



The Everglades National Park and Big Cypress National Preserve Vegetation Mapping Project

Interim Report—*Eastern Big Cypress (Regions 5 & 6), Big Cypress National Preserve*

Natural Resource Report NPS/SFCN/NRR—2019/2035



ON THE COVER

Photograph of flooded Cypress Dome, Big Cypress National Preserve.
Photo credit Magali Guichardot (21 July 2017).

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October 2019

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

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Please cite this publication as:

Ruiz, P. L., A. Lee, C. Thompson, I. Castillo, M. Guichardot, C. P. Perry, A. Arteaga Garcia, M. Foguer, M. C. Prats, E. Garcia, S. Lamosa, R. B. Shamblin, and K. R. T. Whelan. 2019. The Everglades National Park and Big Cypress National Preserve vegetation mapping project: Interim report—Eastern Big Cypress (Regions 5 & 6), Big Cypress National Preserve. Natural Resource Report NPS/SFCN/NRR—2019/2035. National Park Service, Fort Collins, Colorado.

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Acronyms and Abbreviations

2D:	Two-dimensional
3D:	Three-dimensional
AA:	Accuracy Assessment Point
BICY:	Big Cypress National Preserve
CERP:	Comprehensive Everglades Restoration Plan
CIR:	Color infrared
EVER:	Everglades National Park
FGDC:	Federal Geographic Data Committee
GE:	Greater Everglades
GPS:	Global Positioning System
ha:	Hectare
km:	Kilometers
MAP:	Monitoring and Assessment Plan
msl:	Mean sea level
NAD:	North American Datum
NIR:	Near-infrared
NPS:	National Park Service
RECOVER:	REstoration COordination and VERification
RMSE:	Root mean square error
RTKGPS:	Real-time kinematics GPS
SFWMD:	South Florida Water Management District
TP:	Training Point
USACE:	United States Army Corps of Engineers
VCSF:	Vegetation Classification System for South Florida Natural Areas
VMI:	Vegetation Mapping Inventory Program
VP:	Verification Point
WCA:	Water Conservation Areas
WERP:	Western Everglades Restoration Project
WRDA:	Water Resource Development Act

Contributors

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Summary

The Everglades National Park and Big Cypress National Preserve vegetation mapping project is part of the Comprehensive Everglades Restoration Plan (CERP). It is a cooperative effort between the South Florida Water Management District (SFWMD), the United States Army Corps of Engineers (USACE), and the National Park Service (NPS) Vegetation Mapping Inventory Program (VMI). The goal of this project is to produce a spatially and thematically accurate vegetation map of Everglades National Park and Big Cypress National Preserve prior to the completion of restoration efforts. The vegetation map will serve as a record of baseline conditions to: (1) document changes to the spatial extent, pattern, and proportion of plant communities within these two federally-managed units as they respond to hydrologic modifications resulting from the implementation of the CERP; and (2) provide vegetation and land-cover information to NPS park managers and scientists for use in park management, resource management, research, and monitoring.

This project covers an area of approximately 7,400 square kilometers (1.84 million acres [ac]) and consists of seven mapping regions: four regions in Everglades, Regions 1–4, and three in Big Cypress, Regions 5–7. The report that follows focuses on the mapping effort associated with Regions 5 and 6, eastern Big Cypress. Eastern Big Cypress encompasses a total area of 2068.8 square kilometers (798.8 square miles [mi²], or 511,212 acres [ac]) and is bounded by Water Conservation Areas to the east, Shark River Slough/Long Pine Key (Region 1) to the southeast, the Northwest Coastal Everglades (Region 4) to the south, and western Big Cypress National Preserve (Region 7) to the west.

Photo-interpretation was performed by superimposing a 50 × 50-meter (164 × 164-feet [ft] or 0.25 hectare [0.61 ac]) grid cell vector matrix over stereoscopic, 0.15 meters (0.492 ft) spatial resolution, color-infrared aerial imagery on a digital photogrammetric workstation. Photo-interpreters identified the dominant community in each cell by applying majority-rule algorithms, recognizing community-specific spectral signatures, and referencing an extensive ground-truth database. The dominant vegetation community within each grid cell was classified using a hierarchical classification system developed specifically for this project. Additionally, photo-interpreters categorized the absolute cover of cattail (*Typha* sp.) and any exotic species detected as either: Sparse (10–49%), Dominant (50–89%), or Monotypic (90–100%).

A total of 140 thematic classes were used to map eastern Big Cypress. The most common vegetation class was Cypress Forest. Cypress Forest communities (i.e., Domes, Forest, and Strands) accounted for 28.5% of the total area mapped. Other notable classes include Cypress Scrub (24.2%), Pine Woodlands (13.4%), and Mixed Graminoid Freshwater Marshes and Prairies (11.9%). The map has a thematic class accuracy of 93.1% with a lower 90th Percentile Confidence Interval of 90.8%.

Acknowledgments

The United States Army Corps of Engineers (USACE) and the National Park Service (NPS) National Vegetation Inventory Program provided the funding for this project. Special thanks to Theodore N. Schall, Donna George, Javier Cortes, and April Patterson from USACE. From the National Park Service, we would like to recognize Pedro Ramos, Karl Brown, Jed Redwine, Agnes McLean, David Rudnick, Leonard Pearlstine, Tony Pernas, Jimi Sadle, Robert Sobczak, Judd Patterson, Robert Muxo, Mario Londoño, Andrea Atkinson, and Matt Patterson. Fred Sklar from the South Florida Water Management District (SFWMD) and Daniel Gann from the Geographic Information Systems Center at Florida International University (FIU), provided several of the photogrammetric workstations used in this project. The Geographic Information Systems Center at FIU provided multiple interns on the project as well. Helicopter transportation and logistics provided by Big Cypress National Preserve (BICY) Fire and Aviation: Fred Goodwin (pilot), Michael O’Leary, Micheal Roof, Nicholas Connolly, Ashlee Girardi, and Kevin Logiudice. This is a CERP/RECOVER project.

Introduction

Everglades National Park and Big Cypress National Preserve Vegetation Mapping Project

The Everglades National Park and Big Cypress National Preserve vegetation mapping project is a component of the Comprehensive Everglades Restoration Plan (CERP). It is a cooperative effort between the South Florida Water Management District (SFWMD), the United States Army Corps of Engineers (USACE), and the National Park Service (NPS) Vegetation Mapping Inventory Program (VMI). The goal of the project is to produce a spatially and thematically accurate vegetation map of Everglades National Park and Big Cypress National Preserve. The vegetation map will serve as a record of baseline conditions to: (1) document changes to the spatial extent, pattern, and proportion of plant communities within these two federally managed units as they respond to management driven hydrologic modifications resulting from the implementation of the CERP and (2) provide vegetation and land-cover information to NPS park managers and scientists for use in park management, resource management, research, and monitoring.

This project covers an area of approximately 7,400 square kilometers (2,857 mi² or 1.84 million ac) and consists of seven mapping regions: four regions in Everglades, Regions 1–4, and three in Big Cypress, Regions 5–7 (Figure 1). This project was initiated in 2006 with a subcontract to Avineon, Inc. to map one-third of Big Cypress National Preserve (Region 7; 891 square kilometers [344 mi²] or 220,292 ac) and the northwest corner of Region 4 in Everglades National Park (Figure 1). The SFWMD completed a 406-square kilometer (156.7-mi² or 100,378-ac) section of Region 1 in 2010 that included the northernmost portion of Region 1 (Figure 1). Upon completion of this initial section, the photo-interpretation portion of the Everglades and Big Cypress mapping effort was transferred to the USACE Jacksonville District office in Jacksonville, Florida, and project data collection and field support were delegated to the South Florida Caribbean Network (SFCN) in south Florida. In 2015, the network took on the mapping responsibilities associated with Regions 2–6 of this project. This change allowed the project to take advantage of the SFCN's institutional knowledge of botany, community ecology, and remote sensing as well as efficiencies afforded by the network's proximity to Everglades and Big Cypress. The Corps of Engineers priorities then shifted toward the completion of Region 1 and assisting the network with the final quality assurance and quality control (QA/QC) of mapped products.

This report focuses on the mapping effort associated with the mapping of Regions 5 and 6, eastern Big Cypress. The map encompasses a total area of 2,068.8 square kilometers (798.8 mi², 511,212 ac) and is bounded by Water Conservation Areas to the east, Shark River Slough/Long Pine Key (Region 1) to the southeast, the Northwest Coastal Everglades (Region 4) to the south, and western Big Cypress National Preserve (Region 7) to the west.

Everglades National Park

Greater Everglades Mapping Module

National Park Service
U.S. Department of the Interior

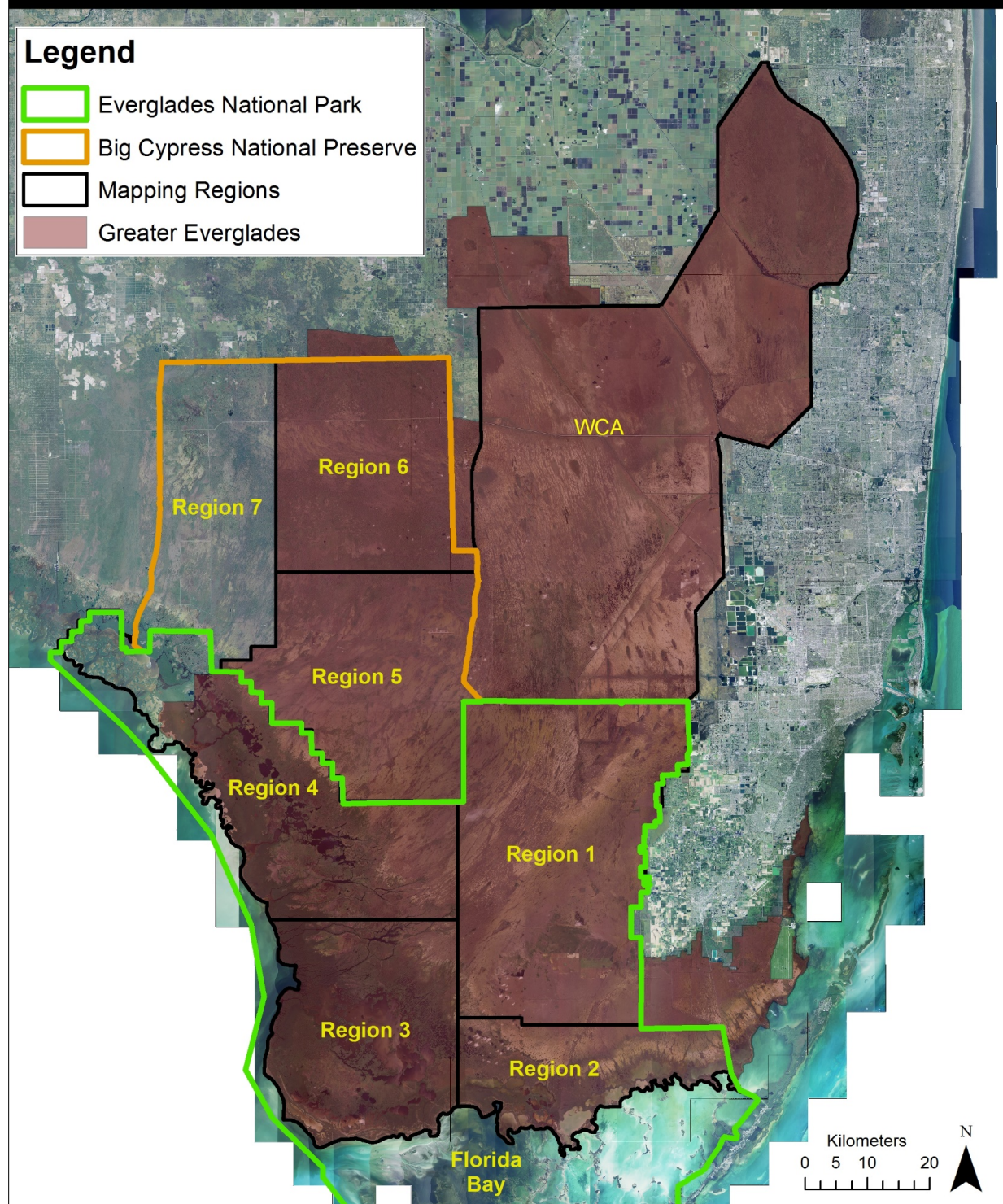


Figure 1. Greater Everglades mapping module and location of mapping regions within Everglades National Park and Big Cypress National Preserve.

Comprehensive Everglades Restoration Plan

Title VI Sec 601 of the Water Resource Development Act (WRDA) of 2000 authorized the Comprehensive Everglades Restoration Plan (CERP) as the framework for the modifications and operational changes needed to restore, preserve, and protect the south Florida ecosystem (Water Resource Development Act 2000). As part of the CERP, Congress authorized the **RE**storation **CO**ordination and **VE**rification (RECOVER) program to: (1) organize and provide scientific and technical support to the interagency body of scientists and managers implementing the CERP, and (2) provide a mechanism, through the Monitoring and Assessment Plan (MAP), for assessing the performance of the CERP (RECOVER 2004). The goal of the CERP MAP is to have a system-wide monitoring and assessment plan that is supported and used by all CERP participants, including tribal nations, to track and measure system wide responses to the implementation of the CERP (RECOVER 2004).

The Monitoring and Assessment Plan consists of six monitoring modules designed to document and establish pre-restoration reference conditions for the Greater Everglades (GE) region, which includes Everglades National Park and Big Cypress National Preserve (Figure 1). Monitoring and Assessment Plan Module Number 3.1.3.4 specifically calls for the creation of a spatially and thematically accurate vegetation map of the entire GE project area that would serve, along with other metrics, as baseline conditions to assess the system-wide performance of the CERP over the next several decades (RECOVER 2004).

For more information regarding the CERP, please visit the [Comprehensive Everglades Restoration Plan website](#).

The National Park Service Vegetation Mapping Inventory Program

The National Park Service Vegetation Mapping Inventory Program (NPS VMI) is a national program designed to classify, describe, and map the vegetation communities within all U.S. national park units except Alaska¹. The NPS VMI program is designed to address the local management needs of each park unit and provide vegetation inventory data for regional and national level management decisions. This program sets guidelines by which all NPS vegetation mapping products must adhere. This ensures consistency throughout all park units and that all VMI mapping projects meet Federal Geographic Data Committee (FGDC) standards on vegetation classification system, metadata, minimum mapping unit, spatial accuracy, and minimum acceptable map accuracy (Owens 1999; Studd et al. 2013).

The NPS Biological Resource Management Division located in Fort Collins, Colorado manages the VMI and maintains a collaborative partnership with the United States Geological Survey Center for Biological Informatics, which provides scientific and technical oversight (Owens 1999). Since its inception in 1992, the NPS VMI has overseen 185 NPS VMI mapping projects. All NPS VMI

¹ National parks in Alaska are being mapped by the Alaska Landcover Inventory Program (<https://www.nps.gov/subjects/aknatureandscience/aklandcover.htm>).

mapping products are expected to be completed by 2022. For more information regarding the NPS VMI program, please visit the [NPS Vegetation Mapping Inventory website](#).

Everglades National Park and Big Cypress National Preserve

Everglades National Park

Everglades National Park is the third-largest national park within the contiguous United States, and the largest park east of the Mississippi River. Congress authorized the establishment of the park in 1934 to protect an ecosystem threatened by drainage, poaching, agricultural development, and urbanization. This was the first time that Congress authorized a national park for the protection of an ecosystem and its biological value, rather than a geographic feature.

Located on the southern tip of the Florida peninsula at about 2° north of the Tropic of Cancer (25.5° N Latitude), the climate of Everglades National Park is more similar to those of tropical regions than that of the continental United States (Duever et al. 1994). Mean daily temperatures range from 17–25°C (62.6–77°F) with average mean daily temperatures rarely falling below 10°C (50°F) during the winter months (Duever et al. 1994; Obeysekera et al. 1999). However, temperatures at or below freezing do occur. Freeze events in the interior Everglades may occur once every two or three years (Ross et al. 2009). There is a well-defined rainy season, May through October; and a dry season, November through April. Rainfall during the summer rainy season typically accounts for nearly 60% of the annual rainfall, which ranges between 119–157 centimeters (46.8–61.8 inches [in]) per year (Duever et al. 1994).

Ground surface elevations within Everglades National Park range from at or below mean sea level (msl) near the coast, to 4.3 meters (14.1 ft) above msl in the interior forests and tree islands. Vegetation communities are arranged along this narrow elevation gradient creating a patch mosaic of mangrove swamps, graminoids marshes and prairies, hammocks and pine woodlands, where elevational differences in millimeters not only determine inundation frequency and duration, but also the community type.

Because of its geographic location and mild climate, Everglades National Park is home to a unique assemblage of both tropical and temperate species. It is home to 400 species of birds, 800 species of vertebrates, 1,600 species of vascular plants, and 125 species of fish; of which 202 are federally- or state-listed species (Patterson et al. 2008). The park is also the only place in the world where alligators (*Alligator mississippiensis*) and crocodiles (*Crocodylus acutus*) coexist.

Many of the external pressures and challenges that triggered the creation of Everglades National Park are still present today. Management decisions and restoration efforts are tied to water quantity and quality issues. Additional stresses from exotic species like the Burmese Python (*Python bivittatus*) and Brazilian pepper (*Schinus terebinthifolius*), climate change and sea-level rise, and a host of other issues continue to challenge park managers and biologists.

Big Cypress National Preserve

Big Cypress National Preserve was officially established in 1974 to conserve and protect natural resources, ecological functionality, and recreational and native tribal land uses. Its designation as a

preserve was the culmination of advocacy from groups of hunters, conservationists, native tribes, and regional water managers. The preserve was established to protect the biodiversity within it, as well as the watershed that provides freshwater to the downstream estuaries along the Gulf Coast of Everglades National Park. The preserve is surrounded by the Water Conservation Areas (WCA) to the east, the Gulf of Mexico to the west, and Everglades National Park to the south (Figure 1). It is connected to several other natural areas that are managed to conserve and protect natural resources and endangered species, such as the Florida panther (*Puma concolor coryi*).

The vegetation communities of Big Cypress are a mosaic of hardwood hammocks, pine woodlands, swamp forests, including cypress domes, strands, and scrub communities, freshwater marshes and prairies, coastal marshes and mangrove forests. These communities contain a high level of both plant and animal biodiversity, including 122 federally- or state-listed species (Patterson et al. 2008). Hydroperiod, water depth, and water quality (including nutrients and salinity), as well as natural perturbations like fires and windstorms, are the primary drivers shaping the community structure and species composition across the preserve landscape.

The climate of the preserve is typical for south Florida with mean annual temperatures ranging between 23°C (73.4°F) and 25°C (77.0°F; Davey et al. 2007). Mean monthly minimum temperature, during winter, typically ranges between 9°C (48.2°F) and 12°C (53.6°F; Davey et al. 2007). In the summer, the mean monthly maximum averages 32.5°C (90.5°F; Davey et al. 2007). The preserve has a well-defined rainy season (May through October) with mean annual precipitation averaging 136 centimeters (53.5 in; Duever et al. 1986).

Ground elevations in the preserve range from 7 meters (22.9 ft) above msl in the northern portions of the preserve to 0.3 meters (0.98 ft) above msl along the southern edge of the preserve (Duever et al. 1986). Like Everglades National Park, subtle differences in elevation typically lead to the presence of contrasting vegetation types within a few meters of each other.

Methods

Imagery

The imagery used for the eastern Big Cypress vegetation map consists of 0.15 meters (0.492 ft.) spatial resolution 4-band (red, green, blue and near infrared) multispectral imagery procured by the NPS VMI. The imagery was obtained between 1 April 2014 and 22 April 2014 using an Intergraph DMC Digital mapping camera. Images acquisition occurred at an average flight altitude of 1,465 meters (4,806.4 ft or 0.91 mi) and had an average forward overlap of 60%. Images are referenced relative to the Universal Transverse Mercator (UTM) Zone 17, North America Datum of 1983 (NAD83).

Correlation analysis between the horizontal and vertical location of each aerial target and the imagery indicated that the horizontal and vertical accuracy of the image dataset met or exceeded FGDC standards for horizontal Second Order Class II (Root Mean Square Error [RMSE] 0.445 m) and vertical Third Order (RMSE 0.372 m) control points. See Appendix A for summary of Aerial Triangulation Report.

Photo-interpretation

This project employs a grid-based, 50 × 50-meter (164 × 164-ft) grid (.25-hectare [.61-ac]) cell, majority rule mapping approach (Rutchev et al. 2008). In contrast to traditional vector mapping methods, where vegetation communities are delineated based on observable boundaries and a set minimum mapping unit (e.g., 10 square meters [107.76 ft²] or 50 square meters [538.1 ft²]), grid-based mapping relies on the determination of the dominant² (majority) community or land cover type present within each grid cell.

At each grid cell, photo-interpreters determine and classify the dominant vegetation community to species level, wherever possible, using the *Vegetation Classification System for South Florida Natural Areas* (Rutchev et al. 2006) as modified in Appendix B. Photo-interpreters additionally categorize the absolute cover of cattail (*Typha* sp.) and any exotic species present in each grid cell as either: Sparse (10–49%), Dominant (50–89%), or Monotypic (90–100%)

Grid-based mapping has significant advantages over the traditional vector mapping approach. For example, it: (1) reduces mapping cost on a per-area basis; (2) reduces photo-interpreter variability; and (3) produces vegetation maps with more landscape heterogeneity since the photo-interpreter must view and classify the dominant vegetation or land cover type within each cell individually and independently of its neighbors (Rutchev and Godin 2009). In addition, grid-based maps are generally better suited for vegetation change analysis and complex map algebra than vector maps (Rutchev and Godin 2009). However, because of the aggregative nature of the majority rule, dominant vegetation classes tend to increase in overall abundance while minor classes tend to decrease in overall abundance becoming less common within the map (He et al. 2002). Consequently, if a grid cell

² The community with the greatest percent cover (majority) in the grid cell.

contains two or more community types of nearly equal cover, the less abundant, rare community within the region is selected over a more common community type. For example, in Shark River Slough, American white waterlily (*Nymphaea odorata*) sloughs are less abundant than sawgrass marshes or Gulf Coast spikerush sloughs. Thus, a split cell containing waterlily and another community type like sawgrass or Gulf Coast spikerush, having equal cover within the grid cell, is classified as waterlily to ensure this community is not underrepresented or missed entirely from the mapping product. Similarly, grid cells dominated by non-vegetative or exotic classes like water, mud, tidal flat, Australian pine (*Casuarina equisetifolia*) or Brazilian pepper, for example, with at least 40% (natural) vegetation cover are classified based on the natural vegetation class and not the dominant non-vegetative or exotic class within the cell (Exotics are captured as a modifier class as described in previous paragraph). Lastly, grid cells containing linear features like roads and canals are classified based on the vegetation community south of east-west running linear features (e.g. US Highway 41, Loop Road, and I-75 in Big Cypress) and to the east for linear features oriented north to south of the non-vegetative feature within the grid cell. This ensures consistency between neighboring grid cells and across the entire map.

Photogrammetric Workstation

Photo-interpreters use a digital photogrammetric workstation running Summit Evolution v7.4 to analyze the 2014 4-band multispectral imagery (Photo 1). Summit Evolution is a software package designed for viewing, capturing, and analyzing three-dimensional (3D) information from stereoscopic imagery. This photogrammetric software package integrates seamlessly with ESRI ArcGIS allowing for, but not limited to, the visualization of 3D data, vector data visualization and editing, and attribute population.

Band Combinations

Photo-interpreters analyze the spectral signature of each grid cell using one of 11 different customizable band channels in Summit Evolution (Table 1). Channels 0 (RGB), 2 (NIRGB), and 3 (NIRRB) were the most frequently used channels to differentiate community types and species within each grid cell (Table 1).

Vegetation Cover Estimation

Vegetation cover for each discrete community type present within a grid cell is determined by partitioning the photogrammetric workstation's cursor into 100 equal-sized squares, each 25 square meters (269 ft²) or 1% of the entire 0.25-hectare (0.61-ac) grid cell. The parameters for the photogrammetric workstation cursor are set to: Grid size = 5; Columns = 11; and Rows = 11. This cursor arrangement allows photo-interpreters to count the total number of 25 square meter (269 ft²) squares occupied by each discrete community type within each grid cell and determine the dominant/majority class present within the 0.25-hectare grid cell.

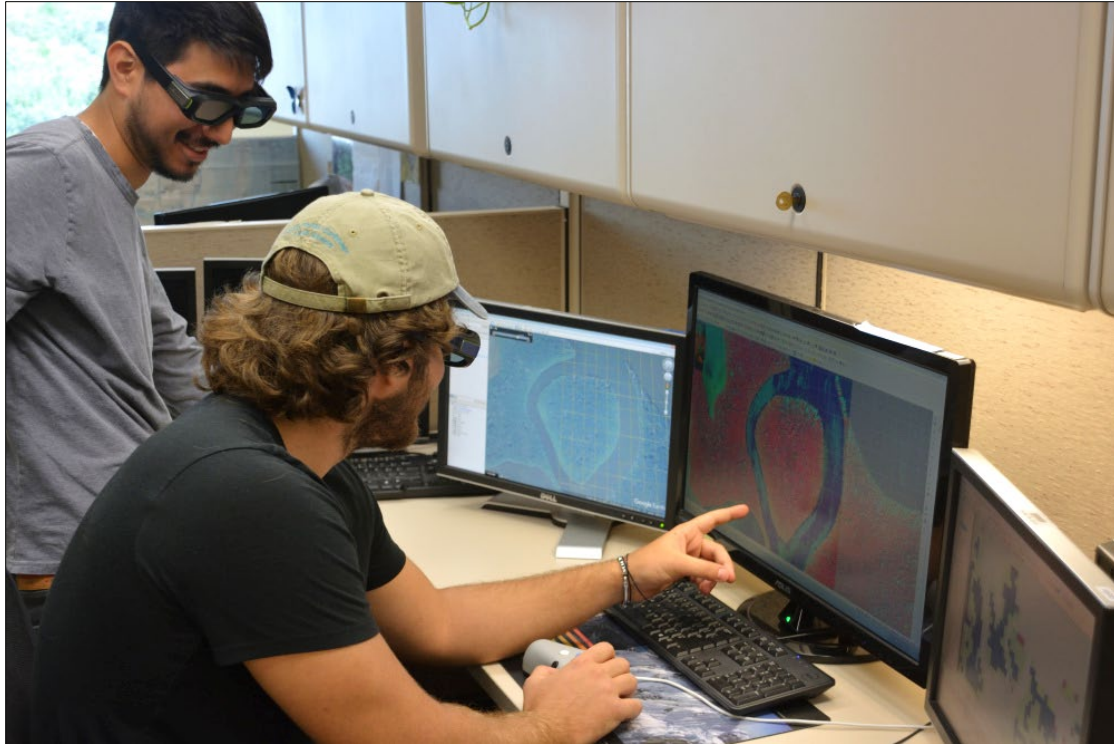


Photo 1. Photo-interpreters (Michael Foguer, left, and Alejandro Arteaga Garcia, right) working on a photogrammetric workstation running Summit Evolution v7.4.

