



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

Interim Report—Southwest Coastal Everglades (Region 3), Everglades National Park

Natural Resource Report NPS/SFCN/NRR—1776



ON THE COVER

Photograph of sand cordgrass (*Spartina bakeri*) with mangroves, Southwest Coastal Everglades, Everglades National Park, taken by Pablo L. Ruiz on 22 November 2016.

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Pablo L. Ruiz¹, Michelle C. Prats¹, Craig P. Perry¹, Alejandro Arteaga Garcia², Michael A. Foguer¹, Joseph Ingram¹, Robert B. Shamblin¹, Magali Guichardot², Kevin R. T. Whelan¹

¹South Florida Caribbean Network Inventory and Monitoring Program
18001 Old Cutler Road, Suite 419
Palmetto Bay, Florida 33157

²Florida International University
11200 SW 8th Street
Miami, Florida 33199

October 2018

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., M. C. Prats, C. P. Perry, A. A. Garcia, M. A. Foguer, J. Ingram, R. B. Shamblin, M. Guichardot, and K. R. T. Whelan. 2018. The Everglades National Park and Big Cypress National Preserve Vegetation Mapping Project: Interim report—Southwest Coastal Everglades (Region 3), Everglades National Park. Natural Resource Report NPS/SFCN/NRR—1776. 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
BT:	Botanical Training Point
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
SWCE:	Southwest Coastal Everglades
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
WRDA:	Water Resource Development Act

Contributors

Pablo L. Ruiz—Ecologist/Project Manager

Michelle C. Prats—Biological Science Technician/Photo-interpreter

Craig P. Perry—Biological Science Technician/Photo-interpreter

Alejandro Arteaga Garcia—FIU Intern/Photo-interpreter & QA/QC

Michael A. Foguer—Biological Science Technician/Photo-interpreter

Joseph Ingram—Biological Science Technician/Photo-interpreter

Robert B. Shamblin—Botanists/Accuracy Assessment Lead

Magali Guichardot—FIU Intern/Photo-interpreter

Kevin R. T. Whelan—Ecologist

Summary

The Everglades National Park (EVER) and Big Cypress National Preserve (BICY) 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 NP and Big Cypress NP 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 Comprehensive Everglades Restoration Plan and the Western Everglades Restoration Project; 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 NP, Regions 1–4, and three in Big Cypress NP, Regions 5–7 (Figure 1). The report that follows focuses on the mapping effort associated with Region 3, the Southwest Coastal Everglades (SWCE); an area geographically centered around Whitewater Bay in Everglades NP. Region 3 encompasses a total area of 990.7 square kilometers (382.5 square miles [mi²], 244,816 ac) and is bounded by Shark River Slough/Long Pine Key (Region 1) to the northeast, Taylor Slough (Region 2) to the east, and the Northwest Coastal Everglades (Region 4) to the north.

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, 0.30 centimeter (11.8 inches [in]) 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 alongside an aerial photograph interpretation key, and referencing an extensive ground-truth database. The dominant vegetation community within in each grid cell was classified using a hierarchical classification system developed specifically for this project. Photo-interpreters additionally noted any evidence of disturbance in each grid cell as either anthropogenic, fire, freeze, or windstorm and categorized the absolute cover of cattail (*Typha* sp.) and any exotic species present as either: Sparse (10–49%), Dominant (50–89%), or Monotypic (90–100%).

A total of 169 thematic classes were used to map Region 3. The most common vegetation class was Mixed Mangrove Forest. This community accounted for approximately 8% of the area mapped. Other notable classes include Short Sawgrass Marsh-Dense (6.1%), Red Mangrove Forest (5.0%), Black Mangrove-Red Mangrove Forest (4.5%), and Red Mangrove Scrub-Open Marsh (4.5%). These five classes plus water, e.g., ponds, lakes, bays, rivers, etc., (26%) account for approximately 54% of the entire area mapped within Region 3. Based on 245 randomly selected points, the accuracy of the Region 3 map was determined to be 89.4% with a lower 90th percentile confidence level of 85.6%.

This report and the geospatial products developed in the preparation of the Southwest Coastal Everglades, Region 3, vegetation map of EVER are stored on the Vegetation Map of Southwest Coastal Everglades (Region 3), Everglades National Park DVD. Stored items include:

- This vegetation inventory report that includes the methods, results, accuracy assessment, and the vegetation classification key;
- An ESRI ArcGIS v10.5 geodatabase containing the Southwest Coastal Everglades, Region 3, vegetation map;
- An ESRI ArcGIS v10.5 geodatabase containing all of the vegetation data collected and a library of oblique aerial photos captured at each vegetation point;
- The metadata for all spatial data; and
- An ESRI ArcGIS symbology legend file.

Please do not distribute this report without a copy of the accompanying DVD (The Vegetation Map of Southwest Coastal Everglades [Region 3], Everglades National Park). Additional copies of the DVD are available from the NPS South Florida Caribbean Network or by contacting the author.

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 April Patterson Theodore N. Schall, and Javier Cortes from USACE; Karl Brown, Agnes McLean, David Rudnick, Jed Redwine, Jimi Sadle, and Leonard Pearlstine from the NPS; Helena C. Giannini, Judd Paterson and Mario Londono from the South Florida Caribbean Network, NPS; and Fred Sklar from the South Florida Water Management District (SFWMD). The 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 Everglades National Park (EVER) and Big Cypress National Preserve (BICY) Fire and Aviation: Fred Goodwin (BICY pilot), Michael O’Leary (BICY Unit Aviation Manager), Clayton Camblin (EVER Unit Aviation Manager), Gary Carnall (EVER Airport Fire Aviation Manager) and staff, Micheal Roof (BICY), Henry DelValle (EVER), Andrew Gill (EVER), and Steve Newland (EVER)

Introduction

Everglades National Park and Big Cypress National Preserve Vegetation Mapping Project

The Everglades National Park (EVER) and Big Cypress National Preserve (BICY) 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 NP and Big Cypress NP. 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 Comprehensive Everglades Restoration Plan and the Western Everglades Restoration Project¹; 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 NP, Regions 1–4, and three in Big Cypress NP, Regions 5–7 (Figure 1). This project was initiated in 2006 with a subcontract to Avineon, Inc. to map one-third of Big Cypress NP (Region 7; 891 square kilometers [344 mi²] or 220,292 ac) and the northwest corner of Region 4 in Everglades NP (Figure 1). The SFWMD completed a 406 square kilometers (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 EVER and BICY 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 NP and Big Cypress NP. 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 Region 3, the Southwest Coastal Everglades (SWCE), an area geographically centered around Whitewater Bay in Everglades NP. Region 3 encompasses a total area of 990.7 square kilometers (382.5 mi² and 244,816 ac) and is

¹ A component of the CERP focused on improving the quantity, quality, timing, and distribution of water needed to restore and connect the Western Glades (BICY) to the Greater Everglades.

bounded by Shark River Slough/Long Pine Key (Region 1) to the northeast, Taylor Slough (Region 2²) to the east, and the Northwest Coastal Everglades (Region 4) to the north (Figure 1).

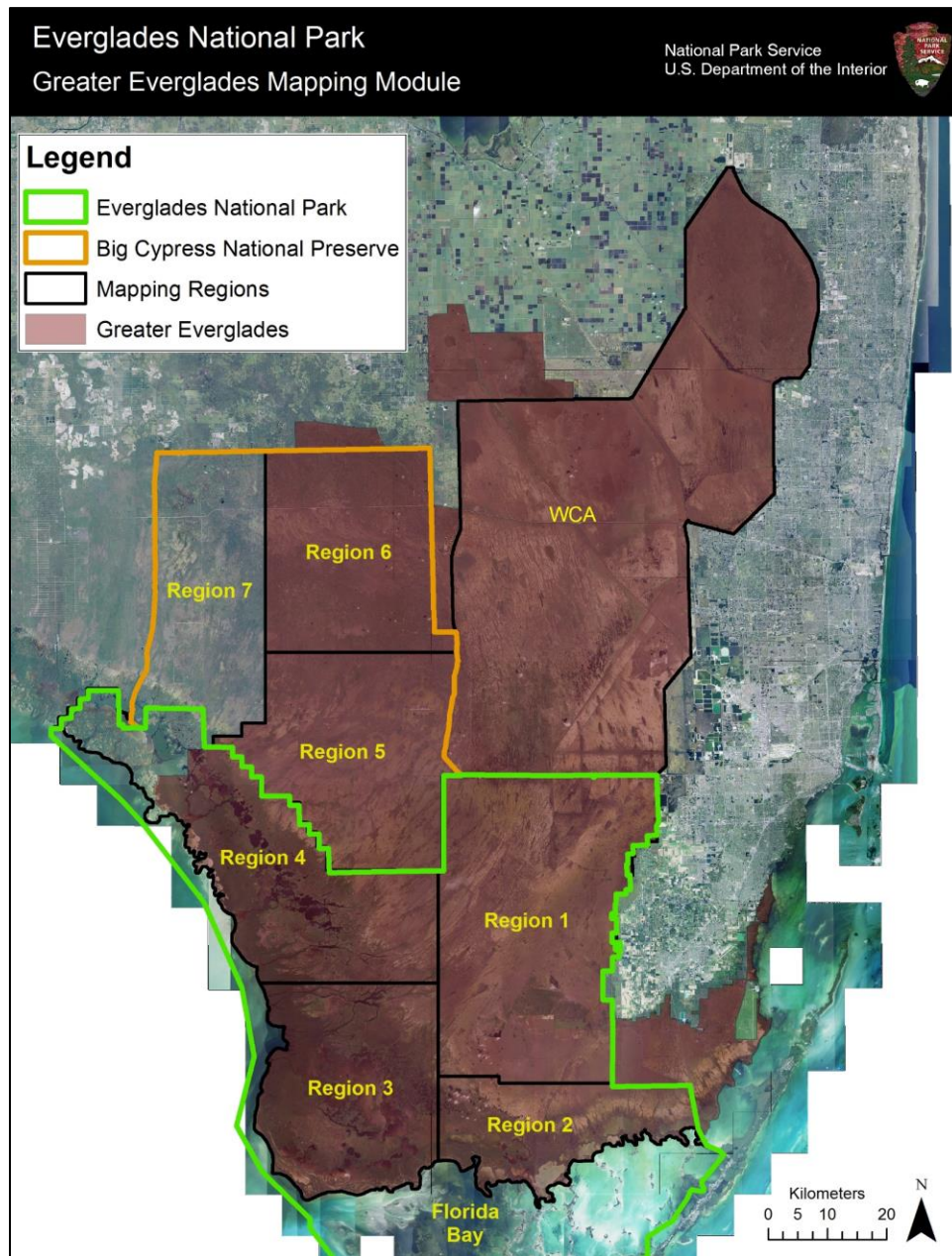


Figure 1. Greater Everglades mapping module and location of mapping regions within Everglades National Park and Big Cypress National Preserve.

² The map for Region 2, the Southeast Saline Everglades, is available for download from the [NPS Integrated Resource Management Applications Data Store](https://irma.nps.gov/DataStore/Reference/Profile/2243281) by using this url: <https://irma.nps.gov/DataStore/Reference/Profile/2243281> (last accessed on 13 June 2018).

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 **VER**ification (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 systemwide 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 NP and Big Cypress NP (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 Alaska³. 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 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](#).

³ National parks in Alaska are being mapped by the Alaska Landcover Inventory Program (<http://science.nature.nps.gov/im/units/akro/inventory/landcover.cfm>).

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 NP is more similar to those of tropical regions than that of the continental United States (Duever et al. 1994). Mean daily temperatures typically 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 the park range from at or below mean sea level (msl) near the coast, to 4.3 meters (14.1 feet [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 forest, 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 NP 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 NP 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 Everglades NP's gulf coast. The preserve is surrounded by the Water Conservation Areas (WCA) to the east, the Gulf of Mexico

to the west, and Everglades NP 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 NP are a mosaic of hardwood hammocks, pine woodlands, swamp forests, including cypress domes, strands, and scrub communities, freshwater marshes and prairies, coastal marshes and mangroves 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. Mean annual temperature is about 23°C (73.4°F) and ranges from about 14°C (57.2°F) in the winter to as high as 28°C (82.4°F) in the summer (Duever et al. 1986). The rainy season is well defined, May through October, with mean annual precipitation averaging 136 centimeters (53.5 in; see 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 NP, 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 Everglades NP vegetation map consists of 0.30 meters (0.98 ft) spatial resolution multispectral digital color-infrared imagery procured by the South Florida Water Management District (SFWMD) in April 2009. The imagery was acquired using a Microsoft-Vexcel UltraCam-X large format digital aerial camera, which provides Level 3 frame images in panchromatic and multispectral bands: red, green, blue, and near-infrared. Images acquisition occurred at an average flight altitude of 4,163 meters (13,658 ft or 2.6 mi) with an average forward overlap of 60% to allow for stereoscopic visualization and estimation of vegetation height through a digital photogrammetric workstation.

A network of 12 aerial targets deployed throughout Everglades NP was used to verify the accuracy of the Airborne Global Positioning System (GPS) and Internal Measurement Unit onboard the aircraft collecting the 2009 imagery. The horizontal and vertical location of each target was determined by using 1-hour static GPS sessions and post-processing using NGS Opus Rapid Static procedures (<https://www.ngs.noaa.gov/OPUS/about.jsp>). In addition, for each image exposure location a real-time kinematic GPS (RTKGPS) observation was acquired. The location of the 12 static targets and the 2,106 RTKGPS image exposure locations were adjusted by the SFWMD using standard least-squares (weighted average), where the locations of the aerial targets were given weighted preference over the RTKGPS image exposure location measurements. Each target and image was referenced relative to the North American Datum (NAD) 1983 High Accuracy Reference Network, State Plane Coordinate System, Florida East Zone 901, and North American Vertical Datum of 1988 (NAVD88). A 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.

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 dominant⁴ (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 A. Photo interpreters additionally categorize the absolute cover of cattail (*Typha* sp.) and any exotic species present in each grid cell as

⁴ The community with the greatest percent cover (majority) in the grid cell.

either: Sparse (10–49%), Dominant (50–89%), or Monotypic (90–100%) and note any evidence of disturbance as anthropogenic, fire, freeze, or windstorm.

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 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. 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-vegetated 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 directly to the east 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 2009 CIR aerial 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.

Spectral Channels

Photo-interpreters analyze the spectral signature of each grid cell using one of 11 different customizable spectral channels in Summit Evolution (Table 1). Spectral channels 0, 1, 3, and 5, were the most frequently used channels in Region 3 to differentiate community types and species within each grid cell. For instance, spectral channel 0 was effective at indicating the presence of buttonwood within a grid cell; spectral channel 3 was effective in the identification of Transitional Bayhead Swamp Forest or Transitional Bayhead Swamp Shrubland communities; and, spectral channel 5 excelled at identifying red mangrove within a grid cell.

Table 1. Designation of spectral channels and their corresponding spectral band (RGB-NIR) combination used in the Summit Evolution photogrammetric workstation to identify vegetation communities. Numbers in parenthesis correspond to the Summit Evolution assigned image band number.

Spectral Channel	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	Red(0), NIR(3), Green(1)
5	NIR(3), Blue(2), Green(1)
6	Red(0), Blue(2), Red(0)
7	Blue(2), NIR(3), Red(0)
8	NIR(3), Green(1), NIR(3)
9	Red(0), Blue(2), NIR(3)
10	NIR(3), Red(0), Red(0)

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 (Photo 1). The parameters for the photogrammetric workstation cursor are set to: Grid size = 16.25; 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 grid cell.

Canopy Height Estimation

Mean vegetation height for the dominant community type within each grid cell is determined by setting the image scale on the photogrammetric workstation to 1:100 and determining the canopy heights at a minimum of 10 randomly located points within the dominant community type found in each grid cell. Because 3D photogrammetric height estimates of digital images are scale-dependent, due to the way the imagery is stored as hierarchical, low to high resolution, copies or image pyramids, the image scale in Summit Evolution is set to 1:100 to ensure consistency in height estimation across all workstations.

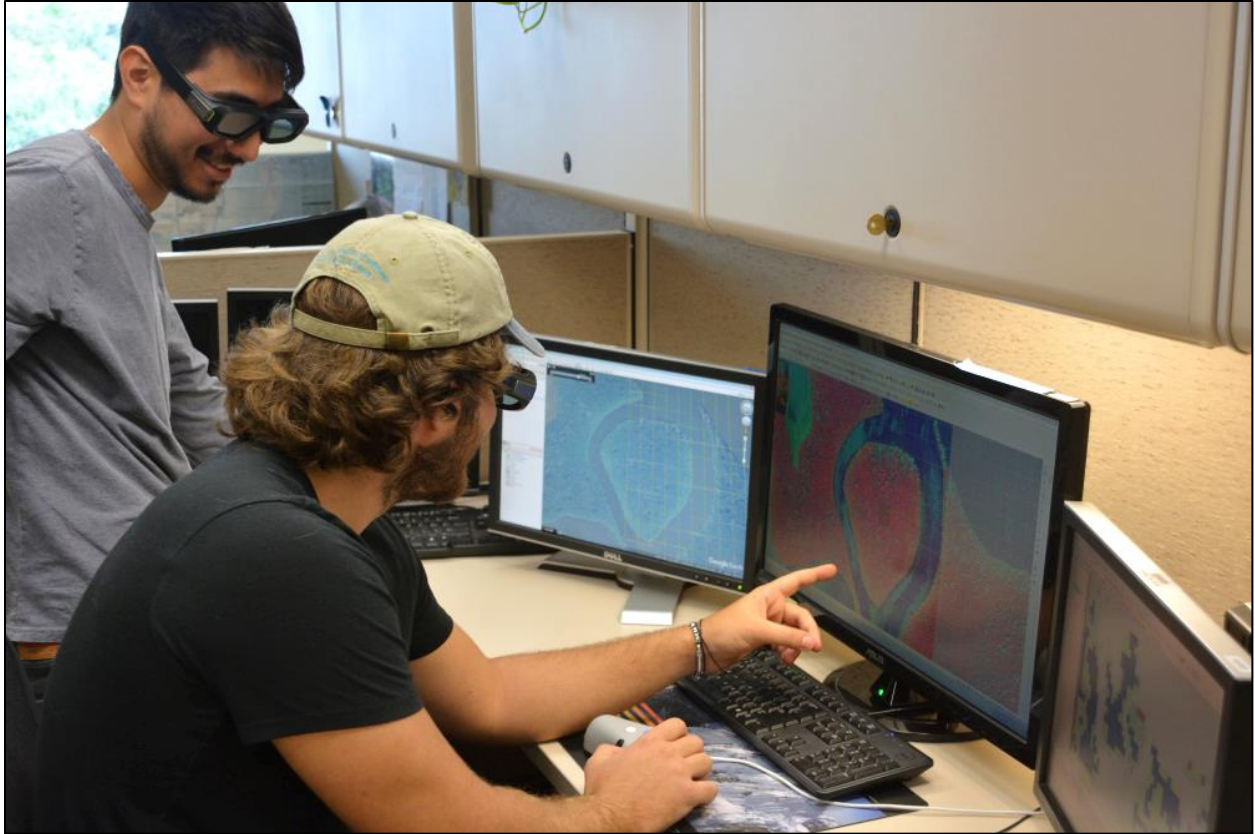


Photo 1. Photo-interpreters (Michael Foguer, left, and Alejandro Arteaga Garcia, right,) working on a photogrammetric workstation running Summit Evolution v7.4.

