057	*Schizachyrium maritimum* - (*Heterotheca subaxillaris*) Grassland
1045	CEGL004755	*Spartina patens* - *Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh
1046	CEGL004057	*Schizachyrium maritimum* - (*Heterotheca subaxillaris*) Grassland
1047	NPSGUIS001	*Panicum repens* Ruderal Grassland
1048	CEGL004057	*Schizachyrium maritimum* - (*Heterotheca subaxillaris*) Grassland
1049	NPSGUIS001	*Panicum repens* Ruderal Grassland
1050	CEGL003920	*Baccharis halimifolia* - *Iva frutescens* - *Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland
1051	CEGL004057	*Schizachyrium maritimum* - (*Heterotheca subaxillaris*) Grassland
1052	CEGL004057	*Schizachyrium maritimum* - (*Heterotheca subaxillaris*) Grassland
1053	CEGL008456	*Typha domingensis* Salt Marsh
1054	CEGL003920	*Baccharis halimifolia* - *Iva frutescens* - *Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland
1055	CEGL004186	*Juncus roemerianus* Salt Marsh
1056	CEGL003813	*Ilex vomitoria* - *Quercus* (*geminata*, *virginiana*) - *Morella cerifera* - *Serenoa repens* Shrubland
1057	CEGL003813	*Ilex vomitoria* - *Quercus* (*geminata*, *virginiana*) - *Morella cerifera* - *Serenoa repens* Shrubland
1058	CEGL003813	*Ilex vomitoria* - *Quercus* (*geminata*, *virginiana*) - *Morella cerifera* - *Serenoa repens* Shrubland
1059	CEGL004755	*Spartina patens* - *Schoenoplectus* (*americanus*, pungens) - (*Distichlis spicata*) Salt Marsh
1060	CEGL004186	*Juncus roemerianus* Salt Marsh
1061	CEGL004190	*Spartina alterniflora* - *Juncus roemerianus* - *Distichlis spicata* Louisianian Zone Tidal Salt Marsh
1062	CEGL004041	*Uniola paniculata* - *Panicum amarum* var. *amarulum* - *Iva imbricata* Grassland
1063	CEGL003920	*Baccharis halimifolia* - *Iva frutescens* - *Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland
1064	CEGL004041	*Uniola paniculata* - *Panicum amarum* var. *amarulum* - *Iva imbricata* Grassland

Table D1 (continued). List of plots and classified vegetation associations.

Plot Code	Classified code	Scientific name
1065	NPSGUIS001	*Panicum repens* Ruderal Grassland
1066	CEGL003920	*Baccharis halimifolia* - *Iva frutescens* - *Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland
1067	CEGL004680	*Pinus elliottii* / *Serenoa repens* - *Ilex glabra* - *Morella cerifera* - *Ilex vomitoria* Woodland
1068	CEGL004186	*Juncus roemerianus* Salt Marsh
1069	CEGL004680	*Pinus elliottii* / *Serenoa repens* - *Ilex glabra* - *Morella cerifera* - *Ilex vomitoria* Woodland
1070	CEGL004680	*Pinus elliottii* / *Serenoa repens* - *Ilex glabra* - *Morella cerifera* - *Ilex vomitoria* Woodland
1071	CEGL004755	*Spartina patens* - *Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh
1072	CEGL003920	*Baccharis halimifolia* - *Iva frutescens* - *Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland
1073	CEGL003864	*Ceratiola ericoides* - (*Chrysoma pauciflosculosa*) / *Polygonella polygama* / *Cladonia leporina* Shrubland
1074	CEGL004680	*Pinus elliottii* / *Serenoa repens* - *Ilex glabra* - *Morella cerifera* - *Ilex vomitoria* Woodland
1075	CEGL004110	*Fimbristylis castanea* - *Paspalum distichum* Marsh
1076	CEGL004110	*Fimbristylis castanea* - *Paspalum distichum* Marsh
1077	CEGL004755	*Spartina patens* - *Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh
1078	CEGL004041	*Uniola paniculata* - *Panicum amarum* var. *amarulum* - *Iva imbricata* Grassland
1079	CEGL003920	*Baccharis halimifolia* - *Iva frutescens* - *Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland
1080	CEGL004186	*Juncus roemerianus* Salt Marsh
1081	CEGL003920	*Baccharis halimifolia* - *Iva frutescens* - *Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland
1082	CEGL004041	*Uniola paniculata* - *Panicum amarum* var. *amarulum* - *Iva imbricata* Grassland
1083	CEGL004110	*Fimbristylis castanea* - *Paspalum distichum* Marsh
1084	CEGL004190	*Spartina alterniflora* - *Juncus roemerianus* - *Distichlis spicata* Louisianian Zone Tidal Salt Marsh
1085	CEGL003813	*Ilex vomitoria* - *Quercus* (*geminata*, *virginiana*) - *Morella cerifera* - *Serenoa repens* Shrubland

Table D1 (continued). List of plots and classified vegetation associations.

Plot Code	Classified code	Scientific name
1086	CEGL003813	*Ilex vomitoria - Quercus* (*geminata*, *virginiana*) - *Morella cerifera - Serenoa repens* Shrubland
1087	CEGL004680	*Pinus elliottii* / *Serenoa repens - Ilex glabra - Morella cerifera - Ilex vomitoria* Woodland
1088	CEGL003813	*Ilex vomitoria - Quercus* (*geminata*, *virginiana*) - *Morella cerifera - Serenoa repens* Shrubland
1089	CEGL003813	*Ilex vomitoria - Quercus* (*geminata*, *virginiana*) - *Morella cerifera - Serenoa repens* Shrubland
1090	CEGL004186	*Juncus roemerianus* Salt Marsh
1091	CEGL004680	*Pinus elliottii* / *Serenoa repens - Ilex glabra - Morella cerifera - Ilex vomitoria* Woodland
1092	CEGL004680	*Pinus elliottii* / *Serenoa repens - Ilex glabra - Morella cerifera - Ilex vomitoria* Woodland
1093	CEGL007028	*Quercus virginiana* / *Vaccinium arboreum - Ilex vomitoria* Forest
1094	CEGL003844	*Cyrilla racemiflora - Lyonia lucida* Wet Shrubland
1095	CEGL007019	*Quercus geminata* / *Serenoa repens - Ilex vomitoria* - (*Sideroxylon lanuginosum*) Forest
1096	CEGL007028	*Quercus virginiana* / *Vaccinium arboreum - Ilex vomitoria* Forest
1097	CEGL003824	*Quercus myrtifolia - Quercus geminata - Ceratiola ericoides - Conradina canescens* Shrubland
1098	CEGL007156	*Nyssa biflora - Magnolia virginiana* - (*Pinus elliottii*) / *Morella* (*caroliniensis*, *inodora*) Swamp Forest
1099	CEGL003554	*Pinus clausa* / *Quercus geminata - Quercus myrtifolia - Conradina canescens* Woodland
1100	CEGL003554	*Pinus clausa* / *Quercus geminata - Quercus myrtifolia - Conradina canescens* Woodland
1101	CEGL003554	*Pinus clausa* / *Quercus geminata - Quercus myrtifolia - Conradina canescens* Woodland
1102	CEGL004658	*Pinus elliottii* - (*Pinus palustris*) / *Ilex vomitoria - Serenoa repens - Morella cerifera* Woodland
1103	CEGL004658	*Pinus elliottii* - (*Pinus palustris*) / *Ilex vomitoria - Serenoa repens - Morella cerifera* Woodland
1104	CEGL004658	*Pinus elliottii* - (*Pinus palustris*) / *Ilex vomitoria - Serenoa repens - Morella cerifera* Woodland
1105	CEGL004953	*Fuirena scirpoides - Panicum tenerum - Dichanthelium wrightianum - Andropogon capillipes* Grassland

Table D1 (continued). List of plots and classified vegetation associations.

Plot Code	Classified code	Scientific name
1106	CEGL004953	*Fuirena scirpoides* - *Panicum tenerum* - *Dichanthelium wrightianum* - *Andropogon capillipes* Grassland
1107	CEGL004953	*Fuirena scirpoides* - *Panicum tenerum* - *Dichanthelium wrightianum* - *Andropogon capillipes* Grassland
1108	CEGL004953	*Fuirena scirpoides* - *Panicum tenerum* - *Dichanthelium wrightianum* - *Andropogon capillipes* Grassland
1109	CEGL004234	*Smilax auriculata* / *Heterotheca subaxillaris* - *Strophostyles helvola* - (*Uniola paniculata*) Grassland
1110	CEGL004958	*Pinus elliottii* / *Spartina patens* - *Juncus roemerianus* - (*Panicum virgatum*) Tidal Woodland
1111	NPSGUIS005	*Pinus elliottii* - *Quercus myrtifolia* - *Quercus geminata* Scrub Woodland
1112	CEGL004187	*Phragmites australis* ssp. *australis* Tidal Ruderal Marsh
1113	NPSGUIS002	*Uniola paniculata* Grassland
1114	CEGL004178	*Cladium mariscus* Tidal Salt Marsh
2000	CEGL003554	*Pinus clausa* / *Quercus geminata* - *Quercus myrtifolia* - *Conradina canescens* Woodland
2001	CEGL004680	*Pinus elliottii* / *Serenoa repens* - *Ilex glabra* - *Morella cerifera* - *Ilex vomitoria* Woodland
2002	CEGL007019	*Quercus geminata* / *Serenoa repens* - *Ilex vomitoria* - (*Sideroxylon lanuginosum*) Forest
2003	CEGL002419	*Nyssa aquatica* Swamp Forest
2004	CEGL007718	*Carex striata* var. *striata* - *Xyris fimbriata* - *Lachnanthes caroliniana* Marsh
2005	CEGL007028	*Quercus virginiana* / *Vaccinium arboreum* - *Ilex vomitoria* Forest
2006	CEGL003554	*Pinus clausa* / *Quercus geminata* - *Quercus myrtifolia* - *Conradina canescens* Woodland
2007	CEGL004962	*Panicum virgatum* - (*Cladium mariscus*, *Juncus roemerianus*) Salt Marsh
2008	CEGL004178	*Cladium mariscus* Tidal Salt Marsh
2009	CEGL004110	*Fimbristylis castanea* - *Paspalum distichum* Marsh
2010	CEGL003813	*Ilex vomitoria* - *Quercus* (*geminata*, *virginiana*) - *Morella cerifera* - *Serenoa repens* Shrubland
2011	CEGL004041	*Uniola paniculata* - *Panicum amarum* var. *amarulum* - *Iva imbricata* Grassland
2012	CEGL004186	*Juncus roemerianus* Salt Marsh
2013	CEGL004953	*Fuirena scirpoides* - *Panicum tenerum* - *Dichanthelium wrightianum* - *Andropogon capillipes* Grassland

Table D1 (continued). List of plots and classified vegetation associations.

Plot Code	Classified code	Scientific name
2014	CEGL004110	*Fimbristylis castanea* - *Paspalum distichum* Marsh
2015	CEGL004057	*Schizachyrium maritimum* - (*Heterotheca subaxillaris*) Grassland
2016	CEGL004041	*Uniola paniculata* - *Panicum amarum* var. *amarulum* - *Iva imbricata* Grassland
2017	CEGL004041	*Uniola paniculata* - *Panicum amarum* var. *amarulum* - *Iva imbricata* Grassland
2018	CEGL004001	*Iva imbricata* / *Uniola paniculata* - *Helianthus debilis* ssp. *debilis* Grassland
2019	CEGL004041	*Uniola paniculata* - *Panicum amarum* var. *amarulum* - *Iva imbricata* Grassland
2020	CEGL003839	*Morella cerifera* / *Spartina patens* Wet Shrubland
2021	CEGL003824	*Quercus myrtifolia* - *Quercus geminata* - *Ceratiola ericoides* - *Conradina canescens* Shrubland
2022	CEGL004953	*Fuirena scirpoides* - *Panicum tenerum* - *Dichanthelium wrightianum* - *Andropogon capillipes* Grassland
2023	CEGL008456	*Typha domingensis* Salt Marsh
2024	CEGL004234	*Smilax auriculata* / *Heterotheca subaxillaris* - *Strophostyles helvola* - (*Uniola paniculata*) Grassland
2025	CEGL003824	*Quercus myrtifolia* - *Quercus geminata* - *Ceratiola ericoides* - *Conradina canescens* Shrubland
2026	CEGL008456	*Typha domingensis* Salt Marsh
2027	CEGL004234	*Smilax auriculata* / *Heterotheca subaxillaris* - *Strophostyles helvola* - (*Uniola paniculata*) Grassland
2028	CEGL004041	*Uniola paniculata* - *Panicum amarum* var. *amarulum* - *Iva imbricata* Grassland
2029	CEGL003813	*Ilex vomitoria* - *Quercus* (*geminata*, *virginiana*) - *Morella cerifera* - *Serenoa repens* Shrubland
2030	–	#N/A
2031	CEGL004962	*Panicum virgatum* - (*Cladium mariscus*, *Juncus roemerianus*) Salt Marsh
2032	CEGL004041	*Uniola paniculata* - *Panicum amarum* var. *amarulum* - *Iva imbricata* Grassland
2033	CEGL003813	*Ilex vomitoria* - *Quercus* (*geminata*, *virginiana*) - *Morella cerifera* - *Serenoa repens* Shrubland
2034	CEGL004186	*Juncus roemerianus* Salt Marsh
2035	CEGL004958	*Pinus elliottii* / *Spartina patens* - *Juncus roemerianus* - (*Panicum virgatum*) Tidal Woodland
2036	CEGL003656	*Pinus palustris* - (*Pinus elliottii*) / *Ilex coriacea* - *Cyrilla racemiflora* Woodland
2037	CEGL003656	*Pinus palustris* - (*Pinus elliottii*) / *Ilex coriacea* - *Cyrilla racemiflora* Woodland

Table D1 (continued). List of plots and classified vegetation associations.

Plot Code	Classified code	Scientific name
2038	CEGL003656	*Pinus palustris* - (*Pinus elliottii*) / *Ilex coriacea* - *Cyrilla racemiflora* Woodland
2039	CEGL003656	*Pinus palustris* - (*Pinus elliottii*) / *Ilex coriacea* - *Cyrilla racemiflora* Woodland
2040	CEGL003656	*Pinus palustris* - (*Pinus elliottii*) / *Ilex coriacea* - *Cyrilla racemiflora* Woodland
2041	CEGL003656	*Pinus palustris* - (*Pinus elliottii*) / *Ilex coriacea* - *Cyrilla racemiflora* Woodland
2042	CEGL003656	*Pinus palustris* - (*Pinus elliottii*) / *Ilex coriacea* - *Cyrilla racemiflora* Woodland
2043	–	#N/A
2044	CEGL004755	*Spartina patens* - *Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh
2045	CEGL004755	*Spartina patens* - *Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh
2046	CEGL008456	*Typha domingensis* Salt Marsh
2047	CEGL003947	*Chrysoma pauciflosculosa* - *Paronychia erecta* Dwarf Shrubland
2048	CEGL004057	*Schizachyrium maritimum* - (*Heterotheca subaxillaris*) Grassland
2049	CEGL004187	*Phragmites australis* ssp. *australis* Tidal Ruderal Marsh
2050	NPSGUIS002	*Uniola paniculata* Grassland
2051	CEGL004057	*Schizachyrium maritimum* - (*Heterotheca subaxillaris*) Grassland
2052	CEGL004755	*Spartina patens* - *Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh
2053	CEGL004186	*Juncus roemerianus* Salt Marsh
2054	CEGL003813	*Ilex vomitoria* - *Quercus* (*geminata*, *virginiana*) - *Morella cerifera* - *Serenoa repens* Shrubland
2055	CEGL004187	*Phragmites australis* ssp. australis Tidal Ruderal Marsh
2056	CEGL003920	*Baccharis halimifolia* - *Iva frutescens* - *Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland
2057	CEGL003813	*Ilex vomitoria* - *Quercus* (*geminata*, *virginiana*) - *Morella cerifera* - *Serenoa repens* Shrubland
2058	CEGL004755	*Spartina patens* - *Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh
2059	CEGL004755	*Spartina patens* - *Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh
2060	–	#N/A
2061	CEGL003920	*Baccharis halimifolia* - *Iva frutescens* - *Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland

Table D1 (continued). List of plots and classified vegetation associations.

