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Natural Resource Stewardship and Science

Biscayne National Park Vegetation Map Project

Natural Resource Technical Report NPS/SFCN/NRTR – 2013/774



ON THE COVER
An aerial view of the mangroves and tidal channels of the Rubicon Keys in Biscayne National Park.
Photograph by: National Park Service South Florida / Caribbean Network.

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Project Summary

The draft Biscayne National Park (BISC) vegetation map was created by Pablo L. Ruiz, Patricia A. Houle, and Michael S. Ross of Florida International University (Cooperative agreement H500 06 5040 Task agreement J2117062272) with the National Park Service South Florida / Caribbean Inventory and Monitoring Network conducting the accuracy assessment and assembling the final joint report and deliverables.

Biscayne National Park's 3,096 hectares of terrestrial vegetation, including the wetlands along the western shore of Biscayne Bay, mangrove islands in the bay, and islands that parallel the mainland, were mapped with a vector-based approach using photo-interpretation of Florida Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute (FWRI) 2005 aerial imagery (30cm, 5-band) as well as 2002 Light Detection and Ranging (LiDAR) data (mainland only). An additional 429 hectares were mapped in areas immediately adjacent to the park boundary. The map was made in UTM, NAD 83, Zone 17N coordinates with a minimum mapping unit of $400m^2$ with notable smaller objects mapped at the photo-interpreter's discretion. The vegetation classification system used is a 6-level hierarchical vegetation classification system developed by Rutchey et al. (2006, ver. 5/22/2007) with 29 new map classes added in this project. Digitized polygons were classified to the highest feasible level of resolution. The map consists of a total of 3,524 hectares delineated into 4,672 polygons representing 100 map classes and using 1,081 training field points. A high resolution shoreline layer was also created as part of this project.

An accuracy assessment of the draft map was conducted by the National Park Service South Florida/Caribbean Inventory and Monitoring Network. The assessment included the imagery positional accuracy, the map positional accuracy, and vegetation classification accuracy. The horizontal accuracy of the aerial imagery was checked using 12 ground control locations and measured ±2.7m at the 95% confidence level. The positional accuracy of well-defined map features was checked with 25 positional accuracy assessment locations and measured ±2.5m at the 95% confidence level. The vegetation classification accuracy was checked using a total of 390 locations to determine if the vegetation community observed in the field matched the annotated map classification at the most detailed level. The draft Biscayne National Park vegetation map's overall accuracy is 83.3% (325 of 390 accuracy assessment locations were acceptable) with a lower 90% confidence level of 80.7% accuracy (Kappa index 82.6%) when assessed at the most detailed level of the classification. The draft Biscayne National Park vegetation map was updated to include corrections to polygons based on findings from the 390 accuracy assessment locations. The final map product for this project is this updated map and is refered to as the Biscayne National Park vegetation map.

Table 1. Summary of area (hectares) of major vegetation types of Biscayne National Park (BISC).

Major Vegetation Type	Mainland - Inside BISC	Mainland Mapped Outside BISC	Elliott Key	Old Rhodes Key	Totten Key	Sands Key	Little Totten Key	Long Arse-nicker	Swan Key	Adams Key	Boca Chita Key	Other Islands	Grand Total
Mangrove	1359.01	312.91	201.82	199.69	126.61	124.98	76.35	52.22	34.09	16.00	3.76	105.06	2612.50
Hammock		8.89	461.00	99.81	58.79	38.44	29.18		12.52	13.13	1.46	8.12	731.35
Anthropogenic	22.48	84.81	2.63							1.31	5.41	0.40	117.03
Other - Natural	17.53	4.13	1.55	1.31	0.67	0.15	1.68		1.10	0.02	1.87	0.31	30.33
Exotic	3.14	6.41	4.94									0.12	14.61
Saltwater Marsh	3.41	5.99					0.08			0.05	0.33	0.004	9.86
Freshwater Marsh		5.39											5.39
Beach			1.53			0.45					0.13	0.07	2.18
Herbaceous Dune			0.40									0.48	0.88
Grand Total	1405.57	428.52	673.87	300.82	186.07	164.02	107.30	52.22	47.71	30.51	12.95	114.57	3524.12

Acknowledgments

We wish to acknowledge the National Park Service (NPS) Vegetation Inventory Program for funding this important project. We would like to thank the NPS staff at Biscayne National Park for their logistical support in providing much needed transportation and equipment essential to complete this project. Special thanks go out to the staff and pilots of HMC helicopters for their service and professionalism. We would also like to thank Mike Kline, Pete Harlem, Jonathan Moser, Jose Luciani, and Eric Sudalter, for assisting in the collection of field data. Pete Harlem was also instrumental in the unearthing of many historical documents as well as aerial photographs, which contributed to our understanding of the geology and ecology of Biscayne National Park. Lastly we would like to thank everyone who assisted in this project for their time and expertise.

Introduction

Biscayne National Park Vegetation Mapping Project Overview

The purpose of this project was to create a spatially and thematically accurate vector map of the terrestrial plant communities of Biscayne National Park (BISC). The National Park Service (NPS) Vegetation Inventory Program (VIP) funded the project. The South Florida/Caribbean Inventory and Monitoring Network (SFCN) of the National Park Service conducted the BISC vegetation mapping project as a joint effort with Florida International University (FIU). The draft map was created by Pablo L. Ruiz, Patricia A. Houle, and Michael S. Ross of Florida International University through photointerpretation of a combination of 2005 aerial imagery and 2002 LiDAR data (Cooperative Agreement H500 06 5040 Task agreement J2117062272). The SFCN conducted the positional accuracy assessment and vegetation classification accuracy assessment following NPS-VIP accuracy standards. In a joint effort, SFCN and FIU created a final map product that updated polygon annotations based on accuracy assessment field data.

Biscayne National Park

Established as a National Park in 1980, Biscayne National Park (BISC) is one of the largest marine parks in the National Park System (Figure 1). It comprises an area of nearly 700 km^2, of which 95% is under water. The remaining 5% consists of a network of freshwater and brackish wetlands along the western shore of Biscayne Bay, mangrove islands in the bay, and islands that parallel the mainland and which define the eastern edge of Biscayne Bay. While these terrestrial communities are limited in area, about 31 km^2, they account for many miles of shoreline, and include a significant portion of the park's biodiversity. Mangrove communities (forest, woodland, shrubland, and scrub) are by far the most abundant vegetation type found within BISC. Additionally coastal hardwood hammocks are an important community type found within BISC that support many unique Caribbean species of trees which are at their most northern limit. Additionally, these hammocks support endangered species such as Semaphore Prickly-pear Cactus and the Schaus Swallowtail butterfly.

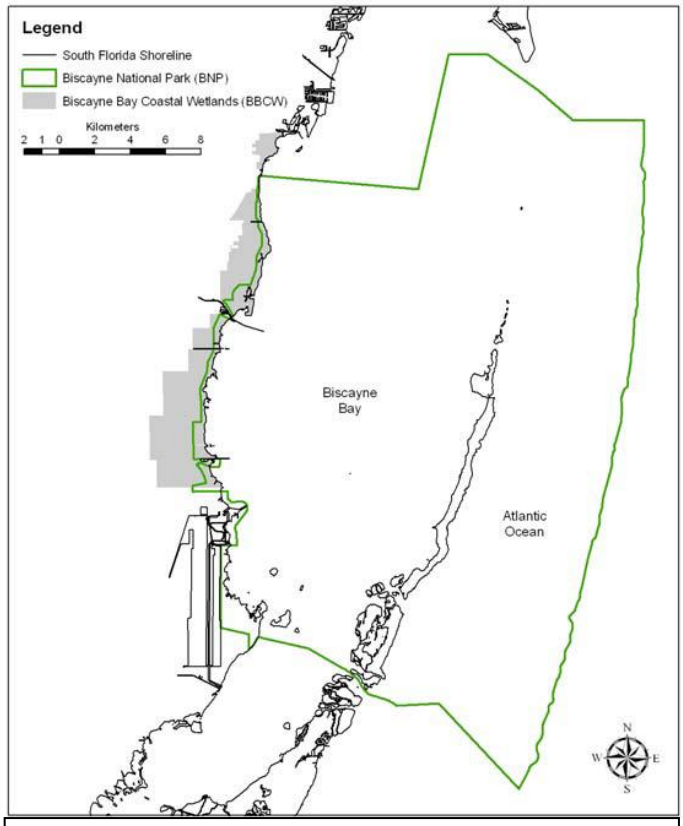


Figure 1. Biscayne National Park (BISC)

Topo-lithographic maps of the park based on 1928 aerial photographs date back to the early 1930's. Although not intended to be

used as vegetation maps, these 1:20,000 scale topographic sheets are likely the first comprehensive vegetation maps that exist of BISC. These topographic sheets depict the vegetation of BISC as a mosaic of broad scale community types characterized by deciduous hammocks, high ground deciduous forests, mangroves, sawgrass on rock, and sloughs and document the extent of anthropogenic alteration in these natural areas for the period.

Other maps of BISC include the 1943 and 1967 maps of Davis, the 1999 Florida statewide Water Management District land cover map, and the 2007 National Wetland Inventory map, among others. Unfortunately, all of these mapping efforts failed to capture the natural complexity and structure of the vegetation communities of BISC. To date, the only two mapping efforts which have succeeded at capturing the nature of the vegetation within BISC are the 1999 vegetation map of Welch et al. (1999) (Figure 2) and the 2002 vegetation map of Ross and Ruiz (2003) (Figure 2). Unfortunately, the Welch et al. 1999 map is nearly 10 years old and represents the conditions of BISC shortly after Hurricane Andrew (August 24, 1992). The Ross and Ruiz 2003 map, on the other hand, while spatially and thematically accurate, was limited in area and only included a small portion of the park along its western shore (Figure 2).

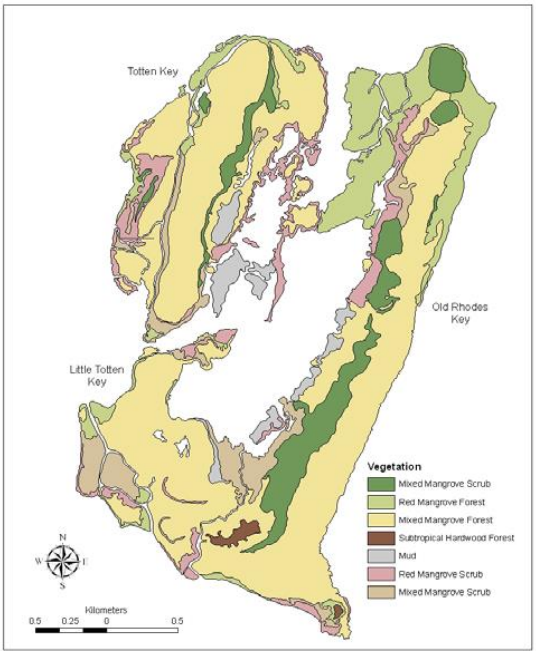


Figure 2. Welch et al. (1999) vegetation map Of Old Rhodes, Totten, and Little Totten Keys, Biscayne National Park.



Figure 3. Ross and Ruiz (2003) vegetation map of the Biscayne Bay Coastal Wetlands between Princeton and Mowry canals.

In 2006, because of the lack of a current, accurate, and useful vegetation map of BISC, the SFCN commissioned the development of a spatially and thematically accurate vegetation map of BISC. This map provides a spatial inventory of the plant communities within the park's jurisdiction with a level of accuracy suitable for planning, implementing, and quantifying management decisions and restoration efforts for the next several decades.

Purpose and layout of this report

This report summarizes the steps involved and the results of the Biscayne National Park (BISC) vegetation mapping project, outlines the various products created, and is organized, together with its associated files, to meet the specifications of the NPS Vegetation Inventory Program. This project is the combined result of the following two efforts:

- Creation of a draft vector map by Pablo Ruiz, Mike Ross and Patricia Houle of Florida International University (See Appendix A).
- Assessment of the positional and classification accuracy of the map product by Kevin R. T. Whelan, Brooke Shamblin, Andrea Atkinson, Judd Patterson, and Brian Witcher of the NPS South Florida/Caribbean Inventory and Monitoring Network (See Appendix B).

The details of these two efforts are found in the respective appendix reports and their results are only briefly summarized here.

Methods

Creation of the map involved the following phases detailed below:

- Imagery Acquisition
- Selection of Vegetation Classification
- Draft Vegetation Map Creation by Florida International University
- Accuracy Assessment of Map by South Florida/Caribbean Network
- Refinement and Finalization of Polygon Classification

Imagery Acquisition

The Florida Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute (FWRI), provided the imagery used in this project. The imagery consists of a set of 316 images taken by Photo Science in May 2005. The images are a comprehensive set of 5-band (Red, Green, Blue, NIR, and Pan-Chromatic) stacked multispectral orthophotos derived from three separate products. According to the metadata, the images were flown at an average altitude of 3,142.2 m which produced an image scale of 1:26,185. Each image covers an area of about 10.5 km^2 with an average overlap of approximately 23% between adjacent images. The images are projected to NAD83 UTM Zone 17N and have a spatial resolution of 0.3048 meters (1ft).

The LiDAR data used in this project was provided and flown by Florida International University International Hurricane Research Center (IHRC 2004). This data was part of a 2002-2003 survey of Miami-Dade County, Florida. However, the extent of the LiDAR coverage for BISC was, unfortunately, limited to the uplands on the western shore of Biscayne Bay starting just north of Turkey Point and did not include any of the islands within BISC. The flight and laser acquisition parameters (altitude, speed, and scan angle, scan rate, and pulse rate) produced, on average, a 650-meter-wide swath of 30 cm wide laser footprints with a nominal point spacing of 1.5 m (IHRC 2004).

Selection of Vegetation Classification

For this map the Vegetation Classification System for South Florida Natural Areas (Rutchey et al. 2007 v5.22.07) was used as the basis for the BISC vegetation classification (Appendix C). The Rutchey et al. (2007) document provides a hierarchical classification system, up to six levels, with level 6 the most detailed and specific. "The different levels of this classification system represent distinctions in ecological communities, taxonomy, individual species, and physical characteristics such as density and height" (Rutchey et al. 2007). This document provides a good identification of vegetation communities in South Florida natural areas and was created by a joint effort of south Florida botanists and vegetation mapping experts including university scientists, federal and state agency staff, and local consultants. Although the classification should be compatible with the National Vegetation Classification System (NVCS), an official cross-walk has not been made. While the classification system attempted to address all south Florida vegetation communities, new ones have inevitably been found and thus the classification is versioned with new additions and changes carefully documented. Version 5.22.07 was used in this project and mapping to "Level 3" in the classification was the minimum resolution required, with the option to map to more detailed levels at the photo-interpreter's discretion.

The classification was adapted by the photo-interpreter to meet the needs of this project in several ways:

- New categories were added when existing ones were did not match vegetation communities found within Biscayne National Park
- Classification Raster ID's were changed from the Rutchey et al. (2007) classification, especially in the case of mangroves to create similar Raster ID patterns across Mangrove Forest, Woodland, Shrub and Scrub to increase speed of coding and reduce error.
- In cases where the Rutchey et al. (2007) classification jumps levels, e.g. from level 4 to level 6 without an intermediate level 5 classification, the current map classification moves the level 6 class up to level 5.
- The photo-interpreter altered some map class definitions so they would fit within MS Office Access and ESRI ArcMap 9.2 personal geodatabase maximum cell character limit of 254 characters. However the reader is referred to the original Rutchey et al. (2007) definitions as the most appropriate definitions.

Draft Vegetation Map Creation by Florida International University

Two separate computer aided classification algorithms, unsupervised and image object segmentation classification, were tried to automate and standardize the delineation of the upland vegetation communities present within BISC. The unsupervised classification was performed in ERDAS Imagine 9.1 while the segmentation of image objects was performed in Definiens Professional® v5. For mapping vegetation communities, Definiens Professional® v5 was mostly unproven but offered tremendous benefits as a remote sensing tool. In contrast to traditional remote sensing classification algorithms, e.g., supervised or unsupervised pixel classification, in which an image is classified at the pixel level, Definiens Professional® v5 classifies images in terms of image objects and their mutual relationships. In other words, pixels with similar brightness values and/or other spectral characteristics are aggregated into image objects (See Appendix A, p. 7 for specific information regarding the methodology used). These image objects are then the target of a supervised classification that assigns thematic classes to each image object. Regrettably, neither one of the two classification methodologies attempted in this mapping effort produced adequate results. However, very fine scale shorelines were effectively and consistently segmented into image objects using Definiens Professional® v5.

Ultimately, vegetation communities were screen digitized at an on screen scale of 1:1500 using ESRI® ArcMapTM 9.2. Delineation of vegetation communities was aided by the use of the Normalized Difference Vegetation Index (NDVI) and Light Detection and Ranging (LiDAR) data, which was available for the mainland portions of BISC. The vegetation map produced was projected to NAD83, UTM Zone 17N (units = meters) and the minimum mapping unit was 400 m^2. Digitized polygons were classified to the highest feasible level of resolution within the six-tiered hierarchical Rutchey et al. (2007) vegetation classification system.

Field data was collected at 1,081 training points (Figure 4). This collection of data helped refine the classification process and ensured that the map would meet the expected accuracy. Field observations primarily focused on data needed to place the vegetation community into a map class.

Data recorded typically included different levels of the vegetation classification and/or final map class, and on occasion, canopy species composition, herbaceous layer species composition, canopy height, canopy cover, and substrate. This information was then used to interpret the spectral signature of unknown types based on the spectral signature of known communities verified by the ground-referenced locations. (See Appendix A for the detailed vegetation mapping methodology, Appendix D for Map Class Descriptions and Photos, and Appendix E for Species Names from Field Training Points).

Accuracy Assessment of Map by South Florida/Caribbean Network

Imagery Horizontal Accuracy

The horizontal accuracy of the aerial imagery was determined by analyzing 12 control point locations spread across the imagery. Imagery control points were selected by inspecting the 2005 imagery for well-defined corners, signs, and parking lot lines. In areas where suitable man-made features did not exist, small, isolated, red mangroves were selected and their centroid was used as the control point. All locations were visited in November 2007 by a team using a Trimble GeoXT GPS unit. At least 120 positions were averaged together to create each control point and differential correction was applied in Trimble Pathfinder Office software to increase spatial accuracy.

Map Feature Positional Accuracy

The positional accuracy of map features was checked by analyzing 25 control point locations scattered across the map. Positional accuracy control points were selected by inspecting the December 2008 vegetation map deliverable and choosing well defined locations including seawalls and docks. In order to create an appropriate spread of points across the park, the centroids of small, isolated red mangroves were once again included. All positional control points were visited by a field crew in January 2009 with a Trimble GeoXT GPS unit. Each control point was created by averaging at least 120 positions together and differential correction was applied in Trimble Pathfinder Office. Several control points used in determining the horizontal accuracy of the imagery were also included in the positional accuracy assessment.

Map Classification Accuracy

There were 390 accuracy assessment points visited in the field. A total of 220 of these locations were assessed using the "point method" in which a randomly chosen 10m radius circle was visited and evaluated, and 170 locations were assessed using the "polygon method" in which the classification of the entire randomly chosen polygon was assessed (used for small polygons only which were easily viewed in their entirety). At each accuracy assessment point (or polygon) two botanists visited the location via a helicopter and observed the vegetation community present. If both botanists agreed that

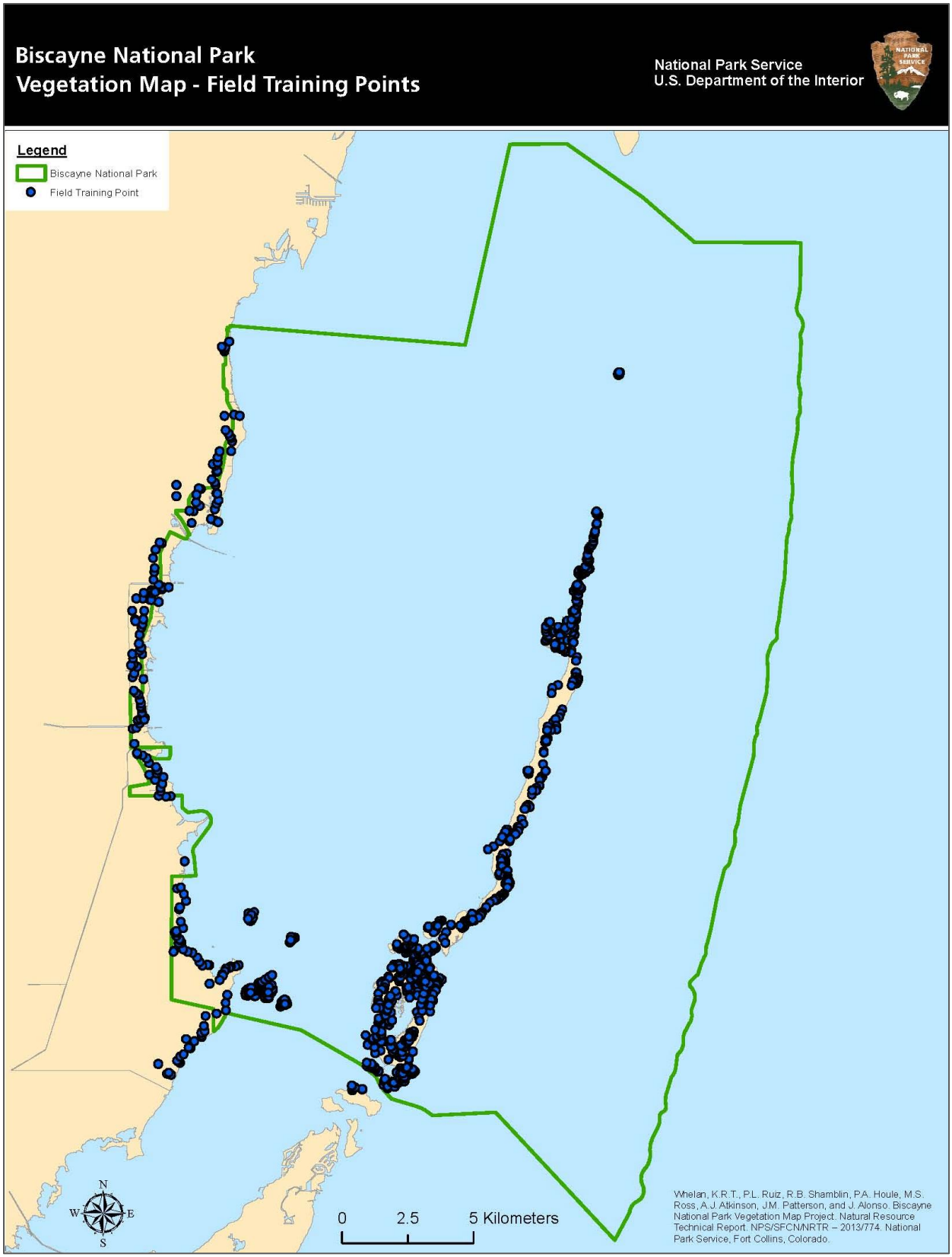


Figure 4. Map of field training points.

the vegetation present corresponded to the map annotation, the point was classified as correct and the botanists proceeded to the next accuracy assessment point. If either botanist felt the vegetation present did not agree with the map annotation, then field data was collected to judge assessment. The sampling design of the accuracy assessment was conducted at Level 3 of the classification as this was the original plan for the project and an expansion to all map classes would require a substantial increase in costs. However as the photo-interpreter occasionally mapped to greater detail, often up to Level 6 in the hierarchical vegetation classification, wherever an accuracy assessment point fell within a polygon that was classified to greater detail (i.e., Level 4-6 of the classification), the field point was evaluated at that level. Anthropogenic areas were not included in the accuracy assessment. (See Appendix B for the detailed accuracy assessment methodology).

Refinement and Finalization of Polygon Classification and Map Product

The final map product is an updated version of the draft vector map based upon the accuracy assessment results. For points that had some form of disagreement between the map annotation and the field classification, SFCN staff in consultation with Pablo Ruiz and Mike Ross of Florida International University, updated the map to match the field classification.

In addition, the method used to generate the draft map created polygons on an image tile by image tile basis. This resulted in adjacent polygons with the same classification split along image tile borders. These adjacent polygons with the same classification have been merged in the final map product. Also polygons that crossed the park boundary were split to allow easy querying of the map within the park boundary.

Results and Discussion

Imagery and Positional Accuracy

Based upon the 12 field visited aerial imagery control points, the RMSE horizontal accuracy of the 2005 imagery was ±1.5 meters. The National Standard for Spatial Data Accuracy (NSSDA) offers a more rigorous test of horizontal accuracy, which was calculated at ±2.7m at the 95% confidence level. Based upon the 25 field visited positional control points, the RMSE positional accuracy of well-defined map features was ±1.4 meters. The NSSDA test of horizontal accuracy was calculated to be ±2.5m at the 95% confidence level.

Vegetation Classification, Hierarchical Key

Vegetation communities within the park were classified to the highest feasible level of resolution, typically classified at Level 6 (typically equivalent to the association level of the National Vegetation Classification System (NVCS)) of the six-tiered hierarchical vegetation classification system developed by Rutchey et al. (2007). A total of 100 map classes were used. However, not all communities mapped were listed within this classification system. At the same time, many of the communities listed in the Rutchey et al. (2007) classification system were not observed within the boundaries of BISC. As a result, the classification system used in this project was modified to include all community types observed and mapped and it excluded types not present within the mapping area.

The map has 100 different map classes. Twenty-nine new map classes were added to the Rutchey et al. (2007) classification system including 15 plant communities, 3 non-vegetative natural map classes and 11 anthropogenic map classes. The hierarchical vegetation key for this map is provided in Appendix C with new classes marked and a cross-walk of map class definitions and Rasterr_ID codes with the Rutchey et al. (2007) classification is provided. Final map classes and descriptions with photos are provided in Appendix D. The original Rutchey et al. (2007) classification is provided for reference purposes in Appendix J.

Vegetation Map and Shoreline

The final vegetation map consists of 4,676 polygons (Figure 5). The total mapped area is 35.2 km^2 of which 31 km^2 are within the borders of BISC. Nearly 55% (16.9 km^2) of these 31 km^2 correspond to the island habitat alone. The residual 4.3 km^2 (i.e., the difference between the total area mapped and the area mapped corresponding to BISC) consist of sections of the mainland that are adjacent to the park boundary (See Figure 5). Appendix F has printable versions of the whole park map and sectional maps highlighting the different islands.

Forest communities within BISC (i.e., mangrove forest & hammock forest), account for 48.0% of the total area mapped. The shrubland and scrub communities combine for 47.6% of all vegetation area. The remaining area was unevenly distributed between woodland (2.2%), marsh (0.1%), dune (0.03%), and exotic (0.3%) communities (Table 2). As an alternative breakdown, mangrove vegetation classes (mangrove forest, woodland, shrub, and scrub) cover 74% of the park, hammock/hardwood forest, woodland, shrub and scrub cover 23% of the park with other general

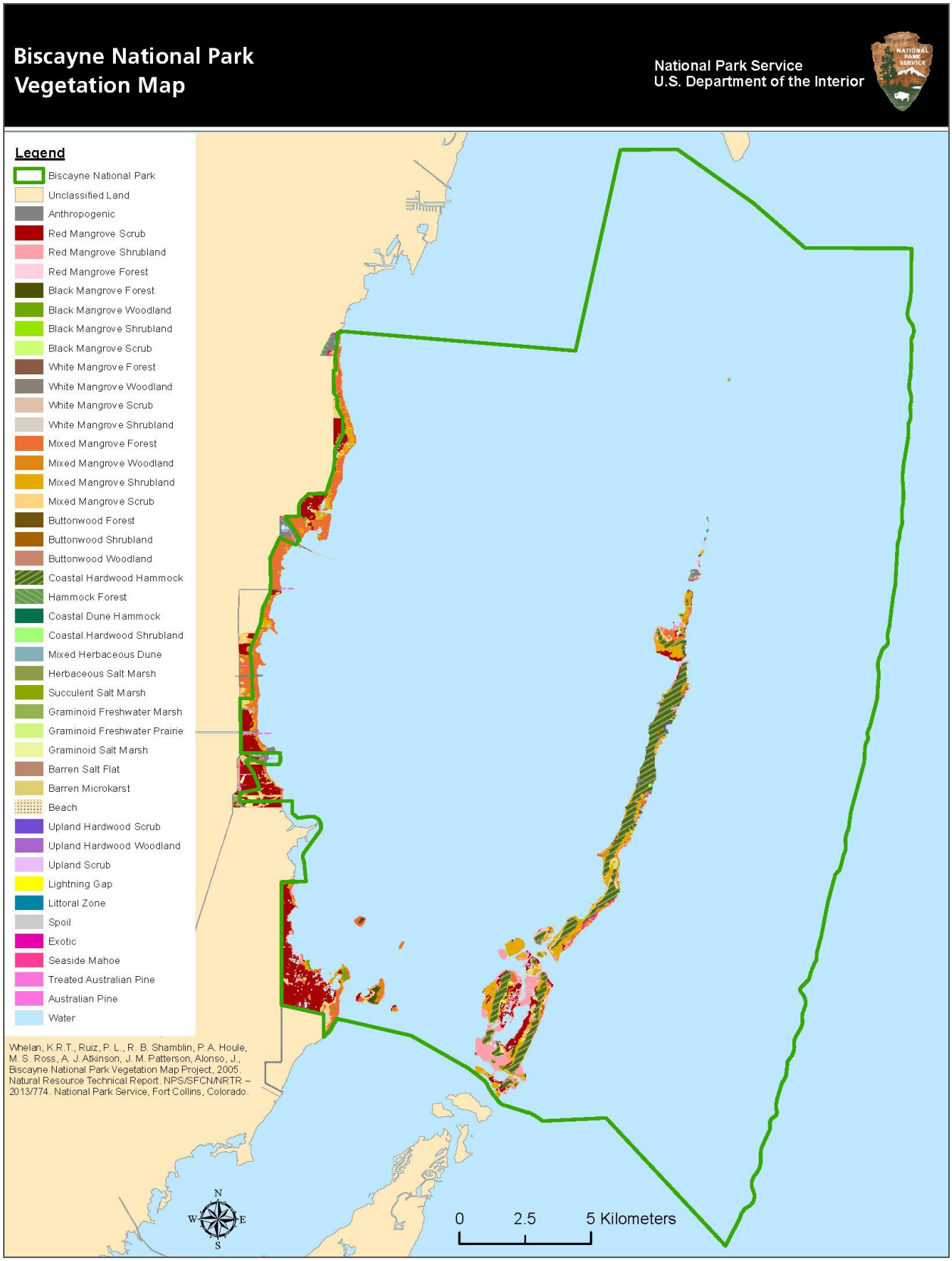


Figure 5. Biscayne National Park vegetation map.

Table 2. Biscayne National Park summary of vegetation community area (hectares) and percent of total at Level 3 in the vegetation classification with the exception of Exotics which are summarized at Level 1 and Anthropogenic classes which are summarized at Level 2. Does not include areas outside of BISC boundaries. See Appendix G for complete summary by full detail map class and by major islands.

Class (L1)	Group (L3)	Area (ha)			Percent		
		Mainland	Islands	Total	Mainland	Islands	Total
Forest	Black Mangrove Forest	5.7	38.1	43.8	0.4%	2.3%	1.4%
	Buttonwood Forest		8.0	8.0		0.5%	0.3%
	Coastal Dune Hammock		3.4	3.4		0.2%	0.1%
	Coastal Hardwood Hammock		708.7	708.7		41.9%	22.9%
	Mixed Mangrove Forest	525.2	117.9	643.0	37.4%	7.0%	20.8%
	Red Mangrove Forest	44.8	31.5	76.3	3.2%	1.9%	2.5%
	White Mangrove Forest		1.1	1.1		0.1%	0.04%
Woodland	Black Mangrove Woodland	13.8	7.7	21.6	1.0%	0.5%	0.7%
	Buttonwood Woodland		13.1	13.1		0.8%	0.4%
	Mixed Mangrove Woodland	2.3	26.4	28.7	0.2%	1.6%	0.9%
	Upland Hardwood Woodland		2.7	2.7		0.2%	0.1%
	White Mangrove Woodland		1.0	1.0		0.1%	0.03%
Shrubland	Black Mangrove Shrubland		8.2	8.2		0.5%	0.3%
	Buttonwood Shrubland		8.3	8.3		0.5%	0.3%
	Coastal Hardwood Shrubland		6.2	6.2		0.4%	0.2%
	Mixed Mangrove Shrubland	168.7	286.8	455.5	12.0%	17.0%	14.7%
	Nicker Bean Shrubland		0.05	0.05		0.003%	0.001%
	Red Mangrove Shrubland	40.8	260.0	300.8	2.9%	15.4%	9.7%
	Upland Shrubland		0.3	0.3		0.02%	0.01%
	White Mangrove Shrubland	1.0	0.9	1.9	0.1%	0.1%	0.1%
Scrub	Black Mangrove Scrub		9.9	9.9		0.6%	0.3%
	Mixed Mangrove Scrub	57.0	37.4	94.4	4.1%	2.2%	3.0%
	Red Mangrove Scrub	499.7	81.0	580.7	35.6%	4.8%	18.8%
	Upland Hardwood Scrub		1.5	1.5		0.1%	0.05%
	Upland Scrub		1.8	1.8		0.1%	0.1%
	White Mangrove Scrub		3.2	3.2		0.2%	0.1%
Marsh	Graminoid Salt Marsh	3.4	0.05	3.5	0.2%	0.003%	0.1%
	Herbaceous Salt Marsh		0.1	0.1		0.003%	0.002%
	Succulent Salt Marsh		0.4	0.4		0.02%	0.01%
Dune	Mixed Herbaceous Dune		0.9	0.9		0.1%	0.03%
Exotic	Exotic	3.1	5.1	8.2	0.22%	0.299%	0.3%
Other	Anthropogenic	22.5	9.7	32.2	1.6%	0.6%	1.0%
	Barren Microkarst		2.0	2.0		0.1%	0.1%
	Barren Salt Flat		0.4	0.4		0.02%	0.01%
	Beach		2.2	2.2		0.1%	0.1%
	Lightning Gap	0.2	0.01	0.2	0.01%	0.0003%	0.01%
	Littoral Zone		0.2	0.2		0.01%	0.01%
	Water	17.4	4.0	21.4	1.2%	0.2%	0.7%
Total		**1405.6 (45.4%)**	**1690.0 (54.6%)**	**3095.6**	**100.0%**		

Table 3. Biscayne National Park vegetation community area (hectares) alternatively summarized by main physiognomic types, e.g. black mangrove forest, woodland, shrub, and scrub are combined into “Black Mangroves”. Excludes areas outside BISC boundaries. Small unnamed mangrove islands lumped with nearest named island or mainland. See Appendix G for complete summary by map class.

	Mainland (in park)	Adams Key	Boca Chita	Elliott Key	Little Totten Key	Long Arsenicker	Old Rhodes Key	Sands Key	Swan Key	Totten Key	Other Islands	Grand Total	%
HAMMOCK	***0.00***	***13.13***	***1.46***	***461.00***	***29.18***	***0.00***	***99.81***	***38.44***	***12.52***	***58.79***	***8.12***	***722.46***	***23.3%***
Coastal Dune Hammock								3.43				3.43	
Coastal Hardwood Hammock		13.13	1.46	461.00	29.18		99.81	35.01	12.52	58.79	8.12	719.03	
MANGROVES	***1359.01***	***16.00***	***3.76***	***201.82***	***76.35***	***52.22***	***199.49***	***124.98***	***34.09***	***126.81***	***105.06***	***2299.59***	***74.3%***
Black Mangroves	19.56	0.50	0.79	7.41	2.23	19.10	13.04	1.71	0.40	8.98	9.74	83.46	
Buttonwood		1.45	0.53	9.34	0.74	0.70	4.28	5.60	1.13	2.88	2.80	29.45	
Red Mangrove	585.34	6.15	0.09	30.13	68.47	8.70	132.56	22.02	16.05	58.17	30.12	957.81	
White Mangrove	0.97	0.16	0.05	0.001	0.45		1.92	1.34			2.40	7.29	
Mixed Mangrove	753.13	7.74	2.29	154.95	4.46	23.72	47.69	94.29	16.50	56.78	60.00	1221.58	
SALTWATER MARSH	***3.41***	***0.05***	***0.33***	***0.00***	***0.08***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.004***	***3.87***	***0.1%***
Graminoid Salt Marsh	3.41	0.05										3.46	
Herbaceous Salt Marsh			0.05									0.05	
Succulent Salt Marsh			0.28		0.08						0.004	0.37	
EXOTIC	***3.14***	***0.00***	***0.00***	***4.94***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.12***	***8.20***	***0.002%***
Australian Pine	0.74										0.06	0.81	
Exotic (unspecified)	0.17										0.06	0.23	
Seaside Mahoe				4.94								4.94	
Treated Australian Pine	2.22											2.22	
OTHER-NATURAL	***17.53***	***0.02***	***1.87***	***1.95***	***1.68***	***0.00***	***1.31***	***0.15***	***1.10***	***0.67***	***0.79***	***26.20***	***0.9%***
Barren Microkarst					0.68		0.59		0.71			1.98	
Barren Salt Flat				0.40								0.40	
Beach			0.13	1.53				0.45			0.07	2.18	
Lightning Gap	0.15										0.01	0.16	
Littoral Zone											0.17	0.17	
Mixed Herbaceous Dune				0.40							0.48	0.88	
Nicker Bean Shrubland				0.05								0.05	
Upland Scrub			1.82									1.82	
Upland Shrubland				0.26								0.26	
Water	17.38	0.02	0.05	0.85	0.99		0.72	0.15	0.39	0.67	0.13	21.36	
ANTHROPOGENIC	***22.48***	***1.31***	***5.41***	***2.63***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.40***	***32.23***	***1.0%***
GRAND TOTALS	***1405.57***	***30.51***	***12.95***	***673.87***	***107.30***	***52.22***	***300.62***	***164.02***	***47.71***	***186.27***	***114.57***	***3095.59***	

categories being minimal (Table 3). The largest single map class is Coastal Hardwood Hammock (709 ha) followed by Mixed Mangrove Forest (546 ha), Red Mangrove Scrub (388 ha), Mixed Mangrove Shrubland (387 ha), Red Mangrove Shrubland (301 ha) and Red Mangrove Scrub-Open Marsh (165 ha). All other map classes were less than 100 ha. Within the park, hardwood hammock, dune, beach, and barren salt flats and microkarst were only found on the islands. Freshwater marsh was only mapped outside the park. Of the mangroves, Mixed Mangrove classes (1222 ha) and Red Mangrove classes (958 ha) dominated. Appendix G contains additional map summary statistic tables at the map class level and by island.

The shoreline layer of the map contains 1,618 polygons (Figure 6). There are 24 named offshore islands that typically consist of many individual polygons. The unnamed polygons include the western shoreline of Biscayne Bay, spoil islands, and red mangrove shrubs scattered along the mainland side of the bay. The named islands account for 16.9 km^2 (4,175 acres) of land, and approximately 264 km of shoreline. There are 88 km of shoreline on the mainland side inside the park. Keep in mind that the shoreline is extremely detailed, and the mapping of tidal creeks, individual red mangroves, and mainland canals influences this shoreline estimate.

Accuracy Assessment

There were 390 accuracy assessment points visited in the field (Figure 7). There was an exact match in classification (complete agreement between NPS botanists and map point classification) for 295 of the 390 points (75.6%) at the most detailed level (Level 6). There was some form of disagreement with the map point classification for 95 of the 390 points (24.4%). An additional 30 points were accepted as having similar habitat classification for a total of 325 points. That is, 325 of the 390 total points were determined to be acceptable. The complete list of points and reasons for rejecting or accepting non-matching points are provided in Appendix B. Appendix H provides a summary matrix of the accuracy assessment results.

Analysis of vegetation classification errors

SFCN investigated the type of errors that occurred for the 65 incorrectly classified points. Analysis of the misclassifications between the vegetation types found in the field compared to what the map annotation for the accuracy assessment points are reported in Table 4 of the Accuracy Assessment report Appendix B.

Below we draw attention to just two map categories that did not meet the criteria of having an upper 90% confidence level of the percentage of points acceptable of 80% or higher (2-tailed test).

- Mixed Mangrove Scrub was found to be incorrect 15 out of 22 times (32% correct). This category was found most often (9 times) to be a Red Mangrove Scrub, and 4 times to be Red Mangrove Shrubland.
- Black Mangrove Forest was found to be incorrect 12 out of 20 times (40% correct). This category was found most often (10 times) to be a Mixed Mangrove Forest.

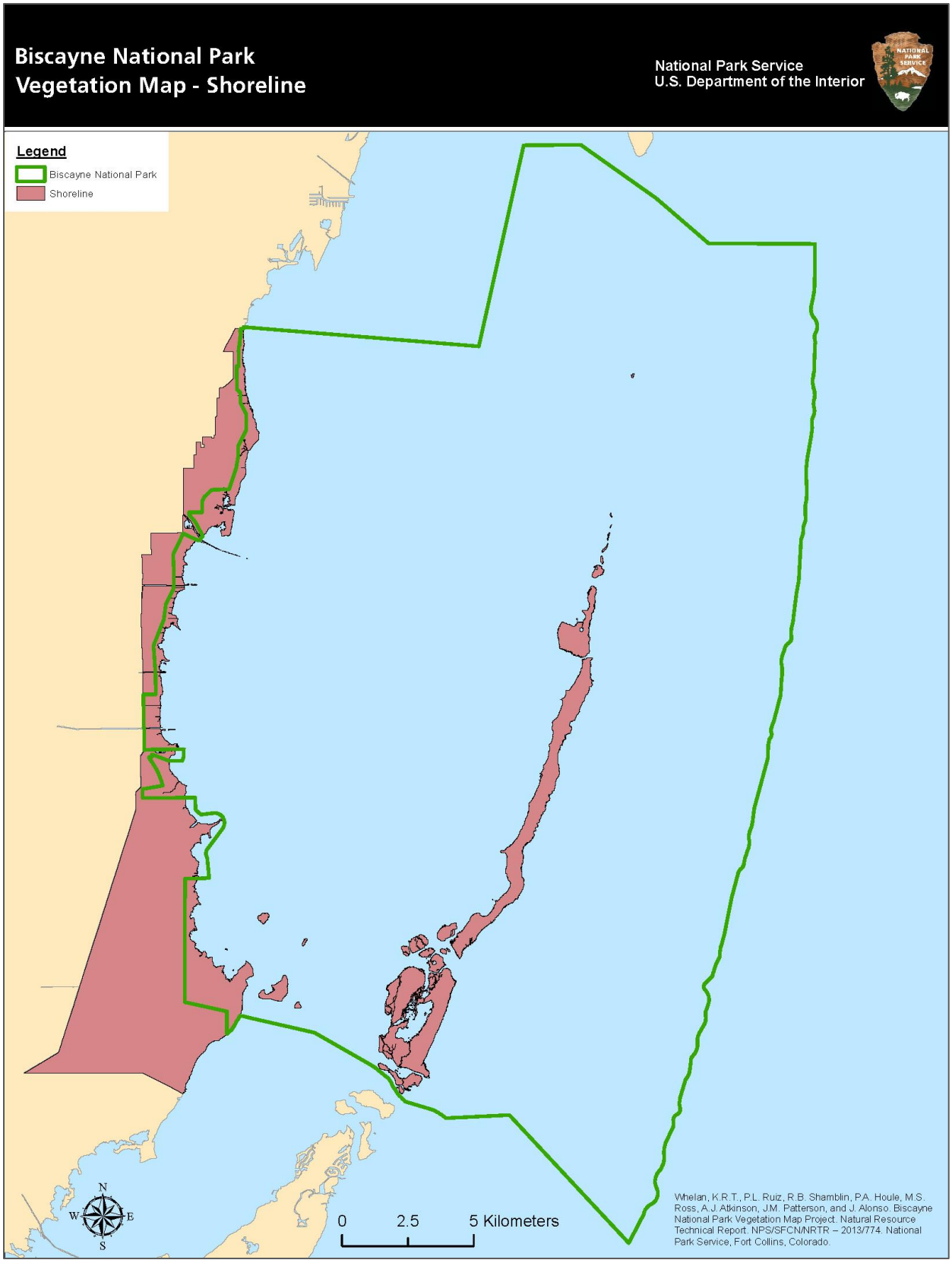


Figure 6. Biscayne National Park map of shoreline and western project boundary.

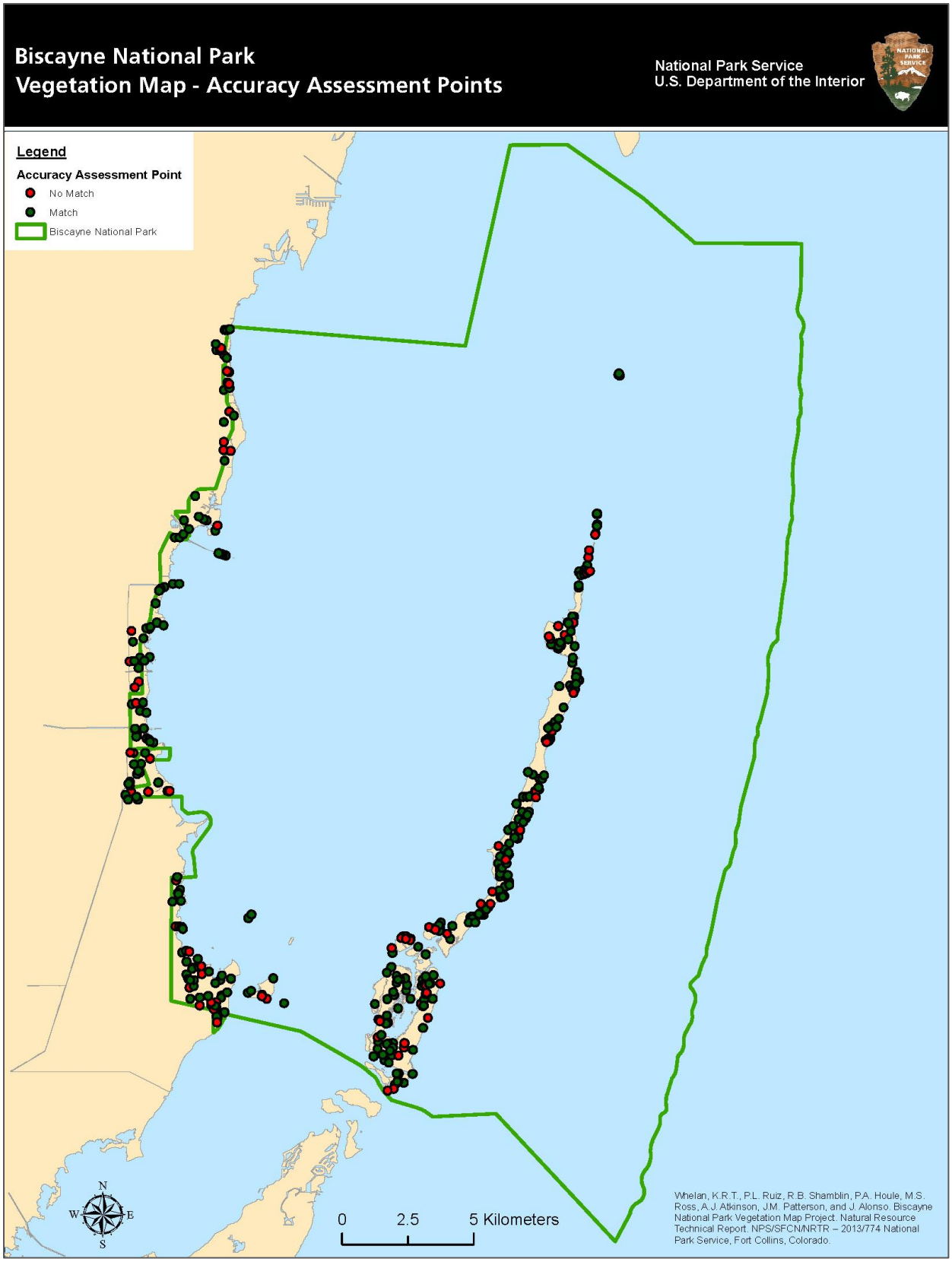


Figure 7. Map of 390 accuracy assessment points.