Table 1. Designation of channel assignments and their corresponding spectral band (Red, Green, Blue, Near-Infrared [NIR]) combinations used in the Summit Evolution photogrammetric workstation to identify vegetation communities. Numbers in parentheses correspond to the Summit Evolution assigned image band number.

Summit Channel Assignment	Band Combination
0	Red(0), Green(1), Blue(2)
1	NIR(3), Red(0), Green(1)
2	NIR(3), Green(1), Blue(2)
3	NIR(3), Red(0), Blue(2)
4	Blue(2), Blue(2), Red(0)
5	NIR(3), Blue(2), Green(1)
6	Red(0), Blue(2), Red(0)
7	Blue(2), Green(1), Red(0)
8	Green(1), Blue(2), Red(0)
9	Blue(2), Red(0), Blue(2)
10	NIR(3), Red(0), Red(0)

Canopy Height Estimation

The vegetation height of the dominant community type within each grid cell is determined by averaging the vegetation height at a minimum of 10 randomly located points for the dominant community type within each grid cell. Additionally, the zoom factor on the photogrammetric workstation was set to 4x to ensure consistency in canopy height estimation by all photo-interpreters. Canopy height estimation of digital images is scale-dependent, due to the way the imagery is stored as hierarchical, low to high resolution, copies or image pyramids. Thus, using a lower (e.g., 2x or 1x) zoom factor could lead to a less precise estimate of canopy height since a lower resolution image pyramid would be used to estimate canopy height.

Vegetation Map

The eastern Big Cypress vegetation map consists of 827,521 0.25-hectare (.61-ac) grid-cells. It is stored in an ESRI ArcGIS v10.5 personal geodatabase along with a dissolve of the vegetation map based on vegetation classes, for faster processing, the geo-political boundary of Big Cypress, the eastern Big Cypress mapping boundary, and a cross-reference table linking the vegetation code to the class name and levels within the classification system. All geospatial data are referenced to the Universal Transverse Mercator (UTM) Zone 17N, North American Datum of 1983 (NAD83).

Vegetation Data Collection

The vegetation data collected on this project include Training Points (TP), Verification Points (VP) and Accuracy Assessment (AA) data points. The AA points are discussed later in this document. A total of 1,271 TP and VP data points were collected for this mapping project (Figure 2).

The TP data points provide species-specific compositional data and structural information. TP points characterize the dominant community within each grid cell. In some instances, however, they represent plant communities smaller than the 0.25-hectare (0.61-ac) grid cell, e.g., patches of cattails, water lily, or other species-specific community type.

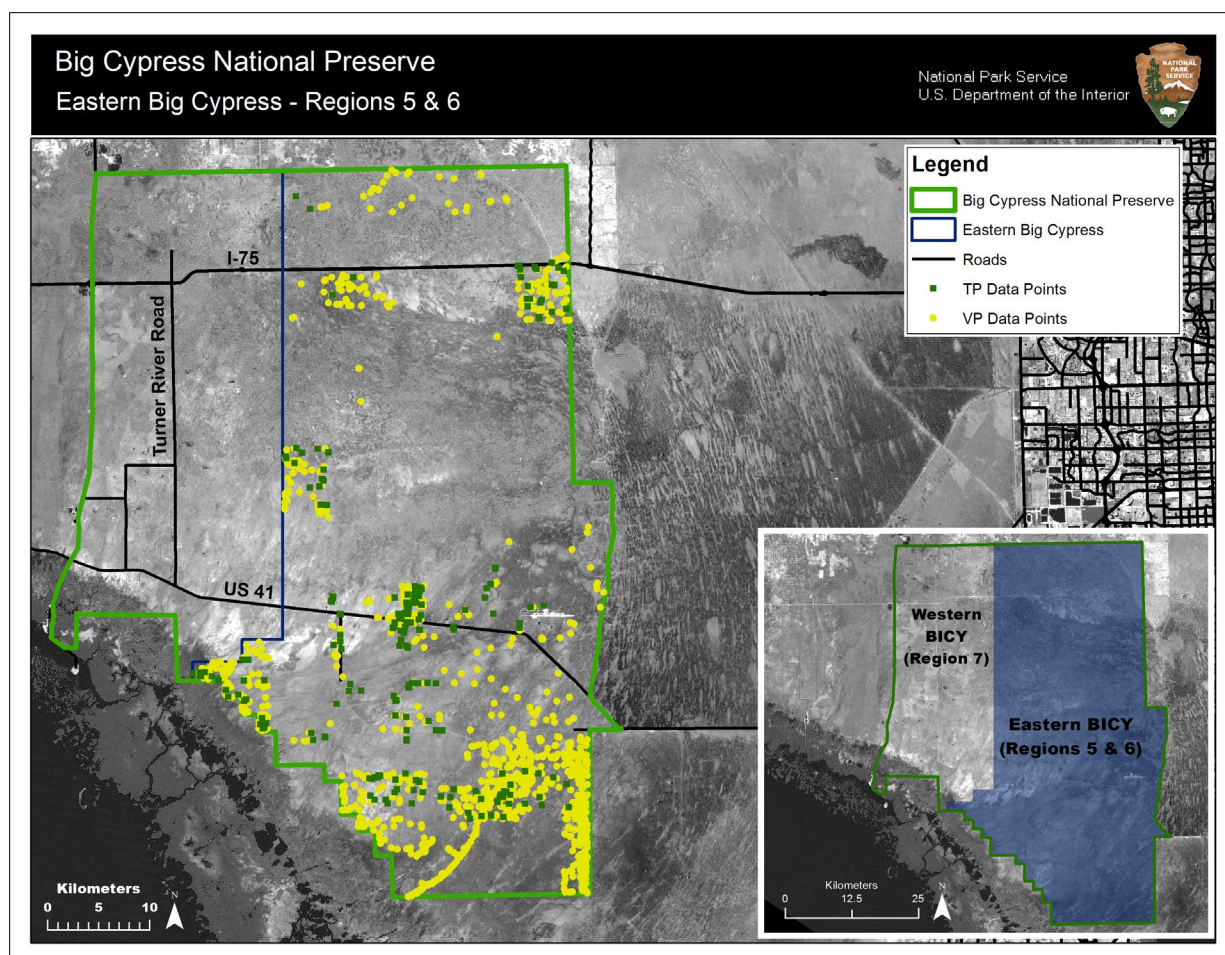


Figure 2. Location of Training Points (TP) and Verification Points (VP) collected in eastern Big Cypress, Regions 5 & 6, Big Cypress National Preserve.

The data collection method for TP and the AA (see Accuracy Assessment section below) data points is identical. Field staff record data on a pre-printed datasheet showing an aerial image of the area being sampled (Figure 3). Data recorded includes visual estimation of canopy height and vegetation cover, the relative cover of each strata (Tree, Shrub, and Herb), the relative cover of the dominant species within each stratum, and the maximum canopy height for each stratum. In addition, digital oblique photos taken at each TP or AA site document the structure and characteristics of the area sampled.

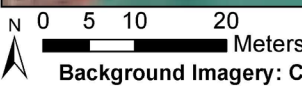
Sequence: Pt TP20867	Photo #: _____ Mark #: _____	GPS unit: 478com	Date/Time: 12/16/2014 Observers: BS / PR	Moved Point?: Y / N Why: _____ Transport: helicopter Heading: _____ Direction: counter clockwise
			General Description of Cell, Veg Type, Comments: (structures, roads, fire, storm damage, water cover, soil cover, etc.)	
			PI question: is this SMXcr	
			Dominant Vegetation Community in Polygon Vegetation Class: _____ Vegetation Cover: _____ % Average Height of Vegetation Class: _____ m	
			Cattail Code: _____ Exotic Codes: _____	
			Tallest per Layer (m): Tree: _____ Shrub: _____ Herb: _____	
			<i>Relative Cover of Plant Species (should add up to 100%)</i> Note: 0.01% or "P" used to indicate species that are present but not a significant cover	
			Trees: _____ % cover (list species and cover for each) 1) _____ 6) _____ 2) _____ 7) _____ 3) _____ 8) _____ 4) _____ 9) _____ 5) _____ 10) _____	
			Shrubs: _____ % cover (list species and cover for each) 1) _____ 6) _____ 2) _____ 7) _____ 3) _____ 8) _____ 4) _____ 9) _____ 5) _____ 10) _____	
Herbs: _____ % cover (list species and cover for each) 1) _____ 6) _____ 2) _____ 7) _____ 3) _____ 8) _____ 4) _____ 9) _____ 5) _____ 10) _____				

Figure 3. Example of a datasheet used to collect vegetation data on this project.

The other type of field data collected are VP Points. These points complement the TP data collection process and serve two purposes: (1) to confirm a common, typically homogeneous, spectral signature within the landscape, e.g., Temperate Hardwood Hammock or Cypress Forest; and (2) document field observed vegetation information, e.g., clumps of Sand Cordgrass (*Spartina bakeri*) or Black-topped Sedge (*Schoenus nigricans*) within a contrasting vegetation type. Typically, structural and composition data is not collected. However, information about key species and canopy height are often recorded to assist photo-interpreters in recognizing species within the area of interest. The VP points are also used to document past disturbance history, exotic species presence, or any other natural phenomena encountered while conducting data collection missions. These data points take significantly less time to collect than TP points and significantly reduce the cost associated with data collection.

These data, including the AA data points, are stored in an ESRI ArcGIS v10.5 geodatabase and are referenced to the Universal Transverse Mercator (UTM) Zone 17N, North American Datum of 1983 (NAD83).

Vegetation Classification System

The Vegetation Classification System for South Florida Natural Areas (VCSF) is a multi-tiered hierarchical classification system developed specifically to map the natural areas occurring within the Greater Everglades (GE) restoration footprint, including the Florida Keys (Rutchev et al. 2006). Creation of the VCSF was a multi-year collaborative effort that included many of the top scientists, botanists, and experts on south Florida community ecology and botany. This classification system fills the gap in the level of detail and lack of specificity found within the U.S. National Vegetation Classification System when it comes to the classification of south Florida plant communities (Rutchev et al. 2006). The latest version of the VCSF is v6.10.09.

The VCSF is a living dynamic document; open to modification as new classes or communities not listed in the classification system are observed in the field. For example, in version v2.1.07 several modifications to the classification system were made in response to field observations and data collected by Ross et al. (2006). Similarly, Ruiz et al. (2008) suggested the inclusion of twenty-one new classes to the classification system based on their observations and work mapping Biscayne National Park. Since plant associations can be fluid combinations of many species, keeping the VCSF open to modification ensures that the classification system remains a useful and comparable way to record plant assemblages over successive generations of vegetation mapping.

The classification system used in this project (Appendix B) is a derivative of the VCSF. It differs from its parent system in several ways:

1. The hierarchical pathways between levels were modified to help photo-interpreters consistently reach the same vegetation class and reduce photo-interpreter variability.
2. Several vegetation class definitions were modified to clarify meaning and to reflect regional differences in species composition.
3. Vegetation classes not occurring within the mapping area were removed, while region-specific observed and documented vegetation classes were added.
4. The vegetation classification key for exotic plant species was not included in this document because it includes all possible known exotic plant species present within south Florida.

The top of the classification system, **Level 1 (Class)**, provides the lowest level of detail about plant communities and is based on dominant physiognomy and structure as followed:

- **Forest (F)**—Stands of trees (5 meters [16.4 ft] or taller) that are of high density (50–100% cover).
- **Woodland (W)**—Stands of trees (5 meters [16.4 ft] or taller) that are of low density (10-49% cover). Trees are evenly spaced out and often in a matrix of sparse shrubs, graminoids, and/or herbaceous vegetation.
- **Shrubland (S)**—Stands of shrubs (shorter than 5 meters [16.4 ft]) that are of high density (50-100% cover).

- **Scrub (C)**—Stands of shrubs (shorter than 5 meters [16.4 ft]) that are of low density (10-49% cover). Shrubs are evenly spaced out and often in a matrix of graminoids and/or herbaceous vegetation.
- **Marsh (M)**—Graminoid and/or herbaceous emergent or floating vegetation in shallow water that stands at or above the ground surface for much of the year. Prairie habitat is included in this class. A marsh can have low density (0-9%) tree and shrub cover.
- **Dune (D)**—Shrub, graminoid and/or herbaceous vegetation associated with a mound or ridge of sediment formed by wind and/or storm deposits.
- **Submerged Aquatic Vegetation (A)**—Vegetation inhabiting a submerged freshwater or marine environment, e.g., *Vallisneria* spp. or *Thalassia* spp.
- **Exotic (E)**—Non-native plant species assemblages.
- **Other (O)**—Anthropogenic or non-vegetative features.

At the next level, **Level 2** (Subclass), the physiognomically defined **Level 1** is modified with a hydrologic designation, e.g., Wetland Forest versus Upland Forest; this is a new modification to the classification system not present in v6.10.09. The next lower level, **Level 3** (Group), replaces the hydrologically defined **Level 2** with a community designation based on additional physiognomic and environmental factors, e.g., Mangrove Forest, Swamp Forest, or Hardwood Hammock. At **Level 4** (Alliance), communities are defined based on the dominant diagnostic species in the upper most stratum, e.g., Black Mangrove Forest, Buttonwood Forest, or Live Oak Hammock. The remaining three levels of the classification system, **Level 5** (Sub alliance), **Level 6** (Association), and **Level 7** (Sub association), continue to subdivide the previous community types by dominant canopy species composition and the understory species assemblages; for example, a **Level 7** mixed-mangrove scrub community in a matrix of sawgrass would have the following nomenclature: Buttonwood-Red Mangrove Scrub-Sawgrass Marsh.

Taxonomic references in the classification system and this document utilize the [Integrated Taxonomic Information System](#).

Quality Assurance and Accuracy Assessment

Classification errors are a reality in all mapping projects. They are typically caused by confusion associated with one or more of the following factors: the spectral and spatial resolution of the imagery, the spectral reparability of the feature(s) or attribute(s) being classified, the classification system, or the skill set of the photo-interpreter team. In a large, complex project with multiple photo-interpreters, managing for errors is critically important to ensure the product meets expectations. Developing tools and techniques to help mitigate and reduce errors is an important aspect of this project.

Photo-interpreter Assessment

Photo-interpreter classification skills and understanding of south Florida vegetation communities were assessed by having all photo-interpreters classify five randomly distributed mapping clusters, consisting of 100 grid cells each, within the area being mapped. This allowed for an evaluation of

each photo-interpreter's understanding of the mapping methodology, classification system, and their knowledge of the vegetation communities present within the area being mapped. It also facilitated an open discussion between all photo-interpreters, creating a peer-to-peer learning environment.

QA/QC of Mapped Products

Quality assurance and quality control (QA/QC) of photo-interpreter mapped products follows the protocol outlined in Rutchey et al. (2008). The lead photo-interpreter verified each grid cell in the stereo environment to ensure that no cell was misclassified due to clerical errors, majority rule determination including class exceptions, and that no artificial edges existed between photo-interpreter mapped products and previously checked areas. Mapping inconsistencies were addressed in an open discussion with all photo-interpreters participating to ensure that these types of errors would be minimized or eliminated in the future. Three QA/QC photo-interpreters, supervised by the project manager, conducted the QA/QC on the eastern Big Cypress vegetation map produced by the eight photo-interpreters working on the project.

Accuracy Assessment

The thematic accuracy of the EVER/BICY vegetation map will be assessed using 2,114 randomly selected grid cells (AA points) collected between 2010 and 2015. The AA data contains the same type of information collected in the TP points discussed previously (see Vegetation Data Collection section), thus its timely collection ensures that temporal vegetation change resulting from natural community succession or perturbation events, like fires and windstorms, would be minimized when assessing final map accuracy. The AA data for eastern Big Cypress was collected in the spring of 2015, within a year of image acquisition. A total of 480 points were selected. However, four points were dropped because of fire, which affected three points, and a multi-community split cell where no dominant community could be determined.

The thematic accuracy of the eastern Big Cypress vegetation map was calculated as the total number of assessment locations considered acceptable divided by the total number of assessment (AA) points (476, Figure 4). In addition, a 1-tailed 90% confidence level was calculated using Zar (1999, p. 527) to determine whether the overall map accuracy was equal to or greater than 80% with 90% confidence as required by the NPS Vegetation Mapping Inventory Program.

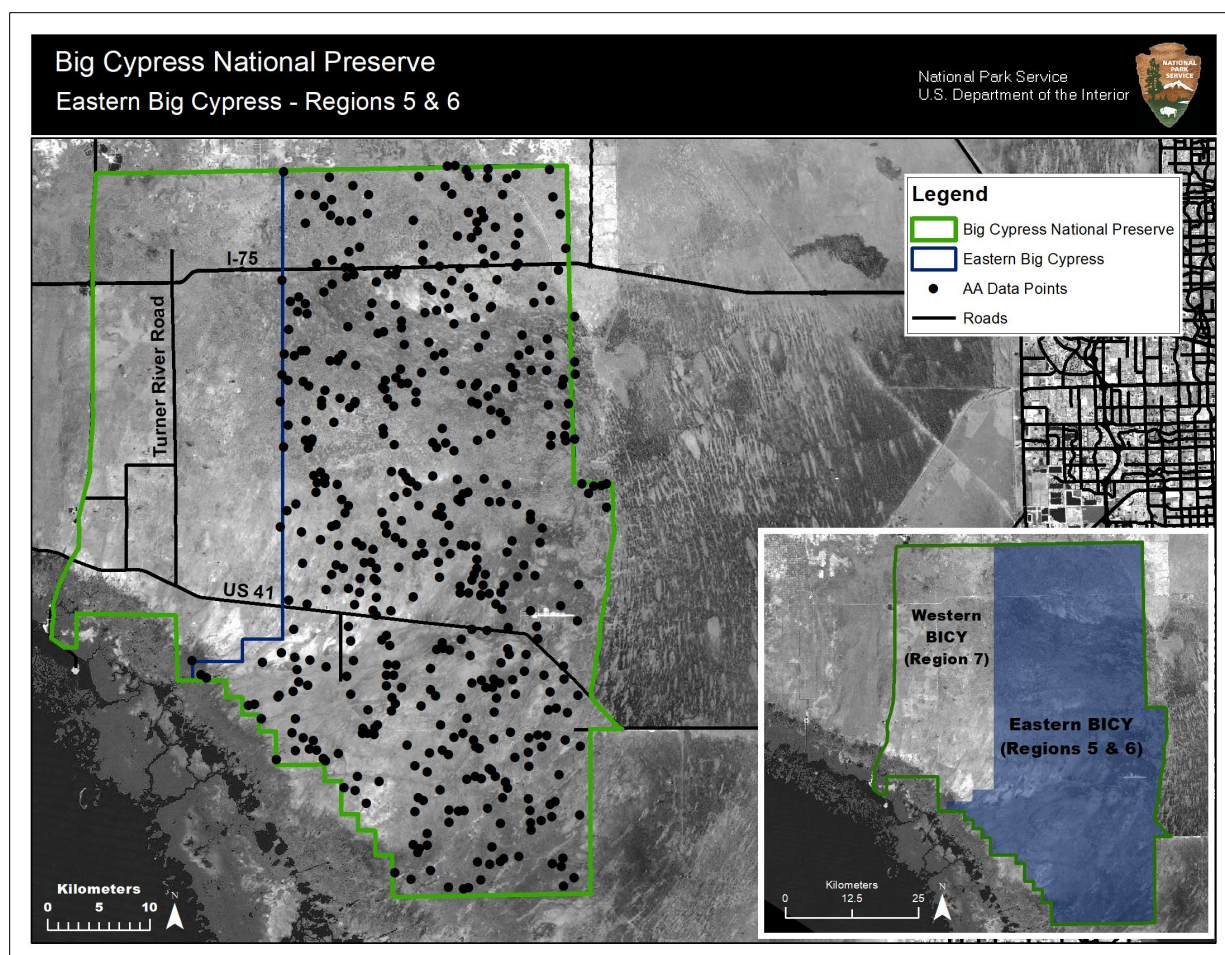


Figure 4. Location of accuracy assessments (AA) points collected in eastern Big Cypress, Regions 5 & 6, Big Cypress National Preserve.

Grid cells were accepted or rejected based on a thorough review of the AA data, including the photos collected. Acceptable AA points included: (1) those that had a one-to-one match between the vegetation class on the map and the field collected AA point data, and (2) those for which the vegetation class differed from the AA dataset, but were considered acceptable because:

1. The AA classification was at a more detailed level than the vegetation map classification, but the vegetation map class was correct at the level mapped.
2. The vegetation map class was at a more detailed level than the AA classification, but the field notes supported the more detailed label as correct.
3. The AA data indicated that the vegetation label was at the boundary between two classes due to height or cover cutoff parameters, i.e. 5-meters (16.4-ft) height between Shrubland and Forest or 50% cover for Scrub and Shrubland. For example, if a Red Mangrove Shrubland was misclassified as a Red Mangrove Forest, the Red Mangrove Forest was accepted because the species composition was correct. This reasoning would apply to Forest versus Woodland

that have a 50% cover cutoff or Marsh versus Scrub that have a 10% woody cover cutoff or for understory graminoid cover.

4. The class modifier for sawgrass, which includes short-dense, short-sparse, tall-dense, and tall-sparse, was misclassified due to cover or height cutoff parameters.
5. The discrepancy between the AA point and the vegetation map classification resulted from the presence of two co-dominant communities, split cell/majority-rule decision, within the grid-cell.
6. The difference between Upland Pines and Lowland Pines is difficult to discern from both the air (helicopter) and the imagery due to similarity in species composition and structure.

The project manager, lead photo-interpreter, and the photo-interpreters working on the project did not have access to the AA data collected.

Results

Vegetation

The eastern Big Cypress vegetation map consists of 140 thematic classes (Figure 5). The majority of classes, 119 out of 140 (85% of all the thematic classes), account for less than 1%, each, of the total area mapped, and combine for approximately 12% (24,386 hectares [60,257 ac]) of the map (Appendix C). The most common vegetation class, Cypress Forest, accounts for 20.4% (42,189 ha [104,252 ac]) of the map (Appendix C). Cypress Scrub marshes and prairies, the next dominant community types mapped, combine for 19.6% (40,637 hectares [100,417 ac]) of the area mapped. Other notable classes include Cypress Domes (6.5%, 13,437 hectares [33,203 ac]) and Freshwater Graminoid Prairies (6.2%, 12,808 hectares [31,649 ac], Appendix C). These five dominant classes comprise 53% of the map (Appendix C).

Forests are the dominant communities in eastern Big Cypress. They account for more than a third (35.5%) of the map area and consist of Swamp Forest (67,640 hectares [167,141 ac]), Hardwood Hammocks (5,689 hectares [14,057 ac]), and Mangrove Forests (23 hectares [57 ac], Table 2). Swamp Forests, which consist of ten community types, combined for nearly a third (32.7%) of the area mapped (Table 2). Cypress Forest, the dominant Swamp Forest community, which subdivides into Cypress Domes, Strands, and Cypress with Hardwoods or Pines, combined for nearly a third (31.9%, 66,021 hectares [163,148 ac]) of the area mapped (Table 2). The remaining Swamp Forest communities; Bayhead Forest, Hardwood Swamp Forest, Pond Apple Forest, Pop Ash Forest, and Red Maple Forest accounted for less than one-percent of the area mapped (Table 2). Transitional Forest communities (Transitional Bayhead Forest and Transitional Hardwood Swamp Forest) combined for approximately 0.03% (70 hectares [171 ac]) of the map area. While these two communities do not represent a significant portion of the landscape, they are indicative of mangrove encroachment into freshwater dominated forest communities. Hardwood Hammock communities within eastern Big Cypress account for 2.7% (5,689 hectares [14,057 ac]) of the map (Table 2). They consist of several Cabbage Palm dominated or co-dominated Hammocks (638 hectares [1,577 ac]) and three Hardwood Hammocks classes (5,501 ha [12,480 ac], consisting of temperate and/or tropical tree species, Table 2). The three Hardwood Hammock classes, Temperate Hardwood Hammocks, Live Oak Hammocks, and Tropical Hardwood Hammocks accounted for 2.2% of the area mapped (Table 2). Palm Hammocks, a minor component of the landscape, comprised just 0.29% of the map. The mangrove forests consisted of Buttonwood Forest, Buttonwood-Red Mangrove Forest and Red Mangrove Forest (Table 2). These mangrove forests are a minor component of the landscape; accounting for only 0.01% (23 hectares [57 ac]) of the map (Table 2).

Woodlands communities account for 20.1% (41,494 hectares [102,534 ac]) of the map area and consists of three different Pine Woodland communities: Pine Flatwoods, Pine Lowland, and Pine Rockland; three communities of Swamp Woodland: Cypress Woodland, Cabbage Palm Lowland, and Hardwood Swamp Woodland, and three Upland Hardwood-Palm Woodland communities: Cabbage Palm Upland, Temperate Hardwood Woodland, and Live Oak-Saw Palmetto Woodland (Table 3). Pine Flatwoods account for nearly 10% (20,271 hectares [50,091 ac]) of the map area and is the dominant woodland community within eastern Big Cypress (Table 3).