Plot Code	Classified code	Scientific name
2062	CEGL004057	*Schizachyrium maritimum* - (*Heterotheca subaxillaris*) Grassland
2063	CEGL003920	*Baccharis halimifolia* - *Iva frutescens* - *Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland
2064	CEGL004962	*Panicum virgatum* - (*Cladium mariscus*, *Juncus roemerianus*) Salt Marsh
2065	CEGL004041	*Uniola paniculata* - *Panicum amarum* var. *amarulum* - *Iva imbricata* Grassland
2066	CEGL003920	*Baccharis halimifolia* - *Iva frutescens* - *Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland
2067	CEGL003920	*Baccharis halimifolia* - *Iva frutescens* - *Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland
2068	CEGL004186	*Juncus roemerianus* Salt Marsh
2069	CEGL004057	*Schizachyrium maritimum* - (*Heterotheca subaxillaris*) Grassland
2070	NPSGUIS001	*Panicum repens* Ruderal Grassland
2071	CEGL003839	*Morella cerifera* / *Spartina patens* Wet Shrubland
2072	NPSGUIS001	*Panicum repens* Ruderal Grassland
2073	CEGL004186	*Juncus roemerianus* Salt Marsh
2074	CEGL004755	*Spartina patens* - *Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh
2075	CEGL003839	*Morella cerifera* / *Spartina patens* Wet Shrubland
2076	CEGL004755	*Spartina patens* - *Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh
2077	CEGL004110	*Fimbristylis castanea* - *Paspalum distichum* Marsh
2078	CEGL004041	*Uniola paniculata* - *Panicum amarum* var. *amarulum* - *Iva imbricata* Grassland
2079	CEGL004755	*Spartina patens* - *Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh
2080	NPSGUIS002	*Uniola paniculata* Grassland
2081	NPSGUIS002	*Uniola paniculata* Grassland
2082	CEGL008456	*Typha domingensis* Salt Marsh
2083	–	#N/A
2084	NPSGUIS001	*Panicum repens* Ruderal Grassland
2085	CEGL003920	*Baccharis halimifolia* - *Iva frutescens* - *Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland
2086	CEGL004755	*Spartina patens* - *Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh

Table D1 (continued). List of plots and classified vegetation associations.

Plot Code	Classified code	Scientific name
2087	CEGL004041	*Uniola paniculata* - *Panicum amarum* var. *amarulum* - *Iva imbricata* Grassland
2088	CEGL004755	*Spartina patens* - *Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh
2089	CEGL008456	*Typha domingensis* Salt Marsh
2090	CEGL003920	*Baccharis halimifolia* - *Iva frutescens* - *Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland
2091	CEGL003920	*Baccharis halimifolia* - *Iva frutescens* - *Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland
2092	CEGL003813	*Ilex vomitoria* - *Quercus* (*geminata*, *virginiana*) - *Morella cerifera* - *Serenoa repens* Shrubland
2093	CEGL004755	*Spartina patens* - *Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh
2094	CEGL004186	*Juncus roemerianus* Salt Marsh
2095	CEGL004958	*Pinus elliottii* / *Spartina patens* - *Juncus roemerianus* - (*Panicum virgatum*) Tidal Woodland
2096	CEGL004680	*Pinus elliottii* / *Serenoa repens* - *Ilex glabra* - *Morella cerifera* - *Ilex vomitoria* Woodland
2097	CEGL003920	*Baccharis halimifolia* - *Iva frutescens* - *Morella cerifera* - (*Ilex vomitoria*) Saline Shrubland
2099	CEGL003839	*Morella cerifera* / *Spartina patens* Wet Shrubland
2100	NPSGUIS005	*Pinus elliottii* - *Quercus myrtifolia* - *Quercus geminata* Scrub Woodland
2101	CEGL003824	*Quercus myrtifolia* - *Quercus geminata* - *Ceratiola ericoides* - *Conradina canescens* Shrubland
2102	CEGL004680	*Pinus elliottii* / *Serenoa repens* - *Ilex glabra* - *Morella cerifera* - *Ilex vomitoria* Woodland
2103	CEGL004638	*Quercus nigra* Ruderal Forest
2104	CEGL008477	*Nyssa biflora* - *Liquidambar styraciflua* / *Magnolia virginiana* / *Hamamelis virginiana* - *Viburnum nudum* Swamp Forest
2105	CEGL007225	*Quercus alba* - *Carya glabra* - *Carya alba* / *Aesculus pavia* Forest
2107	CEGL008477	*Nyssa biflora* - *Liquidambar styraciflua* / *Magnolia virginiana* / *Hamamelis virginiana* - *Viburnum nudum* Swamp Forest
2108	CEGL004638	*Quercus nigra* Ruderal Forest
2109	CEGL004638	*Quercus nigra* Ruderal Forest
3001	CEGL008456	*Typha domingensis* Salt Marsh

Table D1 (continued). List of plots and classified vegetation associations.

Plot Code	Classified code	Scientific name
3002	CEGL003824	*Quercus myrtifolia* - *Quercus geminata* - *Ceratiola ericoides* - *Conradina canescens* Shrubland
3003	CEGL002386	*Nuphar advena* - *Nymphaea odorata* Aquatic Vegetation
3004	CEGL003813	*Ilex vomitoria* - *Quercus* (*geminata*, *virginiana*) - *Morella cerifera* - *Serenoa repens* Shrubland
3005	CEGL003824	*Quercus myrtifolia* - *Quercus geminata* - *Ceratiola ericoides* - *Conradina canescens* Shrubland
3006	CEGL004041	*Uniola paniculata* - *Panicum amarum* var. *amarulum* - *Iva imbricata* Grassland
3007	CEGL004041	*Uniola paniculata* - *Panicum amarum* var. *amarulum* - *Iva imbricata* Grassland
3008	CEGL004680	*Pinus elliottii* / *Serenoa repens* - *Ilex glabra* - *Morella cerifera* - *Ilex vomitoria* Woodland
3009	CEGL003656	*Pinus palustris* - (*Pinus elliottii*) / *Ilex coriacea* - *Cyrilla racemiflora* Woodland
3010	CEGL003656	*Pinus palustris* - (*Pinus elliottii*) / *Ilex coriacea* - *Cyrilla racemiflora* Woodland
4001	NPSGUIS004	Hurricane Impact Area
4002	NPSGUIS004	Hurricane Impact Area
4003	NPSGUIS004	Hurricane Impact Area
4004	NPSGUIS004	Hurricane Impact Area
4005	NPSGUIS004	Hurricane Impact Area
4006	NPSGUIS004	Hurricane Impact Area
4007	NPSGUIS004	Hurricane Impact Area
4009	NPSGUIS004	Hurricane Impact Area
4010	NPSGUIS004	Hurricane Impact Area
4011	CEGL003673	*Pinus elliottii* - (*Pinus serotina*) / *Aristida beyrichiana* - *Rhynchospora oligantha* - *Sarracenia* ssp. Woodland
4012	CEGL003638	*Pinus elliottii* / *Cliftonia monophylla* - *Cyrilla racemiflora* Swamp Woodland
4013	CEGL007718	*Carex striata* var. *striata* - *Xyris fimbriata* - *Lachnanthes caroliniana* Marsh
4015	CEGL003673	*Pinus elliottii* - (*Pinus serotina*) / *Aristida beyrichiana* - *Rhynchospora oligantha* - *Sarracenia* ssp. *Woodland*
4016	NPSGUIS005	*Pinus elliottii* - *Quercus myrtifolia* - *Quercus geminata* Scrub Woodland
4017	NPSGUIS005	*Pinus elliottii* - *Quercus myrtifolia* - *Quercus geminata* Scrub Woodland
4019	NPSGUIS005	*Pinus elliottii* - *Quercus myrtifolia* - *Quercus geminata* Scrub Woodland

Appendix E: Accuracy Assessment Contingency Tables

Table H1 shows the initial calculated accuracty assessment contingency values, and Table H2 shows the revised calculated accuracy assessment contingency table values.

Table H1. Initial/raw accuracy assessment contingency table. Row values are mapped classes and column values are classes assigned in the field.

Map Class Codes	MC101	MC102	MC103	MC104	MC105	MC106	MC107	MC108	MC109	MC110	MC111	MC112	MC113	MC114	MC115	MC201	MC202	MC203	MC204	MC205	MC301	MC302	MC303	MC304	MC305	MC306	MC307	MC308	MC309	MC310	MC311	MC312	MC401	MC402	ROW TOTAL (ni+)
MC101	25*	–	–	–	–	2	–	–	–	–	1	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	30
MC102	–	34*	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	35
MC103	–	4	27*	1	–	–	–	–	–	–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	32
MC104	1	–	–	14*	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	17
MC105	–	–	–	–	38*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	38
MC106	–	–	–	–	–	28*	–	–	–	2	–	1	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	32
MC107	–	–	–	–	–	1	21*	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	23
MC108	–	–	–	–	–	–	–	16*	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	17
MC109	–	–	–	–	–	–	–	–	10*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10
MC110	–	–	–	–	–	–	–	–	–	4*	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5
MC111	–	–	–	–	–	–	–	–	–	–	31*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	31
MC112	–	–	–	–	–	–	–	–	–	–	1	4*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5
MC113	–	–	1	–	1	–	–	–	–	–	2	–	26*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	31
MC114	–	–	–	–	–	–	–	–	–	–	–	–	–	1*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
MC115	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
MC201	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	21*	2	4	–	1	–	–	2	–	1	–	–	–	–	–	–	–	–	–	32
MC202	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	28*	–	–	1	2	–	–	–	–	–	–	–	–	–	–	–	–	–	31
MC203	1	–	–	–	1	–	–	–	1	–	–	–	–	–	–	2	–	26*	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	32
MC204	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
MC205	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	1	–	–	–	32*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	34
MC301	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	30*	–	–	–	–	–	–	–	–	–	–	–	–	–	31
MC302	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5*	–	–	–	–	–	–	–	–	–	–	–	–	5
MC303	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	30*	–	–	–	–	–	–	–	–	–	–	–	32
MC304	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	29*	–	–	–	1	–	1	–	–	–	–	32
MC305	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	2	–	18*	–	–	–	–	–	–	–	–	–	22
MC306	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2	1	–	–	–	–	1	–	–	24*	–	–	–	–	–	–	–	–	30
MC307	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10*	–	–	2	–	–	–	–	12
MC308	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	14*	–	1	–	–	–	–	18
MC309	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2*	–	–	–	–	–	2
MC310	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	12*	–	–	–	–	12
MC311	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1*	–	–	–	1
MC312	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1*	–	–	1
MC401	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	29*	–	31
MC402	–	5	2	–	–	–	–	–	–	–	1	–	2	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	20*	34
TOTAL (n_{+j})	27	44	32	15	41	32	21	16	12	6	39	5	28	1	1	28	33	37	2	35	33	5	36	29	19	27	10	15	2	16	1	1	31	21	701

* The map code for this cell is identical on that row (expected map code) and the for that column (map code assigned in the field) combintation (also with a gray background).

Table H2. Revised accuracy assessment contingency table. Row values are mapped classes and column values are classes assigned in the field.

Map Class Codes	MC101	MC102	MC103	MC104	MC105	MC106	MC107	MC108	MC109	MC110	MC111	MC112	MC113	MC114	MC115	MC201	MC202	MC203	MC204	MC205	MC301	MC302	MC303	MC304	MC305	MC306	MC307	MC308	MC309	MC310	MC311	MC312	MC401	MC402	TOTAL (ni+)
MC101	25*	–	–	–	–	2	–	–	–	–	1	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	30
MC102	–	35*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	35
MC103	1	–	30*	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	32
MC104	–	–	–	16*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	17
MC105	–	–	–	–	38*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	38
MC106	–	–	–	–	–	30*	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	32
MC107	–	–	–	–	–	–	22*	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	23
MC108	–	–	–	–	–	–	–	17*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	17
MC109	–	–	–	–	–	–	–	–	10*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10
MC110	–	–	–	–	–	–	–	–	–	4*	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5
MC111	–	–	–	–	1	–	–	–	–	–	29*	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	31
MC112	–	–	–	–	–	–	–	–	–	–	1	4*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5
MC113	–	–	1	–	1	–	–	–	–	–	1	–	27*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	31
MC114	–	–	–	–	–	–	–	–	–	–	–	–	–	1*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
MC115	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
MC201	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	28*	2	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	32
MC202	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	28*	–	–	1	2	–	–	–	–	–	–	–	–	–	–	–	–	–	31
MC203	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	1	–	30*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	32
MC204	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
MC205	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	1	–	–	–	32*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	34
MC301	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	31*	–	–	–	–	–	–	–	–	–	–	–	–	–	31
MC302	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5*	–	–	–	–	–	–	–	–	–	–	–	–	5
MC303	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	31*	–	–	–	–	–	–	–	–	–	–	–	32
MC304	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	29*	–	–	–	1	–	1	–	–	–	–	32
MC305	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	2	–	19*	–	–	–	–	–	–	–	–	–	22
MC306	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	28*	–	–	–	–	–	–	–	–	30
MC307	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	11*	–	–	1	–	–	–	–	12
MC308	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	15*	–	–	–	–	–	–	18
MC309	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2*	–	–	–	–	–	2
MC310	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	12*	–	–	–	–	12
MC311	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1*	–	–	–	1
MC312	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1*	–	–	1
MC401	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	29*	–	31
MC402	–	3	1	–	–	–	–	–	–	–	1	–	2	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	25*	34
Total (n_{+j})	26	39	33	17	41	32	22	17	11	6	35	4	29	1	1	34	30	34	2	34	34	5	35	29	19	31	11	16	2	14	1	1	29	26	701

* The map code for this cell is identical on that row (expected map code) and the for that column (map code assigned in the field) combintation (also with a gray background).

Appendix F: Photo Signature Interpretation Guide

Panicum repens Ruderal Grassland

Map Class Code: MC101

Color: reds, bright pinks, tans, browns

Texture: smooth to coarse

Crown Size: n/a

Crown Shape: n/a

Density: low

Notes: Variety of textures and colors within *Panicum repens* ruderal grasslands, an overall pinkish tint is usually present that differentiates itself from the surrounding landscape.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, 2016 USACE NCMP LiDAR Data (Figure F1).