Vegetation Map

The Southwest Coastal Everglades (SWCE) vegetation feature class consists of 396,293 0.25-hectare (.61-ac) grid-cells. This feature class along with the Region 3 mapping boundary, a dissolve of the vegetation map based on vegetation classes, and a cross-reference table linking the vegetation code to the class name and levels within the classification system are stored in an ESRI ArcGIS v10.5 personal geodatabase. All geospatial data are referenced to the Universal Transverse Mercator (UTM) Zone 17N, North American Datum of 1983 (NAD83).

The SWCE vegetation feature class contains nine attributes, of which seven are photo-interpreter populated. The vegetation map dissolve feature class contains six attributes. The cross-reference table contains 11 attributes. Please see the metadata in the DVD for descriptions of the feature class attributes.

Vegetation Data Collection

The vegetation data collected on this project include Training Points (TP), Botanical Training (BT) points, and Verification Points (VP) and Accuracy Assessment (AA) data points. The AA points are discussed later in this document. A total of 2,117 TP, BT, and VP data points were collected within Region 3 (Figure 2).

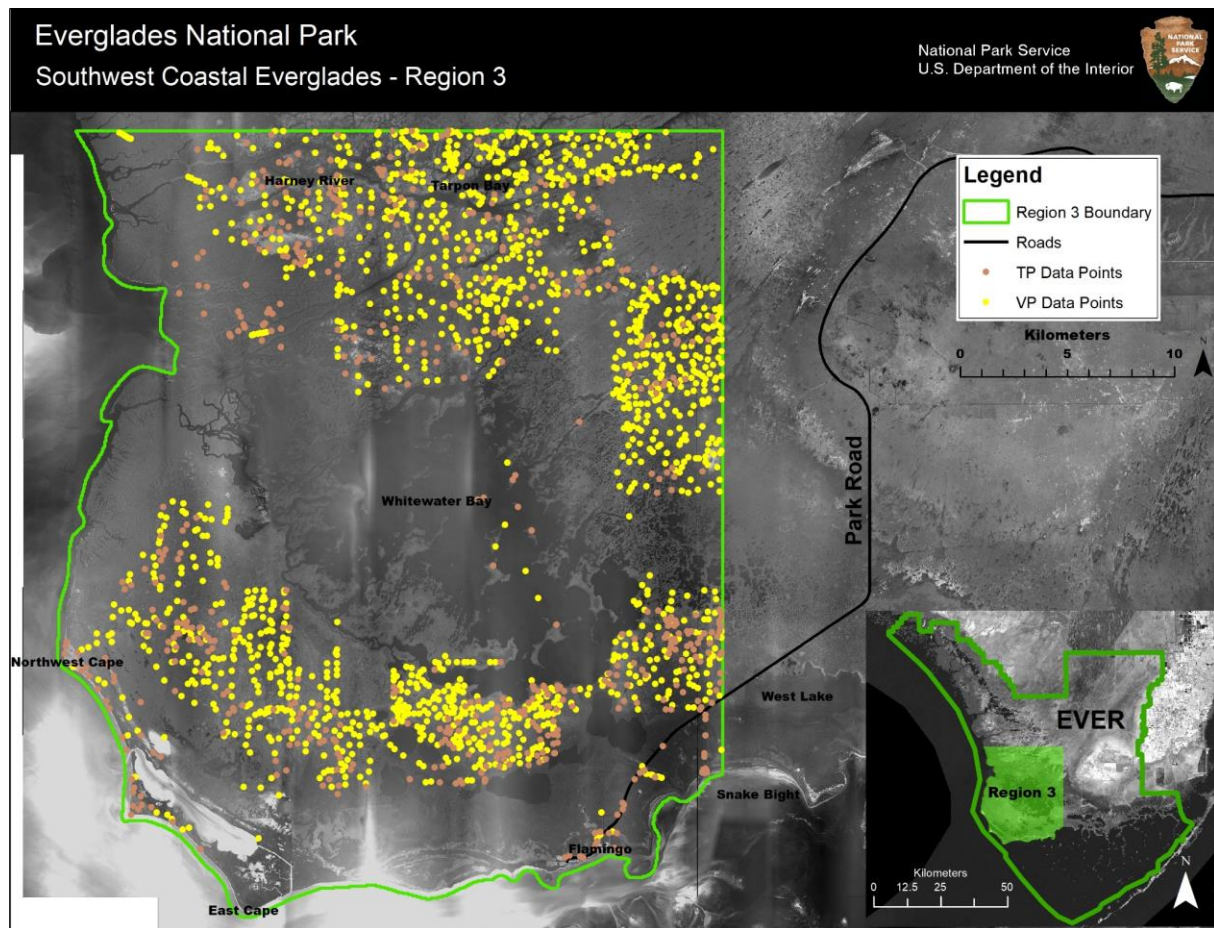


Figure 2. Location of Training Points (TP) and Verification Points (VP) collected within the Southwest Coastal Everglades, Region 3, Everglades National Park.

The TP and BT data points provide species-specific compositional data and structural information. These two geospatial data sets assist in the identification of the dominant community within each grid cell (TP points) or for botanical training (BT). In most cases, 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. Botanical training points are used to teach staff and photo-interpreters the flora and vegetation communities of south Florida. These data points are intended to characterize community types that extend beyond a single grid-cell, e.g., Bayhead Forests, Sawgrass Marshes, Black Mangrove Forests, or Cypress Swamps, even though they typically represent units smaller than the 0.25-hectare (0.61-ac) mapping grid cell.

The data collection method for the TP, BT, 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 strata, and the maximum canopy height for each strata. In addition,

digital oblique photos taken at each TP, BT, 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: _____	
			Relative Cover of Plant Species (should add up to 100%) 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 last type of vegetation data collected are the VP data points. These points complement the TP/BT data collection process and serve two purposes: (1) to confirm a common, typically homogeneous, spectral signature within the landscape, e.g., White Mangrove Shrubland or Common Reed (*Phragmites australis*) Marsh; 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 or BT points and significantly reduce the cost associated with data collection on this project.

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 current 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 A) 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 Region 3 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** (Suballiance), **Level 6** (Association), and **Level 7** (Subassociation), 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 their understanding of south Florida vegetation communities was assessed by having all photo-interpreters classify five randomly distributed mapping clusters, consisting of 100 grid cells each, within Region 3. This procedure allowed for an evaluation of how well each photo-interpreter understands the mapping methodology as well as the vegetation communities within the region 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.

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 2015⁵. The AA data contains the same type of information collected in the TP and BT points discussed previously in this document (see Vegetation Data Collection section), thus its timely collection ensured that temporal vegetation change resulting from natural community succession or perturbation events, like fires and windstorms, would not affect final map accuracy. The AA data for Region 3 was collected in the spring of 2012.

To ascertain the level of confidence associated with the overall project and the individual vegetation classes, a preliminary assessment of thematic accuracy was conducted. The thematic accuracy of the Region 3 vegetation map was calculated as the total number of AA points considered acceptable divided by the total number of AA points collected in Region 3, 245 (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.

⁵ AA data for EVER was collected between 2010 and 2013 while the BICY data was collected in 2015, one year after image acquisition.

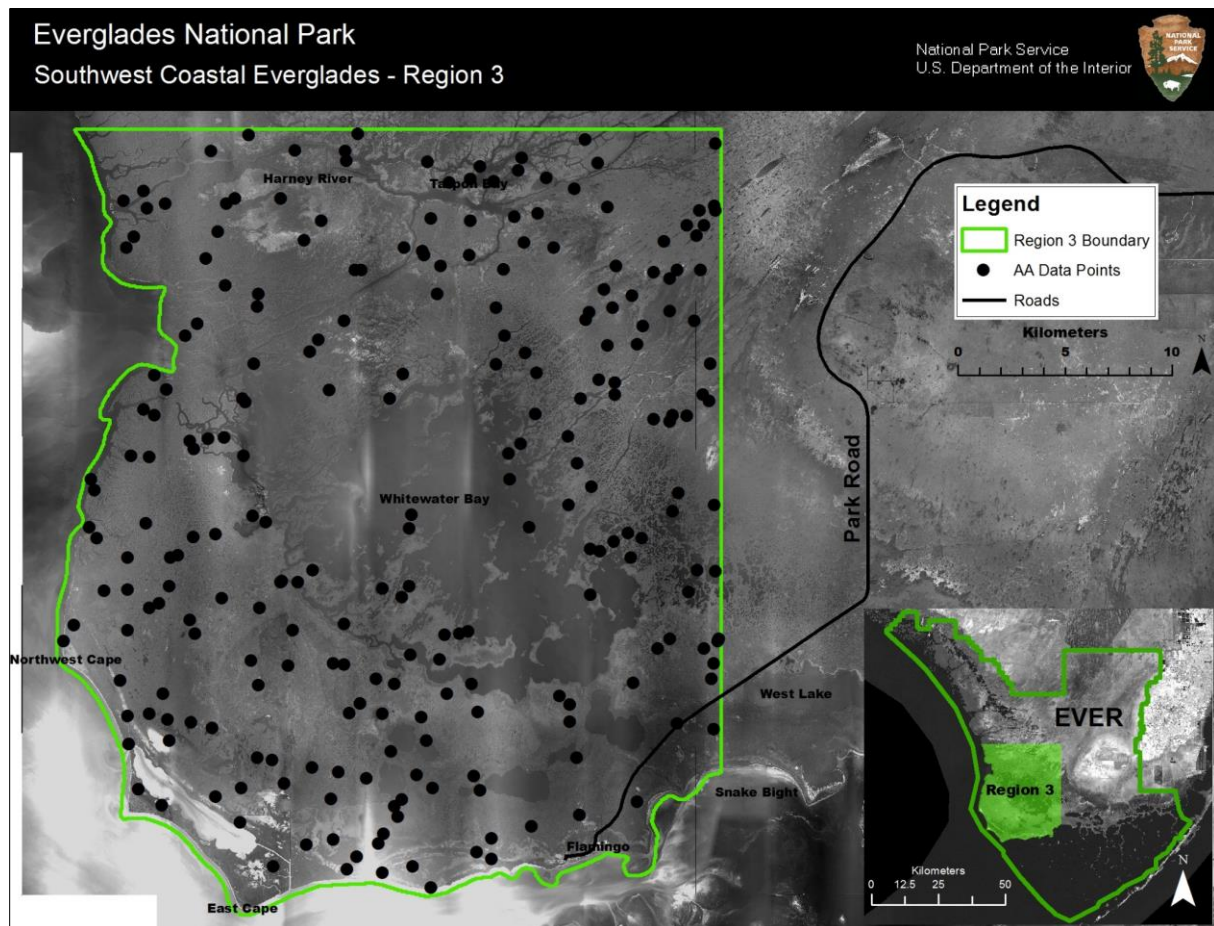


Figure 4. Location of accuracy assessments (AA) points collected within the Southwest Coastal Everglades, Region 3, Everglades NP.

Acceptable AA points included both (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 was different, but considered acceptable because the point data observation was at the cutoff between categories. Grid cells were accepted or rejected based on a thorough review of the AA data and photos collected, and a strict set of criteria.

Reasons for accepting cells without a one-to-one match included:

- When 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.
- When 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.
- When 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.

- When 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.

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

Results

Vegetation

The Southwest Coastal Everglades (SWCE), Region 3 vegetation map consists of 169 thematic classes (Figure 5). Most classes, 88.8% (150 out of 169), account for less than 1% of the map each (Appendix C). The most common vegetation class, Mixed Mangrove Forest-Mixed (a mix of three or more mangrove species including buttonwood), accounts for 7.6% (7,516 hectares [18,572 ac]) of the area mapped. Other notable classes include Short Sawgrass Marsh-Dense (6.1%), Red Mangrove Forest (5.0%), Black Mangrove-Red Mangrove Forest (4.5%), Red Mangrove Scrub-Open Marsh (4.5%), Red Mangrove Scrub-Dominant (more than 85% canopy cover of red mangrove [3.8%]), and Transitional Bayhead Shrubland (3.6%; Appendix C). These seven classes and open water (26.3% of the area mapped within Region 3), account for 61% of the total area mapped within Region 3.

Forest and Woodland communities account for 27.7% of the total area mapped within Region 3 (Table 2). Mangrove Forests account for 25.6% of the total area and consist primarily of Mixed Mangrove Forest—a mix of two or more mangrove species including buttonwood (17.3%), Red Mangrove Forest (5.0%), and Black Mangrove Forest (2.5%). Other Forest types include Coastal Hammocks and Swamp Forest. These two forest types combined account for less than 1.0% of the total area (Table 2). Woodlands account for approximately 1.5% of the total area. Woodlands fall into five types: Mangrove Woodland (1.1%), Swamp Woodland (0.01%), Cabbage Palm Upland (0.04%), Swamp Woodland (0.01%), and Upland Hardwood-Palm Woodland (0.02%). The dominant woodland class is Black Mangrove Woodland (Table 2).

Shrublands account for 15% of the total area mapped and consist of Coastal Hardwood Shrubland (0.02%), Mangrove Shrubland (10.6%), Saw Palmetto Shrubland (< 0.01%), Swamp Shrubland (4.4%), and Tropical Hardwood Shrubland (< 0.01%; Table 3). Mangrove Shrubland was the most common type of shrublands mapped (10.6%) with Red Mangrove Shrubland (3.0%) and Buttonwood-Red Mangrove Shrubland (2.7%) being the most common types mapped (Table 3). Transitional Bayheads—a shrubland community consisting of a mix of mangrove and bayhead species (3.6%), was the most common Swamp Shrubland mapped.

Scrub & Dune communities account for 21.1% of the area mapped and consist of seven types: Cabbage Palm Upland Scrub, Coastal Hardwood Scrub, Swamp Scrub, Mangrove Scrub, Graminoid Dunes and Herbaceous Dunes (Table 4). Mangrove Scrub accounts for 17.4% of the area mapped with Red Mangrove Scrub (12.1%) and Buttonwood-Red Mangrove Scrub (2.4%) being the two most dominant mangrove scrub classes. Transitional Bayhead Swamp Scrub (2.5%) was the most common type of Swamp Scrub mapped. The two Dune communities mapped are located between Northeast Cape and East Cape along the Gulf Coast of Cape Sable. These two communities account for approximately 0.1% of the area mapped within Region 3 (Table 4).

Everglades National Park

Southwest Coastal Everglades - Region 3

National Park Service
U.S. Department of the Interior

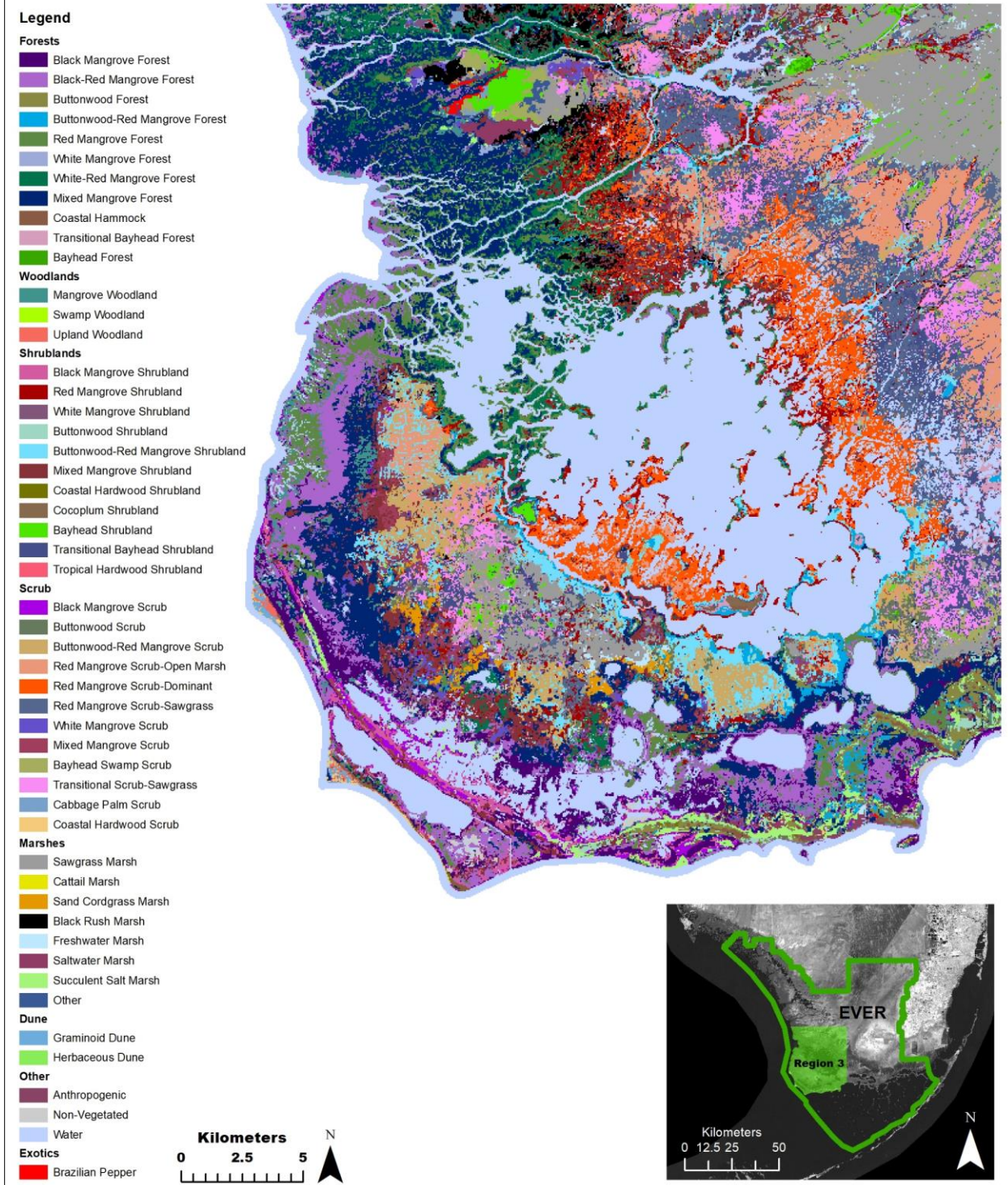


Figure 5. Vegetation map of Southwest Coastal Everglades, Region 3, showing the top 50 vegetation classes.