Big Cypress National Preserve

Eastern Big Cypress - Regions 5 & 6

National Park Service
U.S. Department of the Interior



Legend

Forests

- Hardwood Hammock
- Cabbage Palm Hammock
- Swamp Forest
- Mangroves Forest
- Cypress Forest
 - Dominant
 - Dome
 - Strand
 - Other

Woodlands

- Upland Woodlands
- Swamp Woodlands
- Cypress Woodland
- Pine Flatwoods
- Pine Lowland
- Pine Rockland

Shrubland

- Upland Shrubland
- Swamp Shrubland
- Mangrove Shrubland

Scrub

- Upland Scrub
- Mangrove Scrub
- Swamp Scrub
- Cypress Scrub-Graminoid Marsh
- Cypress Scrub-Graminoid Prairie
- Cypress-Hardwood Scrub

Marsh

- Graminoid Freshwater Marsh
- Graminoid Freshwater Prairie
- Broadleaf Emergent Marsh
- Mixed Graminoid-Broadleaf Freshwater Marsh
- Floating Emergent Marsh
- Herbaceous Freshwater Marsh
- Graminoid Salt Marsh

Other

- Exotics
- Non-Vegetative
- Anthropogenic

Kilometers

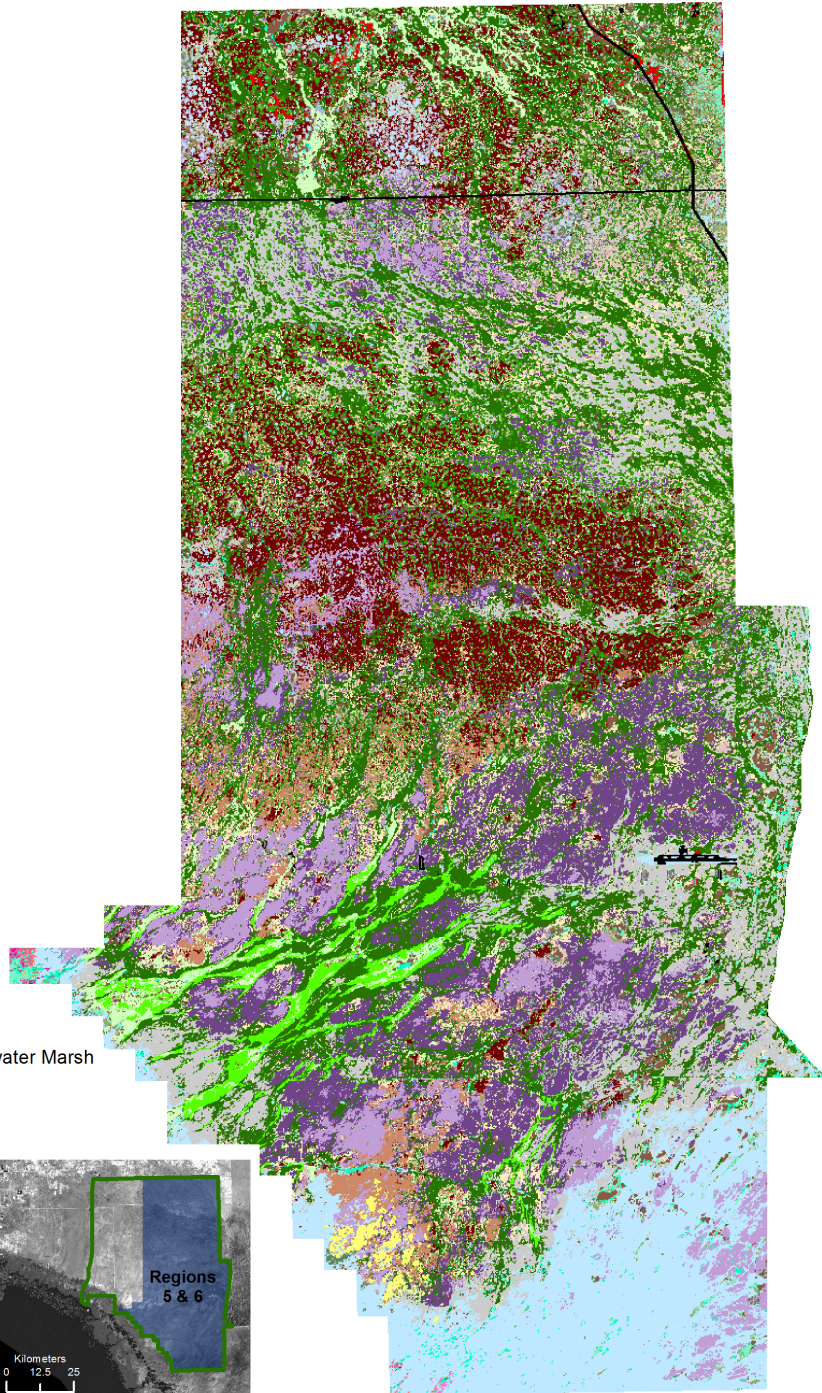
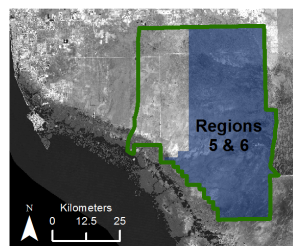
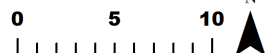


Figure 5. Generalized vegetation map of eastern Big Cypress, Regions 5 and 6, Big Cypress National Preserve.

Table 2. Total area in hectares (ha) and acres (ac) and percent total area mapped of Forest communities within eastern Big Cypress.

Community	Community Type	Area (Ha)	Area (Ac)	Percent Area Mapped
Hardwood Hammock	Hardwood Hammock Total	5,689	14,057	2.7%
	Cabbage Palm Hammock	218	539	0.11%
	Cabbage Palm-Oak Hammock	383	946	0.19%
	Cabbage Palm-Pine Hammock	37	92	0.02%
	Hardwood Hammock-Pine Forest	587	1,449	0.28%
	Live Oak Hammock	1,107	2,734	0.53%
	Temperate Hardwood Hammock	2,549	6,299	1.23%
	Tropical Hardwood Hammock	808	1,997	0.39%
Mangrove Forest	Mangrove Forest Total	23	57	0.01%
	Buttonwood Forest	3	7	< 0.01%
	Buttonwood-Red Mangrove Forest	14	34	0.01%
	Red Mangrove Forest	6	16	< 0.01%
Cypress Forest	Cypress Forest Total	66,024	163,148	31.91%
	Cypress Forest-Dome	13,437	33,203	6.49%
	Cypress Forest-Dominant	42,189	104,252	20.39%
	Cypress Forest-Strand	3,280	8,104	1.59%
	Cypress-Hardwood Forest	5,376	13,283	2.60%
	Cypress-Pine Forest	1,743	4,306	0.84%
Swamp Forest	Swamp Forest Total	1,616	3,993	0.79%
	Bayhead Forest	506	1,251	0.24%
	Hardwood Swamp Forest	767	1,895	0.37%
	Pond Apple Forest	14	35	0.01%
	Pond Apple-Pop Ash Forest	3	7	< 0.01%
	Pop Ash Forest	195	483	0.09%
	Pop Ash-Willow Forest	60	149	0.03%
	Red Maple Forest	1	2	< 0.01%
	Transitional Bayhead Forest	66	162	0.03%
	Transitional Hardwood Swamp Forest	4	9	< 0.01%
Forest Total	–	73,352	181,255	35.41%

Table 3. Total area in hectares (ha) and acres (ac) and percent total area mapped of Woodland communities within eastern Big Cypress.

Community	Community Type	Area (Ha)	Area (Ac)	Percent Area Mapped
Pine Woodland	Pine Woodland Total	27,740	68,547	13.4%
	Pine Flatwoods	20,271	50,091	9.80%
	Pine Lowland	6,799	16,800	3.29%
	Pine Rockland	670	1,656	0.32%
Upland Hardwood-Palm Woodland	Upland Hardwood-Palm Woodland Total	890	2,199	0.43%
	Cabbage Palm Upland	744	1,839	0.36%
	Temperate Hardwood Woodland	90	222	0.04%
	Live Oak-Saw Palmetto Woodland	56	138	0.03%
Wetland Woodland	Wetland Woodland Total	12,864	31,788	6.2%
	Cabbage Palm Lowland	9	23	< 0.01%
	Hardwood Swamp Woodland	14	33	0.01%
	Cypress Woodland	12,841	31,731	6.21%
Woodland Total	–	41,494	102,534	20.0%

Shrublands account for 2.6% (5,444 hectare [13,451 ac]) of the map area and consist of Upland Shrublands (3,317 hectare [8,196 ac]), Swamp Shrublands (2,047 hectare [5,057 ac]), and Mangrove Shrublands (80 hectare [198 ac], Table 4). Upland Shrublands consist of Saw Palmetto Shrubland, Temperate Hardwood Shrubland, and Tropical Hardwood Shrubland (Table 4). The dominant Shrubland community is the Temperate Hardwood Shrubland class. It comprises 1.3% of the map (Table 4). The Swamp Shrubland communities consist of 11 different community types with varying hydrologic tolerances and species composition (see Appendix B for species list and community descriptions). These communities account for about 1.0% of the area mapped (Table 4). Mangrove Shrublands account for 0.04% of the map and consist of Buttonwood-Red Mangrove Shrubland and Red Mangrove Shrubland (Table 4).

Scrub communities account for 25.6% (52,953 hectares [130,849 ac]) of the area mapped and are the second most dominant community type on the map. Scrub communities consists of Swamp Scrub (51,550 ha [127,383 ac]), Upland Scrub (1,356 hectares [3,350 ac]), and Mangrove Scrub (47 hectares [116 ac], Table 5). Cypress Scrub is the dominant Swamp Scrub community and accounts for nearly 94% of the scrub habitat in eastern Big Cypress (Table 5).

Table 4. Total area in hectares (ha) and acres (ac) and percent total area mapped of Shrubland communities within eastern Big Cypress.

Community	Community Type	Area (Ha)	Area (Ac)	Percent Area Mapped
Upland Shrubland	Upland Shrubland Total	3,317	8,196	1.6%
	Saw Palmetto Shrubland	694	1,715	0.34%
	Temperate Hardwood Shrubland	2,596	6,415	1.25%
	Tropical Hardwood Shrubland	27	66	0.01%
Mangrove Shrubland	Mangrove Shrubland Total	80	198	0.03%
	Buttonwood-Red Mangrove Shrubland	29	72	0.01%
	Red Mangrove Shrubland	51	126	0.02%
Swamp Shrubland	Swamp Shrubland Total	2,047	5,058	1.0%
	Bayhead Shrubland	215	530	0.10%
	Cocoplum Shrubland	53	130	0.03%
	Hardwood Swamp Shrubland	352	870	0.17%
	Pond Apple Shrubland	2	6	< 0.01%
	Pond Apple-Pop Ash Shrubland	0	1	< 0.01%
	Pop Ash Shrubland	8	20	< 0.01%
	Pop Ash-Willow Shrubland	12	30	0.01%
	Primrose-Willow Shrubland	2	5	< 0.01%
	Transitional Bayhead Shrubland	91	225	0.04%
	Wax Myrtle Shrubland	203	502	0.10%
	Willow Shrubland	1,109	2,739	0.54%
	Shrubland Total	—	5,444	13,452

Table 5. Total area in hectares (ha) and acres (ac) and percent total area mapped of Scrub communities within eastern Big Cypress.

Community	Community Type	Area (Ha)	Area (Ac)	Percent Area Mapped
Upland Scrub	Upland Scrub Total	1,356	3,350	0.66%
	Cabbage Palm Upland Scrub	96	238	0.05%
	Saw Palmetto Scrub	48	117	0.02%
	Temperate Hardwood Scrub	1,132	2,796	0.55%
	Upland Hardwood Scrub	81	199	0.04%

Table 5 (continued). Total area in hectares (ha) and acres (ac) and percent total area mapped of Scrub communities within eastern Big Cypress.

Community	Community Type	Area (Ha)	Area (Ac)	Percent Area Mapped
Mangrove Scrub	Mangrove Scrub Total	47	116	0.02%
	Red Mangrove Scrub	47	116	0.02%
Cypress Scrub	Cypress Scrub Total	50,035	123,639	24.0%
	Cypress Scrub-Graminoid Marsh	22,368	55,272	10.81%
	Cypress Scrub-Graminoid Prairie	24,191	59,776	11.69%
	Cypress-Hardwood Scrub	3,132	7,738	1.51%
	Cypress-Pine Scrub	345	853	0.17%
Swamp Scrub	Swamp Scrub Total	1,515	3,744	0.57%
	Bayhead Swamp Scrub	122	300	0.06%
	Cabbage Palm Swamp Scrub	1	3	< 0.01%
	Hardwood Swamp Scrub	15	36	0.01%
	Pond Apple Scrub	14	35	0.01%
	Transitional Bayhead Swamp Scrub	0.4	1	< 0.01%
	Wax Myrtle Scrub	970	2,397	0.47%
	Willow Scrub	393	972	0.19%
Scrub Total	–	52,953	130,849	25.3%

Marsh communities accounted for 15.7% (32,414 hectares [80,096 ac]) of the map and consist of eight types: Graminoid Freshwater Marsh (18,977 hectares [46,892 ac]), Graminoid Freshwater Prairie (13,153 hectares [32,501 ac]), Mixed Graminoid-Broadleaf Freshwater Marsh (208 hectares [514 ac]), Broadleaf Emergent Marsh (37 hectares [91 ac]), Floating Emergent Marsh (29 hectares [70 ac]), Open Freshwater Marsh (6 hectares [15 ac]), and Graminoid Salt Marsh (4 hectares [9 ac], Table 6). Graminoid Freshwater Marshes consisted of 12 classes of which Mixed Graminoid Freshwater Marsh was the dominant (Table 6). This class accounted for 4.2% (8,600 hectares [21,250 ac]) of the map. However, it was not the dominant graminoid community mapped. Graminoid Freshwater Prairie accounted for 6.4% (13,153 hectares [32,501 ac]) of the area mapped (Table 6). Graminoid Salt Marshes consisting of Black Rush and Saltgrass accounted for < 0.01% of the area mapped (Table 6).

Table 6. Total area in hectares (ha) and acres (ac) and percent total area mapped of Marsh communities within eastern Big Cypress.

Community	Community Type	Area (Ha)	Area (Ac)	Percent Area Mapped
Broad Leaf Emergent Marsh	Broad Leaf Emergent Marsh Total	37	91	0.02%
	Alligator Flag Marsh	37	91	0.02%
Floating Emergent Marsh	Floating Emergent Marsh Total	29	70	0.01%
	Waterlily Marsh	29	70	0.01%
Herbaceous Freshwater Marsh	Herbaceous Freshwater Marsh Total	1	3	< 0.01%
Mixed Graminoid-Broadleaf Marsh	Mixed Graminoid-Broadleaf Marsh Total	208	514	0.10%
Open Freshwater Marsh	Open Freshwater Marsh Total	6	15	< 0.01%
Graminoid Freshwater Marsh	Graminoid Freshwater Marsh Total	18,977	46,893	9.2%
	Beakrush Marsh	18	44	0.01%
	Cattail Marsh	189	466	0.09%
	Common Reed Marsh	27	65	0.01%
	Graminoid Freshwater Marsh	2	6	< 0.01%
	Common Reed-Cattail Marsh	5	14	< 0.01%
	Mixed Graminoid Marsh	8,600	21,250	4.16%
	Sawgrass-Beakrush Marsh	2,727	6,739	1.32%
	Sawgrass-Cattail Marsh	659	1,628	0.32%
	Sawgrass-Sand Cordgrass Marsh	4	10	< 0.01%
	Sand Cordgrass Marsh	37	93	0.02%
	Spikerush Marsh	762	1,882	0.37%
	Sawgrass Marsh	5,947	14,696	2.9%
Graminoid Freshwater Prairie	Graminoid Freshwater Prairie Total	13,153	32,501	6.4%
	Black Sedge Prairie	345	853	0.17%
	Graminoid Freshwater Prairie	12,808	31,649	6.19%
Graminoid Salt Marsh	Graminoid Salt Marsh Total	3.5	8	< 0.01%
	Black Rush Marsh	0.5	1	< 0.01%
	Saltgrass Marsh	3	7	< 0.01%
Marsh Total	–	32,415	80,095	15.7%

Anthropogenic and Non-Vegetative classes account for less than 0.5% of the total mapping area (Table 7). Anthropogenic features like roads, campgrounds, maintenance facilities, canals and levels, account for 0.4% of the area mapped while the Non-Vegetative classes, mud and water, accounted for 0.03% of the area mapped (Table 7).

Table 7. Total area in hectares (ha) and acres (ac) and percent total area mapped of Anthropogenic and Non-Vegetative classes within eastern Big Cypress.

Class	Class Type	Area (Ha)	Area (Ac)	Percent Area Mapped
Anthropogenic	Anthropogenic Total	834	2,059	0.4%
	Agriculture	2	4	< 0.01%
	Anthropogenic	262	647	0.13%
	Campground	3	8	< 0.01%
	Canal	88	217	0.04%
	Levee	142	350	0.07%
	Pasture	50	124	0.02%
	Road	287	709	0.14%
Non-Vegetative	Non-Vegetative Total	58	142	0.03%
	Mud	4	9	< 0.01%
	Water	54	133	0.03%
Total	–	892	2,201	0.43%

Four exotic plant species were encountered in eastern Big Cypress: Brazilian pepper (*Schinus terebinthifolius*), Punktree (*Melaleuca quinquenervia*), Old World climbing fern (*Lygodium* sp.), and Water Lettuce (*Pistia* spp.). Brazilian pepper, Punktree, and Water Lettuce were detected on the 2014 imagery. The areal coverage of Brazilian pepper in eastern Big Cypress is 2,096 hectares (5,179 ac, Figure 6). Brazilian pepper is mostly present north of I-75 and along the eastern border of the preserve (Figure 6). When present, its infestation density, per grid-cell, was generally below 50% (1,587 hectares [3,920 ac]). However, a quarter (25%) of the times it was found to have an infestation coverage > 50% (509 ha [1,259 ac]). Punktree has an areal coverage of 110 hectares (272 ac, Figure 7)). It is scattered throughout the preserve, but it is generally found near roads, particularly US 41 (Figure 7). Its infestation density, when present, rarely exceeded 50% (108 hectares [2.8 ac]) in a grid-cell. Only 2.8 hectares (4 ac) were found to have an infestation density > 50%. Water Lettuce was detected at a single location, inside a cypress dome. *Lygodium* sp. was detected on the TP/VP aerial surveys. However, it was not detected on the aerial imagery.

Cattail (*Typha sp.*), is a species of concern, because it is usually associated with the presence of high nutrient levels and prolonged hydroperiods (Newman et al. 1996). In eastern Big Cypress, 2,296 hectares (5,673 ac) were found to contain Cattail in densities greater than 10% (Figure 8). The presence of cattails was highest along the eastern and southern boundary of the preserve (Figure 8). When present, cattail densities were generally below 50% (1,911 hectares [4,721 ac]). However, cattail densities exceeded 50% in about 17% (385 hectares [951 ac]) of the total area identified as having cattails.

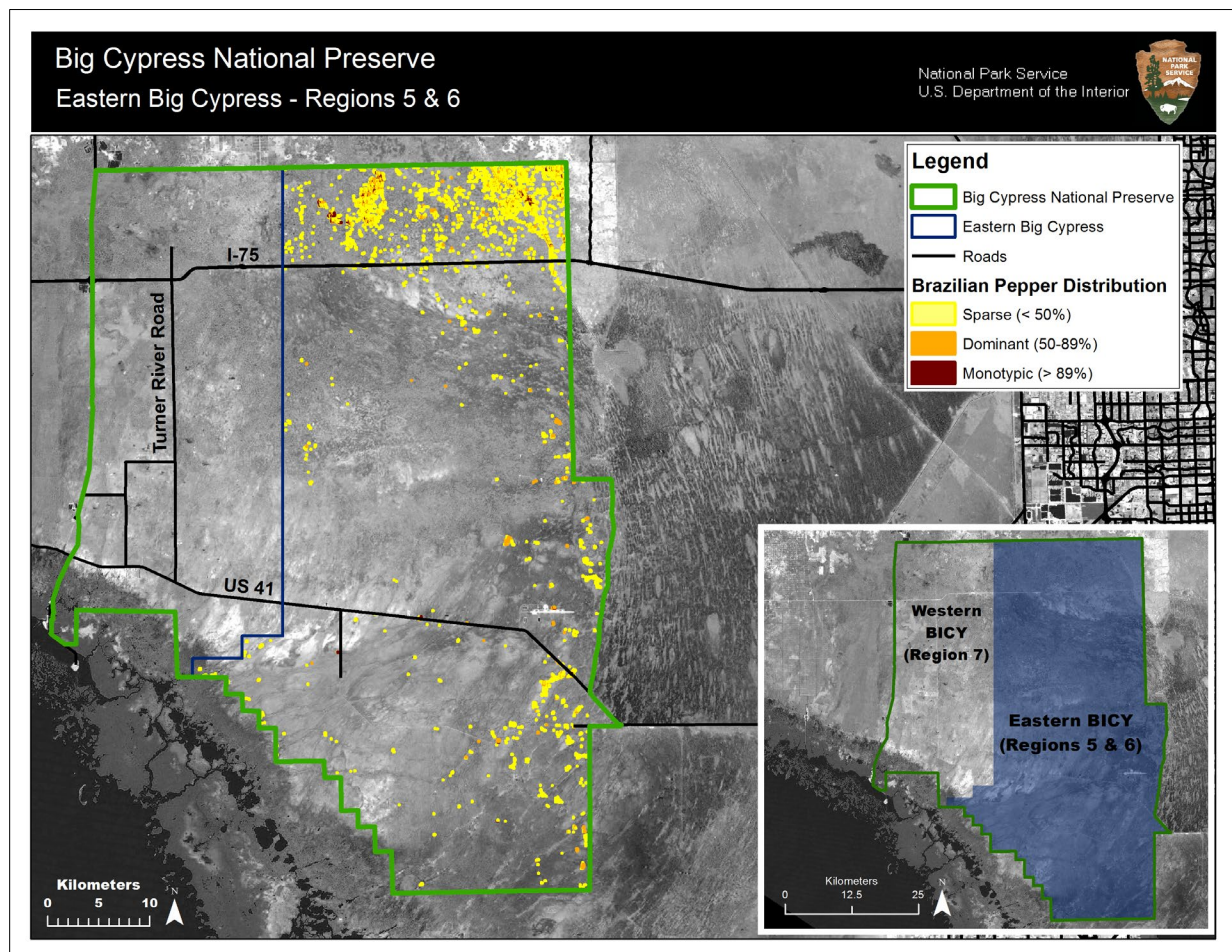


Figure 6. Distribution map and density of Brazilian pepper in eastern Big Cypress, Regions 5 & 6, Big Cypress National Preserve.

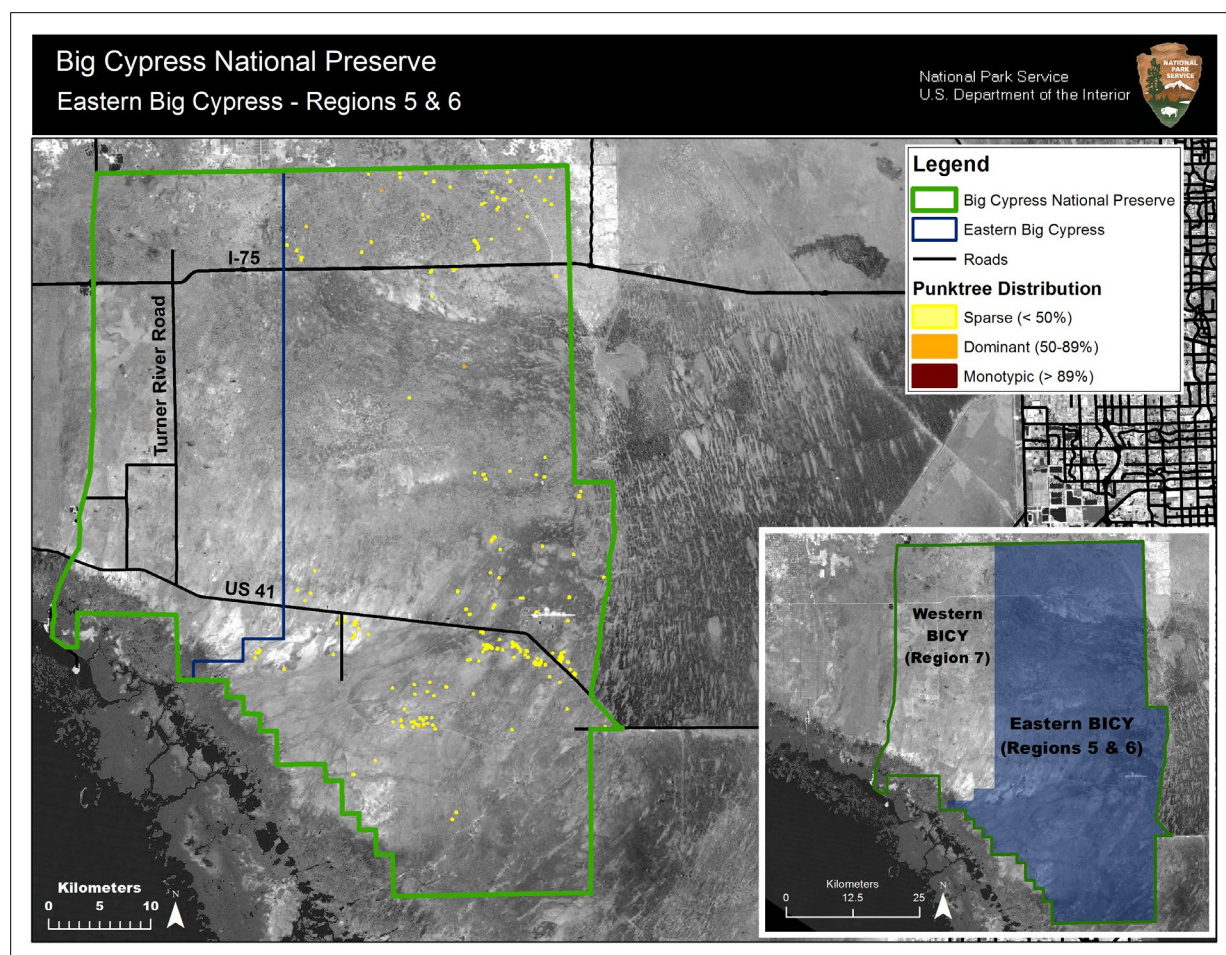


Figure 7. Distribution map and density of Punktree in eastern Big Cypress, Regions 5 & 6, Big Cypress National Preserve.

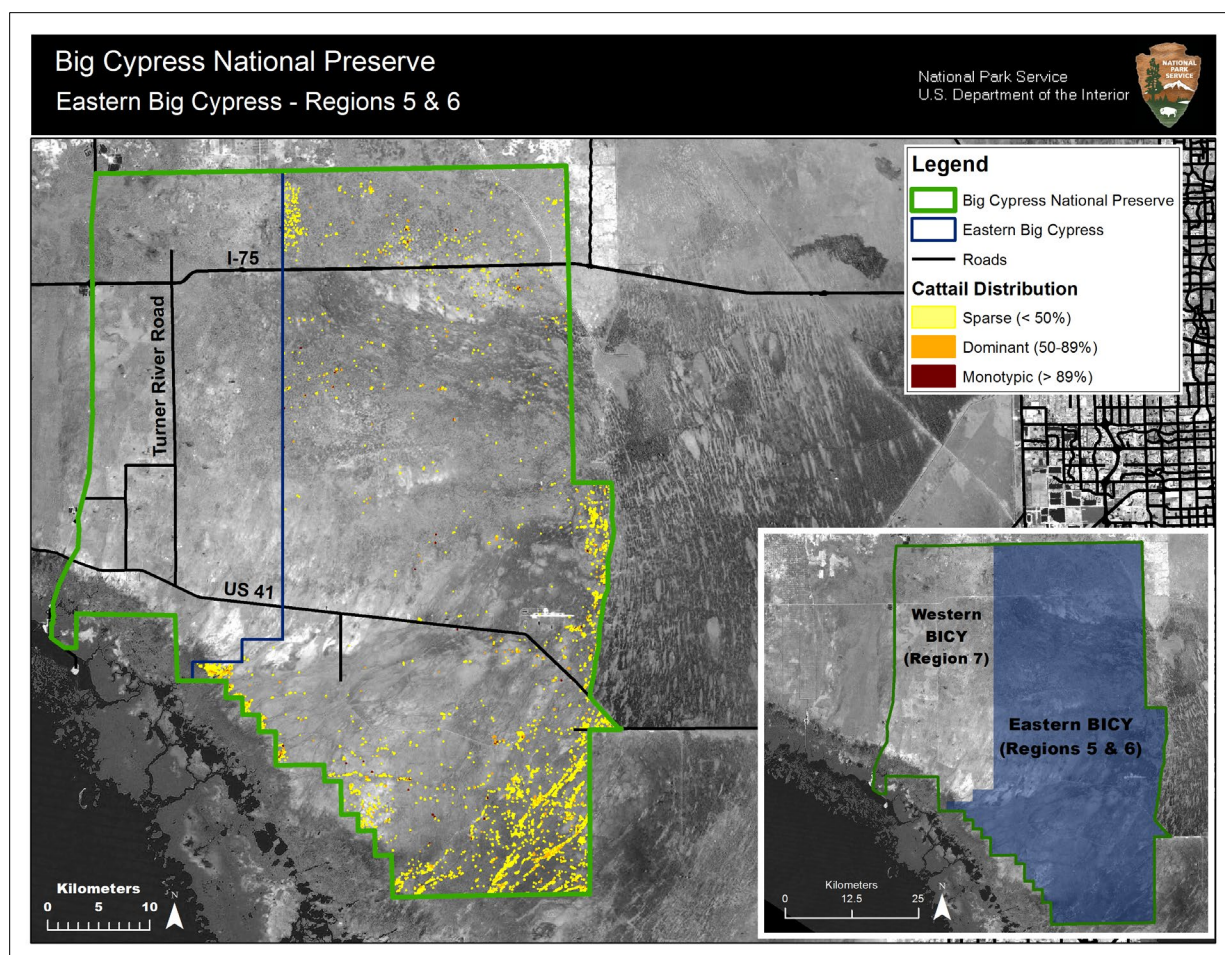


Figure 8. Distribution map and density of cattail in eastern Big Cypress, Regions 5 & 6, Big Cypress National Preserve.