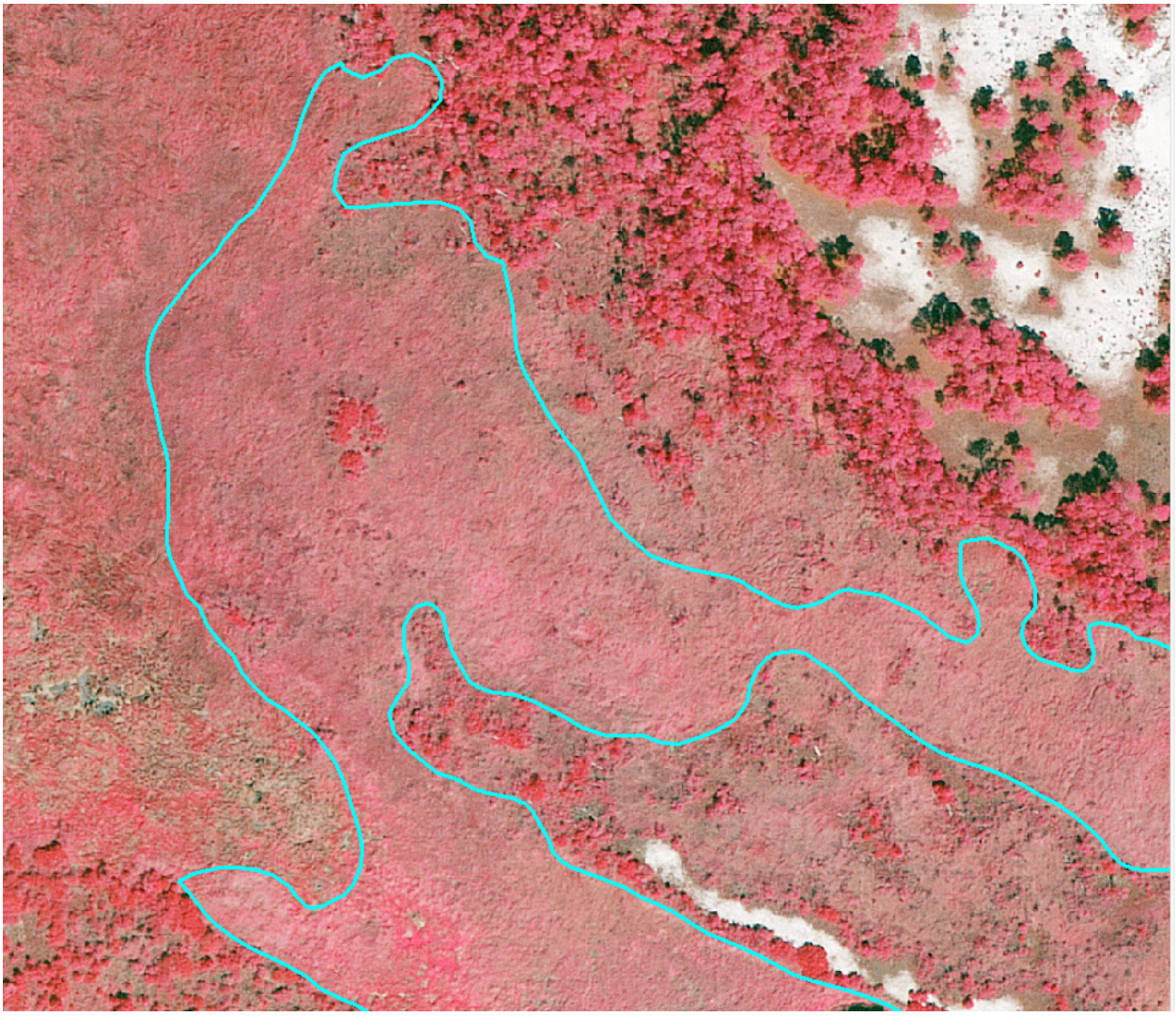


Figure F1. Photo signature example of the MC101 *Panicum repens* Ruderal Grassland map class.

Uniola paniculata – Panicum amarum var*. amarulum - Iva imbricata* Grassland

Map Class Code: MC102

Color: tan, brown, sand, red

Texture: Coarse

Crown Size: n/a

Crown Shape: n/a

Density: low

Notes: Very sparse looking on imagery, sometimes appearing very similar to bare sand, usually confirmed through site visits

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 NOAA NGS Post Nate Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F2).



Figure F2. Photo signature example of the MC102 *Uniola paniculata* – *Panicum amarum* var. *amarulum* – *Iva imbricata* Grassland map class.

Schizachyrium maritimum - (*Heterotheca subaxillaris*) Grassland

Map Class Code: MC103

Color: brown, tan, traces of pink

Texture: coarse

Crown Size: n/a

Crown Shape: n/a

Density: low

Notes: Very sparse and patchy on imagery, sometimes appearing similar to bare sand, typically browner then MC102, usually confirmed through site visits.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 NOAA NGS Post Nate Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F3).

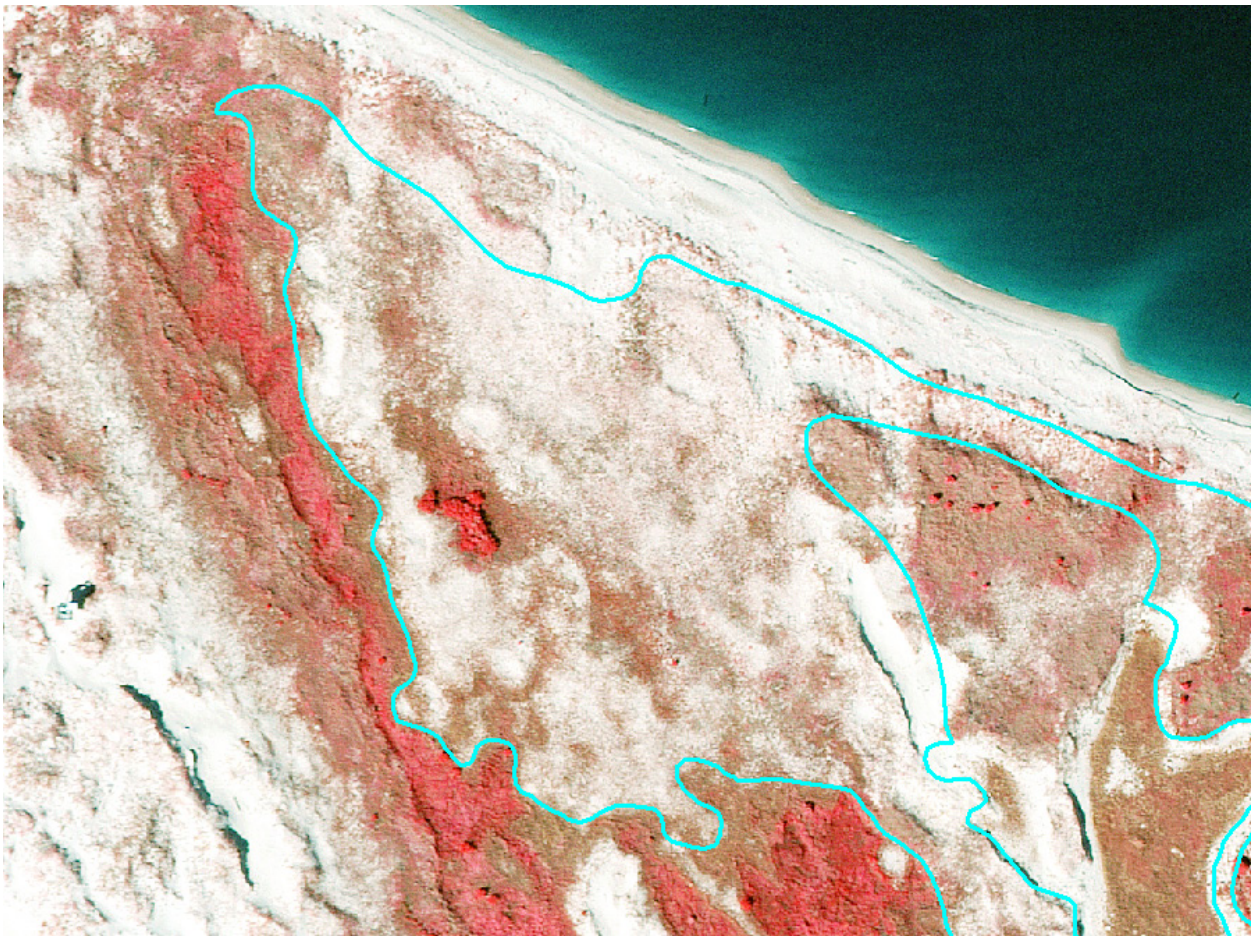


Figure F3. Photo signature example of the MC103 *Schizachyrium maritimum* – (*Heterotheca subaxillaris*) Grassland map class.

Smilax auriculata / Heterotheca subaxillaris - Strophostyles helvola - (*Uniola paniculata*) Grassland

Map Class Code: MC104

Color: brown, tan, pink, red, green

Texture: coarse

Crown Size: n/a

Crown Shape: n/a

Density: low

Notes: Patchy, with some bare sand and some bright red clusters of *Smilax auriculata*.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data. (Figure F4).

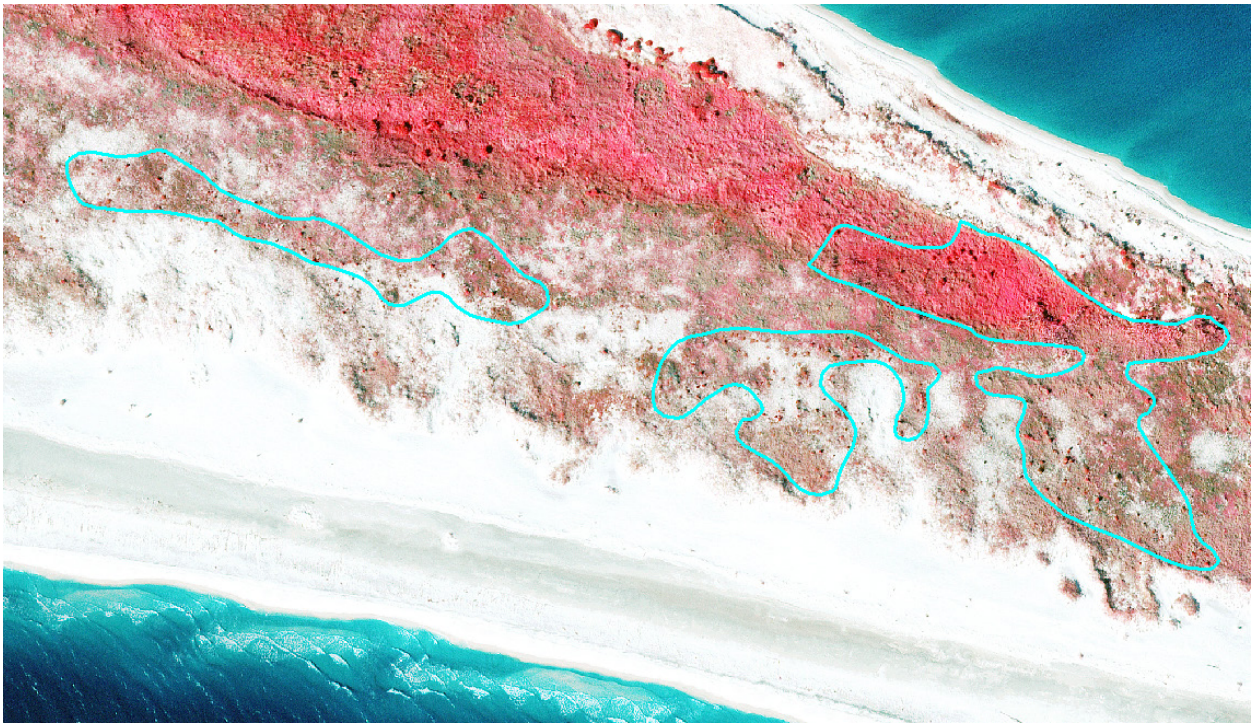


Figure F4. Photo signature example of the MC104 *Smilax auriculata* / *Heterotheca subaxillaris* – *Strophostyles helvola* - (*Uniola paniculata*) Grassland map class.

Fuirena scirpoidea - Panicum tenerum - Dichanthelium wrightianum - Andropogon capillipes **Grassland**

Map Class Code: MC105

Color: brown, yellow, tan, pink

Texture: smooth to coarse

Crown Size: n/a

Crown Shape: n/a

Density: medium

Notes: large brown patches, often against bare sand, occurring within the low spot of an interdunal depression.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F5).

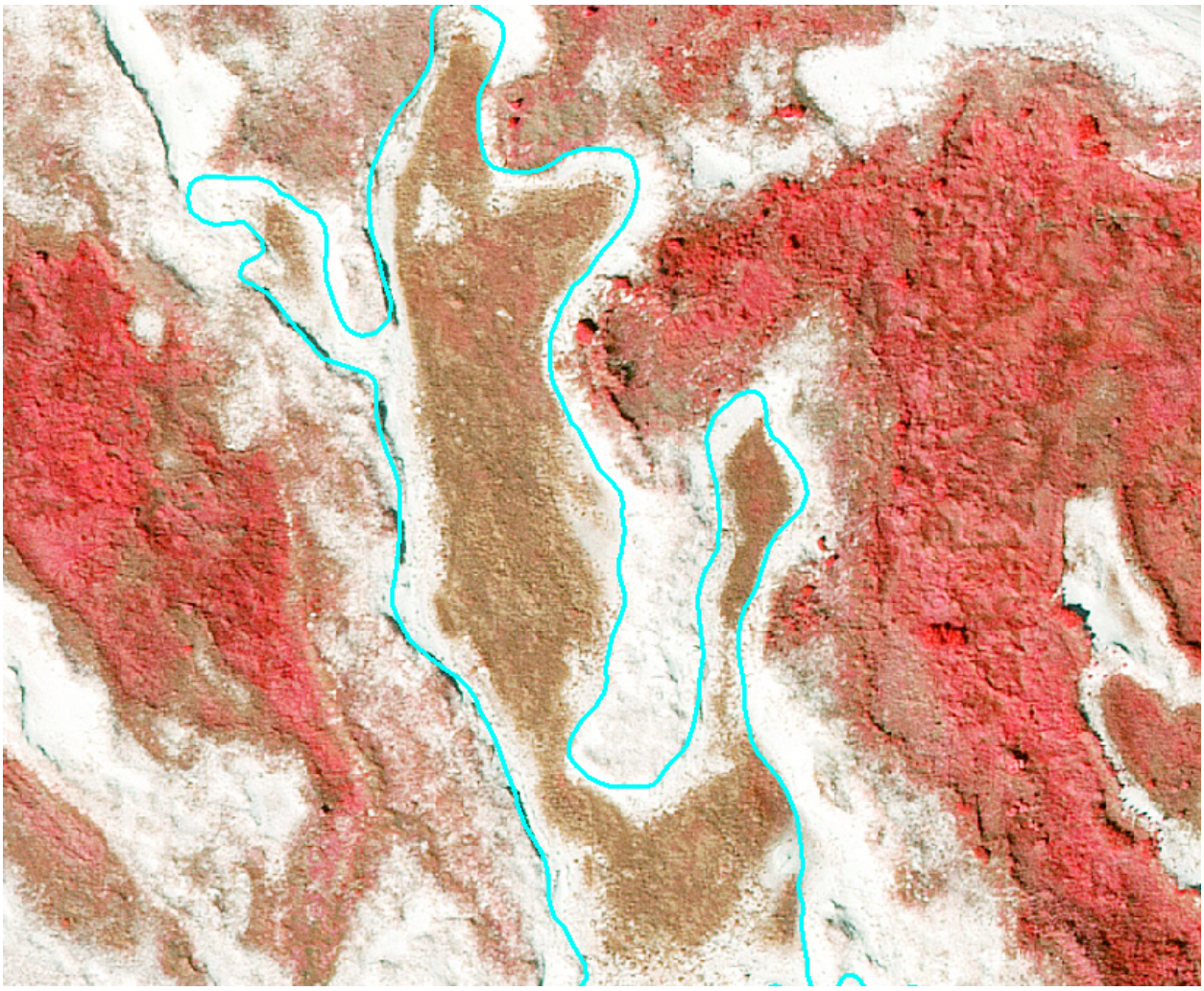


Figure F5. Photo signature example of the MC105 *Fuirena scirpoidea - Panicum tenerum - Dichanthelium wrightianum - Andropogon capillipes* Grassland map class.