During the accuracy assessment if the assessment point was found to be different from the mapped annotation and the rest of the mapped polygon was correctly classified (i.e. the point was different form the rest of the polygon but below the minimum mapping unit) this was noted in the field but the accuracy assessment point was deemed to be correct.

Corrections to map

For all 95 points that had some form of disagreement between the map annotation and the field classification, SFCN staff in consultation with Pablo Ruiz and Mike Ross of Florida International University, updated the map to match the field classification. If it was possible that the accuracy assessment point could have fallen on a small patch, i.e. just below the minimum mapping unit size, that was embedded within a larger polygon that was annotated correctly on the map, the polygon was not updated. In a few cases the field botanists conducting the accuracy assessment also noted when a neighboring polygon was incorrectly classified and these were also corrected in the final map product.

See Appendix B for maps that indicate which locations had unacceptable, acceptable, or 100% match between field assessment and map annotation.

Conclusions and List of Final Products

This Biscayne National Park vegetation map, together with its precise 1:300 scale shoreline, should serve as a turn-of-the-21st century baseline for the extent of vegetation communities within Biscayne National Park. The entire park is only a few meters above mean sea level and this vegetation and shoreline map should be particularly useful for documenting the effects of sea-level rise, tropical storms, and other stressors, on the wetlands and forested communities of Biscayne National Park. The map should also be useful for park planning, assisting management of threatened and endangered species, and evaluating effects of restoration efforts and other activities.

Summary of Final Products and Files

The Biscayne National Park vegetation map was made in UTM, NAD 83, Zone 17N coordinates with a minimum mapping unit of 400m^2. Imagery data used was FWRI 2005 aerial imagery (30cm, 5-band) as well as 2002 Light Detection and Ranging (LiDAR) data. The vegetation classification used is adapted from Rutchey et al. (2007). The map consists of 4,676 polygons with 100 mapping classes of which 29 were new to the Rutchey et al (2007) classification. 390 accuracy assessment points and 1,081 training field points were conducted for this project. This map has an overall map accuracy of 83.3% with a lower 90% confidence level of 80.7% accuracy and with the kappa correction the overall map accuracy is estimated at 82.6%.

Table 4 on the following page provides a summary of the various products and files that accompany this report. Descriptions for the main project geodatabase tables and fields are provided in Appendix I.

Table 4. BISC vegetation mapping projects products or file descriptions and filenames.

Category	Product or File Description	Filename
Aerial photography	Orthophoto mosaic graphic Zip file of spatial orthophoto data Aerial photo flightline index (or image index)	biscortho.pdf biscortho.zip photos.pdf
Project Report	Project report (contains summary report with cooperator's map project report and SFCN's accuracy assessment report as appendices. Also contains a brief description of all products and files, map class descriptions, vegetation classification and hierarchical key, photos of map classes)	biscrpt.pdf
Field data	Graphic showing location of map field training points MS Excel format of field data training points Field plot photos – map field training points Field plot photos – accuracy assessment points	biscplots.pdf plots.xls field_photos_training.zip field_photos_aa.zip
Geospatial Vegetation Information	Zip folder containing personal geodatabase (bisc.mdb) of spatial data (includes data for vegetation polygons, field point data, accuracy assessment data, park boundary, and shoreline) ESRI ArcMap Project file – displays personal geodatabase (MDB) files Graphics of vegetation communities (low resolution): parkwide and sections Graphic of vegetation communities (high resolution) Graphic of shoreline Graphics of individual map sections and islands Although use of the personal geodatabase and ArcMap Project File is recommended, individual shapefiles are also included as zip files: Vegetation polygons Vegetation field data training points Accuracy assessment points Park boundary Shoreline Zip file containing file geodatabase format (alternate format to personal geodatabase above)	bisc.zip bisc_veg_project.mxd bisc.pdf bisc_large.pdf bisc_shl.pdf bisc_sections.pdf bisc_vegetation_polygons.zip bisc_vegetation_points.zip bisc_aa_points.zip bisc_boundary.zip bisc_shoreline.zip bisc_fgdb.gdb
Accuracy Assessment Information	Graphic showing locations of accuracy assessment points Accuracy Assessment contingency table MS Excel format of accuracy assessment data	biscaa.pdf aa_matrix.xls plots_aa.xls
Project Metadata	Geodatabase Aerial photo metadata Field plots metadata Geospatial vegetation metadata Park boundary metadata Accuracy Assessment Metadata Shoreline Metadata	metabisc.txt metabiscortho.txt metabiscfield.txt metabiscspatial.txt metabiscbdy.txt metabiscaa.txt metabiscshl.txt

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Appendix A. Vegetation Map Report for Draft Map Product

"The 2008 Terrestrial Vegetation of Biscayne National Park, FL,USA Derived From Aerial Photography, NDVI, and LiDAR" by Pablo L. Ruiz. Patricia A. Houle, & Michael S. Ross

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The 2008 Terrestrial Vegetation of Biscayne National Park, FL, USA Derived From Aerial Photography, NDVI, and LiDAR

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June 17, 2008

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- Appendix 1: *Hierarchical Classification System with Community Descriptions.* A1-1
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Executive Summary:

Established as a National Park in 1980, Biscayne National Park (BISC) comprises an area of nearly 700 km^2, of which most is under water. The terrestrial portions of BISC include a coastal strip on the south Florida mainland and a set of Key Largo limestone barrier islands which parallel the mainland several kilometers offshore and define the eastern rim of Biscayne Bay. The upland vegetation component of BISC is embedded within an extensive coastal wetland network, including an archipelago of 42 mangrove-dominated islands with extensive areas of tropical hardwood forests or hammocks. Several databases and vegetation maps describe these terrestrial communities. However, these sources are, for the most part, outdated, incomplete, incompatible, or/and inaccurate. For example, the current, Welch et al. (1999), vegetation map of BISC is nearly 10 years old and represents the conditions of Biscayne National Park shortly after Hurricane Andrew (August 24, 1992). As a result, a new terrestrial vegetation map was commissioned by The National Park Service Inventory and Monitoring Program South Florida / Caribbean Network.

A vector map was developed using: a comprehensive set of 2005 5-band (Red, Green, Blue, NIR, and Pan-Chromatic) 30cm pixel aerial photographs; NDVI (calculated from the 2005 aerials); 2002 LiDAR data, available only for mainland portions of BISC; and over 1,000 ground reference points. In general, NDVI helped delineate low productivity zones (Mangrove Scrub) and Non-Vegetative features from adjacent Shrubland and Forest communities. The availability of LiDAR for the mainland proved invaluable and greatly enhanced the overall map resolution and accuracy. In conjunction with traditional aerial photo-interpretations, *Definiens Professional*® v5 remote sensing software was used to create 1:300 scale shorelines. However, we failed to derive an algorithm in *Definiens Professional*® v5 capable of consistently and accurately segmenting the varied community types found in this region. Vegetation communities were classified to the highest feasible level of resolution within a six-tiered hierarchical vegetation classification system. Level 3 of the hierarchy was the minimum resolution accepted, but some communities were mapped to Level 6. However, not all communities mapped or observed in the field were described in the original classification system. As a result, we modified the classification system, adding previously undescribed units where necessary. Forty-two community types were identified and mapped at Level 3. At Level 6, 90 different community types were mapped. The total area mapped was 35.2 km^2, of which 31 km^2 were within the borders of BISC.

By providing a spatial inventory of the plant communities within the BISC, this map, along with existing data, will allow resource managers to effectively focus their restoration efforts and resources on communities that are indicative of relic or pristine conditions, or communities that are likely to benefit the most from active management. Furthermore, this map, with its 1:300 scale shoreline, serves as a turn-of-the-century baseline for the extent of mangroves within Biscayne National Park and, as a result, can be used to monitor the effects of sea-level rise on the wetlands and forested communities of Biscayne National Park for years to come.

Introduction:

Established as a National Park in 1980, Biscayne National Park (BISC) is the largest marine park in North America. It comprises an area of nearly 700 km^2, of which 95% is under water (Figure 1). The remaining 5% consists of uplands embedded within the Biscayne Bay Coastal Wetlands (BBCW), a network of freshwater and brackish wetlands along the western shore of Biscayne Bay, and within a set of Key Largo limestone (Stephenson & Stephenson 1950) barrier islands that parallel the mainland several kilometers offshore and define the eastern rim of Biscayne Bay (Figure 1). While these terrestrial communities are limited in area, about 31 km^2, they extend over many kilometers and account for a significant portion of the Park's biodiversity, which includes many threatened and endangered species of both flora and fauna. Mangrove communities (forest, woodland, shrubland, and scrub) are by far the most abundant vegetation type found within BISC. Coastal Hardwood Hammocks are another important community type found within BISC, which are often overlooked. However, in contrast to the mangrove communities that are found throughout the Park, Coastal Hardwood Hammocks are restricted to the highest elevations within 11 of 42 mangrove-dominated islands found in BISC.

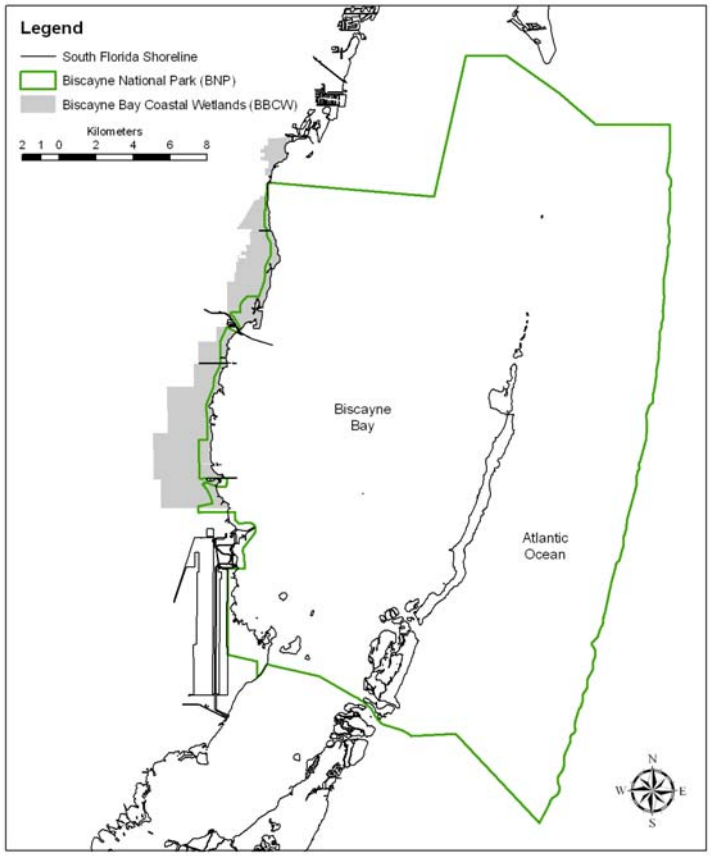


Figure 1: Boundary of Biscayne National Park, Homestead, FL., USA.

Not unlike other natural areas under the stewardship of the National Park System, BISC has endured many years of neglect and abuse by homesteaders and developers who, prior to the establishment of Biscayne National Monument in 1968, had free reign of the area and in many cases successfully drained, cleared, farmed, and developed much of these environmentally sensitive and ecologically important lands. During the latter part of the 1800's, pineapple and lime plantations were common throughout the Florida Keys including many of the islands now part of BISC (Leynes and Cullison 1998). Along with pineapples and limes, other fruits and vegetable were grown on the highly organic and productive soils associated with the Coastal Hardwood Hammock community. As a result, many acres of virgin Coastal Hardwood Hammock were cleared for cultivation and homesteads within BISC (Leynes and Cullison 1998). In the 1920's, Boca Chita, Adams, and Elliott Key were enlarged (Leynes and Cullison 1998) as developers sought to take advantage of the growth and prosperity of Miami Beach and the

surrounding areas as a vacation resort. In conjunction with the homesteaders and on the bequest of developers, public works projects dating back to the early 1900's for the purpose of mosquito control, land reclamation, and storm surge protection combined to compartmentalize and further alter the natural vegetation of BISC (Ruiz & Ross 2004).

Fortunately, 28 years of mitigation efforts have significantly improved the conditions of BISC. However, as a consequence of these historical land management practices, Biscayne Bay and the BBCW have become hydrologically isolated from the interior freshwater watershed that once flowed freely by sheet flow from the Everglades through the transverse glades (Ruiz & Ross 2004). As a result, there has been a marked decrease in the volume and kinetics of freshwater runoff into Biscayne Bay via tidal creeks and springs (Gaiser et al. 2005). This, in turn, has altered the natural seasonal variability of surface water salinities throughout the coastal wetland ecotone of BISC (Gaiser et al. 2005). All of these factors, in conjunction with the steady rise in sea level over the last century (2.2 mm/yr, Ross et al. 1994), have yielded large-scale changes in the composition and structure of the vegetation communities within the mainland portions of BISC. The offshore upland communities of BISC have benefited from their general isolation from the mainland and appear to have, for the most part, returned to a natural state. However, there is still clear evidence of historical anthropogenic perturbations throughout these islands.

Topo-lithographic maps of the Park based on 1928 aerial photographs date back to the early 1930's (Figure 2). Though not intended to be used as vegetation maps, these 1:20,000 scale topographic sheets are likely the first comprehensive vegetation maps that exist of BISC. These topographic sheets depict the vegetation of the BBCW and BISC as a mosaic of broad scale community types characterized by deciduous hammocks, high ground deciduous (forests), mangroves, sawgrass on rock, and sloughs and document the extent of anthropogenic alteration in these natural areas for the period. Other maps of BISC include the 1943 and 1967 maps of Davis, the 1999 Florida statewide water management district land cover map, and the 2007 National Wetland Inventory map, among others. Unfortunately, all of these mapping efforts failed to capture the natural complexity and structure of the vegetation communities of the BBCW and BISC, in particular. To date, the only two mapping efforts which have succeeded at capturing the nature of the vegetation within BISC are the 1999 vegetation map of Welch et al. (1999) (Figure 3) and the 2002

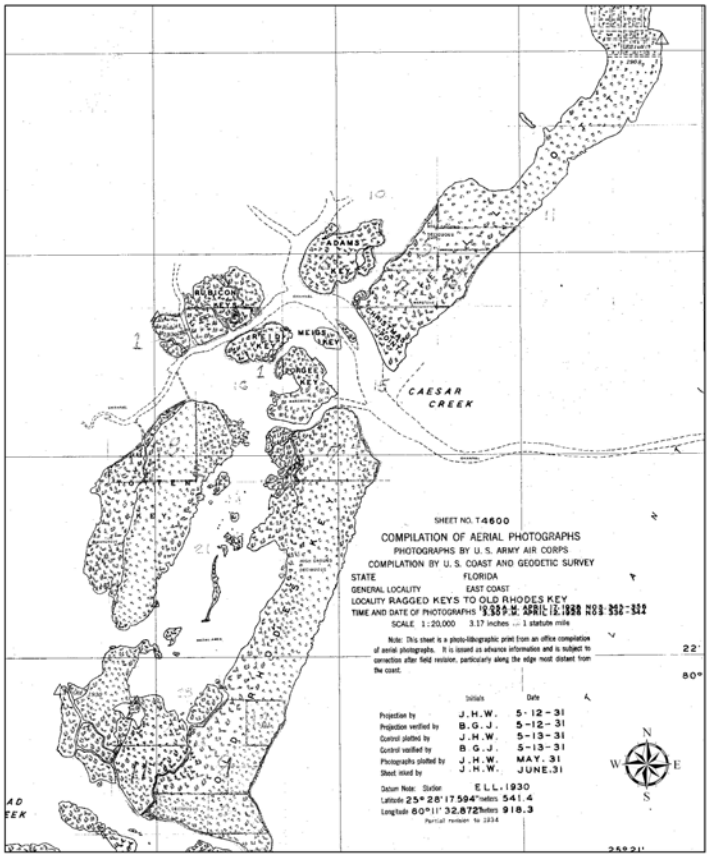


Figure 2: 1931 topo-lithographic sheet of Old Rhodes Key and Totten Key visinity based on 1928 aerial photographs.

vegetation map of Ross and Ruiz (2003) (Figure 4). Unfortunately, the Welch et al (1999) map is plagued with many commission and omission errors, is nearly 10 years old, and represents the conditions of BISC shortly after Hurricane Andrew (August 24, 1992). The 2002 Ross and Ruiz (2003) map, on the other hand, while spatially and thematically accurate, was limited in area and only included a small portion of the Park along its western shore (Figure 4). In 2006, because of the lack of a current, accurate, and useful vegetation map of BISC, the National Park Service Inventory and Monitoring Program South Florida / Caribbean Network commissioned the development of a spatially and thematically accurate vegetation map of BISC. This map, when completed, will provide a spatial inventory of the plant communities within the Park's jurisdiction with a level of accuracy suitable for planning, implementing, and quantifying management decisions and restoration efforts for the next several decades.

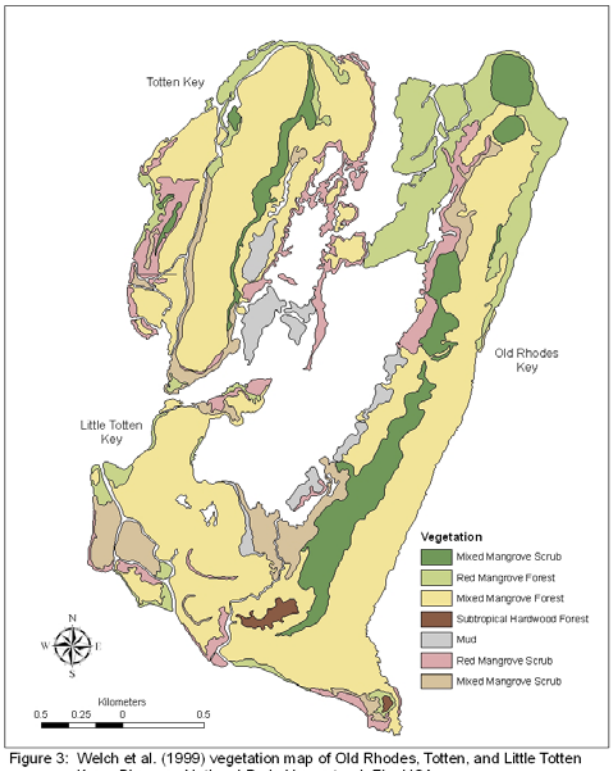


Figure 3: Welch et al. (1999) vegetation map of Old Rhodes, Totten, and Little Totten Keys, Biscayne National Park, Homestead, FL., USA.



Figure 4: Ross and Ruiz (2003) vegetation map of the Biscayne Bay Coastal Wetlands between the Princeton and Mowry Canals, Homestead, FL, USA

Methods:

This project called for the creation of a spatially and thematically accurate vector map of the terrestrial communities of Biscayne National Park. As a result, a map was developed using traditional aerial photo-interpretation techniques, in conjunction with *Definiens Professional*® v5 remote sensing software (Definiens Imaging, 2006), NDVI calculated from the Red and NIR bands of each orthophoto, and LiDAR available for mainland portions of the Park through Florida International University (IHRC 2004). Vegetation communities or polygons were screen-digitized using ESRI® ArcMap™ 9.2 and stored in a Personal Geodatabase. The map is projected to NAD83, UTM Zone 17N (units = meters). The minimum mapping unit was set to 400 m^2, but notable objects smaller than 400 m^2 were sometimes mapped based on the photo-interpreter's discretion. Digitized polygons were classified to the highest feasible level of resolution within the six-tiered hierarchical vegetation classification system developed by Rutchey et al. (2007) v5.22.07. Level 3 of the hierarchy was the minimum resolution required for this mapping project. However, some communities were mapped to Level 6. This map is expected to have a classification accuracy, at Level 3, of no less than 80% with 90% confidence. In addition, the expected minimum positional accuracy for well-defined objects was set at ± 5.0 meters of their actual location.

Imagery:

The Fish and Wildlife Research Institute – Florida Fish and Wildlife Conservation Commission, provided the imagery used in this project. The imagery consists of a set of 316 images taken by Photo Science in May 2005. The images are a 5-band (RGBNIRPan) stacked multispectral orthophoto derived from three separate products. The first consist of a Red-Green-Blue (RGB) product; the second a Color-Infrared (RGNIR) product from which the redundant red and green bands were dropped; and the third a panchromatic (Pan) product. According to the metadata, the images were flown at an averages altitude of 3,142.2 m which produces an image scale of 1:26,185. Each image covers an area of about 10.5 km^2 with an average overlap of approximately 23% between adjacent images. The images are projected to NAD83 UTM Zone 17N and have a spatial resolution of 0.3048 meters. Regrettably, these images are neither spectrally calibrated nor geometrically correct. The calibration issue is the more serious problem in this project, since the lack of spectral correction results in glare and white-outs on bare-ground and water, and in identical vegetation communities having different spectral properties within and across images (Figure 5). The lack of geometric correction caused objects to lean outward from the principal point of the image, even though these images were visually checked against themselves, DOQQs, and different shorelines for planimetric accuracy. As a result, overlapping scenes or pixels from adjacent images were not coincident.

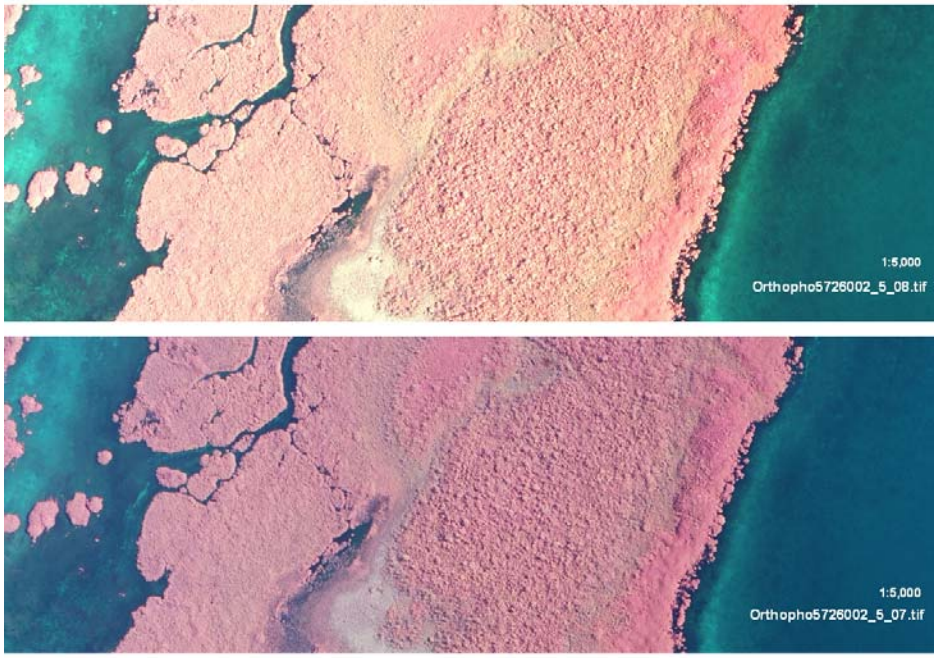


Figure 5: Spectral difference between overlapping adjacent images at 2 standard deviations.

Vegetation Classification System:

Vegetation communities within BISC were classified to the highest feasible level of resolution within the six-tiered hierarchical vegetation classification system developed by Rutchey et al. (2007) v5.22.07. Level 3 (**L3 - Group**) of the hierarchy is the minimum resolution required for this mapping project. However, some communities were mapped to Level 6 (**L6 – Alliance**). Not surprisingly, not all communities registered on the orthophotos, observed in the field, and mapped were listed within this classification system. At the same time, many of the communities listed in the Rutchey et al. (2007) classification system were not observed within the boundaries of BISC. As a result, the classification system used in this project was modified to include all new community types observed and mapped and excluded types not present within the mapping area. Twenty-one new plant community types were added: 7 at Level 3, 5 at Level 4, 8 at Level 5, and 1 at Level 6 (see Appendix 1). Three other modifications were introduced to the Rutchey et al. (2007) classification system.

The first of these was the renaming and restructuring of the original Level 1 *Non-Vegetative* Class to *Other*. This new Level 1 *Other* class was then subdivided into two separate categories at Level 2: *Non-Vegetative* and *Anthropogenic*. This restructuring permits the discrimination, at Level 3, between non-vegetative natural environments (e.g. *Beach*, *Mud*, *& Water*) and environments, either vegetated or not, (e.g. *Lawns & Landscaping*, *Agriculture*, *Parking Lots*, *& Road*) that result from anthropogenic activities. The second modification was the standardization, wherever possible, of Raster ID's so that a species or community type would always be represented by the same number combination. For example, in the Rutchey et al. (2007) classification system, the following Raster ID's 114000, 315000, and 414000 represent the following three red mangrove communities': Forest, Shrubland, and Scrub, respectively.

By standardizing the 4th digit of each Raster ID, in this case to 4, we are able to discern quite easily that the following Raster ID's: 114000, 214000, 314000, and 414000 all represent a community type dominated by red mangrove. The third modification was the removal of blank categories between subordinate levels in the classification system. Aside from these exceptions, the new abridge version of the Rutchey et al. (2007) classification system (Appendix 1) keeps true to the original structure and hierarchy. However, since the Rutchey et al. (2007) classification system was design as an all-encompassing vegetation classification system for Southern Florida it was necessary, in some cases, to append the original community descriptions so that they would be less ambiguous and more relevant to this project (see descriptions below).

At the highest level of the hierarchy, Level 1 (**L1 – Class)**, the new abridged classification system (Appendix 1) has the following structure and requirements:

- **Forest**: High-density stands of trees (>50% tree canopy cover) with heights > 5 meters
- **Woodland**: Low-density stands of trees (10 - 60% tree canopy cover) with heights > 5 meters in a matrix of shrubs, graminoids, and/or herbaceous vegetation.
- **Shrubland**: Stands of small trees and/or shrubs (canopy cover ≥ 50%) with heights < 5 meter tall.
- **Scrub**: Communities of dwarf trees or shrubs typically in a matrix of graminoids, and/or herbaceous vegetation. Canopy cover 10% to 50% but can be as high as 100% for Mangrove. Canopy < 5 meters tall with the exception being for Mangrove which is ≤ 2 meters.
- **Marsh**: Graminoid and/or herbaceous emergent or floating vegetation in shallow water that stands at or above the ground surface for much of the year.
- **Dune**: A ridge of wind blown or windstorm deposited sand or similar material directly inland and parallel to the shoreline which is commonly vegetated by graminoids and/or herbs and sometimes even shrubs.
- **Submerged Aquatic Vegetation**: Vegetation that has evolved the ability to carry out its entire life cycle completely submerged in an aquatic environment.
- **Exotic**: Non-native and invasive vegetation.
- **Other**: Non-vegetative or anthropogenic cover.

The next level in the hierarchy, Level 2 (**L2 – Type)**, modifies the structurally-defined Level 1 with a community designation, for example, *Mangrove Forest* vs *Hammock Forest* or *Mangrove Shrubland* vs *Upland Shrubland*. At Level 3 (**L3 – Group)** the classification system often requires that the previous level (**L2 – Type**) community types be identified by dominant species, such as *Black Mangrove* or *Buttonwood Forest* or *Red Mangrove* or *White*

Mangrove Shrubland, for example. However, this is not always the case. For example, at Level 3, *Hammock Forest* can be subdivided into *Coastal Hardwood Hammocks* or *Coastal Dune Hammocks*. A similar situation occurs within the Level 2 *Salt Marsh* and *Freshwater Marsh* types. At Level 3, these two types are differentiated based on morphological traits like graminoids, herbaceous, or succulent for Salt Marsh or by Marsh or Prairie for Freshwater Marsh. The remaining three levels of the classification system (**L4 - Formation**, **L5 – Alliance**, & **L 6 – Association**) continue to subdivide the previous community types by dominant canopy species composition and than by understory species assemblages; for example, a Level 6 mangrove scrub community might have the following nomenclature *Buttonwood-White Mangrove Scrub-Glasswort*.

Shoreline Segmentation – Definiens Professional® v5:

Definiens Professional® v5 remote sensing software was incorporated into this project as an exploratory methodology for standardizing and automating the digitization of vegetation communities into polygons. For mapping vegetation, *Definiens Professional*® v5 was mostly unproven but offered tremendous benefits as a remote sensing tool. In contrast to traditional remote sensing software in which an image is classified at the pixel level, *Definiens Professional*® v5 classifies images in terms of image objects and their mutual relationships. In other words, pixels with similar brightness values and/or other characteristics are aggregated into image objects. These image objects are then the target of the classification process and not the pixels themselves. Image objects within *Definiens Professional*® v5 are derived by one of three distinct segmentation algorithms: chessboard segmentation; quadtree based segmentation; or multiresolution segmentation. For this project, all image objects were derived using the multiresolution segmentation. This algorithm is a heuristic optimization procedure that locally minimizes the average heterogeneity of image objects for a given resolution (Definiens 2006). Image objects derived from this methodology are created based on three criteria: scale, color, and shape. The scale parameter is an abstract terms that determines the maximum allowed heterogeneity within image objects and their average size (Definiens 2006). Color and shape are mutually exclusive weighted parameters that determine which heterogeneity attributes are minimized during the segmentation process (Definiens 2006). Color emphasizes how brightness values within layers will contribute to the entire homogeneity criterion. On the other hand, shape, composed of two weighted parameters: smoothness and compactness, defines the textural homogeneity of the image objects by either optimizing for smoothness or compactness. Segmentations weighted exclusively towards color result in spectrally homogeneous but spatially heterogeneous image objects, while, segmentations weighted towards shape result in image objects that are spatially homogeneous but spectrally heterogeneous. Regardless of the color weighting, image objects tend to follow natural features more closely when smoothness is emphasized over compactness (Benz et al. 2004).

Multiple exhaustive attempts where made using *Definiens Professional*® v5 to produce image objects that could be classified into distinct vegetation communities. However, it became clear, early on, that these segmentations efforts were accentuating the spectral variability of the imagery and not yielding objects that could be classified into distinctive vegetation

communities based on a homogeneous spectral signature. Our efforts, however, showed that the land-water interface could be effectively and consistently segmented into image objects to create fine scale (1:300) shorelines.

Two similar, yet contrasting, methodologies were developed for the delineation of the land-water interface. The first methodology (Appendix 2) is a multifaceted segmentation algorithm modeled from the initial segmentation efforts designed to classify the varied vegetation communities within BISC. This methodology is described in Appendix 2. The second methodology was developed later in the project to: 1) quickly and efficiently recreate shorelines where the original segmentation was based on an image that was no longer deemed appropriate because of planimetric errors or unsuitable color balance; and 2) capture and preserve the fine scale details associated with small irregular mangrove islands or individual trees found on intertidal zones or shallow lagoons. This methodology, described below, while simplistic and straight forward, was as robust as the original segmentation algorithm and minimized the number of image objects needed to consistently segment land and water into image objects.

To minimize file size and processing time, only the Red and NIR spectral bands of each image were imported into *Definiens Professional*® v5. The NIR band was used to define the no data area. Based on the brightness values of the imported two bands the ratio NDVI (see NDVI methods section for equation and description and used of this ratio) was defined as an arithmetic custom feature. This ratio was later used in the sample editor to help classify the image objects. The next step was to define the scale, color, and shape parameters of the multiresolution segmentation. Because of the lack of spectral calibration, the scale parameter for each image segmentation was determined empirically. In general, the larger the scale parameter used the larger the image objects created. At the same time, the larger the scale parameter the fewer image objects created and the less time it takes to run a segmentation. As a result, the initial scale parameter for all segmentations were set to 100. Subsequent segmentations, if needed, were decreased systematically until they reached a minimum value of 10. Scale parameter values < 10 were impractical with this imagery because of the amount of processing time needed to perform the segmentation and the overwhelming number of image objects created, about 260,000 at this scale. In all cases, the Color parameter was set to 0.8, forcing the Shape parameter to 0.2, and the Compactness and Smoothness were set at 0.2 and 0.8, respectively. After the multiresolution segmentation was completed, a spectral difference segmentation was run to merge spectrally similar adjacent objects. In general, values between 2 and 5 were used. Values greater than 5 usually reduce the number of image objects by half but, as a result, merged too many image objects together and thus created many mixed image objects unsuitable for classification. The next step was to classify the image objects. Classification of the image objects was defined through a class hierarchy dialogue similar to Method 1 (Appendix 2). However, only two classes were used: Water and Land. The Water class has an explicit definition (NDVI less than an optimal value determined empirically for each image), whereas the Land class was defined as those image objects not classified as Water. Once the image objects were classified and the classification validated, the image objects were converted to polygons and merged into their respective classes; Water and Land. These merge features were than exported as a vector shapefile for final editing.

Within ESRI® ArcMap™ 9.2 the newly imported shapefile was converted into a grid and then back-converted into a shapefile for final validation and editing at a scale of 1:300. The reasoning behind this double transformation is as follows: Segmented image objects in *Definiens Professional*® v5 tend to be highly fractal (Figure 6a). The transformation to a grid and then back to a polygon has the effect of removing unnecessary vertices from the polygons and thus smoothing the overall shape of the polygons into slightly more realistic and aesthetically pleasing polygons (Figure 6b). Another advantage of this smoothing transformation is that by smoothing the overall shape of the polygons, shoreline errors that would normally have had to be manually corrected are, for the most part, processed automatically, thus saving precious time in the final editing session.

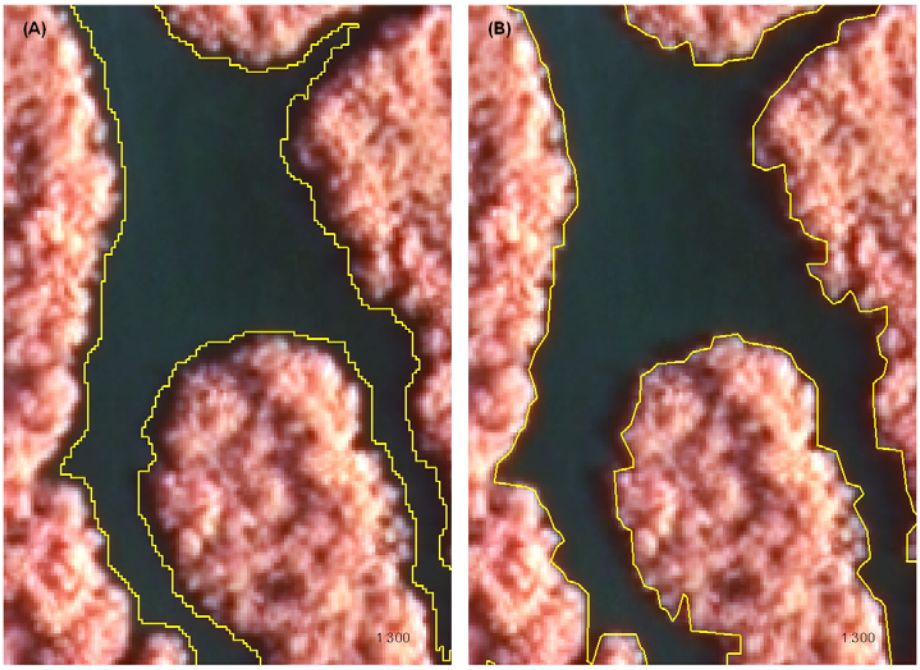


Figure 6: Contrast between shorelines without (A) and with (B) the smoothing transformation. See methods section for methodology.

NDVI:

The Normalized Difference Vegetation Index (NDVI) ratio was calculated for each image as a 1-band gray-scale raster in Erdas Imagine 9.1. NDVI is calculated by subtracting the Red spectral band from the NIR spectral band and than dividing this difference by the sum of the NIR and Red spectral bands (Equation 1).

Equation 1: $NDVI = (NIR - Red) / (NIR + Red)$

Technically, NDVI should be calculated on the corrected radiant flux of each pixel. However, since none of the imagery was spectrally calibrated NDVI was instead calculated using the original brightness values of each pixel. As a result, community trends in NDVI values could only be applied to the imagery it was derived from and not across all images uniformly. In

general, however, NDVI values > 0.3 usually corresponded to heavily vegetated areas with dense canopies characteristic of Shrubland and Forest communities (Figure 7). Scrub communities were usually associated with NDVI values between 0.1 and 0.3 (Figure 7). Soils and bare ground, have a higher reflectance in the near-infrared than in the red and thus exhibited low NDVI values generally between -0.1 – 0.1 (Figure 7). Water, on the other hand, because of its low reflectance in both spectral bands (Red and NIR), tended to have very low NDVI values, usually < -0.1 (Figure 7). Base on these criteria, NDVI helped delineate low productivity zones (Mangrove Scrub) and Non-Vegetative features from adjacent Shrubland and Forest communities. However, NDVI failed to discriminate between the more productive community types (e.g. Hardwood Hammocks, Mangrove Shrublands, and Forest).

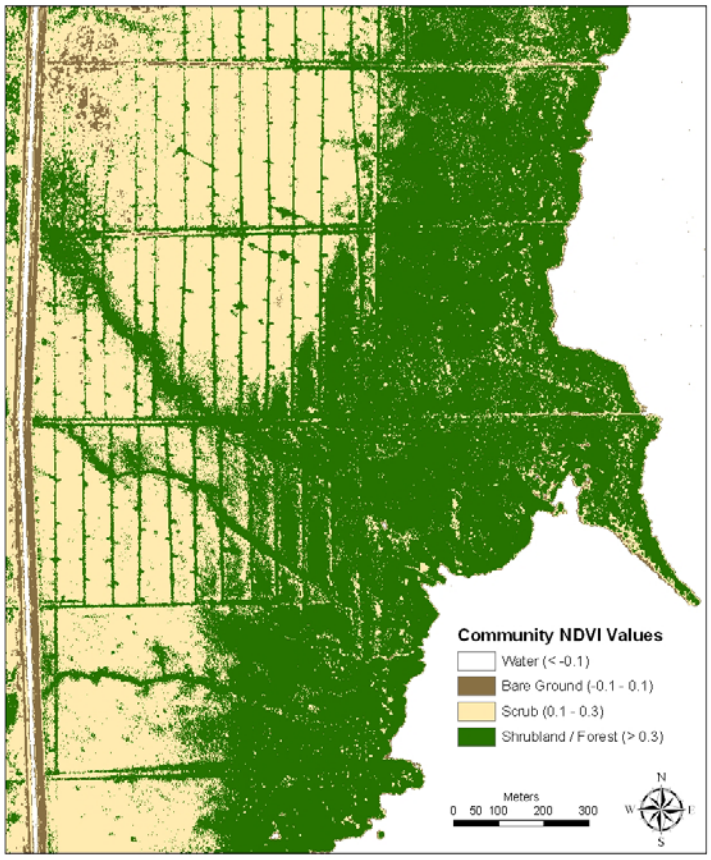


Figure 7: General relationship between community type and NDVI values.

LiDAR:

Light Detection and Ranging (LiDAR) is an active airborne remote sensing technology that uses laser pulses to provide direct and accurate measurements of vegetation structure and topography, among other things. Modern airborne laser systems have demonstrated the ability to: quantify structural changes in mangrove forests following hurricanes (Zhang et al. 2008); provide accurate estimates of forest vertical structure and volume (Zhang et al. 2006, Suárez et

al. 2005), and stem diameters (Hyyppä et al. 2001); and have outperformed other remote sensing systems at estimating mean tree height (Lefsky et al. 2001). In recent years, LiDAR has become an invaluable remote sensing tool with many practical applications including land cover classification and mapping (Bork & Su 2007, Hill & Thomson 2005).

The LiDAR used in this project was provided and flown by Florida International University International Hurricane Research Center (IHRC 2004). This data was part of a 2002-2003 survey of Miami-Dade County, Florida. However, the extent of the LiDAR coverage for BISC was, unfortunately, limited to the uplands on the western shore of Biscayne Bay starting just north of Turkey Point and did not include any of the islands within BISC. The flight and laser acquisition parameters (altitude, speed, and scan angle, scan rate, and pulse rate) produced, on average, a 650-meter-wide swath of 30 cm wide laser footprints with a nominal point spacing of 1.5 m (IHRC 2004). The first return (first-stop) data from this survey was interpolated using kriging to produce 5 ft (1.524 meters) resolution top-surface digital elevation models (DEMs) with a vertical accuracy of ± 0.80 ft (24 cm) (IHRC 2004). For BISC, these DEMs represent the mean canopy height (ft) of the vegetation communities sampled in 2002 (Figure 8). The DEMs are projected to State Plane, Florida East Zone, NAD83 (unit = feet) with NAVD88 (feet) as the vertical datum (IHRC 2004).

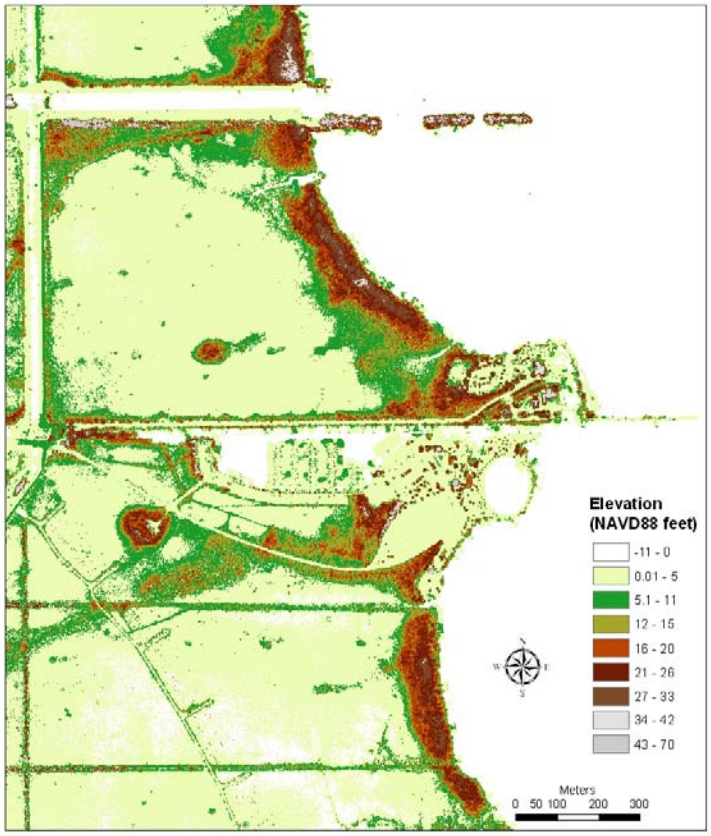


Figure 8: 2002 top-surface digital elevation model (DEM) of LiDAR data for Convoy Point, Homestead, FL.

Since the LiDAR was collected in 2002, the DEMs had to be corrected for canopy height growth between 2002 and 2008 (Table 1). Changes in canopy height were scaled according to community type. Thus, extrapolation of canopy heights was weighted towards the more productive forest community where tree height growth rate can easily reach and exceed 1 m/yr. In contrast, the less productive shrubland and scrub communities would not be expected to have canopy height growth much higher than 20 cm/yr or 5 cm/yr, respectively (Ross et al. unpublished data). The canopy height correction to the DEMs was done in ESRI® ArcMap™ 9.2 as a custom natural breaks classification. Thus, the original DEM values (ft) were reclassified and labeled to show the predicted canopy height in meters for 2008. The classification was saved as a layer file and imported as a symbology each time a new DEM was used.

Table 1: Extrapolation of canopy LiDAR height (m) between 2002 and 2008 used in discriminating between Level 1 community types.

Community Type	2002 LiDAR Height (meters)	2008 Extrapolated LiDAR Height (meters)
Non-Vegetative	< 0	< 0
Scrub	0 – 1.75	0 – 2
	1.75 – 2.1	2 – 2.7
Shrubland	2.1 – 3	2.7 – 3.7
	3 – 3.9	3.7 – 4.9
Forest	> 3.9	> 4.9

Unsupervised Classification:

In an exploratory manner, two independent unsupervised classification methods, pixel based and image-object based, were used in this study to ascertain their potential to classify the vegetation communities of BISC. The area used in this analysis had been previously mapped by Ross and Ruiz (2003) and thus could be use to quantify how well these two methods worked at delineating community boundaries.

In all, three 11-band stacked images were used in this analysis. The 11-band stacked images were derivatives of the original set of images provided for this study and were created using Erdas Imagine 9.1. The first five bands included the Red, Green, Blue, NIR, & Panchromatic bands from the original images, resampled to 0.9 meters. The 6th band was a 3 meter resolution gray-scale NDVI layer. The remaining 5-bands, #'s 7-11, consisted of the five bands from the original images, resampled to 3 meters using a 3x3 fixed window variance filter. Images were cropped to remove areas that contributed excessive glare or were not relevant to the study area. This eliminated unnecessary data from the analysis that might interfere with the classification.

The pixel-based unsupervised classification was carried out using the ISODATA algorithm in Erdas Imagine 9.1. The 11-band image stack described above was resampled to 9 m for this classification, however. A visual inspection of several image resolutions suggested that this scale of resampling preserved the details of the vegetation landscape, while, reducing the 'scatter shot' appearance of individual single pixels of many classes somewhat. The ISODATA algorithm was applied to all 11 bands to produce 40 classes. Subsequently the classification

was opened in ESRI® ArcMap™ 9.2, and classes were combined to produce homogeneous areas that best matched the original resolution of the images (0.3048 m) or the Ross and Ruiz (2003) vegetation map.

The image-object unsupervised classification was initiated in *Definiens Professional*® v5 using the same 11-band image stack described above. A multiresolution segmentation was run using 9 of the 11-bands in the image stack and on a shoreline vector layer, previously created in *Definiens Professional*® v5. While adjusting for scale, several segmentation runs were done. Spectral information was weighted over shape by using a shape factor of 0.2. To reduce the appearance of irregular jagged objects, the smoothness parameter was weighted at 0.8 compared to 0.2 for compactness. Several complete analyses indicated that the size of the image objects created in *Definiens Professional*® v5 has a large impact on the quality of the final product. If objects are too small, they only reflect local variation and not the pattern of the vegetation community. The best classification results were seen with approximately 1,800 image-objects using a scale parameter of 200. This segmentation was then exported to a vector polygon file consisting of 30 features representing spectral information, size, shape, and texture.