Accuracy Assessment

An exact one-to-one match between the Accuracy Assessment (AA) points and the vegetation code on the map (complete agreement between the AA classified point and the grid cell label) occurred for 203 of the 476 AA points (42.6%) selected (Appendix D). The 273 grid cells that did not have a one-to-one correlation were re-examined to determine whether they could be deemed acceptable based on the conditions described in the methods section. This review yielded an additional 240 matching points, increasing the total number of acceptable points to 443. The majority of points (85%) were deemed acceptable because they were mapped at a lower level of detail than the AA point classification or because they were at the cutoff boundary, either cover percentage or canopy height, between two similar classes, e.g., Cypress Forest vs Cypress Woodland (Appendix D).

Based on the total number of accepted AA points (443), the accuracy of the map, regardless of categorical level, is 93.1% with a lower 90th Percentile Confidence Interval of 90.8% (Table 8). Map accuracy decreases as a function of classification level, with less detail levels (Levels 1–5) having greater accuracy than more detail levels (6–7, Table 8). Classification level accuracy was above 94% for all levels except Level 6 (86.7%) and Level 7 (83.3%, Table 8).

Table 8. Results of the accuracy assessment for each level in the classification system.

Classification Level	Number of Points Acceptable	Number of AA Points	Percent Correct	Lower 90th Percentile Confidence Interval
Level 1	464	476	97.5%	96.0%
Level 2	459	476	96.4%	94.7%
Level 3	453	475	95.4%	93.5%
Level 4	422	447	94.4%	92.3%
Level 5	374	397	94.2%	91.9%
Level 6	39	45	86.7%	75.4%
Level 7	5	6	83.3%	41.8%
Overall	443	476	93.1%	90.8%

Out of the 140 thematic classes used on the map, 51 (36.4%) could be verified with at least one AA point (Appendix D). These 51 classes account for 97% of the map area (Table 9). The thematic class accuracy for these classes ranged from 100% to 0% with most classes (39 out of 51, 76%) having an estimated class accuracy of 80% or greater (Table 9). The 12 classes whose accuracy fell below 80% combined for less than 10% of the total map area with most (10 out of the 12) accounting for less than 1% each of the total mapping area (Table 9). The two classes that did not, Mixed Graminoid Freshwater Marsh (MFGX) and Sawgrass-Beakrush Marsh (MFGXcr), are structurally and spectrally similar to several other long-hydroperiod marsh communities, e.g., Spikerush Marsh (MFGc), Beakrush Marsh (MFGc), and Short Sawgrass Marsh Sparse (MFGcSS), that occupy the same hydrologic niche. Two classes were found to have an estimated accuracy of 0%; Cabbage Palm Lowland-Graminoid Marsh and Hardwood Swamp Scrub-Sawgrass Marsh (Table 9). These two classes were assessed with a single assessment location each thus any inference about their overall accuracy within eastern Big Cypress is not appropriate.

Table 9. Number of accuracy assessment locations, class accuracy, and percent map area for all the accuracy assessment points visited within eastern Big Cypress National Preserve.

Vegetation Class	Number of AA Points	Class Accuracy (%)	Percent Map Area (97%)
Cypress Forest-Dominant (FStM)	77	94.8%	20.39%
Cypress Scrub-Graminoid Prairie (CStGP)	67	98.5%	11.69%
Cypress Scrub-Graminoid Marsh (CStG)	28	100.0%	7.95%
Cypress Forest-Dome (FStD)	42	97.6%	6.49%

Table 9 (continued). Number of accuracy assessment locations, class accuracy, and percent map area for all the accuracy assessment points visited within eastern Big Cypress National Preserve.

Vegetation Class	Number of AA Points	Class Accuracy (%)	Percent Map Area (97%)
Graminoid Freshwater Prairie (MFGP)	22	95.5%	6.19%
Cypress Woodland-Graminoid Marsh (WStG)	31	100.0%	4.67%
Mixed Graminoid Freshwater Marsh (MFGX)	13	76.9%	4.16%
Pine Flatwoods-Mixed (WUpFX)	18	94.4%	3.58%
Pine Flatwoods-Shrubs (WUpFS)	18	100.0%	2.97%
Cypress-Hardwood Forest (FStH)	7	85.7%	2.60%
Cypress Scrub-Sawgrass Marsh (CStGc)	19	94.7%	2.52%
Pine Lowland-Graminoid Marsh (WSpG)	14	100.0%	2.25%
Pine Flatwood-Saw Palmetto (WUpFSn)	7	100.0%	2.23%
Cypress Forest-Strand (FStS)	11	100.0%	1.59%
Cypress-Hardwood Scrub-Graminoid Prairie (CStWGP)	6	83.3%	1.50%
Sawgrass-Beakrush Marsh (MFGXcr)	7	71.4%	1.32%
Wax Myrtle Scrub-Graminoid Prairie (CSmGP)	5	80.0%	1.31%
Short Sawgrass Marsh-Sparse (MFGcSS)	5	40.0%	1.31%
Short Sawgrass Marsh-Dense (MFGcSD)	6	83.3%	1.30%
Temperate Hardwood Shrubland (SUT)	3	100.0%	1.25%
Temperate Hardwood Hammock (FHT)	2	100.0%	1.23%
Pine Flatwoods-Graminoid Marsh (WUpFG)	2	100.0%	1.02%
Cypress-Pine Forest (FStp)	2	50.0%	0.84%
Pine Lowland-Mixed (WSpX)	8	100.0%	0.82%
Cypress Woodland-Mixed (WStX)	2	100.0%	0.75%
Cypress-Pine Woodland-Graminoid Marsh (WStpG)	3	66.7%	0.63%
Temperate Hardwood Scrub-Graminoid Prairie (CUTGP)	7	100.0%	0.55%
Live Oak Hammock (FHq)	5	100.0%	0.54%
Tropical Hardwood Hammock (FHS)	1	100.0%	0.38%
Spikerush Marsh (MFGe)	2	50.0%	0.37%

Table 9 (continued). Number of accuracy assessment locations, class accuracy, and percent map area for all the accuracy assessment points visited within eastern Big Cypress National Preserve.

Vegetation Class	Number of AA Points	Class Accuracy (%)	Percent Map Area (97%)
Saw Palmetto Shrubland (SUn)	1	100.0%	0.34%
Cypress Scrub-Spikerush Marsh (CStGe)	3	66.7%	0.33%
Sawgrass-Cattail Marsh (MFGXct)	4	25.0%	0.32%
Hardwood Hammock-Pine Forest (FHp)	1	100.0%	0.28%
Pine Lowland-Shrubs (WSpS)	5	100.0%	0.21%
Cabbage Palm-Live Oak Hammock (Fhoq)	4	75.0%	0.19%
Hardwood Swamp Shrubland (SSH)	1	100.0%	0.17%
Brazilian Pepper (Es)	1	100.0%	0.16%
Cypress Woodland-Shrubs (WStS)	2	100.0%	0.13%
Bayhead Shrubland (SSB)	1	100.0%	0.10%
Cattail Marsh (MFGt)	1	100.0%	0.09%
Cabbage Palm Upland-Saw Palmetto (WUoSn)	1	100.0%	0.07%
Pine Rockland-Shrubs (WUpRS)	1	100.0%	0.07%
Tall Sawgrass Marsh-Dense (MFGcTD)	1	100.0%	0.06%
Cabbage Palm Upland Scrub-Graminoid Prairie (CUoGP)	1	100.0%	0.05%
Temperate Hardwood Woodland (WUHT)	2	100.0%	0.04%
Transitional Bayhead Forest (FSBT)	2	50.0%	0.03%
Live Oak-Saw Palmetto Woodland (WUHqn)	1	100.0%	0.03%
Cabbage Palm-Pine Hammock (FHop)	1	100.0%	0.02%
Hardwood Swamp Scrub-Sawgrass Marsh (CSHGc)	1	0.0%	0.01%
Cabbage Palm Lowland-Graminoid Marsh (WSoG)	1	0.0%	< 0.01%

Conclusion

The accuracy of the eastern Big Cypress vegetation map, 93.1% with a lower 90th Percentile Confidence Interval of 90.8%, meets and exceeds NPS VMI standards. The majority, 76% (38 out of 51), of all thematic classes assessed, regardless of the number of AA points, had an estimated accuracy greater than or equal to 80%. The few classes that did not, were mostly evaluated (10 out of 12 classes, 83.3%) by five or fewer assessment points each. Thus, any inference about their accuracy within eastern Big Cypress is not recommended because of the few number of assessment points each.

This map provides land-cover information to NPS park managers and scientists for use in park management, resource management, research, and monitoring. It serves as a baseline of plant communities in eastern Big Cypress National Preserve prior to the implementation of the Western Everglades Restoration Project (WERP)—a component of CERP that calls for improving the quantity, quality, timing, and distribution of water needed to restore and reconnect the western Everglades ecosystem to the Greater Everglades. It also provides a cost-effective mechanism by which managers can track and document the rate and direction of vegetation change resulting from natural successional processes, disturbance events, sea level rise, and/or management, by allowing for the systematic monitoring of individual grid-cells overtime. Furthermore, this map, coupled with LiDAR, will allow hydrologist and ecologists to run fine-scale predictive models of potential vegetation change within eastern Big Cypress in response to hydrologic manipulation at a 0.25-hectare (0.61-ac) scale.

This vegetation map is the first of two regional maps for Big Cypress National Preserve. The map and report for the western Big Cypress National Preserve, Region 7, is under final peer review and will be available for distribution once finalized. This report marks the completion of the third vegetation map produced by the network for the project area, Everglades National Park and Big Cypress National Preserve. The Southeast Saline Everglades, Region 2, and Southwest Coastal Everglades, Region 3, vegetation maps were completed in 2017 and 2018, respectively. Both maps are available for download from the [NPS Integrated Resource Management Applications Data Store](#). Work on the remaining two Regions, Shark River Slough/Long Pine Key, Region 1, and the Northwest Coastal Everglades, Region 4, in Everglades National Park is ongoing with completion expected in 2020.

Summary of Final Product and Deliverables

The eastern Big Cypress National Preserve, Regions 5 and 6, vegetation map covers an area of 2068.8 square kilometers (798.8 square miles [mi²], 511,212 ac). It is the first of two map products for Big Cypress National Preserve. The map is highly detailed with 140 thematic classes. The most common class is Cypress Forest. Cypress Forest communities (i.e., Domes, Forest, and Strands) account for 28.5% of the total map area. Other notable classes include Cypress Scrub (24.2%), Pine Woodlands (13.4%), and Mixed Graminoid Freshwater Marshes and Prairies (11.9%). The map has a thematic class accuracy of 93.1% with a lower 90th Percentile Confidence Interval of 90.8% and meets the NPS VMI Program map accuracy requirement standard set for all NPS vegetation mapping products.

This report and the geospatial products developed in the preparation of the eastern Big Cypress vegetation map are available from the [NPS Integrated Resource Management Applications Data Store](#). In addition, a digital product, DVD or flash drive, containing the report and all of the digital data, including the field data and photographs, and META data, is available upon request from the network³.

The geospatial data collected and created in this project are stored in an ESRI ArcGIS v10.5 personal geodatabase and are referenced to the Universal Transverse Mercator (UTM) Zone 17N, North American Datum of 1983 (NAD83).

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Phone: 305.252.0347

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Appendix A. Big Cypress National Preserve Aerial Triangulation Report

Prepared for:

National Park Service

Photo Science, Inc. Project No. 22110

October 01, 2014

Produced By:



523 Wellington Way, Suite 375

Lexington, KY 40503

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Project Details

The scope of this project consists of providing color aerial photography, ground control, aerial triangulation, color digital orthos.

Aerial Photography

A total of 49 flight lines of RGB photography, consisting of 6,337 stereo frame photographs, were taken at an altitude of 1,465 meters above ground level for a 1:9600 photo scale (Table A-1; Figure A-1). The photography was obtained on April 01 thru April 22, 2014 using an Intergraph DMC digital mapping camera (serial number 126) having a focal length of 120.00.

Table A-1. List of flight lines and frames.

Flight Line Number	Frame Numbers
100	1–18
101	1–64
102	1–69
103	1–99
104	1–137
105	1–165
106	1–165
107	1–165
108	1–165
109	1–165
110	1–165
111	1–165
112	1–166
113	1–166
114	1–166
115	1–166
116	1–166
117	1–166
118	1–166
119	1–166
120	1–166

Table A-1 (continued). List of flight lines and frames.

Flight Line Number	Frame Numbers
121	1–161
122	1–158
123	1–154
124	1–153
125	1–150
126	1–146
127	1–141
128	1–139
129	1–138
130	1–137
131	1–136
132	1–132
133	1–127
134	1–124
135	1–121
136	1–118
137	1–118
138	1–118
139	1–107
140	1–103
141	1–103
142	1–103
143	1–106
144	1–107
145	1–110
146	1–41
147	1–30

Table A-1 (continued). List of flight lines and frames.

Flight Line Number	Frame Numbers
148	1–20
49 flight lines	6,337 frames

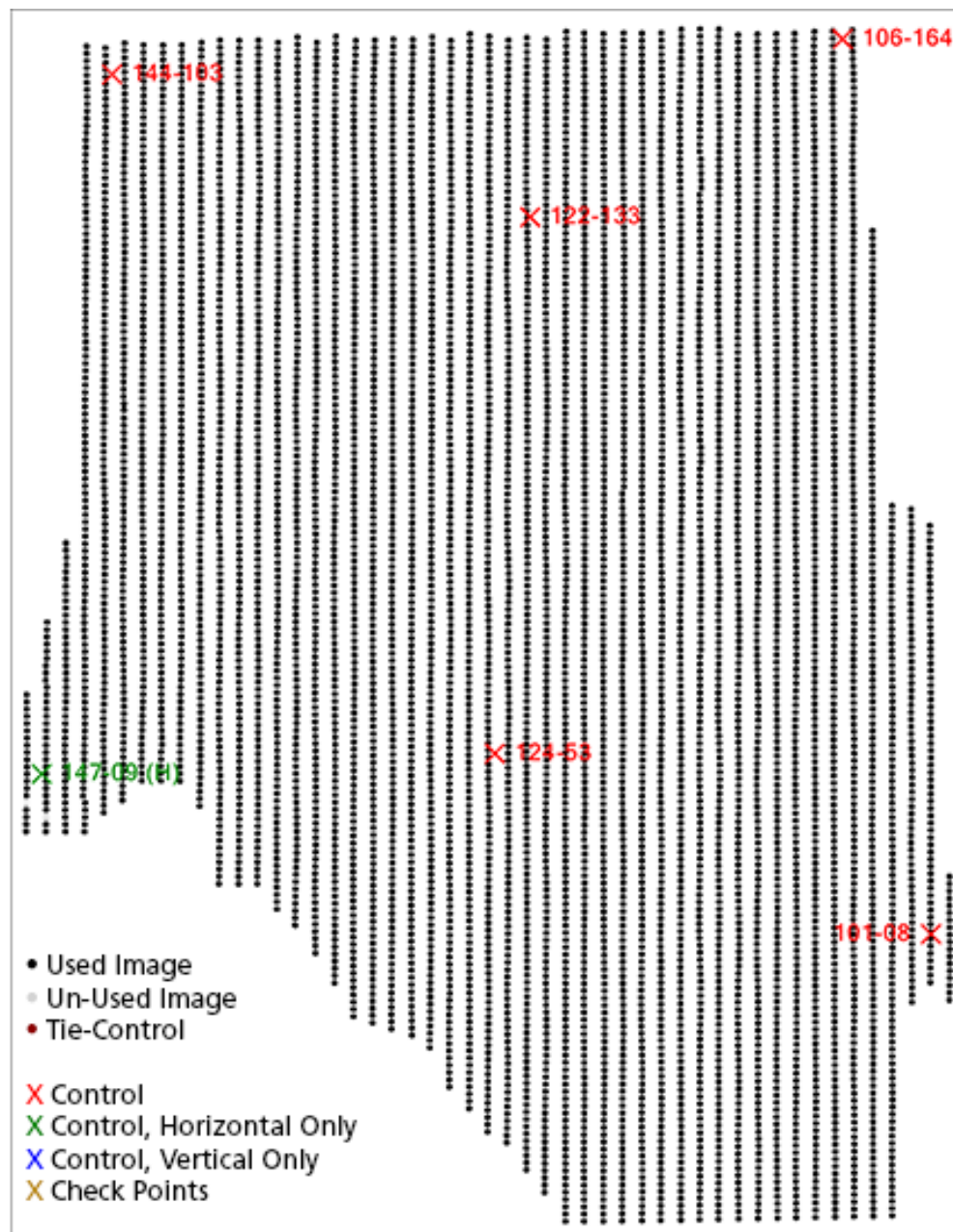


Figure A-1. Location of image centroids representing the 49 image flight lines and the location of ground control locations.

Acquisition Period of Performance

Due to several delays including contracting and weather, acquisition was unable to begin during the prime months of flying in south Florida. Per Mod 0001 to the original contract, the acquisition window was extended to 30 April 2014. To acquire the best possible imagery within that time period, with as little clouds and haze as possible, the decision was made to extend the flight window each day in order to fly whenever the best conditions allowed. This resulted in some imagery being acquired outside the 30-degree sun angle.

Flight Log Descriptions

- FLIGHTLN—Individual planned flight line numbers in the project.
- EXPOS—Total number of frames per flight line.
- ALTITUDE—Flying height above mean sea level with average ground elevation added in.
- FL_Miles—Miles for flight line with total number of frames for whole project.
- Date Flown—Date of flight for each flight line.
- DIR—Direction of flight line flown.
- Time—UTC time of flight. Start and Stop Time.
- Event Number—Frames collected for respective flight date in chronological order.
- EXPO—Frames collected per dates mission in the order from the planned project file.
- CHK ZI—Not applicable
- Comments—Notes from flight crew pertaining to flight line on any information about the flight line captured.

Control

The ground control was established by Photo Science, Inc. using GPS technology. Please refer to the ground control report for more specific detail. The X, Y, Z coordinates of each photo center is included in the final AT adjustment (Table A-2). A total of six photo identification control points were used. The locations of the control points are shown on the photo center diagram.

All statistical data for the control points are given in the Aerial Triangulation section.

See attached Control_RMSE file: 22110_Control_RMSE.txt

Table A-2. Ground Control Points

Point ID	X	Y	Z
101-08	517294.916	2849271.034	3.921
106-164	511736.837	2905434.307	4.492
122-133	492120.600	2894264.519	5.600
124-53	489910.401	2860598.601	3.057
144-103	465858.221	2903221.878	6.423
147-09	461436.022	2859338.311	1.856

Aerial Triangulation Measurement

The measurement of the pass points, flight ties and control data was performed on Intergraph's ISAT, version 13.0, automated aerotriangulation system. Pass points were selected automatically using a sophisticated auto correlation algorithm.

All images were from the DMC mapping camera has a scan resolution of 12 microns

Aerial Triangulation Adjustment

The adjustment of the measurements was performed using a robust aerotriangulation software package on softcopy photogrammetric workstations. The final adjustment of the block was accomplished by using a rigorous simultaneous least squares bundle adjustment. The general procedure is to remove all blunders from the data using automatic blunder detection. The bundle adjustment is then run with minimal ground control to test the photogrammetric measurements for consistency. Next, the full ground control data set, including the ABGPS data, is added to the adjustment holding the horizontal control very loose and the vertical control very tight. Since horizontal control errors can affect the vertical control but not vice-versa, we can detect errors in the vertical control. The horizontal control is then tightened and the effect on the vertical control and the photogrammetric residuals are inspected. The final adjustment makes sure that all of the measurements are in balance with each other and properly represent the actual conditions.

The weights, or estimated standard errors, used in the final adjustment are shown in Table A-3. The estimated standard errors are exactly what the name implies. This shows how close the measurements are to their actual value. The values in Table A-3 were chosen based upon previous experience, requested specifications, and industry standards.

Table A-3. Weights (or estimated standard errors) used in the final adjustment.

Parameter	Measurement Used in the Final Adjustment
Photogrammetric measurements	< 5 microns
Horizontal Control	0.1 meter
Vertical Control	0.1 meter
Tie Control	N/A
IMU Control	0.04 degrees
ABGPS Horizontal Control	0.15 meter
ABGPS Vertical Control	0.15 meter

Aerial Triangulation Results

The aerial triangulation results are given in three sections: airborne GPS (ABGPS), photogrammetric measurements, and ground control. The following parameters were used during the A/T data reduction:

- PhotoT Triangulation—Options
- Adjustment Mode—Absolute
- Precision Computation—Enabled
- Error Detection—Disabled
- Camera Calibration—Disabled
- Self-Calibration—Disabled
- Given EO/GPS—Enabled
- Antenna Offsets—Disabled
- GPS Shift/Drift Correction—Enabled
- INS Shift/Drift Correction—Enabled

Parameters shown in Table A-4.

Table A-4. Parameters.

Parameter	X/Omega	Y/Phi	Z/Kappa	XY
RMS Control	0.1683095	0.3097152	0.0846102	0.2492505
RMS Check	—	—	—	—
RMS Limits	1.0000000	1.0000000	1.0000000	n/a
Max Ground Residual	0.3387330	0.5067068	0.1453715	n/a
Residual Limits	3.0000000	3.0000000	3.0000000	n/a
Mean Std Dev Object	0.0453131	0.0368230	0.0958787	n/a
RMS Photo Position	0.0965757	0.1119614	0.1899436	n/a
RMS Photo Attitude	0.0092524	0.0073340	0.0099380	n/a
Mean Std Dev Photo Position	0.0567913	0.0658506	0.0657082	n/a
Mean Std Dev Photo Attitude	0.0017255	0.0022593	0.0008488	n/a

Key Statistics

- Sigma: 2.9 um
- Number of iterations: 2
- Degrees of Freedom: 317989

Solution Successful.

Current Count

- Control Points Used: 6
- Check Points Used: 0
- Photos Used: 6335
- Photos Not Used: 2
- Image Points Used: 255832

ABGPS Results

See Airborne GPS RMSE file: 22110_ABGPS.txt

Least Squares Ground Residuals

The observations in a simultaneous block adjustment are the photo or model points, and the ground control. The least squares residual for an observation is how much the measured value is moved during the adjustment.

AT Issues

The initial AT delivery lacked a few models that were not created by the software's automatic model creation function. This issue caused these models to not be viewed within the DAT/EM software, and/or wouldn't allow an elevation to be determined on these models. This issue was resolved by manually creating the models in question within the AT software (ISAT). The models were then set up stereoscopically in-house to confirm success.

ABGPS, Control and Tie Point Problems

The Airborne GPS (ABGPS) data for flight lines 147 & 148 suffered from a loss of satellites during that particular mission. As a result, only four satellites instead of the desired eight were observed. Four is the minimum required in order to provide a usable solution, but in this case, the ABGPS vertical solution was weakened due to the dropped satellites. There was limited control on this project (20 points for over 6,500 frames) and these 20 points were originally designated for blind horizontal QC checks on the final ortho tiles. QSI determined the ABGPS wasn't going to provide an adequate solution on its own, so we had to use some of the ground points in the A/T. Six points were selected that fell in locations that would hold the A/T in order to meet the horizontal accuracy specifications in the SOW. The remaining points were withheld, so they could be used for the QC check as stated in the SOW. Everglades City is covered by the flight lines affected by the weak ABGPS solution. Control point 147-09 is also in these flight lines. In the initial AT, this point was used in the solution as a horizontal control point only (the Z was removed) point due to a higher than expected vertical discrepancy. Holding this control point as horizontal only still provided the desired horizontal accuracy as proven by your QC on the final orthos. The A/T was run again with the Z included on 147-09 and that did raise the elevations of the A/T solution around CP 147-09, however in our professional opinion the error from the weakened ABGPS of those 2 flight lines will be pushed out into other areas of the project thusly degrading the vertical accuracy overall. It is our recommendation to move forward with the initial AT as delivered, accepting that the vertical accuracy along strips 147 and 148 are a little less than desired. Again, as proven by the QC using the remaining ground control points, the horizontal accuracy exceeds the accuracy statement in the SOW and the intent in which this project was designed.

Below are two graphics that represent the loss (Figures A-2 and A-3).

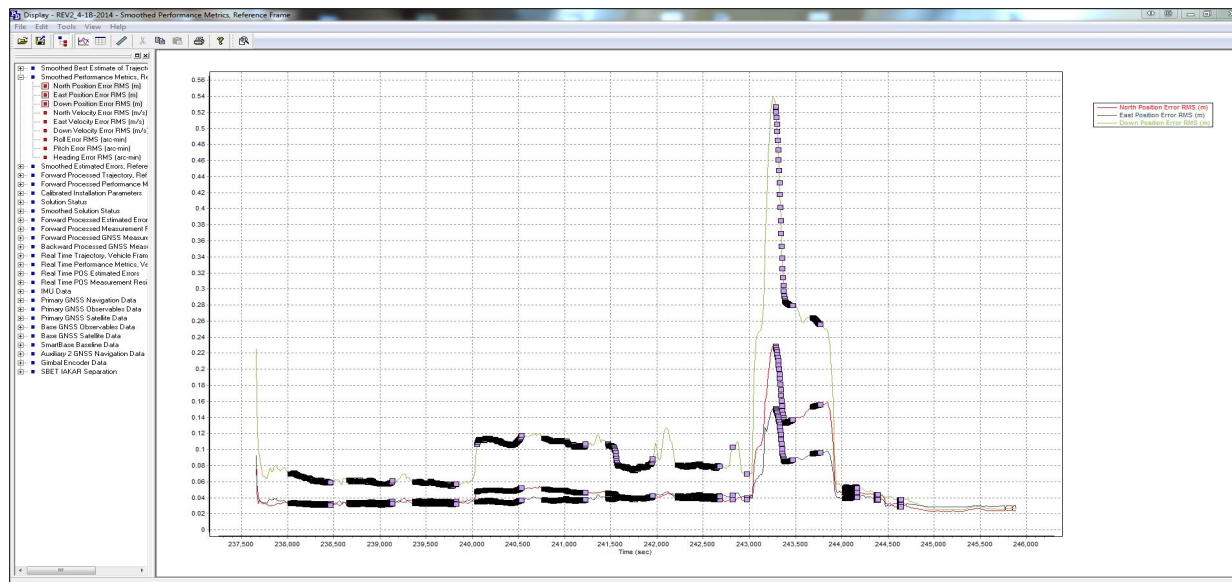


Figure A-2. Satellite signal loss during image acquisition.