Juncus roemerianus Salt Marsh

Map Class Code: MC106

Color: brown, pink, tan, red, black

Texture: Coarse

Crown Size: n/a

Crown Shape: n/a

Density: High

Notes: Dense wetland vegetation, greener then other wetland types, sometimes with patches of open water, variable texture.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F6).

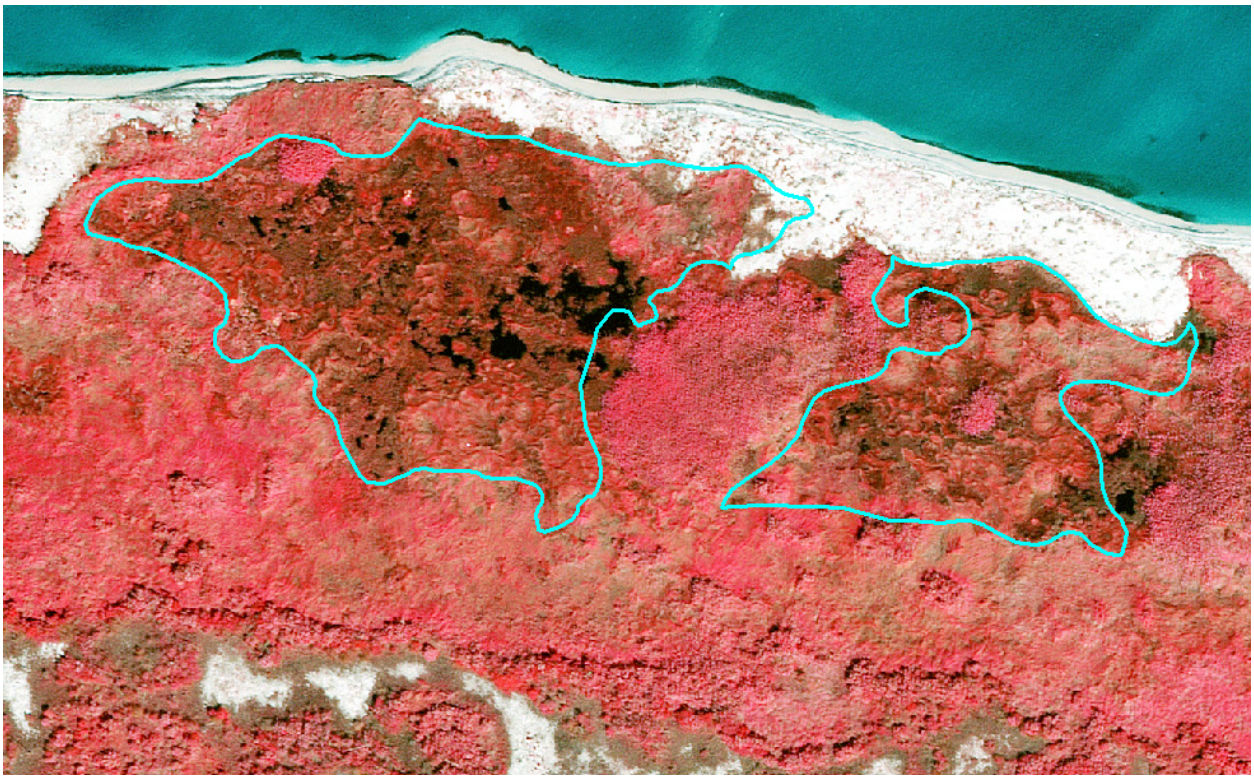


Figure F6. Photo signature example of the MC106 *Juncus roemerianus* Salt Marsh map class.

Typha domingensis Tidal Marsh

Map Class Code: MC107

Color: pink, green, tan, blue, brown

Texture: Coarse

Crown Size: n/a

Crown Shape: n/a

Density: Medium

Notes: Dense wetland vegetation, sometimes with patches of open water, variable texture.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data. (Figure A7).

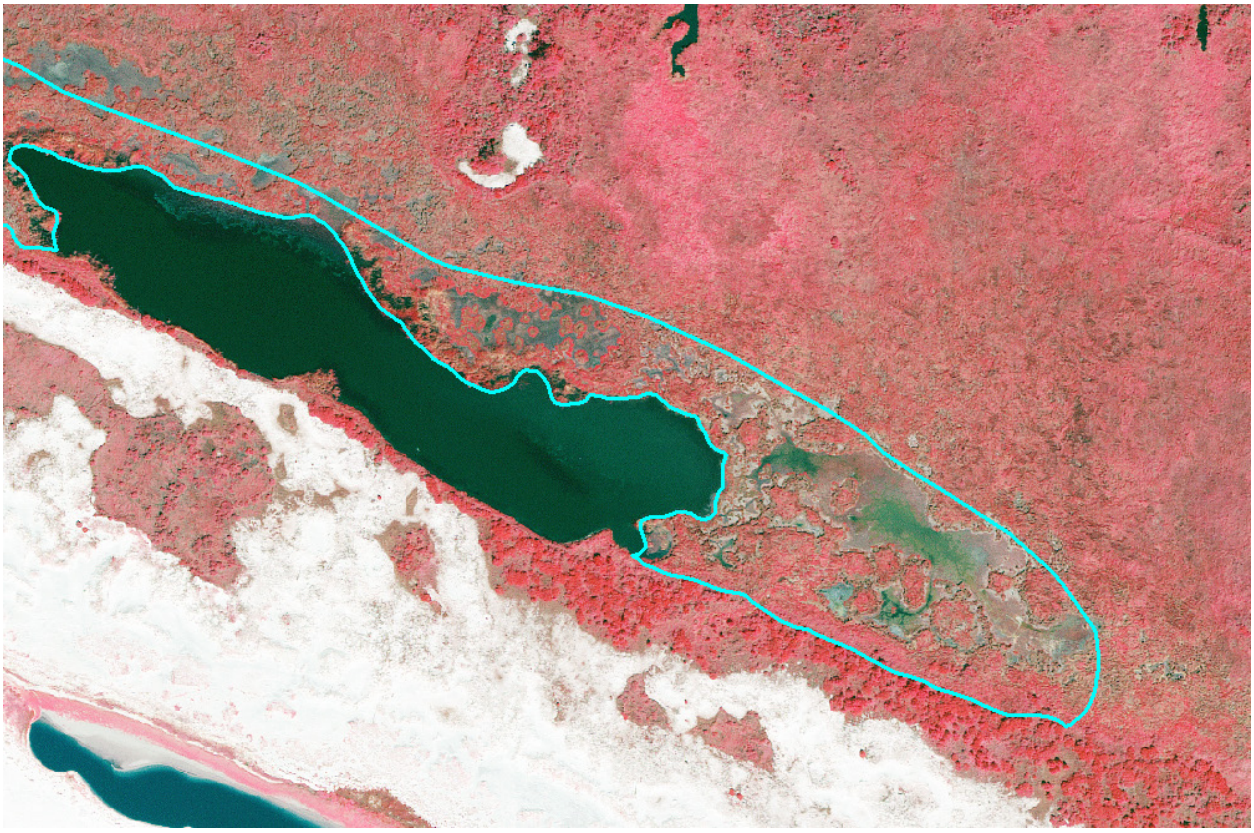


Figure F7. Photo signature example of the MC107 *Typha domingensis* Tidal Marsh map class.

Cladium mariscus Tidal Salt Marsh

Map Class Code: MC108

Color: yellow, brown, red, tan, pink

Texture: Smooth

Crown Size: n/a

Crown Shape: n/a

Density: Medium

Notes: Tall herbaceous wetlands, largely open without woody cover.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F8).

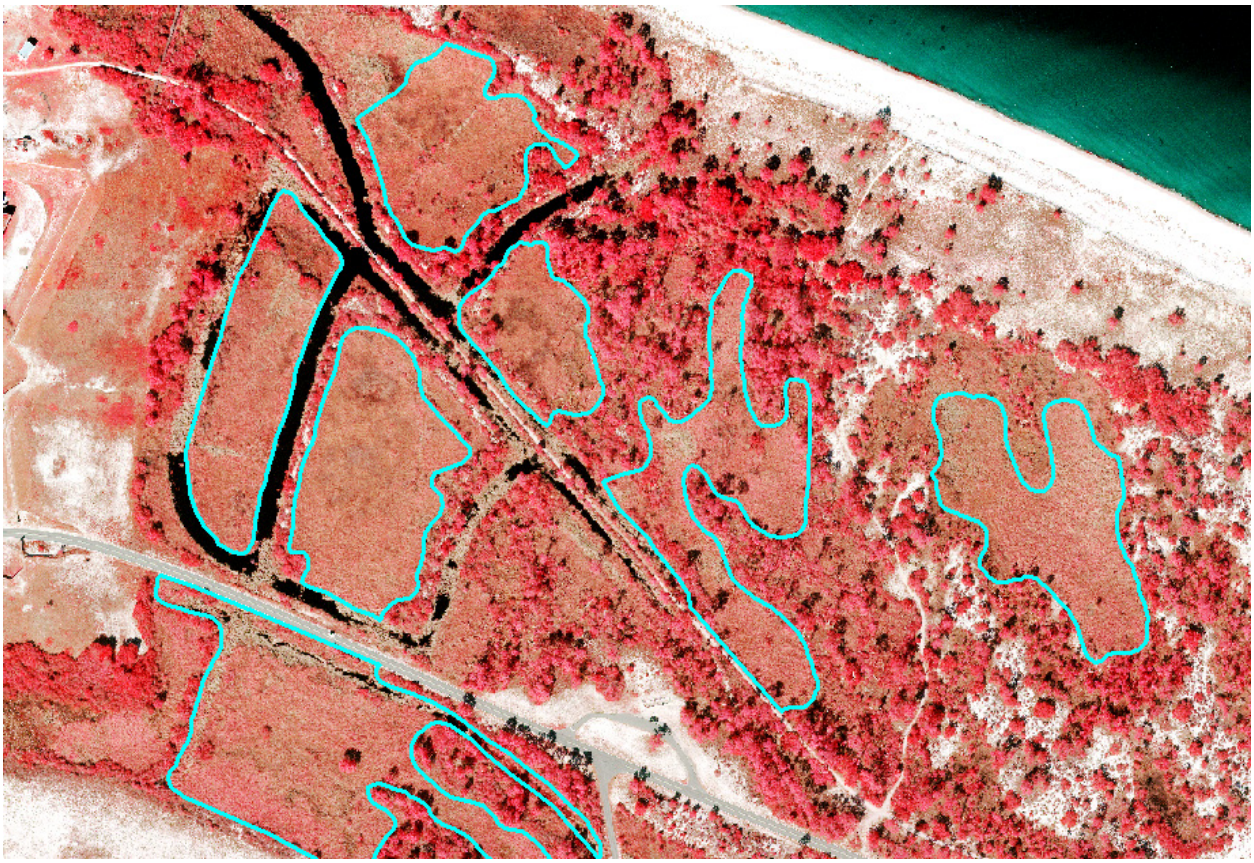


Figure F8. Photo signature example of the MC108 *Cladium mariscus* Tidal Salt Marsh map class.

Phragmites australis ssp. *australis* Tidal Ruderal Marsh

Map Class Code: MC109

Color: brown, tan, Gray, red, pink

Texture: Coarse

Crown Size: n/a

Crown Shape: n/a

Density: Medium

Notes: LiDAR data used to distinguish height breaks between *Phargmites* patches and other wetland areas.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F9).

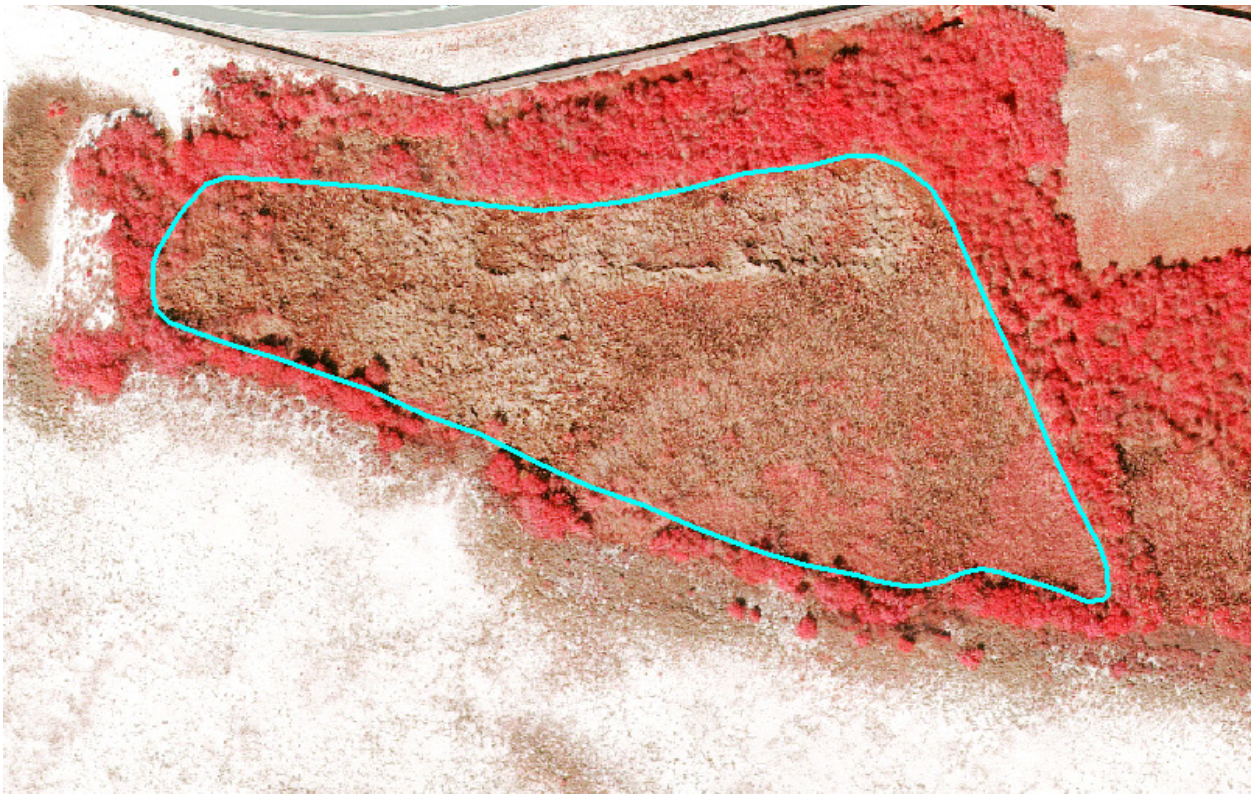


Figure F9. Photo signature example of the MC109 *Phragmites australis* ssp. *australis* Tidal Ruderal Marsh map class.