Table 2. Summary of total area (hectares [ha]) and percent area mapped of forest and woodland communities within Region 3, Everglades National Park.

Community Type	Area (ha)	Percent of Total Area Mapped
Coastal Hammock Total	214.2	0.2%
Buttonwood Hammock	126.3	0.1%
Coastal Dune Hammock	57.5	0.1%
Coastal Hardwood Hammock	4.8	< 0.01%
West Indian Mahogany Hammock	25.8	0.0%
Mangrove Forest Total	25,330.5	25.6%
Black Mangrove Forest	2,452.2	2.5%
Buttonwood Forest	593.8	0.6%
Red Mangrove Forest	4,973.8	5.0%
White Mangrove Forest	196.3	0.2%
Black Mangrove-Buttonwood Forest	328.2	0.3%
Black Mangrove-Red Mangrove Forest	4,484.3	4.5%
Black Mangrove-White Mangrove Forest	319.3	0.3%
Buttonwood-Red Mangrove Forest	1,044.0	1.1%
Buttonwood-White Mangrove Forest	57.5	0.1%
Mixed Mangrove Forest-Mixed	7,516.0	7.6%
White Mangrove-Red Mangrove Forest	3,365.3	3.4%
Mangrove Woodland Total	1,086.8	1.1%
Black Mangrove Woodland	529.3	0.5%
Buttonwood Woodland	87.3	0.1%
Red Mangrove Woodland	115.3	0.1%
Black Mangrove-Buttonwood Woodland	52.3	0.1%
Black Mangrove-Red Mangrove Woodland	294.5	0.3%
Buttonwood-Red Mangrove Woodland	4.3	< 0.01%
White Mangrove-Red Mangrove Woodland	4.0	< 0.01%
Swamp Forest Total	725.0	0.7%
Bayhead Forest	93.5	0.1%
Transitional Bayhead Forest	631.5	0.6%
Swamp Woodland Total	7.8	0.01%
Cabbage Palm Lowland	7.8	0.01%
Upland Hardwood-Palm Woodland Total	59.7	0%
Coastal Hardwood Woodland	17.2	0.02%
Cabbage Palm Upland	42.5	0.04%
Total	27,424.0	27.7%

Table 3. Summary of total area (ha) and percent area mapped of shrubland communities within Region 3, Everglades National Park.

Community Type	Area (ha)	Total Area Mapped (%)
Coastal Hardwood Shrubland Total	22.2	0.02%
Mangrove Shrubland Total	10,517.0	10.62%
Black Mangrove Shrubland	772.7	0.78%
Buttonwood Shrubland	380.0	0.38%
Red Mangrove Shrubland	3,012.0	3.04%
White Mangrove Shrubland	199.3	0.20%
Black Mangrove-Buttonwood Shrubland	87.5	0.09%
Black Mangrove-Red Mangrove Shrubland	175.2	0.18%
Black Mangrove-White Mangrove Shrubland	288.5	0.29%
Buttonwood-Red Mangrove Shrubland	2,652.0	2.68%
Buttonwood-White Mangrove Shrubland	187.8	0.19%
Mixed Mangrove Shrubland-Mixed	1,118.0	1.13%
White Mangrove-Red Mangrove Shrubland	1,644.0	1.66%
Saw Palmetto Shrubland Total	0.2	< 0.01%
Swamp Shrubland Total	4,373.5	4.41%
Bayhead Shrubland	717.0	0.72%
Cocoplum Shrubland	62.5	0.06%
Transitional Bayhead Shrubland	3,592.5	3.63%
Wax Myrtle Shrubland	1.2	< 0.01%
Willow Shrubland	0.3	< 0.01%
Tropical Hardwood Shrubland Total	4.8	< 0.01%
Total	14,917.8	15.06%

Table 4. Summary of total area (ha) and percent area mapped for scrub and dune communities within Region 3, Everglades National Park.

Community Type	Area (ha)	Total Area Mapped (%)
Cabbage Palm Upland Scrub	2.5	< 0.01%
Coastal Hardwood Scrub	71.2	0.07%
Graminoid Dune	75.7	0.08%
Herbaceous Dune	1.7	< 0.01%
Mangrove Scrub Total	17,223.0	17.38%
Black Mangrove Scrub	673.5	0.68%
Buttonwood Scrub	721.8	0.73%

Table 4 (continued). Summary of total area (ha) and percent area mapped for scrub and dune communities within Region 3, Everglades National Park.

Community Type	Area (ha)	Total Area Mapped (%)
Red Mangrove Scrub	11,976.8	12.09%
White Mangrove Scrub	572.3	0.58%
Black Mangrove-Buttonwood Scrub	28.0	0.03%
Black Mangrove-Red Mangrove Scrub	127.5	0.13%
Black Mangrove-White Mangrove Scrub	132.3	0.13%
Buttonwood-Red Mangrove Scrub	2,332.3	2.35%
Buttonwood-White Mangrove Scrub	211.3	0.21%
Mixed Mangrove Scrub-Mixed	144.0	0.15%
White Mangrove-Red Mangrove Scrub	303.5	0.31%
Swamp Scrub Total	3,544.3	3.58%
Bayhead Swamp Scrub	967.0	0.98%
Cabbage Palm Swamp Scrub	84.0	0.08%
Falsewillow Scrub	2.0	< 0.01%
Transitional Bayhead Swamp Scrub	2,474.5	2.50%
Wax Myrtle Scrub	16.8	0.02%
Total	20,918.5	21.11%

Marsh communities account for 9.4% of the area map and consisted of seven types: Floating Emergent Marsh (less than 0.01%), Graminoid Freshwater Marsh (7.0%), Graminoid Salt Marsh (1.5%), Herbaceous Freshwater Marsh (0.07%), Open Freshwater Marsh (0.04%), Open Salt Marsh (less than 0.01%), and Succulent Salt Marsh (0.7%; Table 5). Sawgrass marshes were the most common type of Freshwater Marsh mapped (Table 5). It occurred in the northeast portion of the map adjacent to Regions 1 and 4, within Cape Sable, and south of Harney River (Figure 5). Black Rush Marsh was the most common Graminoid Salt Marsh mapped (Table 5). Succulent marshes, while present, only account for less than 1.0% of the area mapped (Table 5).

Anthropogenic and Non-vegetative classes account for approximately 26.7% of the total mapping area (Table 6). Anthropogenic features like roads, campgrounds, and maintenance facilities account for less than 0.1% of the entire mapped area (Table 6). Non-vegetative classes account for the majority of the area mapped (26.6%), where open water, in the form of lakes, bays, and creeks, accounted for 26.4% of the entire mapped area within Region 3.

Table 5. Summary of total area (ha) and percent area mapped of marsh communities within Region 3, Everglades National Park.

Community Type	Area (ha)	Total Area Mapped (%)
Floating Emergent Marsh Total	4.0	< 0.01%
Waterlily Marsh	4.0	< 0.01%
Graminoid Freshwater Marsh Total	6,943.3	7.01%
Cattail Marsh	11.3	0.01%
Kissimmeegrass Marsh	17.2	0.02%
Mixed Graminoid Freshwater Marsh	47.8	0.05%
Sand Cordgrass Marsh	368.0	0.37%
Sawgrass Marsh	6,187.5	6.25%
Sawgrass-Cattail Marsh	65.5	0.07%
Sawgrass-Sand Cordgrass Marsh	101.5	0.10%
Sawgrass-Black Rush Marsh	84.8	0.09%
Spikerush Marsh	59.8	0.06%
Graminoid Salt Marsh Total	1,515.5	1.53%
Black Rush Marsh	1,210.3	1.22%
Saltgrass-Sand Cordgrass Marsh	143.8	0.15%
Saltgrass Marsh	161.5	0.16%
Herbaceous Freshwater Marsh	68.5	0.07%
Open Freshwater Marsh	43.0	0.04%
Open Salt Marsh	7.7	< 0.01%
Succulent Salt Marsh	701.0	0.71%
Total	9,283.0	9.37%

Table 6. Summary of total area (ha) and percent area mapped for anthropogenic and non-vegetative classes within Region 3, Everglades National Park.

Community Type	Area (ha)	Total Area Mapped (%)
Anthropogenic Total	64.0	0.06%
Anthropogenic	9.0	0.01%
Campground	55.0	0.06%
Non-Vegetative Total	26,395.3	26.6%
Barren Salt Flat	13.7	0.01%
Beach	21.2	0.02%
Soil	97.0	0.10%
Tidal Flat	152.2	0.15%
Water	26,111.0	26.36%
Total	26,459.3	26.7%

Of the two exotic species encountered in Region 3, Brazilian pepper and Old World climbing fern (*Lygodium* sp.), only Brazilian pepper had high enough densities in the 2009 imagery to allow detection and quantification in the map of Region 3 (Figure 6). However, the field data collected, TP and VP data points, indicates that *Lygodium* sp. is common throughout the Region (Figure 7); often found intermixed with sawgrass (Photo 2) or overtopping tree islands (Photo 3). The areal coverage of Brazilian pepper in Region 3 is 1,185 hectares (2,928.6 ac). Brazilian pepper was mostly observed in Cape Sable, west of West Lake, and in interior freshwater marshes adjacent to Harney River. The areal cover of Brazilian pepper was typically below 50% (988 ha [2,441 ac]). However, in the marshes adjacent to Harney River, the areal coverage of Brazilian pepper often exceeded 50% (Figure 6).

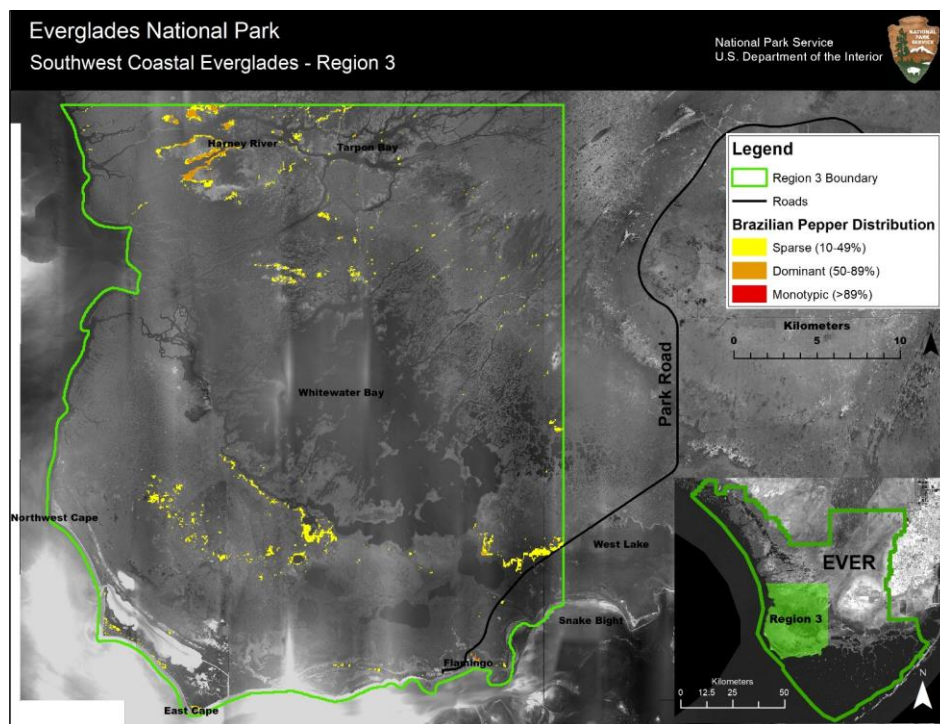


Figure 6. Distribution map and density of Brazilian pepper within the Southwest Coastal Everglades, Region 3, Everglades National Park.

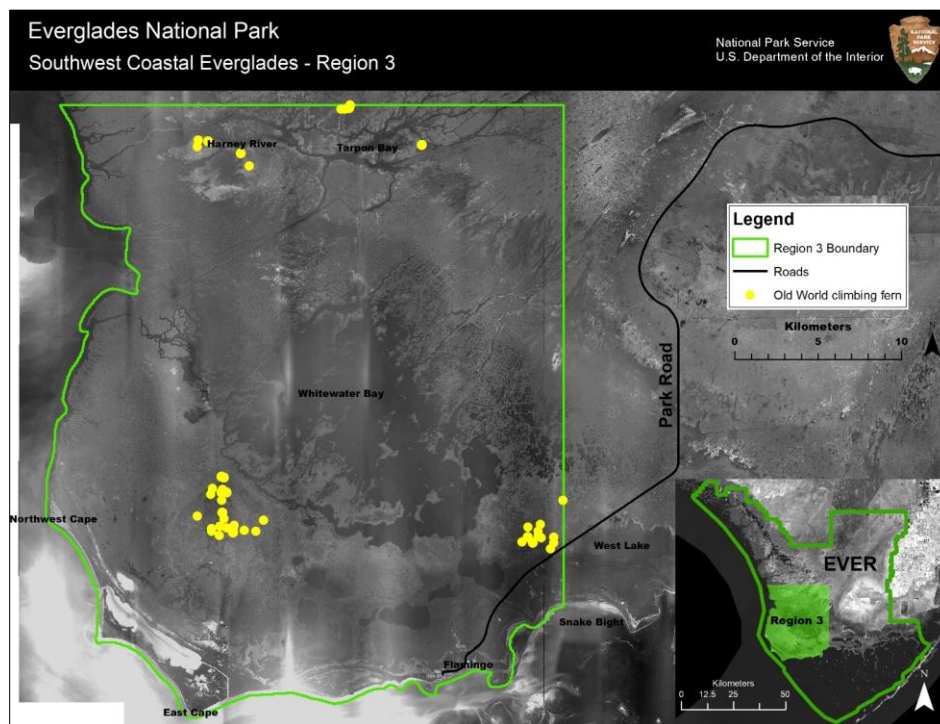


Figure 7. Locations within the Southwest Coastal Everglades, Region 3, Everglades National Park where field crews documented the presence of Old World climbing fern (*Lygodium* sp.). This is an incomplete census, not indicative of the true range and distribution of *Lydoium* sp. within Region 3.



Photo 2. Old World climbing fern intermixed with sawgrass in Cape Sable, Southwest Coastal Everglades, Region 3, Everglades National Park.



Photo 3. Old World climbing fern overtopping hardwood trees in the Southwest Coastal Everglades, Region 3, Everglades National Park.

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). Within Region 3, 362 hectares (895 ac) were found to contain Cattail in densities greater than 10% within a grid cell (Figure 8). With few exceptions, Cattail densities were generally below 50% (347 hectares [857 ac]). However, there were a few instances where it formed monotypic stands (2.3 hectares [5.6 ac]; Figure 8).

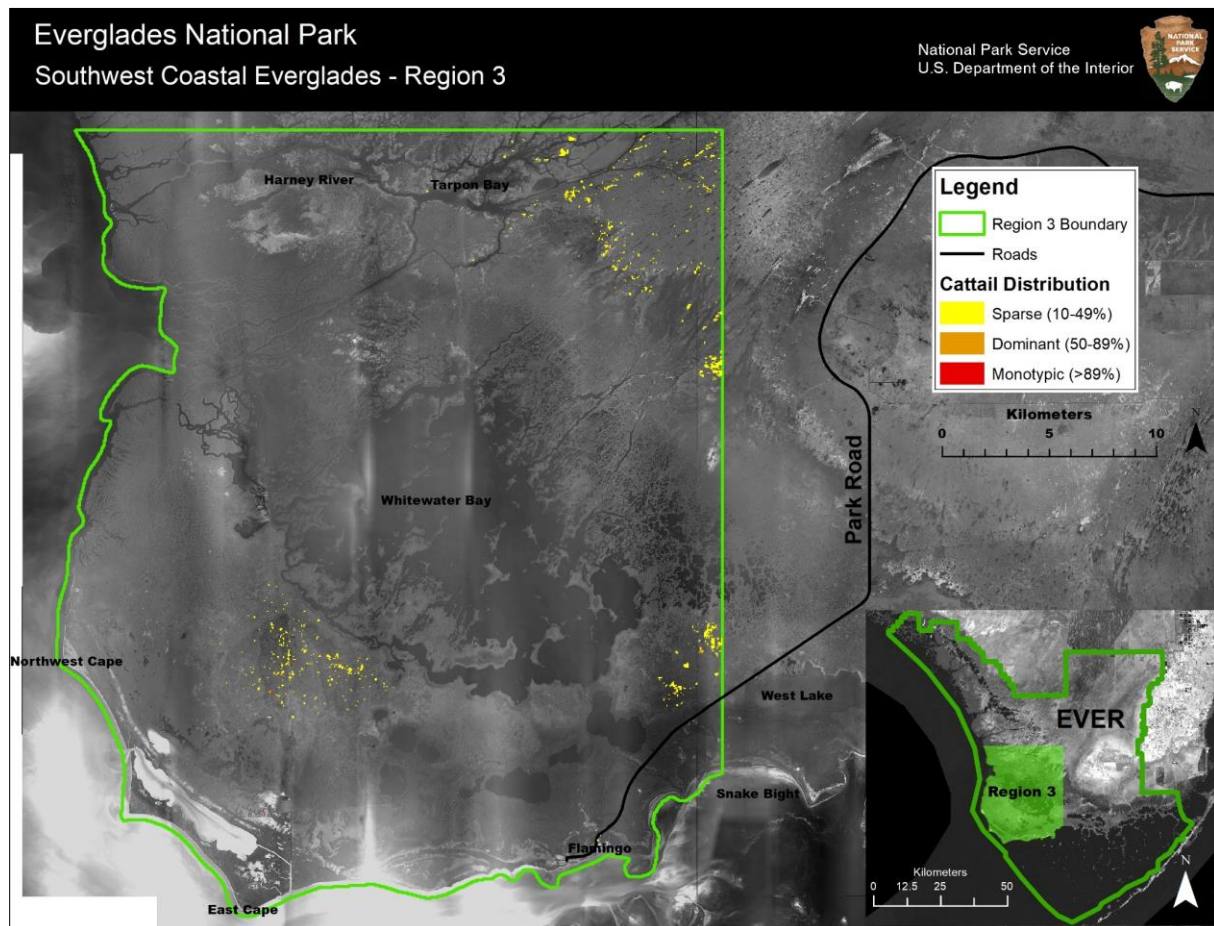


Figure 8. Distribution map and density of cattail in Southwest Coastal Everglades, Region 3, Everglades National Park.