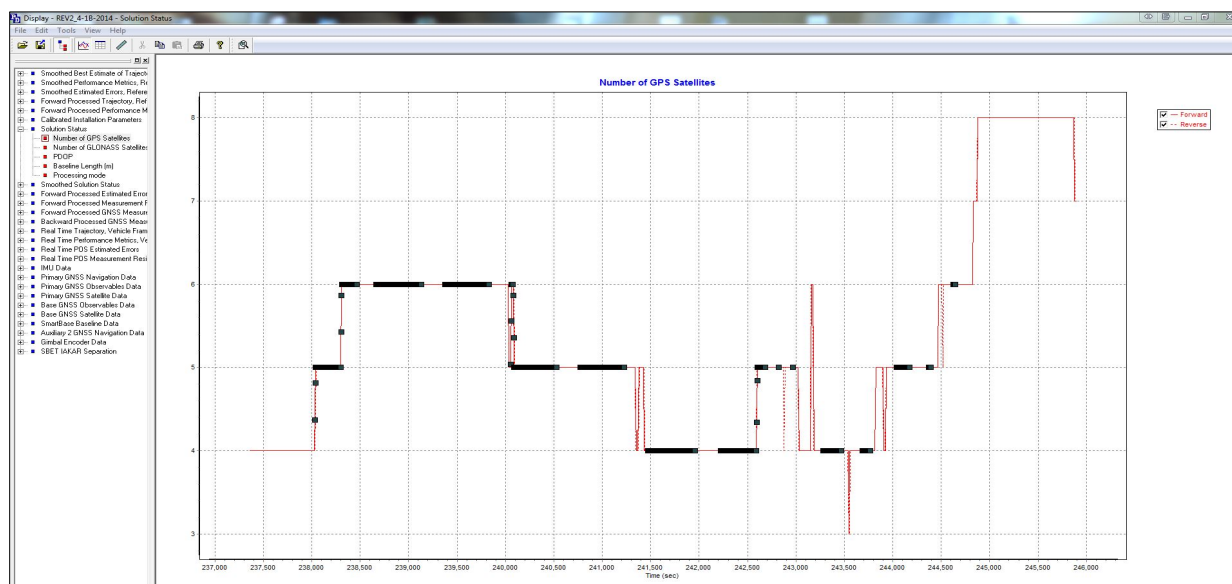


Figure A-3. Satellite signal loss during image acquisition.

Stereo Model Elevation Issue

It has been determined that the difficulty in obtaining tree canopy elevations, using automatic or manual procedures, in the table below is due to these models being comprised of mixed acquisition dates. The mixed acquisition models were due to reflights, which were necessary due to clouds, cloud shadows and haze during original flights. In a stereo model environment, the mixed acquisition dates create tree canopies with varying lean making it difficult for accurately determine the maximum elevation of the canopy.

List of stereo pair models that fail to provide elevation solutions:

- 103-103_36+103-103_35
- 112-112_83+112-112_84
- 112-112_86+112-112_87
- 113-113_105+113-113_106
- 113-113_108+113-113_109
- 113-113_143+113-113_144
- 113-113_148+113_113_149
- 113-113_79+113-113_80
- 113-113_83+113-113_84
- 114-114_67+114-114_66
- 114-114_69+114-114_68
- 116-116_118+116-116_119
- 116-116_119+116-116_120
- 116-116_120+116-116_121
- 116-116_121+116-116_122
- 119-119_58+116-116_57

Delivery Data/Materials

- 22110_CTL.txt-Control and Residuals
- 22110_ABGPS.txt-ABGPS and Residuals
- 22110AT_Report.doc-A/T report

Aerotriangulation Approval

See Table A-5.

Table A-5. Aerotriangulation Results Summary [m—meter].

Parameter	Results
Sigma Naught	2.9
Number of Images	6335
Total Points	6
Image Measurements	255832
Average # of Points per Image	40
Control Points	Six horizontal / five vertical photo ID point
Point Weighting	Photo Measurements – <5 microns ABGPS– 0.15 m Ground Control – 0.1 m
Final Pixel RMSE	0.249 pixels
Ground Control RMSE's	X–0.168 m Y–0.310 m Z–0.085 m

Appendix B. Vegetation Classification Key for The Eastern Big Cypress, Regions 5 and 6, Vegetation Map of Big Cypress National Preserve



Version R56-2019.0723

On the Cover

Landscape scene showing pines, palms, shrubs, and graminoids in Big Cypress National Preserve.
Photo credit Pablo L Ruiz (4 December 2014).

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Introduction

This vegetation classification key was designed to be used in the Everglades National Park (EVER) and Big Cypress National Preserve (BICY) vegetation mapping project to help photo-interpreters determine the appropriate vegetation class within 0.25 ha vegetation mapping cells, the minimum mapping unit (MMU) for this project. This key is modeled after the *Vegetation Classification System for South Florida Natural Areas* v6.15.09 (Rutchev et al. 2006)⁴ which was developed and used to map wetland and upland plant communities in other regions of the Everglades (Rutchev et al. 2008). The classification key presented herein differs from its parent system in several ways: (1) the hierarchical pathway has been streamlined to help photo-interpreters consistently reach the same vegetation class and reduce photo-interpreter variability; (2) vegetation class definitions have been modified to clarify meaning and to reflect regional differences in species composition; (3) vegetation classes not occurring within the mapping area have been removed while region-specific vegetation classes have been added; and (4) the vegetation classification key for exotic plant species is currently not included in this version—users are asked to reference the exotic plant species section in the *Vegetation Classification System for South Florida Natural Areas* (Rutchev et al. 2006) for now. A more detailed list of modifications can be found in the Appendix section at the end of this document.

It is expected that all users of this key will be familiar with most, if not all, of the plant species listed herein and have a general knowledge of the vegetation communities within EVER and BICY and their general distribution. It is expected that all users will have comparable abilities to accurately and precisely estimate vegetation cover and height within the MMU. Discrepancies of $\pm 5\%$ in vegetation cover and height estimates are acceptable between photo-interpreters.

This key is not perfect and is a work in progress. A photo-interpreter should confirm the final keyed answer by reading the vegetation class description and determining whether the answer is plausible. If it is not, the photo-interpreter should revise the answer by examining other possible pathways in the key based on their best professional judgment of possible community types and on the structural and spectral information available. This key should be used hand-in-hand with the photo-interpreter's key, a tool similar to this key but specifically designed to assist in the photo-interpretation of vegetation communities directly from aerial photography based on a community's specific spectral and structural signature.

⁴ The *Vegetation Classification System for South Florida Natural Areas* is a majority rule, hierarchical, and structurally driven classification system. Using this system, community types are keyed out based on their majority cover, average vegetation height, and vegetation density within a minimum mapping unit. This classification system is best applied when using a photogrammetric 3D workstation that allows optimal visualization of the three-dimensional imagery to assist in determination of vegetation height and density.

Glossary

Cover (absolute)—The area covered by the vertical projection of a plant's crown, or community, expressed as a percentage of the total area it occupies within a region of finite size. The absolute cover for all species present shall always add up to 100%.

Cover (density)—The percentage of the area being classified that is occupied by an individual plant species or multiple plant species.

Co-dominant (mixed)—Two or more species that are equally distributed throughout a region of finite size with no significant difference in their absolute cover.

Dominant (dominated by)—The individual species having the highest cover of any species within the area being classified.

Dominant—Species cover between 50-89%. This term is typically used to classify cattail and exotic species cover.

Graminoids—Grasses and grass-like plant species such as sedges and rushes.

Herbaceous—Non-woody vascular plants species (graminoids excluded) typically persisting for only one growing season.

Monotypic—Species cover 90-100%. This term is typically used to classify cattail and exotic species cover.

Tree—Woody plant that is at least 5 meters tall.

Shrub—Woody plant that is shorter than 5 meters.

Sparse—Species cover 10-49%. This term is typically used to classify cattail and exotic species cover. In the marsh context it usually means less than 15%.

Uplands—Rarely flooded communities consisting of semi-flood-tolerant or flood-intolerant plant species.

Wetlands—Regularly flooded communities consisting of flood-tolerant plant species.

Vegetation Classification Key

L1 – Forest (F) – Stands of trees (5 meters or taller) that are of high density (50-100% cover). For exceptions to this rule please refer to Appendix A.

L1 – Woodland (W) – Stands of trees (5 meters or taller) that are of low density (10-49% cover). Trees are evenly spaced out and often in a matrix of sparse shrubs, graminoids, and/or herbaceous vegetation. For exceptions to this rule please refer to Appendix A.

L1 – Shrubland (S) – Stands of shrubs (shorter than 5 meters) that are of high density (50-100% cover). For exceptions to this rule please refer to Appendix A.

L1 – Scrub (C) – Stands of shrubs (shorter than 5 meters) that are of low density (10-49% cover). Shrubs are evenly spaced out and often in a matrix of graminoids and/or herbaceous vegetation. For exceptions to this rule please refer to Appendix A.

L1 – Marsh (M) – Graminoid and/or herbaceous emergent or floating vegetation in shallow water that stands at or above the ground surface for much of the year. Prairie habitat is included in this class. A marsh can have low density (0-9%) tree and shrub cover.

L1 – Exotic (E) – Non-native plant species assemblages.

L1 – Other (O) – Anthropogenic or non-vegetative features.

L1 – Forest (F)

Stands of trees (5 meters or taller) that are of high density (50-100% cover). For exceptions to this rule please refer to Appendix A.

I. Regularly flooded forest consisting of flood tolerant tree species. Most common forest type found in the Everglades.

L2 – Wetland Forest (FW)

1. Regularly flooded forests consisting of salt tolerant tree species. These communities are typically found along saltwater shorelines, interior tidal rivers and creeks, or estuarine zones.

L3 – Mangrove Forest (FM)

2. Seasonally to semi-permanently flooded freshwater forests primarily found in interior wetlands but may extend well into coastal areas.

L3 – Swamp Forest (FS)

II. Rarely flooded forests consisting of flood intolerant hardwood tree species of both temperate and tropical origins. These communities are found throughout the Everglades along coastal areas and offshore islands, pine woodlands, and interior marshes.

L2 – Upland Forest (FU)

1. Rarely flooded forest associated with flood intolerant trees of both temperate and tropical origins. Species composition is highly diverse but varies throughout the region.

L3 – Hardwood Hammock (FH)

L2 – Wetland Forest (FW)

L3 – Mangrove Forest (FM)

1a. Buttonwood (*Conocarpus erectus*) dominant forest. This community is usually characterized by a minimum of 50% Buttonwood (*C. erectus*) trees and shrubs found in a matrix of other species.

L4 – Buttonwood Forest (FMc)

1b. Red Mangrove (*Rhizophora mangle*) dominant forest. This community is usually characterized by a minimum of 50% Red Mangrove (*R. mangle*) trees and shrubs found in a matrix of other species.

L4 – Red Mangrove Forest (FMr)

1c. Mix of mangrove tree species with no particular species having dominance.

L4 – Mixed Mangrove Forest (FMX)

1c.1. Co-dominant mix (20% or less difference in percent cover) of Buttonwood (*Conocarpus erectus*) and Red Mangrove (*Rhizophora mangle*) trees.

L5 – Buttonwood-Red Mangrove Forest (FMXcr)

L3 – Swamp Forest (FS)

2a. Seasonally to semi-permanently flooded dominant to monotypic stands of Willow (*Salix caroliniana*) trees and shrubs in association with Leather Fern (*Acrostichum danaeifolium*), Cattail (*Typha* spp.), Sawgrass (*Cladium jamaicense*), Arrowhead (*Sagittaria* spp.), as well as other freshwater marsh species. This community is usually characterized by a minimum of 50% Willow (*Salix caroliniana*) trees and shrubs. This is an exception to the Forest class because even in the case of Forest height (5 meters or taller) this community is still considered **L1 – Shrubland (S)**.

L4 – Willow Shrubland (SSs)

2b. Seasonally flooded, dominant to monotypic ($\geq 50\%$ cover) stands of Cocoplum (*Chrysobalanus icaco*) trees (≥ 5 meters) and shrubs in association with other wetland species, e.g., Swamp Bay (*Persea palustris*), Red Bay (*P. borbonia*), Dahoon Holly (*Ilex cassine*), Willow (*Salix caroliniana*), Wax Myrtle (*Morella cerifera*), Sweetbay (*Magnolia virginiana*), Cypress (*Taxodium* spp.), and/or Pond Apple (*Annona glabra*), or upland tree species like Poisonwood (*Metopium toxiferum*) and/or Pigeon Plum (*Coccoloba diversifolia*). This community is an exception to the L1 – Forest Class and falls under **L1 – Shrubland (S)**.

L4 – Cocoplum Shrubland (SSy)

2c. Pond-Apple (*Annona glabra*) dominant forest. This community is usually characterized by a minimum of 50% Pond-Apple (*Annona glabra*) trees and shrubs.

L4 – Pond Apple Forest (FSa)

2d. Co-dominant mix (20% or less difference in percent cover) of Pond Apple (*Annona glabra*) and Pop Ash (*Fraxinus caroliniana*) trees, generally including a diverse epiphytic assemblage.

L4 – Pond Apple-Pop Ash Forest (FSaf)

2e. Red Maple (*Acer rubrum*) dominant forest. This community is usually characterized by a minimum of 50% Red Maple (*Acer rubrum*) trees and shrubs.

L4 – Red Maple Forest (FSe)

2f. Pop Ash (*Fraxinus caroliniana*) dominant forest. This community is usually characterized by a minimum of 50% Pop Ash (*Fraxinus caroliniana*) trees and shrubs.

L4 – Pop Ash Forest (FSf)

2g. Co-dominant mix (20% or less difference in percent cover) of Pop Ash (*Fraxinus caroliniana*) and Willow (*Salix caroliniana*) trees and shrubs.

L4 – Pop Ash- Willow Forest (FSfs)

2h. Cypress (*Taxodium* spp.) dominant forest with understory vegetation consisting of Pond Apple (*Annona glabra*), Wax Myrtle (*Morella cerifera*), Pop Ash (*Fraxinus caroliniana*), Cocoplum (*Chrysobalanus icaco*), and Leather Fern (*Acrostichum danaeifolium*).

L4 – Cypress Forest (FSt)

2h.1. Cypress (*Taxodium* spp.) dominant forest typically found in a pond-like depression.

L5 – Cypress Forest-Dome (FStD)

2h.2. Cypress (*Taxodium* spp.) dominant forest typically found in an elongated slough-like or open-ended depression.

L5 – Cypress Forest-Strand (FStS)

2h.3. Cypress (*Taxodium* spp.) forest with at least 90% cypress cover (relative).

L5 – Cypress Forest-Monotypic (FStM)

2h.4. Co-dominant mix (20% or less difference in percent cover) of Cypress (*Taxodium* spp.) with other lowland hardwood trees such as Red Maple (*Acer rubrum*), Pond Apple (*Annona glabra*), Pop Ash (*Fraxinus caroliniana*), Willow (*Salix caroliniana*), and Cabbage Palm (*Sabal palmetto*) with common understory vegetation consisting of Pond Apple (*Annona glabra*), Wax Myrtle (*Myrica cerifera*), Pop Ash (*Fraxinus caroliniana*), Cocoplum (*Chrysobalanus icaco*), and Leather Fern (*Acrostichum danaeifolium*).

L5 – Cypress-Hardwood Forest (FStH)

2h.5. Co-dominant mix (20% or less difference in percent cover) of Cypress (*Taxodium* spp.) with Slash Pine (*Pinus elliottii*). Common understory vegetation can include mixed hardwood shrubs and/or graminoids.

L5 – Cypress-Pine Forest (FStP)

2i. Mix of Swamp Bay (*Persea palustris*), Red Bay (*P. borbonia*), Cocoplum (*Chrysobalanus icaco*), Dahoon Holly (*Ilex cassine*), Willow (*Salix caroliniana*), Wax Myrtle (*Morella cerifera*), Sweetbay (*Magnolia virginiana*), Cypress (*Taxodium* spp.), Pond Apple (*Annona glabra*), and occasionally Buttonwood (*Conocarpus erectus*).

L4 – Bayhead Forest (FSB)

2j. Mix of trees characterized by Buttonwood (*Conocarpus erectus*), Red Mangrove (*Rhizophora mangle*), Cocoplum (*Chrysobalanus icaco*), Wax Myrtle (*Morella cerifera*), Poisonwood (*Metopium toxiferum*), and occasionally West Indian Mahogany (*Swietenia mahagoni*), Swamp Bay (*Persea palustris*), Red Bay (*P. borbonia*), Sweetbay (*Magnolia virginiana*), and Dahoon Holly (*Ilex*

cassine). The signatures for Buttonwood (*C. erectus*) and Dahoon Holly (*I. cassine*) are often confused in regions where the two species co-exist, leaving Red Mangrove (*R. mangle*) as the distinguishing component between the Transitional Bayhead and Bayhead classes in regions where both classes are likely to be found. The significant presence (at least 30% cover) of Buttonwood (*C. erectus*) or Red Mangrove (*R. mangle*) evenly distributed throughout the vegetation matrix sets this class apart from the Bayhead Forest class. Note that when these species are confined to the outside fringe they are not considered indicative of a Transitional Bayhead.

L4 – Transitional Bayhead Forest (FSBT)

2k. Mix of lowland hardwood trees such as Red Maple (*Acer rubrum*), Pop Ash (*Fraxinus caroliniana*), Swamp Bay (*Persea palustris*) and/or Red Bay (*P. borbonia*), Sweetbay (*Magnolia virginiana*), Pond Apple (*Annona glabra*), Willow (*Salix caroliniana*), Laurel Oak (*Quercus laurifolia*), and cabbage Palm (*Sabal palmetto*). Cocoplum (*Chrysobalanus icaco*) commonly found in the understory.

L4 – Hardwood Swamp Forest (FSH)

2l. Mix of lowland hardwood trees such as Red Maple (*Acer rubrum*), Pop Ash (*Fraxinus caroliniana*), Swamp Bay (*Persea palustris*) and/or Red Bay (*P. borbonia*), Sweetbay (*Magnolia virginiana*), Pond Apple (*Annona glabra*), Willow (*Salix caroliniana*), Laurel Oak (*Quercus laurifolia*), and cabbage Palm (*Sabal palmetto*) with at least 30% mangrove cover. Mangrove species may include Red mangrove (*Rhizophora mangle*), White mangrove (*Laguncularia racemosa*), Black mangrove (*Avicennia germinans*) and/or Buttonwood (*Conocarpus erectus*).

L4 – Transitional Hardwood Swamp Forest (FSHT)

L2 – Upland Forest (FU)

L3 – Pine Upland (WUp)

Stands of Slash Pine (*Pinus elliottii*) trees (10-100% cover) in a matrix composed of upland graminoids, herbs, and/or shrubs. Also known as a mesic pine flatwoods. This is an exception to the Woodland class because even in the case of Forest density (50-100% cover) this community is still considered **L1 – Woodland (W)**.

L3 – Hardwood Hammock (FH)

1a. Cabbage Palm (*Sabal palmetto*) dominated forest with sparse, generally less than 25%, Laurel Oak (*Quercus laurifolia*), Live Oak (*Q. virginiana*), Strangler Fig (*Ficus aurea*), and Swamp Fern (*Blechnum* spp.) as a common understory component. This community is usually characterized by a minimum of 50% Cabbage Palm (*S. palmetto*) trees and shrubs found in a matrix of other species.

L4 – Cabbage Palm Hammock (FHo)

1b. Co-dominant mix (20% or less difference in percent cover) of Cabbage Palm (*Sabal palmetto*) and Slash Pine (*Pinus elliottii*) trees. Forest cover must be 90-100%.

L4 – Cabbage Palm-Pine Hammock (FHop)

1c. Co-dominant mix (20% or less difference in percent cover) of Cabbage Palm (*Sabal palmetto*) and Live Oak (*Q. virginiana*) trees.

L4 – Cabbage Palm-Oak Hammock (FHq)

1d. Co-dominant mix (20% or less difference in percent cover) of Slash Pine (*Pinus elliottii*) with Laurel Oak (*Quercus laurifolia*), Live Oak (*Q. virginiana*), and/or Cabbage Palm (*Sabal palmetto*). Common understory vegetation can include mixed hardwood shrubs like Red Mulberry (*Morus rubra*), Sugarberry (*Celtis laevigata*), Common Persimmon (*Diospyros virginiana*), and/or Saw Palmetto (*Serenoa repens*).

L4 – Hardwood Hammock-Pine Forest (FHp)

1e. Live Oak (*Quercus virginiana*) dominated forest commonly found in association with Poisonwood (*Metopium toxiferum*), Pigeon Plum (*Coccoloba diversifolia*), Spicewood (*Calyptanthus pallens*), White Stopper (*Eugenia axillaris*), and occasionally False Tamarind (*Lysiloma latisiliquum*) and Willow Busic (*Sideroxylon salicifolium*). Common understory species include West Indian Lilac (*Tetrazygia bicolor*), Coontie (*Zamia pumila*), and Strap Fern (*Campyloneurum phyllitidis*) among others. This community is usually characterized by a minimum of 50% Live Oak (*Quercus virginiana*) trees and shrubs found in a matrix of other species.

L4 – Live Oak Hammock (FHq)

1f. Mix species assemblage of False Tamarind (*Lysiloma latisiliquum*), Gumbo Limbo (*Bursera simaruba*), Poisonwood (*Metopium toxiferum*), Pigeon Plum (*Coccoloba diversifolia*), False Mastic (*Sideroxylon foetidissimum*), Live Oak (*Quercus virginiana*), Sugarberry (*Celtis laevigata*), White Stopper (*Eugenia axillaris*) and Lancewood (*Nectandra coriacea*). May also contain Strangler Fig (*Ficus aurea*), Swamp Bay (*Persea borbonia*), Dahoon Holly (*Ilex Cassine*), Wax Myrtle (*Morella cerifera*), Myrsine (*Myrsine floridana*), and Willow Busic (*Sideroxylon salicifolium*). Water Oak (*Q. nigra*), Red Maple (*Acer rubrum*), and Laurel Oak (*Q. laurifolia*) may be present as single individuals.

L4 – Tropical Hardwood Hammock (FHS)

1g. Mix species assemblage of Laurel Oak (*Quercus laurifolia*), Live Oak (*Quercus virginiana*), Cabbage Palm (*Sabal palmetto*), and occasionally Strangler Fig (*Ficus aurea*), Red Mulberry (*Morus rubra*), Common Persimmon (*Diospyros virginiana*), and Saw Palmetto (*Serenoa repens*) in the understory.

L4 – Temperate Hardwood Hammock (FHT)

L1 – Woodland (W)

Stands of trees (5 meters or taller) that are of low density (10-49% cover). Trees are evenly spaced out and often in a matrix of sparse shrubs (<50%), graminoids, and/or herbaceous vegetation. If understory shrub cover $\geq 50\%$, then the community is treated as a L1 – Shrubland.

I. Regularly flooded low density stands of trees consisting of flood tolerant tree species.

L2 – Wetland Woodland (WW)

1. Seasonally to semi-permanently flooded low density stands of freshwater tree species.

L3 – Swamp Woodland (WS)

II. Briefly flooded low density stands of trees consisting of semi-flood tolerant or flood intolerant woody species.

L2 – Upland Woodland (WU)

1. Stands of Slash Pine (*Pinus elliottii*) trees (10-100% cover) in a matrix composed of upland graminoids, herbs, and/or shrubs. Also known as a mesic pine flatwoods. This is an exception to the Woodland class because even in the case of Forest density (50-100% cover) this community is still considered **L1 – Woodland (W)**.

L3 – Pine Woodland (WUp)

2. Rarely inundated and well drained open canopy woodland containing a mixed species assemblage of tropical and temperate broad-leaved trees.

L3 – Upland Hardwood Woodland (WUH)

L2 – Wetland Woodland (WW)

L3 – Swamp Woodland (WS)

1a. Cabbage Palm (*Sabal palmetto*) in a matrix composed of marsh graminoids, herbs, and/or shrubs.

L4 – Cabbage Palm Lowland (WSo)

1a.1. Cabbage Palm (*Sabal palmetto*) in a matrix composed predominately of marsh graminoids, such as Sawgrass (*Cladium jamaicense*), Muhly Grass (*Muhlenbergia capillaris*), among others.

L5 – Cabbage Palm Lowland-Graminoid Marsh (WSoG)

1a.2. Cabbage Palm (*Sabal palmetto*) in a matrix composed of a co-dominant mix (20% or less difference in percent cover) of marsh graminoids and shrubs.

L5 – Cabbage Palm Lowland-Mixed (WSoX)

1b. Cypress (*Taxodium* spp.) in a matrix composed of Open Freshwater Marsh, graminoids, herbs, and/or shrubs.

L4 – Cypress Woodland (WSt)

1b.1. Cypress (*Taxodium* spp.) in a matrix composed predominately of graminoids, such as Sawgrass (*Cladium jamaicense*), Switchgrass (*Panicum virgatum*), Maidencane (*P. hemitomon*), among others.

L5 – Cypress Woodland-Graminoid Marsh (WStG)

1b.2. Bald Cypress (*Taxodium distichum*) and/or Pond Cypress (*T. ascendens*) in a matrix composed predominately of shrubs, such as Wax Myrtle (*Myrica cerifera*), Pond Apple (*Annona glabra*), and/or Cocoplum (*Chrysobalanus icaco*).

L5 – Cypress Woodland-Shrubs (WStS)

1b.3. Bald Cypress (*Taxodium distichum*) and/or Pond Cypress (*T. ascendens*) in a matrix composed of marsh or prairie graminoids and shrubs.

L5 – Cypress Woodland-Mixed (WStX)

1b.4. Bald Cypress (*Taxodium distichum*) and/or Pond Cypress (*T. ascendens*) composed predominately of broadleaf emergent species.

L5 – Cypress Woodland-Emergent Marsh (WStE)

1b.5. Co-dominant mix (20% or less difference in percent cover) of Cypress (*Taxodium* spp.) with Slash Pine (*Pinus elliottii*). Common understory vegetation can include mixed hardwood shrubs or various graminoids.

L5 – Cypress-Pine Woodland (WStp)

1b.5i. Bald Cypress (*Taxodium distichum*) and Slash Pine (*Pinus elliottii*) in a matrix composed predominately of graminoids.

L6 – Cypress-Pine Woodland-Graminoid (WStpG)

1b.5ii. Bald Cypress (*Taxodium distichum*) and Slash Pine (*Pinus elliottii*) in a matrix composed predominately of shrubs.

L6 – Cypress-Pine Woodland-Shrubs (WStpS)

1b.5iii. Bald Cypress (*Taxodium distichum*) and Slash Pine (*Pinus elliottii*) in a matrix composed of marsh or prairie graminoids and shrubs.

L6 – Cypress-Pine Woodland-Mixed (WStpX)

1c. Mix of low density lowland hardwood trees such as Laurel Oak (*Quercus laurifolia*), Red Maple (*Acer rubrum*), Cabbage Palm (*Sabal palmetto*), Pop Ash (*Fraxinus caroliniana*), Swamp Bay (*Persea palustris*), Red Bay (*P. borbonia*), and Sweetbay (*Magnolia virginiana*) within a matrix of shrubs and graminoids. This community is different than L4 – **Bayhead Forest (FSB)** or L4 – **Bayhead Shrubland (SSB)**.