Panicum virgatum - (*Cladium mariscus*, *Juncus roemerianus*) Salt Marsh

Map Class Code: MC110

Color: red, pink, gray, brown

Texture: Coarse

Crown Size: n/a

Crown Shape: n/a

Density: High

Notes: Density and texture variable, typically confirmed through site visits.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F10).

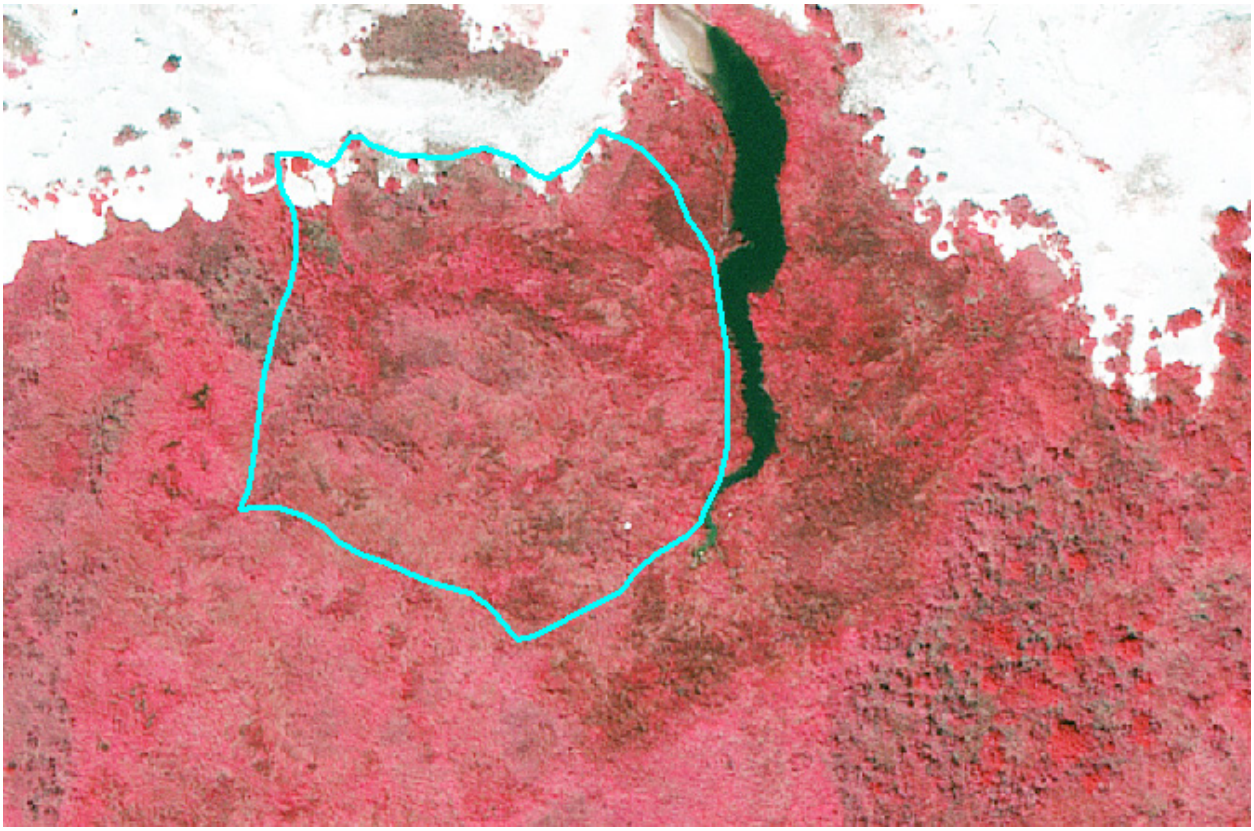


Figure F10. Photo signature example of the MC110 *Panicum virgatum* - (*Cladium mariscus*, *Juncus roemerianus*) Salt Marsh map class.

Spartina patens - *Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh

Map Class Code: MC111

Color: pink, tan, gray, brown

Texture: Smooth to Coarse

Crown Size: n/a

Crown Shape: n/a

Density: Medium

Notes: Small patches of open water usually present, "cowlick" texture of *Spartina patens* usually present.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, 2016 USACE NCMP LiDAR Data (Figure F11).

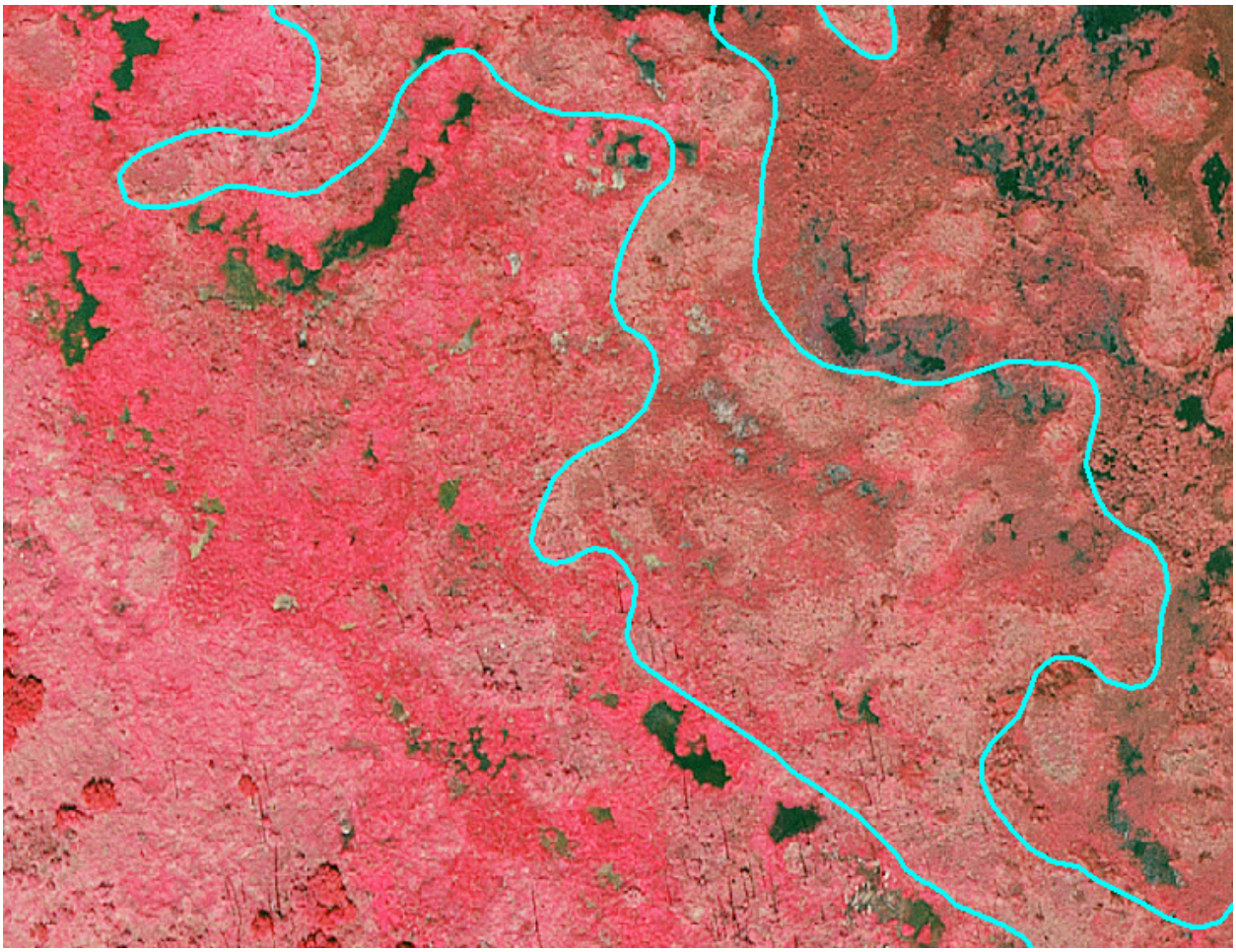


Figure F11. Photo signature example of the MC111 *Spartina patens* - *Schoenoplectus* (*americanus*, *pungens*) - (*Distichlis spicata*) Salt Marsh map class.

Spartina alterniflora - Juncus roemerianus - Distichlis spicata Tidal Salt Marsh

Map Class Code: MC112

Color: red, pink, Blue, green, brown

Texture: Coarse

Crown Size: n/a

Crown Shape: n/a

Density: Medium

Notes: patches of open water common.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F12).



Figure F12. Photo signature example of the MC112 *Spartina alterniflora - Juncus roemerianus - Distichlis spicata* Tidal Salt Marsh map class.

Fimbristylis castanea - Paspalum distichum Marsh

Map Class Code: MC113

Color: brown, green, tan

Texture: Smooth

Crown Size: n/a

Crown Shape: n/a

Density: High

Notes: flooded herbaceous marsh.

Imagery Used: 2017 NOAA NGS Post Nate Imagery, 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F13).



Figure F13. Photo signature example of the MC113 *Fimbristylis castanea - Paspalum distichum* Marsh map class.

Carex striata var. *striata - Xyris fimbriata - Lachnanthes caroliana* Marsh

Map Class Code: MC114

Color: red, pink, brown, tan

Texture: Smooth to Coarse

Crown Size: n/a

Crown Shape: n/a

Density: Medium

Notes: Vegetation community occurred in one area within the park that was confirmed through site visits.

Imagery Used: 2014 and 2016 Hexagon Imagery (Figure F14).

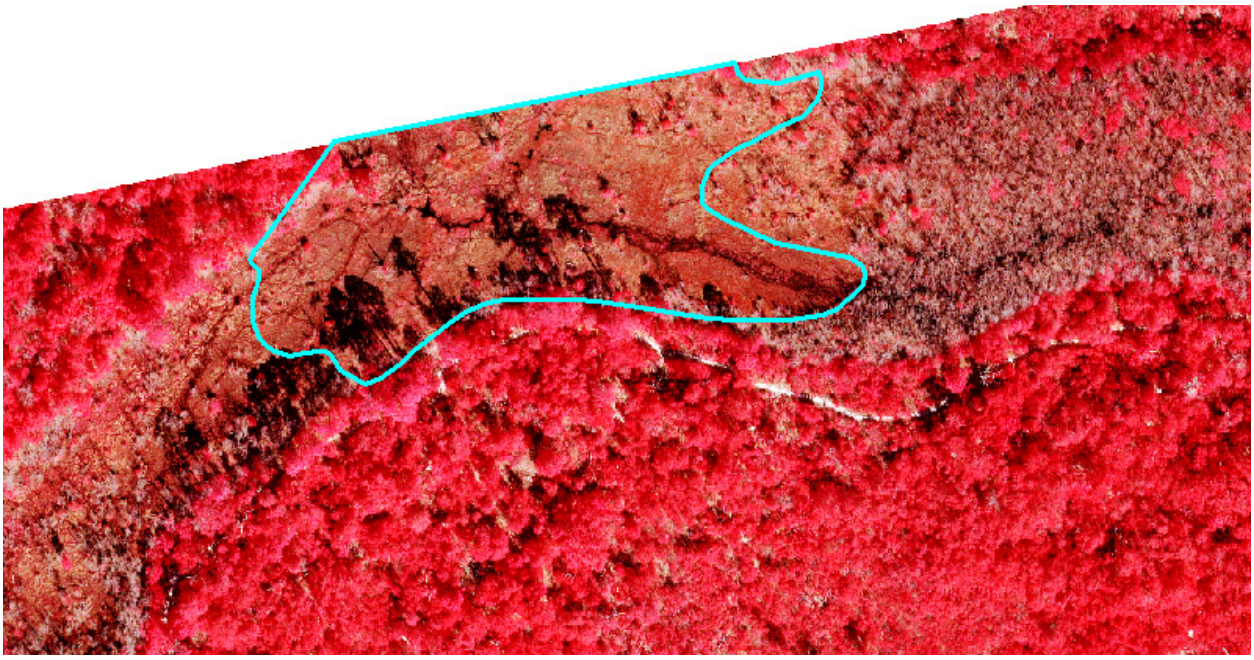


Figure F14. Photo signature example of the MC114 *Carex striata* var. *striata - Xyris fimbriata - Lachnanthes caroliana* Marsh map class.

Nuphar advena - Nymphaea odorata Aquatic Vegetation

Map Class Code: MC115

Color: black, green, gray, brown

Texture: Smooth to Coarse

Crown Size: n/a

Crown Shape: n/a

Density: Medium

Notes: Vegetation community occurred in one area within the park that was confirmed through site visits.

Imagery Used: 2016 FL 15cm Imagery (Figure A15).

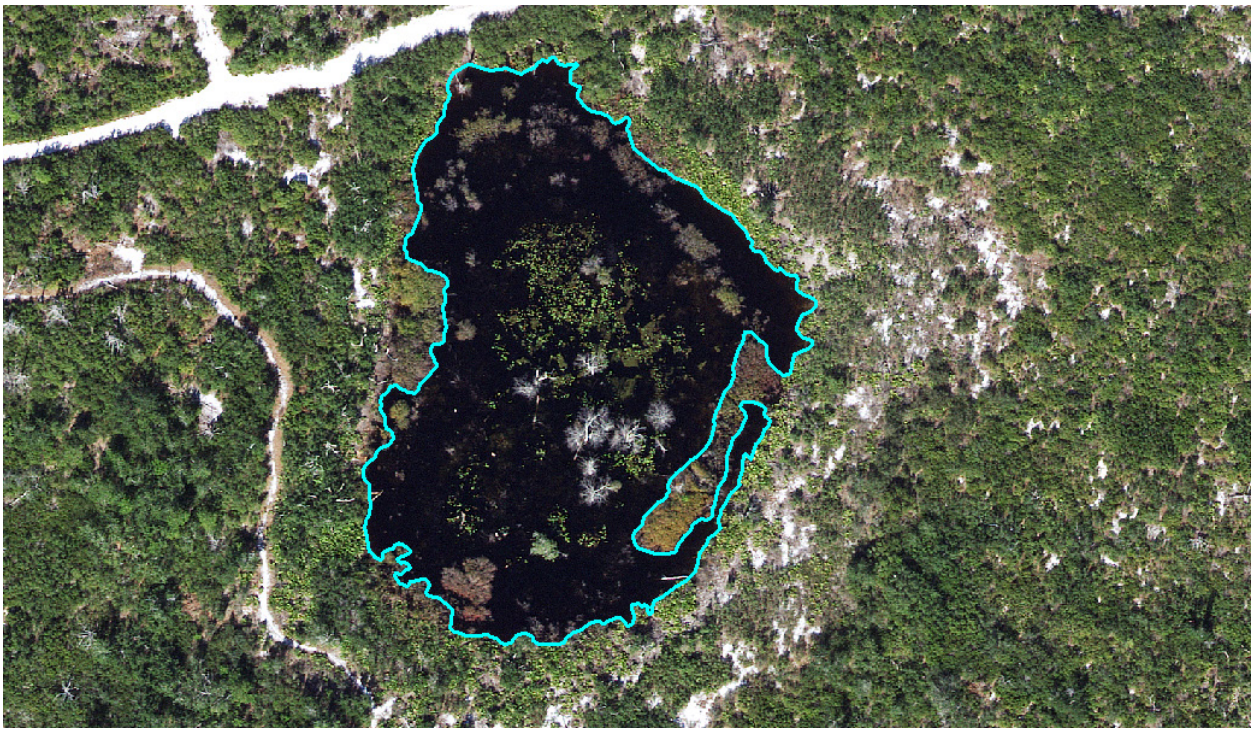


Figure F15. Photo signature example of the MC115 *Nuphar advena - Nymphaea odorata* Aquatic Vegetation map class.