Fire and Windstorm

Fire and windstorm damage was common throughout Region 3 (Figure 9). Fires were restricted to interior marshes along Harney River, Shark River, and in Cape Sable and totaled about 4,219 hectares (10,425.4 ac, Figure 9). Approximately 15,974 hectares (39,472.6 ac), of mostly mangrove forest, exhibited evidence of windstorm damage, likely from the 2005 hurricane season which brought two hurricanes, Hurricane Katrina and Hurricane Wilma, over south Florida. Windstorm damage from 2005 was evident from Snake Bight to East Cape, and along the Gulf Coast, and on many of the mangrove islands in northwest Whitewater Bay (Figure 9).

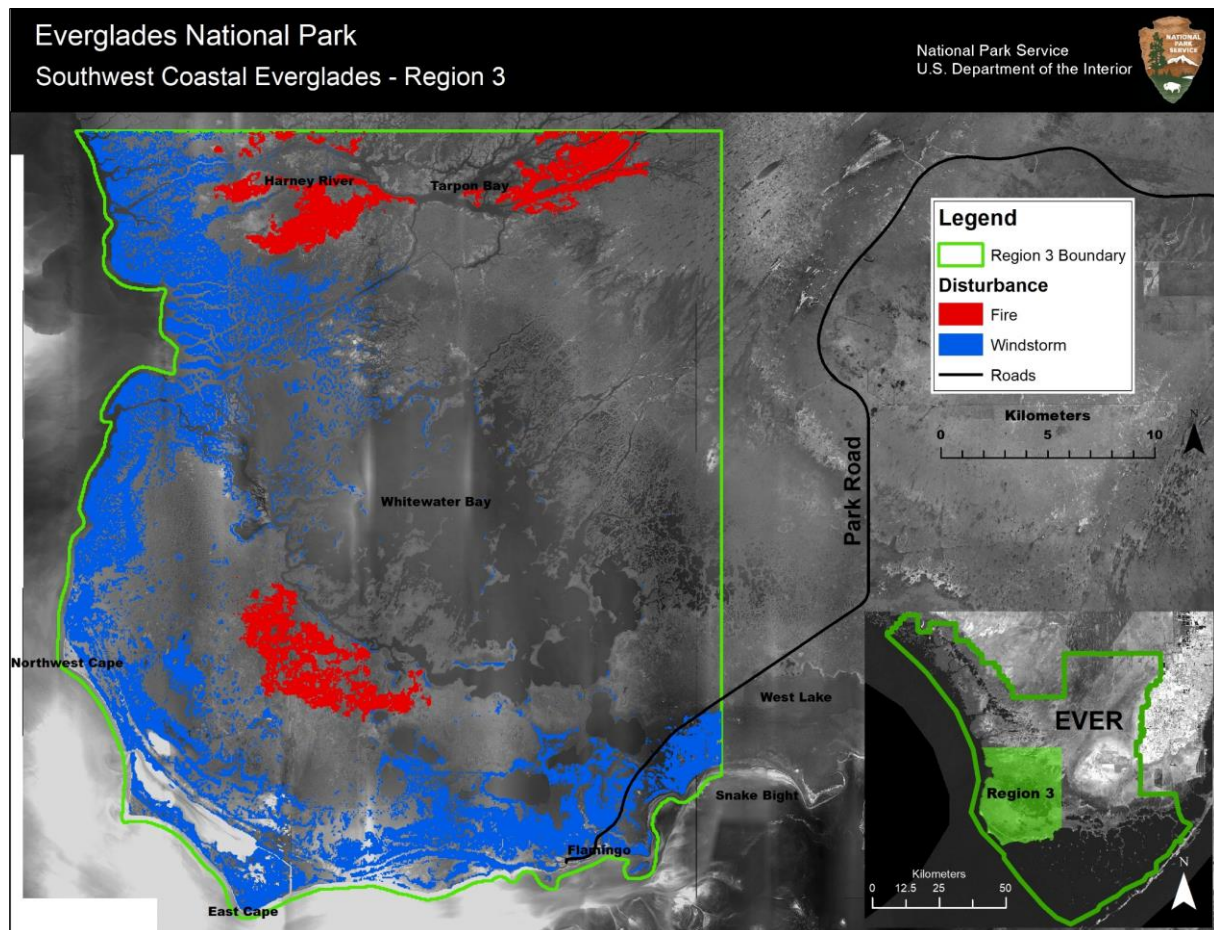


Figure 9. Grid cells within the Southwest Coastal Everglades, Region 3, Everglades National Park, showing evidence of fire or windstorm damage from the 2005 hurricane season.

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 150 of the 245 AA points (61%) selected (Appendix C). The 95 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 previously in the methods section. This analysis yielded an additional 69 matching points, increasing the total number of acceptable points to 219. Based on this number of acceptable AA points, the accuracy of the map, regardless of categorical level, is estimated at 89.4% with a lower 90th Percentile Confidence Interval of 85.6% (Table 7). Map accuracy decreases as a function of classification level with less detail levels (Levels 1–3) generally having greater accuracy than more detail levels (Levels 4–7; Table 7). An exception to this trend occurs at Level 5, where the Level 5 accuracy is approximately 2% greater than the less detailed Level 4 and at Level 7, where level accuracy is 100% (Table 7).

Table 7. 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	227	245	92.7%	89.3%
Level 2	221	245	90.2%	86.5%
Level 3	219	245	89.4%	85.6%
Level 4	189	213	88.7%	84.5%
Level 5	134	148	90.5%	85.6%
Level 6	41	48	85.4%	74.4%
Level 7	3	3	100.0%	46.4%
Overall	219	245	89.4%	85.6%

Out of the 169 thematic classes used on the map, only 47 (28%) could be verified with at least one AA point (Appendix C). Of these, 12 classes, equating to 73% of the area mapped, had more than seven assessment locations (Table 8). Class accuracy for these 12 classes is at or above 85% for all but two classes. The Transitional Bayhead Shrubland and Transitional Bayhead Swamp Scrub-Sawgrass Marsh classes have an estimated accuracy of 31% and 67%, respectively (Table 8). This result is slightly lower, but comparable to the accuracy estimated for these two classes within the Southeast Saline Everglades, Region 2, of the EVER/BICY vegetation map (Ruiz et al. 2017). The estimated accuracy for these two classes is not that surprising. These two classes share similar compositional, structural, and spectral similarities with Red Mangrove Scrub-Sawgrass, Buttonwood-Red Mangrove Scrub-Sawgrass, and Buttonwood-Red Mangrove Shrubland that make classification difficult due to subtle difference in the percent cover of several freshwater hardwood species like Poisonwood (*Metopium toxiferum*) and Dahoon (*Ilex casine*) whose spectral signatures are very similar to Buttonwood (*Conocarpus erectus*).

The accuracy of the remaining classes with fewer than seven assessment locations (35 classes) ranged between 0% and 100%. Nearly two-thirds (28 out of 35, 80%) had an estimated accuracy of 100%. The six classes that did not, consisted of five vegetative classes (Buttonwood-Red Mangrove Forest, 66.7%; White Mangrove-Red Mangrove Forest, 66.7%; Mixed Mangrove Shrubland-Mixed, 66.7%; Bayhead Swamp Scrub-Sawgrass Marsh, 66.7%; and Sand Cordgrass Marsh, 0%) and a non-vegetative class (Tidal Flat; 0%). The accuracy of these six classes was assessed by no more than three AA points each, thus any inference about their accuracy within Region 3 and the map, in general, is not recommended at this time. The errors associated with these classes included majority rule exception associated with split cells containing a non-vegetative class (Tidal Flat or Water) where the non-vegetative class was selected instead of the vegetative class present; estimation of woody cover typically associated with image resolution, and spectral similarity between some

freshwater shrubs and mangrove species. Please see Appendix C for a direct comparison between these classes and the field accessed vegetation class.

Table 8. Accuracy assessment of classes with seven or more accuracy assessment points.

Vegetation Class	Number of AA Points (179 of 245; 73%)	Class Accuracy (%)	Percent Area of Map (72.6%)
Water	29	96.6%	26.4%
Mixed Mangrove Forest-Mixed	22	95.5%	7.6%
Short Sawgrass Marsh-Dense	20	85.0%	6.1%
Red Mangrove Scrub-Dominant	16	87.5%	3.8%
Red Mangrove Forest	16	100.0%	5.0%
Red Mangrove Scrub-Open Marsh	14	100.0%	4.5%
Black Mangrove-Red Mangrove Forest	14	100.0%	4.5%
Transitional Bayhead Shrubland	13	30.8%	3.6%
Red Mangrove Shrubland	12	100.0%	3.4%
Transitional Bayhead Scrub-Sawgrass Marsh	9	66.7%	2.5%
Black Mangrove Forest	7	100.0%	2.5%
Buttonwood-Red Mangrove Shrubland	7	85.7%	2.7%

Discussion

The accuracy of the Region 3 vegetation map, 89.4% with a lower 90th Percentile Confidence Interval of 85.6%, met and exceeded NPS VMI standards. This accuracy is similar to the estimated accuracy of the Southeast Saline Everglades, Region 2, vegetation map where overall map accuracy was estimated at 88.6% with a lower 90th percentile confidence level of 84.6% (Ruiz et al. 2017).

The majority, 83% (39 out of 47), of all thematic classes assessed, regardless of the number of AA points, had an estimated accuracy greater than or equal to 85%. The few classes that did not, were assessed by six or fewer assessment points each. Thus, any inference about their accuracy within Region 3 and the map, in general, is not recommended. Of the twelve thematic classes with sufficient points for assessment (greater than or equal to 7 AA points), ten had accuracies greater than or equal to 85%. The two classes that did not, Transitional Bayhead Shrubland and Transitional Bayhead Swamp Scrub-Sawgrass Marsh, are structurally and compositionally similar, a mix of freshwater hardwood species and mangroves, to other hardwood communities (Bayhead Shrubland, Buttonwood-Red Mangrove Shrubland, or Buttonwood-Red Mangrove Scrub-Sawgrass) found throughout the coastal Everglades. Moreover, these classes are differentiated from each other based on subtle differences in the percent cover of freshwater versus mangroves species present (Appendix A). As a result, it was not possible to consistently identify these communities spectrally, particularly when they occurred adjacent to each other within the freshwater-marine ecotone.

The design of the accuracy assessment, a random draw of approximately 250 assessment points per region, does not permit the assessment of every individual thematic class found within the map. This is a known limitation of the project and a cost compromise. However, as additional regions are completed, the number of AA points available for individual thematic class assessment will increase and allow for a better estimate of thematic map class accuracy and overall map accuracy. For comparison, a more rigorous sampling consisting of the complete census of each thematic class in Region 3 would require a draw of about 4,400 grid cells. The collection of this data would add an additional \$300,000 in helicopter costs to the mapping of Region 3 and would take about 88 days to complete. Assuming a similar sampling intensity for the other Regions in this project, the cost of helicopter use, alone, would run about \$2 million dollars and take about 528 days to complete.

Conclusion

This vegetation map is a baseline of plant community distribution within the Southwest Coastal Everglades at the turn of the 21st century. It provides land-cover information to NPS park managers and scientists for use in park management, resource management, research, and monitoring. 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 monitoring individual grid-cells overtime. Furthermore, this map, coupled with recently acquired LiDAR, will allows hydrologist and ecologists to run fine-scale predictive models of potential vegetation change within the SWCE in response to hydrologic manipulation and sea level rise by applying known community hydrologic and salinity tolerances to different hydrologic, salinity, and disturbance scenarios at a 0.25-hectare (0.61-ac) scale.

This vegetation map is the second of four regional maps of Everglades NP to be completed. The Southeast Saline Everglades, Region 2, vegetation map (Ruiz et al. 2017) was completed last year and is available for download from the [NPS Integrated Resource Management Applications Data Store](#). Work on the remaining two Regions (Region 1, and 4) is ongoing, with final map completion expected in 2019. The mapping of Regions 5 and 6 in Big Cypress NP is in progress, with completion expected in 2019. The map report for Region 7 in Big Cypress NP is under final peer review and will be available for distribution once finalized.

Summary of Final Product and Deliverables (DVD)

The Southwest Coastal Everglades (SWCE), Region 3, vegetation map of Everglades NP covers an area of approximately 990.7 square kilometers (382.5 square miles [mi²], 244,816 ac). This is the second map of four produced for Everglades NP to date and consists of 169 thematic classes. Overall map accuracy is estimated at 89.4% with a lower 90th Percentile Confidence Interval of 85.6%, and meets the NPS VMI Program map accuracy requirement standard set for all NPS vegetation mapping products.

All of 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).

This report and the geospatial products developed in the preparation of the SWCE, Region 3, vegetation map of EVER are stored on *The Vegetation Map of the Southwest Coastal Everglades* (Region 3), Everglades National Park DVD. Stored items include:

- This vegetation inventory report that includes the methods, results, accuracy assessment, and the vegetation classification and photo-interpretation keys.
- An ESRI ArcGIS v10.5 geodatabase containing the SWCE, Region 3, vegetation map;
- An ESRI ArcGIS v10.5 geodatabase containing all of the vegetation data collected and a library of oblique aerial photos captured at each vegetation point;
- The metadata for all spatial data.
- An ESRI ArcGIS symbology legend file

Please do not distribute this report without a copy of the accompanying DVD (*The Vegetation Map of the Southwest Coastal Everglades* (Region 3), Everglades National Park). Additional copies of the DVD are available from the NPS South Florida Caribbean Network or by contacting the autho

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Appendix A. Vegetation Classification Key for the Everglades National Park and Big Cypress National Preserve: Southwest Coastal Everglades, Region 3.



Version R3-2018.0614

ON THE COVER

Photo of mangroves, bayhead species, and sawgrass (Transitional Bayhead Shrubland) in Everglades National Park, taken by Michael Foguer on 21 July 2016

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Vegetation Classification for the Everglades National Park (EVER) and Big Cypress National Preserve (BICY) Vegetation Mapping Project

Introduction

This vegetation classification key was designed for the Southwest Coastal Everglades (SWCE), Region 3, of the Everglades National Park (EVER) and Big Cypress National Preserve (BICY) vegetation mapping project. This key is modeled after the *Vegetation Classification System for South Florida Natural Areas* v6.15.09 (Rutchey et al. 2006) which was developed and used to map wetland and upland plant communities in other regions of the Everglades (Rutchey et al. 2008). The classification key presented in this report differs from its parent system in several ways:

1. The hierarchical pathways between levels in the classification system were streamlined to help photo-interpreters consistently reach the same vegetation class and reduce photo-interpreter variability.
2. Many vegetation class definitions were modified to clarify meaning and to reflect regional differences in species composition.
3. Vegetation classes not occurring within the SWCE mapping area were removed, while region-specific observed and documented vegetation classes were added.
4. The vegetation classification key for exotic plant species is not included in this document because of its length and inclusion of all possible known exotic plant species present within south Florida. Please see the *Vegetation Classification System for South Florida Natural Areas* for a breakdown of the Exotic key.

Users of this key should be familiar with most, if not all, of the plant species listed and have a general knowledge of the vegetation communities found within the SWCE and their general distribution.

Glossary

Cover (absolute): The relative area covered by a plant or a 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 plant community

Co-dominant (mixed): Two or more species that are equally distributed, $\pm 20\%$, 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: A perennial plant that has a permanent woody main stem or trunk that is at least 5 meters tall.

Shrub: A perennial plant that has a permanent singular or multi stemmed woody trunk that is less than 5 meters tall.

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).

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**.

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

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.

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 (<10%) tree and shrub cover.

L1 – Dune (D) – Shrub, graminoid and/or herbaceous vegetation associated with a mound or ridge of sediment formed by wind and/or storm deposits.

L1 – Submerged Aquatic Vegetation (A) – Vegetation inhabiting a submerged freshwater or marine environment, e.g., *Vallisneria* spp. or *Thalassia* spp.

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).

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. Black Mangrove (*Avicennia germinans*) dominant forest. This community is usually characterized by a minimum of 50% Black Mangrove (*A. germinans*) trees and shrubs found in a matrix of other species.

L4 – Black Mangrove Forest (FMa)

1b. 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)

1c. White Mangrove (*Laguncularia racemosa*) dominant forest. This community is usually characterized by a minimum of 50% White Mangrove (*L. racemosa*) trees and shrubs found in a matrix of other species.

L4 – White Mangrove Forest (FMI)

1d. 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)

1e. Co-dominant mix (20% or less difference in percent cover) between two mangrove tree species with no particular species having dominance.