L4 – Hardwood Swamp Woodland (WSH)

L2 – Upland Woodland (WU)

L3 – Pine Woodland (WUp)

1a. Pine Upland found on low ridges of oolitic limestone.

L4 – Pine Rockland (WUpR)

1a.1. Pine Rockland in a matrix composed predominately of graminoids, such as Bluestem (*Andropogon* spp.), Gamagrass (*Tripsacum* spp.), Threeawn (*Aristida* spp.), Lovegrass (*Eragrostis* spp.), Witchgrass (*Dichanthelium* spp.), Panicgrass (*Panicum* spp.), among others.

L5 – Pine Rockland-Graminoid (WUpRG)

1a.2. Pine Rockland in a matrix composed predominately of shrubs and trees, such as Wax Myrtle (*Myrica cerifera*), Saw Palmetto (*Serenoa repens*), Cabbage Palm (*Sabal palmetto*), Rough velvetseed (*Guettarda scabra*), Varnishleaf (*Dodonaea viscosa*), St. John's-Wort (*Hypericum* spp.), and other upland hardwood species.

L5 – Pine Rockland-Shrubs (WUpRS)

1a.3. Pine Rockland in a matrix composed of a co-dominant mix (20% or less difference in percent cover) of upland graminoids and shrubs.

L5 – Pine Rockland-Mixed (WUpRX)

1b. Pine Upland found on moderately to well-drained sandy soils.

L4 – Pine Flatwoods (WUpF)

1b.1. Pine Flatwoods in a matrix composed predominately of graminoids, such as Broomgrass (*Andropogon longiberbis*), Gamagrass (*Tripsacum* spp.), Threeawn (*Aristida* spp.), Lovegrass (*Eragrostis* spp.), Witchgrass (*Dichanthelium* spp.), Panicgrass (*Panicum* spp.), among others.

L5 – Pine Flatwoods-Graminoid (WUpFG)

1b.2. Pine Flatwoods in a matrix composed predominately of shrubs and trees, such as Wax Myrtle (*Myrica cerifera*), Saw Palmetto (*Serenoa repens*), Cabbage Palm (*Sabal palmetto*),

Fetterbush (*Lyonia lucida*), Tarflower (*Bejaria racemosa*), Rusty Staggerbush (*Lyonia ferruginea*), St. John's Wort (*Hypericum* spp.), and other upland hardwood species.

L5 – Pine Flatwoods-Shrubs (WUpFS)

1b.2i. Pine Flatwoods in a matrix composed predominately of Saw Palmetto (*Serenoa repens*).

L6 – Pine Flatwoods-Saw Palmetto (WUpFSn)

1b.3. Pine Flatwoods in a matrix composed of a co-dominant mix (20% or less difference in percent cover) of upland graminoids and shrubs.

L5 – Pine Flatwoods-Mixed (WUpFX)

1c. Slash Pine (*Pinus elliottii*) in a matrix composed of marsh graminoids, herbs, and/or shrubs. This community is commonly referred to as hydric pine flatwoods.

L4 – Pine Lowland (WSp)

1c.1. Slash Pine (*Pinus elliottii*) in a matrix composed predominately of graminoids, such as Sawgrass (*Cladium jamaicense*), Muhly Grass (*Muhlenbergia capillaris*), Panicgrass (*Panicum* spp.), Paspalum (*Paspalum* spp.), Little Bluestem (*Schizachyrium rhizomatum*), Flatsedge (*Cyperus* spp.), Spikerush (*Eleocharis* spp.), Fimbry (*Fimbristylis* spp.), Beaksedge (*Rhynchospora* spp.), Bulrush (*Scirpus* spp.), Nutrush (*Scleria* spp.), Yelloweyed Grass (*Xyris* spp.), Bluestem (*Andropogon* spp.), Threeawn (*Aristida* spp.), Witchgrass (*Dichanthelium* spp.), Lovegrass (*Eragrostis* spp.), Dropseed (*Sporobolus* spp.), and Hairsedge (*Bulbostylis* spp.).

L5 – Pine Lowland-Graminoid (WSpG)

1c.2. Slash Pine (*Pinus elliottii*) in a matrix composed predominately of shrubs and trees, such as Wax Myrtle (*Myrica cerifera*), Cabbage Palm (*Sabal palmetto*), Dahoon Holly (*Ilex cassine*), Red Bay (*Persea borbonia*), Buttonbush (*Cephalanthus occidentalis*), and other hardwood swamp species.

L5 – Pine Lowland-Shrubs (WSpS)

1c.3. Slash Pine (*Pinus elliotti*) in a matrix composed of a co-dominant mix (20% or less difference in percent cover) of lowland graminoids and shrubs.

L5 – Pine Lowland-Mixed (WSpX)

L3 – Upland Hardwood / Palm Woodland (WUH)

2a. Mix species assemblage of Laurel Oak (*Quercus laurifolia*), Live Oak (*Q. virginiana*), Cabbage Palm (*Sabal palmetto*), and occasionally Strangler Fig (*Ficus aurea*), Red Mulberry (*Morus rubra*),

Sugarberry (*Celtis laevigata*), Common Persimmon (*Diospyros virginiana*), and/or Saw Palmetto (*Serenoa repens*). This community is most abundant within Big Cypress National Preserve.

L4 – Temperate Hardwood Woodland (WUHT)

2b. Open canopy stands of Live Oak (*Q. virginiana*) with a Saw Palmetto (*Serenoa repens*) dominant understory. This community is most abundant within Big Cypress National Preserve.

L4 – Live Oak-Saw Palmetto Woodland (WUHqn)

2c. Cabbage Palm (*Sabal palmetto*) in a matrix composed of upland graminoids, herbs, and/or shrubs.

L4 – Cabbage Palm Upland (WUo)

2c.1. Cabbage Palm (*Sabal palmetto*) in a matrix composed predominately of upland graminoids.

L5 – Cabbage Palm Upland-Graminoid Marsh (WUoG)

2c.2. Cabbage Palm (*Sabal palmetto*) in a matrix composed predominately of upland shrubs.

L5 – Cabbage Palm Upland-Shrubs (WUoS)

2c.2i. Cabbage Palm (*Sabal palmetto*) in a matrix composed predominately of Saw Palmetto (*Serenoa repens*).

L6 – Cabbage Palm Upland-Saw Palmetto (WUoS_n)

2c.3. Cabbage Palm (*Sabal palmetto*) in a matrix composed of a co-dominant mix (20% or less difference in percent cover) of upland graminoids and shrubs.

L5 – Cabbage Palm Upland-Mixed (WUoX)

L1 – Shrubland (S)

Stands of shrubs (shorter than 5 meters) that are of high density (50-100% cover). Mangrove communities with mean canopy heights of 2 meters or less with canopy cover greater than 10% are an exception to the Shrubland Class and fall under L1 – Scrub class.

I. Shrubs adapted to regularly flooded conditions.

L2 – Wetland Shrubland (SW)

1. Regularly flooded salt tolerant shrubs. These communities are typically found along saltwater shorelines, interior tidal rivers and creeks, or estuarine zones. Mangrove shrubs (taller than 2 meters but shorter than 5 meters) that are of high density (50-100% cover) are considered **L1 – Shrubland (S)**, and if they are of low density (10-49% cover) they are considered **L1 – Scrub (C)**. Dwarf mangrove shrubs (2 meters or shorter) are an exception to the Shrubland class because regardless of density (10-100% cover) they are **L1 – Scrub (C)**.

L3 – Mangrove Shrubland (SM)

2. Seasonally to semi-permanently flooded freshwater shrubs primarily found in interior wetlands but may extend well into coastal zone.

L3 – Swamp Shrubland (SS)

II. Rarely flooded shrub communities consisting of semi-flood tolerant or flood intolerant woody species.

L2 – Upland Shrubland (SU)

1. Saw Palmetto (*Serenoa repens*) dominant Shrubland.

L3 – Saw Palmetto Shrubland (SUn)

2. Mix of Gumbo Limbo (*Bursera simaruba*), Poisonwood (*Metopium toxiferum*), Pigeon Plum (*Coccoloba diversifolia*), White Stopper (*Eugenia axillaris*), Strangler Fig (*Ficus aurea*), Red Bay (*Persea borbonia*), Dahoon Holly (*Ilex Cassine*), Saffron Plum (*Sideroxylon celastrinum*), Sugarberry (*Celtis laevigata*), False Mastic (*Sideroxylon foetidissimum*), Wax Myrtle (*Myrica cerifera*), and Myrsine (*Myrsine floridana*). Similar to **L4 – Tropical Hardwood Hammock (FHS)** except average vegetation height is less than 5 meters.

L3 – Tropical Hardwood Shrubland (SUH)

3. Mix of Saw Palmetto (*Serenoa repens*), Dahoon Holly (*Ilex cassine*), Myrtle (*Morera cerifera*), Fetterbush (*Lyonia lucida*) and/or Coastal Plain Staggerbush (*Lyonia fruticosa*), Cabbage Palm (*Sabal palmetto*), Live Oak (*Q. virginiana*), and Colicwood (*Myrsine cubana*).

L3 – Temperate Hardwood Shrubland (SUT)

L2 – Wetland Shrubland (SW)

L3 – Mangrove Shrubland (SM)

1a. Red Mangrove (*Rhizophora mangle*) dominant Shrubland.

L4 – Red Mangrove Shrubland (SMr)

1b. Mix of mangrove tree species with no particular species having dominance.

L4 – Mixed Mangrove Shrubland (SMX)

1b.1. Co-dominant mix (20% or less difference in percent cover) of Buttonwood (*Conocarpus erectus*) and Red Mangrove (*Rhizophora mangle*) shrubs.

L5 – Buttonwood-Red Mangrove Shrubland (SMXcr)

L3 – Swamp Shrubland (SS)

2a. Cypress (*Taxodium* spp.) shrubs, < 5 meter tall, with 10-100% cover are considered **L1 – Scrub (C)**.

L4 – Cypress Scrub (CSt)

2b. Pond Apple (*Annona glabra*) dominant Shrubland.

L4 – Pond Apple Shrubland (SSa)

2c. Co-dominant mix (20% or less difference in percent cover) of Pond Apple (*Annona glabra*) and Pop Ash (*Fraxinus caroliniana*) shrubs.

L4 – Pond Apple-Pop Ash Shrubland (SSaf)

2d. Pop Ash (*Fraxinus caroliniana*) dominant Shrubland.

L4 – Pop Ash Shrubland (SSf)

2e. Co-dominant mix (20% or less difference in percent cover) of Pop Ash (*Fraxinus caroliniana*) and Willow (*Salix caroliniana*) shrubs.

L4 – Pop Ash-Willow Shrubland (SSfs)

2f. Anglestem Primrosewillow (*Ludwigia leptocarpa*) and occasionally Mexican Primrosewillow (*L. octovalvis*) dominant shrubland.

L4 – Primrosewillow Shrubland (SSI)

2g. Wax Myrtle (*Morella cerifera*) dominant Shrubland.

L4 – Wax Myrtle Shrubland (SSm)

2h. Seasonally to semi-permanently flooded dominant to monotypic stands of Willow (*Salix caroliniana*) trees and shrubs in association with Leather Fern (*Acrostichum danaeifolium*), Cattail (*Typha* spp.), Sawgrass (*Cladium jamaicense*), Arrowhead (*Sagittaria* spp.), as well as other freshwater marsh species. This community is usually characterized by a minimum of 50% Willow (*Salix caroliniana*) trees and shrubs. This is an exception to the Forest class because even in the case of Forest height (5 meters or taller) this community is still considered **L1 – Shrubland (S)**.

L4 – Willow Shrubland (SSs)

2i. Seasonally flooded dominant to monotypic stands of Cocoplum (*Chrysobalanus icaco*) trees and shrubs in association with other wetland species, e.g., Swamp Bay (*Persea palustris*), Red Bay (*P. borbonia*), Dahoon Holly (*Ilex cassine*), Willow (*Salix caroliniana*), Wax Myrtle (*Morella cerifera*), Sweetbay (*Magnolia virginiana*), Cypress (*Taxodium* spp.), and/or Pond Apple (*Annona glabra*), or upland tree species at higher elevation sites, e.g., Poisonwood (*Metopium toxiferum*) and/or Pigeon Plum (*Coccoloba diversifolia*). This community is usually characterized by a minimum of 50% Cocoplum (*C. icaco*) trees and shrubs. This is an exception to the Forest class because even if average vegetation height is 5 meters or taller is still considered **L1 – Shrubland (S)**.

L4 – Cocoplum Shrubland (SSy)

2j. Mix of flood tolerant fresh water tree and shrub species like Swamp Bay (*Persea palustris*), Red Bay (*P. borbonia*), Cocoplum (*Chrysobalanus icaco*), Dahoon Holly (*Ilex cassine*), Willow (*Salix caroliniana*), Wax Myrtle (*Morella cerifera*), Sweetbay (*Magnolia virginiana*), Cypress (*Taxodium* spp.), Pond Apple (*Annona glabra*), and occasionally Buttonwood (*Conocarpus erectus*).

L4 – Bayhead Shrubland (SSB)

2k. Mixed assemblage of shrubs characterized by Buttonwood (*Conocarpus erectus*), Red Mangrove (*Rhizophora mangle*), Cocoplum (*Chrysobalanus icaco*), Wax Myrtle (*Morella cerifera*), Poisonwood (*Metopium toxiferum*), Swamp Bay (*Persea palustris*), Red Bay (*P. borbonia*), Sweetbay (*Magnolia virginiana*), Dahoon Holly (*Ilex cassine*), and occasionally West Indian Mahogany (*Swietenia mahagoni*). The signatures for Buttonwood and Dahoon Holly (*I. cassine*) are often confused in regions where the two species co-exist, leaving Red Mangrove (*R. mangle*) as the distinguishing component between the Transitional Bayhead and Bayhead classes in regions where both classes are likely to be found. The significant presence (at least 30% cover) of Buttonwood (*C. erectus*) or Red Mangrove (*R. mangle*) evenly distributed throughout the vegetation matrix sets this class apart from the Bayhead Shrubland class. Note that when these species are confined to the fringe they are not considered indicative of a Transitional Bayhead.

L4 – Transitional Bayhead Shrubland (SSBT)

2l. Mix of lowland hardwood trees such as Red Maple (*Acer rubrum*), Pop Ash (*Fraxinus caroliniana*), Red Bay (*Persea borbonia*), Swamp Bay (*P. palustris*), Sweetbay (*Magnolia virginiana*), Pond Apple (*Annona glabra*), Willow (*Salix caroliniana*), Cocoplum (*Chrysobalanus*

icaco), Cabbage Palm (*Sabal palmetto*), Wax Myrtle (*Morella cerifera*), Dahoon Holly (*Ilex cassine*), and Cypress (*Taxodium* spp.).

L4 – Hardwood Swamp Shrubland (SSH)

L2 – Upland Shrubland (SU)

1. Saw Palmetto (*Serenoa repens*) dominant Shrubland.

L3 – Saw Palmetto Shrubland (SUn)

2. Mix of Gumbo Limbo (*Bursera simaruba*), Poisonwood (*Metopium toxiferum*), Pigeon Plum (*Coccoloba diversifolia*), White Stopper (*Eugenia axillaris*), Strangler Fig (*Ficus aurea*), Swamp Bay (*Persea borbonia*), Dahoon Holly (*Ilex Cassine*), Saffron Plum (*Sideroxylon celastrinum*), Sugarberry (*Celtis laevigata*), False Mastic (*S. foetidissimum*), Wax Myrtle (*Morella cerifera*), and Myrsine (*Myrsine floridana*); similar to **L4 – Tropical Hardwood Hammock (FHS)** except canopy heights are less than 5 meters.

L3 – Tropical Hardwood Shrubland (SUH)

3. Mix of Saw Palmetto (*Serenoa repens*), Dahoon Holly (*Ilex cassine*), Myrtle (*Morella cerifera*), Fetterbush (*Lyonia lucida*) and/or Coastal Plain Staggerbush (*Lyonia fruticosa*), Cabbage Palm (*Sabal palmetto*), Live Oak (*Q. virginiana*), and occasionally Colicwood (*Myrsine cubana*).

L3 – Temperate Hardwood Shrubland (SUT)

L1 – Scrub (C)

Stands of shrubs (shorter than 5 meters) that are of low density (10-49% cover) and evenly spaced out in a matrix of graminoids and/or herbaceous vegetation. Mangrove communities with mean canopy heights of 2 meters or less with canopy cover greater than 10% are an exception to the Shrubland Class and fall under L1 – Scrub class.

I. Shrubs adapted to regularly flooded conditions.

L2 – Wetland Scrub (CW)

1. Regularly flooded salt tolerant shrubs. These communities are typically found along saltwater shorelines, interior tidal rivers and creeks, or estuarine zones. Mangrove shrubs (taller than 2 meters but shorter than 5 meters) that are of high density (50-100% cover) are considered **L1 – Shrubland (S)**, and if they are of low density (10-49% cover) they are considered **L1 – Scrub (C)**. Dwarf mangrove shrubs (2 meters or shorter) are an exception to the Shrubland class because regardless of density (10-100% cover) they are **L1 – Scrub (C)**.

L3 – Mangrove Scrub (CM)

2. Seasonally to semi-permanently flooded freshwater shrubs primarily found in interior wetlands but may extend well into coastal zone.

L3 – Swamp Scrub (CS)

II. Rarely flooded shrub communities consisting of semi-flood tolerant or flood intolerant woody species found on marl or rocky substrate.

L2 – Upland Scrub (CU)

1. Mix of dwarf trees and/or shrubs consisting of Saw Palmetto (*Serenoa repens*), Wax Myrtle (*Morella cerifera*), Cabbage Palm (*Sabal palmetto*), Red Bay (*Persea borbonia*), Myrsine (*Myrsine cubana*), Dahoon Holly (*Ilex cassine*), Live Oak (*Q. virginiana*), *Lyonia* sp. (Fetterbush [*Lyonia lucida*] or Coastal Plain Staggerbush [*Lyonia fruticosa*]) and *Hypericum* species in a matrix of prairie grasses & herbs. Cypress (*Taxodium* spp.) cover below 10%. This community is common in the marl prairies of Big Cypress National Preserve.

L3 – Temperate Hardwood Scrub (CUT)

2. Mix of dwarf trees and/or shrubs such as Poisonwood (*Metopium toxiferum*), Red Bay (*Persea borbonia*), Myrsine (*Myrsine floridana*), Wax Myrtle (*Morella cerifera*), Dahoon Holly (*Ilex cassine*), Buttonwood (*Conocarpus erectus*), Cocoplum (*Chrysobalanus icaco*), Varnish Leaf (*Dodonaea viscosa*), Cabbage Palm (*Sabal palmetto*), West Indian Mahogany (*Swietenia mahagoni*), an/or Saffron Plum (*Sideroxylon celastrinum*) in a matrix of prairie grasses, herbs, and, at times, including various species of vines. Canopy density will range from 10-49%. This community is typically found in marl prairie environments or along the edge of pine rocklands on marl or rocky soils.

L3 – Upland Hardwood Scrub (CUW)

3. Cabbage Palm (*Sabal palmetto*) dominant scrub.

L3 – Cabbage Palm Upland Scrub (CUo)

4. Saw Palmetto (*Serenoa repens*) dominant scrub.

L3 – Saw Palmetto Scrub (CUn)

L2 – Wetland Scrub (CW)

L3 – Mangrove Scrub (CM)

1a. Red Mangrove (*Rhizophora mangle*) dominant scrub.

L4 – Red Mangrove Scrub (CMr)

1a.1. Red Mangrove (*Rhizophora mangle*) scrub in a matrix composed predominately of graminoids.

L5 – Red Mangrove Scrub-Graminoid Marsh (CMrG)

1a.1i. Red Mangrove (*Rhizophora mangle*) scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

L6 – Red Mangrove Scrub-Sawgrass Marsh (CMrGc)

1a.1ii. Red Mangrove (*Rhizophora mangle*) scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).

L6 – Red Mangrove Scrub-Saltgrass Marsh (CMrGd)

1a.1iii. Red Mangrove (*Rhizophora mangle*) scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).

L6 – Red Mangrove Scrub-Spikerush Marsh (CMrGe)

1a.1iv. Red Mangrove (*Rhizophora mangle*) scrub in a matrix composed predominately of Cordgrass (*Spartina* spp.).

L6 – Red Mangrove Scrub-Cordgrass Marsh (CMrGn)

1a.1v. Red Mangrove (*Rhizophora mangle*) scrub in a matrix composed predominately of Cattail (*Typha* spp.).

L6 – Red Mangrove Scrub-Cattail Marsh (CMrGt)

1a.2. Red Mangrove (*Rhizophora mangle*) scrub in a matrix composed predominately of Open Freshwater Marsh or Open Saltwater Marsh, both of which have less than 15% marsh vegetation. Mangroves can occur in both salt and freshwater dominated marshes.

L5 – Red Mangrove Scrub-Open Marsh (CMrO)

L3 – Swamp Scrub (CS)

2a. Mixed assemblage of dwarf trees and/or shrubs such as Red Bay (*Persea borbonia*), Sweet Bay (*Magnolia virginiana*), Pond Apple (*Annona glabra*), Willow (*Salix caroliniana*), Wax Myrtle (*Morella cerifera*), Dahoon Holly (*Ilex cassine*), and/or Cocoplum (*Chrysobalanus icaco*) in a matrix of long-hydroperiod grasses, herbs, and, at times, including various species of vines. Canopy density will range from 10-49%. This community is typical of tree island tails or drainage areas with peat soils.

L4 – Bayhead Swamp Scrub (CSB)

2a.1. Bayhead Swamp Scrub in a matrix composed predominately of Freshwater Graminoid Marsh.

L5 – Bayhead Swamp Scrub-Graminoid Marsh (CSBG)

2a.1i. Bayhead Swamp Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

L6 – Bayhead Swamp Scrub-Sawgrass Marsh (CSBGc)

2a.1ii. Bayhead Swamp Scrub in a matrix composed predominately of Cattail (*Typha* spp.).

L6 – Bayhead Swamp Scrub-Cattail Marsh (CSBGt)

2b. Mixed assemblage of shrubs characterized by Buttonwood (*Conocarpus erectus*), Red Mangrove (*Rhizophora mangle*), Cocoplum (*Chrysobalanus icaco*), Wax Myrtle (*Morella cerifera*), Poisonwood (*Metopium toxiferum*), and occasionally West Indian Mahogany (*Swietenia mahagoni*), Swamp Bay (*Persea palustris*), Red Bay (*P. borbonia*), Sweetbay (*Magnolia virginiana*), and Dahoon Holly (*Ilex cassine*). The signatures for Buttonwood and Dahoon Holly (*I. cassine*) are often confused in regions where the two species co-exist, leaving Red Mangrove (*R. mangle*) as the distinguishing component between the Transitional Bayhead and Bayhead classes in regions where both classes are likely to be found. The significant presence (at least 30% cover) of Buttonwood (*C. erectus*) or Red Mangrove (*R. mangle*) evenly distributed throughout the vegetation matrix sets this class apart from the Bayhead Scrub class. Note that when these species are confined to the outside fringe they are not considered indicative of a Transitional Bayhead. Shrub cover will range from 10-49%.

L4 – Transitional Bayhead Swamp Scrub (CSBT)

2b.1. Transitional Bayhead Swamp Scrub in a matrix composed predominately of Freshwater Graminoid Marsh.

L5 – Transitional Bayhead Swamp Scrub-Graminoid Marsh (CSBTG)

2b.1i. Transitional Bayhead Swamp Scrub in a matrix composed predominately of Cordgrass (*Spartina bakeri*).

L6 – Transitional Bayhead Swamp Scrub-Cordgrass Marsh (CSBTGn)

2c. Mixed assemblage of dwarf trees and/or shrubs such as Red Maple (*Acer rubrum*), Pop Ash (*Fraxinus caroliniana*), Swamp Bay (*Persea palustris*), Red Bay (*P. borbonia*), Sweetbay (*Magnolia virginiana*), Laurel Oak (*Quercus laurifolia*), Pond Apple (*Anona glabra*), Willow (*Salix caroliniana*), Cocoplum (*Chrysolabanus icaco*), Cabbage Palm (*Sabal palmetto*), Wax Myrtle (*Morella cerifera*), Myrsine (*Myrsine floridana*) and/or Dahoon Holly (*Ilex cassine*) with Cypress (*Taxodium* spp.) cover below 10% cover.

L4 – Hardwood Swamp Scrub (CSH)

2c.1. Hardwood Swamp Scrub in a matrix composed predominately of Freshwater Graminoid Marsh.

L5 – Hardwood Swamp Scrub-Graminoid Marsh (CSHG)

2c.1i. Hardwood Swamp Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

L6 – Hardwood Swamp Scrub- Sawgrass Marsh (CSHGc)

2d. Pond Apple (*Annona glabra*) characterized by canopy densities from 10-49% in a matrix of graminoids and/or herbaceous vegetation.

L4 – Pond Apple Scrub (CSa)

2d.1. Pond Apple Scrub in a matrix composed predominately of Freshwater Graminoid Marsh.

L5 – Pond Apple Scrub-Graminoid Marsh (CSaG)

2d.1i. Pond Apple Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

L6 – Pond Apple Scrub-Sawgrass Marsh (CSaGc)

2d.1ii. Pond Apple Scrub in a matrix composed predominately of Beakrush (*Rhynchospora* spp.).

L6 – Pond Apple Scrub-Beakrush Marsh (CSaGr)

2d.1iii. Pond Apple Scrub in a matrix composed predominately of Cattail (*Typha* spp.).

L6 – Pond Apple Scrub-Cattail Marsh (CSaGt)

2e. Wax Myrtle (*Myrica cerifera*) characterized by canopy densities from 10-49% in a matrix of graminoids and/or herbaceous vegetation.

L4 – Wax Myrtle Scrub (CSm)

2e.1. Wax Myrtle Scrub in a matrix composed predominately of Freshwater Graminoid Marsh.

L5 – Wax Myrtle Scrub-Graminoid Marsh (CSmG)

2e.1i. Wax Myrtle Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

L6 – Wax Myrtle Scrub-Sawgrass Marsh (CSmGc)

2e.2. Wax Myrtle scrub in a matrix composed predominately of Freshwater Graminoid Prairie species.

L5 – Wax Myrtle Scrub-Graminoid Prairie (CSmGP)

2f. Willow (*Salix caroliniana*) characterized by canopy densities from 10-49% in a matrix of graminoids and/or herbaceous vegetation.

L4 – Willow Scrub (CSs)

2f.1. Willow Scrub in a matrix composed predominately of Freshwater Graminoid Marsh.

L5 – Willow Scrub-Graminoid Marsh (CSsG)

2f.1i. Willow Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

L6 – Willow Scrub-Sawgrass Marsh (CSsGc)

2f.1ii. Willow Scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).

L6 – Willow Scrub-Spikerush Marsh (CSsGe)

2f.1iii. Willow Scrub in a matrix composed predominately of Common Reed (*Phragmites australis*).

L6 – Willow Scrub-Common Reed Marsh (CSsGg)

2f.1iv. Willow Scrub in a matrix composed predominately of Sand Cordgrass (*Spartina bakeri*).