Many of the exported features were highly correlated. To improve the performance of the subsequent principal components analysis (PCA), features were removed so that correlations between them did not typically exceed 60 percent. Representative features used in the PCA included: area, roundness, compactness, shape index, mean object NDVI pixels in object, mean of variance filtered NIR pixels, mean of variance filtered panchromatic pixels, mean of red pixels in object, mean of green pixels, mean of blue pixels, mean of NIR pixels, mean of panchromatic pixels, SD of NDVI pixels in object, ratio of object length to width, max difference, density and asymmetry.

PCA on the attributes of the exported image objects was carried out using Proc PRINCOMP in SAS v9. Based on previous results, the first 4-5 axes of the PCA usually represent about 80-85% of the total variability. As a result, these axes were used in the subsequent cluster analysis. A cluster analysis was also carried out in SAS using the K-means clustering algorithm, Proc FASTCLUS. Many of the 20-40 classes found represented non-vegetation areas, such as artifacts in the boundaries of the imagery and water areas. In one case, seven of 30 classes representing mixed vegetation were reclassified into 20 additional classes. Once the PCA and cluster analyses were complete, the attribute table was merged back into the object geometry shapefile in ESRI® ArcMap™ v9.2. A visual assessment of the unsupervised classification was done by comparing object boundaries and classes with the Ross and Ruiz (2003) vegetation map and with the original aerial photographs of the study area.

Geodatabase Design & Mapping:

Currently, geodatabases are the most efficient way of editing and storing spatial information. Geodatabases merge traditional GIS data formats and data management tools to create a geospatial environment, which maintains consistency and accuracy by defining how data is stored, accessed, modified, and managed within a single file. For this project, a Personal

Geodatabase, containing 19 feature datasets and 5 feature classes, was created in ESRI® ArcCatalog™ v9.2. All feature datasets and classes within the Geodatabase are projected to NAD83, UTM Zone 17N (unit = meters).

Each feature dataset within the Geodatabase represents an island or region within BISC and contains a topology and two feature classes, *shoreline* and *vegetation*. The naming convention for each topology and feature class is defined by using the feature dataset name as the prefix and the topology and feature class type, *shoreline* or *vegetation*, as the suffix (e.g. , *Adams_Key_Topology*, *Adams_Key_Shoreline* or *Adams_Key_Vegetation*). Within each feature dataset, the topology contains three rules that ensure the proper management of coincident geometry between polygons and the *shoreline* and *vegetation* feature classes. The *shoreline* feature class defines the land-water interface. The structure of this feature class remains consistent throughout all feature datasets and contains the following default ESRI attribute: OBJECTID, SHAPE, SHAPE_Length (m), & SHAPE_Area (m^2). The structure of the *vegetation* feature class is also constant throughout the geodatabase and contains the following attributes for each record: OBJECTID, SHAPE, AUTHOR, QC, RASTER ID, L1, L2, L3, L4, L5, L6, Photo, SHAPE_Length, & SHAPE_Area (Table 2).

Table 2: Description of attributes for vegetation feature class.

Attributes	Description
OBJECTID	ESRI default (ID)
SHAPE	ESRI default (polygon)
AUTHOR	Person responsible for the creation or last edit of that record
QC	Date used to designate when the record was verified in the field or to suggest a high degree of confidence regarding its classification on the day it was digitized
RASTER ID	Numeric string representing the mapped vegetation at the lowest level of the classification
L1	Level 1 classification
L2	Level 2 classification
L3	Level 3 classification
L4	Level 4 classification
L5	Level 5 classification
L6	Level 6 classification
Photo	Orthophoto used to create this record
SHAPE_Length	ESRI default (shape perimeter m)
SHAPE_Area	ESRI default (shape area m^2)

The five, additional, independent feature classes in the geodatabase; i.e. *BISC_Boundary*, *GR_Points*, *OrthoPhoto_Index*, *Shoreline*, & *Vegetation*, represent miscellaneous thematic layers that define the extent of the map, document the data collected, and summarize the spatial information populated within the geodatabase. The *BISC_Boundary* feature class contains one record denoting the 2006 legislative boundary of Biscayne National Park. This feature was acquired directly from The National Park Service Inventory and Monitoring Program South Florida / Caribbean Network. *GR_Points* is a point feature class populated with the 1,081 ground-reference data points collected to assist in the identification of unknown types or regions within the imagery or to ground-truth communities and areas already mapped. This feature class contains both structural and species information. *OrthoPhoto_Index* is a

polygon feature class that servers as the photo index for this project. It documents which orthophoto was used to delineate the shoreline and map the vegetation for a particular region. Knowing and documenting this information was crucial because the imagery provided were not geometrically correct, as discussed previously. Consequently, digitized features not paired with the originating orthophoto could have, on average, a spatial offset of 2 meters or more. The last two feature classes, *Shoreline* and *Vegetation* contain all of the data within each of the 19 feature datasets and are the master Shoreline and Vegetation feature classes.

Edits to all feature classes were done within the geodatabase environment in ESRI® ArcMap™ v 9.2. The *Definiens Professional*® v5 shorelines were edited using the 2005 original imagery at a scale of 1:300. The vegetation communities, on the other hand, were delineated (digitized) at a 1:1500 scale using the 2005 imagery. Delineation of the vegetation boundaries was facilitated by overlaying the imagery, with a 25% transparency, over the NDVI raster or the LiDAR DEMs (Figure 9A & 9B, respectively).

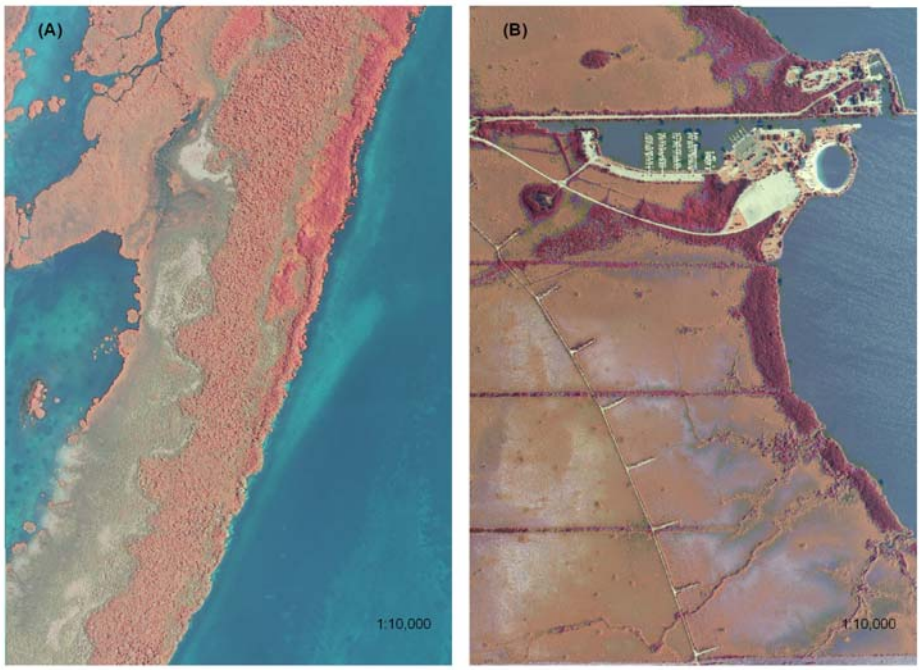


Figure 9: NDVI (A) and LiDAR (B) overtopped by imagery with 25% transparency.

Accuracy Assessment & Ground-truthing:

The accuracy assessment of this map will be subcontracted to an independent contractor within 12 months of project completion. This will ensure that the integrity of the map is not compromised and that the minimum standards set forth by the cooperative agreement between the National Park Service and Florida International University, for this project, are met.

Over 1,000 ground-reference points accessed by helicopter, boat, and on foot (Figure 10) were used to ensure that the map would meet the expected accuracy of 80% with an allowable error of 10% at Level 3 of the classification. On average, 120 individual sites were visited per day. A total of 9 field days were used on this endeavor; four of which were helicopter days. Field observations included, but were not limited to, maximum canopy height, canopy species composition, herbaceous layer species composition, and, on occasion, substrate. The GPS locations of each site visited was recorded directly into a field-book using a handheld GPS or populated into a geodatabase directly via a submeter accurate GIS/GPS integrated system. This information was then used to interpret the spectral signature of unknown types based on the spectral signature of known communities verified by the ground-referencing locations.

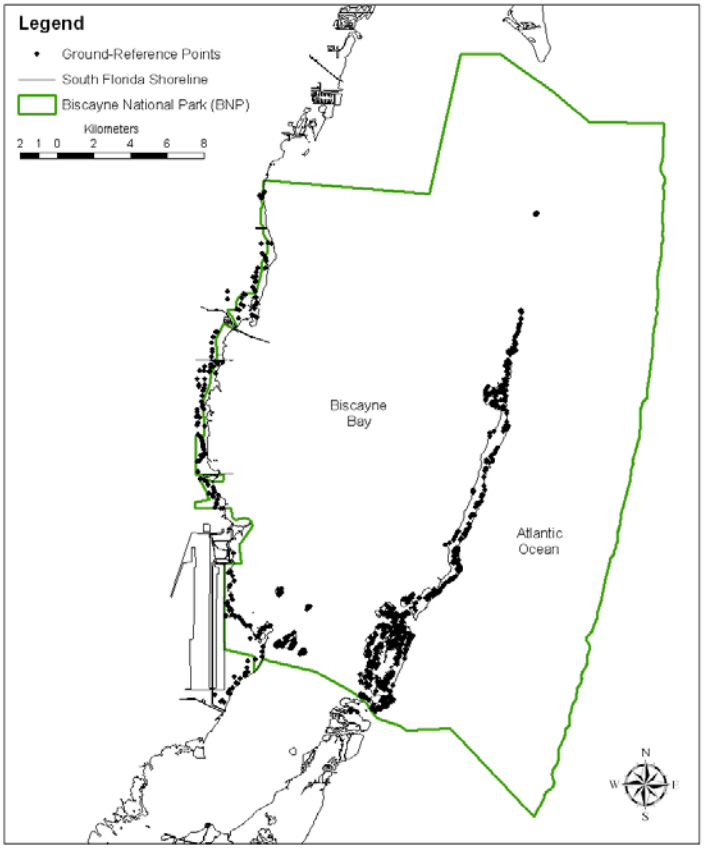


Figure 10: Distribution of ground-reference points used to map Biscayne National Park.

Results & Discussion:

Vegetation Classification System:

One of the unstated goals of this project was to determine the potential and effectiveness of the Rutchey classification system at mapping and capturing the natural complexity and structure of the varied plant communities arrayed along local environmental gradients in BISC. To that end, we found the classification system adequate. However, inherent issues with the classification system, particularly within the mangrove subcategories, created issues that necessarily lead to commission & omission errors. Providing a sound solution to these issues is beyond the scope of this project and report. Nonetheless, the following are worth noting:

- The classification system relies heavily on knowing the following three parameters: height, density, & species composition. Height and density are the most important at the highest level of the hierarchy; i.e. Level 1. Conversely, species composition becomes important at the 3rd level of the classification and thereafter. Height and density are usually difficult and at times impossible to discern from most aerial photography unless one of the following criteria are met: 1) the imagery is of high enough quality and has a spectral resolution that allows for individual crown to be identified; 2) the imagery consists of stereoscopic pairs and a stereoscope is used; or 3) there is enough textural contrast and shadow between communities that their vertical structure can be inferred. As a result, if the imagery, along with the methodology used, fails to recognize and meet the criteria described above, a situation is created where classification errors can occur at a level within the classification system (i.e. Level 1) where they should not be occurring. These errors are problematic since they are then inherited by the subordinate categories. Few can argue that there is a clear solution to this problem. However, the incorporation of LiDAR can mitigate and significantly, if not completely, eliminate classification errors within the 1st Level of this classification system and thus increase the overall accuracy of a map.

- Based on height and density, the Exotic Level 1 Class should be merged into the corresponding 1st Level structural class (i.e. Forest, Woodland, Shrubland, or Scrub). For example, a greater than 5 meter tall stand of Australian Pine with greater than 50% cover should be assigned to the L1 – Class: Forest with the following or similar hierarchical structure:

    L1: Forest
    L2: Non-Native Forest (or similar description)
    L3: Australian Pine (*Casuarina* sp.) Forest
    L4: subcategory if applicable (specific species)
    L5: subcategory if applicable (treated or not treated)
    L6: subcategory if applicable

  This reorganization is logically consistent to the overall organization of the Rutchey et al. classification system and is applicable to all non-native community types. Moreover, this

hierarchical structure emphasizes the nature and structure of the non-native community. By documenting these communities based on their canopy structure, resource managers are better able to properly ascertain the amount of resources needed for exotic control teams to effectively combat, eradicate, and mitigate these communities.

Co-dominance between native and non-native species and the multi-structural (stratum) characteristics of plant communities are related issues that should be addressed, in general as well as in BISC. For example, it is not uncommon for Australian Pine to be associated with a mixed mangrove community (e.g. Buttonwoods and White mangroves) in a Forest setting in which neither association (i.e. mangroves or non-natives) is dominant. Other examples include dense mixed-mangrove shrublands overtopped by a sparse or full canopy (30-75% cover) of Australian Pine, which are commonly associated with both mosquito & drainage ditches; Australian Pine shrubs or individual trees in a matrix of sawgrass (*Cladium jamaicense*); or mangrove forests (mixed or monotypic) with a dense understory of Brazilian Pepper (*Schinus terebinthifolius*) or Shoebutton Ardisia (*Ardisia elliptica*). These examples may seem like extreme cases rarely seen, but in actuality are commonplace throughout many of the interior wetlands located on the western shore of Biscayne Bay. Unfortunately, deriving a classification which can properly address these complexities is not easy and requires a significant amount of further thought and discussion by the authors and end users of the Rutchey classification system.

- At the 3rd level of the mangrove hierarchy, regardless of class (i.e. Forest, Woodland, Shrubland, Scrub), the cartographer or photo-interpreter is faced with the challenge of identifying mangrove communities at species level (e.g. Black Mangrove Forest, Mixed Mangrove Shrubland, or Red Mangrove Scrub, etc.). In many instances, it is not an easy task to distinguish dominant species (e.g., Black Mangrove, Red Mangrove, Mixed Mangrove), and commission and omission errors are commonplace. In regard to the overall organization of the other community types within the classification system (e.g. the Marsh category, which contains a complete hierarchical structure), it would seem that this species level of detail is better suited for the next lower level (**L4 - Alliance**) or lower within the classification system. The reason for this is two fold. For one, it would eliminate the gap in the mangrove hierarchy that currently exists between Level 3 and Level 5; i.e. there is no Level 4 to transition between many Level 3 (e.g. Red Mangrove Scrub) and Level 5 communities (e.g. Red Mangrove Scrub-Graminoid). The other reason is in the difficulty in determining the mangrove species composition from imagery alone at Level 3, particularly in the Shrubland and Scrub classes. Furthermore, there are many instances when the spectral signature of a lower level community associate like, Saltwort (*Batis maritima*), is readily recognized but the mangrove community associated with it is not (Figure 11). For example, in Figure 11, the succulent understory (yellowish in color) is clearly visible, while the species composition of the overtopping community, if one is present at all, is more difficult, if not impossible to distinguish. Thus, without auxiliary data this community has a high probability of being misclassified based on the overwhelming signature of Saltwort, thereby affecting the thematic accuracy of the map.

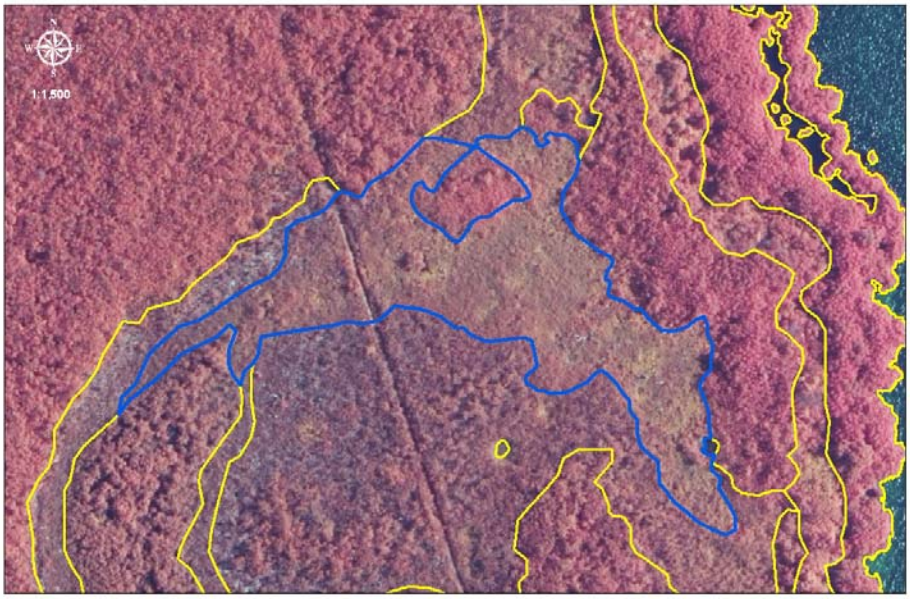


Figure 11: The succulent understory of the community outlined in blue (definable at Level 5 of the classification) is clearly visible, but the structure and species composition of the canopy, defined at Level 3, is difficult to determined. Based on a ground survey, this community was determined to be a Mixed Mangrove (Buttonwood-White Mangrove) Scrub with an understory dominated by Saltwort.

The solution to the two issues discussed in this bullet might be solved with the following modification to the classification system. The example below applies to Mangrove Scrub, but could apply equally well to other Scrub, Shrub, or Woodland categories:

L2: Mangrove Scrub
L3: Mangrove Scrub-Closed Canopy
L4: Black Mangrove Scrub
L4: Mixed Mangrove Scrub
L5: Black Mangrove-Red Mangrove Scrub
L3: Mangrove Scrub-Succulent
L4: Mangrove Scrub-Glasswort
L5: *White Mangrove Scrub-Glasswort*
L4: Mangrove Scrub-Saltwort
L5: *Black Mangrove Scrub-Saltwort*
L4: Black Mangrove Scrub-Succulent
L5: *Black Mangrove Scrub-Saltwort*
L4: White Mangrove Scrub-Succulent
L5: *White Mangrove Scrub-Glasswort*
L4: Mangrove Scrub-Mixed Succulent
L4: Mixed Mangrove Scrub-Succulent
L5: Buttonwood-White Mangrove-Succulent
L6: *Buttonwood-White Mangrove-Saltwort*
L5: Mixed Mangrove Scrub-Saltwort
L6: *Buttonwood-White Mangrove-Saltwort*
L4: Mixed Mangrove Scrub-Mixed Succulent
L3: Mangrove Scrub Graminoid

While the entire hierarchy is not displayed, the general structure and trend can be followed. By applying this hierarchical structure, the gaps between Level 3 and Level 5 are now gone. Moreover, from a remote sensing perspective, communities or individual plants or groups of plants that are readily discerned but buried deep in the classification hierarchy are now moved up into an appropriate level while communities with a complex and/or ambiguous spectral signature are demoted or grouped logically to minimize commission and omission errors. This restructuring of the classification system provides multiple pathways, at the lower levels of the hierarchy, for specific detailed community types to be arrived at while minimizing community misclassification at higher levels. Multiple pathways might appear problematic, but if the goal is to minimize classification errors and ensure a thematically correct map, while avoiding gaps within subcategories, this may prove to be the best solution within the parameters of the Rutchey et al. (2007) classification system.

NDVI & LiDAR:

As discussed in the methods section, NDVI was instrumental at delineating Non-Vegetative communities and low productivity zones from adjacent more productive communities. However, since the imagery was not spectrally calibrated, the interpretation of NDVI values shifted with each new image used. As a result, the use of NDVI was somewhat impractical because established rule sets had to be confirmed and calibrated each time a new image was used. Nevertheless, the potential of NDVI to distinguish communities along a productivity gradient was demonstrated in this mapping project.

In contrast, by providing direct and accurate seamless estimates of canopy heights for an area, LiDAR overcame the limitations inherent to NDVI and proved superior at distinguishing communities and their boundaries regardless of class and productivity. Consequently, the availability of LiDAR for the mainland portions of the park significantly improved the spatial and thematic accuracy for this section of the map. Moreover, LiDAR notably reduced the amount of time needed to interpret images and digitize plant communities. Furthermore, the multi-dimensionality of LiDAR (i.e. not only does it provide information regarding the mean canopy height for a vegetative community it also possesses information regarding vertical structure, stand volume, basal area, and on topographic relief, among others things.) contributes and enhance our understanding of the spatial and temporal dynamics of plant communities. As such, within the context of resource management, protection, and restoration LiDAR is an invaluable tool, which permits for the quick collection, analysis, and interpretation of large volumes of both spatial and temporal data over large areas without the logistical cost and difficulty associated with ground surveys.

Unsupervised Classification:

Figure 12 shows the pixel-based unsupervised classification using the ISODATA algorithm overlaid with the Ross & Ruiz (2003) vegetation map of the area, for comparison. In general, this classification outlines many of the community boundaries identified by Ross & Ruiz (2003). However, it failed to produce homogeneous areas characterized by one or two pixel classes, which are essential to properly isolate and delineate community types, particularly at the scale of this map. Since many of these classes appear closely related in space, the original 40 classes were consolidated into 10 new cover classes, which are described in Table 3. Taken as a whole, this new classification (Figure 13) matches more closely with the community boundaries drawn by Ross & Ruiz (2003). Nevertheless, the same 'scatter shot' effect which plagued the original classification remains. As a result, most communities still appear as a multi-pixel class aggregate making community delineation very difficult and impractical for this project.



Figure 12: Comparison of unsupervised classification with 40 classes overlaid with the Ruiz & Ross (2004) vegetation boundaries in black.



Figure 13: Comparison of unsupervised classification with 10 classes overlaid with the Ruiz & Ross (2004) vegetation boundaries in black.

Table 3: Description of unsupervised classification cover classes shown on Figure 12.

Class	Color	Description
1	Bright Blue	Water
2	Light Blue	Salt marsh and heavier scrub mangrove in areas between ditches.
3	Yellow	Scrub mangrove in areas of less vegetation west of class shown in light blue.
4	Green	Transitions to denser more textured vegetation.
5	Aqua	Coastal mangrove and some interior non-mangrove areas. This class is picking up areas of rougher texture for coastal and interior areas and when present in the fringe mangrove area is associated with the taller tree canopy.
6	Brown	Associated with rough textured areas near drainage ditches and the border with green and purple areas.
7	Purple	Associated with interior and transitional mangrove areas.
8	Black	Associated with drainage ditches, edges of water bodies, and tree shadows.
9	Red	Main association with *C. equisetifolia* forest in western part of image and coastal bordering fringe mangrove.
10	Orange	Lesser association with *C. equisetifolia* forest.

Image objects created in *Definiens Professional*® v5 containing a 17 factor attribute table were analyzed in SAS v9 using a principal components analysis (PCA) and K-means cluster analysis. The first five axes represented 84% of the variation observed in the data (Table 4). The 17 factors forming the basis of the PCA grouped into four distinct categories based on spectral and textural properties, shape, and a miscellaneous "other" category (Table 5).

Table 4: Eigenvalues for the correlation matrix

PC	Eigenvalue	Difference	Proportion	Cumulative
1	6.195	2.951	0.364	0.364
2	3.244	0.909	0.191	0.555
3	2.335	0.894	0.137	0.693
4	1.441	0.374	0.085	0.777
5	1.067	0.300	0.063	0.840
6	0.768	0.244	0.045	0.885
7	0.524	0.041	0.031	0.916
8	0.483	0.165	0.028	0.945
9	0.317	0.099	0.019	0.963

Based on the eigenvectors (Table 5), PC1 (36%) is a composite of several spectral measures. PC2 (19%) has a negative association with shape (Table 5). PC3 (14%) also appears to have a strong association with the overall shape of each feature. PC4 (9%) and PC5 (6%) are minor components.

Table 5: Eigenvectors (factor scores) computed for the correlation matrix.

Group	Factor	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Spectral	Red	0.286	0.273	-0.187	0.163	0.049
	Green	0.320	0.218	-0.238	0.205	0.002
	Blue	0.235	0.280	-0.251	0.332	0.025
	NIR	0.360	-0.121	-0.119	-0.154	-0.108
	Pan	0.365	0.124	-0.203	0.083	-0.020
	NDVI	0.280	-0.259	-0.093	-0.276	-0.140
Texture	SD NIR	0.151	-0.002	0.196	-0.373	0.500
	VarNIR	0.240	0.228	0.226	-0.296	0.164
	VarPan	0.252	0.266	0.087	-0.217	0.205
Shape	Area	0.146	-0.364	-0.023	0.162	-0.283
	Roundness	0.248	-0.308	0.221	0.225	0.236
	Compactness	0.144	-0.233	0.311	0.426	0.334
	Shape Index	0.252	-0.130	0.424	0.176	-0.113
	Ratio L to W	0.122	0.234	0.341	-0.175	-0.488
	Density	0.083	-0.328	-0.360	-0.314	0.177
	Asymmetry	0.133	0.118	0.314	-0.085	-0.249
Other	Max Diff	-0.263	0.324	0.116	0.124	0.233

In total, 1871 objects were classified into 30 classes using the first five principal components (Table 4) with K-means clustering implemented in Proc FASTCLUS. Seven of the original 30 classes (Class 6, 16, 17, 18, 19, 21 and 27) were found to be a mix of vegetation types that did not separate well into any one class. To improve the separability of these classes, a new cluster analysis was executed on only those objects (712) that grouped into these seven classes.

The results of this second cluster analysis are shown in Figure 14. Out of the 20 new classes, three had to be omitted because they were image artifacts. The results obtained from the remaining 17 classes reveal that the image object boundaries were not following the vegetation patterns visible in the aerial photographs, despite their small size and the inclusion of additional layers to capture texture information (variance filter) and to strengthen the signal (NDVI) between poorly and highly vegetated areas. Possibly, the scale parameter for the multiresolution segmentation was set too large. However, decreasing the scale setting would have created smaller objects that tend to be more jagged and abstract in shape, are heavily influenced by light and shadow, and thus are not representative of the community. In the

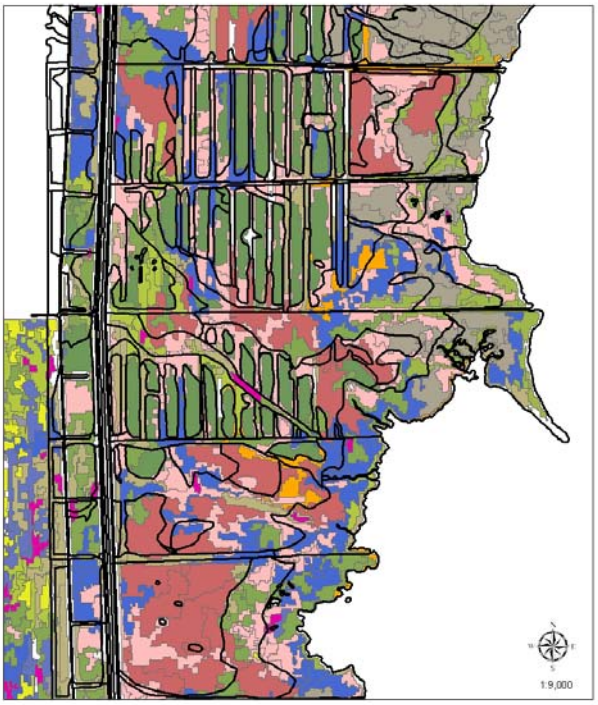


Figure 14: Comparison of object-based unsupervised classification with 17 classes overlaid with the Ruiz & Ross (2004) vegetation boundaries in black.

end, this unsupervised classification method also failed to properly classify and delineate community types within BISC.

In general, computer-based classification methods (pixel-based or object-based) of vegetation require that: 1) the imagery is radiometrically and geometrically corrected and 2) the spectral signature of the vegetation being classified is distinct enough to allow for its classification or separation into separate unique classes or vegetation communities, in this case. If these two parameters are not met, the computer-based classification will tend to have a high degree of commission and omission errors. In the case of this project, the imagery did not meet these standards and the vegetation types being classified did not have exclusive spectral signatures at Level 3 of the classification, the minimum required for this project. At the same time, the classification system applied (Appendix 1) relies heavily on knowing the canopy height and tree density of the area or community being mapped. As a result, without LiDAR (only available for the mainland portions of BISC) or stereo imagery, these parameters become very difficult to establish, thus further diminishing the potential of the computer-based classification to distinguish between communities whose spectral signature are similar or identical but differ only in canopy height (e.g. Red Mangrove Shrubland vs Red Mangrove Forest). As a result, for a project of this size, the logistics of using a computer-based classification was determined to be far less efficient and prone to a higher degree of error than the ocular identification and hand digitizing of vegetation communities.

The Vegetation of Biscayne National Park:

Ideally, mapping efforts should coincide with the acquisition of the imagery being used. In practice, however, this is rarely the case. Realistically because of delays associated in contracting and budgeting, and image acquisition, availability, and/or procurement, it is not uncommon, for most mapping efforts, to be initiated several months to a year or more after the imagery was initially flown. Moreover, the extent, scale, and detail required of a map along with the work force available can extend the temporal separation between the imagery and the final product by several more months or years (see Welch et al. 1999). Luckily, most vegetative communities tend to be relatively inert and resistant to structural and/or compositional change during the lifespan of most mapping projects. However, because of perturbations, both natural and anthropogenic, communities sometimes change rapidly creating conditions on the ground that are no longer coincident with the imagery. This has the unfortunate effect of creating a classification impasse for the cartographer who must decide between mapping what is currently there and known against what might have been prior to the perturbation event. This is also a major problem in the accuracy assessment phase of all mapping project.

For this project, the imagery dated to May 2005 (see methods section), but mapping efforts did not commence until nearly two years later, in March 2007. Consequently, the map (Plate 1) represents the vegetation communities of BISC between March 2007 and June 2008 when the first and last polygons were drawn, respectively, and when ground referencing and truthing efforts ceased, in February 2008. Arguably and reasonably, the point could also be made, based on the image acquisition date, that this map really represents the vegetation of BISC in

2005. However, since all mapping activities were conducted nearly three years after the imagery was taken, and the accuracy assessment won't be complete until nearly a year after map production, it is best to consider it a representation of the vegetation communities of BISC in 2007-08, or for brevity, 2008.

However, ongoing exotic removal and restoration efforts, particularly on Elliott Key and Boca Chita, created conditions on the ground that were no longer coincident with the imagery or definable within the classification system. As a result, on Elliott Key, for example, areas treated for *Thespesia populnea* (Seaside Mahoe) were systematically classified based on the 2005 spectral signature which suggested a monotypic community of this species. These areas could have been classified as Treated Seaside Mahoe. However, conditions on the ground, in 2008, were ambiguous and indicative of a transitional state between treated and non-treated Seaside Mahoe communities with some units completely devoid of vegetation and others showing signs of an emerging mixed mangrove Shrubland, dotted with emerging Seaside Mahoe seedling and saplings, in a succulent herbaceous matrix. Moreover, since the imagery did not allow for the delineation of these new transitional units we had no choice but to map them, by default, based on how they appeared on the imagery. Fortunately, this is an exception and not the norm within the map.

The map created for the project (Plate 1) encompasses a total area of 35.2 km^2 of which 31 km^2 are within the borders of BISC. Nearly 55% (17.0 km^2) of these 31 km^2 correspond to the island habitat alone. The residual 4.2 km^2 (i.e. the difference between the total area mapped and the area mapped corresponding to BISC) consist of sections of the mainland that are adjacent to the park boundary (Figure 1). While not within the legislative jurisdiction of the National Park Service and BISC, these wetlands are an important component of the overall protection and ecological health of the communities that fall within the Park, including Biscayne Bay. As a result, some efforts were directed towards mapping these ecologically important lands. Unfortunately, only a small percentage of the total area in the BBCW were mapped.

Forest communities within BISC; i.e. Mangrove Forest & Hammock Forest, on both the mainland and islands, account for 48.4% of the total area mapped (Table 6). In contrast, the Shrubland and Scrub communities combine for almost 49% of all vegetation area (Table 6). The remaining area was distributed unevenly between Woodland (2%), Marsh (0.2%), Dune (0.03%), and Exotic (0.3%) communities (Table 6).

The total forested area within the Park was greater on the islands than on the mainland, 9.0 km^2 vs 5.7 km^2, respectively (Table 6). However, mangrove forest communities were more abundant on the mainland than on the islands (Table 6). The Coastal Hardwood Hammock community with a total area of 7.023 km^2 (i.e. 22.7% of the total area mapped) was the overall dominant community type present within all of BISC (Table 6) but only occurred on the islands. Woodlands are a minor component of both island and mainland habitats. The distribution of Woodlands were slightly greater on the islands than in the mainland. Red and Mixed Mangrove Shrublands on the islands account for almost 3 times the total area of shrublands of any sort on the mainland (Table 6). In contrast, the scrub mangrove communities of the mainland accounted for almost 4 times the total area of scrub habitat of all

types on the islands (Table 6). Marshes, like Woodlands, were a minor component of both island and mainland habitats. However, Marshes were more common on the mainland than on the islands (Table 6). The Dune class was the only class found exclusively on the islands but it only accounted for 0.1% of the total area mapped within the island community. Exotics, at 0.27% of the total area mapped, were a minor component of both the mainland and island habitats.

Descriptively, the vegetation of BISC (Plate 1) consists of a complex mosaic of physiognomically distinct communities distributed along a hydrologic and salinity gradient that, along with nutrient availability and substrate type, ultimately determines plant community composition and productivity. The physiography of the landscape serves as a template controlling hydrology and salinity, and thereby regulating the distribution and structure of the communities. Soil type and depth are equally important, particularly on the mainland portions of BISC where the topographic gradient is subtle (Meeder et al. 2000) and soil depths can reach and exceed 1 m (Gaiser et al. 2006, Meeder et al. 2000). In contrast, soil depth on the upland portions of the islands rarely exceeds a few decimeters, but the topographic gradient between adjacent mangrove and hardwood hammock communities may easily exceed 1 meter. This juxtaposition in topography and substrate (both in type and depth) between the mainland and islands create unique environments that support unique communities within BISC (Table 6). This is particularly true for the Marsh class, where three of the four Level 3 Marsh types documented (e.g. Herbaceous Salt Marsh, Succulent Salt Marsh, and Graminoid Freshwater Prairie) are found exclusively in the island environment but not on the mainland (Table 6). There are other examples of this, most notably, the two Hammock Forest types that are exclusive to the islands (Table 6). Coincidently, both of these hammock communities, though floristically and structurally similar, have distinctive soil characteristics, which sets them apart. Exclusive to the mainland, on the other hand, we find extensive areas of *Rhizophora mangle* dwarf trees (red mangrove scrub) in a matrix of either *Fimbristylis spadicea* (Marsh Fimbry) or *Juncus roemerianus* (Black Rush), as well as isolated Salt Marsh communities dominated by Black Rush. It is worth noting that these Black Rush Salt Marshes are a relic community that is slowly being displaced by the encroachment of mangroves, particularly *R. mangle*.

Table 6: Summary statistics for all **Level – 3** communities, except Exotic (**Level – 1**) identified and mapped within BISC.

Class (L1)	Group (L3)	Area (km^2)			Percent		
		Mainland	**Islands**	**Total**	**Mainland**	**Islands**	**Total**
Forest	Black Mangrove Forest	0.0571	0.399	0.457	0.4	2.4	1.47
	Buttonwood Forest	0.0000	0.081	0.081	0.0	0.5	0.26
	White Mangrove Forest	0.0000	0.000	0.000	0.0	0.0	0.00
	Red Mangrove Forest	0.4478	0.319	0.767	3.2	1.9	2.48
	Mixed Mangrove Forest	5.2444	1.110	6.354	37.3	6.6	20.53
	Coastal Hardwood Hammock	0.0000	7.023	7.023	0.0	41.6	22.69
	Coastal Dune Hammock	0.0000	0.034	0.034	0.0	0.2	0.11
Woodland	Black Mangrove Woodland	0.1343	0.185	0.319	1.0	1.1	1.03
	Buttonwood Woodland	0.0000	0.115	0.115	0.0	0.7	0.37
	White Mangrove Woodland	0.0000	0.042	0.042	0.0	0.3	0.14
	Mixed Mangrove Woodland	0.0229	0.097	0.120	0.2	0.6	0.39
	Upland Hardwood Woodland	0.0000	0.027	0.027	0.0	0.2	0.09
Shrubland	Black Mangrove Shrubland	0.0000	0.081	0.081	0.0	0.5	0.26
	Buttonwood Shrubland	0.0000	0.093	0.093	0.0	0.6	0.30
	White Mangrove Shrubland	0.0097	0.011	0.021	0.1	0.1	0.07
	Red Mangrove Shrubland	0.4085	2.525	2.934	2.9	14.9	9.48
	Mixed Mangrove Shrubland	1.6943	3.100	4.794	12.1	18.3	15.49
	Coastal Hardwood Shrubland	0.0000	0.063	0.063	0.0	0.4	0.20
Scrub	Black Mangrove Scrub	0.0000	0.101	0.101	0.0	0.6	0.33
	White Mangrove Scrub	0.0000	0.030	0.030	0.0	0.2	0.10
	Red Mangrove Scrub	4.9972	0.807	5.804	35.5	4.8	18.75
	Mixed Mangrove Scrub	0.5742	0.374	0.948	4.1	2.2	3.06
	Upland Scrub	0.0000	0.002	0.002	0.0	0.0	0.01
	Upland Hardwood Scrub	0.0000	0.015	0.015	0.0	0.1	0.05
Marsh	Graminoid Salt Marsh	0.0341	0.0005	0.035	0.2	0.0	0.11
	Herbaceous Salt Marsh	0.0000	0.001	0.001	0.0	0.0	0.00
	Succulent Salt Marsh	0.0000	0.004	0.004	0.0	0.0	0.01
	Graminoid Freshwater Prairie	0.0000	0.017	0.017	0.0	0.1	0.05
Dune	Mixed Herbaceous Dune	0.0000	0.009	0.009	0.0	0.1	0.03
Exotic	Exotic	0.0314	0.051	0.082	0.2	0.3	0.26
Other	Barren Microkarst	0.0000	0.020	0.020	0.0	0.1	0.06
	Barren Salt Flat	0.0000	0.004	0.004	0.0	0.0	0.01
	Beach	0.0000	0.022	0.022	0.0	0.1	0.07
	Lightning Gap	0.0013	0.0001	0.001	0.0	0.0	0.00
	Littoral Zone	0.0000	0.002	0.002	0.0	0.0	0.01
	Water	0.1738	0.040	0.214	1.2	0.2	0.69
	Anthropogenic	0.2248	0.097	0.322	1.6	0.6	1.04
Total		**14.1 (45.4%)**	**16.9 (54.6%)**	**31.0**	**100**		

Conclusion:

By providing a spatial inventory of the plant communities within BISC, this map, directs managers to focus their attention on relic, rare, and fragmented communities (e.g. *J. roemerianus* salt marshes found on the mainland or mangrove shrublands in a matrix of *Spartina bakeri* found on to Elliott Key) that are generally more vulnerable to anthropogenic and natural perturbations. This is particularly true in the case of the species rich Coastal Hardwood Hammock community. This fragmented upland coastal community serves as refugia for many threatened and endangered species, both flora and fauna. However, since this community is only found on the eastern rim of Biscayne Bay, at a few meters above mean sea level, it is highly vulnerable to the effects of tropical storms and hurricanes and their accompanying storm surge, and, without question, sea-level rise. Moreover, in conjunction with existing data, managers can use this map to isolate communities that are likely to benefit the most from restoration efforts. Finally, this map, with its highly accurate and precise 1:300 scale shoreline, serves as a turn-of-the-21st-century baseline for the extent of mangroves within Biscayne National Park. As a result, it can be useful for monitoring the effects of sea-level rise on the wetlands and forested communities of Biscayne National Park.

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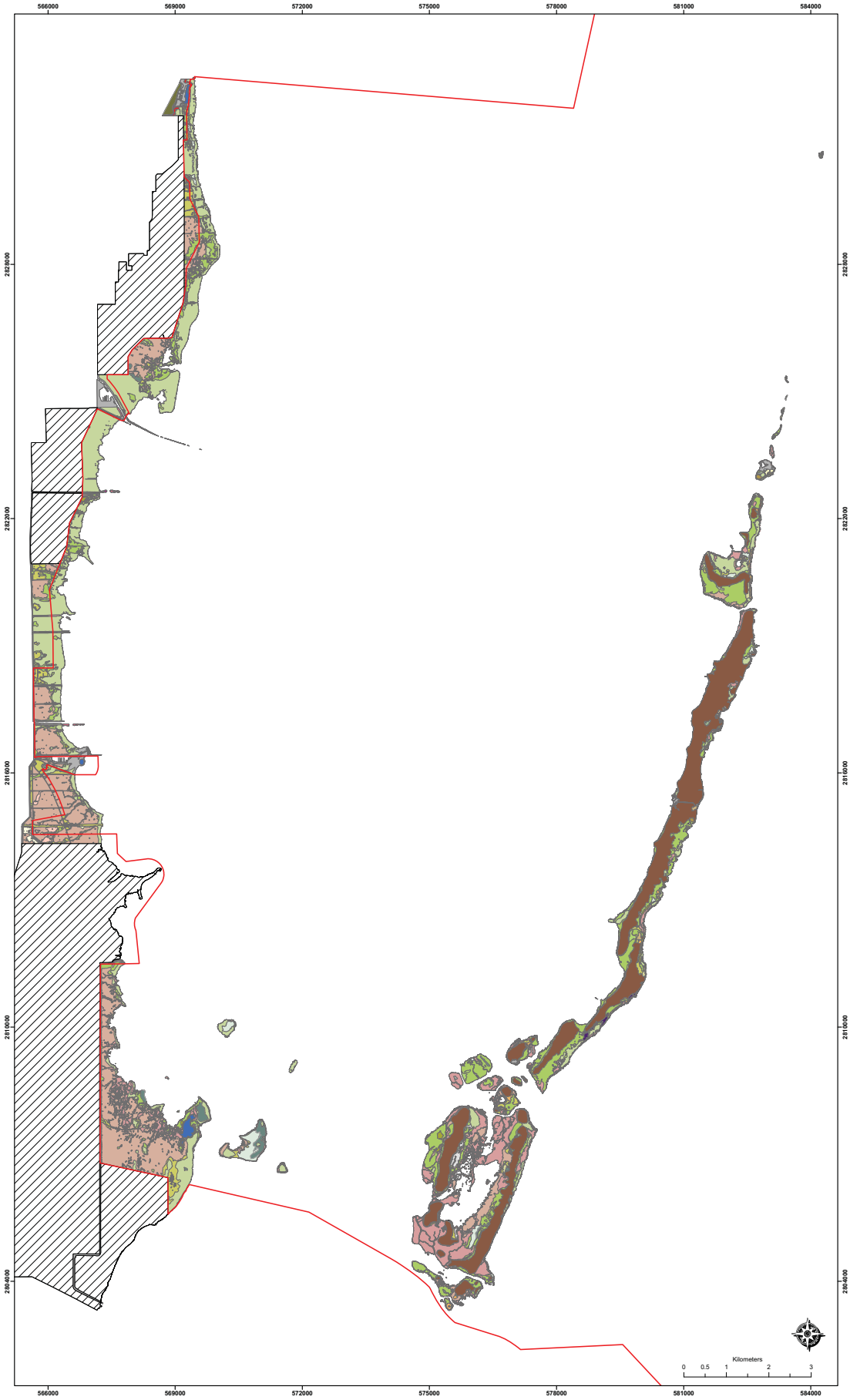
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Plate 1

The 2008 Terrestrial Vegetation of Biscayne National Park

The 2008 Terrestrial Vegetation of Biscayne National Park



Vegetation

Forest
- Hammock Forest
- Coastal Hardwood Hammock
- Coastal Dune Hammock
- Black Mangrove Forest
- Buttonwood Forest
- White Mangrove Forest
- Red Mangrove Forest
- Mixed Mangrove Forest

Woodland
- Upland Hardwood Woodland
- Black Mangrove Woodland
- Buttonwood Woodland
- White Mangrove Woodland
- Mixed Mangrove Woodland

Shrubland
- Coastal Hardwood Shrubland
- Upland Shrubland
- Black Mangrove Shrubland
- Buttonwood Shrubland
- White Mangrove Shrubland
- Red Mangrove Shrubland
- Mixed Mangrove Shrubland

Scrub
- Upland Scrub
- Upland Hardwood Scrub
- Black Mangrove Scrub
- White Mangrove Scrub
- Red Mangrove Scrub
- Mixed Mangrove Scrub

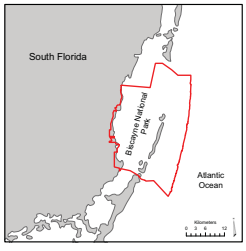
Marsh
- Succulent Salt Marsh
- Herbaceous Salt Marsh
- Graminoid Salt Marsh
- Graminoid Freshwater Prairie
- Graminoid Freshwater Marsh

Dune
- Mixed Herbaceous Dune

Exotic
- Exotic
- Australian Pine
- Treated Australian Pine
- Seaside Mahoe

Other
- Anthropogenic
- Barren Microkarst
- Barren Salt Flat
- Beach
- Lightning Gap
- Littoral Zone
- Inland Lakes or Pools
- Unclassified

Biscayne National Park Boundary



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SOUTH FLORIDA TERRESTRIAL ECOSYSTEMS LAB
Florida International University, Miami, FL 33199

Authored by: Pablo L Ruiz
Funded by: National Park Service South Florida / Caribbean Network
Date: June 2008
Base Map Source: 2005 Multispectral (RGBNIRPan) Aerial Photos
Datum: NAD83 UTM Zone17N (units = meters)

Appendix 1

Hierarchical Classification System with Community Descriptions

L1 - Class

Class	*Author*	*Raster ID*	*Rutchey ID*
Forest	Rutchey et al.	100000	100000
High-density stands of trees (> 50% tree canopy cover) with heights > 5 meters.			
Woodland	Rutchey et al.	200000	200000
Low-density stands of trees (10 - 60% tree canopy cover) with heights > 5 meters in a matrix of shrubs, graminoids, and/or herbaceous vegetation.			
Shrubland	Rutchey et al.	300000	300000
Stands of small trees and/or shrubs (canopy cover ≥ 50%) with heights < 5 meter tall.			
Scrub	Rutchey et al.	400000	400000
Communities of dwarf trees or shrubs typically in a matrix of graminoids, and/or herbaceous vegetation. Canopy cover 10% to 50% but can be as high as 100% for Mangrove and Cypress classes. Canopy < 5 meters tall with the exception being for Mangrove which is ≤ 2 meters.			
Marsh	Rutchey et al.	500000	500000
Graminoid and/or herbaceous emergent or floating vegetation in shallow water that stands at or above the ground surface for much of the year.			
Dune	Rutchey et al.	600000	600000
A ridge of wind blown or windstorm deposited sand or similar material directly inland and parallel to the shoreline that is commonly vegetated by graminoids and/or herbs and sometimes even shrubs.			
Submerged Aquatic Vegetation	Rutchey et al.	700000	700000
Vegetation that has evolved the ability to carry out its entire life cycle completely submerged in an aquatic environment.			
Exotic	Rutchey et al.	800000	800000
Non-native and invasive vegetation.			
Other	Ruiz & Ross	900000	900000
Non-vegetative or anthropogenic cover.			
Unclassified	Ruiz & Ross	999999	
Unclassified vegetation or land cover.			