Ilex vomitoria - Quercus (*geminata, virginiana*) *- Morella cerifera - Serenoa repens* Shrubland

Map Class Code: MC201

Color: tan, red, brown

Texture: moderate

Crown Size: n/a

Crown Shape: n/a

Density: low

Notes: Sparse shrubland usually near coastlines or alongside marshes, LiDAR used to confirm height thresholds.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F16).

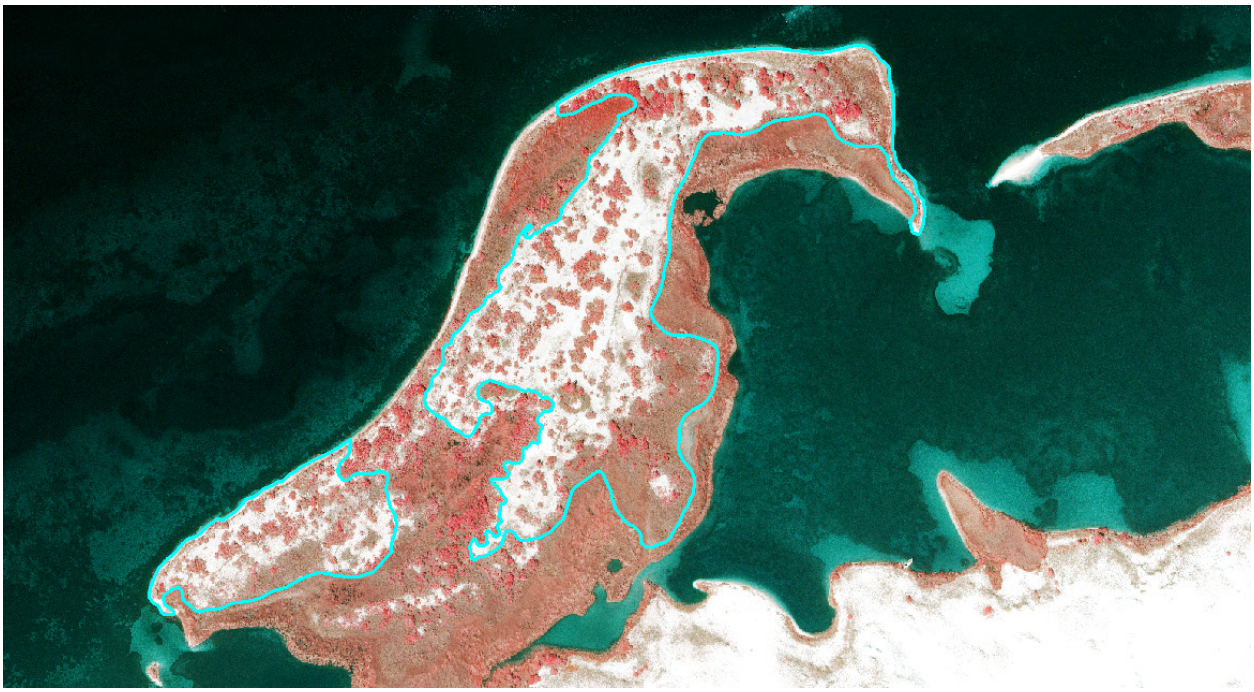


Figure F16. Photo signature example of the MC201 *Ilex vomitoria - Quercus* (*geminata*, *virginiana*) - *Morella cerifera - Serenoa repens* Shrubland map class.

Quercus myrtifolia - Quercus geminata - Ceratiola ericoides - Conradina canescens Shrubland

Map Class Code: MC202

Color: red, pink, brown, copper

Texture: moderate

Crown Size: n/a

Crown Shape: n/a

Density: medium

Notes: LiDAR data used to distinguish height thresholds and determine *Pinus clausa* abundance.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F7).



Figure F17. Photo signature example of the MC202 *Quercus myrtifolia - Quercus geminata - Ceratiola ericoides - Conradina canescens* Shrubland map class.

Baccharis halimifolia - Morella cerifera - (Ilex vomitoria) Saline Shrubland

Map Class Code: MC203

Color: brown, dark red, tan, pink

Texture: moderate

Crown Size: n/a

Crown Shape: n/a

Density: low

Notes: Sparse shrubland usually near coastlines or alongside marshes, LiDAR used to confirm height thresholds.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figur F18).



Figure F18. Photo signature example of the MC203 *Baccharis halimifolia - Morella cerifera -* (*Ilex vomitoria*) Saline Shrubland map class.

Cyrilla racemiflora - Lyonia lucida Wet Shrubland

Map Class Code: MC204

Color: copper, brown, pink, black, white, orange

Texture: Coarse

Crown Size: Small

Crown Shape: Round

Density: Medium

Notes: Wet shrubland usually occurring in shallow depression, LiDAR data used to confirm height thresholds, LiDAR DEM also used to locate shallow depressions.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F19).



Figure F19. Photo signature example of the MC204 *Cyrilla racemiflora - Lyonia lucida* Wet Shrubland map class.

Ceratiola ericoides - Chrysoma pauciflosculosa Shrubland

Map Class Code: MC205

Color: brown, tan, red, pink

Texture: Coarse

Crown Size: n/a

Crown Shape: n/a

Density: Low

Notes: Low growing shrubland, usually sparse with sand under vegetation, confirmed through site visits.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure 20).



Figure F20. Photo signature example of the MC205 *Ceratiola ericoides - Chrysoma pauciflosculosa* Shrubland map class.

Pinus clausa / *Quercus geminata - Quercus myrtifolia - Conradina canescens* Woodland

Map Class Code: MC301

Color: green, light green, copper, brown, gray

Texture: Coarse

Crown Size: Small

Crown Shape: Irregular

Density: Medium

Notes: LiDAR data used to confirm pine abundance, site visits used to confirm pine species.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F21).

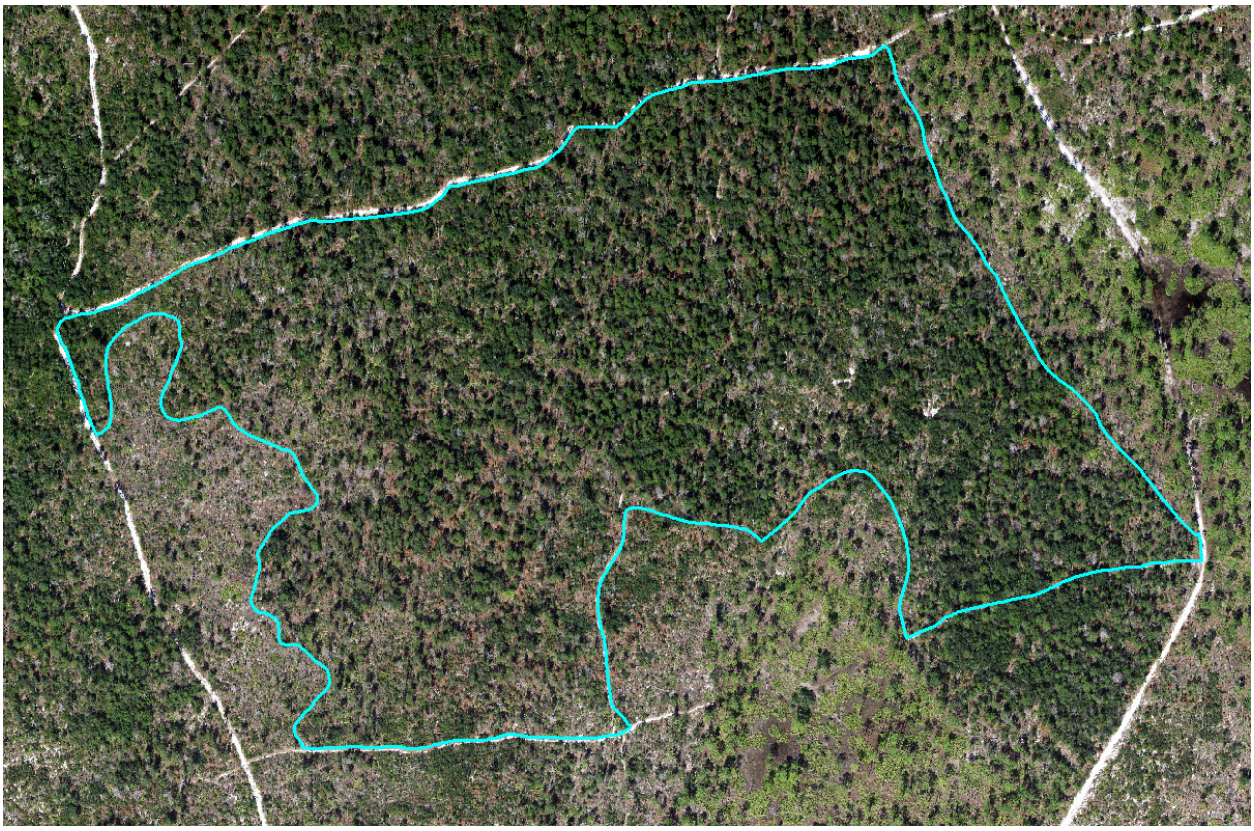


Figure F21. Photo signature example of the MC301 *Pinus clausa* / *Quercus geminata* - *Quercus myrtifolia* - *Conradina canescens* Woodland map class.

Pinus elliottii / *Cliftonia monophylla* - *Cyrilla racemiflora* Swamp Woodland

Map Class Code: MC302

Color: green, light green, tan, black

Texture: Coarse

Crown Size: Small

Crown Shape: Round

Density: Medium

Notes: Wet woodland usually occurring in shallow depression, LiDAR data used to confirm height thresholds, LiDAR DEM also used to locate shallow depressions. Usually thinner canopy over standing water.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F22).



Figure F22. Photo signature example of the MC302 *Pinus elliottii* / *Cliftonia monophylla - Cyrilla racemiflora* Swamp Woodland map class.

Pinus elliottii / *Serenoa repens - Ilex vomitoria* Woodland

Map Class Code: MC303

Color: light green, green, tan, brown

Texture: Coarse

Crown Size: Moderate

Crown Shape: Irregular

Density: Medium

Notes: LiDAR data used to confirm pine abundance, site visits used to confirm pine species, upper canopy usually 60% cover or less, litter and bare sand often underneath.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F23).



Figure F23. Photo signature example of the MC303 *Pinus elliottii* / *Serenoa repens - Ilex vomitoria* Woodland map class.

Pinus elliottii - (*Pinus palustris*) / *Ilex vomitoria - Serenoa repens - Morella cerifera* Woodland

Map Class Code: MC304

Color: Light green, green, tan, brown, gray, copper

Texture: Coarse

Crown Size: Moderate to Small

Crown Shape: Irregular

Density: Low to High

Notes: LiDAR data used to confirm pine abundance, site visits used to confirm pine species, canopy density and composition highly variable.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F24).

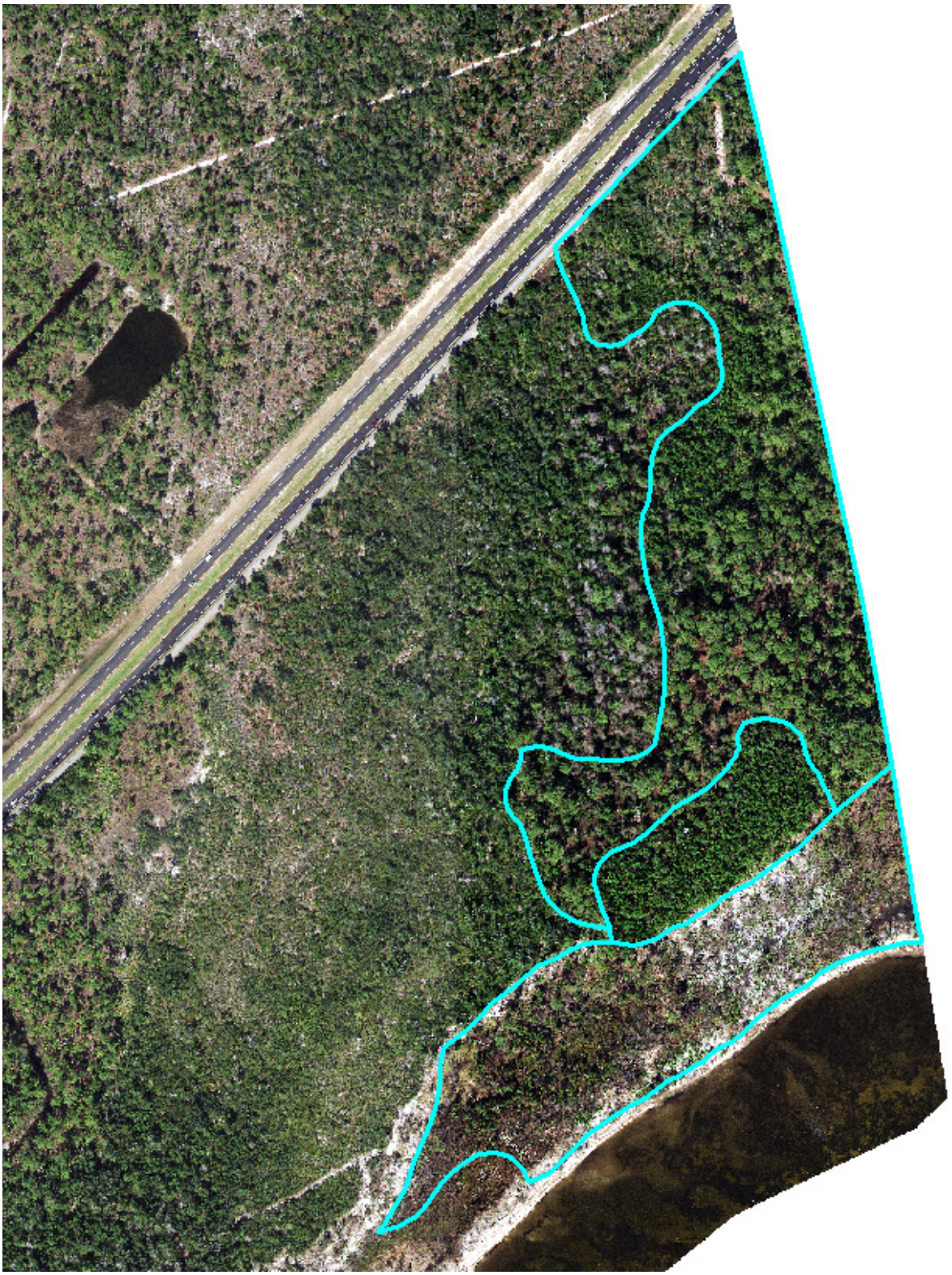


Figure F24. Photo signature example of the MC304 *Pinus elliottii* - (*Pinus palustris*) / *Ilex vomitoria* - *Serenoa repens* - *Morella cerifera* Woodland map class.