L4 – Mixed Mangrove Forest (FMX)

1e.1. Co-dominant mix (20% or less difference in percent cover) of Black Mangrove (*Avicennia germinans*) and Buttonwood (*Conocarpus erectus*) trees.

L5 – Black Mangrove-Buttonwood Forest (FMXac)

1e.2. Co-dominant mix (20% or less difference in percent cover) of Black Mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) trees.

L5 – Black Mangrove-White Mangrove Forest (FMXal)

1e.3. Co-dominant mix (20% or less difference in percent cover) of Black Mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) trees.

L5 – Black Mangrove-Red Mangrove Forest (FMXar)

1e.4. Co-dominant mix (20% or less difference in percent cover) of Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) trees.

L5 – Buttonwood-White Mangrove Forest (FMXcl)

1e.5. 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)

1e.6. Co-dominant mix (20% or less difference in percent cover) of White Mangrove (*Laguncularia racemosa*) and Red Mangrove (*Rhizophora mangle*) trees.

L5 – White Mangrove-Red Mangrove Forest (FMXlr)

1e.7. Co-dominant mix consisting of three or more mangrove tree species. This community is characterized by having no particular species in dominance, meaning there is 20% or less difference in percent cover between the most and least abundant mangrove tree species.

L5 – Mixed Mangrove Forest-Mixed (FMXX)

L3 – Swamp Forest (FS)

2a. 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)

2b. 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*), Pond Apple (*Annona glabra*), and occasionally Buttonwood (*Conocarpus erectus*) or Cypress (*Taxodium* spp.).

L4 – Bayhead Forest (FSB)

2c. 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)

L2 – Upland Forest (FU)

L3 – Hardwood Hammock (FH)

1a. Coastal hardwood forest containing a species rich assemblage of tropical and temperate broad-leaved trees typified by the presence of Pigeon Plum (*Coccoloba diversifolia*), False Mastic (*Sideroxylon foetidissimum*), Gumbo Limbo (*Bursera simaruba*), Strangler Fig (*Ficus aurea*), White Stopper (*Eugenia axillaris*), Jamaican Dogwood (*Piscidia piscipula*), Buttonwood (*Conocarpus erectus*), Spanish Stopper (*E. foetida*), West Indian Mahogany (*Swietenia mahagoni*), Cabbage Palm (*Sabal Palmetto*), Soapberry (*Sapindus saponaria*), Satinleaf (*Chrysophyllum oliviforme*), Wild Lime (*Zanthoxylum fagara*), Blackbead (*Pithecellobium keyense*), Spanish Bayonet (*Yucca aloifolia*), Catclaw Blackbead (*P. unguis-cati*), Triangle Cactus (*Acanthocereus tetragonus*), Prickly Pear (*Opuntia stricta*), Wild Cinnamon (*Canella winterana*), Sea Grape (*C. uvifera*), Geigertree (*Cordia sebestena*), Milk Bark (*Drypetes lateriflora*), Seven Year Apple (*Genipa clusiifolia*), Crabwood (*Gymnanthes lucida*), Manchineel (*Hippomane mancinella*), Joewood (*Jacquinia keyensis*), Thach Palm species (*Leucothrinax morrisii* or *Thrinax radiata*), Poisonwood (*Metopium toxiferum*), and Florida bully (*Sideroxylon reclinatum*), among other species.

L4 – Coastal Hammock (FHC)

1a.1. Coastal upland forest containing a mixture of tropical and temperate broad-leaved trees such as Pigeon Plum (*Coccoloba diversifolia*), False Mastic (*Sideroxylon foetidissimum*), Gumbo Limbo (*Bursera simaruba*), Strangler Fig (*Ficus aurea*), White Stopper (*Eugenia axillaris*), Jamaican Dogwood (*Piscidia piscipula*), Spanish Stopper (*E. foetida*), West Indian Mahogany (*Swietenia mahagoni*), Cabbage Palm (*Sabal Palmetto*), Soapberry (*Sapindus saponaria*), Satinleaf (*Chrysophyllum oliviforme*), Wild Lime (*Zanthoxylum fagara*), Spanish Bayonet (*Yucca aloifolia*), Triangle Cactus (*Acanthocereus tetragonus*), Prickly Pear (*Opuntia stricta*), Wild Cinnamon (*Canella winterana*), Thach Palm specie (*Thrinax radiata*), Poisonwood (*Metopium toxiferum*), and Florida bully (*Sideroxylon reclinatum*) among other. This community is generally found along coastal creeks and interior mangrove forest on calcerous substrate and/or shells.

L5 – Coastal Hardwood Hammock (FHCC)

1a.2. Hammock forests containing a mixture of tropical broad-leaved trees such as False Mastic (*Sideroxylon foetidissimum*), Gumbo Limbo (*Bursera simaruba*), Strangler Fig (*Ficus aurea*), White Stopper (*Eugenia axillaris*), Jamaican Dogwood (*Piscidia piscipula*), Spanish Stopper (*E. foetida*), Wild Lime (*Zanthoxylum fagara*), Blackbead (*Pithecellobium keyense*), Spanish Bayonet (*Yucca aloifolia*), Catclaw Blackbead (*P. unguis-cati*), Triangle Cactus (*Acanthocereus tetragonus*), and Prickly Pear (*Opuntia stricta*), among others found along coastal areas on sandy dunes (shell mounds excluded).

L5 – Coastal Dune Hammock (FHCD)

1a.3. Coastal hardwood hammock forest dominated by Buttonwood (*Conocarpus erectus*) in a matrix of tropical hardwood species like Jamaican Dogwood (*Piscidia piscipula*), Sea Grape (*Coccoloba uvifera*), Blackbead (*Pithecellobium keyense*), Spanish Bayonet (*Yucca aloifolia*), Catclaw Blackbead (*P. unguis-cati*), Triangle Cactus (*Acanthocereus tetragonus*), Prickly Pear (*Opuntia stricta*), and Spanish Stopper (*Eugenia foetida*), among others.

L5 – Buttonwood Hammock (FHCc)

1a.4. Coastal hardwood hammock forest dominated by West Indian Mahogany (*Swietenia mahagoni*) in a matrix of Jamaican Dogwood (*Piscidia piscipula*), Buttonwood (*Conocarpus erectus*), Wild Cinnamon (*Canella winterana*), Spanish Stopper (*Eugenia foetida*), Gumbo Limbo (*Bursera simaruba*), Strangler Fig (*Ficus aurea*), Pigeon Plum (*Coccoloba diversifolia*), and False Mastic (*Sideroxylon foetidissimum*), among others.

L5 – West Indian Mahogany Hammock (FHCg)

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

L3 – Mangrove Woodland (WM)

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

L3 – Upland Hardwood-Palm Woodland (WUH)

L2 – Wetland Woodland (WW)

L3 – Mangrove Woodland (WM)

1a. Black Mangrove (*Avicennia germinans*) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.

L4 – Black Mangrove Woodland (WMa)

1a.1. Black Mangrove (*Avicennia germinans*) in a matrix composed predominately of graminoids.

L5 – Black Mangrove Woodland-Graminoid Marsh (WMaG)

1a.2. Black Mangrove (*Avicennia germinans*) in a matrix composed predominately of Open Freshwater Marsh or Open Saltwater Marsh, both of which have less than 15% marsh vegetation.

L5 – Black Mangrove Woodland-Open (WMaO)

1a.3. Black Mangrove (*Avicennia germinans*) in a matrix composed predominately of succulents.

L5 – Black Mangrove Woodland-Succulent Marsh (WMaS)

1b. Buttonwood (*Conocarpus erectus*) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.

L4 – Buttonwood Woodland (WMc)

1b.1. Buttonwood (*Conocarpus erectus*) in a matrix composed predominately of graminoids.

L5 – Buttonwood Woodland-Graminoid Marsh (WMcG)

1b.2. Buttonwood (*Conocarpus erectus*) in a matrix composed predominately of succulents.

L5 – Buttonwood Woodland-Succulent Marsh (WMcS)

1c. Red Mangrove (*Rhizophora mangle*) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.

L4 – Red Mangrove Woodland (WMr)

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

L5 – Red Mangrove Woodland-Graminoid Marsh (WMrG)

1c.2. Red Mangrove (*Rhizophora mangle*) in a matrix composed predominately of Open Freshwater Marsh or Open Saltwater Marsh, both of which have less than 15% marsh vegetation.

L5 – Red Mangrove Woodland-Open (WMrO)

1c.3. Red Mangrove (*Rhizophora mangle*) in a matrix composed predominately of succulents.

L5 – Red Mangrove Woodland-Succulent Marsh (WMrS)

1d. Co-dominant mix (20% or less difference in percent cover) between two mangrove tree species in a matrix composed of salt marsh graminoids, herbs, and/or succulents.

L4 – Mixed Mangrove Woodland (WMX)

1d.1. Co-dominant mix (20% or less difference in percent cover) of Black Mangrove (*Avicennia germinans*) and Buttonwood (*Conocarpus erectus*) trees.

L5 – Black Mangrove-Buttonwood Woodland (WMXac)

1d.1i. Co-dominant mix (20% or less difference in percent cover) of Black Mangrove (*Avicennia germinans*) and Buttonwood (*Conocarpus erectus*) trees in a matrix of graminoids.

L6 – Black Mangrove-Buttonwood Woodland-Graminoid Marsh (WMXacG)

1d.1ii. Co-dominant mix (20% or less difference in percent cover) of Black Mangrove (*Avicennia germinans*) and Buttonwood (*Conocarpus erectus*) trees in a matrix composed predominately of herbaceous vegetation.

L6 – Black Mangrove-Buttonwood Woodland-Herbaceous Marsh (WMXacH)

1d.1iii. Co-dominant mix (20% or less difference in percent cover) of Black Mangrove (*Avicennia germinans*) and Buttonwood (*Conocarpus erectus*) trees in a matrix of succulents.

L6 – Black Mangrove-Buttonwood Woodland-Succulent Marsh (WMXacS)

1d.2. Co-dominant mix (20% or less difference in percent cover) of Black Mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) trees.

L5 – Black Mangrove-Red Mangrove Woodland (WMXar)

1d.2i. Co-dominant mix (20% or less difference in percent cover) of Black Mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) trees in a matrix of graminoids.

L6 – Black Mangrove-Red Mangrove Woodland-Graminoid Marsh (WMXarG)

1d.2ii. Co-dominant mix (20% or less difference in percent cover) of Black Mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) trees with an open understory.

L6 – Black Mangrove-Red Mangrove Woodland-Open (WMXarO)

1d.2iii. Co-dominant mix (20% or less difference in percent cover) of Black Mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) trees in a matrix of succulents.

L6 – Black Mangrove-Red Mangrove Woodland-Succulent Marsh (WMXarS)

1d.3. Co-dominant mix (20% or less difference in percent cover) of Buttonwood (*Conocarpus erectus*) and Red Mangrove (*Rhizophora mangle*) trees.

L5 – Buttonwood-Red Mangrove Woodland (WMXcr)

1e.3i. Co-dominant mix (20% or less difference in percent cover) of Buttonwood (*Conocarpus erectus*) and Red Mangrove (*Rhizophora mangle*) trees in a matrix of succulents.

L6 – Buttonwood-Red Mangrove Woodland-Succulent Marsh (WMXcrS)

1d.4. Co-dominant mix (20% or less difference in percent cover) of White Mangrove (*Laguncularia racemosa*) and Red Mangrove (*Rhizophora mangle*) trees.

L5 – White Mangrove-Red Mangrove Woodland (WMXlr)

1d.4i. Co-dominant mix (20% or less difference in percent cover) of White Mangrove (*Laguncularia racemosa*) and Red Mangrove (*Rhizophora mangle*) trees in a matrix of graminoids.

L6 – White Mangrove-Red Mangrove Woodland-Graminoid Marsh (WMXlrG)

L3 – Swamp Woodland (WS)

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

L4 – Cabbage Palm Lowland (WSO)

2a.1. Cabbage Palm (*Sabal palmetto*) in a matrix composed predominately of marsh graminoids, such as Sawgrass (*Cladium jamaicense*), Muhly Grass (*Muhlenbergia capillaris*), or other graminoid species.

L5 – Cabbage Palm Lowland-Graminoid Marsh (WSoG)

2a.2. Cabbage Palm (*Sabal palmetto*) in a matrix composed predominately of marsh shrubs, such as Buttonwood (*Conocarpus erectus*), Wax Myrtle (*Morella cerifera*), or other shrubss.

L5 – Cabbage Palm Lowland-Shrubs (WSoS)

2a.3. 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)

L2 – Upland Woodland (WU)

L3 – Upland Hardwood-Palm Woodland (WUH)

1a. Mix of Gumbo Limbo (*Bursera simaruba*), Cabbage Palm (*Sabal palmetto*), Jamaican Dogwood (*Piscidia piscipula*), Pigeon Plum (*Coccoloba diversifolia*), Sea Grape (*C. uvifera*), West Indian Mahogany (*Swietenia mahagoni*), and White Stopper (*Eugenia axillaris*). May also contain Strangler Fig (*Ficus aurea*), False Mastic (*Sideroxylon foetidissimum*), Wax Myrtle (*Morella cerifera*), Myrsine (*Myrsine floridana*), and Willow Busic (*Sideroxylon salicifolium*) among others.

L4 – Coastal Hardwood Woodland (WUHC)

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

L4 – Cabbage Palm Upland (WUo)

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

L5 – Cabbage Palm Upland-Graminoid Prairie (WUoG)

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. Coastal Shrubland characterized by a mixed species assemblage of Sea Grape (*Coccoloba uvifera*), Gumbo Limbo (*Bursera simaruba*), West Indian Mahogany (*Swietenia mahagoni*), Spanish Stopper (*Eugenia foetida*), Poisonwood (*Metopium toxiferum*), Willow Busic (*Sideroxylon salicifolium*), Jamaican Dogwood (*Piscidia piscipula*), Florida Thatch Palm (*Thrinax radiata*). Common understory components include Pricklypear (*Opuntia stricta*), Triangle Cactus (*Acanthocereus tetragonus*), among others.

L3 – Coastal Hardwood Shrubland (SUC)

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*), False Mastic (*Sideroxylon foetidissimum*), Wax Myrtle (*Morella 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. Saw Palmetto (*Serenoa repens*) dominant Shrubland.

L3 – Saw Palmetto Shrubland (SUn)

L2 – Wetland Shrubland (SW)

L3 – Mangrove Shrubland (SM)

1a. Black Mangrove (*Avicennia germinans*) dominant Shrubland.

L4 – Black Mangrove Shrubland (SMA)

1b. Buttonwood (*Conocarpus erectus*) dominant Shrubland.

L4 – Buttonwood Shrubland (SMc)

1c. White Mangrove (*Laguncularia racemosa*) dominant Shrubland.

L4 – White Mangrove Shrubland (SMI)

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

L4 – Red Mangrove Shrubland (SMr)

1e. Co-dominant mix (20% or less difference in percent cover) between two mangrove tree species with no particular species having dominance.

L4 – Mixed Mangrove Shrubland (SMX)

1e.1. Co-dominant mix (20% or less difference in percent cover) of Black Mangrove (*Avicennia germinans*) and Buttonwood (*Conocarpus erectus*) shrubs.

L5 – Black Mangrove-Buttonwood Shrubland (SMXac)

1e.2. Co-dominant mix (20% or less difference in percent cover) of Black Mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) shrubs.

L5 – Black Mangrove-White Mangrove Shrubland (SMXal)

1e.3. Co-dominant mix (20% or less difference in percent cover) of Black Mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) shrubs.

L5 – Black Mangrove-Red Mangrove Shrubland (SMXar)

1e.4. Co-dominant mix (20% or less difference in percent cover) of Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) shrubs.

L5 – Buttonwood-White Mangrove Shrubland (SMXcl)

1e.5. 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)

1e.6. Co-dominant mix (20% or less difference in percent cover) of White Mangrove (*Laguncularia racemosa*) and Red Mangrove (*Rhizophora mangle*) shrubs.

L5 – White Mangrove-Red Mangrove Shrubland (SMXlr)

1e.7. Co-dominant mix consisting of three or more mangrove tree species. This community is characterized by having no particular species in dominance, meaning there is 20% or less difference in percent cover between the most and least abundant mangrove tree species.

L5 – Mixed Mangrove Shrubland-Mixed (SMXX)

L3 – Swamp Shrubland (SS)

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

L4 – Bayhead Shrubland (SSB)

2b. Mixed assemblage of shrubs characterized by Buttonwood (*Conocarpus erectus*), Red Mangrove (*Rhizophora mangle*), Cocoplum (*Chrysobalanus icaco*), Wax Myrtle (*Morella cerifera*), Poisonwood (*Metopium toxiferum*), Red Bay (*Persea 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)

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

L4 – Wax Myrtle Shrubland (SSm)

2d. 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 (*S. 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)

2e. 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)

L2 – Upland Shrubland (SU)

L3 – Coastal Hardwood Shrubland (SUC)

Coastal Shrubland characterized by a mixed species assemblage of Sea Grape (*Coccoloba uvifera*), Gumbo Limbo (*Bursera simaruba*), West Indian Mahogany (*Swietenia mahagoni*), Spanish Stopper (*Eugenia foetida*), Poisonwood (*Metopium toxiferum*), Willow Busic (*Sideroxylon salicifolium*), Jamaican Dogwood (*Piscidia piscipula*), Florida Thatch Palm (*Thrinax radiata*). Common understory components

include Pricklypear (*Opuntia stricta*), Triangle Cactus (*Acanthocereus tetragonus*), among others.

L3 – Tropical Hardwood Shrubland (SUH)

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 (*Sideroxylon 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 – Saw Palmetto Shrubland (SUn)

Saw Palmetto (*Serenoa repens*) dominant Shrubland.

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 (C)** 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. Coastal Scrub characterized by a mixed species assemblage of Sea Grape (*Coccoloba uvifera*), Gumbo Limbo (*Bursera simaruba*), West Indian Mahogany (*Swietenia mahagoni*), Spanish Stopper (*Eugenia foetida*), Poisonwood (*Metopium toxiferum*), Willow Busic (*Dipholis salicifolia*), Jamaican Dogwood (*Piscidia piscipula*), Florida Thatch Palm (*Thrinax radiata*), Bahama Maidenbush (*Savia bahamensis*), Florida Swampprivet (*Forestiera segregata*), Pride-of-Big-Pine (*Strumpfia maritima*), and Yellow Necklacepod (*Sophora tomentosa*).