L2 - Type

Type	*Author*	*Raster ID*	*Rutchey ID*
Mangrove Forest	Rutchey et al.	110000	110000
Regularly flooded (tidal) forest found along coastal areas dominated by salt tolerant species.			
Hammock Forest	Rutchey et al.	130000	130000
Rarely inundated and well drained forests containing a mixture of tropical and temperate broad-leaved trees.			
Mangrove Woodland	Rutchey et al.	210000	210000
Regularly flooded (tidal) open canopy forest found along coastal areas dominated by salt tolerant species.			
Upland Woodland	Rutchey et al.	230000	230000
Rarely inundated and well drained open canopy forests containing a mixture of tropical and temperate broad-leaved trees.			
Mangrove Shrubland	Rutchey et al.	310000	310000
Regularly flooded (tidal) shrubland found along coastal areas dominated by salt tolerant species			
Upland Shrubland	Rutchey et al.	340000	340000
Rarely inundated and well drained shrublands containing a mixture of tropical and temperate broad-leaved trees.			
Mangrove Scrub	Rutchey et al.	410000	410000
Tidal and seasonally flooded dwarf (< 2 m height) mangrove trees found along coastal areas and in the transition zone between freshwater and marine dominated environments. Canopy densities are generally between 10% - 50% but can be as high as 100%.			
Upland Scrub	Rutchey et al.	430000	430000
Upland graminoid and/or herbaceous dominant communities in a matrix of dwarf (< 2 m height) trees and/or shrubs.			
Salt Marsh	Rutchey et al.	510000	510000
Marsh consisting of salt tolerant (halophilic) graminoid and/or herbaceous vegetation.			
Freshwater Marsh	Rutchey et al.	520000	520000
Marsh consisting of freshwater graminoid and/or herbaceous vegetation.			
Herbaceous Dune	Rutchey et al.	620000	620000
Herbaceous dominated dune.			

L2 - Type	*Author*	*Raster ID*	*Rutchey ID*
Australian Pine	Rutchey et al.	803000	803000
Macrophyte community consisting of River Sheoak (*Casuarina cunninghamiana*), Australian Pine (*C. equisetifolia*), and/or Suckering Australian Pine (*C. glauca*).			
Treated Australian Pine	Rutchey et al.	804000	804000
Macrophyte community treated for the presence of River Sheoak (*Casuarina cunninghamiana*), Australian Pine (*C. equisetifolia*), and/or Suckering Australian Pine (*C. glauca*).			
Seaside Mahoe	Rutchey et al.	833000	833000
Macrophyte community consisting of *Thespesia populnea*.			
Non-Vegetative	Ruiz & Ross	910000	
Non-vegetative coverage			
Anthropogenic	Ruiz & Ross	920000	
Non-natural coverage associated with human infrastructure and/or activities.			

L3 - Group

Group	*Author*	*Raster ID*	*Rutchey ID*
Black Mangrove Forest	Rutchey et al.	111000	111000
Black Mangrove (*Avicennia germinans*) dominated forest found along the coast.			
Buttonwood Forest	Rutchey et al.	112000	112000
Buttonwood (*Conocarpus erectus*) dominated forest usually found on the landward edge of the coastal mangrove zone.			
White Mangrove Forest	Rutchey et al.	113000	113000
White Mangrove (*Laguncularia racemosa*) dominated forest found along the coast.			
Red Mangrove Forest	Rutchey et al.	114000	114000
Red Mangrove (*Rhizophora mangle*) dominated forest found along the coast.			
Mixed Mangrove Forest	Rutchey et al.	115000	115000
Mixed mangrove forest with no particular species of dominance found along the coast.			
Coastal Hardwood Hammock	Rutchey et al.	131000	131000
Forest containing a mixture of tropical and temperate broad-leaved trees found along coastal areas on rocky substrate overtoped by an organic layer.			
Coastal Dune Hammock	Ruiz & Ross	137000	
Forest containing a mixture of tropical and temperate broad-leaved trees found along coastal areas on a dune (shell mounds excluded).			
Black Mangrove Woodland	Rutchey et al.	211000	212000
Black Mangrove (*Avicennia germinans*) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.			
Buttonwood Woodland	Rutchey et al.	212000	211000
Buttonwood (*Conocarpus erectus*) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.			
White Mangrove Woodland	Ruiz & Ross	213000	
White Mangrove (*Laguncularia racemosa*) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.			
Mixed Mangrove Woodland	Ruiz & Ross	215000	
Mixed assemblage of mangrove tree species in a matrix composed of salt marsh graminoids, herbs, and/or succulents.			

L3 - Group	Author	Raster ID	Rutchey ID
Upland Hardwood Woodland	Rutchey et al.	233000	233000
Woodland containing a mixture of tropical and temperate broad-leaved trees found along coastal areas on rocky substrate with little or no soil.			
Black Mangrove Shrubland	Rutchey et al.	311000	311000
Black Mangrove (*Avicennia germinans*) dominant shrubland predominately found in the upper part of the intertidal zone or on higher elevations.			
Buttonwood Shrubland	Rutchey et al.	312000	313000
Buttonwood (*Conocarpus erectus*) dominant shrubland usually found on the landward edge of the coastal mangrove zone or on the edge of hammocks.			
White Mangrove Shrubland	Rutchey et al.	313000	314000
White Mangrove (*Laguncularia racemosa*) dominant shrubland found throughout the intertidal zone.			
Red Mangrove Shrubland	Rutchey et al.	314000	315000
Red Mangrove (*Rhizophora mangle*) dominant shrubland found on the middle and lower portions of the intertidal and upper subtidal zone.			
Mixed Mangrove Shrubland	Rutchey et al.	315000	316000
Mixed of mangrove shrubland with no particular species of dominance found along the coast.			
Coastal Hardwood Shrubland	Rutchey et al.	342000	342000
Shrubland containing a mixture of tropical and temperate broad-leaved trees found along coastal areas on rocky substrate with little or no soil.			
Black Mangrove Scrub	Rutchey et al.	411000	411000
Black Mangrove (*Avicennia germinans*) dominant scrub predominately found in the upper part of the intertidal zone or on higher elevations.			
White Mangrove Scrub	Rutchey et al.	413000	413000
White Mangrove (*Laguncularia racemosa*) dominant scrub found throughout the intertidal zone.			
Red Mangrove Scrub	Rutchey et al.	414000	414000
Red Mangrove (*Rhizophora mangle*) dominant scrub found on the middle and lower portions of the intertidal and upper subtidal zone.			
Mixed Mangrove Scrub	Rutchey et al.	415000	415000
Mixed of mangrove scrub with no particular species of dominance found along the coast.			
Upland Hardwood Scrub	Rutchey et al.	431000	431000
Scrub containing a mixture of tropical and temperate broad-leaved trees found along coastal areas on rocky substrate with little or no soil.			

L3 - Group	*Author*	*Raster ID*	*Rutchey ID*
Graminoid Salt Marsh	Rutchey et al.	511000	511000
Graminoid dominated salt marsh			
Herbaceous Salt Marsh	Rutchey et al.	512000	512000
Herbaceous dominated salt marsh.			
Succulent Salt Marsh	Rutchey et al.	514000	514000
Succulent dominated salt marsh.			
Graminoid Freshwater Marsh	Rutchey et al.	522000	522000
Graminoid dominated freshwater marsh.			
Graminoid Freshwater Prairie	Rutchey et al.	523000	523000
Short hydroperiod freshwater marsh characterized by a mixture of low-stature grasses and sedges.			
Mixed Herbaceous Dune	Ruiz & Ross	623000	
Mixed herbaceous dominated dune.			
Barren Salt Flat	Rutchey et al.	910010	907000
Barren, generally hypersaline, flats exposed at low tide.			
Beach	Rutchey et al.	910020	901000
Sand and fine shell and coral fragments found along the shoreline.			
Littoral Zone	Ruiz & Ross	910030	
Shoreline that is submerged at high tide and exposed at low tide and is usually devoid of upland vegetation.			
Lightning Gap	Ruiz & Ross	910050	
Canopy gaps created by cloud to ground lightning strikes.			
Mud	Rutchey et al.	910070	903000
Moist or dry open ground.			
Water	Rutchey et al.	910120	904000
Open water areas such as ponds, lakes, rivers, bays, and estuaries.			
Barren Microkarst	Ruiz & Ross	910130	
Karst topography devoid of vegetation usually found around the perimeter of Coastal Hardwood Hammocks.			

L3 - Group	*Author*	*Raster ID*	*Rutchey ID*
Campground	Ruiz & Ross	920010	
Area designated for camping			
Canal	Rutchey et al.	920020	902020
Water bodies specifically designed to direct water from one location to another.			
Dock	Ruiz & Ross	920030	
A place used as a landing place or moorage for boats.			
Lawns & Landscaping	Ruiz & Ross	920040	
Ground that is covered with grass and/or trees and is maintained for its esthetics.			
Levee	Rutchey et al.	920050	902060
Elevated berm, generally with an access road, utilized to contain a body of water such as a lake or marsh			
Parking Lot	Ruiz & Ross	920060	
Area used for the parking of motor vehicles.			
Quarry	Rutchey et al.	920070	902080
Area used for mining rocks, minerals, or other natural resources.			
Road	Rutchey et al.	920080	902100
Paved and unpaved roads other than levees.			
Seawall	Ruiz & Ross	920090	
A wall or embankment to protect the shore from erosion or to act as a breakwater.			
Trail	Ruiz & Ross	920110	
A marked or established path or route designed to be followed.			
Spoil	Rutchey et al.	920120	902110
Earth and rock excavated or dredged.			
Walkway	Ruiz & Ross	920120	
A path, passage, etc. for pedestrians.			
Agriculture	Rutchey et al.	921000	902010
Fields designated for the production of goods or food through the cultivation of plants.			

L3 - Group	*Author*	*Raster ID*	*Rutchey ID*
Building	Ruiz & Ross	922000	
A roofed and walled structure built for permanent use.			
Unknown	Rutchey et al.	929999	908000
Unknown land cover.			

L4 - Formation

Formation	*Author*	*Raster ID*	*Rutchey ID*
Black Mangrove-Buttonwood Forest	Rutchey et al.	115100	115100
Black mangrove (*Avicennia germinans*) and Buttonwood (*Conocarpus erectus*) trees with the cover of either species ranging between 25-75%.			
Black Mangrove-White Mangrove Forest	Rutchey et al.	115200	115200
Black mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) trees with the cover of either species ranging between 25-75%.			
Black Mangrove-Red Mangrove Forest	Rutchey et al.	115300	115300
Black mangrove (*Avicennia germinans*) and Red Mangrove *(Rhizophora mangle*) trees with the cover of either species ranging between 25-75%.			
Buttonwood-White Mangrove Forest	Rutchey et al.	115400	115400
Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) trees with the cover of either species ranging between 25-75%.			
Black Mangrove Woodland-Succulent	Rutchey et al.	211030	211030
Black Mangrove (*Avicennia germinans*) trees in a matrix composed predominately of succulents.			
Buttonwood Woodland-Succulent	Rutchey et al.	212030	211030
Buttonwood (*Conocarpus erectus*) trees in a matrix composed predominately of succulents.			
Buttonwood-White Mangrove Woodland	Ruiz & Ross	215400	
Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) trees with the cover of either species ranging between 25-75%.			
Black Mangrove Shrubland-Succulent	Ruiz & Ross	311040	
Black Mangrove (*Avicennia germinans*) shrubs in a matrix composed predominately of succulents.			
Buttonwood Shrubland-Succulent	Ruiz & Ross	312040	
Buttonwood (*Conocarpus erectus*) shrubs in a matrix composed predominately of succulents.			
White Mangrove Shrubland-Succulent	Ruiz & Ross	313040	
White Mangrove (*Laguncularia racemosa*) shrubs in a matrix composed predominately of succulents.			
Mixed Mangrove Shrubland-Succulent	Ruiz & Ross	315040	
Mixed mangrove shrubs in a matrix composed predominately of succulents.			

L4 -Formation	*Author*	*Raster ID*	*Rutchey ID*
Black Mangrove-White Mangrove Shrubland	Rutchey et al.	315200	316200
Black mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) shrubs with the cover of either species ranging between 25-75%.			
Black Mangrove-Red Mangrove Shrubland	Rutchey et al.	315300	316300
Black mangrove (Avicennia germinans) and Red Mangrove (Rhizophora mangle) shrubs with the cover of either species ranging between 25-75%.			
Buttonwood-White Mangrove Shrubland	Rutchey et al.	315500	316500
Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) shrubs with the cover of either species ranging between 25-75%.			
Buttonwood-Red Mangrove Shrubland	Rutchey et al.	315600	316600
Buttonwood (*Conocarpus erectus*) and Red Mangrove (*Rhizophora mangle*) shrubs with the cover of either species ranging between 25-75%.			
White Mangrove-Red Mangrove Shrubland	Rutchey et al.	315700	316700
White Mangrove (*Laguncularia racemosa*) and Red Mangrove (*Rhizophora mangle*) shrubs with the cover of either species ranging between 25-75%.			
Black Mangrove Scrub-Succulent	Rutchey et al.	411040	411040
Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of succulents.			
White Mangrove Scrub-Succulent	Rutchey et al.	413040	413040
White Mangrove (*Laguncularia racemosa*) scrub in a matrix composed predominately of succulents.			
Red Mangrove Scrub-Graminoid	Rutchey et al.	414010	414010
Red Mangrove (*Rhizophora mangle*) scrub in a matrix composed predominately of graminoids.			
Red Mangrove Scrub-Open Marsh	Rutchey et al.	414030	414030
Red Mangrove (*Rhizophora mangle*) scrub in a matrix composed predominately of Open Marsh or Open Salt Marsh.			
Red Mangrove Scrub-Dominant	Rutchey et al.	414050	414050
Greater than 50% areal coverage of dwarf Red Mangrove (*Rhizophora mangle*) trees.			
Mixed Mangrove Scrub-Graminoid	Rutchey et al.	415010	415010
Mixed mangrove scrub in a matrix composed predominately of graminoids.			
Mixed Mangrove Scrub-Succulent	Rutchey et al.	415040	415040
Mixed mangrove scrub in a matrix composed predominately of succulents.			

L4 -Formation	*Author*	*Raster ID*	*Rutchey ID*
Black Mangrove-White Mangrove Scrub	Rutchey et al.	415200	415200
Black mangrove *(Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) dwarf trees with the cover of either species ranging between 25-75%.			
Black Mangrove-Red Mangrove Scrub	Rutchey et al.	415300	415300
Black mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) dwarf trees with the cover of either species ranging between 25-75%.			
Buttonwood-White Mangrove Scrub	Rutchey et al.	415400	415400
Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) dwarf trees with the cover of either species ranging between 25-75%.			
Buttonwood-Red Mangrove Scrub	Rutchey et al.	415500	415500
Buttonwood (*Conocarpus erectus*) and Red Mangrove (*Rhizophora mangle*) dwarf trees with the cover of either species ranging between 25-75%.			
White Mangrove-Red Mangrove Scrub	Rutchey et al.	415700	415600
White Mangrove (*Laguncularia racemosa*) and Red Mangrove (*Rhizophora mangle*) dwarf trees with the cover of either species ranging between 25-75%.			
Black Rush	Rutchey et al.	511200	511200
Black Rush (*Juncus roemerianus*) dominated salt marsh.			
Cordgrass	Rutchey et al.	511400	511400
Sand Cordgrass (*Spartina bakeri*) and/or Gulf Cordgrass (*S. spartinae*) dominated salt marsh.			
Glasswort	Rutchey et al.	514200	514200
Glasswort (*Salicornia spp*.) dominated salt marsh.			
Sawgrass	Rutchey et al.	522100	522100
Sawgrass (*Cladium jamaicense*) dominated marsh.			
Commercial	Ruiz & Ross	922010	
A building or complex housing retail business.			
Government	Ruiz & Ross	922020	
A building or complex housing government offices.			
Historical	Ruiz & Ross	922030	
A building or complex with historical significances			

L4 -Formation	*Author*	*Raster ID*	*Rutchey ID*
Industrial	Ruiz & Ross	922040	
A building or complex housing factories.			
Lighthouse	Ruiz & Ross	922050	
A tower or structure designed to emit light and aid in navigation.			
Pump Station	Rutchey et al.	922060	902040
A Structure used to move water through canals.			
Residential	Ruiz & Ross	922070	
A building or complex used as a permanent dwelling.			

L5 - Alliance

Alliance	*Author*	*Raster ID*	*Rutchey ID*
Black Mangrove Woodland-Saltwort	Ruiz & Ross	211031	
Black Mangrove (*Avicennia germinans*) trees in a matrix composed predominately of Saltwort (Batis maritima).			
Buttonwood-White Mangrove Woodland-Herbaceous	Ruiz & Ross	215420	
Buttonwood *(Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) trees in a matrix composed predominately of herbaceous vegetation.			
Black Mangrove Shrubland-Saltwort	Ruiz & Ross	311041	
Black Mangrove (*Avicennia germinans*) shrubs in a matrix composed predominately of Saltwort (*Batis maritima*).			
Buttonwood Shrubland-Saltwort	Ruiz & Ross	312041	
Buttonwood (*Conocarpus erectus*) shrubs in a matrix composed predominately of Saltwort (*Batis maritima*).			
Black Mangrove-White Mangrove Shrubland-Succulent	Ruiz & Ross	315210	
Black Mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) shrubs in a matrix composed predominately of succulent vegetation.			
Buttonwood-White Mangrove Shrubland-Succulent	Ruiz & Ross	315510	
Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) shrubs in a matrix composed predominately of succulent vegetation.			
Buttonwood-White Mangrove Shrubland-Graminoid	Ruiz & Ross	315520	
Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) shrubs in a matrix composed predominately of graminoids.			
Black Mangrove Scrub-Saltwort	Rutchey et al.	411041	411041
Black Mangrove (*Avicennia germinans*) dwarf trees in a matrix composed predominately of Saltwort (*Batis maritima*).			
White Mangrove Scrub-Saltwort	Rutchey et al.	413041	413041
White Mangrove (*Laguncularia racemosa*) dwarf trees in a matrix composed predominately of Saltwort (*Batis maritima*).			
White Mangrove Scrub-Glasswort	Rutchey et al.	413042	413042
White Mangrove (*Laguncularia racemosa*) dwarf trees in a matrix composed predominately of Glasswort (*Salicornia bigelovii*).			
Red Mangrove Scrub-Sawgrass	Rutchey et al.	414011	414011
Red Mangrove (*Rhizophora mangle*) dwarf trees in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).			

L5 -Alliance	*Author*	*Raster ID*	*Rutchey ID*
Red Mangrove Scrub-Frimbry	Rutchey et al.	414014	414014

Red Mangrove (*Rhizophora mangle*) dwarf trees in a matrix composed predominately of Marsh Frimbry (*Fimbristylis spadicea*).

Red Mangrove Scrub-Black Rush	Rutchey et al.	414015	414015

Red Mangrove (*Rhizophora mangle*) dwarf trees in a matrix composed predominately of Black Rush (Juncus roemerianus).

Red Mangrove Scrub-Subtidal	Ruiz & Ross	414051	

Red Mangrove (*Rhizophora mangle*) dwarf trees in a subtidal environment.

Mixed Mangrove Scrub-Black Rush	Rutchey et al.	415015	

Mixed mangrove dwarf trees in a matrix composed predominately of Black Rush (*Juncus roemerianus*).

Black Mangrove-White Mangrove Scrub-Succulent	Rutchey et al.	415240	415240

Black Mangrove (*Avicennia germinans*) & White Mangrove (*Laguncularia racemosa*) dwarf trees in a matrix composed predominately of succulents.

Buttonwood-White Mangrove Scrub-Graminoid	Rutchey et al.	415410	415410

Buttonwood (*Conocarpus erectus*) & White Mangrove (*Laguncularia racemosa*) dwarf trees in a matrix composed predominately of graminoids.

Buttonwood-White Mangrove Scrub-Succulent	Rutchey et al.	415440	415440

Buttonwood (*Conocarpus erectus*) & White Mangrove (*Laguncularia racemosa*) dwarf trees in a matrix composed predominately of succulents.

Buttonwood-Red Mangrove Scrub-Graminoid	Rutchey et al.	415510	415510

Buttonwood (*Conocarpus erectus*) & Red Mangrove (*Rhizophora mangle*) dwarf trees in a matrix composed predominately of graminoids.

L6 - Association

Association	*Author*	*Raster ID*	*Rutchey ID*
Buttonwood-White Mangrove Shrubland-Cordgrass	Ruiz & Ross	315521	
Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) shrubs in a matrix composed predominately of Sand Cordgrass (*Spartina bakeri*).			
Black Mangrove-White Mangrove Scrub-Saltwort	Rutchey et al.	415241	415241
Black Mangrove (*Avicennia germinans)* -White Mangrove (*Laguncularia racemosa)* dwarf trees in a matrix composed predominately of Saltwort (*Batis maritima*).			
Buttonwood-White Mangrove Scrub-Cordgrass	Rutchey et al.	415417	415417
Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) dwarf trees in a matrix composed predominately of Sand Cordgrass (*Spartina bakeri*).			
Buttonwood-White Mangrove Scrub-Glasswort	Rutchey et al.	415442	415442
Buttonwood (*Conocarpus erectus*) & White Mangrove (*Laguncularia racemosa*) dwarf trees in a matrix composed predominately of Glasswort (*Salicornia bigelovii*).			
Buttonwood-Red Mangrove Scrub-Sawgrass	Rutchey et al.	415511	415511
Buttonwood (*Conocarpus erectus*) & Red Mangrove (*Rhizophora mangle*) dwarf trees in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).			

Appendix 2

Definiens Professional® v5 Segmentation Algorithm

In *Definiens Professional*® v5, two process trees were created and saved – one for coastal shorelines and one for island shorelines. They are named Land_Water_Boundary_Coast and Land_Water_Boundary_Keys. Both processes contain the same steps, but parameters were altered within the listed functions. Within the Process Tree, processes are grouped into the general areas of Segmentation, Classification, Merge objects and Export. The Process Tree for the Keys is shown in Fig. 1.

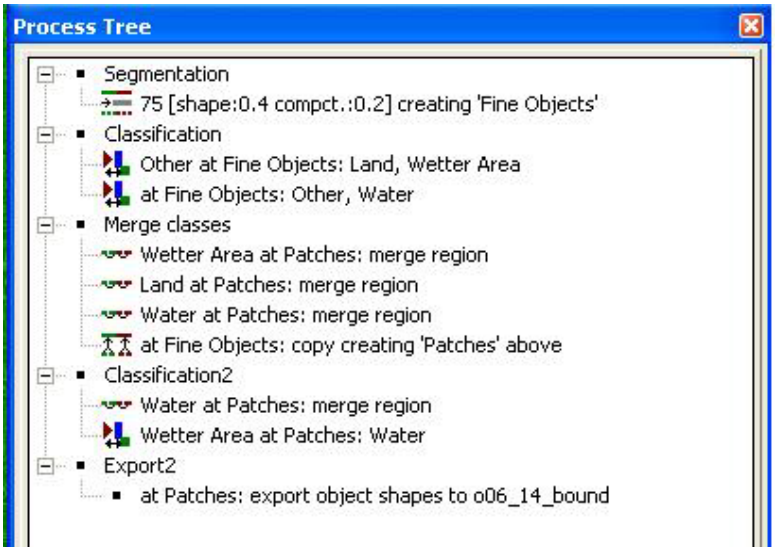


Fig. 1: Process Tree for shoreline creation using *Definiens Professional*® V5. This tree is used for the Keys. The Process Tree used for coastal areas is similar.

To create a project in *Definiens Professional*® v5, we loaded the image of interest, then defined the No Data areas. The near infrared band rarely reads zero in the scene; therefore we use band 4 = 0 as the definition of the No Data area. Next, image objects were created using multiresolution segmentation. In multiresolution segmentation, there are several parameters that can be evaluated. For both the keys and the coastal area, the best segmentation results were seen using only the NIR band 4 of the image and adjusting the Composition of Homogeneity Criteria to 0.6 for color and 0.4 for shape. This ratio refers to the relative importance of spectral input and shape for the image objects. The shape criteria was placed as high as 0.4 to give image objects that were more compact and therefore easier to edit later in ArcGIS as a shapefile.

Fig. 2a & 2b show the segmentation parameters for the coastal area and the keys. Because the coastal area is simpler in vegetation patterns, the scale parameter is 150 rather than 75 in the keys. The scale parameter is used as a threshold for heterogeneity calculations to determine if two objects are similar enough to be merged or kept separate. The remaining parameters are the same in the two multiresolution segmentation processes.

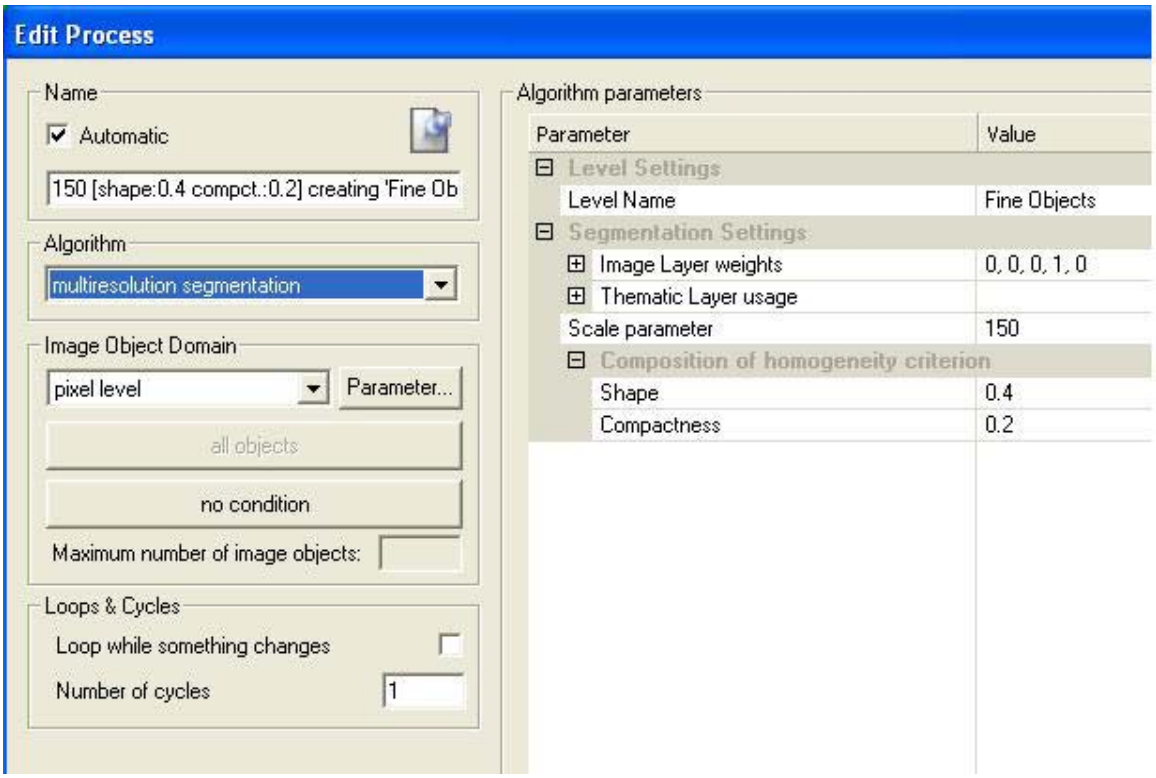


Fig. 2a: Multiresolution segmentation parameters for coastal area.

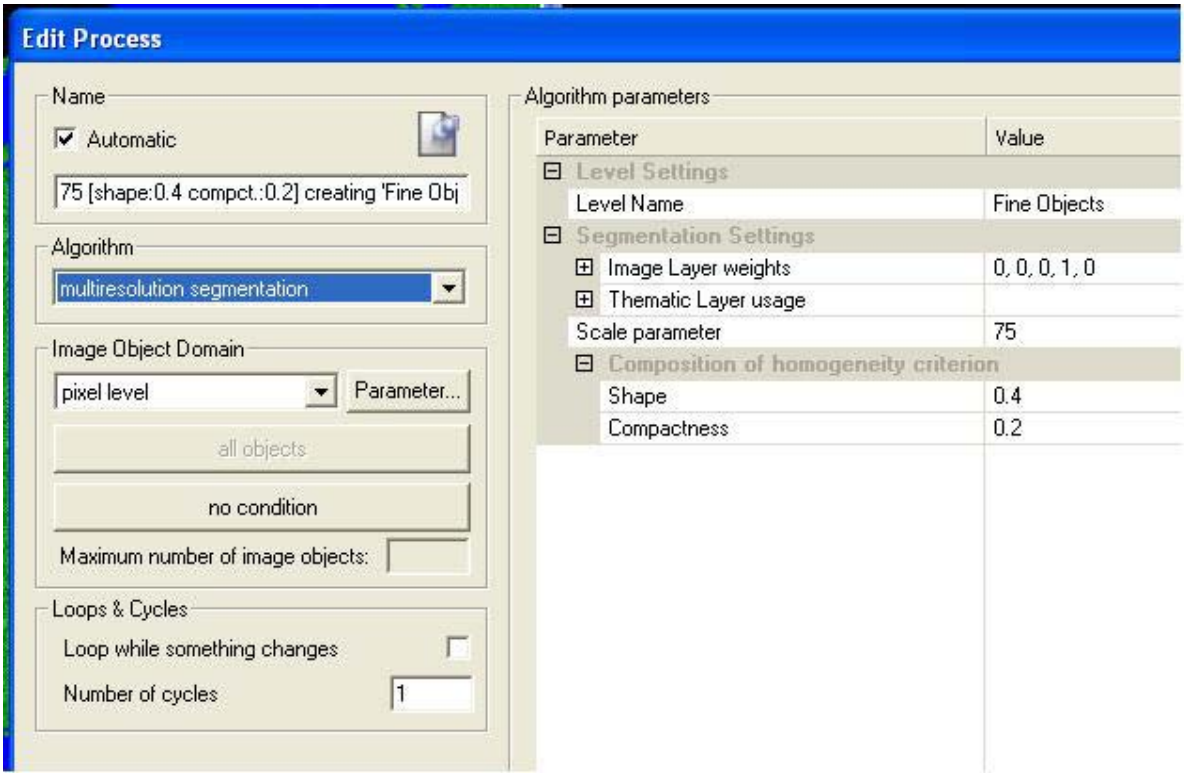


Fig. 2b: Multiresolution segmentation parameters for keys.

Classification of the image objects is defined through the Class Hierarchy. Fig. 3 shows the Class Hierarchy. There are two levels in the hierarchy. In the first level, objects are classified as Water or Other (not water). The Water class has an explicit definition; whereas the Other class is defined as those objects not classed as Water. In the second level, the Other objects are further classified into Wetter Area and Land (not wetter area). Again, here the Wetter Area class has an explicit definition, and the Land Class are those objects not classed as Wetter Area.

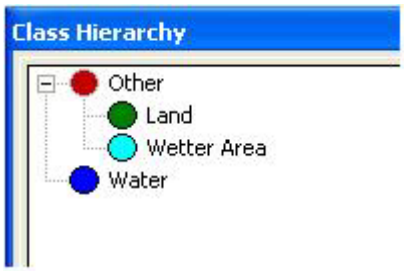


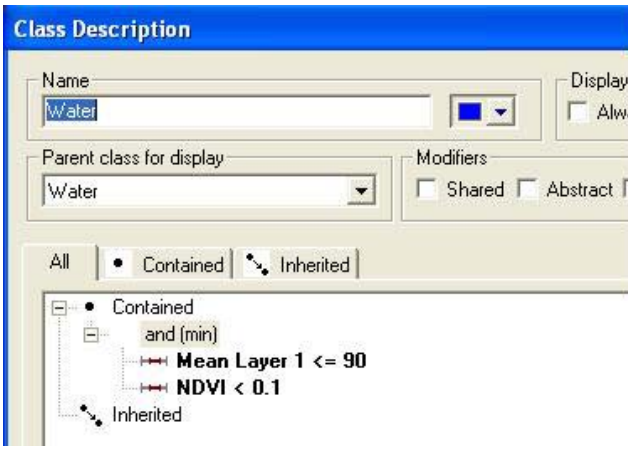
Fig. 3: Class Hierarchy for classification of objects as Land or Water.

To help reduce the influence of the spectral variability of the images in the classification, a ratio, NDVI, was defined as a custom feature using the brightness values:

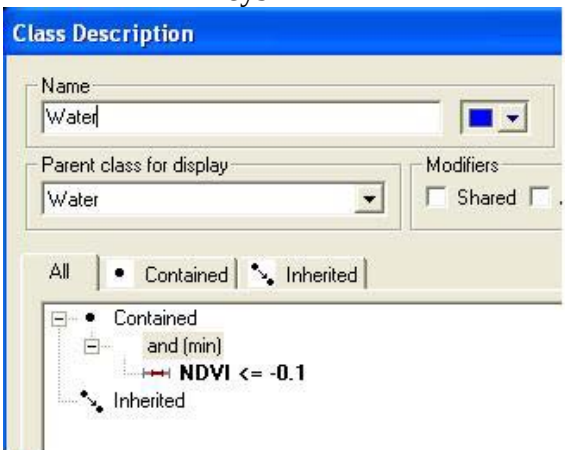
$$NDVI = (NIR - Red)/(NIR + Red) = (Band\ 4 - Band\ 1)/(Band\ 4 + Band\ 1)$$

Classes were than classified as followed (Fig 4.)

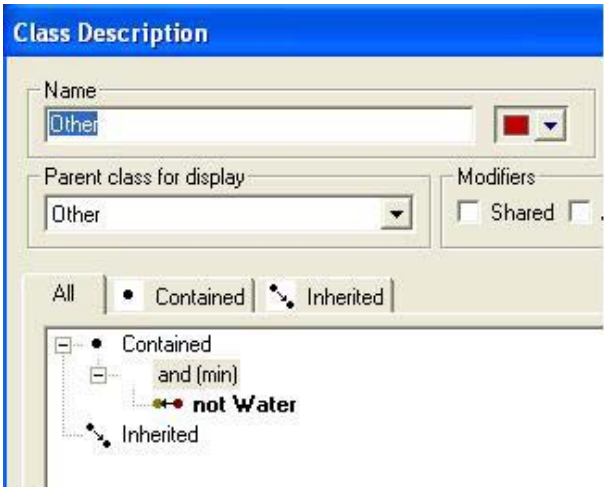
Coastal Area



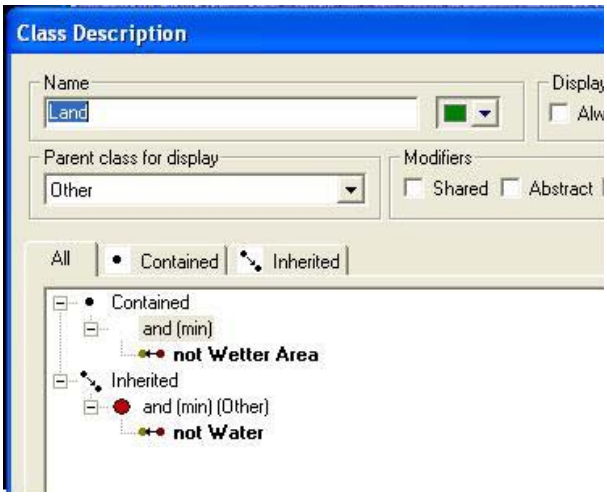
Keys

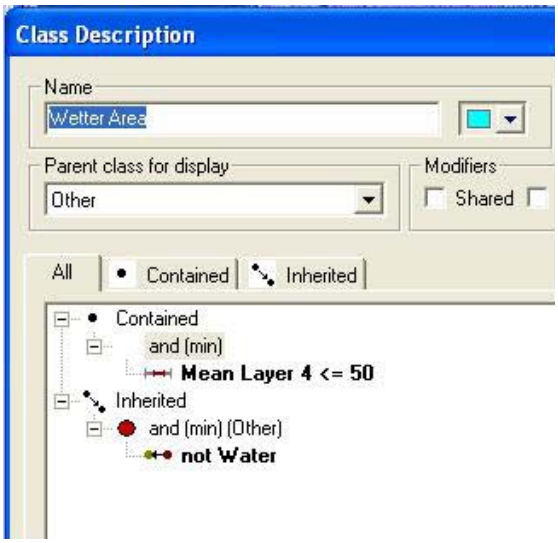


Coastal Area



Keys





The Wetter Area class includes areas having shallow water and NDVI just above the cutoff for deeper water. For the coastal area the Wetter Area class is defined as a threshold using NIR (Band 4 <= 50).

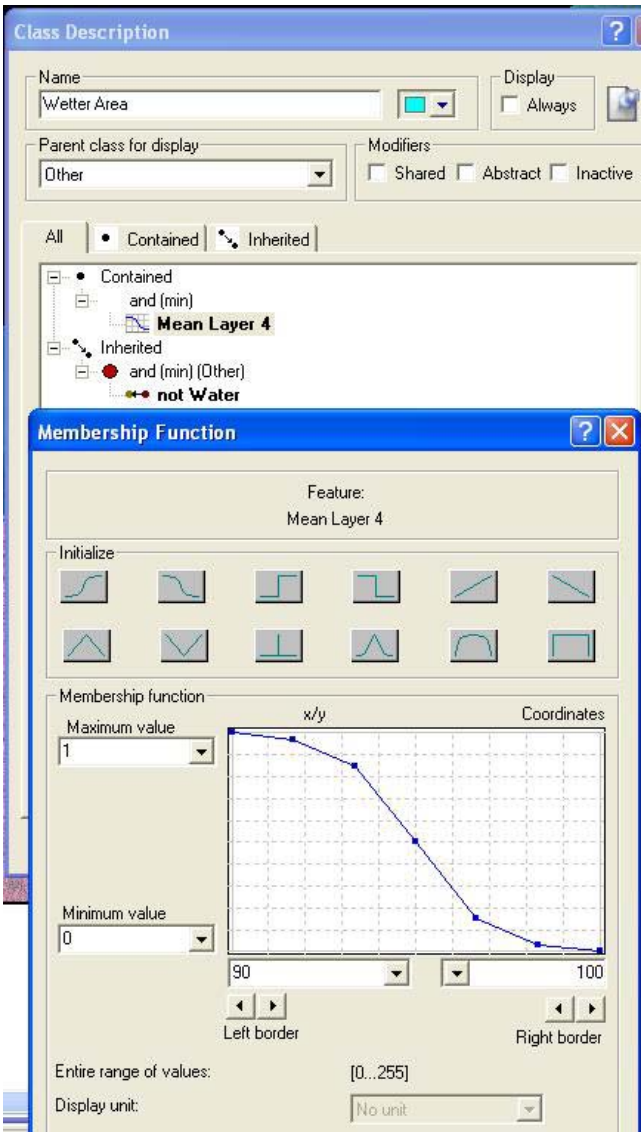


Fig 4: class descriptions and functions used for classification.

In contrast the definition of Wetter Area of the keys is defined by a fuzzy less than function with a mean value of 95.

In general the differences between the keys and the coastal areas are:

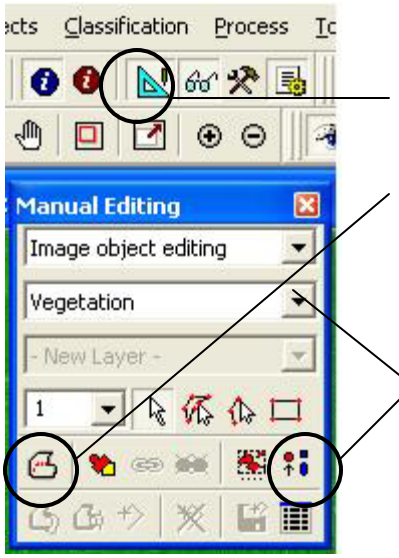
Water is defined by a lower threshold for the keys (<=-0.1 vs. <0.1).

Band 1 (Red) is also included in the coastal area.

Wetter Area is defined in the NIR as a threshold <= 50 for the coastal area and fuzzy less than 90-100 for the keys.

These class descriptions, which are included with the process tree and rule set, are loaded for each analysis. However, since each scene is different in its spectral properties, it was necessary to alter the rules to get adequate delineation of the shoreline.

It was also necessary to manually change object boundaries and classifications due to the four factors described there. There are a couple of ways to manually assign classes to objects. To get all of the features needed, click on the Manual Editing Toolbar Button (Fig. 5) rather than using the Process Tree. The lower limit for resolving mangrove tree islands was a diameter of about 10 meters, depending on the quality of the photograph.



Click this button to access toolbar.

Click this button to cut an image object.

Click this button to manually classify an object, and select class from drop-down menu.

Fig. 5:. Manual Editing Toolbar.

When the objects and classes closely follow the shorelines in the image, then objects can be merged and exported. In V4 (Ecognition), classification based image object fusion could be done in a couple of steps. In V5 the following steps must be done to merge adjoining objects having the same class:

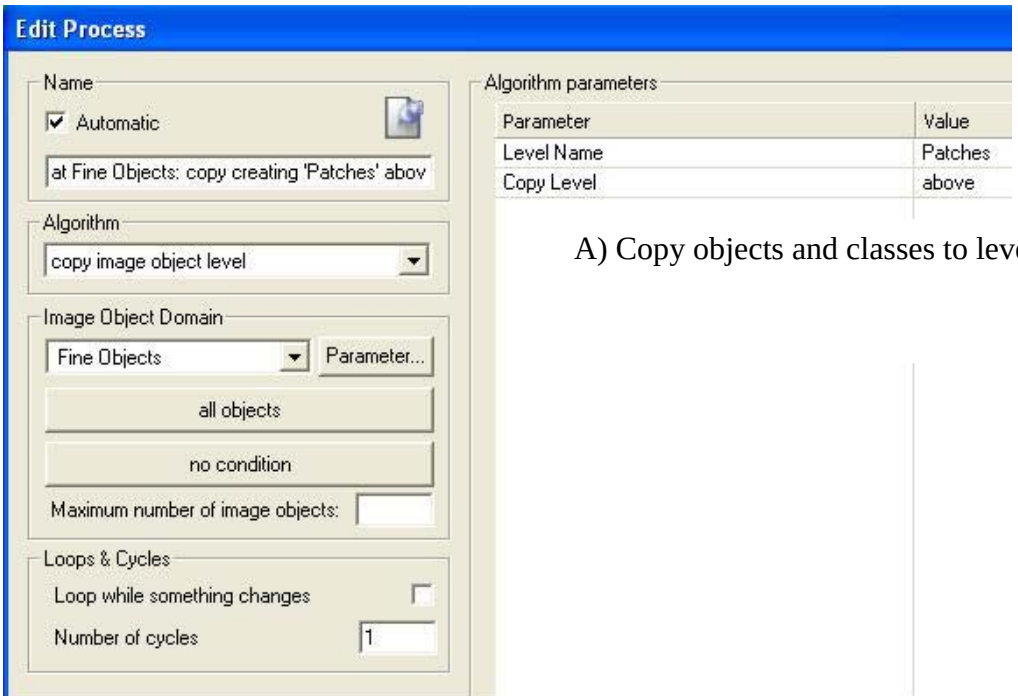
1. Copy all the objects and their classification to a 'higher level'. The image object fusion will be done at this new level while preserving the original segmentation and classification.

2. Use the Merge Region function for each class individually. This is real important, otherwise the entire image will end up as a single large object. The Merge Classes steps in the Process Tree are shown in Fig. 6, and the individual steps are shown in Fig. 7.

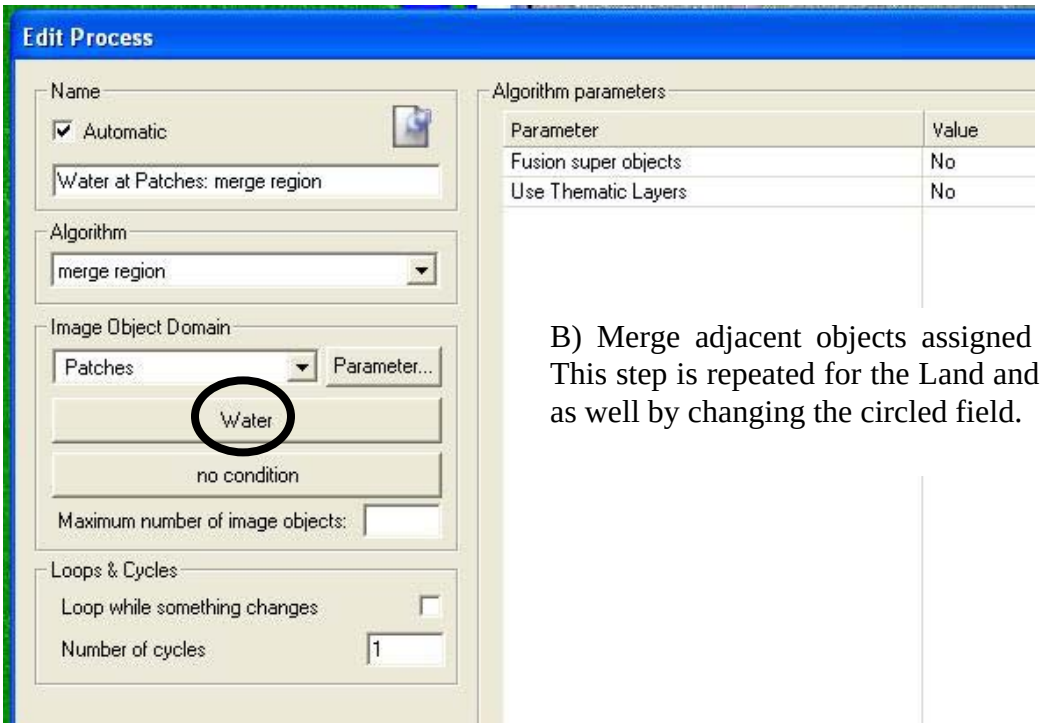


Fig. 6:. Merging objects portion of Process Tree.

Note: The processes nested under each category are read from bottom to top.



A) Copy objects and classes to level above.



B) Merge adjacent objects assigned the class of Water. This step is repeated for the Land and Wetter Area classes as well by changing the circled field.

Fig. 7:. Parameters for copying level and merging objects by class.

At this point, the image has been segmented and the objects classified as Land, Wetter Areas (shallow water) and Water (Deep water). For the purposes of creating shorelines, the project is simplified by changing the class of Wetter Areas to Water then repeating the object fusion. Assigning objects to a particular class is done through the Process Tree (Fig. 8).