Pinus elliottii - (*Quercus myrtifolia*) - *Quercus geminata* Scrub Woodland
Map Class Code: MC305

Color: light green, green, tan, brown, copper

Texture: Coarse

Crown Size: Moderate to Small

Crown Shape: Irregular or round

Density: Medium

Notes: LiDAR data used to confirm pine abundance, site visits used to confirm pine species.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F25).

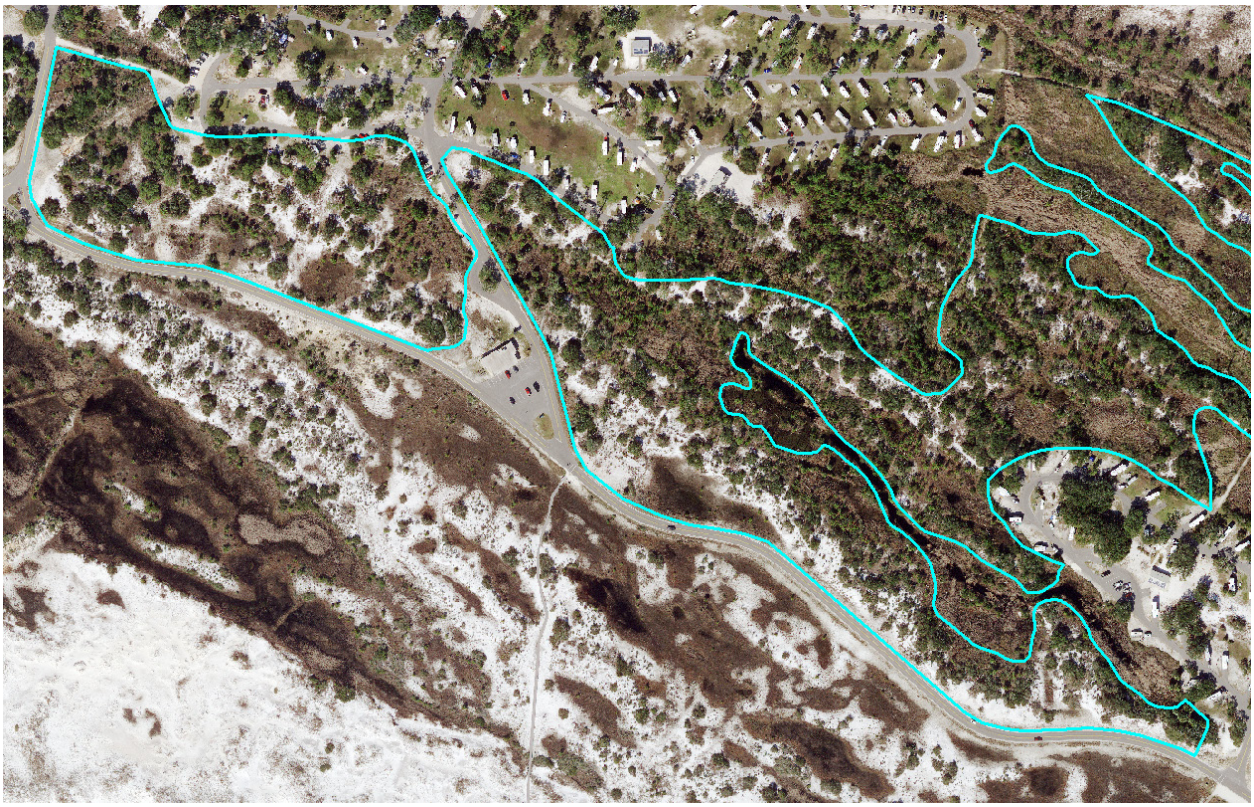


Figure F25. Photo signature example of the MC305 *Pinus elliottii* - (*Quercus myrtifolia*) - *Quercus geminata* Scrub Woodland map class.

Quercus geminata - Quercus virginana / *Serenoa repens - Ilex vomitoria* Forest
Map Class Code: MC306

Color: light green, green, gray, yellow

Texture: Coarse

Crown Size: Moderate

Crown Shape: Irregular

Density: Medium

Notes: LiDAR data used to confirm lack of pine abundance, canopy dieback from salt spray is typically evident.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F26).



Figure F26. Photo signature example of the MC306 *Quercus geminata - Quercus virginana / Serenoa repens - Ilex vomitoria* Forest map class.

Quercus virginiana - (*Pinus elliottii*, *Sabal palmetto*) / *Persea borbonia - Callicarpa americana* Forest

Map Class Code: MC307

Color: red, pink, tan

Texture: Coarse

Crown Size: Moderate to Large

Crown Shape: Irregular

Density: High

Notes: LiDAR data used to confirm pine abundance, canopy dieback from salt spray is typically evident.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F27).



Figure F27. Photo signature example of the MC307 *Quercus virginiana* - (*Pinus elliottii*, *Sabal palmetto*) / *Persea borbonia* - *Callicarpa americana* Forest map class.

Nyssa biflora - *Magnolia virginiana* - (*Pinus elliottii*) / *Morella* (*caroliniensis*, *inodora*) Swamp Forest

Map Class Code: MC308

Color: green, light green, brown, tan

Texture: Coarse

Crown Size: Moderate

Crown Shape: Round

Density: High

Notes: Wet forest usually occurring in shallow depression, LiDAR data used to confirm height thresholds, LiDAR DEM also used to locate shallow depressions, canopy dieback from salt spray is typically evident, community type confirmed through site visits.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F28).



Figure F28. Photo signature example of the MC308 *Nyssa biflora* - *Magnolia virginiana* - (*Pinus elliottii*) / Morella (*caroliniensis*, *inodora*) Swamp Forest map class.

Nyssa aquatica Swamp Forest

Map Class Code: MC309

Color: green, gray, brown, tan

Texture: Coarse

Crown Size: Moderate

Crown Shape: Irregular

Density: High

Notes: Wet forest usually occurring in shallow depression, LiDAR data used to confirm height thresholds, LiDAR DEM also used to locate shallow depressions, wintertime leaf-off image used to delineate community boundary, community type confirmed through site visits.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F29).

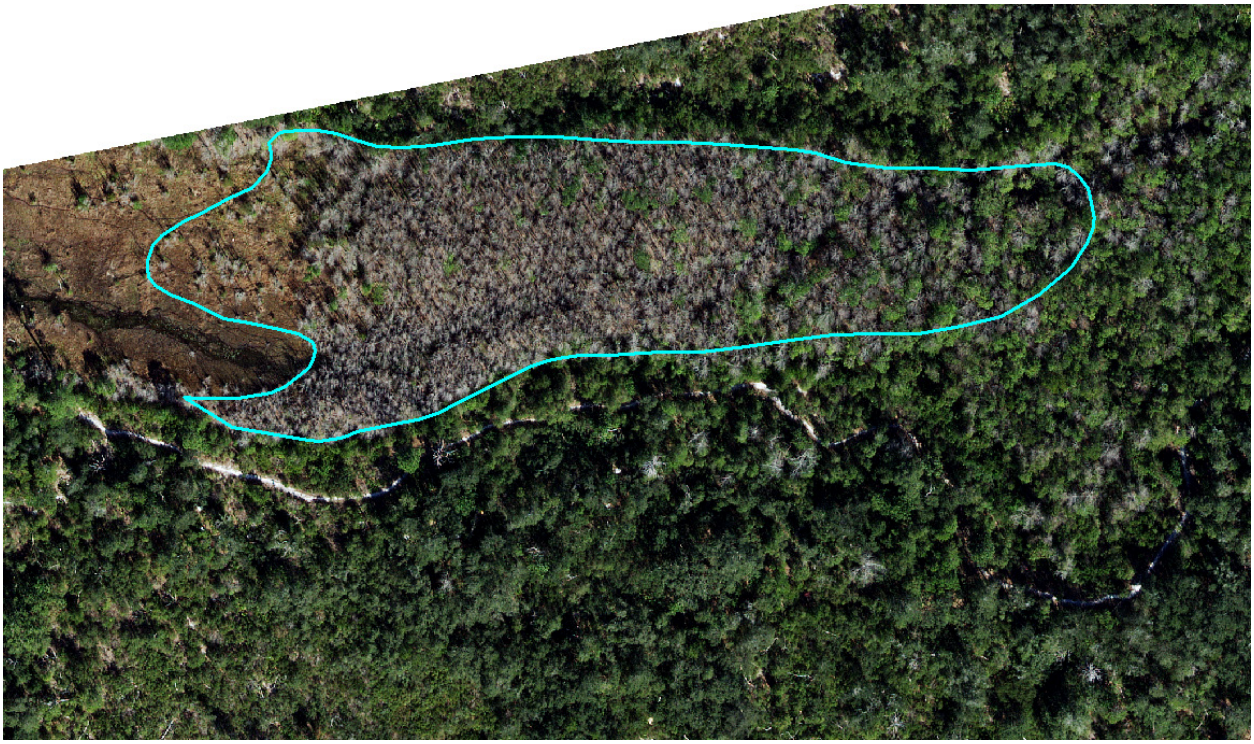


Figure F29. Photo signature example of the MC309 *Nyssa aquatica* Swamp Forest map class.

Quercus nigra Ruderal Forest

Map Class Code: MC310

Color: red, pink, tan

Texture: Coarse

Crown Size: Moderate

Crown Shape: Irregular

Density: High

Notes: LiDAR data used to confirm lack of pine abundance, community type confirmed through site visit.

Imagery Used: 2014 Hexagon Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F30).

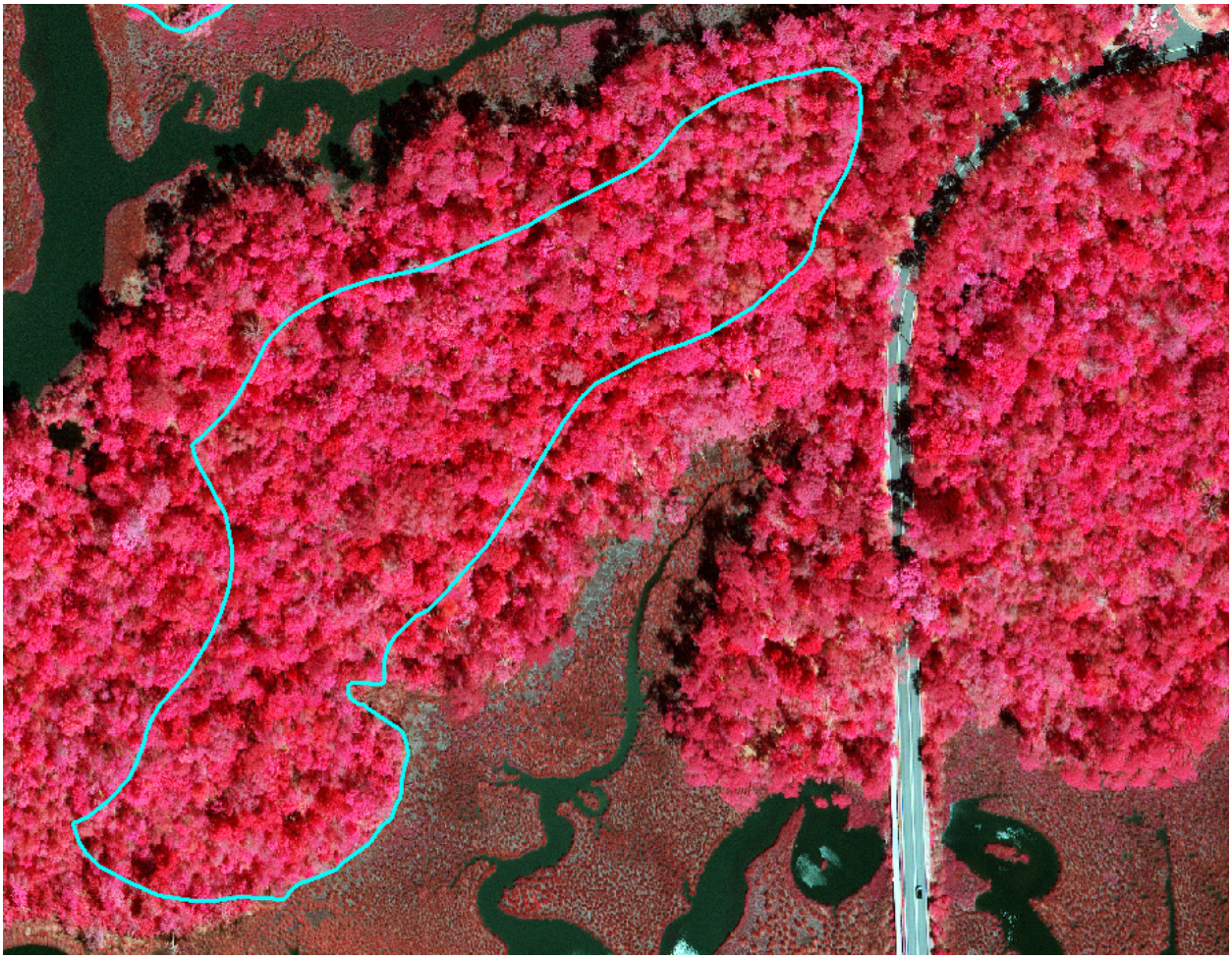


Figure F30. Photo signature example of the MC310 *Quercus nigra* Ruderal Forest map class.

Quercus alba - Carya glabra - Carya tomentosa / *Aesculus pavia* Forest

Map Class Code: MC311

Color: red, pink, tan

Texture: Coarse

Crown Size: Moderate to High

Crown Shape: Irregular

Density: High

Notes: LiDAR data used to confirm lack of pine abundance, community type confirmed through site visit.

Imagery Used: 2014 Hexagon Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data. (Figure F31).



Figure F31. Photo signature example of the MC311 *Quercus alba - Carya glabra - Carya tomentosa / Aesculus pavia* Forest map class.

Fagus grandifolia - Magnolia grandiflora - Quercus michauxii - Quercus nigra / Rhododendron canescens Forest

Map Class Code: MC312

Color: red, pink, tan, gray

Texture: Coarse

Crown Size: Moderate

Crown Shape: Irregular to Round

Density: High

Notes: LiDAR data used to confirm lack of pine abundance, community type confirmed through site visit.

Imagery Used: 2014 Hexagon Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F32).