L6 – Willow Scrub-Sand Cordgrass Marsh (CSsGn)

2f.1v. Willow Scrub in a matrix composed predominately of Cattail (*Typha* spp.).

L6 – Willow Scrub-Cattail Marsh (CSsGt)

2f.2. Willow Scrub in a matrix composed predominately of broadleaf emergent vegetation.

L5 – Willow Scrub-Emergent Marsh (CSsE)

2g. Cypress (*Taxodium* spp.) shrubs with 10-100% cover. This is an exception to the Shrubland class because even in the case of Shrubland density (50-100% cover) this community is still considered **L1 – Scrub (C)**.

L4 – Cypress Scrub (CSt)

2g.1. Cypress Scrub in a matrix composed predominately of Freshwater Graminoid Marsh.

L5 – Cypress Scrub-Graminoid Marsh (CStG)

2g.1i. Cypress Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

L6 – Cypress Scrub-Sawgrass Marsh (CStGc)

2g.1ii. Cypress Scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).

L6 – Cypress Scrub-Spikerush Marsh (CStGe)

2g.1iii. Cypress Scrub in a matrix composed predominately of Cordgrass (*Spartina bakeri*).

L6 – Cypress Scrub-Cordgrass Marsh (CStGn)

2g.1iv. Cypress Scrub in a matrix composed predominately of Cattail (*Typha* spp.).

L6 – Cypress Scrub-Cattail Marsh (CStGt)

2g.2. Cypress (*Taxodium* spp.) Scrub in a matrix composed predominately of Freshwater Graminoid Prairie species.

L5 – Cypress Scrub-Graminoid Prairie (CStGP)

2g.3. Cypress (*Taxodium* spp.) Scrub containing at least 10% cover of other hardwood trees and/or shrubs such as Wax Myrtle (*Myrica cerifera*), Cabbage palm (*Sabal palmetto*), Red Maple (*Acer rubrum*), Myrsine (*Myrsine floridiana*), Dahoon Holly (*Ilex Cassine*), Cocoplum (*Chrysobalanus icaco*), Swamp Bay (*Persea palustris*) and/or Pond Apple (*Anona glabra*).

L5 – Cypress-Hardwood Scrub (CStW)

2g.3i. Cypress (*Taxodium* spp.)-hardwood scrub mix in a matrix composed predominately of Freshwater Graminoid Marsh.

L6 – Cypress-Hardwood Scrub-Graminoids (CStWG)

2g.3i.a. Cypress (*Taxodium* spp.)-hardwood scrub mix in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

L7 – Cypress-Hardwood Scrub-Sawgrass Marsh (CStWGc)

2g.3i.b. Cypress (*Taxodium* spp.)-hardwood scrub mix in a matrix composed predominately of Sand Cordgrass (*Spartina bakeri*).

L7 – Cypress-Hardwood Scrub-Sand Cordgrass Marsh (CStWGn)

2g.3i.c. Cypress (*Taxodium* spp.)-hardwood scrub mix in a matrix composed predominately of Cattail (*Typha* spp.).

L7 – Cypress-Hardwood Scrub-Cattail Marsh (CStWGt)

2g.3ii. Cypress (*Taxodium* spp.)-hardwood scrub mix in a matrix composed predominately of Freshwater Graminoid Prairie species.

L6 – Cypress-Hardwood Scrub-Graminoid Prairie (CStWGP)

2g.4. Co-dominant scrub mix (20% or less difference in percent cover) of Cypress (*Taxodium* spp.) and Slash Pine (*Pinus elliottii*). Common understory vegetation can include mixed hardwood shrubs or various graminoids.

L5 – Cypress-Pine Scrub (CStp)

2g.4i. Cypress-Slash Pine Scrub in a matrix composed predominately of Freshwater Graminoid Prairie species.

L6 – Cypress Pine Scrub- Graminoid Prairie (CStpGP)

2h. Cabbage Palm (*Sabal palmetto*) Scrub characterized by canopy densities from 10-49% in a matrix of graminoids and/or herbaceous vegetation.

L4 – Cabbage Palm Swamp Scrub (CSo)

2h.1. Cabbage Palm Scrub in a matrix composed predominately of Freshwater Graminoid Marsh.

L5 – Cabbage Palm Swamp Scrub-Graminoid Marsh (CSoG)

2h.1i. Cabbage Palm Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

L6 – Cabbage Palm Swamp Scrub-Sawgrass Marsh (CSoGc)

L2 – Upland Scrub (CU)

L3 – Temperate Hardwood Scrub (CUT)

1a. Temperate Hardwood Scrub in a matrix of short-hydroperiod graminoids species such as Muhly Grass (*Muhlenbergia capillaris* var. *filipes*), Sawgrass (*Cladium jamaicense*), and/or Little Bluestem (*Schizachyrium* spp.), among others.

L4 – Temperate Hardwood Scrub-Graminoid Prairie (CUTGP)

L3 – Upland Hardwood Scrub (CUW)

2a. Upland Hardwood Scrub in a matrix of Freshwater Graminoid Marsh.

L4 – Upland Hardwood Scrub-Graminoid Marsh (CUWG)

2a.1. Upland Hardwood Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

L5 – Upland Hardwood Scrub-Sawgrass Marsh (CUWGc)

2b. Upland Hardwood Scrub in a matrix of short-hydroperiod graminoids species such as Muhly Grass (*Muhlenbergia capillaris* var. *filipes*), Sawgrass (*Cladium jamaicense*), and/or Little Bluestem (*Schizachyrium* spp.), among others. Pond Apple and Willow may be present in solutions holes or depressions.

L4 – Upland Hardwood Scrub-Graminoid Prairie (CUWGP)

L3 – Cabbage Palm Upland Scrub (CUo)

3a. Cabbage Palm (*Sabal palmetto*) Scrub in a matrix of short-hydroperiod graminoids species such as Muhly Grass (*Muhlenbergia capillaris* var. *filipes*), Sawgrass (*Cladium jamaicense*), Little Bluestem (*Schizachyrium* spp.), among others.

L4 – Cabbage Palm Upland Scrub-Graminoid Prairie (CUoGP)

L3 – Saw Palmetto Scrub (CUn)

4a. Saw Palmetto (*Serenoa repens*) Scrub in a matrix of short-hydroperiod graminoids species such as Muhly Grass (*Muhlenbergia capillaris* var. *filipes*), Sawgrass (*Cladium jamaicense*), and/or Little Bluestem (*Schizachyrium* spp.), among others.

L4 – Saw Palmetto Scrub-Graminoid Prairie (CUnGP)

L1 – Marsh (M)

Graminoid and/or herbaceous emergent or floating vegetation in shallow water that stands at or above the ground surface for much of the year. Prairie habitat is included in this class. A marsh can have low density (0-9%) tree and shrub cover.

I. A saline wetland consisting of salt tolerant graminoid and/or herbaceous vegetation.

L2 – Salt Marsh (MS)

1. Saltgrass (*Distichlis spicata*), Black Rush (*Juncus roemerianus*), Keysgrass (*Monanthochloe littoralis*), Gulf Cordgrass (*Spartina spartinae*), Marshhay Cordgrass (*S. patens*), and/or Dropseed (*Sporobolus* spp.) dominated salt marsh.

L3 – Graminoid Salt Marsh (MSG)

II. Freshwater graminoid and/or herbaceous marsh.

L2 – Freshwater Marsh (MF)

1. Golden Leather Fern (*Acrostichum aureum*), Leather Fern (*A. danaeifolium*), Pickerelweed (*Pontederia cordata*), Lanceleaf Arrowhead (*Sagittaria lancifolia*), and/or Alligator Flag (*Thalia geniculata*) broadleaf emergent dominated freshwater marsh.

L3 – Broadleaf Emergent Marsh (MFB)

2. Long hydroperiod marsh consisting of Sawgrass (*Cladium jamaicense*), Spikerush (*Eleocharis* spp.), Soft Rush (*Juncus effusus*), Maidencane (*Panicum hemitomom*), Common Reed (*Phragmites australis*), Cattail (*Typha* spp.) and/or Sand Cordgrass (*Spartina bakeri*), among others.

L3 – Graminoid Freshwater Marsh (MFG)

3. Short hydroperiod marsh characterized by a mix of graminoids that includes low-stature Sawgrass (*Cladium jamaicense*), Muhly Grass (*Muhlenbergia capillaris* var. *filipes*), Little Bluestem (*Schizachyrium rhizomatum*), and Black Sedge (*Schoenus nigricans*), among others.

L3 – Graminoid Freshwater Prairie (MFGP)

4. Floating emergent dominated freshwater marsh.

L3 – Floating Emergent Marsh (MFF)

5. Herbaceous dominated marsh consisting of Morning Glory (*Ipomoea* spp.), Hempvine (*Mikania* spp.), and/or Smartweed (*Polygonum* spp.) among others.

L3 – Herbaceous Freshwater Marsh (MFH)

6. Open water with less than 15% vegetation cover consisting of a mix of sparse graminoids, herbaceous, and/or emergent freshwater vegetation, such as Spikerush (*Eleocharis* spp.), Panicgrass (*Panicum* spp.), Sawgrass (*Cladium jamaicense*), Cattail (*Typha* spp.), Arrowhead (*Sagittaria* spp.), Pickerelweed (*Pontederia cordata*), Waterlily (*Nymphaea* spp.), Green Arum (*Peltandra virginica*), Swamp-Lily (*Crinum americanum*), Spider-lilies (*Hymenocallis* spp.), among others.

L3 – Open Freshwater Marsh (MFO)

7. Co-dominant mix (20% or less difference in percent cover) of two or more long hydroperiod freshwater graminoid such as sawgrass (*Cladium jamaicense*), cattail (*Typha* spp.), and/or spikerush (*Eleocharis* spp.) in association with broadleaf species such as Alligator Flag (*Thalia geniculata*), Arrowhead (*Sagittaria* spp.), and/or Pickerelweed (*Pontederia cordata*), for example.

L3 – Mixed Graminoid-Broadleaf Freshwater Marsh (MFXGB)

L2 – Salt Marsh (MS)

L3 – Graminoid Salt Marsh (MSG)

1a. Saltgrass (*Distichlis spicata*) dominated salt marsh.

L4 – Saltgrass Marsh (MSGd)

1b. Black Rush (*Juncus roemerianus*) dominated salt marsh.

L4 – Black Rush Marsh (MSGj)

L2 – Freshwater Marsh (MF)

L3 – Broadleaf Emergent Marsh (MFB)

1a. Alligator Flag (*Thalia geniculata*) dominated marsh.

L4 – Alligator Flag Marsh (MFBt)

L3 – Graminoid Freshwater Marsh (MFG)

2a. Sawgrass (*Cladium jamaicense*) dominated marsh.

L4 – Sawgrass Marsh (MFGc)

2a.1. Sawgrass Marsh with average height of 2 meters or taller.

L5 – Tall Sawgrass Marsh (MFGcT)

2a.1i. Tall Sawgrass Marsh with 50-100% Sawgrass (*Cladium jamaicense*) cover.

L6 – Tall Sawgrass Marsh-Dense (MFGcTD)

2a.2. Sawgrass Marsh with average height shorter than 2 meters.

L5 – Short Sawgrass Marsh (MFGcS)

2a.2i. Sawgrass Marsh with 50-100% Sawgrass (*Cladium jamaicense*) cover. Spikerush (*Eleocharis cellulosa*) and Beakrush (*Rhynchospora* sp.) maybe present as well (10-25% cover).

L6 – Short Sawgrass Marsh-Dense (MFGcSD)

2a.2ii. Short statured (< 1 m tall) Sawgrass Marsh with 15-49% Sawgrass (*Cladium jamaicense*) cover. Spikerush (*Eleocharis cellulosa*), Beakrush (*Rhynchospora* sp.), and/or Panicgrass (*Panicum* sp.), among others, maybe be present. However, their combined cover does not exceed that of Sawgrass. This class differs from **Mixed Graminoid Freshwater Marsh** (MFGX) in that Sawgrass is the dominant graminoid species present, otherwise MFGX.

L6 – Short Sawgrass Marsh-Sparse (MFGcSS)

2b. Coastal Spikerush (*Eleocharis cellulosa*), Slim Spikerush (*E. elongata*), and/or Knotted Spikerush (*E. interstincta*) dominated marsh.

L4 – Spikerush Marsh (MFGe)

2c. Common Reed (*Phragmites australis*) dominated marsh.

L4 – Common Reed Marsh (MFGg)

2d. Beakrush (*Rhynchospora* spp.) dominated marsh. Found commonly growing with Sawgrass (*Cladium jamaicense*). Beakrush found in the substantial presence of Little Bluestem (*Schizachyrium rhizomatum*) and/or Muhly Grass (*Muhlenbergia capillaris* var. *filipes*) is characteristic of a **L3 – Graminoid Freshwater Prairie** (MFGP).

L4 – Beakrush Marsh (MFGr)

2e. Cattail (*Typha* spp.) dominated marsh.

L4 – Cattail Marsh (MFGt)

2f. Sand Cordgrass (*Spartina bakeri*) dominated freshwater marsh.

L4 – Sand Cordgrass Marsh (MFGn)

2g. Co-dominant mix of two or more graminoid marsh species like Spikerush (*Eleocharis* spp.), Panicgrass (*Panicum* spp.), Sawgrass (*Cladium jamaicense*), and/or Beakrush (*Rhynchospora* spp.), among others. This community is characterized by having no particular graminoid species in dominance, meaning there is 15% or less difference in percent cover between two or more graminoid species.

L4 – Mixed Graminoid Freshwater Marsh (MFGX)

2g.1. Co-dominant mix of Sawgrass (*Cladium jamaicense*) and Beakrush (*Rhynchospora tracyi*). This community is characterized by having no particular graminoid species in dominance, meaning there is 15% or less difference in percent cover between two or more graminoid species.

L5 – Sawgrass-Rhynchospora Marsh (MFGXcr)

2g.2. Co-dominant mix of Sawgrass (*Cladium jamaicense*) and Cattail (*Typha* spp.). This community is characterized by having no particular graminoid species in dominance, meaning there is 15% or less difference in percent cover between two or more graminoid species.

L5 – Sawgrass-Cattail Marsh (MFGXct)

2g.3. Co-dominant mix of Sawgrass (*Cladium jamaicense*) and Sand Cordgrass (*Spartina bakeri*). This community is characterized by having no particular graminoid species in dominance, meaning there is 15% or less difference in percent cover between two or more graminoid species.

L5 – Sawgrass- Sand Cordgrass Marsh (MFGXcn)

2g.4. Co-dominant mix of Common Reed (*Phragmites australis*) and Cattail (*Typha* spp.). This community is characterized by having no particular graminoid species in dominance, meaning there is 15% or less difference in percent cover between two or more graminoid species.

L5 – Common Reed-Cattail Marsh (MFGXgt)

L3 – Graminoid Freshwater Prairie (MFGP)

3a. Black Sedge (*Schoenus nigricans*) dominated wet prairie.

L4 – Black Sedge Prairie (MFGPh)

L3 – Floating Emergent Marsh (MFF)

4a. Waterlily (*Nymphaea odorata*) dominated marsh.

L4 – Waterlily Marsh (MFFy)

L3 – Herbaceous Freshwater Marsh (MFH)

5. Herbaceous dominated marsh consisting of Morning Glory (*Ipomoea* spp.), Hempvine (*Mikania* spp.), and/or Smartweed (*Polygonum* spp.) among others.

L3 – Open Freshwater Marsh (MFO)

6. Open water with less than 15% vegetation cover consisting of a mix of sparse graminoids, herbaceous, and/or emergent freshwater vegetation, such as Spikerush (*Eleocharis* spp.), Panicgrass (*Panicum* spp.), Sawgrass (*Cladium jamaicense*), Cattail (*Typha* spp.), Arrowhead (*Sagittaria* spp.),

Pickerelweed (*Pontederia cordata*), Waterlily (*Nymphaea* spp.), Green Arum (*Peltandra virginica*), Swamp-Lily (*Crinum americanum*), Spider-lilies (*Hymenocallis* spp.), among others.

L3 – Mixed Graminoid-Broadleaf Freshwater Marsh (MFXGB)

7. Co-dominant mix (20% or less difference in percent cover) of two or more long hydroperiod freshwater graminoid such as sawgrass (*Cladium jamaicense*), cattail (*Typha* spp.), and/or spikerush (*Eleocharis* spp.) in association with broadleaf species such as Alligator Flag (*Thalia geniculata*), Arrowhead (*Sagittaria* spp.), and/or Pickerelweed (*Pontederia cordata*), for example.

L1 – Exotic (E)

Non-native species assemblages. A cell label should reflect its native vegetation whenever possible with exotic codes being secondary. Level 2 codes for the exotic species present in this map are listed below. Level 3 codes designate the density or coverage of the exotic within the grid cell: Sparse (10-49% cover), Dominant (50-89% cover), and Monotypic (90-100% cover). Users are asked to reference exotic plant species codes in the *Vegetation Classification System for South Florida Natural Areas* (Rutchev et al. 2006) for a comprehensive list of potential exotic plant communities.

L2 – *Lygodium* (El) including Japanese Climbing Fern (*Lygodium japonicum*) and Old-world Climbing Fern (*L. microphyllum*).

L2 – *Melaleuca* (Em) (*Melaleuca quinquenervia*)

L2 – *Water Lettuce* (Epi) (*Pistia stratiotes*)

L2 – *Brazilian Pepper* (Es) (*Schinus terebinthifolius*)

L1 – Other (O)

Anthropogenic or non-vegetative features.

I. Non-Vegetative cover.

L2 – Non-Vegetative (ON)

1. A mixture of water and fine-grained sediment.

L3 – Mud (ONM)

2. Open water areas such as ponds, lakes, rivers, bays, and estuaries.

L3 – Water (ONW)

II. Non-natural coverage associated with human infrastructure and/or activities.

L2 – Anthropogenic (OA)

1. An area of cleared land manipulated for the purpose of growing crops.

L3 – Agriculture (OAA)

2. An artificial waterway constructed to allow the passage of boats or ships inland, or to convey water.

L3 – Canal (OAC)

3. A place used for camping via tents or recreational vehicles. In some cases it may be equipped with cooking grills, connections for water and electricity, and bathrooms.

L3 – Campground (OAG)

4. An embankment built to prevent the overflow of water from a river, canal, or lake.

L3 – Levee (OAL)

5. Land covered with graminoids and sparse shrubs suitable for grazing animals, especially cattle or other ungulate.

L3 – Pasture (OAP)

6. A hard flat open passageway built for the movement of vehicles, people, and animals between two or more points. In previous versions of the classification **OATr** was used.

L3 – Road (OAR)

References

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Appendix A-1 in Appendix B: Exceptions to Level 1 Classes

L1 – Forest (F) – Stands of trees (5 meters or taller) that are of high density (50-100% cover).

Exceptions:

Stands of Slash Pine (*Pinus elliottii* var. *densa*) trees of Forest density are considered Woodland.

Stands of Willow (*Salix caroliniana*) trees of Forest density are considered Shrubland.

Stands of Cocoplum (*Chrysobalanus icaco*) trees of Forest density are considered Shrubland.

L1 – Woodland (W) – Stands of trees (5 meters or taller) that are of low density (10-49% cover). Trees are evenly spaced out and often in a matrix of sparse shrubs, graminoids, and/or herbaceous vegetation.

Exceptions:

If a Woodland contains dense shrub cover (50% or more), it is considered Shrubland. This does not apply to pineland and Cypress (*Taxodium* spp.) communities – these can have a dense shrub understory and still be considered Woodland.

Stands of Slash Pine (*Pinus elliottii* var. *densa*) trees of Forest density are considered Woodland.

L1 – Shrubland (S) – Stands of shrubs (shorter than 5 meters) that are of high density (50-100% cover).

Exceptions:

Stands of Cypress (*Taxodium* spp.) shrubs of Shrubland density are considered Scrub.

Stands of Sea-Oxeye (*Borrchia arborescens*) shrubs of Shrubland density are considered Scrub.

Stands of Buttonbush (*Cephalanthus occidentalis*) shrubs of Shrubland density are considered Scrub.

Mangrove communities averaging heights of 2 meters or shorter, regardless of density (10-100% cover) are considered Scrub.

Stands of Willow (*Salix caroliniana*) trees of Forest density are considered Shrubland.

Stands of Cocoplum (*Chrysobalanus icaco*) trees of Forest density are considered Shrubland.

If a Woodland contains dense shrub cover (50% or more), it is considered Shrubland. This does not apply to pineland and Cypress (*Taxodium* spp.) communities – these can have a dense shrub understory and still be considered Woodland.

L1 – Scrub (C) – Stands of shrubs (shorter than 5 meters) that are of low density (10-49% cover). Shrubs are evenly spaced out and often in a matrix of graminoids and/or herbaceous vegetation.

Exceptions:

Stands of Cypress (*Taxodium* spp.) shrubs of Shrubland density are considered Scrub.

Stands of Sea-Oxeye (*Borrchia arborescens*) shrubs of Shrubland density are considered Scrub.

Stands of Buttonbush (*Cephalanthus occidentalis*) shrubs of Shrubland density are considered Scrub.

Mangrove communities averaging heights of 2 meters or shorter, regardless of density (10-100% cover) are considered Scrub.

Appendix C. Area, Percentage, and Frequency of all Thematic Classes Mapped in the Eastern Big Cypress, Regions 5 and 6, Vegetation Map of Big Cypress National Preserve

Table C-1. Thematic class area, percentage, and frequency [ha—hectare; ac—acre].

Vegetation Code	Vegetation Class	Area (ha)	Area (ac)	Percent Area	Grid-Cells Mapped
OAA	Agriculture	1.5	3.7	< 0.01%	6
MFBt	Alligator Flag Marsh	36.8	90.8	0.02%	147
OA	Anthropogenic	262.0	647.4	0.13%	1,048
FSB	Bayhead Forest	506.3	1,251.0	0.24%	2,025
SSB	Bayhead Shrubland	214.5	530.0	0.10%	858
CSBGt	Bayhead Swamp Scrub-Cattail Marsh	3.3	8.0	< 0.01%	13
CSBGc	Bayhead Swamp Scrub-Sawgrass Marsh	118.3	292.2	0.06%	473
MFGGr	Beakrush Marsh	17.8	43.9	0.01%	71
MSGj	Black Rush Marsh	0.5	1.2	< 0.01%	2
MFGPh	Black Sedge Prairie	345.0	852.5	0.17%	1,380
Es	Brazilian Pepper	332.3	821.0	0.16%	1,329
FMc	Buttonwood Forest	2.8	6.8	< 0.01%	11
FMXcr	Buttonwood-Red Mangrove Forest	13.8	34.0	0.01%	55
SMXcr	Buttonwood-Red Mangrove Shrubland	29.0	71.7	0.01%	116
FHo	Cabbage Palm Hammock	218.0	538.7	0.11%	872
WSoG	Cabbage Palm Lowland-Graminoid Marsh	7.0	17.3	< 0.01%	28
WSoX	Cabbage Palm Lowland-Mixed	2.3	5.6	< 0.01%	9
CSoGc	Cabbage Palm Swamp Scrub-Sawgrass Marsh	1.3	3.1	< 0.01%	5
CUoGP	Cabbage Palm Upland Scrub-Graminoid Prairie	96.3	237.8	0.05%	385
WUoG	Cabbage Palm Upland-Graminoid Marsh	43.8	108.1	0.02%	175
WUoX	Cabbage Palm Upland-Mixed	165.0	407.7	0.08%	660
WUoSn	Cabbage Palm Upland-Saw Palmetto	146.0	360.8	0.07%	584
WUoS	Cabbage Palm Upland-Shrubs	389.5	962.5	0.19%	1,558
FHoq	Cabbage Palm-Live Oak Hammock	382.8	945.8	0.19%	1,531
FHop	Cabbage Palm-Pine Hammock	37.3	92.0	0.02%	149
OAG	Campground	3.3	8.0	< 0.01%	13

Vegetation Code	Vegetation Class	Area (ha)	Area (ac)	Percent Area	Grid-Cells Mapped
OAC	Canal	87.8	216.8	0.04%	351
MFGt	Cattail Marsh	188.5	465.8	0.09%	754
SSy	Cocoplum Shrubland	52.5	129.7	0.03%	210
MFGg	Common Reed Marsh	26.5	65.5	0.01%	106
MFGXgt	Common Reed-Cattail Marsh	5.5	13.6	< 0.01%	22
FStD	Cypress Forest-Dome	13,436.8	33,202.9	6.49%	53,747
FStM	Cypress Forest-Monotypic	42,189.3	104,251.9	20.39%	168,757
FStS	Cypress Forest-Strand	3,279.8	8,104.4	1.59%	13,119
CStGt	Cypress Scrub-Cattail Marsh	17.0	42.0	0.01%	68
CStG	Cypress Scrub-Graminoid Marsh	16,446.8	40,640.8	7.95%	65,787
CStGP	Cypress Scrub-Graminoid Prairie	24,190.5	59,776.0	11.69%	96,762
CStGn	Cypress Scrub-Sand Cordgrass Marsh	1.0	2.5	< 0.01%	4
CStGc	Cypress Scrub-Sawgrass Marsh	5,217.0	12,891.5	2.52%	20,868
CStGe	Cypress Scrub-Spikerush Marsh	686.0	1,695.1	0.33%	2,744
WStE	Cypress Woodland-Emergent Marsh	1.3	3.1	< 0.01%	5
WStG	Cypress Woodland-Graminoid Marsh	9,658.3	23,866.1	4.67%	38,633
WStX	Cypress Woodland-Mixed	1,542.8	3,812.2	0.75%	6,171
WStS	Cypress Woodland-Shrubs	261.3	645.6	0.13%	1,045
FStH	Cypress-Hardwood Forest	5,375.5	13,283.1	2.60%	21,502
CStWGt	Cypress-Hardwood Scrub-Cattail Marsh	0.5	1.2	< 0.01%	2
CStWG	Cypress-Hardwood Scrub-Graminoid Marsh	351.5	868.6	0.17%	1,406
CStWGP	Cypress-Hardwood Scrub-Graminoid Prairie	2,680.3	6,623.0	1.30%	10,721
CStWGn	Cypress-Hardwood Scrub-Sand Cordgrass Marsh	0.5	1.2	< 0.01%	2
CStWGc	Cypress-Hardwood Scrub-Sawgrass Marsh	98.8	244.0	0.05%	395
FStp	Cypress-Pine Forest	1,742.5	4,305.8	0.84%	6,970
CStpGP	Cypress-Pine Scrub-Graminoid Prairie	345.0	852.5	0.17%	1,380
WStpG	Cypress-Pine Woodland-Graminoid Marsh	1,298.5	3,208.7	0.63%	5,194
WStpX	Cypress-Pine Woodland-Mixed	70.5	174.2	0.03%	282
WStpS	Cypress-Pine Woodland-Shrubs	8.8	21.6	< 0.01%	35
MFG	Graminoid Freshwater Marsh	2.3	5.6	< 0.01%	9
MFGP	Graminoid Freshwater Prairie	12,807.8	31,648.6	6.19%	51,231