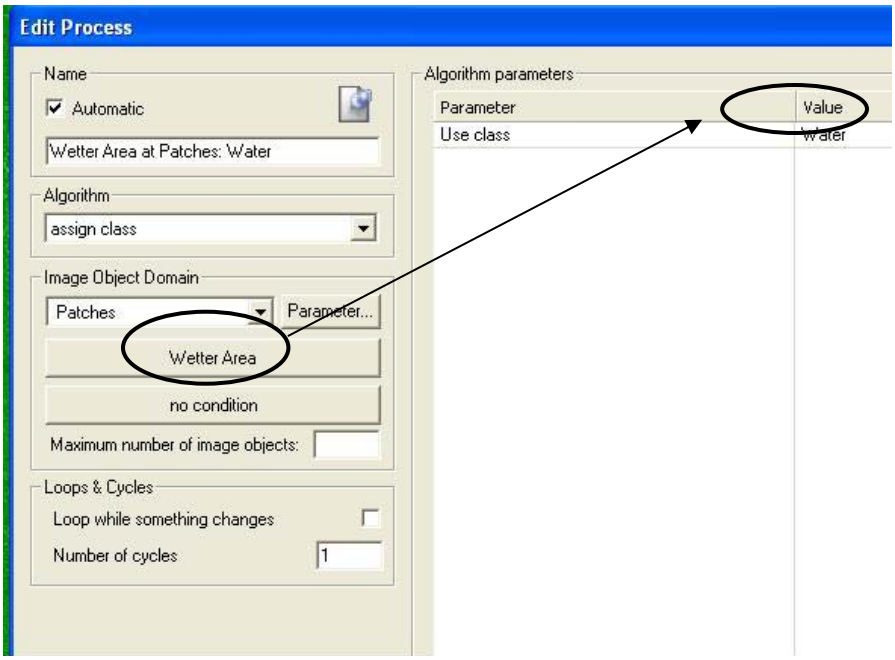


Fig. 8:. Assign class to an object. Here objects classed as Wetter Area are changed to the Water class.

The result of the classification in Fig 9. The green area are objects classified as Land, and the blue areas are classified as water.

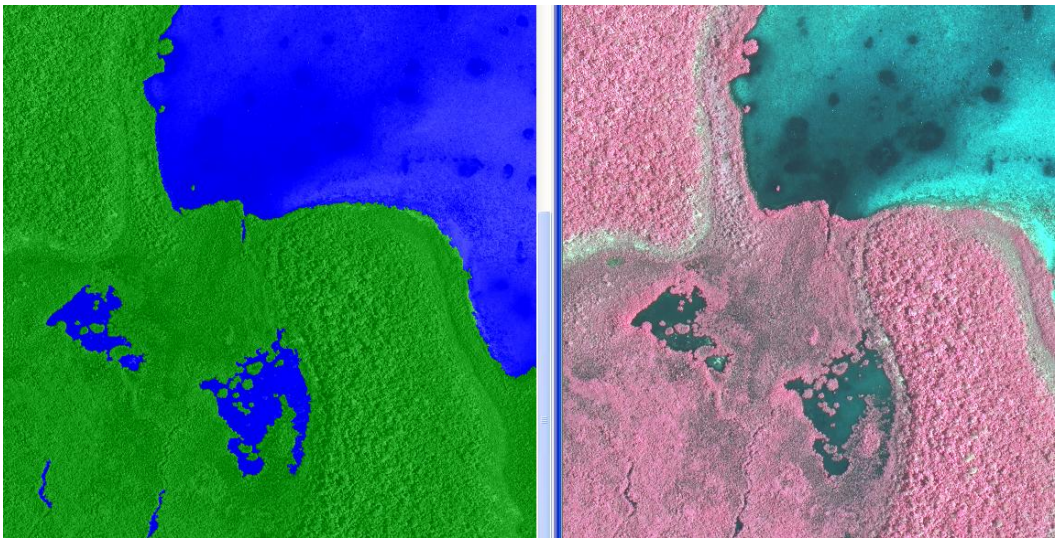


Fig. 9: Results of classification based on algorithm developed.

The last step in the process is to export the objects as a shapefile. The shapefile can be assigned a projection and edited in ArcGIS.

Appendix B. Accuracy Assessment of the Draft Terrestrial Vegetation Map of Biscayne National Park, FL

Accuracy Assessment of the Draft Terrestrial Vegetation Map of Biscayne National Park, FL

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Summary

The terrestrial vegetation of 42 mangrove-dominated islands as well as the mangrove-dominated mainland shoreline of Biscayne National Park was mapped by Pablo L. Ruiz, Patricia A. Houle, and Michael S. Ross of Florida International University (Cooperative agreement H500 06 5040 Task agreement J2117062272). The map was produced using a vector-based approach and photo-interpretation from 2005 aerial imagery acquired by the Fish and Wildlife Research Institute – Florida Fish and Wildlife Conservation Commission (FWRI) and South Florida Water Management (SFWMD) as well as 2002 (Miami-Dade) Light Detection and Ranging (LiDAR) data (mainland only). Biscayne National Park's 20,913 terrestrial acres were delineated into 4,987 polygons representing 103 vegetation classes. The accuracy assessment procedures included: checking the 2005 aerial imagery for horizontal positional accuracy, checking the positional accuracy of the vegetation map features, and assessing the accuracy of the vegetation type attributed to the polygons.

There were 12 ground control locations checked for horizontal accuracy of aerial imagery and 25 positional accuracy assessment locations for the map features. A total of 390 points were checked to determine if the vegetation community observed in the field matched the annotated map classification. The current draft BISC Vegetation Map's overall accuracy was assessed to be 83.3% (325 of 390 points acceptable) with a lower 90% confidence level of 80.7% accuracy (Kappa index 82.6%) which was deemed acceptable by SFCN. Thus the deliverable meets the accuracy requirement.

Introduction

The National Park Service Inventory and Monitoring – Vegetation Mapping Inventory Program (NPS-VMP) accuracy standards requires 80% classification accuracy with 90% confidence as well as positional accuracy of well-defined objects of at least 40 feet (12.2 meters) (http://biology.usgs.gov/npsveg/standards.html).

The terrestrial vegetation of 42 mangrove-dominated islands as well as the mangrove-dominated mainland shoreline of Biscayne National Park was mapped by Pablo L. Ruiz, Patricia A. Houle, and Michael S. Ross of Florida International University (Cooperative agreement H500 06 5040 Task agreement J2117062272). Funding for the project came from the NPS-VMP through the National Park Service South Florida / Caribbean Network (SFCN).

The map was produced using a vector based approach and photo-interpretation from the FWRI-SFWMD 2005 aerial imagery (30cm, 5-band) as well as 2002 Light Detection and Ranging (LiDAR) data (mainland only). Biscayne National Park's 20,913 terrestrial acres were delineated into 4,672 polygons representing 103 vegetation classes. The minimum mapping unit (MMU) was 400m^2. The vegetation classification system used is a 6-level hierarchical vegetation classification system by Rutchey *et al.* (2006). SFCN conducted an accuracy assessment of the map following guidance from the NPS-VMP standards (1994). This document details the: (1) imagery positional accuracy assessment and the map positional accuracy assessment and (2) vegetation classification accuracy assessment procedures and results.

Methods

Horizontal accuracy of base aerial imagery and positional accuracy assessment of map locations

The horizontal accuracy of the 2005 FWRI-SFWMD aerial imagery was determined by analyzing 12 control point locations spread across the imagery (Table B-1). Locations were considered to be suitable control points if they were visible in the 2005 aerial imagery and had a well-defined corner (e.g. dock or corner of seawall). A field crew visited each control point in November 2008 with a Trimble ProXR or GeoXT Global Positioning System (GPS) unit. After locating a control point location, the field crew collected a single GPS point by averaging 120 positions. These points were differentially post-processed using Trimble Pathfinder software and a correction file downloaded from the nearby Richmond base station. With position averaging and differential post-processing, the Trimble GeoXT 2005 and ProXR GPS units are capable of sub-meter accuracy. The corrected GPS points were exported to a shapefile for use in the Root Mean Square Error (RMSE) calculation.

To determine the horizontal accuracy of the imagery, the shapefile of corrected control points was overlaid on the 2005 aerial imagery in ESRI ArcMap. The distance in meters between each corrected control point and the expected position of the control point on the image was determined. The RMSE was calculated by squaring the offsets, averaging these squared offsets, and finally taking the square root.

The positional accuracy of map features was checked by analyzing 25 control point locations scattered across the map. Suitable control point locations were mapped well-defined corners of objects (n=12). Due to the insufficient number of well-defined control point locations, we also used very small red mangrove clumps (n=13). The center of the clump was used for most red mangrove to reduce error caused by growth between the 2005 imagery and the 2009 field visit. Control points locations were found by visually inspecting the December 2008 vegetation map deliverable. Several control points used in determining the horizontal accuracy of the imagery were also included in the positional accuracy assessment. Each new control point was visited by a field crew in January 2009. At each point, the crew collected a single waypoint using 120 averaged positions on a Trimble GeoXT 2005 or Trimble Pro XR GPS. These averaged waypoints differentially post-processed in Trimble Pathfinder software using the Richmond base station correction file. The corrected control points were exported to a shapefile for use in the RMSE calculation.

Selection of the number and the spatial location of accuracy assessment points

The vegetation classification accuracy of the map was determined using a stratified random procedure described in NBS/NPS VMP Accuracy Assessment Procedures (1994) with some modifications.

SFCN staff determined to assess the accuracy at Level 3 of the hierarchical classification as this was what the cooperator had agreed to in the Cooperative Agreement. Basic summary information was extracted from the June 2008 deliverable including the number of polygons, minimum polygon area, maximum polygon area, and total area for each Level 3 map category [Note: The number of

polygons was slightly inflated because each imagery photo was mapped separately and polygons that overlapped imagery analysis boundaries were broken into two or more polygons].

All map classifications were assessed for accuracy including areas outside park boundaries with a few exceptions:

- Very small mangrove tree "islands" well below the MMU of 400m^2 were not included in the vegetation classification accuracy assessment (although they were used to check positional accuracy as described above). These were often visible on the imagery and the software used by the cooperator successfully drew boundaries around them and both the cooperator and SFCN agreed to leave them in the map. However, photointerpreting each small island would have been prohibitively expensive for the cooperator. Therefore it was assumed to be red mangrove scrub if the island was less than 5 m^2 and assumed to be red mangrove shrubland if the island was between 5 and 400 m^2 based upon species life history.
- Anthropogenic categories were excluded including buildings, campgrounds, docks, lawns & landscaping, parking lots, roads, seawalls, trails, and walkways.

The total area and number of polygons per Level 3 map class were used to divide the map classes into the NBS/NPS VMP Accuracy Assessment scenarios A, B, C, D, and E (Table B-2). Between 1-30 accuracy assessment points for each scenario were selected as shown in Table B-2 and described below:

- Scenario A (Random Point Method 30 points): Each Level 3 vegetation category in scenario A was selected from the June 2008 deliverable using an attribute query and exported to a shapefile. These shapefiles were further processed with the Dissolve tool to create a single polygon for each vegetation category. Within each dissolved polygon, the AlaskaPak v2.2 extension for ArcMap randomly placed 40 points into a new shapefile. The Near tool in ArcMap was used to calculate the distance from each point to its nearest neighboring point. The results of this tool were automatically added to a NEAR_DIST field for each random point. Finally, the first 30 points with a NEAR_DIST of ≥30m were selected and exported into a combined shapefile of accuracy assessment points for all vegetation categories.
- Scenario B: There were no vegetation categories that fell into this class.
- Scenario C (Hybrid Point/Polygon Method 20 points): All Level 3 vegetation categories which fell into Scenario C used the method outlined for Scenario D below with the exception of "Black Mangrove Forest". Due to the distribution of polygon sizes in this vegetation category (a few very large and many small), a hybrid method was chosen where 10 points were selected using the method outlined for Scenario A (above) and 10 polygons were selected using the method outlined for Scenario D (below).
- Scenario D (Random Polygon Method): Each Level 3 vegetation category in Scenario D was selected from the June 2008 deliverable using an attribute query and exported to a new shapefile. Within this shapefile, the AlaskaPak v2.2 extension for ArcMap randomly selected 5 polygons and exported them to the combined shapefile of all accuracy assessment polygons.

- Scenario E (All Polygon Method): Each Level 3 vegetation category in Scenario E was selected from the June 2008 deliverable using an attribute query and exported to the combined shapefile of all accuracy assessment polygons.

The final procedure was to calculate a 10m buffer around each of the random point locations (Scenario A and C). Each point was then inspected to ensure that the point and its 10m buffer were entirely inside the polygon. If the buffer included part of an adjacent polygon, the point and its buffer were moved toward the center until there was no more overlap. In rare situations the shape of polygons smaller than 3000 m^2 (the majority of the polygons in the Biscayne Vegetation Map are extremely elongated due to regional geology) did not allow for the 10m buffer to fit entirely within the polygon. In these situations, the point was moved to a location that maximized the fit of the 10m buffer.

Additionally, there were a number of instances in which the 10 m assessment point would fit in the polygon and the polygon was small enough that the entire polygon was assessed instead of a circular assessment plot. A total of 220 accuracy assessment locations were assessed using the "point method" and 170 accuracy assessment locations were assessed using the "polygon method".

Two points were dropped from the original 392 locations leaving a total of 390 accuracy assessment locations:

1) Two accuracy assessment points were originally assigned to "Coastal Dune Hammock" based upon there being only 2 polygons of this category present in the map. Upon further inspection the two polygons were found to be adjacent with one being an artificial sliver created by imagery mapping boundaries. Thus the two polygons were treated as one and visited as a single polygon during the accuracy assessment.
2) One "Buttonwood Woodland" point was dropped during the field visit. This polygon was also a sliver caused by the imagery mapping boundaries. This point was not replaced with another random point as that day was the last day of helicopter flights.

Field method for checking the vegetation accuracy assessment point

At each accuracy assessment point (or polygon) two botanists visited the location via a helicopter (Figures B-1 and B-2) and observed the vegetation community present using one of two methods:

a) Point method (Scenario A): the botanists assessed the vegetation classification of a circle of approximately 10.0 m radius (MMU=314m^2).
b) Polygon method (Scenario D, E): the botanists assessed the classification of the entire polygon.

If both botanists agreed that the vegetation present corresponded to the map attribute, the point was classified as correct and the botanists proceeded to the next accuracy assessment point. If either botanist felt the vegetation present did not agree with the map annotation, then the following information was collected: date, time, photograph numbers, dominant vegetation strata and the dominant species (up to 3 species), habitat description, canopy height, and canopy density.

Several Global Positioning System (GPS) devices assisted in finding assessment locations. Primary navigation relied upon a Garmin GPSmap 478 chartplotter with preloaded waypoints (10 m) circular

plots, or polygons). In the vicinity of an assessment location, a Garmin 60Csx connected to a laptop running ESRI ArcMap v9.2 was used to display outlined vegetation polygons and labels on top of the 2005 aerial imagery. Additionally, the botanist referred to a color printed hardcopy of the accuracy assessment site with level 6 vegetation class labels for the assessment site and the surrounding vegetation communities. Use of both live GPS tracking and color printed hardcopies ensured that the proper assessment site was reviewed.

Before the beginning of each helicopter flight both botanists and the helicopter pilot would be calibrated by flying to a training assessment location. The training location was a 10 m radius circle ($314m^2$) laid out in a field and the helicopter would fly to this location using the GPS guidance system. The helicopter hovered at two altitudes (50 and 75 ft) and the botanist using fixed location within the helicopter determined the area encompassed by the sample plot.

It took six field days to check the 390 accuracy assessment points.

Statistical methods

The overall vegetation classification accuracy assessment was calculated as the number of accuracy assessment points considered "acceptable" divided by the total number of points. "Acceptable" points included both those that a) had a complete match between the map annotation and the field assessment at Level 6 (the most detailed level of description association level see Rutchey et al.2006), plus b) those for which the map annotation was different but deemed acceptable by SFCN staff primarily because the field vegetation was near a difficult-to-distinguish cutoff between categories. The lower 1-tailed 90% confidence interval was calculated using confidence limits for population proportions as described in Zar (1999, p. 527). To achieve 80% accuracy with 90% confidence, a total of 323 of 390 points needed to be correct. As recommended in the Accuracy Assessment Procedures (1994) a Kappa correction was also calculated which accounts for the probability of classifying a point accurately by random chance.

Although overall map accuracy was assessed at Level 3, individual class accuracy was assessed at Level 6, as it was felt this would be most useful to future map users. Each individual Level 6 vegetation classification category was assessed for categorical accuracy using a two-tailed confidence limit (Zar, 1999, p.527). Those for which the confidence limits did not include 80% accuracy with 90% confidence were flagged and discussed further in the Results and Discussion section.

Results and Discussion

Horizontal accuracy of base aerial imagery and positional accuracy assessment of well-defined map locations

Based upon 12 field visited control points, the horizontal accuracy (RSME) of the 2005 imagery was 1.5 meters. Based upon the 25 field visited control points, the positional accuracy (RSME) of digitized map features was 1.4 meters (Figure B-3).

Vegetation classification accuracy assessment

There were 390 accuracy assessment points visited in the field. There was an exact match in classification (complete agreement between NPS botanists and map point classification) for 295 of the 390 points (75.6%) at the most detailed level (Level 6). There was some form of disagreement with the map point classification for 95 of the 390 points (24.4%). All 95 of these points were checked to determine the type and degree of difference between the field classification and the map classification and whether the map classification would be acceptable. The reason for either accepting the map classification or rejecting the map classification was noted for each. This determination was based upon the field data, photographs of the disputed classification points, and the classification itself. The complete list of points and reasons for rejecting or accepting non-matching points are provided in the accompanying Table B-4. An additional 30 points were accepted as having similar habitat classification for a total of 325 points. That is, 325 of the 390 total points were determined to be acceptable for an overall map accuracy of 83.3% with a lower 90% confidence level of 80.7% accuracy and with the kappa correction the overall map accuracy is estimated at 82.6%. Figures B-4 to B-14 are maps that indicate by assessment section (1-9) which locations had unacceptable, acceptable or 100% match between field assessment and map annotation.

Examples of reasons for "accepting" a non-matching classification include:

a) If a forest was misclassified as a shrubland or vice versa (typically when canopy heights were near 5 m). These height discrepancies were accepted if the dominant species were a match. For example, if a Red Mangrove Shrubland was misclassified as a Red Mangrove Forest, it was accepted. However, if a Red Mangrove Shrubland was misclassified as a Black Mangrove Shrubland or Forest, it was rejected as a species misclassification. The reasoning is that in many instances the 5 meter height cutoff between a forest and shrubland was difficult to discern.
b) If a shrubland was misclassified as scrub or vice versa (typically when canopy heights were near 2 m). Again, if the species were a match, then the height discrepancy was accepted. The same reasoning applies due to many instances when the 2 meter cutoff between the shrubland versus scrub distinction was difficult to determine.
c) If a forest was misclassified as woodland or vice versa and the percent canopy cover in the dominant strata in the field data was near the 60% cover cutoff. The point was accepted as accurate, but only if the dominant species were a match. For example, if a Red Mangrove Forest was misclassified as a Red Mangrove Woodland.
d) One case where a Lightning Gap turned out to be a dead tree.

A total of 65 accuracy assessment points were not acceptable mainly due to species misclassification.

Analysis of vegetation classification errors

We then investigated the type of errors that occurred for the 65 incorrectly classified points. Analysis of the misclassifications between the vegetation types found in the field compared to what the map annotation for the accuracy assessment points are reported in Accuracy Assessment Matrix Table 4.

Below we draw attention to the few map categories that did not meet the criteria of having an upper 90% confidence level of the percentage of points acceptable of 80% or higher (2-tailed test). In practical terms, it is very difficult to make strong statements regarding individual vegetation category accuracy with less than 5 accuracy assessment locations. These two map categories remained below the threshold:

a) Mixed Mangrove Scrub was found to be incorrect 15 out of 22 times (32% correct). This category was found most often (9 times) to be a Red Mangrove Scrub, and 4 times to be Red Mangrove Shrubland.
b) Black Mangrove Forest was found to be incorrect 12 out of 20 times (40% correct). This category was found most often (10 times) to be a Mixed Mangrove Forest.

The following six categories were found to be correct less than 75 % of the time; however, strict interpretation of the upper 90% confidence level suggest that these would pass the 80% acceptable level. However, caution maybe warranted when using these vegetation categories.

c) Black Mangrove Shrubland was found to be incorrect 2 out of 5 times (60% correct). In both cases this category was found to be a Red Mangrove Shrubland.
d) Black Mangrove Woodland was found to be incorrect 2 out of 5 times (60% correct). In both cases this category was found to be a Red Mangrove Shrubland.
e) Mixed Mangrove Shrubland was found to be incorrect 7 out of 21 times (67% correct). This category was found to be Red Mangrove Shrubland, Buttonwood Shrubland, or Black Mangrove Woodland.
f) Buttonwood Shrubland was found to be incorrect 7 out of 19 times (63% correct). This category was found most often (5 times) to be a Shrubland with a different species dominating, once to be a Buttonwood Forest, and once to be a Buttonwood Woodland which were acceptable.
g) Black Mangrove-Red Mangrove Forest was found to be incorrect 2 out of 6 times (67% correct). This category was found once to be Black Mangrove Woodland and Mixed Mangrove Forest which were acceptable.
h) Red Mangrove Shrubland was found to be incorrect 8 out of 30 times (73% correct). This category was found most often (4 times) to be a Red Mangrove Forest which were acceptable, and once each to be a Black Mangrove Forest, Black Mangrove Shrubland, Mixed Mangrove Shrubland, and White Mangrove Forest which were not acceptable.

Additionally, the accuracy assessment field code was compared with the annotation used on the map at Level 6 (Table 5). Even when some points were determined acceptable, there were 6 instances where the field code category might have been underused or difficult to determine.

1) Black Mangrove Woodland was determined in the field 10 times. It was incorrectly classified 7 times (30% correct). This category on the map annotation was found to be Black Mangrove-Red Mangrove Forest, Black Mangrove-Red Mangrove Shrubland, Mixed Mangrove Scrub, Mixed Mangrove Shrubland, and White Mangrove Woodland all of which were unacceptable. In two cases it was annotated as Black Mangrove Forest which was acceptable.

2) Buttonwood Woodland was determined in the field 6 times. It was incorrectly classified 4 times (33% correct). This category on the map annotation was found to be White Mangrove Woodland and Upland Scrub which were not accepted. It was classified as Buttonwood Shrubland which was acceptable.
3) Black Mangrove Shrubland was determined in the field 7 times. It was incorrectly classified 4 times (43% correct). This category on the map annotation was found to be Buttonwood Shrubland, Coastal Hardwood Shrubland, Red Mangrove Shrubland, and White Mangrove Shrubland none of which were acceptable.
4) Red Mangrove Shrubland was determined in the field 42 times. It was incorrectly classified 20 times (52% correct). This category on the map annotation was found to be Black Mangrove Shrubland, Black Mangrove Woodland, Buttonwood Shrubland, Mixed Mangrove Scrub, and Mixed Mangrove Shrubland none of which were acceptable. The map annotated 3 times as Red Mangrove Forest, and 4 times as Red Mangrove Scrub all of which were acceptable. After considering the acceptable classification the Red Mangrove Shrubland was correct 69% of the time.
5) Mixed Mangrove Forest was determined in the field 38 times. It was incorrectly classified 17 times (55% correct). This category on the map annotation was found to be Black Mangrove Forest (10 times), Red Mangrove Forest (3 times), and once each for White Mangrove-Red Mangrove Shrubland, and Cordgrass all were not acceptable. Once for Black Mangrove-Red Mangrove Forest and once for Mixed Mangrove Shrubland each were deemed acceptable.
6) Red Mangrove Scrub was determined in the field 27 times. It was incorrectly classified 11 times (59% correct). This category was found most often on the map annotation to be Mixed Mangrove Scrub (9 times) which were unacceptable. In one case it was annotated to be Buttonwood-Red Mangrove Scrub which was acceptable.

Mixed Mangrove Scrub, Red Mangrove Scrub, Mixed Mangrove Forest, and portions of Black Mangrove Forest were all evaluated with the point method using a circle of radius 10m (area = 314 m^2). While this is smaller than the map minimum mapping unit of 400 m^2, we don't feel this had much impact on the results as a circle of 400m^2 (radius 11.3m) is only slightly larger.

During the accuracy assessment if the assessment point was found to be different from the mapped annotation and the rest of the mapped polygon was correctly classified (i.e. the point was different form the rest of the polygon but below the minimum mapping unit) this was noted in the field but the accuracy assessment point was deemed to be correct.

Corrections to map

For all 95 points that had some form of disagreement between the map annotation and the field classification, SFCN staff in consultation with Pablo Ruiz and Mike Ross of Florida International University, updated the map to match the field classification in some cases as follows:

a) where a polygon was assessed in its entirety by the field crew
b) where a point fell in a polygon that was highly homogenous and the field classification was definitely not localized to a patch within a larger, different polygon.

If it was possible that the accuracy assessment point could have fallen on a localized, different patch within a larger polygon that was better attributable to the map annotation, the polygon attribute was left unchanged.

In four cases the polygon adjacent to the polygon being assessed was found to be better attributable by a different category than the map annotation. The polygon adjacent to accuracy assessment (AA) point 157 was found to be better attributable as a Seaside Mahoe Shrubland rather than a White Mangrove Woodland.

The polygon adjacent to AA 242 (a polygon) was found to be better attributable as a Coastal Hardwood Hammock rather than a Mixed Mangrove Shrubland.

The polygon surrounding AA 313 (a polygon) was found to be better attributable as a Buttonwood Woodland rather than a Mixed Mangrove Forest.

The polygon adjacent to AA 385 (a polygon) was found to be better attributable with a Buttonwood-White Mangrove Scrub-Saltwort component rather than having a Buttonwood-White Mangrove Scrub-Glasswort component.

Conclusion

There are some minor misclassifications for some vegetation categories; however, the draft Biscayne National Park Vegetation Map is an excellent vegetation map that will be useful to resource management and others well into the future. There was an exact match in classification (complete agreement between NPS botanists and map point classification) for 295 of the 390 points (75.6%) at the most detailed level (Level 6). There were a number of locations that were deemed acceptable do to being on the cut off between category definitions, generally height or canopy cover estimates. Thus the draft Biscayne National Park Vegetation Map overall accuracy was assessed to be 83.3%. The draft Biscayne National Park Vegetation Map documents the current status of the terrestrial vegetation communities in a spatially relevant manner. There is high confidence in many of the vegetation categories even at this highly detailed level.

Literature Cited

NBS/NPS Vegetation Mapping Program Accuracy Assessment Procedures. 1994. Prepared by Environmental Systems Research Institute, the National center for Geographic Information and Analysis, and The Nature Conservancy. URL: http://biology.usgs.gov/npsveg/aa/indexdoc.html.

Rutchey, K., T. Schall, A. Atkinson, M.S. Ross, D.T. Jones, M. Madden, L. Vilchek, K. Bradley, J. Snyder, J. Burch, T. Pernas, B. Witcher, M. Pyne, R. White, T.J. Smith, J. Sadle, C.S. Smith, M. Patterson, and G. Gann. 2006. Vegetation Classification System for South Florida Natural Areas.

Zar, J. H. 1999. Biostatistical Analysis, Fourth Edition. Prentice-Hall, Inc. Upper Saddle River, New Jersey. Pp. 527-529.



Figure B-1. K. Whelan and R. B. Shamblin visiting an accuracy assessment point via helicopter.

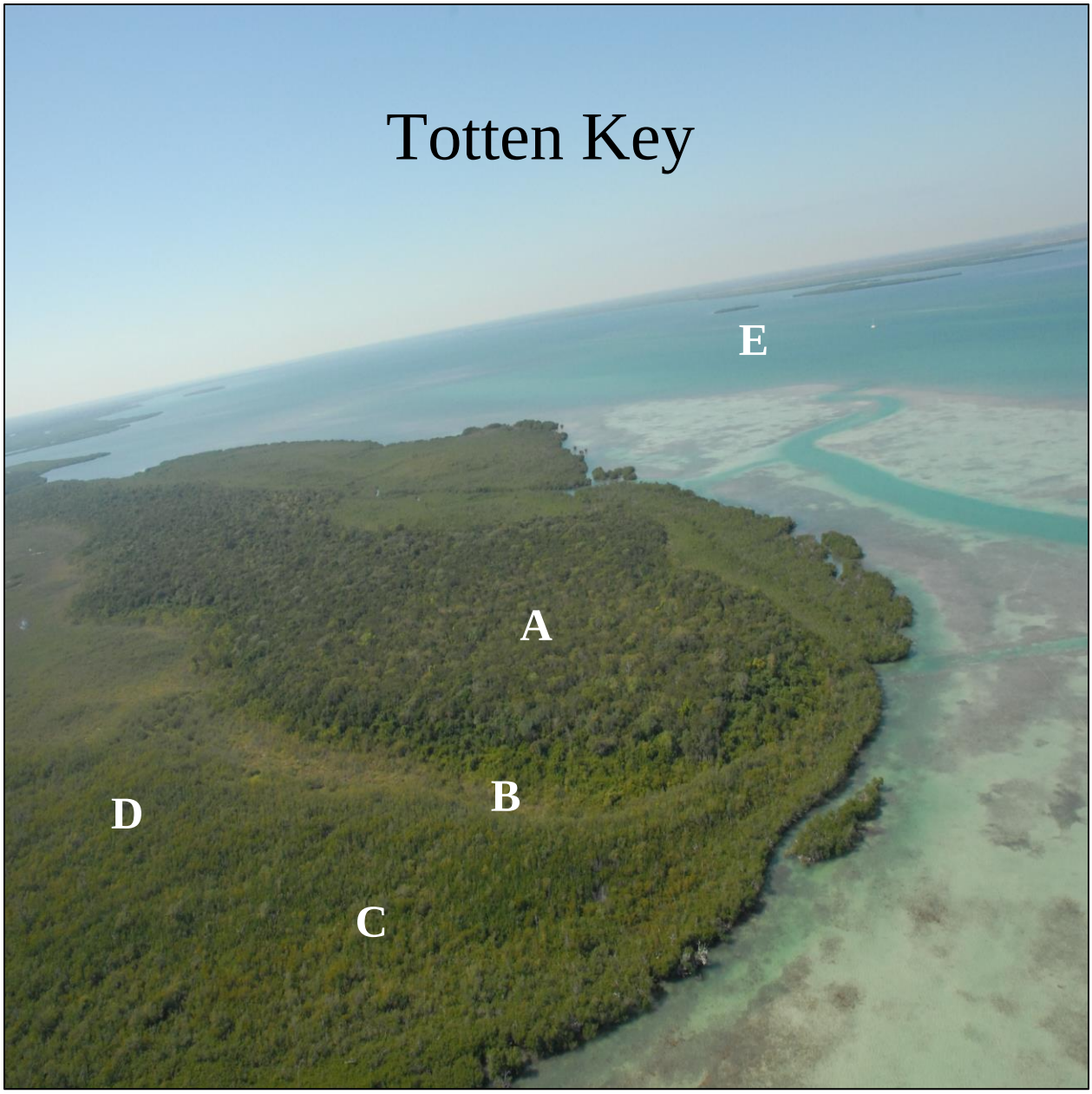


Figure B-2. An aerial view of the north end of Totten Key. A. Is Coastal Hardwood Hammock, B. Buttonwood Woodland, C. Mixed Mangrove Forest, D. Mixed Mangrove Shrubland, and E. Biscayne Bay. Picture taken on January 22,2009 By Robert B. Shamblin.

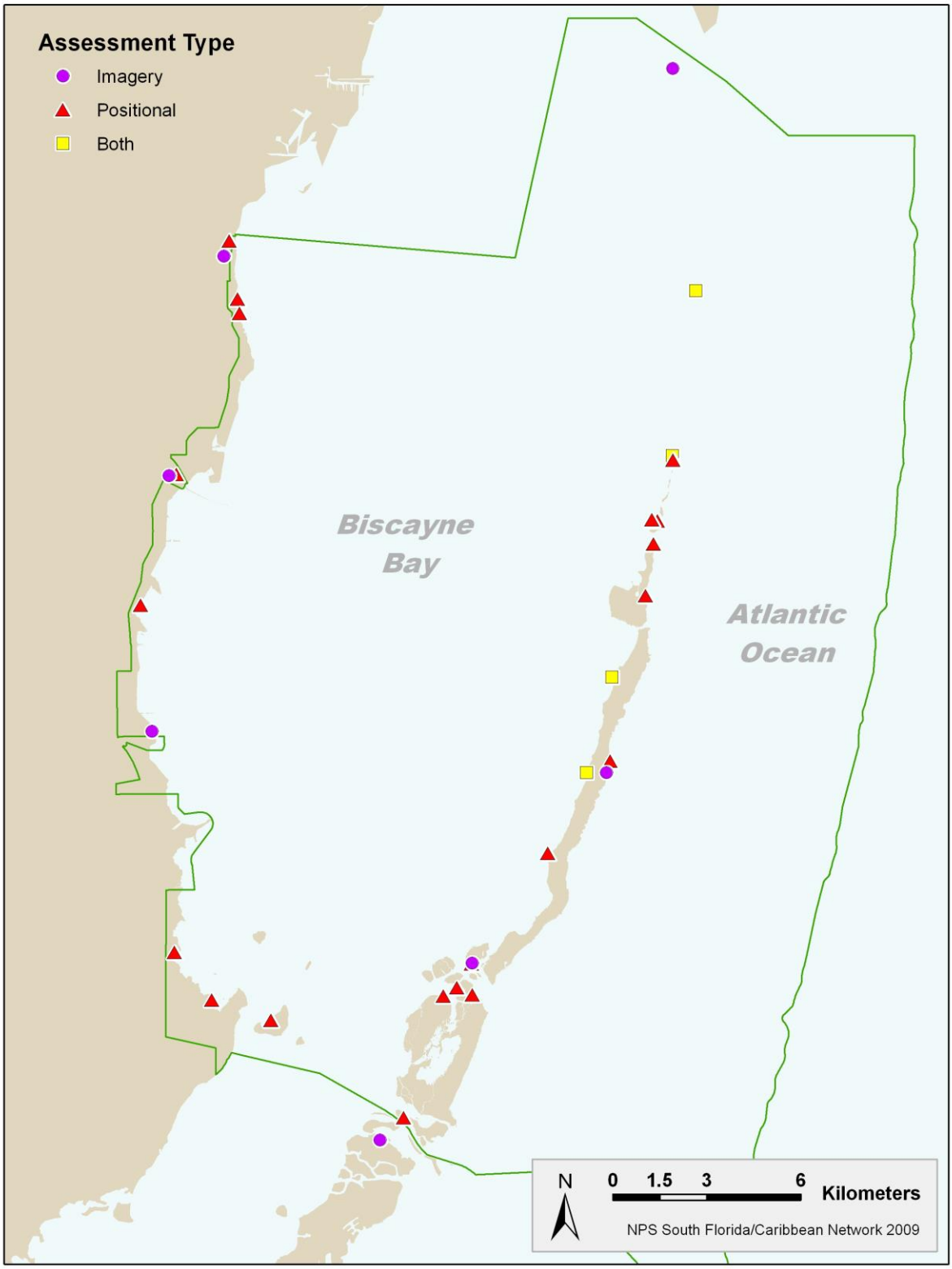


Figure B-3. Location of the control points for both positional and imagery accuracy assessment.

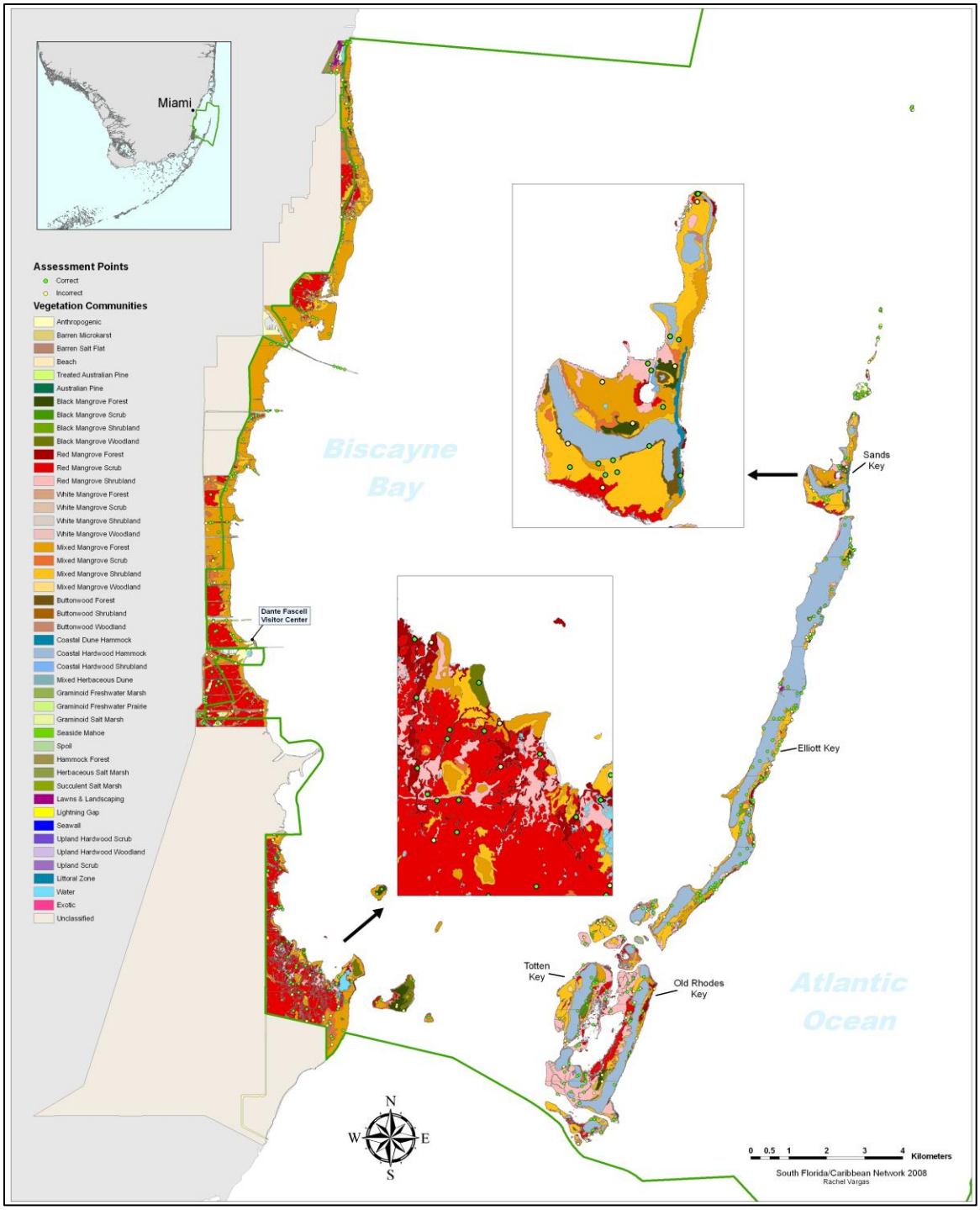


Figure B-4. Location of the 390 accuracy assessment positions with small detailed maps depicting the south shore of the mainland and of Sands Key.

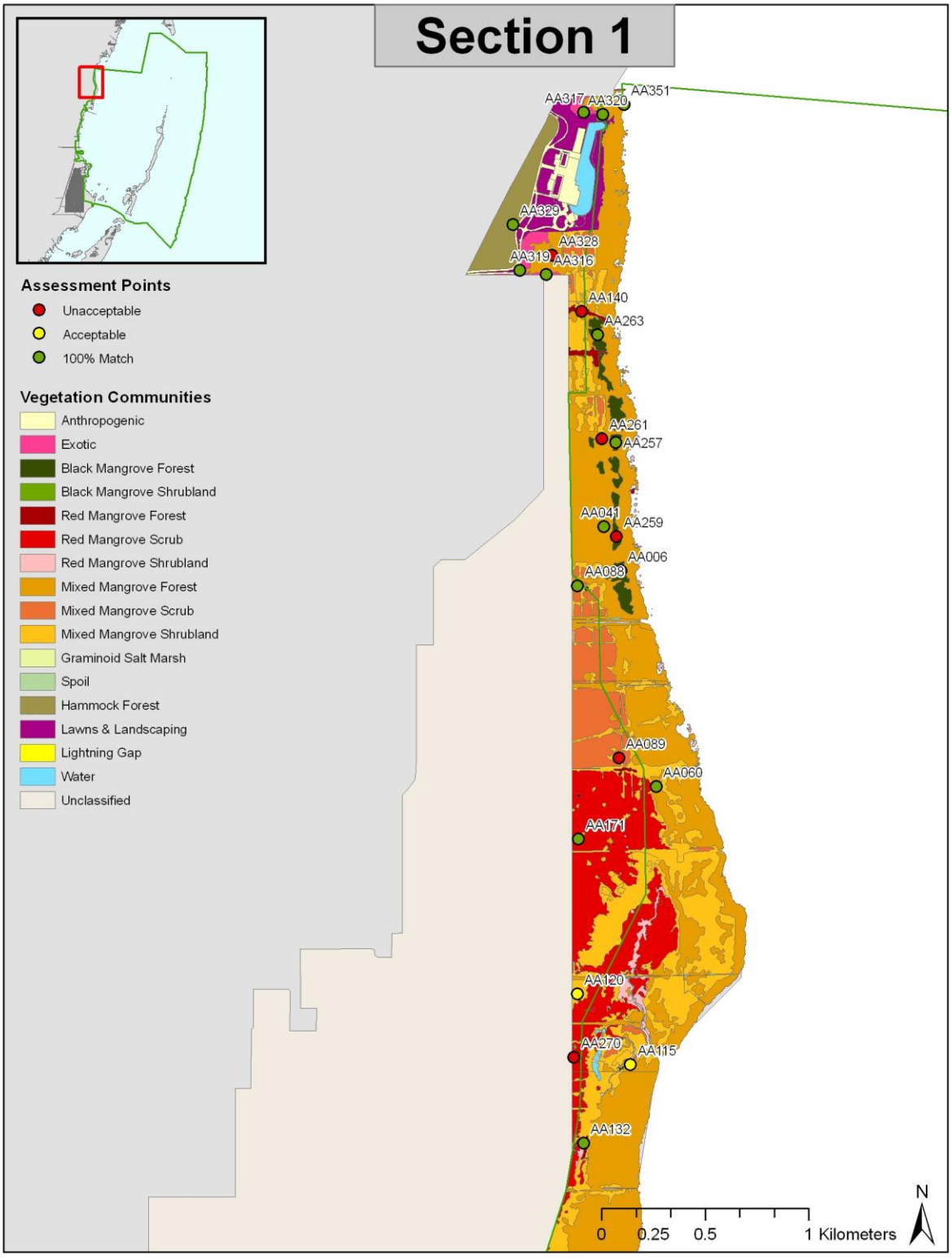


Figure B-5. Detailed view of Section 1 assessment area.

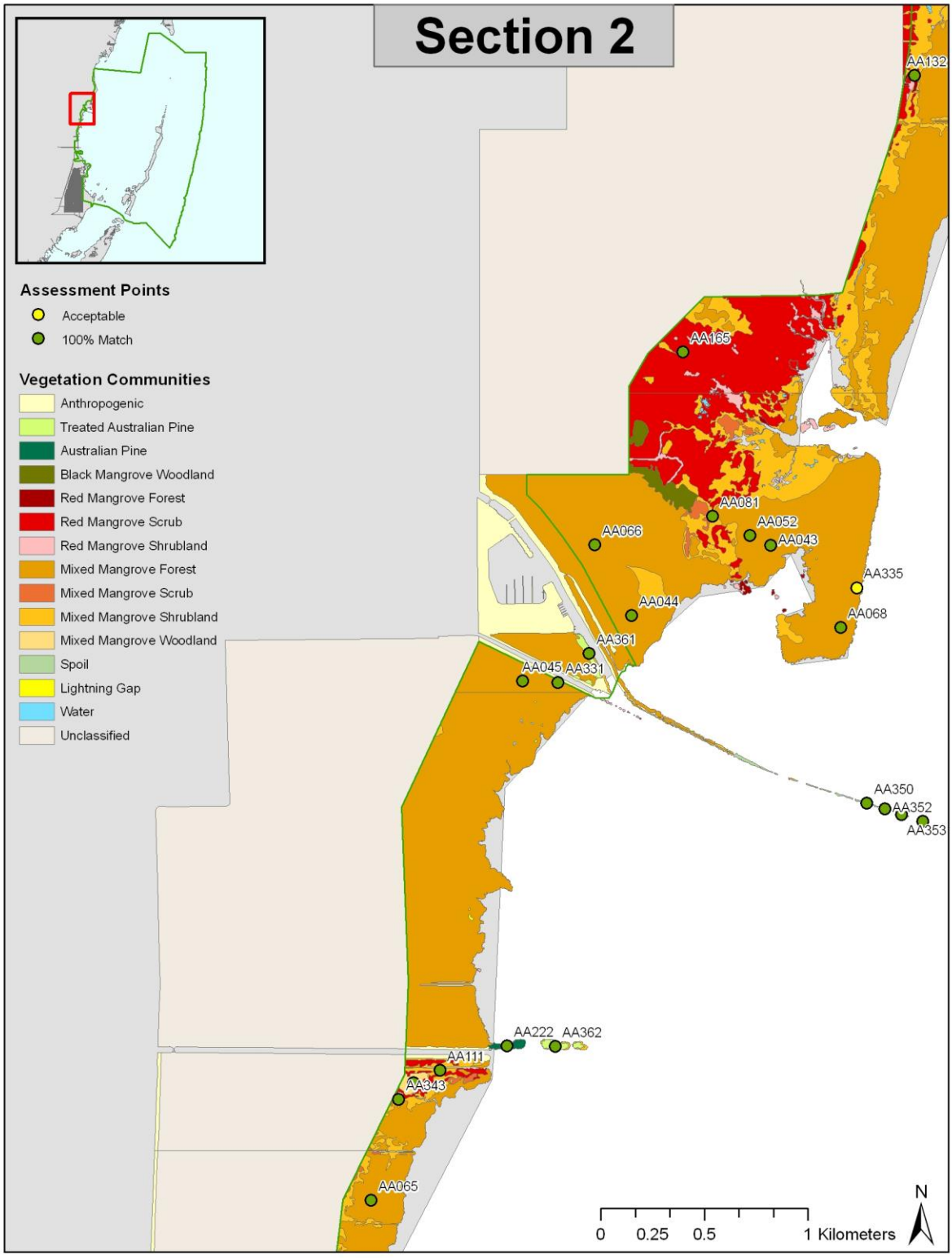


Figure B-6. Detailed view of Section 2 assessment area.