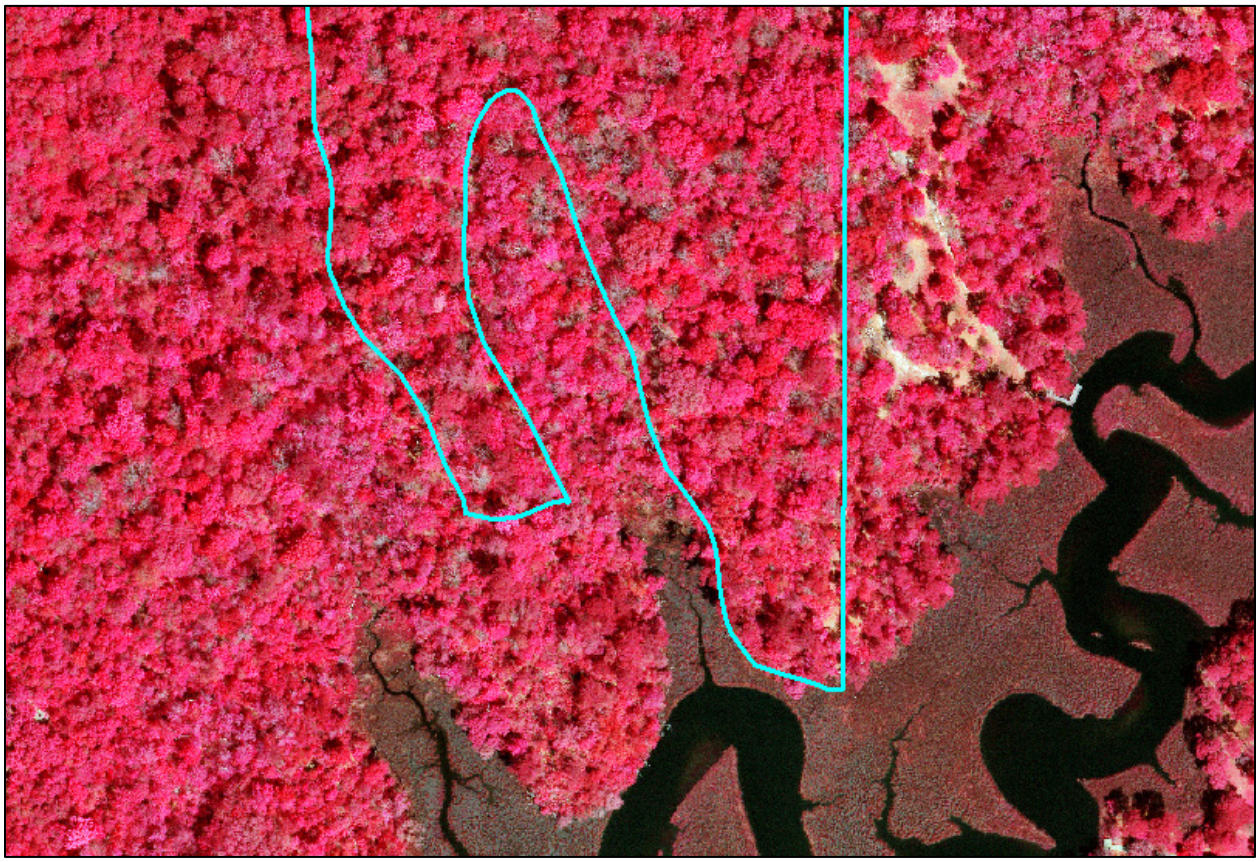


Figure F32. Photo signature example of the MC312 *Fagus grandifolia - Magnolia grandiflora - Quercus michauxii - Quercus nigra* / *Rhododendron canescens* Forest map class.

Beach Bare Sand

Map Class Code: MC401

Color: tan, white

Texture: Smooth

Crown Size: n/a

Crown Shape: n/a

Density: n/a

Notes: Multiple images and band combinations used to confirm lack of vegetation.

Imagery Used: 2017 NOAA NGS Post Nate Imagery, 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F33).



Figure F33. Photo signature example of the MC401 Beach Bare Sand map class.

Hurricane Impact Area

Map Class Code: MC402

Color: tan, pink, green, brown, red

Texture: Smooth

Crown Size: n/a

Crown Shape: n/a

Density: n/a

Notes: Washed-out patches evident throughout post-hurricane image.

Imagery Used: 2017 NOAA NGS Post Nate Imagery, 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figures F34 and F35).

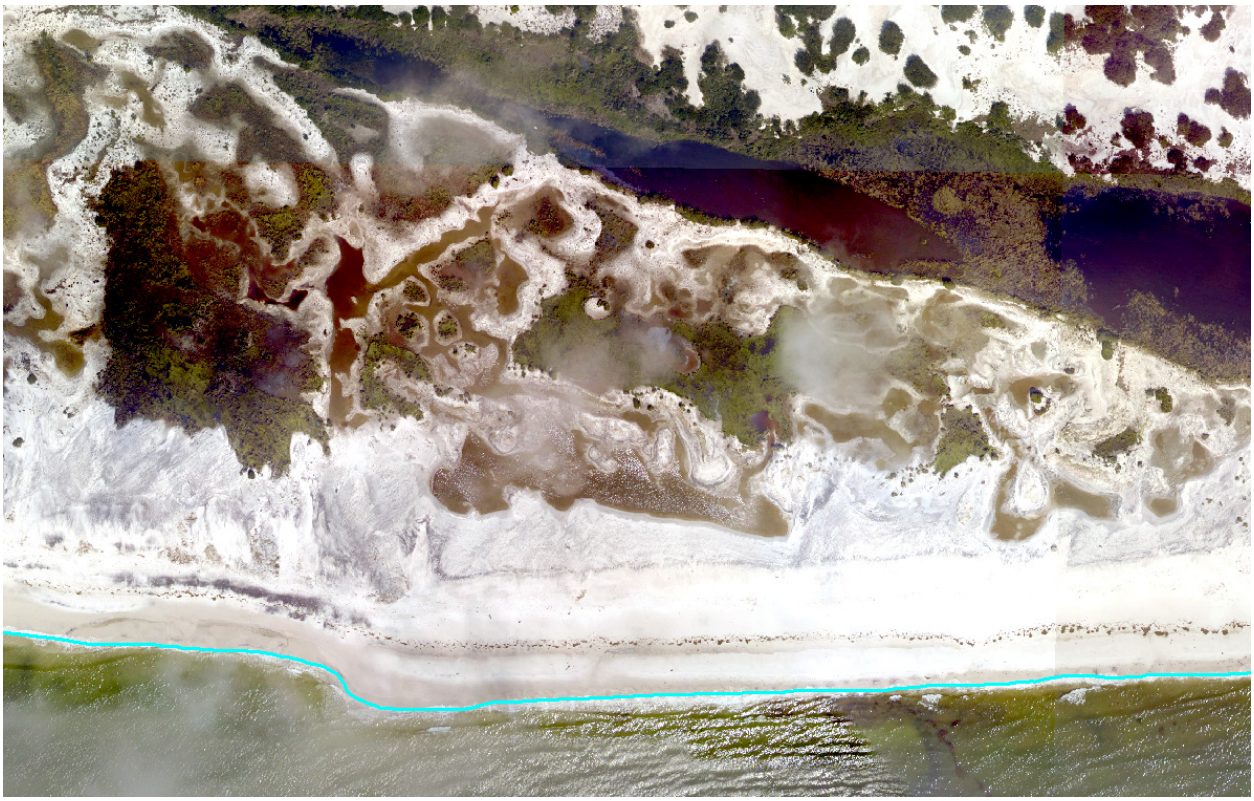


Figure F34. Photo signature example of the MC402 Hurricane Impact Area map class after Hurricane Nate.

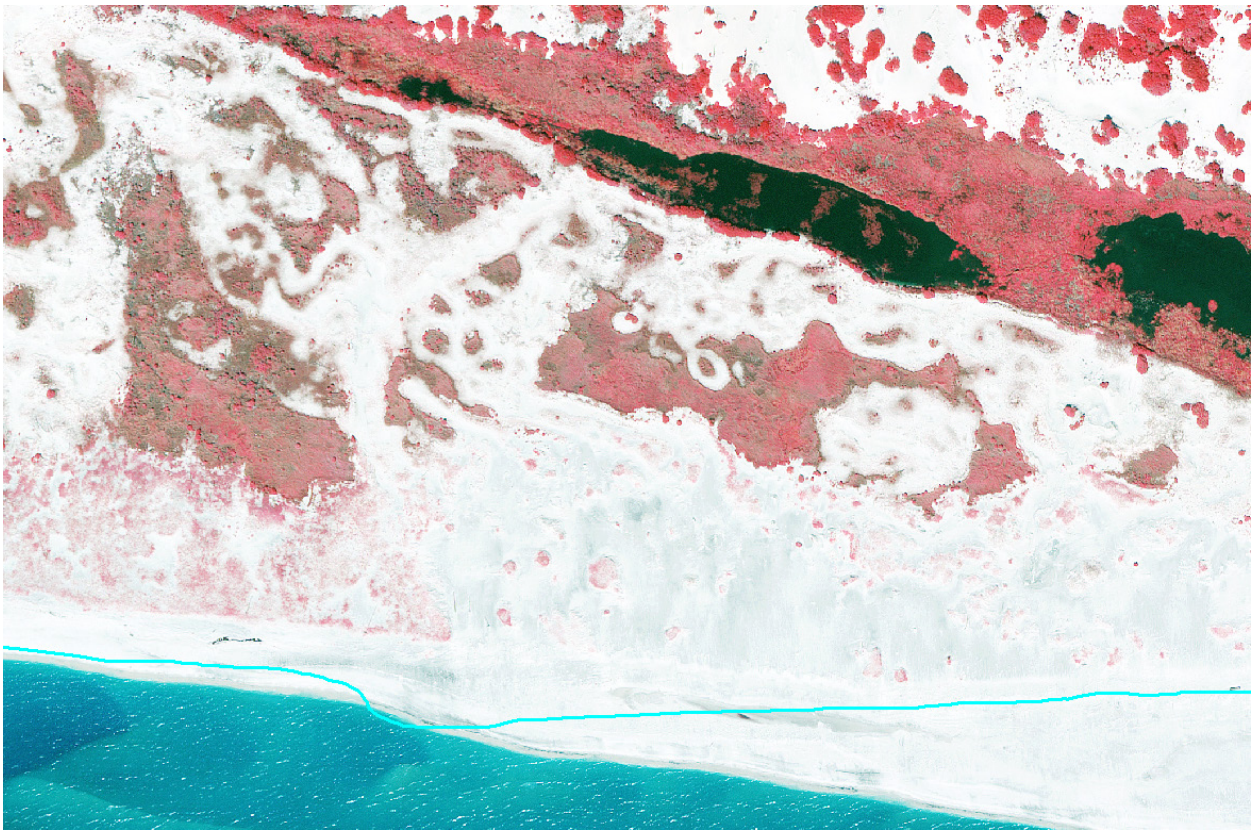


Figure F35. Photo signature example of the MC402 Hurricane Impact Area map class before Hurricane Nate.

Non-vegetated / Barren Land, Borrow Pit, Cut Bank

Map Class Code: LC001

Color: tan, brown, red

Texture: Smooth to Coarse

Crown Size: n/a

Crown Shape: n/a

Density: n/a

Notes: Most recent image used to determine land use history.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F36).



Figure F36. Photo signature example of the LC001 Non-vegetated / Barren Land, Borrow Pit, Cut Bank map class.

Developed, Open Space

Map Class Code: LC002

Color: tan, brown, red, white, gray

Texture: Smooth

Crown Size: n/a

Crown Shape: n/a

Density: n/a

Notes: Lawns, Parks, Camping areas, etc.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F37).



Figure F37. Photo signature example of the LC002 Developed, Open Space map class.

Developed, Low - High Intensity

Map Class Code: LC003

Color: gray, tan, red, brown

Texture: Smooth

Crown Size: n/a

Crown Shape: n/a

Density: n/a

Notes: Parking lots, Buildings, etc.

Imagery Used: 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data.



Figure F38. Photo signature example of the LC003 Developed, Low - High Intensity map class.

Water / Ocean

Map Class Code: LC004

Color: black, green, blue, tan

Texture: Smooth

Crown Size: n/a

Crown Shape: n/a

Density: n/a

Notes: --

Imagery Used: 2017 NOAA NGS Post Nate Imagery, 2014 and 2016 Hexagon Imagery, 2017 Florida NAIP Imagery, 2016 Mississippi NAIP Imagery, and 2016 USACE NCMP LiDAR Data (Figure F39).

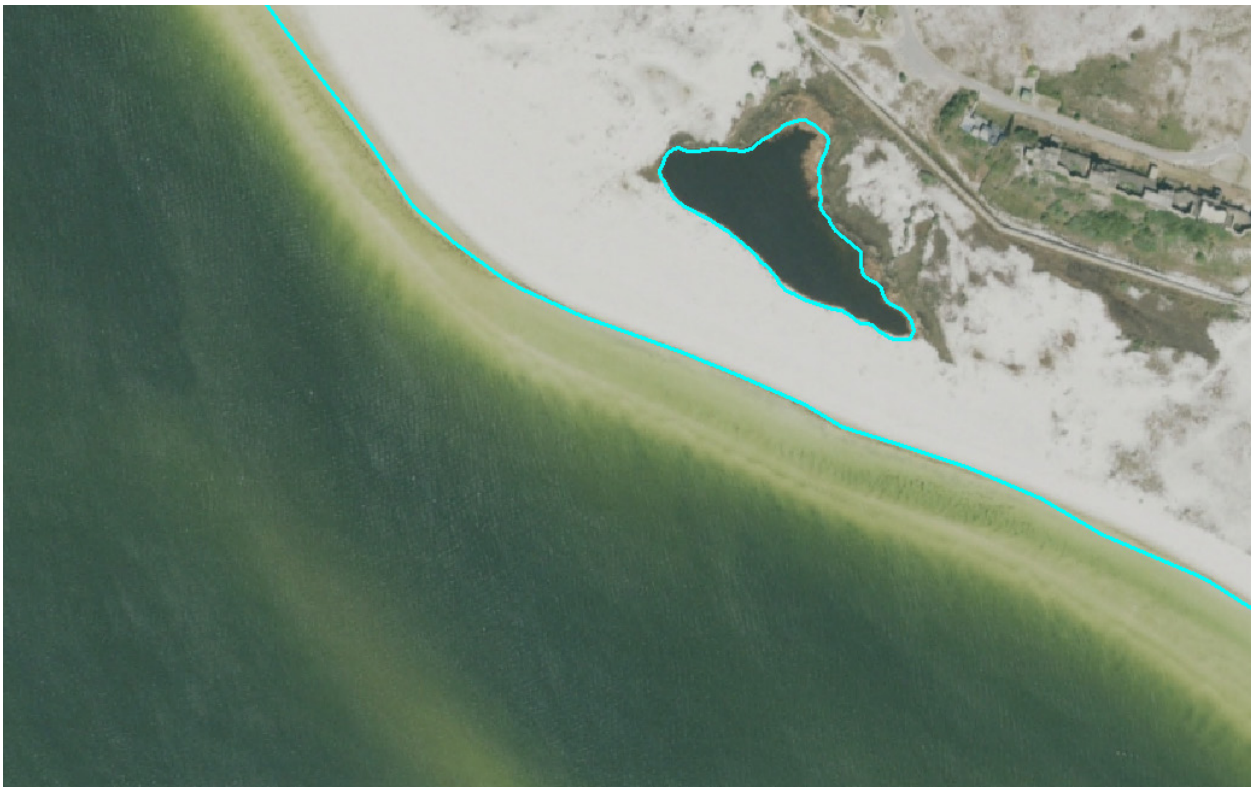


Figure F39. Photo signature example of the LC004 Water / Ocean map class.

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.

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