Vegetation Code	Vegetation Class	Area (ha)	Area (ac)	Percent Area	Grid-Cells Mapped
FHp	Hardwood Hammock-Pine Forest	586.5	1,449.3	0.28%	2,346
FSH	Hardwood Swamp Forest	767.0	1,895.3	0.37%	3,068
CSHGc	Hardwood Swamp Scrub-Sawgrass Marsh	14.5	35.8	0.01%	58
SSH	Hardwood Swamp Shrubland	352.0	869.8	0.17%	1,408
WSH	Hardwood Swamp Woodland	13.5	33.4	0.01%	54
MFH	Herbaceous Freshwater Marsh	1.3	3.1	< 0.01%	5
OAL	Levee	141.5	349.7	0.07%	566
FHq	Live Oak Hammock	1,106.5	2,734.2	0.53%	4,426
WUHqn	Live Oak-Saw Palmetto Woodland	55.8	137.8	0.03%	223
Em	Melaleuca	2.3	5.6	< 0.01%	9
MFGX	Mixed Graminoid Freshwater Marsh	8,599.5	21,249.8	4.16%	34,398
MFXGB	Mixed Graminoid-Broadleaf Freshwater Marsh	208.0	514.0	0.10%	832
ONM	Mud	3.5	8.6	< 0.01%	14
MFO	Open Freshwater Marsh	6.3	15.4	< 0.01%	25
OAP	Pasture	50.3	124.2	0.02%	201
WUpFG	Pine Flatwoods-Graminoid Marsh	2,104.0	5,199.1	1.02%	8,416
WUpFX	Pine Flatwoods-Mixed	7,407.5	18,304.3	3.58%	29,630
WUpFSn	Pine Flatwoods-Saw Palmetto	4,615.3	11,404.5	2.23%	18,461
WUpFS	Pine Flatwoods-Shrubs	6,144.5	15,183.4	2.97%	24,578
WSpG	Pine Lowland-Graminoid Marsh	4,655.3	11,503.4	2.25%	18,621
WSpX	Pine Lowland-Mixed	1,700.3	4,201.4	0.82%	6,801
WSpS	Pine Lowland-Shrubs	443.3	1,095.3	0.21%	1,773
WUpRG	Pine Rockland-Graminoids	259.8	641.9	0.13%	1,039
WUpRX	Pine Rockland-Mixed	274.0	677.1	0.13%	1,096
WUpRS	Pine Rockland-Shrubs	136.3	336.7	0.07%	545
FSa	Pond Apple Forest	14.0	34.6	0.01%	56
CSaGr	Pond Apple Scrub-Beakrush Marsh	1.0	2.5	< 0.01%	4
CSaGt	Pond Apple Scrub-Cattail Marsh	2.0	4.9	< 0.01%	8
CSaGc	Pond Apple Scrub-Sawgrass Marsh	11.3	27.8	0.01%	45
SSa	Pond Apple Shrubland	2.3	5.6	< 0.01%	9
FSaf	Pond Apple-Pop Ash Forest	3.0	7.4	< 0.01%	12

Vegetation Code	Vegetation Class	Area (ha)	Area (ac)	Percent Area	Grid-Cells Mapped
SSaf	Pond Apple-Pop Ash Shrubland	0.3	0.6	< 0.01%	1
FSf	Pop Ash Forest	195.5	483.1	0.09%	782
SSf	Pop Ash Shrubland	8.3	20.4	< 0.01%	33
FSfs	Pop Ash-Willow Forest	60.3	148.9	0.03%	241
SSfs	Pop Ash-Willow Shrubland	12.0	29.7	0.01%	48
SSI	Primrosewillow Shrubland	2.0	4.9	< 0.01%	8
FMr	Red Mangrove Forest	6.5	16.1	< 0.01%	26
CMrGt	Red Mangrove Scrub-Cattail Marsh	4.0	9.9	< 0.01%	16
CMrGn	Red Mangrove Scrub-Cordgrass Marsh	2.0	4.9	< 0.01%	8
CMrO	Red Mangrove Scrub-Open Marsh	12.5	30.9	0.01%	50
CMrGd	Red Mangrove Scrub-Saltgrass Marsh	0.3	0.6	< 0.01%	1
CMrGc	Red Mangrove Scrub-Sawgrass Marsh	11.3	27.8	0.01%	45
CMrGe	Red Mangrove Scrub-Spikerush Marsh	17.0	42.0	0.01%	68
SMr	Red Mangrove Shrubland	51.0	126.0	0.02%	204
FSe	Red Maple Forest	0.8	1.9	< 0.01%	3
OAR	Road	287.0	709.2	0.14%	1,148
MSGd	Saltgrass Marsh	3.0	7.4	< 0.01%	12
MFGn	Sand Cordgrass Marsh	37.5	92.7	0.02%	150
CUnGP	Saw Palmetto Scrub-Graminoid Prairie	47.5	117.4	0.02%	190
SUn	Saw Palmetto Shrubland	694.0	1,714.9	0.34%	2,776
MFGXcr	Sawgrass-Beakrush Marsh	2,727.3	6,739.2	1.32%	10,909
MFGXct	Sawgrass-Cattail Marsh	658.8	1,627.8	0.32%	2,635
MFGXcn	Sawgrass-Sand Cordgrass Marsh	4.0	9.9	< 0.01%	16
MFGcSD	Short Sawgrass Marsh-Dense	3,112.5	7,691.2	1.50%	12,450
MFGcSS	Short Sawgrass Marsh-Sparse	2,701.8	6,676.2	1.31%	10,807
MFGe	Spikerush Marsh	761.8	1,882.3	0.37%	3,047
MFGcTD	Tall Sawgrass Marsh-Dense	133.0	328.7	0.06%	532
FHT	Temperate Hardwood Hammock	2,549.3	6,299.3	1.23%	10,197
CUTGP	Temperate Hardwood Scrub-Graminoid Prairie	1,131.5	2,796.0	0.55%	4,526
SUT	Temperate Hardwood Shrubland	2,596.3	6,415.5	1.25%	10,385
WUHT	Temperate Hardwood Woodland	90.0	222.4	0.04%	360

Vegetation Code	Vegetation Class	Area (ha)	Area (ac)	Percent Area	Grid-Cells Mapped
FSBT	Transitional Bayhead Forest	65.5	161.9	0.03%	262
SSBT	Transitional Bayhead Shrubland	91.3	225.5	0.04%	365
CSBTGn	Transitional Bayhead Swamp Scrub-Cordgrass Marsh	0.3	0.6	< 0.01%	1
FSHT	Transitional Hardwood Swamp Forest	3.8	9.3	< 0.01%	15
FHS	Tropical Hardwood Hammock	808.3	1,997.2	0.39%	3,233
SUH	Tropical Hardwood Shrubland	26.8	66.1	0.01%	107
CUWGP	Upland Hardwood Scrub-Graminoid Prairie	23.5	58.1	0.01%	94
CUWGc	Upland Hardwood Scrub-Sawgrass Marsh	57.0	140.9	0.03%	228
ONW	Water	53.8	132.8	0.03%	215
Epi	Water Lettuce	0.3	0.6	< 0.01%	1
MFFy	Waterlily Marsh	28.5	70.4	0.01%	114
CSmGP	Wax Myrtle Scrub-Graminoid Prairie	921.0	2,275.8	0.45%	3,684
CSmGc	Wax Myrtle Scrub-Sawgrass Marsh	49.0	121.1	0.02%	196
SSm	Wax Myrtle Shrubland	203.0	501.6	0.10%	812
CSsGt	Willow Scrub-Cattail Marsh	54.3	134.1	0.03%	217
CSsGg	Willow Scrub-Common Reed Marsh	0.8	1.9	< 0.01%	3
CSsE	Willow Scrub-Emergent Marsh	3.8	9.3	< 0.01%	15
CSsGn	Willow Scrub-Sand Cordgrass Marsh	6.5	16.1	< 0.01%	26
CSsGc	Willow Scrub-Sawgrass Marsh	326.5	806.8	0.16%	1,306
CSsGe	Willow Scrub-Spikerush Marsh	1.8	4.3	< 0.01%	7
SSs	Willow Shrubland	1,108.5	2,739.2	0.54%	4,434.0

Appendix D. Accuracy Assessment Table for the eastern Big Cypress, Regions 5 and 6, Vegetation Map of Big Cypress National Preserve.

Table D-1. Accuracy assessment table for the eastern Big Cypress vegetation map. Superscripts identify the acceptance criteria as outlined in the methods section of the report and are as followed: (1) vegetation map class correct at level mapped; (2) vegetation map class more detailed than assessment points; (3) assessment point at boundary between two similar classes, height or cover, difference; (4) sawgrass class modifier; (5) split cell/majority rule decision; (6) similarity between Lowland Pine and Upland Pines.

Map Annotation	Accuracy Assessment Annotation	One-to-One Match	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Bayhead Shrubland (SSB)	Bayhead Shrubland	1	1	1	—	—
	Bayhead Shrubland Total	1	1	1	100	100
Brazilian Pepper (Es)	Brazilian Pepper	1	1	1	—	—
	Brazilian Pepper Total	1	1	1	100	100
Cabbage Palm Lowland-Graminoid Marsh (WSoG)	Buttonwood Shrubland	0	0	1	—	—
	Cabbage Palm Lowland-Graminoid Marsh Total	0	0	0	0	0
Cabbage Palm Upland Scrub-Graminoid Prairie (CUoGP)	Cabbage Palm Upland Scrub-Sawgrass Prairie ¹	0	1	1	—	—
	Cabbage Palm Upland Scrub-Graminoid Prairie Total	0	1	1	100	100
Cabbage Palm Upland-Saw Palmetto (WUoSn)	Cabbage Palm Upland-Saw Palmetto	1	1	1	—	—
	Cabbage Palm Upland-Saw Palmetto Total	1	1	1	100	100
	Cypress Forest	0	0	1	—	—
	Cabbage Palm-Live Oak Hammock	1	1	1	—	—

Map Annotation	Accuracy Assessment Annotation	One-to-One Match	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Cabbage Palm-Live Oak Hammock (FHoq)	Temperate Hardwood Hammock ²	0	2	2	—	—
	Cabbage Palm-Live Oak Hammock Total	1	3	4	25	75
Cabbage Palm-Pine Hammock (FHop)	Cabbage Palm-Pine Hammock	1	1	1	—	—
	Cabbage Palm-Pine Hammock Total	1	1	1	100	100
Cattail Marsh (MFGt)	Cattail Marsh	1	1	1	—	—
	Cattail Marsh Total	1	1	1	100	100
Cypress Forest-Dome (FStD)	Cypress Forest-Dome	35	35	35	—	—
	Cypress Scrub-Graminoid Prairie ⁵	0	1	1	—	—
	Cypress Forest ³	0	2	2	—	—
	Cypress-Pine Forest	0	0	1	—	—
	Cypress Woodland-Spikerush Marsh ⁵	0	1	1	—	—
	Cypress Woodland-Graminoid Prairie Mixed ⁵	0	1	1	—	—
	Cypress Woodland-Shrubs ³	0	1	1	—	—
	Cypress Forest-Dome Total	35	41	42	83	98
Cypress Forest-Monotypic (FStM)	Cypress Forest-Monotypic	29	29	29	—	—
	Cypress Scrub-Sawgrass Marsh	0	0	2	—	—
	Temperate Hardwood Hammock	0	0	1	—	—
	Cypress Forest-Dome ¹	0	12	12	—	—
	Cypress-Pine Forest	0	0	1	—	—

Map Annotation	Accuracy Assessment Annotation	One-to-One Match	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
	Cypress Forest-Strand ³	0	17	17	—	—
	Cypress Woodland-Sawgrass Marsh ³	0	7	7	—	—
	Cypress Woodland-Graminoid Prairie ³	0	4	4	—	—
	Cypress Woodland-Sawgrass Prairie ³	0	1	1	—	—
	Cypress Woodland-Graminoid Mixed Prairie ³	0	2	2	—	—
	Cypress Woodland-Shrubs ⁵	0	1	1	—	—
	Cypress Forest-Monotypic Total	29	73	77	38	95
Cypress Forest-Strand (FStS)	Cypress Forest-Strand	10	10	10	—	—
	Cypress Forest-Dome ³	0	1	1	—	—
	Cypress Forest-Strand Total	10	11	11	91	100
Cypress Scrub-Graminoid Marsh (CStG)	Cypress Scrub-Graminoid Marsh	2	2	2	—	—
	Cypress Scrub-Sawgrass Marsh ¹	0	15	15	—	—
	Cypress Scrub-Spikerush Marsh ¹	0	4	4	—	—
	Cypress Scrub-Graminoid Prairie ¹	0	2	2	—	—
	Cypress Scrub-Open Marsh ³	0	4	4	—	—
	Cypress Woodland-Sawgrass Marsh ³	0	1	1	—	—
	Cypress Scrub-Graminoid Marsh Total	2	28	28	7	100
	Cypress Scrub-Graminoid Prairie	41	41	42	—	—
	Cypress Scrub-Sawgrass Marsh	0	0	0	—	—

Map Annotation	Accuracy Assessment Annotation	One-to-One Match	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Cypress Scrub-Graminoid Prairie (CStGP)	Cypress Scrub-Sawgrass Prairie ¹	0	17	17	—	—
	Cypress Scrub-Muhly Grass Prairie	0	2	2	—	—
	Cypress Scrub-Graminoid Mixed Prairie	0	3	3	—	—
	Graminoid Freshwater Prairie	0	1	1	—	—
	Muhly Grass Prairie ³	0	1	1	—	—
	Cypress Woodland-Graminoid Mixed Prairie ³	0	1	1	—	—
	Cypress Scrub-Graminoid Prairie Total	41	66	67	61	99
Cypress Scrub-Sawgrass Marsh (CStGc)	Cypress Scrub-Sawgrass Marsh ¹	0	6	6	—	—
	Cypress Scrub-Sawgrass Marsh-Tall ¹	0	1	1	—	—
	Cypress Scrub-Sawgrass Prairie ³	0	4	4	—	—
	Cypress Woodland-Sawgrass Marsh ³	0	6	6	—	—
	Cypress Woodland-Sawgrass Prairie ³	0	1	1	—	—
	Cypress Scrub-Sawgrass Marsh Total	0	18	18	0	100
Cypress Scrub-Spikerush Marsh (CStGe)	Cypress Scrub-Spikerush Marsh	1	1	1	—	—
	Cypress Scrub-Graminoid Marsh	0	1	1	—	—
	Cypress Scrub-Sawgrass Marsh	0	0	1	—	—
	Cypress Scrub-Spikerush Marsh Total	1	2	3	33	67
	Cypress Woodland-Graminoid Marsh	0	0	0	—	—
	Cypress Scrub-Sawgrass Marsh ³	0	1	1	—	—

Map Annotation	Accuracy Assessment Annotation	One-to-One Match	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Cypress Woodland-Graminoid Marsh (WStG)	Cypress Scrub-Sawgrass Prairie ³	0	4	4	—	—
	Cypress Woodland-Sawgrass Marsh ¹	0	7	7	—	—
	Cypress Woodland-Graminoid Prairie ¹	0	13	13	—	—
	Cypress Woodland-Sawgrass Prairie ¹	0	1	1	—	—
	Cypress Woodland-Muhly Grass Prairie ¹	0	1	1	—	—
	Cypress Woodland-Graminoid Prairie Mixed ³	0	3	3	—	—
	Cypress Woodland-Mixed ³	0	1	1	—	—
	Cypress Woodland-Graminoid Marsh Total	0	31	31	0	100
Cypress Woodland-Mixed (WStX)	Cypress Woodland-Mixed	0	0	0	—	—
	Cypress Woodland-Shrubs ³	0	2	2	—	—
	Cypress Woodland-Mixed Total	0	2	2	0	100
Cypress Woodland-Shrubs (WStS)	Cypress Woodland-Shrubs	0	0	0	—	—
	Cypress Woodland-Sawgrass Marsh ³	0	1	1	—	—
	Pine Flatwoods-Shrubs ⁶	0	1	1	—	—
	Cypress Woodland-Shrubs (Total)	0	2	2	0	100
Cypress-Hardwood Forest (FStH)	Cypress-Hardwood Forest	4	4	4	—	—
	Cypress Forest-Monotypic ²	0	1	2	—	—
	Cypress Forest-Strand ²	0	1	1	—	—
	Cypress Forest-Strand Total	4	6	7	57	86

Map Annotation	Accuracy Assessment Annotation	One-to-One Match	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Cypress-Hardwood Scrub-Graminoid Prairie (CStWGP)	Cypress-Hardwood Scrub-Graminoid Prairie	5	5	5	—	—
	Cabbage Palm Upland Scrub-Graminoid Prairie	0	0	1	—	—
	Cypress-Hardwood Scrub-Graminoid Prairie Total	5	5	6	83	83
Cypress-Pine Forest (FStp)	Cypress-Pine Forest	1	1	1	—	—
	Pine Flatwoods-Shrubs	0	0	1	—	—
	Cypress-Pine Forest Total	1	1	2	50	50
Cypress-Pine Woodland-Graminoid Marsh (WStpG)	Cypress-Pine Woodland-Graminoid Marsh	0	0	0	—	—
	Pine Lowland-Graminoid Marsh ²	0	1	1	—	—
	Cypress Woodland-Sawgrass Prairie ¹	0	1	1	—	—
	Pine Flatwoods-Mixed	0	0	1	—	—
	Cypress-Pine Woodland-Graminoid Marsh Total	0	2	3	0	67
Graminoid Freshwater Prairie (MFGP)	Graminoid Freshwater Prairie	6	6	6	—	—
	Cypress Scrub-Sawgrass Prairie	0	0	1	—	—
	Sawgrass Prairie ¹	0	4	4	—	—
	Muhly Grass Prairie ¹	0	5	5	—	—
	Little Bluestem Prairie ¹	0	1	1	—	—
	Mixed Graminoid Prairie ¹	0	5	5	—	—
	Graminoid Freshwater Prairie Total	6	21	22	27	95
	Hardwood Hammock-Pine Forest	0	0	0	—	—

Map Annotation	Accuracy Assessment Annotation	One-to-One Match	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Hardwood Hammock-Pine Forest (FHp)	Temperate Hardwood Hammock ³	0	1	1	—	—
	Hardwood Hammock-Pine Forest Total	0	1	1	0	100
Hardwood Swamp Scrub-Sawgrass Marsh (CSHGc)	Cabbage Palm Lowland-Graminoid Marsh	0	1	1	—	—
	Hardwood Swamp Scrub-Sawgrass Marsh Total	0	1	1	0	0
Hardwood Swamp Shrubland (SSH)	Hardwood Swamp Shrubland	0	0	0	—	—
	Hardwood Swamp Forest ³	0	1	1	—	—
	Hardwood Swamp Shrubland Total	0	1	1	0	100
Live Oak Hammock (FHq)	Live Oak Hammock	3	3	3	—	—
	Temperate Hardwood Hammock ³	0	2	2	—	—
	Live Oak Hammock Total	3	5	5	60	100
Live Oak-Saw Palmetto Woodland (WUHqn)	Live Oak-Saw Palmetto Woodland	0	0	0	—	—
	Temperate Hardwood Woodland ²	0	1	1	—	—
	Live Oak-Saw Palmetto Woodland Total	0	1	1	0	100
Mixed Graminoid Freshwater Marsh (MFGX)	Mixed Graminoid Freshwater Marsh	2	2	2	—	—
	Cypress Scrub-Panicgrass Marsh	0	0	1	—	—
	Spikerush Marsh ³	0	3	4	—	—
	Beakrush Marsh ³	0	3	4	—	—
	Sawgrass-Beakrush Marsh ¹	0	2	2	—	—
	Mixed Graminoid Freshwater Marsh Total	2	10	13	15	77

Map Annotation	Accuracy Assessment Annotation	One-to-One Match	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Pine Flatwoods-Graminoid Marsh (WUpFG)	Pine Flatwoods-Graminoid Marsh	0	0	0	—	—
	Pine Flatwoods-Mixed ³	0	2	2	—	—
	Pine Flatwoods-Graminoid Marsh Total	0	2	2	0	100
Pine Flatwoods-Mixed (WUpFX)	Pine Flatwoods-Mixed	13	13	13	—	—
	Pine Lowland-Graminoid Marsh ⁶	0	1	1	—	—
	Pine Lowland-Mixed ⁶	0	1	1	—	—
	Cypress Woodland-Graminoid Marsh	0	0	1	—	—
	Pine Flatwoods-Saw Palmetto ³	0	2	2	—	—
	Pine Flatwoods-Mixed Total	13	17	18	72	94
Pine Flatwoods-Saw Palmetto (WUpFSn)	Pine Flatwoods-Saw Palmetto	5	5	5	—	—
	Pine Lowland-Shrubs ⁶	0	1	1	—	—
	Pine Flatwoods-Mixed ³	0	1	1	—	—
	Pine Flatwoods-Saw Palmetto Total	5	7	7	71	100
Pine Flatwoods-Shrubs (WUpFS)	Pine Flatwoods-Shrubs	11	11	11	—	—
	Pine Lowland-Shrubs ⁶	0	1	1	—	—
	Pine Flatwoods-Saw Palmetto ¹	0	5	5	—	—
	Pine Flatwoods-Mixed ³	0	1	1	—	—
	Pine Flatwoods-Shrubs Total	11	18	18	61	100
	Pine Lowland-Graminoid Marsh	6	6	6	—	—

Map Annotation	Accuracy Assessment Annotation	One-to-One Match	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Pine Lowland-Graminoid Marsh (WSpG)	Pine Lowland-Mixed ³	0	3	3	—	—
	Pine Flatwoods-Graminoid Marsh ⁶	0	4	4	—	—
	Pine Flatwoods-Mixed ⁶	0	1	1	—	—
	Pine Lowland-Graminoid Marsh Total	6	14	14	43	100
Pine Lowland-Mixed (WSpX)	Pine Lowland-Mixed	4	4	4	—	—
	Pine Flatwoods-Mixed ⁶	0	4	4	—	—
	Pine Lowland-Mixed Total	4	8	8	50	100
Pine Lowland-Shrubs (WSpS)	Pine Lowland-Mixed	2	2	2	—	—
	Pine Flatwoods-Shrubs ⁶	0	3	3	—	—
	Pine Lowland-Mixed Total	2	5	5	40	100
Pine Rockland-Shrubs (WUpRS)	Pine Rockland-Shrubs	1	1	1	—	—
	Pine Rockland-Shrubs Total	1	1	1	100	100
Saw Palmetto Shrubland (SUn)	Saw Palmetto Shrubland	1	1	1	—	—
	Saw Palmetto Shrubland Total	1	1	1	100	100
Sawgrass-Beakrush Marsh (MFGXcr)	Sawgrass-Beakrush Marsh	3	3	3	—	—
	Short Sawgrass Marsh-Sparse ³	0	1	1	—	—
	Sawgrass Prairie ¹	0	0	1	—	—
	Mixed Graminoid Prairie	0	0	1	—	—
	Mixed Graminoid Freshwater Marsh ²	0	1	1	—	—

Map Annotation	Accuracy Assessment Annotation	One-to-One Match	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
	Sawgrass-Beakrush Marsh Total	3	5	7	43	71
Sawgrass-Cattail Marsh (MFGXct)	Sawgrass-Cattail Marsh	0	0	0	—	—
	Willow Scrub-Sawgrass Marsh	0	0	1	—	—
	Short Sawgrass Marsh-Sparse	0	0	1	—	—
	Tall Sawgrass Marsh-Dense ²	0	1	1	—	—
	Cattail Marsh	0	0	1	—	—
	Sawgrass-Cattail Marsh Total	0	1	4	0	25
Short Sawgrass Marsh-Dense (MFGcSD)	Short Sawgrass Marsh-Dense	3	3	3	—	—
	Tall Sawgrass Marsh-Dense ⁴	0	1	1	—	—
	Tall Sawgrass Marsh-Sparse ⁴	0	1	1	—	—
	Mixed Graminoid Prairie	0	0	1	—	—
	Short Sawgrass Marsh-Dense Total	3	5	6	50	83
Short Sawgrass Marsh-Sparse (MFGcSS)	Short Sawgrass Marsh-Sparse Total	1	1	1	—	—
	Cypress Scrub-Little Bluestem Prairie	0	0	1	—	—
	Short Sawgrass Marsh-Dense ⁴	0	1	1	—	—
	Beakrush Marsh	0	0	2	—	—
	Short Sawgrass Marsh-Sparse Total	1	2	5	20	40
Spikerush Marsh (MFGe)	Spikerush Marsh	1	1	1	—	—
	Cypress Scrub-Spikerush Marsh	0	0	1	—	—

Map Annotation	Accuracy Assessment Annotation	One-to-One Match	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
	Spikerush Marsh Total	1	1	2	50	50
Tall Sawgrass Marsh-Dense (MFGcTD)	Tall Sawgrass Marsh-Dense	1	1	1	—	—
	Tall Sawgrass Marsh-Dense Total	1	1	1	100	100
Temperate Hardwood Hammock (FHT)	Temperate Hardwood Hammock	1	1	1	—	—
	Forest Hardwood ²	0	1	1	—	—
	Temperate Hardwood Hammock Total	1	2	2	50	100
Temperate Hardwood Scrub-Graminoid Prairie (CUTGP)	Temperate Hardwood Scrub-Graminoid Prairie	0	0	0	—	—
	Wax Myrtle Scrub-Graminoid Prairie ¹	0	2	2	—	—
	Saw Palmetto Scrub-Graminoid Prairie ¹	0	2	2	—	—
	Cabbage Palm Upland Scrub-Graminoid Prairie ¹	0	1	1	—	—
	Graminoid Freshwater Prairie ³	0	1	1	—	—
	Pine Lowland-Mixed ²	0	1	1	—	—
	Temperate Hardwood Scrub-Graminoid Prairie Total	0	7	7	0	100
Temperate Hardwood Shrubland (SUT)	Temperate Hardwood Shrubland	0	0	0	—	—
	Saw Palmetto Shrubland ¹	0	2	2	—	—
	Wax Myrtle Shrubland ³	0	1	1	—	—
	Temperate Hardwood Shrubland Total	0	3	3	0	100
Temperate Hardwood Woodland (WUHT)	Temperate Hardwood Woodland	1	1	1	—	—
	Live Oak Hammock ³	0	1	1	—	—

Map Annotation	Accuracy Assessment Annotation	One-to-One Match	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
	Temperate Hardwood Woodland Total	1	2	2	50	100
Transitional Bayhead Forest (FSBT)	Transitional Bayhead Forest	0	0	0	—	—
	Buttonwood-Red Magnrove Forest	0	0	1	—	—
	Transitional Bayhead Shrubland ³	1	1	1	—	—
	Transitional Bayhead Forest Total	1	1	2	50	50
Tropical Hardwood Hammock (FHS)	Tropical Hardwood Hammock	1	1	1	—	—
	Tropical Hardwood Hammock Total	1	1	1	100	100
Wax Myrtle Scrub-Graminoid Prairie (CSmGP)	Wax Myrtle Scrub-Graminoid Prairie	3	3	3	—	—
	Wax Myrtle Scrub-Sawgrass Marsh ³	0	1	1	—	—
	Graminoid Freshwater Prairie	0	0	1	—	—
	Wax Myrtle Scrub-Graminoid Prairie Total	3	4	5	60	80

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

NPS 160/165405, 176/165405, October 2019

National Park Service
U.S. Department of the Interior



[Natural Resource Stewardship and Science](#)

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