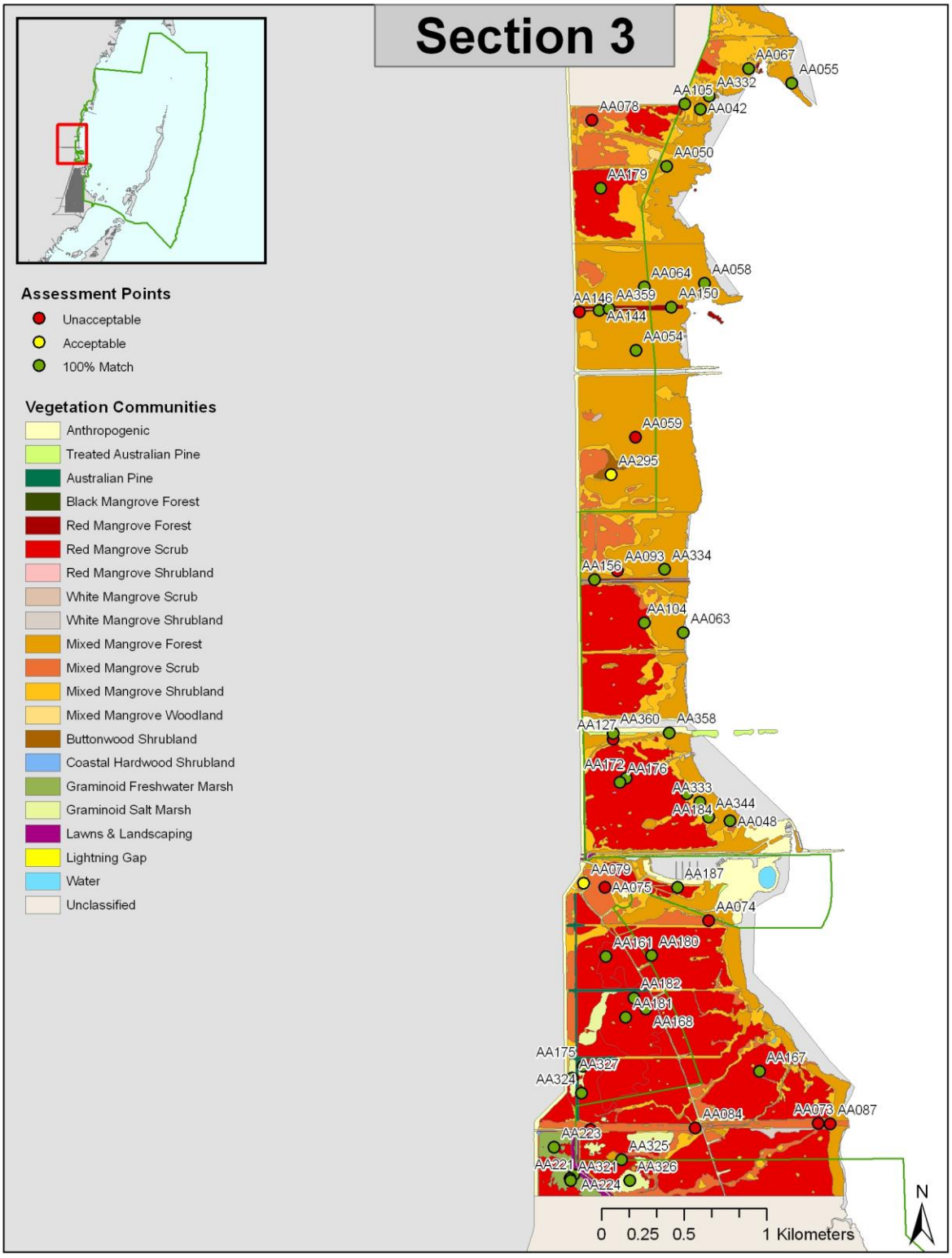


Figure B-7. Detailed view of Section 3 assessment area.

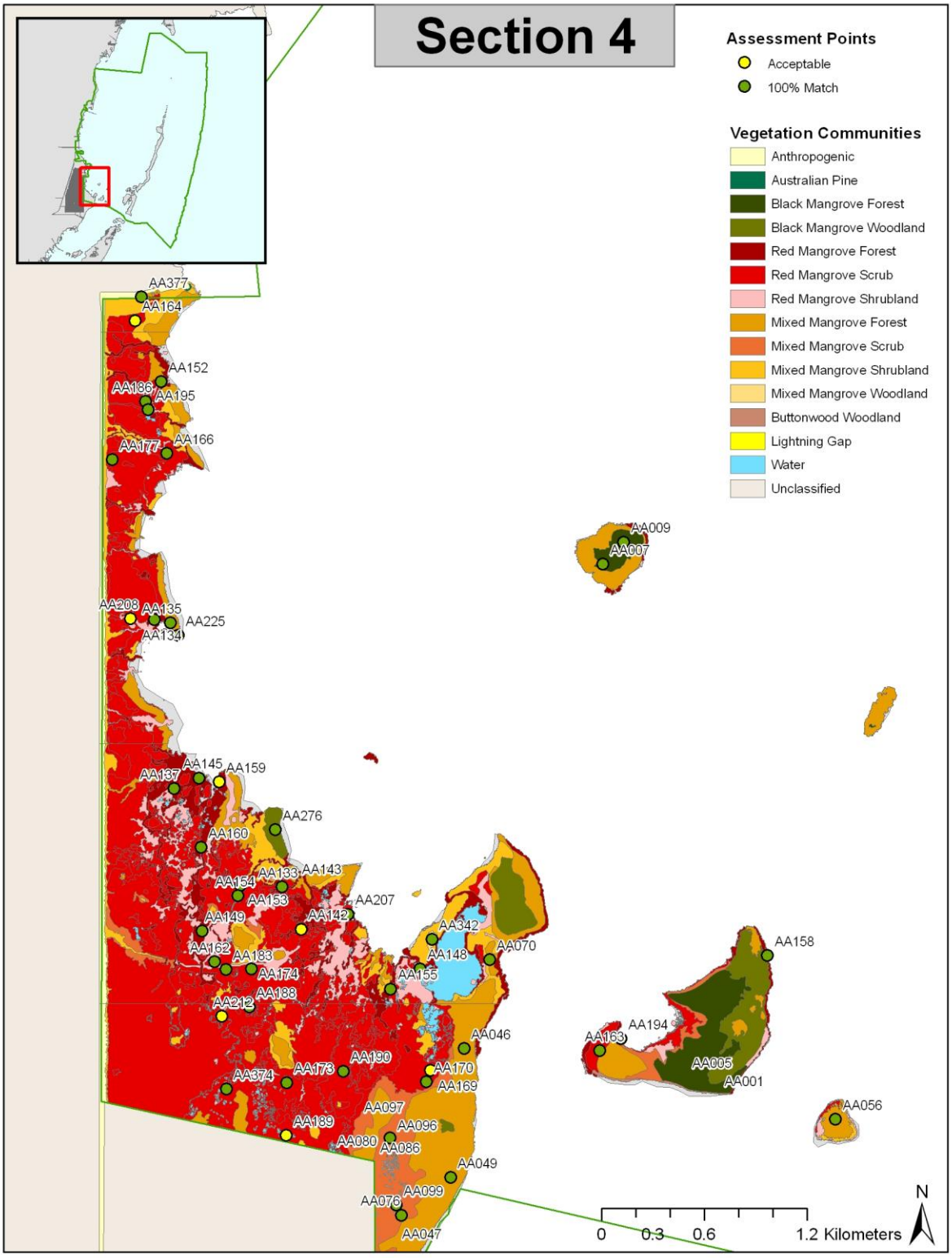


Figure B-8. Detailed view of Section 4 assessment area.

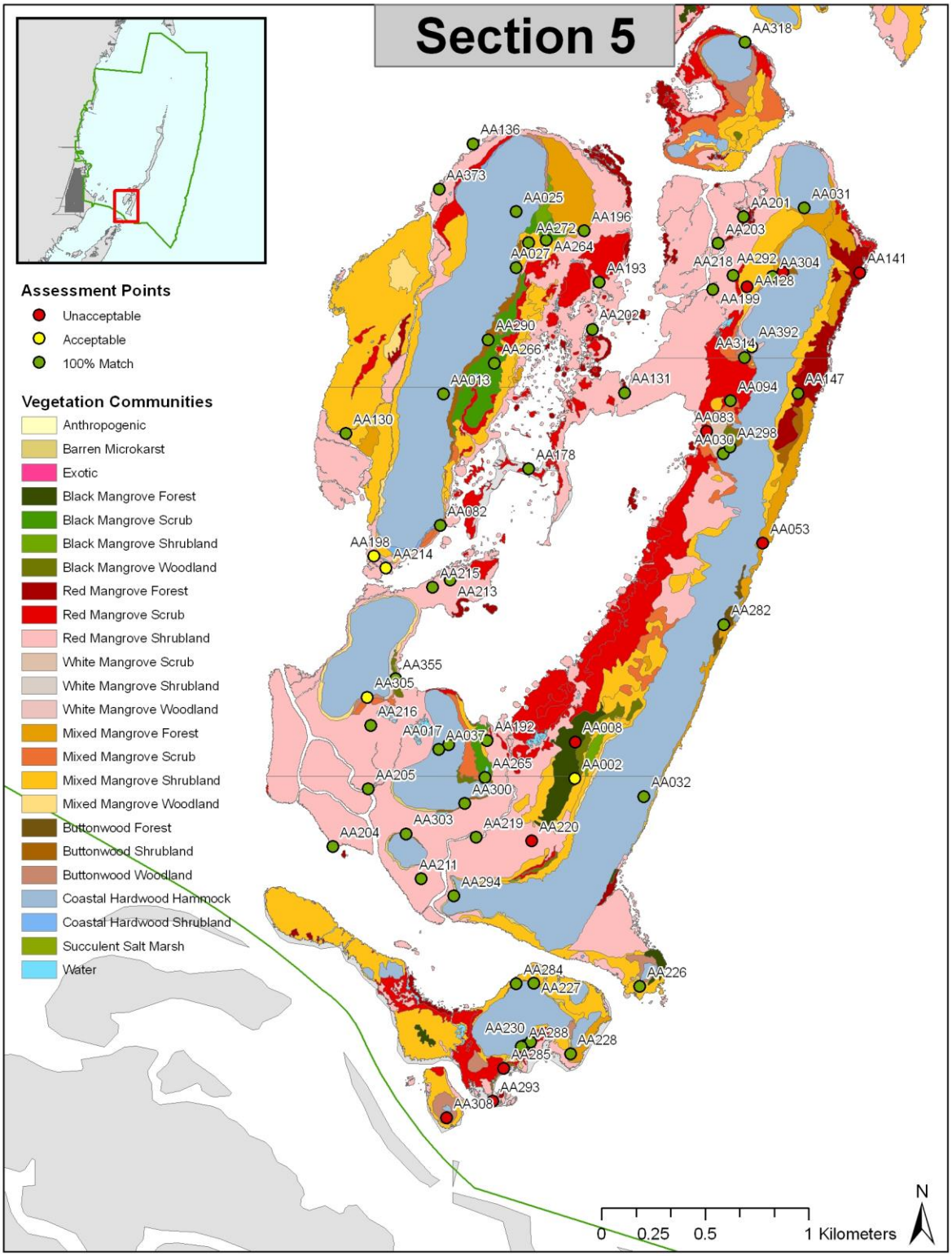


Figure B-9. Detailed view of Section 5 assessment area.

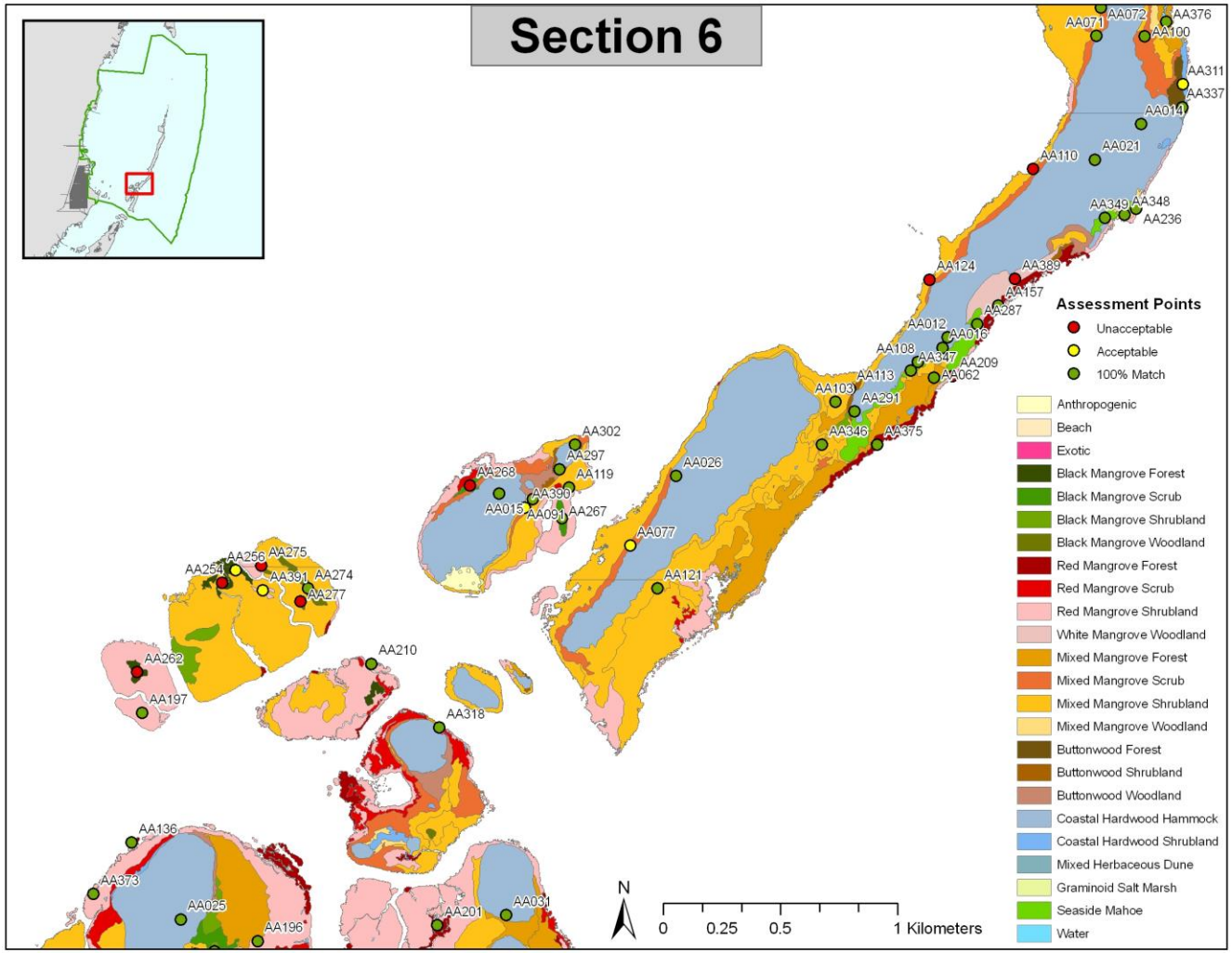


Figure B-10. Detailed view of Section 6 assessment area.

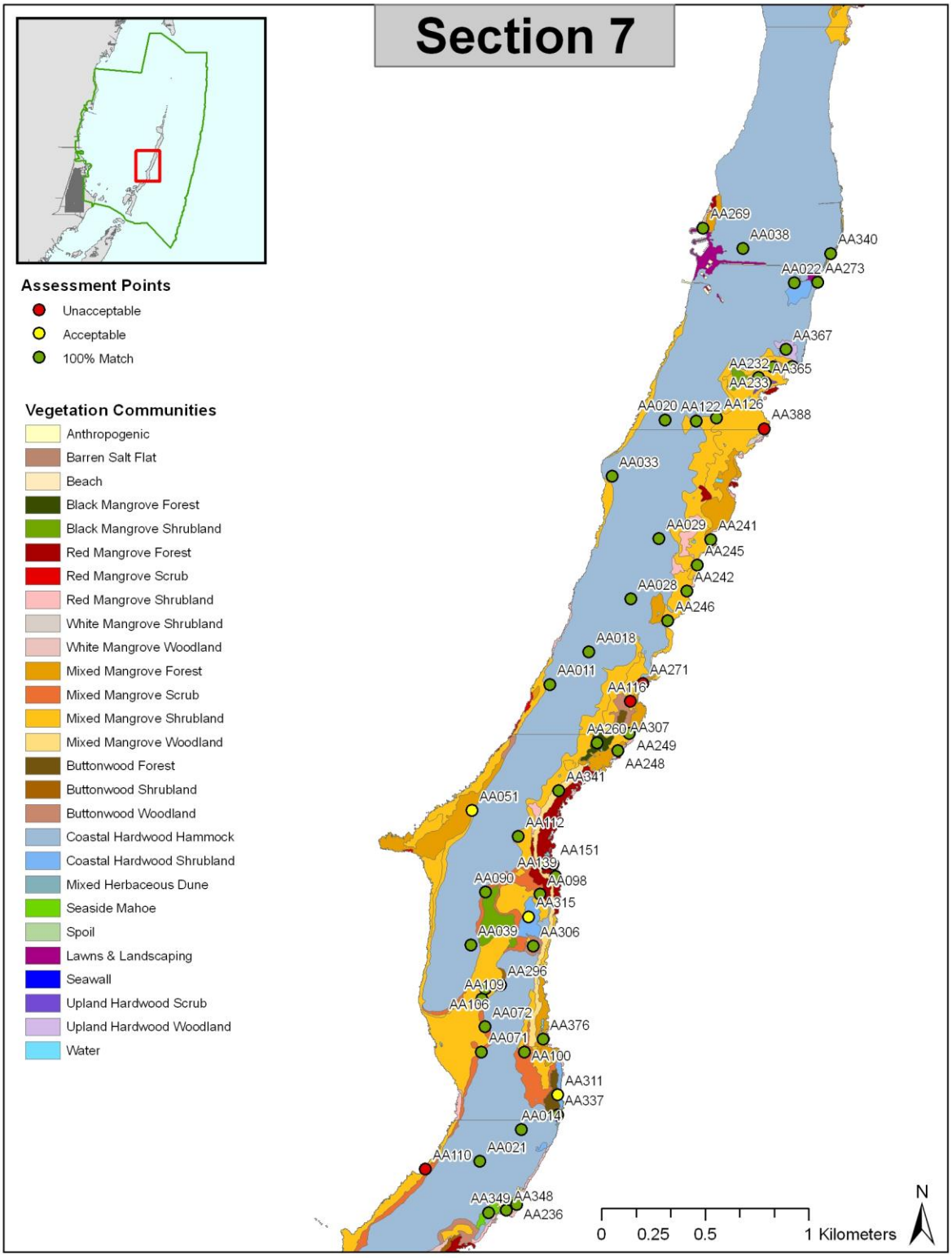


Figure B-11. Detailed view of Section 7 assessment area.

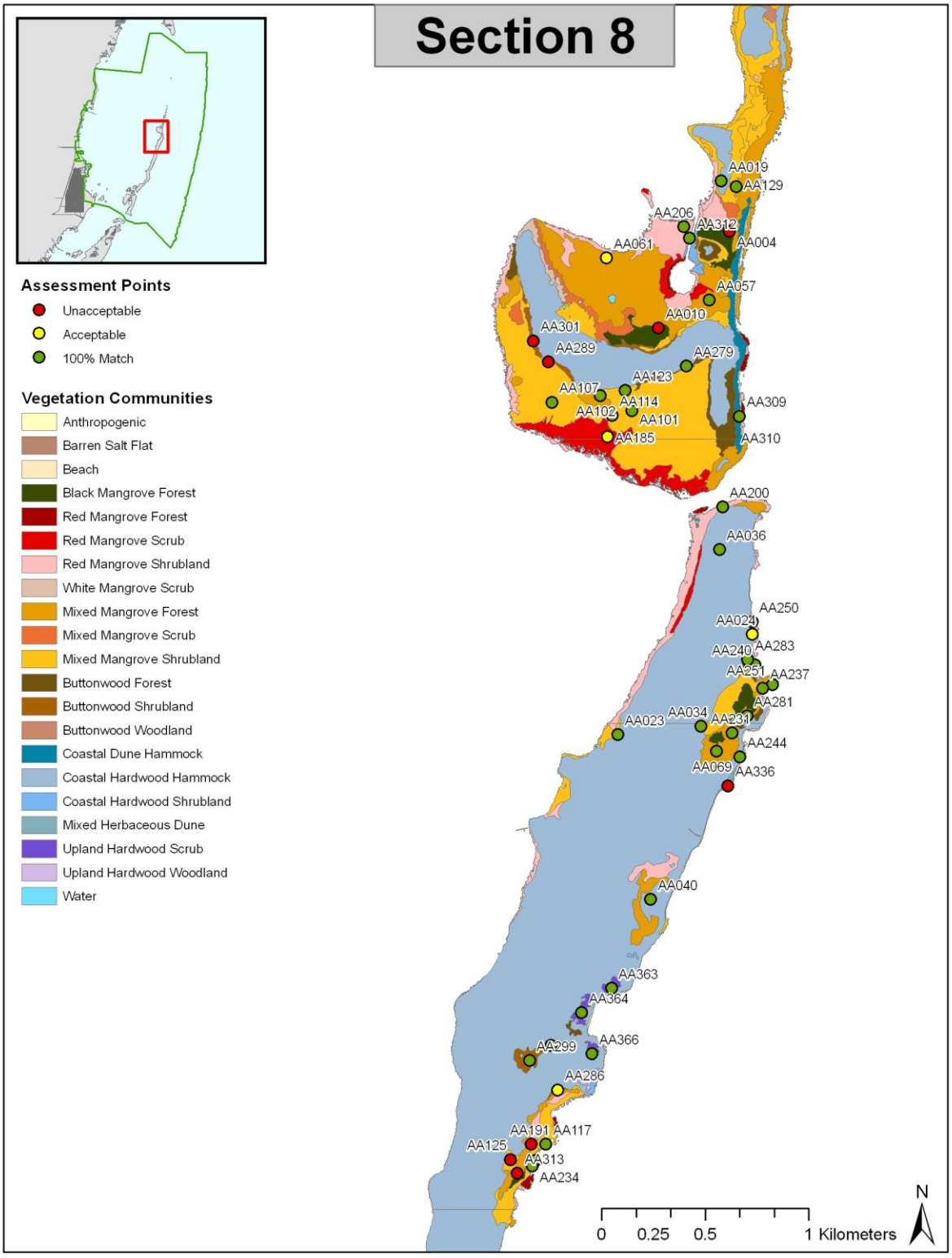


Figure B-12. Detailed view of Section 8 assessment area.

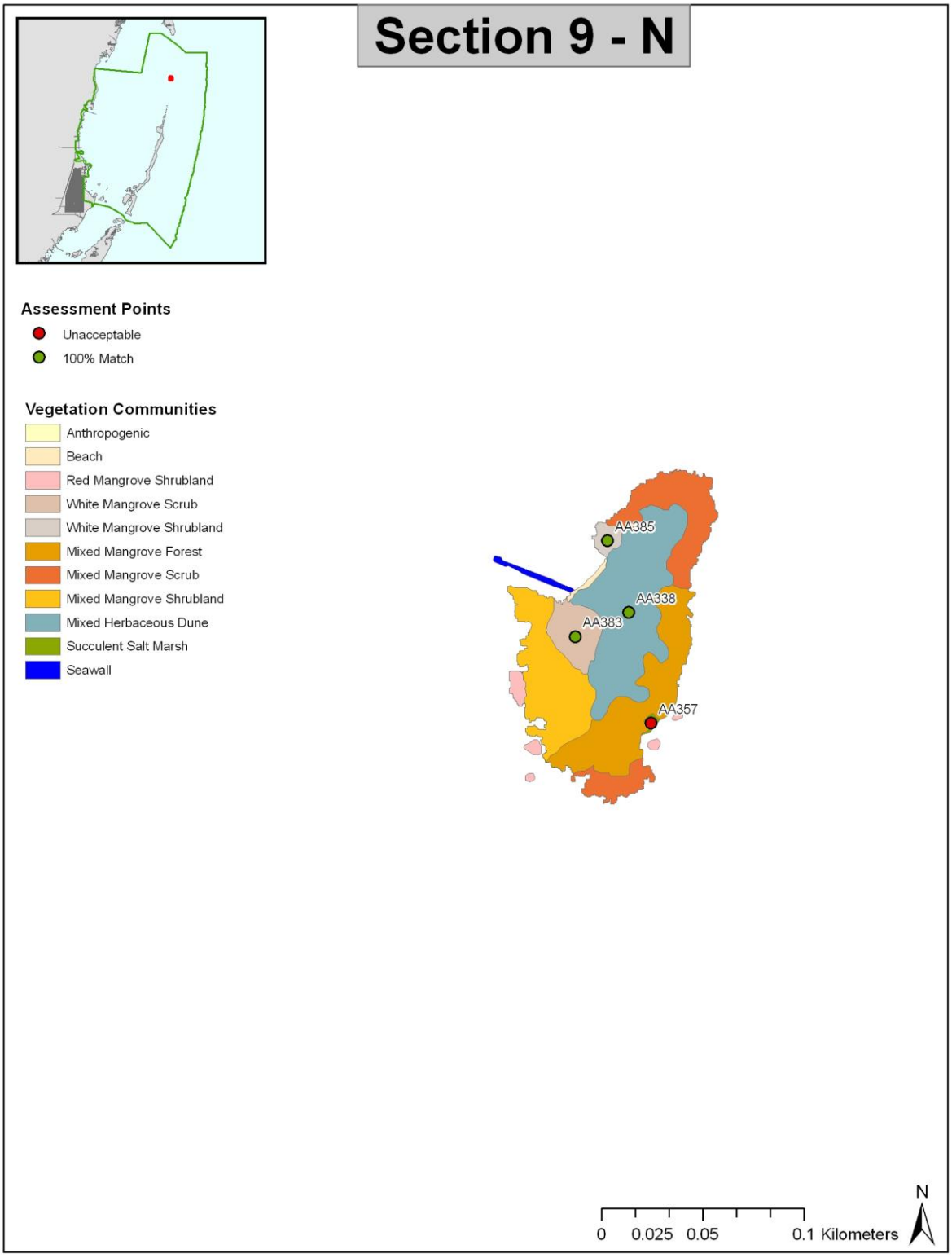


Figure B-13. Detailed view of Section 9 North assessment area.

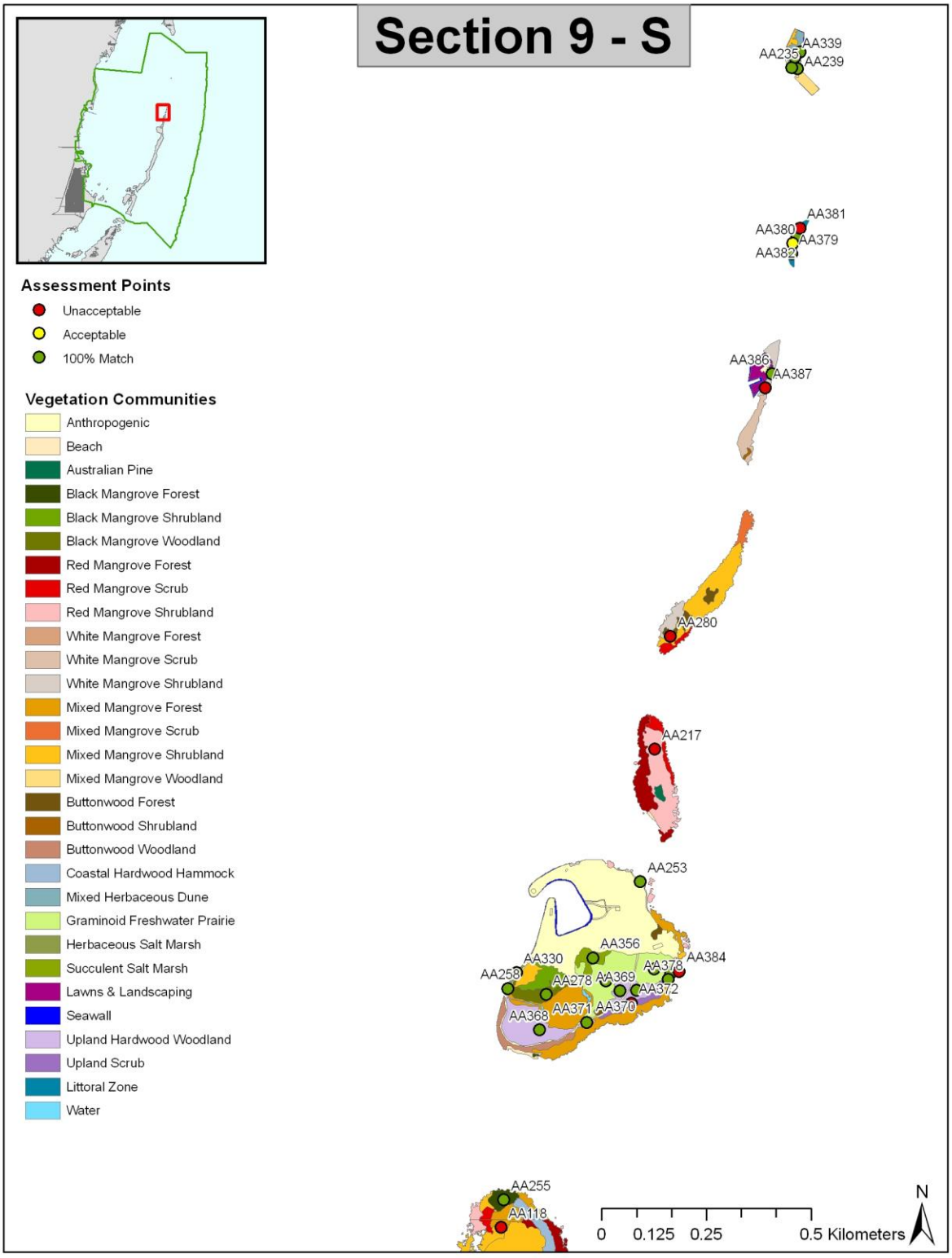


Figure B-14. Detailed view of Section 9 South assessment area.

Table B-1. Number of points used for horizontal accuracy of base aerial imagery and positional accuracy assessment of map features.

Control Point Type	Number points used for assessment of horizontal accuracy of imagery	Number points used for positional accuracy of map features
Center of Red Mangrove	-	12
Corner of Dock	5	5
Corner of Seawall	1	3
North edge of Red Mangrove	-	1
Corner of Lighthouse	-	1
End of Trail	-	1
Corner of Concrete Pad/Sidewalk	3	2
Center of Fire Ring	1	-
Painted Parking Lot Symbols	2	-

Table B-2. Method for choosing the number of accuracy assessment points per map classification category and randomly selection process (based on Section 8.2.1.2 of NBS/NPS VMP Accuracy Assessment Procedures (1994).

Scenario	Description	Polygons in class	Area occupied by class	Number of Accuracy Assessment points in class	Method for selection of accuracy assessment points
A	Abundant. Many polygons that cover a large area.	>>30	>>50 ha	30	Accuracy assessment points (radius 10m) were randomly selected from area across all polygons. Points within 30m of another point in the same polygon were dropped and the next randomly selected point used. Points within 10m of an edge were moved inwards towards the polygon center.
B	Relatively abundant. Class has few polygons that cover a large area.	< 30	>> 50 ha	20	No vegetation categories fell into this class.
C	Relatively rare. Class has many polygons, but covers a small area. Many polygons are close to the MMU.	> 30	< 50 ha	20	For "Black Mangrove Forest", which had some very large polygons and many small polygons, 10 points were randomly selected from area of all polygons (see A above); 10 points were randomly selected from small polygons (see D below). For all other categories, Scenario D was used (see below)
D	Rare. Class has few polygons, which may be widely distributed. Most or all polygons are close to the MMU.	>5, <30	<50 ha	5	Instead of points, polygons were randomly selected from all possible polygons. Accuracy assessment was conducted on entire polygon.
E	Very rare. Class has too few polygons to permit sampling. Polygons are close to the MMU.	< 5	< 50 ha	Visit all and confirm	All polygons were visited and accuracy assessment was conducted on entire polygon.

>>= Greatly exceeds

Table B-3. Number of accuracy assessment points and scenario for selection used per Level 3 category in vegetation map based on number of polygons and area.

Annotation used on the map - Level 3	Number Polygons*	Area (ha)	#Accuracy Assessment Points	Scenario used to pick AA points
Australian Pine	13	4.0	5	D
Barren Microkarst	16	2.0	5	D
Barren Salt Flat	3	0.4	3	E
Beach	70	2.2	20	C
Black Mangrove Forest	40	45.7	20	C
Black Mangrove Scrub	10	10.1	5	D
Black Mangrove Shrubland	22	8.2	5	D
Black Mangrove Woodland	22	31.9	5	D
Buttonwood Forest	18	8.1	5	D
Buttonwood Shrubland	32	10.6	20	C
Buttonwood Woodland	22	11.5	5 (4)**	D
Coastal Dune Hammock	2	3.4	2 (1)***	E
Coastal Hardwood Hammock	47	702.3	30	A
Coastal Hardwood Shrubland	22	6.4	5	D
Exotic	5	2.4	5	E
Graminoid Freshwater Marsh	1	5.4	1	E
Graminoid Freshwater Prairie	2	1.7	2	E
Graminoid Salt Marsh	11	9.4	5	D
Hammock Forest	1	8.9	1	E
Herbaceous Salt Marsh	1	0.1	1	E
Lightning Gap	17	0.1	5	D
Mixed Herbaceous Dune	6	0.9	5	D
Mixed Mangrove Forest	280	730.4	30	A
Mixed Mangrove Scrub	151	136.5	30	A
Mixed Mangrove Shrubland	589	524.5	30	A
Mixed Mangrove Woodland	18	12.4	5	D
Red Mangrove Forest	203	78.5	30	A
Red Mangrove Scrub	704	707.5	30	A
Red Mangrove Shrubland	1937	293.5	30	A
Seaside Mahoe	4	4.9	4	E
Spoil	18	0.6	5	D
Succulent Salt Marsh	3	0.4	3	E
Treated Australian Pine	13	3.4	5	D
Upland Hardwood Scrub	4	1.5	4	E
Upland Hardwood Woodland	6	2.7	5	D
Upland Scrub	1	0.2	1	E
Water	467	25.5	5	C
White Mangrove Forest	1	0.0	1	E
White Mangrove Scrub	14	3.2	5	D
White Mangrove Shrubland	15	2.1	5	D
White Mangrove Woodland	4	4.2	4	E
Total	**4815**	**3407.6**	**392 (390)**	

* = Includes unmerged slivers caused by polygons overlapping imagery boundaries

** = 1 polygon was an unmerged sliver of an adjacent polygon. A single accuracy assessment was conducted on the entire polygon instead of doing two separate polygons.

*** = 1 point fell on an unmerged sliver that caused confusion in the field and the point was dropped.

Table B-4. Accuracy assessment matrix at 100% match per Level 6 category. Grouped by the map annotation compared to what was found in the field.

Annotation used on the map-L6	Accuracy Assessment Field Code	Correct	Incorrect	Total	Percent Correct
Australian Pine	Australian Pine	5		5	
	Australian Pine Total	5		5	100
Barren Microkarst	Barren Microkarst	5		5	
	Barren Microkarst Total	5		5	100
Barren Salt Flat	Barren Salt Flat	3		3	
	Barren Salt Flat Total	3		3	100
Beach	Beach	20		20	
	Beach Total	20		20	100
Black Mangrove Forest	Black Mangrove Forest	8		8	
	Black Mangrove Woodland [2]		2	2	
	Mixed Mangrove Forest		10	10	
	Black Mangrove Forest Total	8	12	20	40
Black Mangrove Scrub	Black Mangrove Scrub	3		3	
	Red Mangrove Scrub		1	1	
	Black Mangrove Scrub Total	3	1	4	75
Black Mangrove Scrub-Saltwort	Black Mangrove Scrub-Saltwort	1		1	
	Black Mangrove Scrub-Saltwort Total	1		1	100
Black Mangrove Shrubland	Black Mangrove Shrubland	3		3	
	Red Mangrove Shrubland		2	2	
	Black Mangrove Shrubland Total	3	2	5	60
Black Mangrove Woodland	Black Mangrove Woodland	3		3	
	Red Mangrove Shrubland		2	2	
	Black Mangrove Woodland Total	3	2	5	60
Black Mangrove-Red Mangrove Forest	Black Mangrove Woodland		1	1	
	Black Mangrove-Red Mangrove Forest	4		4	
	Mixed Mangrove Forest [4]		1	1	
	Black Mangrove-Red Mangrove Forest Total	4	2	6	67
Black Mangrove-Red Mangrove Scrub	Black Mangrove-Red Mangrove Scrub	1		1	
	Black Mangrove-Red Mangrove Scrub Total	1		1	100
Black Mangrove-Red Mangrove Shrubland	Black Mangrove Woodland		1	1	
	Black Mangrove-Red Mangrove Shrubland	2		2	
	Black Mangrove-Red Mangrove Shrubland Total	2	1	3	67
Black Rush	Black Rush	4		4	
	Black Rush Total	4		4	100
Buttonwood Forest	Buttonwood Forest	4		4	
	Coastal Hardwood Hammock		1	1	
	Buttonwood Forest Total	4	1	5	80
Buttonwood Shrubland	Black Mangrove Shrubland		1	1	
	Black Mangrove-Buttonwood Shrubland[4]		1	1	
	Buttonwood Forest [1]		1	1	
	Buttonwood Shrubland	12		12	

Annotation used on the map-L6	Accuracy Assessment Field Code	Correct	Incorrect	Total	Percent Correct
	Buttonwood Woodland [1]		1	1	
	Red Mangrove Shrubland		2	2	
	White Mangrove Shrubland		1	1	
	Buttonwood Shrubland Total	12	7	19	63
Buttonwood Shrubland-Saltwort	Buttonwood Shrubland-Saltwort	1		1	
	Buttonwood Shrubland-Saltwort Total	1		1	100
Buttonwood Woodland	Buttonwood Shrubland [1]		1	1	
	Buttonwood Woodland	2		2	
	Mixed Mangrove Shrubland		1	1	
	Buttonwood Woodland Total	2	2	4	50
Buttonwood-Red Mangrove Scrub	Buttonwood-Red Mangrove Shrubland [1]		1	1	
	Red Mangrove Scrub[4]		1	1	
	Buttonwood-Red Mangrove Scrub Total		2	2	0
Buttonwood-White Mangrove Scrub-Succulent	Buttonwood-White Mangrove Scrub-Succulent	1		1	
	Buttonwood-White Mangrove Scrub-Succulent Total	1		1	100
Buttonwood-White Mangrove Shrubland	Buttonwood-White Mangrove Shrubland	2		2	
	Buttonwood-White Mangrove Shrubland Total	2		2	100
Coastal Dune Hammock	Coastal Dune Hammock	1		1	
	Coastal Dune Hammock Total	1		1	100
Coastal Hardwood Hammock	Coastal Hardwood Hammock	29		29	
	Tropical Hardwood Shrubland [1]		1	1	
	Coastal Hardwood Hammock Total	29	1	30	97
Coastal Hardwood Shrubland	Black Mangrove Shrubland		1	1	
	Coastal Hardwood Hammock [1]		1	1	
	Coastal Hardwood Shrubland	2		2	
	Upland Hardwood Woodland [1]		1	1	
	Coastal Hardwood Shrubland Total	2	3	5	40
Cordgrass	Mixed Mangrove Forest		1	1	
	Cordgrass Total		1	1	0
Exotic	Exotic	5		5	
	Exotic Total	5		5	100
Glasswort	Saltwort		1	1	
	Glasswort Total		1	1	0
Graminoid Freshwater Prairie	Graminoid Freshwater Prairie	2		2	
	Graminoid Freshwater Prairie Total	2		2	100
Hammock Forest	Hammock Forest	1		1	
	Hammock Forest Total	1		1	100
Herbaceous Salt Marsh	Herbaceous Salt Marsh	1		1	
	Herbaceous Salt Marsh Total	1		1	100
Lightning Gap	Big Dead Tree [3]		1	1	
	Lightning Gap	4		4	
	Lightning Gap Total	4	1	5	80
Mixed Herbaceous Dune	Mixed Herbaceous Dune	4		4	
	Upland Hardwood Scrub		1	1	
	Mixed Herbaceous Dune Total	4	1	5	80

Annotation used on the map-L6	Accuracy Assessment Field Code	Correct	Incorrect	Total	Percent Correct
Mixed Mangrove Forest	Black Mangrove Forest		1	1	
	Mixed Mangrove Forest	21		21	
	Mixed Mangrove Shrubland [1]		1	1	
	White Mangrove Forest		1	1	
	Mixed Mangrove Forest Total	21	3	24	88
Mixed Mangrove Scrub	Black Mangrove Woodland		1	1	
	Mixed Mangrove Scrub	7		7	
	Mixed Mangrove Shrubland [1]		1	1	
	Red Mangrove Scrub		9	9	
	Red Mangrove Shrubland		4	4	
	Mixed Mangrove Scrub Total	7	15	22	32
Mixed Mangrove Scrub-Succulent	Mixed Mangrove Scrub-Succulent	4		4	
	Mixed Mangrove Scrub-Succulent Total	4		4	100
Mixed Mangrove Shrubland	Black Mangrove Woodland		1	1	
	Buttonwood Shrubland		2	2	
	Mixed Mangrove Forest [1]		1	1	
	Mixed Mangrove Shrubland	14		14	
	Red Mangrove Shrubland		3	3	
	Mixed Mangrove Shrubland Total	14	7	21	67
Mixed Mangrove Shrubland-Succulent	Mixed Mangrove Shrubland-Succulent	3		3	
	Mixed Mangrove Shrubland-Succulent Total	3		3	100
Mixed Mangrove Woodland	Mixed Mangrove Woodland	5		5	
	Mixed Mangrove Woodland Total	5		5	100
Red Mangrove Forest	Mixed Mangrove Forest		3	3	
	Red Mangrove Forest	24		24	
	Red Mangrove Shrubland [1]		3	3	
	Red Mangrove Forest Total	24	6	30	80
Red Mangrove Scrub	Red Mangrove Scrub	16		16	
	Red Mangrove Shrubland [1]		4	4	
	Red Mangrove Scrub Total	16	4	20	80
Red Mangrove Scrub-Black Rush	Red Mangrove Scrub-Black Rush	1		1	
	Red Mangrove Scrub-Black Rush Total	1		1	100
Red Mangrove Scrub-Fimbry	Red Mangrove Scrub-Fimbry	3		3	
	Red Mangrove Scrub-Fimbry Total	3		3	100
Red Mangrove Scrub-Open Marsh	Red Mangrove Scrub-Open Marsh	5		5	
	Red Mangrove Scrub-Open Marsh Total	5		5	100
Red Mangrove Scrub-Subtidal	Red Mangrove Scrub-Subtidal	1		1	
	Red Mangrove Scrub-Subtidal Total	1		1	100
Red Mangrove Shrubland	Black Mangrove Forest		1	1	
	Black Mangrove Shrubland		1	1	
	Mixed Mangrove Shrubland		1	1	
	Red Mangrove Forest [1]		4	4	
	Red Mangrove Shrubland	22		22	
	White Mangrove Forest		1	1	
	Red Mangrove Shrubland Total	22	8	30	73
Sawgrass	Sawgrass	1		1	

Annotation used on the map-L6	Accuracy Assessment Field Code	Correct	Incorrect	Total	Percent Correct
	Sawgrass Total	1		1	100
Seaside Mahoe	Seaside Mahoe	4		4	
	Seaside Mahoe Total	4		4	100
Spoil	Spoil	5		5	
	Spoil Total	5		5	100
Succulent Salt Marsh	Succulent Salt Marsh	2		2	
	Succulent Salt Marsh Total	2		2	100
Treated Australian Pine	Treated Australian Pine	5		5	
	Treated Australian Pine Total	5		5	100
Upland Hardwood Scrub	Upland Hardwood Scrub	3		3	
	Upland Hardwood Shrubland [1]		1	1	
	Upland Hardwood Scrub Total	3	1	4	75
Upland Hardwood Woodland	Upland Hardwood Woodland	5		5	
	Upland Hardwood Woodland Total	5		5	100
Upland Scrub	Buttonwood Woodland		1	1	
	Upland Scrub Total		1	1	0
Water	Water	5		5	
	Water Total	5		5	100
White Mangrove Forest	White Mangrove Forest	1		1	
	White Mangrove Forest Total	1		1	100
White Mangrove Scrub	Black Mangrove Scrub		1	1	
	White Mangrove Scrub	2		2	
	White Mangrove Shrubland [1]		1	1	
	White Mangrove Scrub Total	2	2	4	50
White Mangrove Scrub-Glasswort	White Mangrove Scrub-Glasswort	1		1	
	White Mangrove Scrub-Glasswort Total	1		1	100
White Mangrove Shrubland	Black Mangrove Shrubland		1	1	
	White Mangrove Forest [1]		1	1	
	White Mangrove Shrubland	2		2	
	White Mangrove Shrubland Total	2	2	4	50
White Mangrove Shrubland-Succulent	Coastal Hardwood Shrubland		1	1	
	White Mangrove Shrubland-Succulent Total		1	1	0
White Mangrove Woodland	Black Mangrove Woodland		1	1	
	Buttonwood Woodland		2	2	
	White-Red Mangrove Shrubland		1	1	
	White Mangrove Woodland Total		4	4	0
White Mangrove-Red Mangrove Shrubland	Mixed Mangrove Forest		1	1	
	White Mangrove-Red Mangrove Shrubland Total		1	1	0
Grand Total		**295**	**95**	**390**	**76**

[1] Accepted vegetation height discrepancy

[2] Accepted vegetation cover discrepancy

[3] Accepted value because the dead tree might have been caused by lightning strike

[4] Accepted value because the point was on the edge between categories

Table B-5. Accuracy assessment matrix at 100% match per Level 6 category. Grouped by field code compared to the map annotation.