L3 – Coastal Hardwood Scrub (CUC)

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

L3 – Cabbage Palm Upland Scrub (CUo)

L2 – Wetland Scrub (CW)

L3 – Mangrove Scrub (CM)

1a. Black Mangrove (*Avicennia germinans*) dominant scrub.

L4 – Black Mangrove Scrub (CMa)

1a.1. Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of graminoids.

L5 – Black Mangrove Scrub-Graminoid Marsh (CMaG)

1a.1i. Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).

L6 – Black Mangrove Scrub-Black Rush Marsh (CMaGj)

1a.2. Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of herbaceous vegetation.

L5 – Black Mangrove Scrub-Herbaceous Marsh (CMaH)

1a.3. Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of Open Freshwater Marsh or Open Saltwater Marsh, both of which have less than 15% marsh vegetation.

L5 – Black Mangrove Scrub-Open Marsh (CMaO)

1a.4. Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of succulents.

L5 – Black Mangrove Scrub-Succulent Marsh (CMaS)

1a.5. Black Mangrove (*Avicennia germinans*) scrub with an average height up to 2m, and mangrove cover of 85% or more.

L5 – Black Mangrove Scrub-Dominant (CMaD)

1b. Buttonwood (*Conocarpus erectus*) dominant scrub.

L4 – Buttonwood Scrub (CMc)

1b.1. Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of graminoids.

L5 – Buttonwood Scrub-Graminoid Marsh (CMcG)

1b.1i. Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

L6 – Buttonwood Scrub-Sawgrass Marsh (CMcGc)

1b.1ii. Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).

L6 – Buttonwood Scrub-Saltgrass Marsh (CMcGd)

1b.1iii. Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).

L6 – Buttonwood Scrub-Spikerush Marsh (CMcGe)

1b.1iv. Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).

L6 – Buttonwood Scrub-Black Rush Marsh (CMcGj)

1b.1v. Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of Sand Cordgrass (*Spartina bakeri*).

L6 – Buttonwood Scrub-Sand Cordgrass Marsh (CMcGn)

1b.2. Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of Open Freshwater Marsh or Open Saltwater Marsh, both of which have less than 15% marsh vegetation.

L5 – Buttonwood Scrub-Open Marsh (CMcO)

1b.3. Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of succulents.

L5 – Buttonwood Scrub-Succulent Marsh (CMcS)

1b.4. Buttonwood (*Conocarpus erectus*) scrub with an average height up to 2m, and mangrove cover of 85% or more.

L5 – Buttonwood Scrub-Dominant (CMCd)

1c. White Mangrove (*Laguncularia racemosa*) dominant scrub.

L4 – White Mangrove Scrub (CMI)

1c.1. White Mangrove (*Laguncularia racemosa*) scrub in a matrix composed predominately of graminoid.

L5 – White Mangrove Scrub- Graminoid Marsh (CMIg)

1c.1i. White Mangrove (*Laguncularia racemosa*) scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

L6 – White Mangrove Scrub-Sawgrass Marsh (CMIgC)

1c.1ii. White Mangrove (*Laguncularia racemosa*) scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).

L6 – White Mangrove Scrub-Saltgrass Marsh (CMIgD)

1c.1iii. White Mangrove (*Laguncularia racemosa*) scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).

L6 – White Mangrove Scrub-Black Rush Marsh (CMIgJ)

1c.1iv. White Mangrove (*Laguncularia racemosa*) scrub in a matrix composed predominately of Sand Cordgrass (*Spartina bakeri*).

L6 – White Mangrove Scrub-Sand Cordgrass Marsh (CMIgN)

1c.2. White Mangrove (*Laguncularia racemosa*) scrub in a matrix composed predominately of Open Freshwater Marsh or Open Saltwater Marsh, both of which have less than 15% marsh vegetation.

L5 – White Mangrove Scrub- Open Marsh (CMIO)

1c.3. White Mangrove (*Laguncularia racemosa*) scrub in a matrix composed predominately of succulents.

L5 – White Mangrove Scrub-Succulent Marsh (CMIS)

1c.4. White Mangrove (*Laguncularia racemosa*) scrub with an average height up to 2m, and mangrove cover of 85% or more.

L5 – White Mangrove Scrub-Dominant (CMID)

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

L4 – Red Mangrove Scrub (CMr)

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

L5 – Red Mangrove Scrub-Graminoid Marsh (CMrG)

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

L6 – Red Mangrove Scrub-Sawgrass Marsh (CMrGc)

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

L6 – Red Mangrove Scrub-Saltgrass Marsh (CMrGd)

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

L6 – Red Mangrove Scrub-Spikerush Marsh (CMrGe)

1d.1iv. Red Mangrove (*Rhizophora mangle*) scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).

L6 – Red Mangrove Scrub-Black Rush Marsh (CMrGj)

1d.1v. Red Mangrove (*Rhizophora mangle*) scrub in a matrix composed predominately of Sand Cordgrass (*Spartina bakeri*).

L6 – Red Mangrove Scrub-Sand Cordgrass Marsh (CMrGn)

1d.1vi. Red Mangrove (*Rhizophora mangle*) scrub in a matrix composed predominately of Cattails (*Typha* spp.).

L6 – Red Mangrove Scrub-Cattail Marsh (CMrGt)

1d.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.

L5 – Red Mangrove Scrub-Open Marsh (CMrO)

1d.3. Red Mangrove (*Rhizophora mangle*) scrub in a matrix composed predominately of succulents.

L5 – Red Mangrove Scrub-Succulent Marsh (CMrS)

1d.4. Red Mangrove (*Rhizophora mangle*) scrub with an average height up to 2m, and mangrove cover of 85% or more.

L5 – Red Mangrove Scrub-Dominant (CMrD)

1e. Co-dominant mix (20% or less difference in percent cover) between two mangrove tree species with no particular species having dominance.

L4 – Mixed Mangrove Scrub (CMX)

1e.1. Co-dominant mix (20% or less difference in percent cover) of Black Mangrove (*Avicennia germinans*) and Buttonwood (*Conocarpus erectus*) scrub.

L5 – Black Mangrove-Buttonwood Scrub (CMXac)

1e.1i. Black Mangrove-Buttonwood Scrub in a matrix composed predominately of graminoids.

L6 – Black Mangrove-Buttonwood Scrub-Graminoid Marsh (CMXacG)

1e.1i.a. Black Mangrove-Buttonwood Scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).

L7 – Black Mangrove-Buttonwood Scrub-Saltgrass Marsh (CMXacGd)

1e.1ii. Black Mangrove-Buttonwood Scrub in a matrix composed predominately of succulents.

L6 – Black Mangrove-Buttonwood Scrub-Succulent Marsh (CMXacS)

1e.2. Co-dominant mix (20% or less difference in percent cover) of Black Mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) scrub.

L5 – Black Mangrove-White Mangrove Scrub (CMXal)

1e.2i. Black Mangrove-White Mangrove Scrub in a matrix composed predominately of graminoids.

L6 – Black Mangrove-White Mangrove Scrub-Graminoid Marsh (CMXalG)

1e.2i.a. Black Mangrove-White Mangrove Scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).

L7 – Black Mangrove-White Mangrove Scrub-Saltgrass Marsh (CMXalGd)

1e.2i.b. Black Mangrove-White Mangrove Scrub in a matrix composed predominately of Sand Cordgrass (*Spartina bakeri*).

L7 – Black Mangrove-White Mangrove Scrub-Sand Cordgrass Marsh (CMXalGn)

1e.2ii. Black Mangrove-White Mangrove Scrub in a matrix composed predominately of Open Freshwater Marsh or Open Saltwater Marsh, both of which have less than 15% marsh vegetation.

L6 – Black Mangrove-White Mangrove Scrub-Open Marsh (CMXalO)

1e.2iii. Black Mangrove-White Mangrove Scrub in a matrix composed predominately of succulents.

**L6 – Black Mangrove-White Mangrove Scrub-Succulent Marsh
(CMXalS)**

1e.2iv. Black Mangrove-White Mangrove Scrub with an average height up to 2 meters, and mangrove cover of 85% or more.

L6 – Black Mangrove-White Mangrove Scrub-Dominant (CMXalD)

1e.3. Co-dominant mix (20% or less difference in percent cover) of Black Mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) scrub.

L5 – Black Mangrove-Red Mangrove Scrub (CMXar)

1e.3i. Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of graminoids.

**L6 – Black Mangrove-Red Mangrove Scrub-Graminoid Marsh
(CMXarG)**

1e.3i.a. Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of Sawgrass (*Cladium Jamaicense*).

**L7 – Black Mangrove-Red Mangrove Scrub-Sawgrass Marsh
(CMXarGc)**

1e.3i.b. Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).

**L7 – Black Mangrove-Red Mangrove Scrub-Saltgrass Marsh
(CMXarGd)**

1e.3ii. Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of Open Freshwater Marsh or Open Saltwater Marsh, both of which have less than 15% marsh vegetation.

L6 – Black Mangrove-Red Mangrove Scrub-Open Marsh (CMXarO)

1e.3iii. Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of succulents.

**L6 – Black Mangrove-Red Mangrove Scrub-Succulent Marsh
(CMXarS)**

1e.4. Co-dominant mix (20% or less difference in percent cover) of Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) scrub.

L5 – Buttonwood-White Mangrove Scrub (CMXcl)

1e.4i. Buttonwood-White Mangrove Scrub in a matrix composed predominately of graminoids.

**L6 – Buttonwood-White Mangrove Scrub-Graminoid Marsh
(CMXclG)**

1e.4i.a. Buttonwood-White Mangrove Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

**L7 – Buttonwood-White Mangrove Scrub-Sawgrass Marsh
(CMXclGc)**

1e.4i.b. Buttonwood-White Mangrove Scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).

**L7 – Buttonwood-White Mangrove Scrub-Saltgrass Marsh
(CMXclGd)**

1e.4i.c. Buttonwood-White Mangrove Scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).

**L7 – Buttonwood-White Mangrove Scrub-Black Rush Marsh
(CMXclGj)**

1e.4i.d. Buttonwood-White Mangrove Scrub in a matrix composed predominately of Sand Cordgrass (*Spartina bakeri*).

**L7 – Buttonwood-White Mangrove Scrub-Sand Cordgrass
Marsh (CMXclGn)**

1e.4i.e. Buttonwood-White Mangrove Scrub in a matrix composed predominately of Kissimmeegrass (*Paspalidium geninatum*).

**L7 – Buttonwood-White Mangrove Scrub-Kissimmeegrass
Marsh (CMXclGu)**

1e.4ii. Buttonwood-White Mangrove Scrub in a matrix composed predominately of succulents.

**L6 – Buttonwood-White Mangrove Scrub-Succulent Marsh
(CMXclS)**

1e.4iii. Buttonwood-White Mangrove Scrub with an average height up to 2m, and mangrove cover of 85% or more.

L6 – Buttonwood-White Mangrove Scrub-Dominant (CMXclD)

1e.5. Co-dominant mix (20% or less difference in percent cover) of Buttonwood (*Conocarpus erectus*) and Red Mangrove (*Rhizophora mangle*) scrub.

L5 – Buttonwood-Red Mangrove Scrub (CMXcr)

1e.5i. Buttonwood-Red Mangrove Scrub in a matrix composed predominately of graminoids.

**L6 – Buttonwood-Red Mangrove Scrub-Graminoid Marsh
(CMXcrG)**

1e.5i.a. Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

**L7 – Buttonwood-Red Mangrove Scrub-Sawgrass Marsh
(CMXcrGc)**

1e.5i.b. Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).

**L7 – Buttonwood-Red Mangrove Scrub-Saltgrass Marsh
(CMXcrGd)**

1e.5i.c. Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).

**L7 – Buttonwood-Red Mangrove Scrub-Spikerush Marsh
(CMXcrGe)**

1e.5i.d. Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).

**L7 – Buttonwood-Red Mangrove Scrub-Black Rush Marsh
(CMXcrGj)**

1e.5i.e. Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Sand Cordgrass (*Spartina bakeri*).

**L7 – Buttonwood-Red Mangrove Scrub-Sand Cordgrass
Marsh (CMXcrGn)**

1e.5i.f. Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Kissimmeegrass (*Paspalidium geninatum*).

**L7 – Buttonwood-Red Mangrove Scrub-Kissimmeegrass Marsh
(CMXcrGu)**

1e.5ii. Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Open Freshwater Marsh or Open Saltwater Marsh, both of which have less than 15% marsh vegetation.

L6 – Buttonwood-Red Mangrove Scrub-Open Marsh (CMXcrO)

1e.5iii. Buttonwood-Red Mangrove Scrub in a matrix composed predominately of succulents.

L6 – Buttonwood-Red Mangrove Scrub-Succulent Marsh (CMXcrS)

1e.5iv. Buttonwood-Red Mangrove Scrub with an average height up to 2 meters, and mangrove cover of 85% or more.

L6 – Buttonwood-Red Mangrove Scrub-Dominant (CMXcrD)

1e.6. Co-dominant mix (20% or less difference in percent cover) of White Mangrove (*Laguncularia racemose*) and Red Mangrove (*Rhizophora mangle*) scrub.

L5 – White Mangrove-Red Mangrove Scrub (CMXlr)

1e.6i. White Mangrove-Red Mangrove Scrub in a matrix composed predominately of graminoids.

**L6 – White Mangrove-Red Mangrove Scrub-Graminoid Marsh
(CMXlrG)**

1e.6i.a. White Mangrove-Red Mangrove Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

**L7 – White Mangrove-Red Mangrove Scrub-Sawgrass Marsh
(CMXlrGc)**

1e.6i.b. White Mangrove-Red Mangrove Scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).

**L7 – White Mangrove-Red Mangrove Scrub-Saltgrass Marsh
(CMXlrGd)**

1e.6i.c. White Mangrove-Red Mangrove Scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).

**L7 – White Mangrove-Red Mangrove Scrub-Black Rush
Marsh (CMXlrGj)**

1e.6i.d. White Mangrove-Red Mangrove Scrub in a matrix composed predominately of Sand Cordgrass (*Spartina bakeri*).

**L7 – White Mangrove-Red Mangrove Scrub-Sand Cordgrass
Marsh (CMXlrGn)**

1e.6i.e. White Mangrove-Red Mangrove Scrub in a matrix composed predominately of Cattail (*Typha* spp.).

**L7 – White Mangrove-Red Mangrove Scrub-Cattail Marsh
(CMXlrGt)**

1e.6ii. White Mangrove-Red Mangrove Scrub in a matrix composed predominately of Open Freshwater Marsh or Open Saltwater Marsh, both of which have less than 15% marsh vegetation.

**L6 – White Mangrove-Red Mangrove Scrub-Open Marsh
(CMXlrO)**

1e.6iii. White Mangrove-Red Mangrove Scrub in a matrix composed predominately of succulents.

**L6 – White Mangrove-Red Mangrove Scrub-Succulent Marsh
(CMXlrS)**

1e.6iv. White Mangrove-Red Mangrove Scrub with an average height up to 2 meters, and mangrove cover of 85% or more.

L6 – White Mangrove-Red Mangrove Scrub-Dominant (CMXlrD)

1e.7. Co-dominant mix consisting of three or more mangrove tree species. This community is characterized by having no particular species in dominance, meaning there is 20% or less difference in percent cover between the most and least abundant mangrove tree species.

L5 – Mixed Mangrove Scrub-Mixed (CMXX)

1e.7i. Mixed Mangrove Scrub-Mixed in a matrix composed predominately of graminoids.

L6 – Mixed Mangrove Scrub-Mixed-Graminoid Marsh (CMXXG)

1e.7i.a. Mixed Mangrove Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

L7 – Mixed Mangrove Scrub-Sawgrass Marsh (CMXXGc)

1e.7i.b. Mixed Mangrove Scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).

L7 – Mixed Mangrove Scrub-Saltgrass Marsh (CMXXGd)

1e.7i.c. Mixed Mangrove Scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).

L7 – Mixed Mangrove Scrub-Black Rush Marsh (CMXXGj)

1e.7i.d. Mixed Mangrove Scrub in a matrix composed predominately of Sand Cordgrass (*Spartina bakeri*).

L7 – Mixed Mangrove Scrub-Cordgrass Marsh (CMXXGn)

1e.7ii. Mixed Mangrove Scrub-Mixed in a matrix composed predominately of Open Freshwater Marsh or Open Saltwater Marsh, both of which have less than 15% marsh vegetation.

L6 – Mixed Mangrove Scrub-Mixed-Open Marsh (CMXXO)

1e.7iii. Mixed Mangrove Scrub-Mixed in a matrix composed predominately of succulents.

L6 – Mixed Mangrove Scrub-Mixed-Succulent Marsh (CMXXS)

1e.7iv. Mixed Mangrove Scrub-Mixed with an average height up to 2m, and mangrove cover of 85% or more.

L6 – Mixed Mangrove Scrub-Mixed-Dominant (CMXXD)

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 Black Rush (*Juncus roemerianus*).

L6 – Bayhead Swamp Scrub-Black Rush Marsh (CSBGj)

2a.2. Bayhead Swamp Scrub in a matrix composed predominately of herbaceous vegetation.

L5 – Bayhead Swamp Scrub-Herbaceous Marsh (CSBH)

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 (*Persea 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 Sawgrass (*Cladium jamaicense*).

L6 – Transitional Bayhead Swamp Scrub-Sawgrass Marsh (CSBTGc)

2b.1ii. Transitional Bayhead Swamp Scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).

L6 – Transitional Bayhead Swamp Scrub-Spikerush Marsh (CSBTGe)

2b.1iii. Transitional Bayhead Swamp Scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).