Accuracy Assessment Field Code	Annotation used on the map-L6	Correct	Incorrect	Grand Total	Percent Correct
Australian Pine	Australian Pine	5		5	
	Australian Pine Total	5		5	100
Barren Microkarst	Barren Microkarst	5		5	
	Barren Microkarst Total	5		5	100
Barren Salt Flat	Barren Salt Flat	3		3	
	Barren Salt Flat Total	3		3	100
Beach	Beach	20		20	
	Beach Total	20		20	100
Big Dead Tree	Lightning Gap[3]		1	1	
	Big Dead Tree Total		1	1	0
Black Mangrove Forest	Black Mangrove Forest	8		8	
	Mixed Mangrove Forest		1	1	
	Red Mangrove Shrubland		1	1	
	Black Mangrove Forest Total	8	2	10	80
Black Mangrove Scrub	Black Mangrove Scrub	3		3	
	White Mangrove Scrub		1	1	
	Black Mangrove Scrub Total	3	1	4	75
Black Mangrove Scrub-Saltwort	Black Mangrove Scrub-Saltwort	1		1	
	Black Mangrove Scrub-Saltwort Total	1		1	100
Black Mangrove Shrubland	Black Mangrove Shrubland	3		3	
	Buttonwood Shrubland		1	1	
	Coastal Hardwood Shrubland		1	1	
	Red Mangrove Shrubland		1	1	
	White Mangrove Shrubland		1	1	
	Black Mangrove Shrubland Total	3	4	7	43
Black Mangrove Woodland	Black Mangrove Forest[2]		2	2	
	Black Mangrove Woodland	3		3	
	Black Mangrove-Red Mangrove Forest		1	1	
	Black Mangrove-Red Mangrove Shrubland		1	1	
	Mixed Mangrove Scrub		1	1	
	Mixed Mangrove Shrubland		1	1	
	White Mangrove Woodland		1	1	
	Black Mangrove Woodland Total	3	7	10	30
Black Mangrove-Buttonwood Shrubland	Buttonwood Shrubland[4]		1	1	
	Black Mangrove-Buttonwood Shrubland Total		1	1	0
Black Mangrove-Red Mangrove Forest	Black Mangrove-Red Mangrove Forest	4		4	
	Black Mangrove-Red Mangrove Forest Total	4		4	100
Black Mangrove-Red Mangrove Scrub	Black Mangrove-Red Mangrove Scrub	1		1	
	Black Mangrove-Red Mangrove Scrub Total	1		1	100
Black Mangrove-Red Mangrove Shrubland	Black Mangrove-Red Mangrove Shrubland	2		2	
	Black Mangrove-Red Mangrove Shrubland Total	2		2	100
Black Rush	Black Rush	4		4	
	Black Rush Total	4		4	100
Buttonwood Forest	Buttonwood Forest	4		4	

Accuracy Assessment Field Code	Annotation used on the map-L6	Correct	Incorrect	Grand Total	Percent Correct
	Buttonwood Shrubland[1]		1	1	
	Buttonwood Forest Total	4	1	5	80
Buttonwood Shrubland	Buttonwood Shrubland	12		12	
	Buttonwood Woodland[1]		1	1	
	Mixed Mangrove Shrubland		2	2	
	Buttonwood Shrubland Total	12	3	15	80
Buttonwood Shrubland-Saltwort	Buttonwood Shrubland-Saltwort	1		1	
	Buttonwood Shrubland-Saltwort Total	1		1	100
Buttonwood Woodland	Buttonwood Shrubland[1]		1	1	
	Buttonwood Woodland	2		2	
	Upland Scrub		1	1	
	White Mangrove Woodland		2	2	
	Buttonwood Woodland Total	2	4	6	33
Buttonwood-Red Mangrove Shrubland	Buttonwood-Red Mangrove Scrub[1]		1	1	
	Buttonwood-Red Mangrove Shrubland Total		1	1	0
Buttonwood-White Mangrove Scrub-Succulent	Buttonwood-White Mangrove Scrub-Succulent	1		1	
	Buttonwood-White Mangrove Scrub-Succulent Total	1		1	100
Buttonwood-White Mangrove Shrubland	Buttonwood-White Mangrove Shrubland	2		2	
	Buttonwood-White Mangrove Shrubland Total	2		2	100
Coastal Dune Hammock	Coastal Dune Hammock	1		1	
	Coastal Dune Hammock Total	1		1	100
Coastal Hardwood Hammock	Buttonwood Forest		1	1	
	Coastal Hardwood Hammock	29		29	
	Coastal Hardwood Shrubland[1]		1	1	
	Coastal Hardwood Hammock Total	29	2	31	94
Coastal Hardwood Shrubland	Coastal Hardwood Shrubland	2		2	
	White Mangrove Shrubland-Succulent		1	1	
	Coastal Hardwood Shrubland Total	2	1	3	67
Upland Hardwood Woodland	Coastal Hardwood Shrubland[1]		1	1	
	Upland Hardwood Woodland Total		1	1	0
Exotic	Exotic	5		5	
	Exotic Total	5		5	100
Graminoid Freshwater Prairie	Graminoid Freshwater Prairie	2		2	
	Graminoid Freshwater Prairie Total	2		2	100
Hammock Forest	Hammock Forest	1		1	
	Hammock Forest Total	1		1	100
Herbaceous Salt Marsh	Herbaceous Salt Marsh	1		1	
	Herbaceous Salt Marsh Total	1		1	100
Lightning Gap	Lightning Gap	4		4	
	Lightning Gap Total	4		4	100
Mixed Herbaceous Dune	Mixed Herbaceous Dune	4		4	
	Mixed Herbaceous Dune Total	4		4	100
Mixed Mangrove Forest	Black Mangrove Forest		10	10	
	Black Mangrove-Red Mangrove Forest[4]		1	1	
	Cordgrass		1	1	
	Mixed Mangrove Forest	21		21	

Accuracy Assessment Field Code	Annotation used on the map-L6	Correct	Incorrect	Grand Total	Percent Correct
	Mixed Mangrove Shrubland[1]		1	1	
	Red Mangrove Forest		3	3	
	White Mangrove-Red Mangrove Shrubland		1	1	
	Mixed Mangrove Forest Total	21	17	38	55
Mixed Mangrove Scrub	Mixed Mangrove Scrub	7		7	
	Mixed Mangrove Scrub Total	7		7	100
Mixed Mangrove Scrub-Succulent	Mixed Mangrove Scrub-Succulent	4		4	
	Mixed Mangrove Scrub-Succulent Total	4		4	100
Mixed Mangrove Shrubland	Buttonwood Woodland		1	1	
	Mixed Mangrove Forest[1]		1	1	
	Mixed Mangrove Scrub[1]		1	1	
	Mixed Mangrove Shrubland	14		14	
	Red Mangrove Shrubland		1	1	
	Mixed Mangrove Shrubland Total	14	4	18	78
Mixed Mangrove Shrubland-Succulent	Mixed Mangrove Shrubland-Succulent	3		3	
	Mixed Mangrove Shrubland-Succulent Total	3		3	100
Mixed Mangrove Woodland	Mixed Mangrove Woodland	5		5	
	Mixed Mangrove Woodland Total	5		5	100
Red Mangrove Forest	Red Mangrove Forest	24		24	
	Red Mangrove Shrubland[1]		4	4	
	Red Mangrove Forest Total	24	4	28	86
Red Mangrove Scrub	Black Mangrove Scrub		1	1	
	Buttonwood-Red Mangrove Scrub[4]		1	1	
	Mixed Mangrove Scrub		9	9	
	Red Mangrove Scrub	16		16	
	Red Mangrove Scrub Total	16	11	27	59
Red Mangrove Scrub-Black Rush	Red Mangrove Scrub-Black Rush	1		1	
	Red Mangrove Scrub-Black Rush Total	1		1	100
Red Mangrove Scrub-Fimbry	Red Mangrove Scrub-Fimbry	3		3	
	Red Mangrove Scrub-Fimbry Total	3		3	100
Red Mangrove Scrub-Open Marsh	Red Mangrove Scrub-Open Marsh	5		5	
	Red Mangrove Scrub-Open Marsh Total	5		5	100
Red Mangrove Scrub-Subtidal	Red Mangrove Scrub-Subtidal	1		1	
	Red Mangrove Scrub-Subtidal Total	1		1	100
Red Mangrove Shrubland	Black Mangrove Shrubland		2	2	
	Black Mangrove Woodland		2	2	
	Buttonwood Shrubland		2	2	
	Mixed Mangrove Scrub		4	4	
	Mixed Mangrove Shrubland		3	3	
	Red Mangrove Forest[1]		3	3	
	Red Mangrove Scrub[1]		4	4	
	Red Mangrove Shrubland	22		22	
	Red Mangrove Shrubland Total	22	20	42	52
Saltwort	Glasswort		1	1	
	Saltwort Total		1	1	0
Sawgrass	Sawgrass	1		1	
	Sawgrass Total	1		1	100
Seaside Mahoe	Seaside Mahoe	4		4	
	Seaside Mahoe Total	4		4	100
Spoil	Spoil	5		5	
	Spoil Total	5		5	100

Accuracy Assessment Field Code	Annotation used on the map-L6	Correct	Incorrect	Grand Total	Percent Correct
Succulent Salt Marsh	Succulent Salt Marsh	2		2	
	Succulent Salt Marsh Total	2		2	100
Treated Australian Pine	Treated Australian Pine	5		5	
	Treated Australian Pine Total	5		5	100
Upland Hardwood Scrub	Mixed Herbaceous Dune		1	1	
	Upland Hardwood Scrub	3		3	
	Upland Hardwood Scrub Total	3	1	4	75
Tropical Hardwood Shrubland	Coastal Hardwood Hammock[1]		1	1	
	Upland Hardwood Scrub[1]		1	1	
	Tropical Hardwood Shrubland Total		2	2	0
Upland Hardwood Woodland	Upland Hardwood Woodland	5		5	
	Upland Hardwood Woodland Total	5		5	100
Water	Water	5		5	
	Water Total	5		5	100
White Mangrove Forest	Mixed Mangrove Forest		1	1	
	Red Mangrove Shrubland		1	1	
	White Mangrove Forest	1		1	
	White Mangrove Shrubland[1]		1	1	
	White Mangrove Forest Total	1	3	4	25
White Mangrove Scrub	White Mangrove Scrub	2		2	
	White Mangrove Scrub Total	2		2	100
White Mangrove Scrub-Glasswort	White Mangrove Scrub-Glasswort	1		1	
	White Mangrove Scrub-Glasswort Total	1		1	100
White Mangrove Shrubland	Buttonwood Shrubland		1	1	
	White Mangrove Scrub[1]		1	1	
	White Mangrove Shrubland	2		2	
	White Mangrove Shrubland Total	2	2	4	50
White-Red Mangrove Shrubland	White Mangrove Woodland		1	1	
	White-Red Mangrove Shrubland Total		1	1	0
Grand Total		**295**	**95**	**390**	**76**

[1] Accepted vegetation height discrepancy

[2] Accepted vegetation cover discrepancy

[3] Accepted value because the dead tree might have been caused by lightning strike

[4] Accepted value because the point was on the edge between categories

Appendix C. Vegetation Hierarchical Key and Classification

Table C-1. Biscayne National Park vegetation classification hierarchical key. …….....C-2

Table C-2. Vegetation classification hierarchy with map class definitions and cross-walk to Rutchey et al (2007) Raster ID codes and definitions. ……..…….C-6

Table C-1. Biscayne National Park vegetation classification hierarchical key.

Level	Classification name	Map Class	Raster ID	New Map Class
1	**FOREST**			
2	**Mangrove Forest**			
3	**Black Mangrove Forest**	Yes	111000	
3	**Buttonwood Forest**	Yes	112000	
3	**White Mangrove Forest**	Yes	113000	
3	**Red Mangrove Forest**	Yes	114000	
3	**Mixed Mangrove Forest**	Yes	115000	
4	***Black Mangrove-Buttonwood Forest***	Yes	115100	
4	***Black Mangrove-White Mangrove Forest***	Yes	115200	
4	***Black Mangrove-Red Mangrove Forest***	Yes	115300	
4	***Buttonwood-White Mangrove Forest***	Yes	115400	
2	**Hammock Forest**	Yes	130000	
3	**Coastal Hardwood Hammock**	Yes	131000	
3	**Coastal Dune Hammock**	Yes	137000	New
1	**WOODLAND**			
2	**Mangrove Woodland**			
3	**Black Mangrove Woodland**	Yes	211000	
4	***Black Mangrove Woodland-Succulent***	Yes	211030	
5	Black Mangrove Woodland-Saltwort	Yes	211031	New
3	**Buttonwood Woodland**	Yes	212000	
4	***Buttonwood Woodland-Succulent***	Yes	212030	
3	**White Mangrove Woodland**	Yes	213000	New
3	**Mixed Mangrove Woodland**	Yes	215000	New
4	***Buttonwood-White Mangrove Woodland***			

Level	Classification name	Map Class	Raster ID	New Map Class
5	Buttonwood-White Mangrove Woodland-Herbaceous	Yes	215420	New
2	**Upland Woodland**			
3	**Upland Hardwood Woodland**	Yes	233000	
1	**SHRUBLAND**			
2	**Mangrove Shrubland**			
3	**Black Mangrove Shrubland**	Yes	311000	
4	***Black Mangrove Shrubland-Succulent***			
5	Black Mangrove Shrubland-Saltwort	Yes	311041	New
3	**Buttonwood Shrubland**	Yes	312000	
4	***Buttonwood Shrubland-Succulent***			
5	Buttonwood Shrubland-Saltwort	Yes	312041	New
3	**White Mangrove Shrubland**	Yes	313000	
3	**Red Mangrove Shrubland**	Yes	314000	
3	**Mixed Mangrove Shrubland**	Yes	315000	
4	***Mixed Mangrove Shrubland-Succulent***	Yes	315040	New
4	***Black Mangrove-White Mangrove Shrubland***	Yes	315200	
5	Black Mangrove-White Mangrove Shrubland-Succulent	Yes	315210	New
4	***Black Mangrove-Red Mangrove Shrubland***	Yes	315300	
4	***Buttonwood-White Mangrove Shrubland***	Yes	315500	
5	Buttonwood-White Mangrove Shrubland-Succulent	Yes	315510	New
5	Buttonwood-White Mangrove Shrubland-Graminoid			
6	*Buttonwood-White Mangrove Shrubland-Cordgrass*	Yes	315521	New
4	***Buttonwood-Red Mangrove Shrubland***	Yes	315600	

Level	Classification name	Map Class	Raster ID	New Map Class
4	***White Mangrove-Red Mangrove Shrubland***	Yes	315700	
2	**Upland Shrubland**	Yes	340000	
3	**Coastal Hardwood Shrubland**	Yes	342000	
3	**Nicker Bean Shrubland**	Yes	341000	
1	**SCRUB**			
2	**Mangrove Scrub**			
3	**Black Mangrove Scrub**	Yes	411000	
4	***Black Mangrove Scrub-Succulent***			
5	Black Mangrove Scrub-Saltwort	Yes	411041	
3	**White Mangrove Scrub**	Yes	413000	
4	***White Mangrove Scrub-Succulent***	Yes	413040	
5	White Mangrove Scrub-Saltwort	Yes	413041	
5	White Mangrove Scrub-Glasswort	Yes	413042	
3	**Red Mangrove Scrub**	Yes	414000	
4	***Red Mangrove Scrub-Graminoid***			
5	Red Mangrove Scrub-Sawgrass	Yes	414011	
5	Red Mangrove Scrub-Fimbry	Yes	414014	
5	Red Mangrove Scrub-Black Rush	Yes	414015	
5	Red Mangrove Scrub-Sawgrass/Black Rush	Yes	414010	New
4	***Red Mangrove Scrub-Open Marsh***	Yes	414030	
4	***Red Mangrove Scrub-Dominant***			
5	Red Mangrove Scrub-Subtidal	Yes	414051	New
3	**Mixed Mangrove Scrub**	Yes	415000	
4	***Mixed Mangrove Scrub-Graminoid***			
5	Mixed Mangrove Scrub-Black Rush	Yes	415015	

Level	Classification name	Map Class	Raster ID	New Map Class
4	***Mixed Mangrove Scrub-Succulent***	Yes	415040	
4	***Black Mangrove-White Mangrove Scrub***	Yes	415200	
5	Black Mangrove-White Mangrove Scrub-Succulent			
6	*Black Mangrove-White Mangrove Scrub-Saltwort*	Yes	415241	
4	***Black Mangrove-Red Mangrove Scrub***	Yes	415300	
4	***Buttonwood-White Mangrove Scrub***			
5	Buttonwood-White Mangrove Scrub-Graminoid			
6	Buttonwood-White Mangrove Scrub-Cordgrass	Yes	415417	
5	Buttonwood-White Mangrove Scrub-Succulent	Yes	415440	
6	*Buttonwood-White Mangrove Scrub-Saltwort*	Yes	415441	
4	***Buttonwood-Red Mangrove Scrub***	Yes	415500	
5	Buttonwood-Red Mangrove Scrub-Graminoid			
6	*Buttonwood-Red Mangrove Scrub-Sawgrass*	Yes	415511	
6	*Buttonwood-Red Mangrove Scrub-Sawgrass/Black Rush*	Yes	415510	New
4	***White Mangrove-Red Mangrove Scrub***	Yes	415700	
2	**Upland Scrub**	Yes	430000	
3	**Upland Hardwood Scrub**	Yes	431000	
1	**MARSH**			
2	**Salt Marsh**			
3	**Graminoid Salt Marsh**	Yes	511000	
4	***Black Rush***	Yes	511200	
4	***Cordgrass***	Yes	511400	
3	**Herbaceous Salt Marsh**	Yes	512000	
3	**Succulent Salt Marsh**	Yes	514000	

Level	Classification name	Map Class	Raster ID	New Map Class
4	***Saltwort***	Yes	514100	
2	**Freshwater Marsh**			
3	**Graminoid Freshwater Marsh**			
4	***Sawgrass***	Yes	522100	
1	**DUNE**			
2	**Herbaceous Dune**			
3	**Mixed Herbaceous Dune**	Yes	623000	New
1	**EXOTIC**	Yes	800000	
2	**Australian Pine**	Yes	803000	
2	**Treated Australian Pine**	Yes	804000	
2	**Seaside Mahoe**	Yes	833000	
1	**OTHER**			
2	**Non-Vegetative**			
3	**Barren Salt Flat**	Yes	910010	
3	**Beach**	Yes	910020	
3	**Littoral Zone**	Yes	910030	New
3	**Lightning Gap**	Yes	910050	New
3	**Water**	Yes	910120	
3	**Barren Microkarst**	Yes	910130	New
2	**Anthropogenic**	Yes	920000	
3	**Campground**	Yes	920010	New
3	**Dock**	Yes	920030	New
3	**Lawns & Landscaping**	Yes	920040	New
3	**Parking Lot**	Yes	920060	New

Level	Classification name	Map Class	Raster ID	New Map Class
3	**Road**	Yes	920080	
3	**Seawall**	Yes	920090	New
3	**Trail**	Yes	920110	New
3	**Spoil**	Yes	920120	
3	**Walkway**	Yes	920130	New
3	**Building**	Yes	922000	New
4	***Commercial***	Yes	922010	New
4	***Lighthouse***	Yes	922050	New
4	***Residential***	Yes	922070	New
Totals		*100*		*29*

Table C-2. Vegetation classification hierarchy with map class definitions and cross-walk to Rutchey et al (2007) Raster ID codes and definitions.

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
1	**FOREST**					High-density stands of trees (> 50% tree canopy cover) with heights > 5 meters.	High-density stands of trees (≥50% tree canopy cover) with heights greater than five meters. Tree canopy cover from 50% - 60% will be considered Forest unless specifically described in the Woodland section of this classification system.
2	**Mangrove Forest**					Regularly flooded (tidal) forest found along coastal areas dominated by salt tolerant species.	Regularly flooded forests that are typically found along saltwater shorelines, including Black Mangrove (*Avicennia germinans*), White Mangrove (*Laguncularia racemosa*), Red Mangrove (*Rhizophora mangle*), and Buttonwood (*Conocarpus erectus*).
3	**Black Mangrove Forest**	Yes	111000		111000	Black Mangrove (Avicennia germinans) dominated forest found along the coast.	Black Mangrove (Avicennia germinans) dominant forest. Black mangrove is distinguishable from other mangrove species by leaves with grayish undersurfaces, by green, flattened “lima bean-like” fruits, by dark to blackish bark, and by the presence of numerous short breathing roots projecting vertically from the ground below and around the tree.
3	**Buttonwood Forest**	Yes	112000		112000	Buttonwood (Conocarpus erectus) dominated forest usually found on the landward edge of the coastal mangrove zone.	Buttonwood (*Conocarpus erectus*) dominant forest with variable understory composition.

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
3	**White Mangrove Forest**	Yes	113000		113000	White Mangrove (Laguncularia racemosa) dominated forest found along the coast.	White Mangrove (*Laguncularia racemosa*) dominant forest.
3	**Red Mangrove Forest**	Yes	114000		114000	Red Mangrove (Rhizophora mangle) dominated forest found along the coast.	Red Mangrove (*Rhizophora mangle*) dominant forest.
3	**Mixed Mangrove Forest**	Yes	115000		115000	Mixed mangrove forest with no particular species of dominance found along the coast.	Mix of mangrove species with no particular species of dominance.
4	***Black Mangrove-Buttonwood Forest***	Yes	115100		115100	Black mangrove (Avicennia germinans) and Buttonwood (Conocarpus erectus) trees with the cover of either species ranging between 25-75%.	Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and Buttonwood (*Conocarpus erectus*) trees.
4	***Black Mangrove-White Mangrove Forest***	Yes	115200		115200	Black mangrove (Avicennia germinans) and White Mangrove (Laguncularia racemosa) trees with the cover of either species ranging between 25-75%.	Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) trees.
4	***Black Mangrove-Red Mangrove Forest***	Yes	115300		115300	Black mangrove (Avicennia germinans) and Red Mangrove (Rhizophora mangle) trees with the cover of either species ranging between 25-75%.	Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) trees.

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
4	***Buttonwood-White Mangrove Forest***	Yes	115400		115400	Buttonwood (Conocarpus erectus) and White Mangrove (Laguncularia racemosa) trees with the cover of either species ranging between 25-75%.	Co-dominant mix (60/40% or 40/60% split) of Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) trees.
2	**Hammock Forest**	Yes	130000		130000	Rarely inundated and well drained forests containing a mixture of tropical and temperate broad-leaved trees.	Briefly flooded forests

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
3	**Coastal Hardwood Hammock**	Yes	131000		131000	Forest containing a mixture of tropical and temperate broad-leaved trees found along coastal areas on rocky substrate overtoped by an organic layer.	Most common species are Pigeon Plum (Coccoloba diversifolia), False Mastic (Sideroxylon foetidissimum), Gumbo Limbo (Bursera simaruba), Strangler Fig (Ficus aurea), and White Stopper (Eugenia axillaris) but can potentially have many of the same species found in the Tropical Hardwood Hammock (FHS) category. However, it must also include some of the following in species as well: Jamaican Dogwood (Piscidia piscipula), Spanish Stopper (Eugenia foetidia), Mahogany (Swietenia mahagoni), Cabbage Palm (Sabal Palmetto), Wild Lime (Zanthoxylum fagara),] Blackbead (Pithecellobium keyense), Spanish Bayonet (Yucca aloifolia), Catclaw Blackbead (Pithecellobium unguis-cati), Triangle Cactus (Acanthocereus tetragonus), Prickly Pear (Opuntia stricta), Wild Cinnamon (Canella winterana), Sea Grape (Coccoloba uvifera), Buttonwood (Conocarpus erectus), Geiger Tree (Cordia Sebestena), Milk Bark (Drypetes lateriflora), Seven Year Apple (Genipa clusiifolia), Crabwood (Gymnanthes lucida), Mancinella (Hippomane mancinella), Joewood (Jacquinia keyensis), and Thrinax (Thrinax morrissii, Thrinax. radiata).
3	**Coastal Dune Hammock**	Yes	137000	New	137000	Forest containing a mixture of tropical and temperate broad-leaved trees found along coastal areas on dunes	

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
						(shell mounds excluded).	
1	**WOODLAND**					Low-density stands of trees (10 - 60% tree canopy cover) with heights > 5 meters in a matrix of shrubs, graminoids, and/or herbaceous vegetation.	Specific described communities of low-density stands of trees (10 - 60% tree canopy cover) with heights greater than five meters in a matrix of shrubs, graminoids, and/or herbaceous vegetation.
2	**Mangrove Woodland**					Regularly flooded (tidal) open canopy forest found along coastal areas dominated by salt tolerant species.	Regularly flooded woodlands that are typically found along saltwater shorelines.
3	**Black Mangrove Woodland**	Yes	211000		212000	Black Mangrove (Avicennia germinans) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.	Black Mangrove (*Avicennia germinans*) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.
4	***Black Mangrove Woodland-Succulent***	Yes	211030		211030	Black Mangrove (Avicennia germinans) trees in a matrix composed predominately of succulents.	Black Mangrove (*Avicennia germinans*) in a matrix composed predominately of succulents.
5	Black Mangrove Woodland-Saltwort	Yes	211031	New	211031	Black Mangrove (Avicennia germinans) trees in a matrix composed predominately of Saltwort (Batis maritima).	
3	**Buttonwood Woodland**	Yes	212000		211000	Buttonwood (Conocarpus erectus) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.	Buttonwood (*Conocarpus erectus*) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
4	***Buttonwood Woodland-Succulent***	Yes	212030		212030	Buttonwood (Conocarpus erectus) trees in a matrix composed predominately of succulents.	Buttonwood *(Conocarpus erectus)* in a matrix composed predominately of succulents.
3	**White Mangrove Woodland**	Yes	213000	New	213000	White Mangrove (Laguncularia racemosa) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.	
3	**Mixed Mangrove Woodland**	Yes	215000	New	215000	Mixed assemblage of mangrove tree species in a matrix composed of salt marsh graminoids, herbs, and/or succulents.	
4	***Buttonwood-White Mangrove Woodland***					Buttonwood (Conocarpus erectus) and White Mangrove (Laguncularia racemosa) trees with the cover of either species ranging between 25-75%.	
5	Buttonwood-White Mangrove Woodland-Herbaceous	Yes	215420	New	215420	Buttonwood (Conocarpus erectus) and White Mangrove (Laguncularia racemosa) trees in a matrix composed predominately of herbaceous vegetation.	
2	**Upland Woodland**					Rarely inundated and well drained open canopy forests containing a mixture of tropical and temperate broad-leaved trees.	Briefly flooded woodlands

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
3	**Upland Hardwood Woodland**	Yes	233000		233000	Woodland containing a mixture of tropical and temperate broad-leaved trees found along coastal areas on rocky substrate with little or no soil.	Mix of Live Oak (Quercus virginiana), False Tamarind (Lysiloma latisiliquum), Gumbo Limbo (Bursera simaruba), Poisonwood (Metopium toxiferum), Pigeon Plum (Coccoloba diversifolia), and White Stopper (Eugenia axillaris). May also contain Strangler Fig (Ficus aurea), Swamp Bay (Persea borbonia), Dahoon Holly (Ilex Cassine), Sugarberry (Celtis laevigata), False Mastic (Sideroxylon foetidissimum), Wax Myrtle (Myrica cerifera), and Myrsine (Myrsine floridana), Willow Bustic (Sideroxylon salicifolium), Water Oak (Quercus nigra), Red Maple (Acer rubrum), Laural Oak (Quercus laurifolia) and Lancewood (Nectandra coriacea), Laural Oak (Quercus laurifolia), Cabbage Palm (Sabal palmetto), Red Mulberry (Morus rubra), Hackberry (Celtis laevigata), and Common Persimmon (Diospyros virginiana).
1	**SHRUBLAND**					Stands of small trees and/or shrubs (canopy cover ≥ 50%) with heights < 5 meter tall.	High-density stands of small trees and/or shrubs (≥50% tree/shrub canopy cover) with heights less than five meters. Exception: Mangrove shrubs less than or equal to 2 meters are scrub - see scrub section; Willow shrublands can be greater than 5 meters.

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
2	**Mangrove Shrubland**					Regularly flooded (tidal) shrubland found along coastal areas dominated by salt tolerant species	Regularly flooded shrublands that are typically found along saltwater shorelines, including Black Mangrove (Avicennia germinans), White Mangrove (Laguncularia racemosa), Red Mangrove (Rhizophora mangle), Buttonwood (Conocarpus erectus), and Sea-Oxeye (Borrichia spp). Canopy heights are generally less than five meters and greater than two meters.
3	**Black Mangrove Shrubland**	Yes	311000		311000	Black Mangrove (Avicennia germinans) dominant shrubland predominately found in the upper part of the intertidal zone or on higher elevations.	Black Mangrove (Avicennia germinans) dominant shrubland. Black mangrove is distinguishable from other mangrove species by leaves with grayish undersurfaces, by green, flattened "lima bean-like" fruits, by dark to blackish bark, and by the presence of numerous short breathing roots projecting vertically from the ground below and around the tree.
4	***Black Mangrove Shrubland-Succulent***					Black Mangrove (Avicennia germinans) shrubs in a matrix composed predominately of succulents.	
5	Black Mangrove Shrubland-Saltwort	Yes	311041	New	311041	Black Mangrove (Avicennia germinans) shrubs in a matrix composed predominately of Saltwort (Batis maritima).	

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
3	**Buttonwood Shrubland**	Yes	312000		313000	Buttonwood (Conocarpus erectus) dominant shrubland usually found on the landward edge of the coastal mangrove zone or on the edge of hammocks.	Buttonwood (*Conocarpus erectus*) dominant shrubland.
4	***Buttonwood Shrubland-Succulent***					Buttonwood (Conocarpus erectus) shrubs in a matrix composed predominately of succulents.	
5	Buttonwood Shrubland-Saltwort	Yes	312041	New	312041	Buttonwood (Conocarpus erectus) shrubs in a matrix composed predominately of Saltwort (Batis maritima).	
3	**White Mangrove Shrubland**	Yes	313000		314000	White Mangrove (Laguncularia racemosa) dominant shrubland found throughout the intertidal zone.	White Mangrove (*Laguncularia racemosa*) dominant shrubland.
3	**Red Mangrove Shrubland**	Yes	314000		315000	Red Mangrove (Rhizophora mangle) dominant shrubland found on the middle and lower portions of the intertidal and upper subtidal zone.	Red Mangrove (*Rhizophora mangle*) dominant shrubland.
3	**Mixed Mangrove Shrubland**	Yes	315000		316000	Mixed of mangrove shrubland with no particular species of dominance found along the coast.	Mix of mangrove species with no particular species of dominance.
4	***Mixed Mangrove Shrubland-Succulent***	Yes	315040	New	315040	Mixed mangrove shrubs in a matrix composed predominately of succulents.	

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
4	***Black Mangrove-White Mangrove Shrubland***	Yes	315200		316200	Black mangrove (Avicennia germinans) and White Mangrove (Laguncularia racemosa) shrubs with the cover of either species ranging between 25-75%.	Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) shrubs.
5	Black Mangrove-White Mangrove Shrubland-Succulent	Yes	315210	New	315210	Black Mangrove (Avicennia germinans) and White Mangrove (Laguncularia racemosa) shrubs in a matrix composed predominately of succulent vegetation.	
4	***Black Mangrove-Red Mangrove Shrubland***	Yes	315300		316300	Black mangrove (Avicennia germinans) and Red Mangrove (Rhizophora mangle) shrubs with the cover of either species ranging between 25-75%.	Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) shrubs.
4	***Buttonwood-White Mangrove Shrubland***	Yes	315500		316500	Buttonwood (Conocarpus erectus) and White Mangrove (Laguncularia racemosa) shrubs with the cover of either species ranging between 25-75%.	Co-dominant mix (60/40% or 40/60% split) of Buttonwood (*Conocarpus erectus*) or White Mangrove (*Laguncularia racemosa*) shrubs.
5	Buttonwood-White Mangrove Shrubland-Succulent	Yes	315510	New	315510	Buttonwood (Conocarpus erectus) and White Mangrove (Laguncularia racemosa) shrubs in a matrix composed predominately of succulent vegetation.	

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
5	Buttonwood-White Mangrove Shrubland-Graminoid					Buttonwood (Conocarpus erectus) and White Mangrove (Laguncularia racemosa) shrubs in a matrix composed predominately of graminoids.	
6	*Buttonwood-White Mangrove Shrubland-Cordgrass*	Yes	315521	New	315521	Buttonwood (Conocarpus erectus) and White Mangrove (Laguncularia racemosa) shrubs in a matrix composed predominately of Sand Cordgrass (Spartina bakeri).	
4	***Buttonwood-Red Mangrove Shrubland***	Yes	315600		316600	Buttonwood (Conocarpus erectus) and Red Mangrove (Rhizophora mangle) shrubs with the cover of either species ranging between 25-75%.	Co-dominant mix (60/40% or 40/60% split) of Buttonwood (*Conocarpus erectus*) and Red Mangrove (*Rhizophora mangle*) shrubs.
4	***White Mangrove-Red Mangrove Shrubland***	Yes	315700		316700	White Mangrove (Laguncularia racemosa) and Red Mangrove (Rhizophora mangle) shrubs with the cover of either species ranging between 25-75%.	Co-dominant mix (60/40% or 40/60% split) of White Mangrove (*Laguncularia racemosa*) and Red Mangrove (*Rhizophora mangle*) shrubs.
2	**Upland Shrubland**	Yes	340000		340000	Rarely inundated and well drained shrublands containing a mixture of tropical and temperate broad-leaved trees.	Briefly flooded shrublands

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
3	**Coastal Hardwood Shrubland**	Yes	342000		342000	Shrubland containing a mixture of tropical and temperate broad-leaved trees found along coastal areas on rocky substrate with little or no soil.	Mix of Sea Grape (Coccoloba uvifera), Gumbo Limbo (Bursera simaruba), Mahogany (Swietenia mahagoni), Spanish Stopper (Eugenia foetida), Poisonwood (Metopium toxiferum), Willow Bustic (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.
3	**Nicker Bean Shrubland**	Yes	341000		341000	Nicker Bean (*Caesalpinia bundoc*) dominant shrubland.	Nicker Bean (*Caesalpinia bundoc*) dominant shrubland.
1	**SCRUB**					Communities of dwarf trees or shrubs typically in a matrix of graminoids, and/or herbaceous vegetation. Canopy cover 10% to 50% but can be as high as 100% for Mangroves. Canopy < 5 meters tall with the exception being for Mangrove which is ≤ 2 meters.	Specific described communities of dwarf trees or low density shrubs typically in a matrix of graminoids, and/or herbaceous vegetation. Canopy cover ranges from 10% to 50% but can be as much as 100% for Mangrove and Cypress classes. Canopy heights are less than 5 meters with the exception being for Mangrove which is less than or equal to 2 meters.

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
2	**Mangrove Scrub**					Tidal and seasonally flooded dwarf (< 2 m height) magrove trees found along coastal areas and in the transition zone between freshwater and marine dominated environments. Canopy densities are generally between 10% - 50% but can be as high as 100%.	Regularly flooded dwarf trees that are typically found along saltwater shorelines and especially in the transition zone between freshwater and saltwater dominated environments. Mangrove scrub includes dwarf Black Mangrove (Avicennia germinans), dwarf White Mangrove (Laguncularia racemosa), dwarf Red Mangrove (Rhizophora mangle), and/or dwarf Buttonwood (Conocarpus erectus) with canopy heights less than two meters. Canopy densities are generally from 10% - 50% but can be as high as 100%.
3	**Black Mangrove Scrub**	Yes	411000		411000	Black Mangrove (Avicennia germinans) dominant scrub predominately found in the upper part of the intertidal zone or on higher elevations.	Black Mangrove (*Avicennia germinans*) dominant scrub.
4	***Black Mangrove Scrub-Succulent***					Black Mangrove (Avicennia germinans) scrub in a matrix composed predominately of succulents.	Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of succulents.
5	Black Mangrove Scrub-Saltwort	Yes	411041		411041	Black Mangrove (Avicennia germinans) dwarf trees in a matrix composed predominately of Saltwort (Batis maritima).	Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of Saltwort (*Batis maritima*).
3	**White Mangrove Scrub**	Yes	413000		413000	White Mangrove (Languncularia racemosa) dominant scrub found	White Mangrove (*Languncularia racemosa*) dominant scrub.

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
						throughout the intertidal zone.	
4	***White Mangrove Scrub-Succulent***	Yes	413040		413040	White Mangrove (Languncularia racemosa) scrub in a matrix composed predominately of succulents.	White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of succulents.
5	White Mangrove Scrub-Saltwort	Yes	413041		413041	White Mangrove (Languncularia racemosa) dwarf trees in a matrix composed predominately of Saltwort (Batis maritima).	White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of Saltwort (*Batis maritima*).
5	White Mangrove Scrub-Glasswort	Yes	413042		413042	White Mangrove (Languncularia racemosa) dwarf trees in a matrix composed predominately of Glasswort (Salicornia bigelovii).	White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of Glasswort (*Salicornia* spp.).
3	**Red Mangrove Scrub**	Yes	414000		414000	Red Mangrove (Rizophora mangle) dominant scrub found on the middle and lower portions of the intertidal and upper subtidal zone.	Red Mangrove (*Rizophora mangle*) dominant scrub; occasionally mixed with sparse Cocoplum (*Chrysobalanus icaco*), Wax Myrtle (*Myrica cerifera*), and/or Buttonwood (*Conocarpus erectus*).
4	***Red Mangrove Scrub-Graminoid***					Red Mangrove (Rizophora mangle) scrub in a matrix composed predominately of graminoids.	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of graminoids.
5	Red Mangrove Scrub-Sawgrass	Yes	414011		414011	Red Mangrove (Rizophora mangle) dwarf trees in a matrix composed predominately of Sawgrass (Cladium jamaicense).	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
5	Red Mangrove Scrub-Fimbry	Yes	414014		414014	Red Mangrove (Rizophora mangle) dwarf trees in a matrix composed predominately of Marsh Frimbry (Fimbristylis spadicea).	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Marsh Frimbry (*Fimbristylis spadicea*).
5	Red Mangrove Scrub-Black Rush	Yes	414015		414015	Red Mangrove (Rizophora mangle) dwarf trees in a matrix composed predominately of Black Rush (Juncus roemerianus).	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).
5	Red Mangrove Scrub-Sawgrass/Black Rush	Yes	414010	New	414010	Red Mangrove (Rizophora mangle) dwarf trees in a matrix composed of a mixture of Black Rush (Juncus roemerianus) and Sawgrass (Cladium jamaicense).	
4	***Red Mangrove Scrub-Open Marsh***	Yes	414030		414030	Red Mangrove (Rizophora mangle) scrub in a matrix composed predominately of Open Marsh or Open Salt Marsh.	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Open Marsh or Open Salt Marsh. Red Mangrove can occur in both salt and freshwater dominated marshes.
4	***Red Mangrove Scrub-Dominant***					Greater than 50% areal coverage of dwarf Red Mangrove (Rizophora mangle) trees.	Greater than 50% areal coverage of Red Mangrove (*Rizophora mangle*) scrub.
5	Red Mangrove Scrub-Subtidal	Yes	414051	New	414051	Red Mangrove (Rhizophora mangle) dwarf trees in a subtidal environment.	
3	**Mixed Mangrove Scrub**	Yes	415000		415000	Mixed of mangrove scrub with no particular species of dominance found along the coast.	Mix of mangrove species with no particular species of dominance.

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
4	***Mixed Mangrove Scrub-Graminoid***					Mixed mangrove scrub in a matrix composed predominately of graminoids.	Mixed mangrove scrub in a matrix composed predominately of graminoids.
5	Mixed Mangrove Scrub-Black Rush	Yes	415015		415015	Mixed mangrove dwarf trees in a matrix composed predominately of Black Rush (Juncus roemerianus).	Mixed mangrove scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).
4	***Mixed Mangrove Scrub-Succulent***	Yes	415040		415040	Mixed mangrove scrub in a matrix composed predominately of succulents.	Mixed mangrove scrub in a matrix composed predominately of succulents.
4	***Black Mangrove-White Mangrove Scrub***	Yes	415200		415200	Black mangrove (Avicennia germinans) and White Mangrove (Laguncularia racemosa) dwarf trees with the cover of either species ranging between 25-75%.	Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) scrub.
5	Black Mangrove-White Mangrove Scrub-Succulent					Black Mangrove (Avicennia germinans) & White Mangrove (Languncularia racemosa) dwarf trees in a matrix composed predominately of succulents.	Black Mangrove-White Mangrove Scrub in a matrix composed predominately of succulents.
6	*Black Mangrove-White Mangrove Scrub-Saltwort*	Yes	415241		415241	Black Mangrove-White Mangrove dwarf trees in a matrix composed predominately of Saltwort (Batis maritima).	Black Mangrove-White Mangrove Scrub in a matrix composed predominately of Saltwort (*Batis maritima*).

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
4	***Black Mangrove-Red Mangrove Scrub***	Yes	415300		415300	Black mangrove (Avicennia germinans) and Red Mangrove (Rhizophora mangle) dwarf trees with the cover of either species ranging between 25-75%.	Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) scrub.
4	***Buttonwood-White Mangrove Scrub***					Buttonwood (Conocarpus erectus) and White Mangrove (Laguncularia racemosa) dwarf trees with the cover of either species ranging between 25-75%.	Co-dominant mix (60/40% or 40/60% split) of Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) scrub.
5	Buttonwood-White Mangrove Scrub-Graminoid					Buttonwood (Conocarpus erectus) & White Mangrove (Languncularia racemosa) dwarf trees in a matrix composed predominately of graminoids.	Buttonwood-White Mangrove Scrub in a matrix composed predominately of graminoids.
6	Buttonwood-White Mangrove Scrub-Cordgrass	Yes	415417		415417	Buttonwood (Conocarpus erectus) and White Mangrove (Laguncularia racemosa) dwarf trees in a matrix composed predominately of Sand Cordgrass (Spartina bakeri).	Buttonwood-White Mangrove Scrub in a matrix composed predominately of Cordgrass (*Spartina* spp.).
5	Buttonwood-White Mangrove Scrub-Succulent	Yes	415440		415440	Buttonwood (Conocarpus erectus) & White Mangrove (Languncularia racemosa) dwarf trees in a matrix composed predominately of succulents.	Buttonwood-White Mangrove Scrub in a matrix composed predominately of succulents.

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
6	*Buttonwood-White Mangrove Scrub-Saltwort*	Yes	415441		415441	Buttonwood (Conocarpus erectus) & White Mangrove (Laguncularia racemosa) dwarf trees in a matrix composed predominately of Saltwort (Batis maritima).	Buttonwood-White Mangrove Scrub in a matrix composed predominately of Saltwort (Batis maritima).
4	***Buttonwood-Red Mangrove Scrub***	Yes	415500		415500	Buttonwood (Conocarpus erectus) and Red Mangrove (Rhizophora mangle) dwarf trees with the cover of either species ranging between 25-75%.	Co-dominant mix (60/40% or 40/60% split) of Buttonwood (*Conocarpus erectus*) and Red Mangrove (*Rhizophora mangle*) scrub.
5	Buttonwood-Red Mangrove Scrub-Graminoid					Buttonwood (Conocarpus erectus) & Red Mangrove (Rizophora mangle) dwarf trees in a matrix composed predominately of graminoids.	Buttonwood-Red Mangrove Scrub in a matrix composed predominately of graminoids.
6	*Buttonwood-Red Mangrove Scrub-Sawgrass*	Yes	415511		415511	Buttonwood (Conocarpus erectus) & Red Mangrove (Rizophora mangle) dwarf trees in a matrix composed predominately of Sawgrass (Cladium jamaicense).	Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).
6	*Buttonwood-Red Mangrove Scrub-Sawgrass/Black Rush*	Yes	415510	New	415510	Buttonwood (Conocarpus erectus) & Red Mangrove (Rizophora mangle) dwarf trees in a matrix composed of a mixture of Black Rush (Juncus roemerianus) and Sawgrass (Cladium jamaicense).	

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
4	***White Mangrove-Red Mangrove Scrub***	Yes	415700		415600	White Mangrove (Laguncularia racemosa) and Red Mangrove (Rhizophora mangle) dwarf trees with the cover of either species ranging between 25-75%.	Co-dominant mix (60/40% or 40/60% split) of White Mangrove (*Laguncularia racemosa*) and Red Mangrove (*Rhizophora mangle*) scrub.
2	**Upland Scrub**	Yes	430000		430000	Upland graminoid and/or herbaceous dominant communities in a matrix of dwarf (< 2 m height) trees and/or shrubs.	Upland graminoid and/or herbaceous dominant communities with dwarf trees and/or shrubs.
3	**Upland Hardwood Scrub**	Yes	431000		431000	Scrub containing a mixture of tropical and temperate broad-leaved trees found along coastal areas on rocky substrate with little or no soil.	Mix of dwarf trees and/or shrubs such as Live Oak (Quercus virginiana), Poisonwood (Metopium toxiferum), Red Bay (Persea borbonia), Sweet Bay (Magnolia virginiana), Myrsine (Myrsine floridana), Wax Myrtle (Myrica cerifera), Dahoon Holly (Ilex cassine), Buttonwood (Conocarpus erectus), Cocoplum (Chrysobalanus icaco), Varnish Leaf (Dodonaea viscosa), and/or Trema (Trema spp.) in a matrix of grasses, herbs, and, at times, including various species of vines. Canopy density will range from 10% - 49%. Canopy heights can vary according to the composition of hardwoods.
1	**MARSH**					Graminoid and/or herbaceous emergent or floating vegetation in shallow water that stands at or above the ground surface for much of the year.	Graminoid and/or herbaceous emergent or floating vegetation in shallow water that stands at or above the ground surface for much of the year.

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
2	**Salt Marsh**					Marsh consisting of salt tolerant (halophilic) graminoid and/or herbaceous vegetation.	A marsh consisting of salt tolerant graminoid and/or herbaceous vegetation.
3	**Graminoid Salt Marsh**	Yes	511000		511000	Graminoid dominated salt marsh	Graminoid dominated salt marsh.
4	***Black Rush***	Yes	511200		511200	Black Rush (Juncus roemerianus) dominated salt marsh.	Black Rush (*Juncus roemerianus*) dominated salt marsh.
4	***Cordgrass***	Yes	511400		511400	Sand Cordgrass (Spartina bakeri) and/or Gulf Cordgrass (S. spartinae) dominated salt marsh.	Sand Cordgrass (*Spartina bakeri*) and/or Gulf Cordgrass (*S. spartinae*) dominated salt marsh.
3	**Herbaceous Salt Marsh**	Yes	512000		512000	Herbaceous dominated salt marsh.	Herbaceous dominated salt marsh.
3	**Succulent Salt Marsh**	Yes	514000		514000	Succulent dominated salt marsh.	Succulent dominated salt marsh.
4	***Saltwort***	Yes	514100		514100	Saltwort (*Batis maritima*) dominated salt marsh	Saltwort (*Batis maritima*) dominated salt marsh
2	**Freshwater Marsh**					Marsh consisting of freshwater graminoid and/or herbaceous vegetation.	Freshwater graminoid and/or herbaceous marsh.
3	**Graminoid Freshwater Marsh**					Graminoid dominated freshwater marsh.	Graminoid dominated freshwater marsh.
4	***Sawgrass***	Yes	522100		522100	Sawgrass (Cladium jamaicense) dominated marsh.	Sawgrass (*Cladium jamaicense*) dominated marsh.