L6 – Transitional Bayhead Swamp Scrub-Black Rush Marsh (CSBTGj)

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

L4 – Wax Myrtle Scrub (CSm)

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

L5 – Wax Myrtle Scrub-Graminoid Marsh (CSmG)

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

L6 – Wax Myrtle Scrub-Sawgrass Marsh (CSmGc)

2d. 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)

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

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

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

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

2e. Saltwater Falsewillow (*Baccharis angustifolia*), Silverling (*B. glomeruliflora*), and/or Groundsel Bush (*B. halimifolia*) characterized by canopy densities from 10-49% in a matrix of graminoids and/or herbaceous vegetation.

L4 – Falsewillow Scrub (CSr)

2e.1. Saltwater Falsewillow (*Baccharis angustifolia*), Silverling (*B. glomeruliflora*), and/or Groundsel Bush (*B. halimifolia*) Scrub in a matrix composed predominately of Freshwater Graminoid Marsh.

L5 – Falsewillow Scrub-Graminoid Marsh (CSrG)

2e.1i. Saltwater Falsewillow (*Baccharis angustifolia*), Silverling (*B. glomeruliflora*), and/or Groundsel Bush (*B. halimifolia*) Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

L6 – Falsewillow Scrub-Sawgrass Marsh (CSrGc)

L2 – Upland Scrub (CU)

L3 – Coastal Hardwood Scrub (CUC)

Coastal Scrub characterized by a mixed species assemblage of Sea Grape (*Coccoloba uvifera*), Gumbo Limbo (*Bursera simaruba*), West Indian Mahogany (*Swietenia mahagoni*), Spanish Stopper (*Eugenia foetida*), Poisonwood (*Metopium toxiferum*), Willow Busic (*Dipholis salicifolia*), Jamaican Dogwood (*Piscidia piscipula*), Florida Thatch Palm (*Thrinax radiata*), Bahama Maidenbush (*Savia bahamensis*), Florida Swampprivet (*Forestiera segregata*), Pride-of-Big-Pine (*Strumpfia maritima*), and Yellow Necklacepod (*Sophora tomentosa*). Common understory components include Pricklypear (*Opuntia stricta*), Triangle Cactus (*Acanthocereus tetragonus*), among others.

L3 – Cabbage Palm Upland Scrub (CUo)

2a. 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)

2a.1. Cabbage Palm (*Sabal palmetto*) Scrub in a matrix composed of a mixed prairie species assemblage of Sawgrass (*Cladium jamaicense*), Muhly Grass (*Muhlenbergia capillaris* var. *filipes*), and/or Little Bluestem (*Schizachyrium rhizomatum*). 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 – Cabbage Palm Upland Scrub- Mixed Graminoid Prairie (CUoGPX)

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)

2. Open (less than 15% vegetation) dominated salt marsh often with a mix of sparse graminoids and/or herbaceous salt marsh vegetation, such as Black Rush (*Juncus roemerianus*) and/or Cordgrass (*Spartina* spp.).

L3 – Open Salt Marsh (MSO)

3. Saltwort (*Batis maritima*), Glasswort (*Salicornia* spp.), and/or Sea Purslane (*Sesuvium* spp.) dominated salt marsh.

L3 – Succulent Salt Marsh (MSS)

II. Freshwater graminoid and/or herbaceous marsh.

L2 – Freshwater Marsh (MF)

1. Floating emergent dominated freshwater marsh.

L3 – Floating Emergent Marsh (MFF)

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

L3 – Graminoid Freshwater Marsh (MFG)

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

L3 – Herbaceous Freshwater Marsh (MFH)

4. 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)

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)

1c. Co-dominant mix of two or more graminoid marsh species like Saltgrass (*Distichlis spicata*), Black Rush (*Juncus roemerianus*), and/or 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.

L4 – Mixed Graminoid Salt Marsh (MSGX)

1c.1. Co-dominant mix of Saltgrass (*Distichlis spicata*) 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 – Saltgrass- Sand Cordgrass Marsh (MSGXdn)

L3 – Open Salt Marsh (MSO)

Open (less than 15% vegetation) dominated salt marsh often with a mix of sparse graminoids and/or herbaceous salt marsh vegetation, such as Black Rush (*Juncus roemerianus*) and/or Cordgrass (*Spartina* spp.).

L3 – Succulent Salt Marsh (MSS)

Saltwort (*Batis maritima*), Glasswort (*Salicornia* spp.), and/or Sea Purslane (*Sesuvium* spp.) dominated salt marsh.

L2 – Freshwater Marsh (MF)

L3 – Floating Emergent Marsh (MFF)

1a. Waterlily (*Nymphaea odorata*) dominated marsh.

L4 – Waterlily Marsh (MFFy)

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. Short Sawgrass Marsh with 50-100% Sawgrass (*Cladium jamaicense*) cover.

L6 – Short Sawgrass Marsh-Dense (MFGcSD)

2a.2ii. Short Sawgrass Marsh with 15-49% Sawgrass (*Cladium jamaicense*) cover.

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. Sand Cordgrass (*Spartina bakeri*) dominated marsh.

L4 – Sand Cordgrass Marsh (MFGn)

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

L4 – Cattail Marsh (MFGt)

2e. Kissimmeegrass (*Paspalidium geninatum*) dominated marsh.

L4 – Kissimmeegrass Marsh (MFGu)

2f. 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)

2f.1. Co-dominant mix of Sawgrass (*Cladium jamaicense*) and Black Rush (*Juncus roemerianus*). 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- Black Rush Marsh (MFGXcj)

2f.2. 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)

2f.3. 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)

L3 – Herbaceous Freshwater Marsh (MFH)

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

L3 – Open Freshwater Marsh (MFO)

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.

L1 – Dune (D)

Shrub, graminoid and/or herbaceous vegetation associated with a mound or ridge of sediment formed by wind and/or storm deposits.

I. Graminoid dominated dune.

L2 – Graminoid Dune (DG)

II. Herbaceous dominated dune.

L2 – Herbaceous Dune (DH)

L1 – Exotic (E)

Non-native species assemblages. A cell label should reflect its native vegetation whenever possible. Exotic codes should be secondary. Level 2 codes exist for exotics and treated exotics. Level 3 codes split these into cover classes: Sparse (10-49% cover), Dominant (50-89% cover), and Monotypic (90-100% cover). The structure looks like this:

Users are asked to reference exotic plant species codes in the *Vegetation Classification System for South Florida Natural Areas* (Rutchev et al. 2006) for the complete vegetation classification key for exotic plant species. The species listed therein are as follows:

I. Brazilian Pepper (*Schinus terebinthifolius*).

L2 – Brazilian Pepper (Es)

L1 – Other (O)

Anthropogenic or non-vegetative features.

I. Non-Vegetative cover.

L2 – Non-Vegetative (ON)

1. Ground covered in sand that is adjacent to lakes, bays, oceans, or other large bodies of water.

L3 – Beach (ONB)

2. Exposed open ground or peat, particularly in hurricane damaged mangrove forests with < 10% vegetation cover.

L3 – Soil (ONO)

3. Barren, generally hypersaline, flats found above the high tide mark created by storm-driven tidal events.

L3 – Barren Salt Flat (ONS)

4. Shallow intertidal sand or mud areas which are regularly exposed to the atmosphere at low tide.

L3 – Tidal Flat (ONT)

5. 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. 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)

Literature Cited

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Rutchev, K., T. Schall, and F. Sklar. 2008. Development of vegetation maps for assessing Everglades restoration progress. *Wetlands* 28 (3): 806-816.

Appendix B. Hierarchical Level, Area, Percentage, and Frequency of Thematic Classes Mapped within the Southwest Coastal Everglades, Region 3, of the Everglades National Park and Big Cypress National Preserve Vegetation Map

Table B-1. Vegetation Code Area and Percentage of Each Vegetation Code Mapped in Region 3 of EVER and BICY Vegetation Map.

Thematic Class	Hierarchical Level	Area (ha)	Percent Area (%)	Frequency
Anthropogenic	2	9.0	0.01%	36
Barren Salt Flat	3	13.7	0.01%	55
Bayhead Forest	4	93.5	0.09%	374
Bayhead Shrubland	4	717.0	0.72%	2,868
Bayhead Swamp Scrub-Black Rush Marsh	6	5.8	0.01%	23
Bayhead Swamp Scrub-Herbaceous Marsh	5	25.0	0.03%	100
Bayhead Swamp Scrub-Sawgrass Marsh	6	936.3	0.95%	3,745
Beach	3	21.2	0.02%	85
Black Mangrove Forest	4	2,452.2	2.48%	9,809
Black Mangrove Scrub-Black Rush Marsh	6	1.3	< 0.01%	5
Black Mangrove Scrub-Dominant	5	2.0	< 0.01%	8
Black Mangrove Scrub-Herbaceous Marsh	5	3.3	< 0.01%	13
Black Mangrove Scrub-Open Marsh	5	208.8	0.21%	835
Black Mangrove Scrub-Succulent Marsh	5	458.2	0.46%	1,833
Black Mangrove Shrubland	4	772.7	0.78%	3,091
Black Mangrove Woodland-Open Marsh	5	171.0	0.17%	684
Black Mangrove Woodland-Succulent Marsh	5	326.0	0.33%	1,304
Black Mangrove-Buttonwood Forest	5	328.2	0.33%	1,313
Black Mangrove-Buttonwood Scrub-Saltgrass Marsh	7	1.5	< 0.01%	6
Black Mangrove-Buttonwood Scrub-Succulent Marsh	6	26.5	0.03%	106
Black Mangrove-Buttonwood Shrubland	5	87.5	0.09%	350

Thematic Class	Hierarchical Level	Area (ha)	Percent Area (%)	Frequency
Black Mangrove-Buttonwood Woodland-Graminoid Marsh	6	15.7	0.02%	63
Black Mangrove-Buttonwood Woodland-Herbaceous Marsh	6	1.5	< 0.01%	6
Black Mangrove-Buttonwood Woodland-Succulent Marsh	6	35.0	0.04%	140
Black Mangrove-Graminoid Marsh	5	32.3	0.03%	129
Black Mangrove-Red Mangrove Forest	5	4,484.3	4.53%	17,937
Black Mangrove-Red Mangrove Scrub-Open Marsh	6	100.5	0.10%	402
Black Mangrove-Red Mangrove Scrub-Saltgrass Marsh	7	4.0	< 0.01%	16
Black Mangrove-Red Mangrove Scrub-Sawgrass Marsh	7	2.3	< 0.01%	9
Black Mangrove-Red Mangrove Scrub-Succulent Marsh	6	20.7	0.02%	83
Black Mangrove-Red Mangrove Shrubland	5	175.2	0.18%	701
Black Mangrove-Red Mangrove Woodland-Graminoid Marsh	6	23.7	0.02%	95
Black Mangrove-Red Mangrove Woodland-Open Marsh	6	209.3	0.21%	837
Black Mangrove-Red Mangrove Woodland-Succulent Marsh	6	61.5	0.06%	246
Black Mangrove-White Mangrove Forest	5	319.3	0.32%	1,277
Black Mangrove-White Mangrove Scrub-Cordgrass Marsh	7	4.5	< 0.01%	18
Black Mangrove-White Mangrove Scrub-Dominant	6	3.7	< 0.01%	15
Black Mangrove-White Mangrove Scrub-Open Marsh	6	7.2	0.01%	29
Black Mangrove-White Mangrove Scrub-Saltgrass Marsh	7	72.5	0.07%	290
Black Mangrove-White Mangrove Scrub-Succulent Marsh	6	44.2	0.04%	177
Black Mangrove-White Mangrove Shrubland	5	288.5	0.29%	1,154
Black Rush Marsh	4	1,210.3	1.22%	4,841
Brazilian Pepper	2	70.8	0.07%	283
Buttonwood Forest	4	593.8	0.60%	2,375
Buttonwood Hammock	5	126.3	0.13%	505
Buttonwood Scrub-Black Rush Marsh	6	42.5	0.04%	170

Thematic Class	Hierarchical Level	Area (ha)	Percent Area (%)	Frequency
Buttonwood Scrub-Cordgrass Marsh	6	89.5	0.09%	358
Buttonwood Scrub-Dominant	5	2.3	< 0.01%	9
Buttonwood Scrub-Open Marsh	5	4.3	< 0.01%	17
Buttonwood Scrub-Saltgrass Marsh	6	8.8	0.01%	35
Buttonwood Scrub-Sawgrass Marsh	6	457.5	0.46%	1,830
Buttonwood Scrub-Spikerush Marsh	6	1.0	< 0.01%	4
Buttonwood Scrub-Succulent	5	116.0	0.12%	464
Buttonwood Shrubland	4	380.0	0.38%	1,520
Buttonwood Woodland-Graminoid Marsh	5	12.8	0.01%	51
Buttonwood Woodland-Succulent Marsh	5	74.5	0.08%	298
Buttonwood-Red Mangrove Forest	5	1,044.0	1.05%	4,176
Buttonwood-Red Mangrove Scrub-Black Rush Marsh	7	99.8	0.10%	399
Buttonwood-Red Mangrove Scrub-Cordgrass Marsh	7	257.0	0.26%	1,028
Buttonwood-Red Mangrove Scrub-Dominant	6	190.5	0.19%	762
Buttonwood-Red Mangrove Scrub-Graminoid Marsh	6	10.3	0.01%	41
Buttonwood-Red Mangrove Scrub-Kissimmeegrass Marsh	7	13.5	0.01%	54
Buttonwood-Red Mangrove Scrub-Open Marsh	6	574.5	0.58%	2,298
Buttonwood-Red Mangrove Scrub-Saltgrass Marsh	7	117.0	0.12%	468
Buttonwood-Red Mangrove Scrub-Sawgrass Marsh	7	1,016.0	1.03%	4,064
Buttonwood-Red Mangrove Scrub-Spikerush Marsh	7	49.3	0.05%	197
Buttonwood-Red Mangrove Scrub-Succulent Marsh	6	4.5	< 0.01%	18
Buttonwood-Red Mangrove Shrubland	5	2,652.0	2.68%	10,608
Buttonwood-Reg Mangrove Woodland-Succulent Marsh	6	4.3	< 0.01%	17
Buttonwood-White Mangrove Forest	5	57.5	0.06%	230
Buttonwood-White Mangrove Scrub-Black Rush Marsh	7	10.8	0.01%	43
Buttonwood-White Mangrove Scrub-Cordgrass Marsh	7	79.5	0.08%	318
Buttonwood-White Mangrove Scrub-Dominant	6	18.0	0.02%	72
Buttonwood-White Mangrove Scrub-Kissimmeegrass Marsh	7	3.5	< 0.01%	14

Thematic Class	Hierarchical Level	Area (ha)	Percent Area (%)	Frequency
Buttonwood-White Mangrove Scrub-Saltgrass Marsh	7	42.3	0.04%	169
Buttonwood-White Mangrove Scrub-Sawgrass Marsh	7	49.0	0.05%	196
Buttonwood-White Mangrove Scrub-Succulent Marsh	6	8.3	0.01%	33
Buttonwood-White Mangrove Shrubland	5	187.8	0.19%	751
Cabbage Palm Lowland-Graminoid Marsh	5	5.3	0.01%	21
Cabbage Palm Lowland-Mixed	5	2.0	< 0.01%	8
Cabbage Palm Lowland-Shrubs	5	0.5	< 0.01%	2
Cabbage Palm Scrub-Mixed Graminoid Prairie	5	2.5	< 0.01%	10
Cabbage Palm Swamp Scrub-Sawgrass Marsh	6	84.0	0.08%	336
Cabbage Palm Upland-Graminoid Prairie	4	42.5	0.04%	170
Campground	3	55.0	0.06%	220
Cattail Marsh	4	11.3	0.01%	45
Coastal Dune Hammock	5	57.5	0.06%	230
Coastal Hardwood Hammock	5	4.8	< 0.01%	19
Coastal Hardwood Scrub	3	71.2	0.07%	285
Coastal Hardwood Shrubland	3	22.2	0.02%	89
Coastal Hardwood Woodland	4	17.2	0.02%	69
Cocoplum Shrubland	4	62.5	0.06%	250
Falsewillow Scrub-Sawgrass Marsh	6	2.0	< 0.01%	8
Graminoid Dune	2	75.7	0.08%	303
Herbaceous Dune	2	1.7	< 0.01%	7
Herbaceous Freshwater Marsh	3	68.5	0.07%	274
Kissimmeegrass Marsh	4	17.2	0.02%	69
Mixed Graminoid Freshwater Marsh	4	47.8	0.05%	191
Mixed Mangrove Forest-Mixed	5	7,516.0	7.59%	30,064
Mixed Mangrove Scrub-Mixed-Black Rush Marsh	7	8.0	0.01%	32
Mixed Mangrove Scrub-Mixed-Cordgrass Marsh	7	22.0	0.02%	88
Mixed Mangrove Scrub-Mixed-Dominant	6	13.8	0.01%	55
Mixed Mangrove Scrub-Mixed-Open Marsh	6	11.5	0.01%	46
Mixed Mangrove Scrub-Mixed-Saltgrass Marsh	7	50.8	0.05%	203

Thematic Class	Hierarchical Level	Area (ha)	Percent Area (%)	Frequency
Mixed Mangrove Scrub-Mixed-Sawgrass Marsh	7	35.0	0.04%	140
Mixed Mangrove Scrub-Mixed-Succulent Marsh	6	3.0	< 0.01%	12
Mixed Mangrove Shrubland-Mixed	5	1,118.0	1.13%	4,472
Open Freshwater Marsh	3	43.0	0.04%	172
Open Salt Marsh	3	7.7	0.01%	31
Red Mangrove Forest	4	4,973.8	5.02%	19,895
Red Mangrove Scrub-Black Rush Marsh	6	261.5	0.26%	1,046
Red Mangrove Scrub-Cattail Marsh	6	4.8	< 0.01%	19
Red Mangrove Scrub-Cordgrass Marsh	6	35.0	0.04%	140
Red Mangrove Scrub-Dominant	5	3,718.8	3.75%	14,875
Red Mangrove Scrub-Open Marsh	5	4,451.0	4.49%	17,804
Red Mangrove Scrub-Saltgrass Marsh	6	38.0	0.04%	152
Red Mangrove Scrub-Sawgrass Marsh	6	3,366.8	3.40%	13,467
Red Mangrove Scrub-Spikerush Marsh	6	91.5	0.09%	366
Red Mangrove Scrub-Succulent Marsh	5	9.5	0.01%	38
Red Mangrove Shrubland	4	3,012.0	3.04%	12,048
Red Mangrove Woodland-Graminoid Marsh	5	10.2	0.01%	41
Red Mangrove Woodland-Open Marsh	5	96.0	0.10%	384
Red Mangrove Woodland-Succulent Marsh	5	9.0	0.01%	36
Saltgrass Marsh	4	161.5	0.16%	646
Saltgrass-Sand Cordgrass Marsh	5	143.8	0.15%	575
Sand Cordgrass Marsh	4	368.0	0.37%	1,472
Saw Palmetto Shrubland	3	0.2	< 0.01%	1
Sawgrass-Cattail Marsh	5	65.5	0.07%	262
Sawgrass-Sand Cordgrass Marsh	5	101.5	0.10%	406

Appendix C. Accuracy Assessment Table for the Southwest Coastal Everglades, Region 3, Vegetation Map.

Table C-1. Accuracy assessment table for the Region 3 vegetation map.

Map Annotation	Accuracy Assessment Annotation	One-to-One Matched Points	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Bayhead Forest	Bayhead Forest	1	1	1	—	—
	Bayhead Forest Total	1	1	1	100	100
Bayhead Shrubland	Bayhead Shrubland	1	1	1	—	—
	Bayhead Shrubland Total	1	1	1	100	100
Bayhead Swamp Scrub-Sawgrass Marsh	Bayhead Swamp Scrub-Sawgrass Marsh	1	1	1	—	—
	Short Sawgrass Marsh-Dense ²	0	0	1	—	—
	Wax Myrtle Scrub-Sawgrass Marsh ³	0	1	1	—	—
	Bayhead Swamp Scrub-Sawgrass Marsh Total	1	2	3	33	67
Black Mangrove Forest	Black Mangrove Forest	7	7	7	—	—
	Black Mangrove Forest Total	7	7	7	100	100

¹accepted vegetation height discrepancy

²accepted vegetation cover discrepancy

³accepted species discrepancy

⁴accepted modifier discrepancy

Table C-1 (continued). Accuracy assessment table for the Region 3 vegetation map.

Map Annotation	Accuracy Assessment Annotation	One-to-One Matched Points	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Black Mangrove Scrub-Succulent Marsh	Black Mangrove Scrub-Saltwort Marsh ³	0	2	2	—	—
	Black Mangrove Scrub-Succulent Marsh Total	0	2	2	0	100
Black Mangrove Shrubland	Black Mangrove Shrubland	2	2	2	—	—
	Black Mangrove Scrub-Saltwort Marsh ¹	0	1	1	—	—
	Black Mangrove Shrubland Total	2	3	3	67	100
Black Mangrove Woodland-Open Marsh	Black Mangrove Woodland-Open Marsh	1	1	1	—	—
	Black Mangrove Forest ²	0	1	1	—	—
	Black Mangrove Woodland-Open Marsh Total	1	2	2	50	100
Black Mangrove Woodland-Succulent Marsh	Black Mangrove Woodland-Succulent Marsh	1	1	1	—	—
	Black Mangrove Woodland-Succulent Marsh Total	1	1	1	100	100
Black Mangrove-Buttonwood Forest	Buttonwood Forest ³	0	1	1	—	—
	Black Mangrove-Buttonwood Forest Total	0	1	1	0	100

¹accepted vegetation height discrepancy

²accepted vegetation cover discrepancy

³accepted species discrepancy

⁴accepted modifier discrepancy

Table C-1 (continued). Accuracy assessment table for the Region 3 vegetation map.

Map Annotation	Accuracy Assessment Annotation	One-to-One Matched Points	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Black Mangrove-Buttonwood Shrubland	Black Mangrove-Buttonwood Shrubland	1	1	1	—	—
	Black Mangrove-Buttonwood Shrubland Total	1	1	1	100	100
Black Mangrove-Red Mangrove Forest	Black Mangrove-Red Mangrove Forest	13	13	13	—	—
	Red Mangrove Shrubland ³	0	1	1	—	—
	Black Mangrove-Red Mangrove Forest Total	13	14	14	93	100
Black Mangrove-Red Mangrove Shrubland	Black Mangrove-Red Mangrove Shrubland	1	1	1	—	—
	Red Mangrove Shrubland ³	0	1	1	—	—
	Black Mangrove-Red Mangrove Shrubland Total	1	2	2	50	100
Black Mangrove-White Mangrove Forest	Mixed Mangrove Forest-Mixed ³	0	1	1	—	—
	Black Mangrove-White Mangrove Forest Total	0	1	1	0	100
Black Mangrove-White Mangrove Shrubland	Black Mangrove-White Mangrove Shrubland	1	1	1	—	—
	Black Mangrove-White Mangrove Shrubland Total	1	1	1	100	100

¹accepted vegetation height discrepancy

²accepted vegetation cover discrepancy

³accepted species discrepancy

⁴accepted modifier discrepancy

Table C-1 (continued). Accuracy assessment table for the Region 3 vegetation map.

Map Annotation	Accuracy Assessment Annotation	One-to-One Matched Points	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Black Rush Marsh	Black Rush Marsh	3	3	3	—	—
	Black Rush Marsh Total	3	3	3	100	100
Buttonwood Forest	Buttonwood Forest	2	2	2	—	—
	Buttonwood Forest Total	2	2	2	100	100
Buttonwood-Red Mangrove Forest	Buttonwood-Red Mangrove Forest	2	2	2	—	—
	Buttonwood Shrubland	0	0	1	—	—
	Buttonwood-Red Mangrove Forest Total	2	2	3	67	67
Buttonwood-Red Mangrove Scrub-Dominant	Buttonwood-Red Mangrove Scrub-Dominant	1	1	1	—	—
	Buttonwood-Red Mangrove Scrub-Open Marsh ²	0	1	1	—	—
	Buttonwood-Red Mangrove Scrub-Dominant Total	1	2	2	50	100
Buttonwood-Red Mangrove Scrub-Open Marsh	Red Mangrove Scrub-Open Marsh ³	0	2	2	—	—
	Buttonwood-Red Mangrove Scrub-Open Marsh Total	0	2	2	0	100

¹accepted vegetation height discrepancy

²accepted vegetation cover discrepancy

³accepted species discrepancy

⁴accepted modifier discrepancy

Table C-1 (continued). Accuracy assessment table for the Region 3 vegetation map.

Map Annotation	Accuracy Assessment Annotation	One-to-One Matched Points	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Buttonwood-Red Mangrove Scrub-Sawgrass Marsh	Buttonwood-Red Mangrove Scrub-Sawgrass Marsh	1	1	1	—	—
	Buttonwood Scrub-Sawgrass Marsh ³	0	1	1	—	—
	Buttonwood-Red Mangrove Shrubland ²	0	1	1	—	—
	Buttonwood-Red Mangrove Scrub-Sawgrass Marsh Total	1	3	3	33	100
Buttonwood-Red Mangrove Shrubland	Buttonwood-Red Mangrove Shrubland	3	3	3	—	—
	Black Mangrove-Red Mangrove Shrubland ³	0	1	1	—	—
	Buttonwood Scrub-Sawgrass Marsh	0	0	1	—	—
	Buttonwood-Red Mangrove Scrub ²	0	1	1	—	—
	Mixed Mangrove Shrubland-Mixed ³	0	1	1	—	—
	Buttonwood-Red Mangrove Shrubland Total	3	6	7	43	86

¹accepted vegetation height discrepancy

²accepted vegetation cover discrepancy

³accepted species discrepancy

⁴accepted modifier discrepancy

Table C-1 (continued). Accuracy assessment table for the Region 3 vegetation map.

Map Annotation	Accuracy Assessment Annotation	One-to-One Matched Points	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Coastal Hardwood Hammock	Buttonwood Forest ³	0	1	1	—	—
	Coastal Hardwood Hammock Total	0	1	1	0	100
Coastal Hardwood Scrub	Coastal Hardwood Scrub	1	1	1	—	—
	Coastal Hardwood Scrub Total	1	1	1	100	100
Mixed Mangrove Forest-Mixed	Mixed Mangrove Forest-Mixed	13	13	13	—	—
	Black Mangrove-Buttonwood Forest ³	0	1	1	—	—
	Black Mangrove-Red Mangrove Forest ³	0	6	6	—	—
	Black Mangrove-White Mangrove Forest ³	0	1	1	—	—
	White Mangrove-Red Mangrove Shrubland	0	0	1	—	—
	Mixed Mangrove Forest-Mixed Total	13	21	22	59	95
Mixed Mangrove Shrubland-Mixed	Black Mangrove-Buttonwood Shrubland ³	0	1	1	—	—
	Red Mangrove Shrubland	0	0	1	—	—

¹accepted vegetation height discrepancy

²accepted vegetation cover discrepancy

³accepted species discrepancy

⁴accepted modifier discrepancy

Table C-1 (continued). Accuracy assessment table for the Region 3 vegetation map.

Map Annotation	Accuracy Assessment Annotation	One-to-One Matched Points	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Mixed Mangrove Shrubland-Mixed (continued)	White Mangrove-Red Mangrove Scrub ²	0	1	1	—	—
	Mixed Mangrove Shrubland-Mixed Total	0	2	3	0	67
Open Salt Marsh	Saltwort Marsh ³	0	1	1	—	—
	Open Salt Marsh Total	0	1	1	0	100
Open Salt Marsh	Saltwort Marsh ³	0	1	1	—	—
	Open Salt Marsh Total	0	1	1	0	100
Red Mangrove Forest	Red Mangrove Forest	13	13	13	—	—
	Black Mangrove-Red Mangrove Forest ³	0	1	1	—	—
	Red Mangrove Shrubland ¹	0	2	2	—	—
	Red Mangrove Forest Total	13	16	16	81	100
Red Mangrove Scrub-Dominant	Red Mangrove Scrub-Dominant	10	10	10	—	—
	Red Mangrove Scrub-Open Marsh ²	0	1	1	—	—
	Red Mangrove Scrub-Spikerush Marsh ³	0	2	2	—	—
	Red Mangrove Shrubland ²	0	1	1	—	—

¹accepted vegetation height discrepancy

²accepted vegetation cover discrepancy

³accepted species discrepancy

⁴accepted modifier discrepancy

Table C-1 (continued). Accuracy assessment table for the Region 3 vegetation map.

Map Annotation	Accuracy Assessment Annotation	One-to-One Matched Points	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Red Mangrove Scrub-Dominant (continued)	Water	0	0	1	—	—
	White Mangrove Scrub-Black Rush Marsh	0	0	1	—	—
	Red Mangrove Scrub-Dominant Total	10	14	16	63	88
Red Mangrove Scrub-Open Marsh	Red Mangrove Scrub-Open Marsh	11	11	11	—	—
	Red Mangrove Scrub-Sawgrass Marsh ³	0	2	2	—	—
	Red Mangrove Shrubland ²	0	1	1	—	—
	Red Mangrove Scrub-Open Marsh Total	11	14	14	79	100
Red Mangrove Scrub-Sawgrass Marsh	Red Mangrove Scrub-Sawgrass Marsh	5	5	5	—	—
	White Mangrove-Red Mangrove Scrub-Sawgrass Marsh ³	0	1	1	—	—
	Red Mangrove Scrub-Sawgrass Marsh Total	5	6	6	83	100
Red Mangrove Scrub-Spikerush Marsh	Red Mangrove Scrub-Spikerush Marsh	1	1	1	—	—

¹accepted vegetation height discrepancy

²accepted vegetation cover discrepancy

³accepted species discrepancy

⁴accepted modifier discrepancy

Table C-1 (continued). Accuracy assessment table for the Region 3 vegetation map.

Map Annotation	Accuracy Assessment Annotation	One-to-One Matched Points	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Red Mangrove Scrub-Spikerush Marsh (continued)	Red Mangrove Scrub-Open Marsh ³	0	1	1	—	—
	Red Mangrove Scrub-Spikerush Marsh Total	1	2	2	50	100
Red Mangrove Shrubland	Red Mangrove Shrubland	9	9	9	—	
	Red Mangrove Scrub-Cordgrass Marsh ³	0	1	1	—	
	Red Mangrove Scrub-Dominant ²	0	2	2	—	
	Red Mangrove Shrubland Total	9	12	12	75	100
Saltgrass-Sand Cordgrass Marsh	Sand Cordgrass Marsh ³	0	1	1	—	—
	Saltgrass-Sand Cordgrass Marsh Total	0	1	1	0	100
Sand Cordgrass Marsh	Buttonwood-White Mangrove Scrub-Cordgrass Marsh	0	0	1	—	—
	Sand Cordgrass Marsh Total	0	0	1	100	100
Sawgrass-Black Rush Marsh	Red Mangrove Scrub-Black Rush Marsh ³	0	1	1	—	—
	Sawgrass-Black Rush Marsh Total	0	1	1	0	100

¹accepted vegetation height discrepancy

²accepted vegetation cover discrepancy

³accepted species discrepancy

⁴accepted modifier discrepancy

Table C-1 (continued). Accuracy assessment table for the Region 3 vegetation map.

Map Annotation	Accuracy Assessment Annotation	One-to-One Matched Points	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Short Sawgrass Marsh-Dense	Short Sawgrass Marsh-Dense	10	10	10	—	—
	Red Mangrove Scrub-Sawgrass Marsh	0	0	1	—	—
	Sawgrass-Sand Cordgrass Marsh ³	0	1	1	—	—
	Tall Sawgrass Marsh-Dense ⁴	0	3	3	—	—
	Transitional Bayhead Swamp Scrub-Sawgrass Marsh ²	0	1	2	—	—
	Short Sawgrass Marsh-Sparse ⁴	0	2	3	—	—
	Short Sawgrass Marsh-Dense Total	10	17	20	50	85
Spikerush Marsh	Short Sawgrass Marsh ³	0	1	1	—	—
	Spikerush Marsh Total	0	1	1	0	100
Succulent Salt Marsh	Saltwort Marsh ³	0	1	1	—	—
	Succulent Salt Marsh Total	0	1	1	0	100
Tidal Flat	Black Mangrove-Red Mangrove Forest	0	0	1	—	—
	Tidal Flat Total	0	0	1	0	0

¹accepted vegetation height discrepancy

²accepted vegetation cover discrepancy

³accepted species discrepancy

⁴accepted modifier discrepancy

Table C-1 (continued). Accuracy assessment table for the Region 3 vegetation map.

Map Annotation	Accuracy Assessment Annotation	One-to-One Matched Points	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Transitional Bayhead Forest	Transitional Bayhead Forest	1	1	1	—	100
	Transitional Bayhead Shrubland ¹	0	1	1	—	
	Transitional Bayhead Forest Total	1	2	2	50	
Transitional Bayhead Shrubland	Transitional Bayhead Shrubland	3	3	3	—	—
	Buttonwood Scrub-Sawgrass Marsh	0	0	3	—	—
	Buttonwood Shrubland	0	0	1	—	—
	Buttonwood-Red Mangrove Shrubland	0	0	1	—	—
	Red Mangrove Scrub-Dominant	0	0	1	—	—
	Red Mangrove Scrub-Sawgrass Marsh	0	0	2	—	—
	Red Mangrove Shrubland	0	0	1	—	—
	Transitional Bayhead Swamp Scrub-Sawgrass Marsh ²	0	1	1	—	—
	Transitional Bayhead Shrubland Total	3	4	13	23	31

¹accepted vegetation height discrepancy

²accepted vegetation cover discrepancy

³accepted species discrepancy

⁴accepted modifier discrepancy

Table C-1 (continued). Accuracy assessment table for the Region 3 vegetation map.

Map Annotation	Accuracy Assessment Annotation	One-to-One Matched Points	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
Transitional Bayhead Swamp Scrub-Sawgrass Marsh	Transitional Bayhead Swamp Scrub-Sawgrass Marsh	4	4	4	—	—
	Buttonwood Scrub-Sawgrass Marsh	0	0	1	—	—
	Red Mangrove Scrub-Sawgrass Marsh	0	0	2	—	—
	Transitional Bayhead Shrubland ²	0	2	2	—	—
	Transitional Bayhead Swamp Scrub-Sawgrass Marsh Total	4	6	9	44	67
Water	Water	26	26	26	—	—
	Red Mangrove Forest	0	0	1	—	—
	Tidal Flat ²	0	2	2	—	—
	Water Total	26	28	29	90	97
White Mangrove Forest	White Mangrove Shrubland ²	0	2	2	—	—
	White Mangrove Forest Total	0	2	2	0	100
White Mangrove Scrub-Black Rush Marsh	White Mangrove Scrub-Black Rush Marsh	1	1	1	—	—
	White Mangrove Scrub-Black Rush Marsh Total	1	1	1	100	100

¹accepted vegetation height discrepancy

²accepted vegetation cover discrepancy

³accepted species discrepancy

⁴accepted modifier discrepancy

Table C-1 (continued). Accuracy assessment table for the Region 3 vegetation map.

Map Annotation	Accuracy Assessment Annotation	One-to-One Matched Points	Number of Accepted Points	Number of Accuracy Assessment Points	One-to-One Match Correct (%)	Final Map Annotation Assessment (%)
White Mangrove-Red Mangrove Forest	Red Mangrove Forest ³	0	1	1	—	—
	Red Mangrove Shrubland	0	0	1	—	—
	White Mangrove-Red Mangrove Shrubland ¹	0	1	1	—	—
	White Mangrove-Red Mangrove Forest Total	0	2	3	0	67
White Mangrove-Red Mangrove Shrubland	Buttonwood-Red Mangrove Shrubland ³	0	1	1	—	—
	Red Mangrove Shrubland ³	0	2	2	—	—
	White Mangrove Shrubland ³	0	1	1	—	—
	White Mangrove-Red Mangrove Shrubland Total	0	4	4	0	100
Total	—	150	219	245	61	89

¹accepted vegetation height discrepancy

²accepted vegetation cover discrepancy

³accepted species discrepancy

⁴accepted modifier discrepancy

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 160/148829, October 2018

National Park Service
U.S. Department of the Interior



[Natural Resource Stewardship and Science](#)

1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525