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
1	**DUNE**					A ridge of wind blown or windstorm deposited sand or similar material directly inland and parallel to the shoreline which is commonly vegetated by graminoids and/or herbs and sometimes even shrubs.	Beach-dune associated graminoids and/or herbaceous vegetation.
2	**Herbaceous Dune**					Herbaceous dominated dune.	Herbaceous dominated dune.
3	**Mixed Herbaceous Dune**	Yes	623000	New	623000	Mixed herbaceous dominated dune.	
1	**EXOTIC**	Yes	800000		800000	Non-native and invasive vegetation.	Non-native and often invasive vegetation.
2	**Australian Pine**	Yes	803000		803000	Macrophyte community consisting of River Sheoak (Casuarina cunninghamiana), Australian Pine (C. equisetifolia), and/or Suckering Australian Pine (C. glauca).	River Sheoak (*Casuarina cunninghamiana*), Australian Pine (*C. equisetifolia*), and Suckering Australian Pine (*C. glauca*).
2	**Treated Australian Pine**	Yes	804000		804000	Macrophyte community treated for the presence of River Sheoak (Casuarina cunninghamiana), Australian Pine (C. equisetifolia), and/or Suckering Australian Pine (C. glauca).	Treated River Sheoak (*Casuarina cunninghamiana*), Australian Pine (*C. equisetifolia*), and Suckering Australian Pine (*C. glauca*).
2	**Seaside Mahoe**	Yes	833000		833000	Machrophyte community consisting of Thespesia populnea.	*Thespesia populnea*
1	**OTHER**					Non-vegetative or anthropogenic cover.	
2	**Non-Vegetative**					Non-vegetative coverage	Non-vegetative areal coverage.

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
3	**Barren Salt Flat**	Yes	910010		907000	Barren, generally hypersaline, flats exposed at low tide.	Barren, generally hypersaline, flats exposed at low tide.
3	**Beach**	Yes	910020		901000	Sand and fine shell and coral fragments found along the shoreline.	Sand covered ground adjacent to lakes, bays, oceans, or other large bodies of water.
3	**Littoral Zone**	Yes	910030	New	910030	Shoreline that is submerged at high tide and exposed at low tide and is usually devoid of upland vegetation.	
3	**Lightning Gap**	Yes	910050	New	910050	Canopy gaps created by cloud to ground lightning strikes.	
3	**Water**	Yes	910120		904000	Open water areas such as ponds, lakes, rivers, bays, and estuaries.	Open water areas such as ponds, lakes, rivers, bays, and estuaries.
3	**Barren Microkarst**	Yes	910130	New	910130	Karst topography devoid of vegetation usually found around the perimeter of Coastal Hardwood Hammocks.	
2	**Anthropogenic**	Yes	920000		920000	Non-natural coverage associated with human infrastructure and/or activities.	
3	**Campground**	Yes	920010	New	920010	Area designated for camping	
3	**Dock**	Yes	920030	New	920030	A place used as a landing place or moorage for boats.	
3	**Lawns & Landscaping**	Yes	920040	New	920040	Ground that is covered with grass and/or trees and is maintained for its esthetics.	

Lvl	Classification name	Map Class	Raster ID	New Map Class	Rutchey et al ID	Photo-interpreter Map Class Description	Rutchey et al. (2007) Map Class Description
3	**Parking Lot**	Yes	920060	New	920060	Area used for the parking of motor vehicles.	
3	**Road**	Yes	920080		902100	Paved and unpaved roads other than levees.	Paved and unpaved roads other than levees.
3	**Seawall**	Yes	920090	New	920090	A wall or embankment to protect the shore from erosion or to act as a breakwater.	
3	**Trail**	Yes	920110	New	920110	A marked or established path or route designed to be followed.	
3	**Spoil**	Yes	920120		902110	Earth and rock excavated or dredged.	Areas such as power lines and abandoned agricultural areas.
3	**Walkway**	Yes	920130	New	920130	A path, passage, etc. for pedestrians.	
3	**Building**	Yes	922000	New	922000	A roofed and walled structure built for permanent use.	
4	***Commercial***	Yes	922010	New	922010	A building or complex housing retail business.	
4	***Lighthouse***	Yes	922050	New	922050	A tower or structure designed to emit light and aid in navigation.	
4	***Residential***	Yes	922070	New	922070	A building or complex used as a permanent dwelling.	

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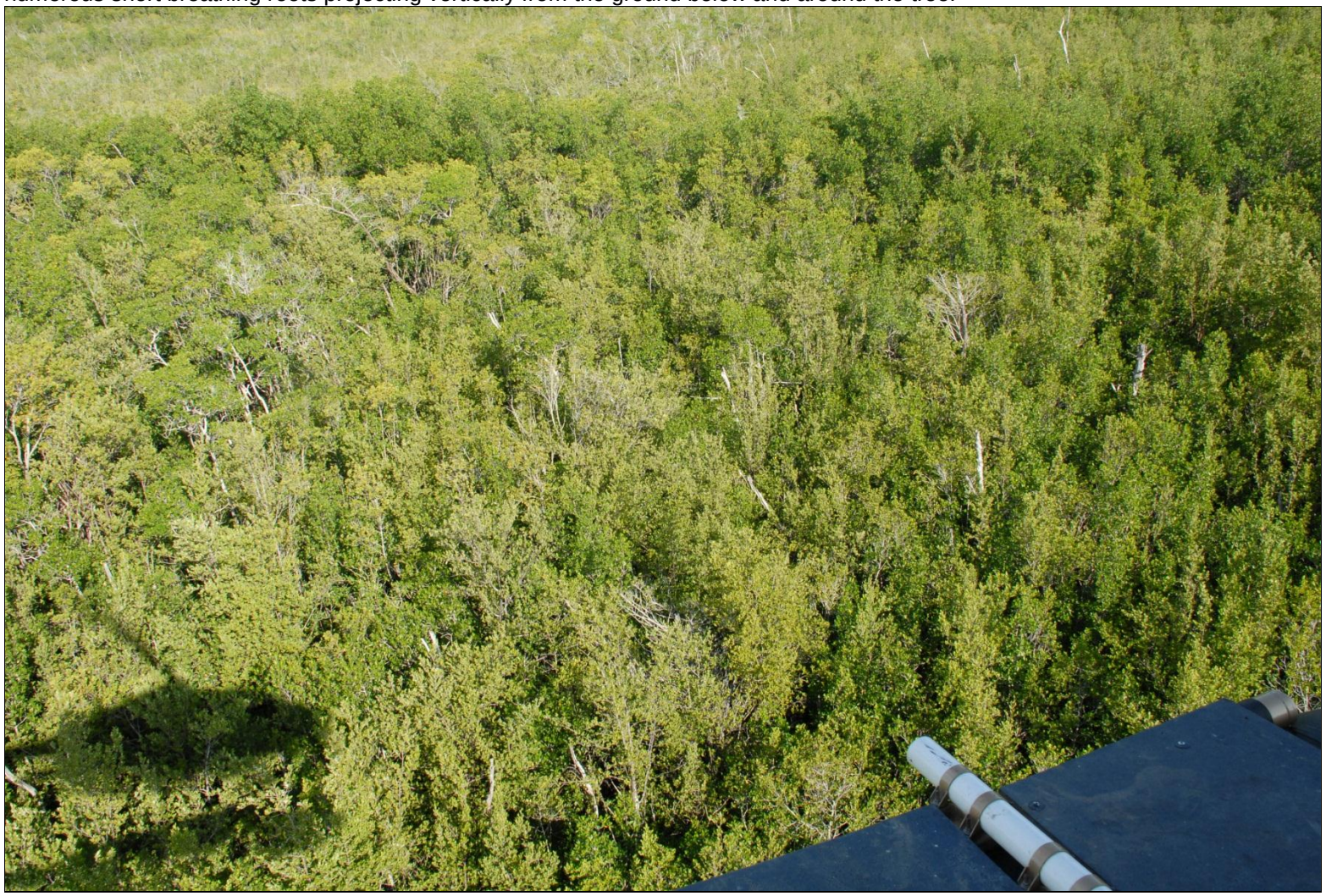
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111000 Black Mangrove Forest

Ruiz et al. (2008): Black Mangrove (*Avicennia germinans*) dominated forest found along the coast.

Rutchey et al. (5/22/2007): Black Mangrove (*Avicennia germinans*) dominant forest. Black mangrove is distinguishable from other mangrove species by leaves with grayish undersurfaces, by green, flattened “lima bean-like” fruits, by dark to blackish bark, and by the presence of numerous short breathing roots projecting vertically from the ground below and around the tree.



112000 Buttonwood Forest

Ruiz et al. (2008): Buttonwood (*Conocarpus erectus*) dominated forest usually found on the landward edge of the coastal mangrove zone.
Rutchey et al. (5/22/2007): Buttonwood (*Conocarpus erectus*) dominant forest with variable understory composition.



113000 White Mangrove Forest

Ruiz et al. (2008): White Mangrove (*Laguncularia racemosa*) dominated forest found along the coast.
Rutchey et al. (5/22/2007): White Mangrove (*Laguncularia racemosa*) dominant forest.



114000 Red Mangrove Forest

Ruiz et al. (2008): Red Mangrove (*Rhizophora mangle*) dominated forest found along the coast.
Rutchey et al. (5/22/2007): Red Mangrove (*Rhizophora mangle*) dominant forest.



115000 Mixed Mangrove Forest

Ruiz et al. (2008): Mixed mangrove forest with no particular species of dominance found along the coast.

Rutchey et al. (5/22/2007): Mix of mangrove species with no particular species of dominance.



115100 Black Mangrove-Buttonwood Forest

Ruiz et al. (2008): Black mangrove (*Avicennia germinans*) and Buttonwood (*Conocarpus erectus*) trees with the cover of either species ranging between 25-75%.

Rutchey et al. (5/22/2007): Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and Buttonwood (*Conocarpus erectus*) trees.



Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

115200 Black Mangrove-White Mangrove Forest

Ruiz et al. (2008): Black mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) trees with the cover of either species ranging between 25-75%.

Rutchey et al. (5/22/2007): Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) trees.



Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

115300 Black Mangrove-Red Mangrove Forest

Ruiz et al. (2008): Black mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) trees with the cover of either species ranging between 25-75%.

Rutchey et al. (5/22/2007): Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) trees.



Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

115400 Buttonwood-White Mangrove Forest

Ruiz et al. (2008): Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) trees with the cover of either species ranging between 25-75%.

Rutchey et al. (5/22/2007): Co-dominant mix (60/40% or 40/60% split) of Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) trees.



130000 Hammock Forest

Ruiz et al. (2008): Rarely inundated and well drained forests containing a mixture of tropical and temperate broad-leaved trees.
Rutchey et al. (5/22/2007): Briefly flooded forests



131000 Coastal Hardwood Hammock

Ruiz et al. (2008): Forest containing a mixture of tropical and temperate broad-leaved trees found along coastal areas on rocky substrate overtoped by an organic layer.

Rutchey et al. (5/22/2007): Most common species are Pigeon Plum (Coccoloba diversifolia), False Mastic (Sideroxylon foetidissimum), Gumbo Limbo (Bursera simaruba), Strangler Fig (Ficus aurea), and White Stopper (Eugenia axillaris) but can potentially have many of the same species found in the Tropical Hardwood Hammock (FHS) category. However, it must also include some of the following in species as well: Jamaican Dogwood (Piscidia piscipula), Spanish Stopper (Eugenia foetidia), Mahogany (Swietenia mahagoni), Cabbage Palm (Sabal Palmetto), Wild Lime (Zanthoxylum fagara),] Blackbead (Pithecellobium keyense), Spanish Bayonet (Yucca aloifolia), Catclaw Blackbead (Pithecellobium unguis-cati), Triangle Cactus (Acanthocereus tetragonus), Prickly Pear (Opuntia stricta), Wild Cinnamon (Canella winterana), Sea Grape (Coccoloba uvifera), Buttonwood (*Conocarpus erectus*), Geiger Tree (Cordia Sebestena), Milk Bark (Drypetes lateriflora), Seven Year Apple (Genipa clusiifolia), Crabwood (Gymnanthes lucida), Mancinella (Hippomane mancinella), Joewood (Jacquinia keyensis), and Thrinax (Thrinax morrissii, Thrinax. radiata).



137000 Coastal Dune Hammock

Ruiz et al. (2008): Forest containing a mixture of tropical and temperate broad-leaved trees found along coastal areas on dunes (shell mounds excluded).



211000 Black Mangrove Woodland

Ruiz et al. (2008): Black Mangrove (*Avicennia germinans*) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.

Rutchey et al. (5/22/2007): Black Mangrove (*Avicennia germinans*) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.



211030 Black Mangrove Woodland-Succulent

Ruiz et al. (2008): Black Mangrove (*Avicennia germinans*) trees in a matrix composed predominately of succulents.
Rutchey et al. (5/22/2007): Black Mangrove (*Avicennia germinans*) in a matrix composed predominately of succulents.



Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

211031 Black Mangrove Woodland-Saltwort

Ruiz et al. (2008): Black Mangrove (*Avicennia germinans*) trees in a matrix composed predominately of Saltwort (*Batis maritima*).



Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

212000 Buttonwood Woodland

Ruiz et al. (2008): Buttonwood (*Conocarpus erectus*) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.
Rutchey et al. (5/22/2007): Buttonwood (*Conocarpus erectus*) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.



212030 Buttonwood Woodland-Succulent

Ruiz et al. (2008): Buttonwood (*Conocarpus erectus*) trees in a matrix composed predominately of succulents.
Rutchey et al. (5/22/2007): Buttonwood *(Conocarpus erectus)* in a matrix composed predominately of succulents.



Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

213000 White Mangrove Woodland

Ruiz et al. (2008): White Mangrove (*Laguncularia racemosa*) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.

NO PHOTO AVAILABLE

215000 Mixed Mangrove Woodland

Ruiz et al. (2008): Mixed assemblage of mangrove tree species in a matrix composed of salt marsh graminoids, herbs, and/or succulents.



215420 Buttonwood-White Mangrove Woodland-Herbaceous

Ruiz et al. (2008): Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) trees in a matrix composed predominately of herbaceous vegetation.



233000 Upland Hardwood Woodland

Ruiz et al. (2008): Woodland containing a mixture of tropical and temperate broad-leaved trees found along coastal areas on rocky substrate with little or no soil.

Rutchey et al. (5/22/2007): Mix of Live Oak (Quercus virginiana), False Tamarind (Lysiloma latisiliquum), Gumbo Limbo (Bursera simaruba), Poisonwood (Metopium toxiferum), Pigeon Plum (Coccoloba diversifolia), and White Stopper (Eugenia axillaris). May also contain Strangler Fig (Ficus aurea), Swamp Bay (Persea borbonia), Dahoon Holly (Ilex Cassine), Sugarberry (Celtis laevigata), False Mastic (Sideroxylon foetidissimum), Wax Myrtle (Myrica cerifera), and Myrsine (Myrsine floridana), Willow Bustic (Sideroxylon salicifolium), Water Oak (Quercus nigra), Red Maple (Acer rubrum), Laural Oak (Quercus laurifolia) and Lancewood (Nectandra coriacea), Laural Oak (Quercus laurifolia), Cabbage Palm (Sabal palmetto), Red Mulberry (Morus rubra), Hackberry (Celtis laevigata), and Common Persimmon (Diospyros virginiana).



Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

311000 Black Mangrove Shrubland

Ruiz et al. (2008): Black Mangrove (*Avicennia germinans*) dominant shrubland predominately found in the upper part of the intertidal zone or on higher elevations.

Rutchey et al. (5/22/2007): Black Mangrove (*Avicennia germinans*) dominant shrubland. Black mangrove is distinguishable from other mangrove species by leaves with grayish undersurfaces, by green, flattened “lima bean-like” fruits, by dark to blackish bark, and by the presence of numerous short breathing roots projecting vertically from the ground below and around the tree.



311041 Black Mangrove Shrubland-Saltwort

Ruiz et al. (2008): Black Mangrove (*Avicennia germinans*) shrubs in a matrix composed predominately of Saltwort (Batis maritima).



Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

312000 Buttonwood Shrubland

Ruiz et al. (2008): Buttonwood (*Conocarpus erectus*) dominant shrubland usually found on the landward edge of the coastal mangrove zone or on the edge of hammocks.

Rutchey et al. (5/22/2007): Buttonwood (*Conocarpus erectus*) dominant shrubland.



312041 Buttonwood Shrubland-Saltwort

Ruiz et al. (2008): Buttonwood (*Conocarpus erectus*) shrubs in a matrix composed predominately of Saltwort (Batis maritima).



Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

313000 White Mangrove Shrubland

Ruiz et al. (2008): White Mangrove (*Laguncularia racemosa*) dominant shrubland found throughout the intertidal zone.
Rutchey et al. (5/22/2007): White Mangrove (*Laguncularia racemosa*) dominant shrubland.



314000 Red Mangrove Shrubland

Ruiz et al. (2008): Red Mangrove (*Rhizophora mangle*) dominant shrubland found on the middle and lower portions of the intertidal and upper subtidal zone.

Rutchey et al. (5/22/2007): Red Mangrove (*Rhizophora mangle*) dominant shrubland.



315000 Mixed Mangrove Shrubland

Ruiz et al. (2008): Mixed of mangrove shrubland with no particular species of dominance found along the coast.
Rutchey et al. (5/22/2007): Mix of mangrove species with no particular species of dominance.



315040 Mixed Mangrove Shrubland-Succulent

Ruiz et al. (2008): Mixed mangrove shrubs in a matrix composed predominately of succulents.



315200 Black Mangrove-White Mangrove Shrubland

Ruiz et al. (2008): Black mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) shrubs with the cover of either species ranging between 25-75%.
Rutchey et al. (5/22/2007): Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) shrubs.

NO PHOTO AVAILABLE

315210 Black Mangrove-White Mangrove Shrubland-Succulent

Ruiz et al. (2008): Black Mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) shrubs in a matrix composed predominately of succulent vegetation.

NO PHOTO AVAILABLE

315300 Black Mangrove-Red Mangrove Shrubland

Ruiz et al. (2008): Black mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) shrubs with the cover of either species ranging between 25-75%.

Rutchey et al. (5/22/2007): Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) shrubs.



315500 Buttonwood-White Mangrove Shrubland

Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) shrubs with the Ruiz et al. (2008): cover of either species ranging between 25-75%.

Rutchey et al. (5/22/2007): Co-dominant mix (60/40% or 40/60% split) of Buttonwood (*Conocarpus erectus*) or White Mangrove (*Laguncularia racemosa*) shrubs.



Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

315510 Buttonwood-White Mangrove Shrubland-Succulent

Ruiz et al. (2008): Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) shrubs in a matrix composed predominately of succulent vegetation.

NO PHOTO AVAILABLE

315521 Buttonwood-White Mangrove Shrubland-Cordgrass

Ruiz et al. (2008): Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) shrubs in a matrix composed predominately of Sand Cordgrass (*Spartina bakeri*).



315600 Buttonwood-Red Mangrove Shrubland

Ruiz et al. (2008): Buttonwood (*Conocarpus erectus*) and Red Mangrove (*Rhizophora mangle*) shrubs with the cover of either species ranging between 25-75%.

Rutchey et al. (5/22/2007): Co-dominant mix (60/40% or 40/60% split) of Buttonwood (*Conocarpus erectus*) and Red Mangrove (*Rhizophora mangle*) shrubs.



315700 White Mangrove-Red Mangrove Shrubland

Ruiz et al. (2008): White Mangrove (*Laguncularia racemosa*) and Red Mangrove (*Rhizophora mangle*) shrubs with the cover of either species ranging between 25-75%.

Rutchey et al. (5/22/2007): Co-dominant mix (60/40% or 40/60% split) of White Mangrove (*Laguncularia racemosa*) and Red Mangrove (*Rhizophora mangle*) shrubs.



340000 Upland Shrubland

Ruiz et al. (2008): Rarely inundated and well drained shrublands containing a mixture of tropical and temperate broad-leaved trees.
Rutchey et al. (5/22/2007): Briefly flooded shrublands

NO PHOTO AVAILABLE

341000 Nicker Bean Shrubland

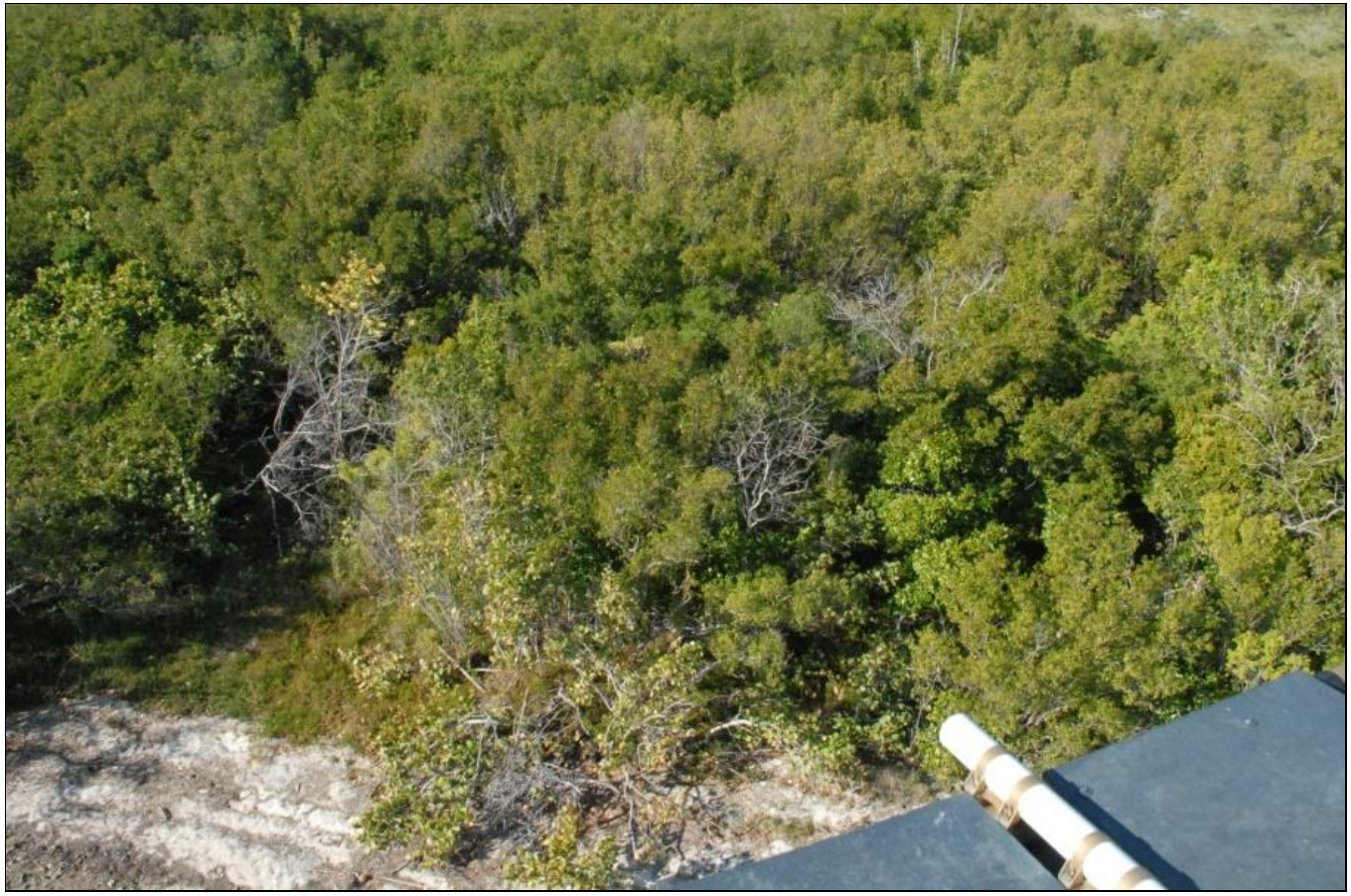
Ruiz et al. (2008): Nicker Bean (*Caesalpinia bundoc*) dominant shrubland.
Rutchey et al. (5/22/2007): Nicker Bean (*Caesalpinia bundoc*) dominant shrubland.

NO PHOTO AVAILABLE

342000 Coastal Hardwood Shrubland

Ruiz et al. (2008): Shrubland containing a mixture of tropical and temperate broad-leaved trees found along coastal areas on rocky substrate with little or no soil.

Rutchey et al. (5/22/2007): Mix of Sea Grape (Coccoloba uvifera), Gumbo Limbo (*Bursera simaruba*), Mahogany (*Swietenia mahagoni*), Spanish Stopper (*Eugenia foetida*), Poisonwood (*Metopium toxiferum*), Willow Bustic (*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.



411000 Black Mangrove Scrub

Ruiz et al. (2008): Black Mangrove (*Avicennia germinans*) dominant scrub predominately found in the upper part of the intertidal zone or on higher elevations.

Rutchey et al. (5/22/2007): Black Mangrove (*Avicennia germinans*) dominant scrub.



411041 Black Mangrove Scrub-Saltwort

Ruiz et al. (2008): Black Mangrove (*Avicennia germinans*) dwarf trees in a matrix composed predominately of Saltwort (Batis maritima).
Rutchey et al. (5/22/2007): Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of Saltwort (*Batis maritima*).



Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

413000 White Mangrove Scrub

Ruiz et al. (2008): White Mangrove (Languncularia racemosa) dominant scrub found throughout the intertidal zone.
Rutchey et al. (5/22/2007): White Mangrove (*Languncularia racemosa*) dominant scrub.



413040 White Mangrove Scrub-Succulent

Ruiz et al. (2008): White Mangrove (Languncularia racemosa) scrub in a matrix composed predominately of succulents.
Rutchey et al. (5/22/2007): White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of succulents.

NO PHOTO AVAILABLE

413041 White Mangrove Scrub-Saltwort

Ruiz et al. (2008): White Mangrove (Languncularia racemosa) dwarf trees in a matrix composed predominately of Saltwort (Batis maritima).
Rutchey et al. (5/22/2007): White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of Saltwort (*Batis maritima*).

NO PHOTO AVAILABLE

413042 White Mangrove Scrub-Glasswort

Ruiz et al. (2008): White Mangrove (Languncularia racemosa) dwarf trees in a matrix composed predominately of Glasswort (Salicornia bigelovii).
Rutchey et al. (5/22/2007): White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of Glasswort (*Salicornia* spp.).

NO PHOTO AVAILABLE

414000 Red Mangrove Scrub

Ruiz et al. (2008): Red Mangrove (Rizophora mangle) dominant scrub found on the middle and lower portions of the intertidal and upper subtidal zone.

Rutchey et al. (5/22/2007): Red Mangrove (*Rizophora mangle*) dominant scrub; occasionally mixed with sparse Cocoplum (*Chrysobalanus icaco*), Wax Myrtle (*Myrica cerifera*), and/or Buttonwood (*Conocarpus erectus*).



414010 Red Mangrove Scrub-Sawgrass/Black Rush

Ruiz et al. (2008): Red Mangrove (Rizophora mangle) dwarf trees in a matrix composed of a mixture of Black Rush (Juncus roemerianus) and Sawgrass (Cladium jamaicense).



414011 Red Mangrove Scrub-Sawgrass

Ruiz et al. (2008): Red Mangrove (Rizophora mangle) dwarf trees in a matrix composed predominately of Sawgrass (Cladium jamaicense).
Rutchey et al. (5/22/2007): Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).



414014 Red Mangrove Scrub-Fimbry

Red Mangrove (Rizophora mangle) dwarf trees in a matrix composed predominately of Marsh Ruiz et al. (2008): Frimbry (Fimbristylis spadicea). Rutchey et al. (5/22/2007): Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Marsh Frimbry (*Fimbristylis spadicea*).



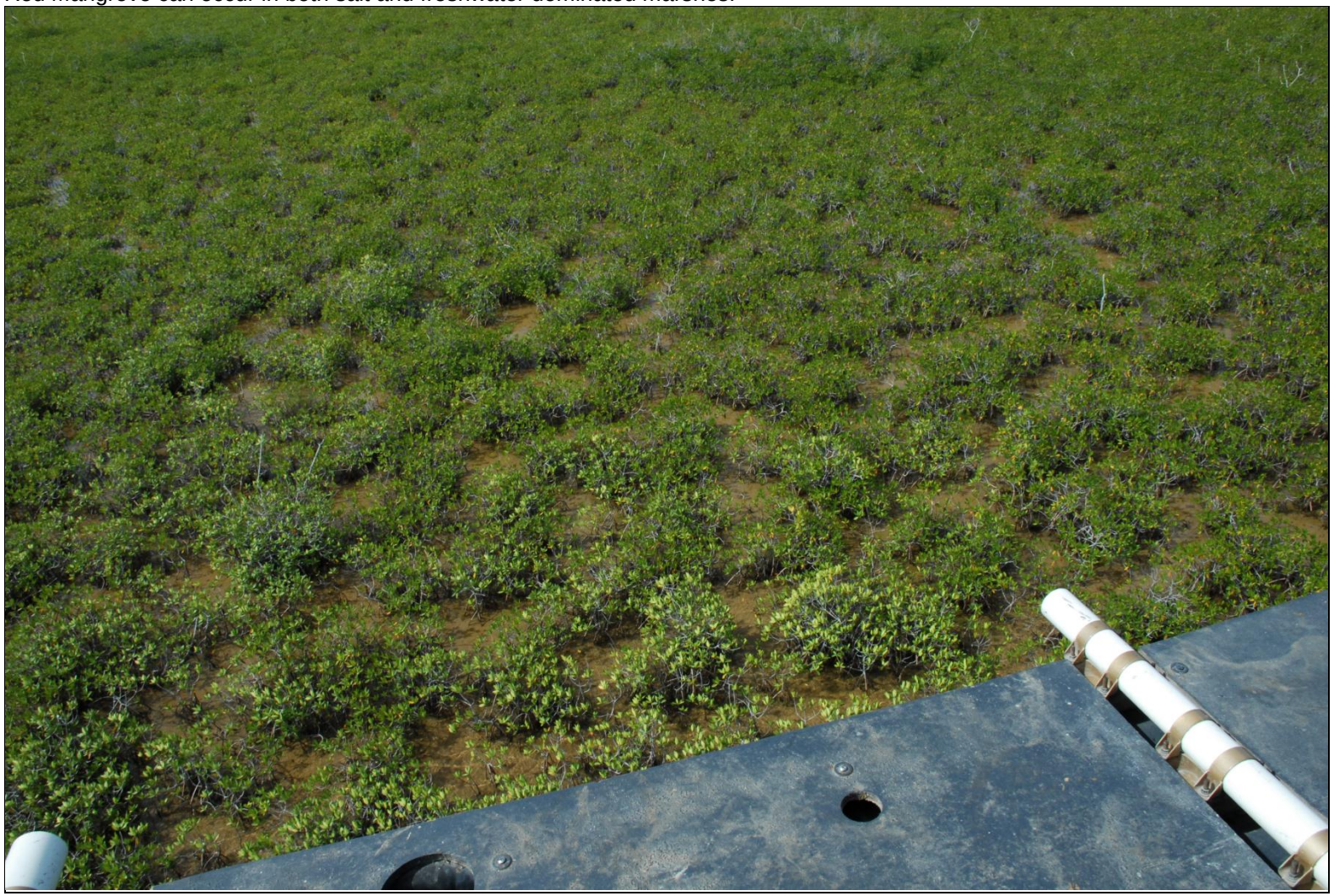
414015 Red Mangrove Scrub-Black Rush

Ruiz et al. (2008): Red Mangrove (Rizophora mangle) dwarf trees in a matrix composed predominately of Black Rush (Juncus roemerianus).
Rutchey et al. (5/22/2007): Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).



414030 Red Mangrove Scrub-Open Marsh

Ruiz et al. (2008): Red Mangrove (Rizophora mangle) scrub in a matrix composed predominately of Open Marsh or Open Salt Marsh.
Rutchey et al. (5/22/2007): Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Open Marsh or Open Salt Marsh. Red Mangrove can occur in both salt and freshwater dominated marshes.



414051 Red Mangrove Scrub-Subtidal

Ruiz et al. (2008): Red Mangrove (*Rhizophora mangle*) dwarf trees in a subtidal environment.



415000 Mixed Mangrove Scrub

Ruiz et al. (2008): Mixed of mangrove scrub with no particular species of dominance found along the coast.
Rutchey et al. (5/22/2007): Mix of mangrove species with no particular species of dominance.



415000 Mixed Mangrove Scrub-Black Rush

Ruiz et al. (2008): Mixed mangrove dwarf trees in a matrix composed predominately of Black Rush (Juncus roemerianus).
Rutchey et al. (5/22/2007): Mixed mangrove scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).



Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

415040 Mixed Mangrove Scrub-Succulent

Ruiz et al. (2008): Mixed mangrove scrub in a matrix composed predominately of succulents.
Rutchey et al. (5/22/2007): Mixed mangrove scrub in a matrix composed predominately of succulents.



415200 Black Mangrove-White Mangrove Scrub

Ruiz et al. (2008): Black mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) dwarf trees with the cover of either species ranging between 25-75%.
Rutchey et al. (5/22/2007): Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) scrub.

NO PHOTO AVAILABLE

415241 Black Mangrove-White Mangrove Scrub-Saltwort

Ruiz et al. (2008): Black Mangrove-White Mangrove dwarf trees in a matrix composed predominately of Saltwort (Batis maritima).
Rutchey et al. (5/22/2007): Black Mangrove-White Mangrove Scrub in a matrix composed predominately of Saltwort (*Batis maritima*).



415300 Black Mangrove-Red Mangrove Scrub

Ruiz et al. (2008): Black mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) dwarf trees with the cover of either species ranging between 25-75%.

Rutchey et al. (5/22/2007): Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) scrub.



415417 Buttonwood-White Mangrove Scrub-Cordgrass

Ruiz et al. (2008): Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) dwarf trees in a matrix composed predominately of Sand Cordgrass (*Spartina bakeri*).

Rutchey et al. (5/22/2007): Buttonwood-White Mangrove Scrub in a matrix composed predominately of Cordgrass (*Spartina* spp.).

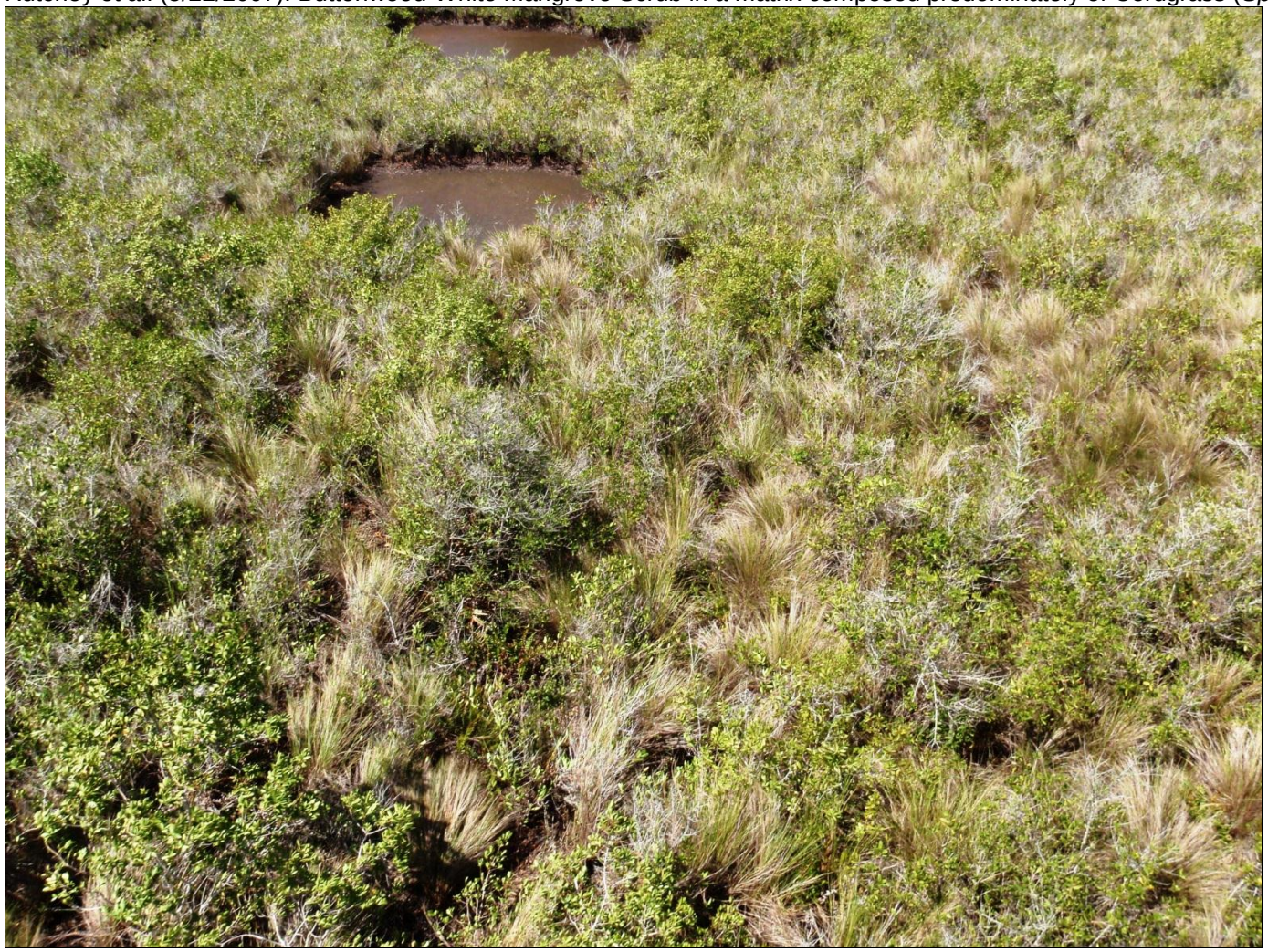


Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

415440 Buttonwood-White Mangrove Scrub-Succulent

Ruiz et al. (2008): Buttonwood (*Conocarpus erectus*) & White Mangrove (Languncularia racemosa) dwarf trees in a matrix composed predominately of succulents.
Rutchey et al. (5/22/2007): Buttonwood-White Mangrove Scrub in a matrix composed predominately of succulents.

NO PHOTO AVAILABLE

415441 Buttonwood-White Mangrove Scrub-Saltwort

Ruiz et al. (2008): Black Mangrove-White Mangrove dwarf trees in a matrix composed predominately of Saltwort (Batis maritima).
Rutchey et al. (5/22/2007): Black Mangrove-White Mangrove Scrub in a matrix composed predominately of Saltwort (Batis maritima).

NO PHOTO AVAILABLE

415500 Buttonwood-Red Mangrove Scrub

Ruiz et al. (2008): Buttonwood (*Conocarpus erectus*) and Red Mangrove (*Rhizophora mangle*) dwarf trees with the cover of either species ranging between 25-75%.

Rutchey et al. (5/22/2007): Co-dominant mix (60/40% or 40/60% split) of Buttonwood (*Conocarpus erectus*) and Red Mangrove (*Rhizophora mangle*) scrub.



415510 Buttonwood-Red Mangrove Scrub-Sawgrass/Black Rush

Ruiz et al. (2008): Buttonwood (*Conocarpus erectus*) & Red Mangrove (Rizophora mangle) dwarf trees in a matrix composed of a mixture of Black Rush (Juncus roemerianus) and Sawgrass (Cladium jamaicense).



415511 Buttonwood-Red Mangrove Scrub-Sawgrass

Ruiz et al. (2008): Buttonwood (*Conocarpus erectus*) & Red Mangrove (Rizophora mangle) dwarf trees in a matrix composed predominately of Sawgrass (Cladium jamaicense).

Rutchey et al. (5/22/2007): Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).



Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

415700 White Mangrove-Red Mangrove Scrub

Ruiz et al. (2008): White Mangrove (*Laguncularia racemosa*) and Red Mangrove (*Rhizophora mangle*) dwarf trees with the cover of either species ranging between 25-75%.
Rutchey et al. (5/22/2007): Co-dominant mix (60/40% or 40/60% split) of White Mangrove (*Laguncularia racemosa*) and Red Mangrove (*Rhizophora mangle*) scrub.

NO PHOTO AVAILABLE

430000 Upland Scrub

Ruiz et al. (2008): Upland graminoid and/or herbaceous dominant communities in a matrix of dwarf (< 2 m height) trees and/or shrubs.
Rutchey et al. (5/22/2007): Upland graminoid and/or herbaceous dominant communities with dwarf trees and/or shrubs.



431000 Upland Hardwood Scrub

Ruiz et al. (2008): Scrub containing a mixture of tropical and temperate broad-leaved trees found along coastal areas on rocky substrate with little or no soil.

Rutchey et al. (5/22/2007): Mix of dwarf trees and/or shrubs such as Live Oak (Quercus virginiana), Poisonwood (Metopium toxiferum), Red Bay (Persea borbonia), Sweet Bay (Magnolia virginiana), Myrsine (Myrsine floridana), Wax Myrtle (Myrica cerifera), Dahoon Holly (Ilex cassine), Buttonwood (*Conocarpus erectus*), Cocoplum (Chrysobalanus icaco), Varnish Leaf (Dodonaea viscosa), and/or Trema (Trema spp.) in a matrix of grasses, herbs, and, at times, including various species of vines. Canopy density will range from 10% - 49%. Canopy heights can vary according to the composition of hardwoods.



511000 Graminoid Salt Marsh

Ruiz et al. (2008): Graminoid dominated salt marsh

Rutchey et al. (5/22/2007): Graminoid dominated salt marsh.



Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

511200 Black Rush

Ruiz et al. (2008): Black Rush (Juncus roemerianus) dominated salt marsh.

Rutchey et al. (5/22/2007): Black Rush (*Juncus roemerianus*) dominated salt marsh.



Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

511400 Cordgrass

Ruiz et al. (2008): Sand Cordgrass (*Spartina bakeri*) and/or Gulf Cordgrass (S. spartinae) dominated salt marsh.
Rutchey et al. (5/22/2007): Sand Cordgrass (*Spartina bakeri*) and/or Gulf Cordgrass (*S. spartinae*) dominated salt marsh.



Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

623000 Herbaceous Salt Marsh

Ruiz et al. (2008): Herbaceous dominated salt marsh.
Rutchey et al. (5/22/2007): Herbaceous dominated salt marsh.

NO PHOTO AVAILABLE

514000 Succulent Salt Marsh

Ruiz et al. (2008): Succulent dominated salt marsh.

Rutchey et al. (5/22/2007): Succulent dominated salt marsh.



514100 Saltwort

Ruiz et al. (2008): Saltwort (Batis maritima) dominated salt marsh.

Rutchey et al. (5/22/2007): Saltwort (Batis maritima) dominated salt marsh.



522100 Sawgrass

Ruiz et al. (2008): Sawgrass (Cladium jamaicense) dominated marsh.

Rutchey et al. (5/22/2007): Sawgrass (*Cladium jamaicense*) dominated marsh.



Photo was taken in Everglades National Park. No photo from Biscayne National Park was available.

623000 Mixed herbaceous dominated dune

Ruiz et al. (2008): Mixed herbaceous dominated dune.



800000 Exotic

Ruiz et al. (2008): Non-native and invasive vegetation.
Rutchey et al. (5/22/2007): Non-native and often invasive vegetation.



803000 Australian Pine

Ruiz et al. (2008): Macrophyte community consisting of River Sheoak (Casuarina cunninghamiana), Australian Pine (C. equisetifolia), and/or Suckering Australian Pine (C. glauca).

Rutchey et al. (5/22/2007): River Sheoak (*Casuarina cunninghamiana*), Australian Pine (*C. equisetifolia*), and Suckering Australian Pine (*C. glauca*).



804000 Treated Australian Pine

Ruiz et al. (2008): Macrophyte community treated for the presence of River Sheoak (Casuarina cunninghamiana), Australian Pine (C. equisetifolia), and/or Suckering Australian Pine (C. glauca).

Rutchey et al. (5/22/2007): Treated River Sheoak (*Casuarina cunninghamiana*), Australian Pine (*C. equisetifolia*), and Suckering Australian Pine (*C. glauca*).



833000 Seaside Mahoe

Ruiz et al. (2008): Machrophyte community consisting of Thespesia populnea.

Rutchey et al. (5/22/2007): *Thespesia populnea*





910010 Barren Salt Flat

Ruiz et al. (2008): Barren, generally hypersaline, flats exposed at low tide.

Rutchey et al. (5/22/2007): Barren, generally hypersaline, flats exposed at low tide.



910020 Beach

Ruiz et al. (2008): Sand and fine shell and coral fragments found along the shoreline.

Rutchey et al. (5/22/2007): Sand covered ground adjacent to lakes, bays, oceans, or other large bodies of water.



910030 Littoral Zone

Ruiz et al. (2008): Shoreline that is submerged at high tide and exposed at low tide and is usually devoid of upland vegetation.



910050 Lightning Gap

Ruiz et al. (2008): Canopy gaps created by cloud to ground lightning strikes.



910120 Water

Ruiz et al. (2008): Open water areas such as ponds, lakes, rivers, bays, and estuaries.

Rutchey et al. (5/22/2007): Open water areas such as ponds, lakes, rivers, bays, and estuaries.



910130 Barren Microkarst

Ruiz et al. (2008): Karst topography devoid of vegetation usually found around the perimeter of Coastal Hardwood Hammocks.



920000 Anthropogenic

Ruiz et al. (2008): Non-natural coverage associated with human infrastructure and/or activities.



920010 Campground

Ruiz et al. (2008): Area designated for camping



920030 Dock

Ruiz et al. (2008): A place used as a landing place or moorage for boats.



920040 Lawns & Landscaping

Ruiz et al. (2008): Ground that is covered with grass and/or trees and is maintained for its esthetics.



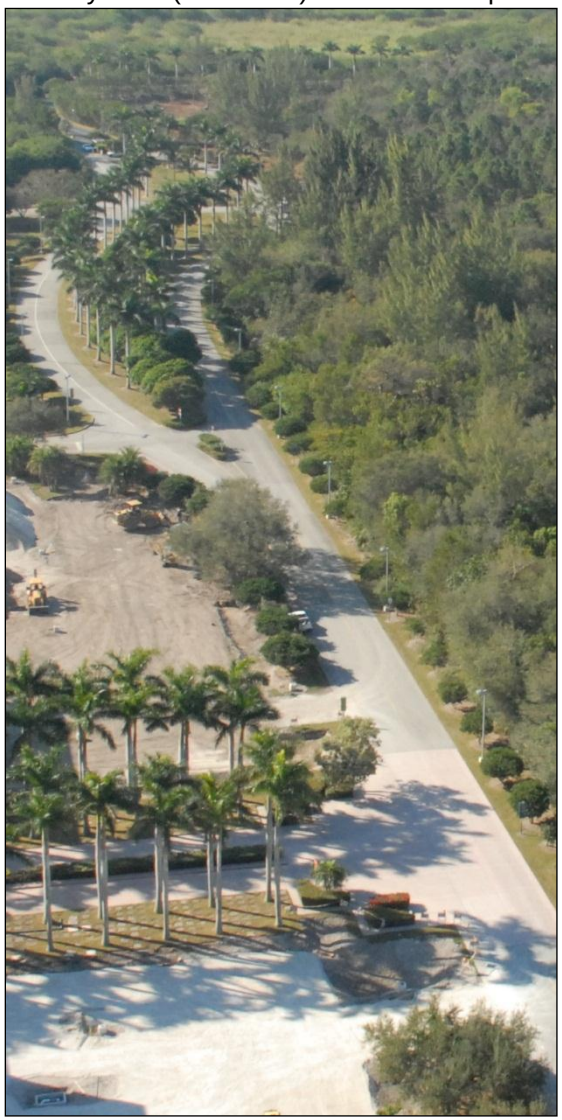
920060 Parking Lot

Ruiz et al. (2008): Area used for the parking of motor vehicles.



920080 Road

Ruiz et al. (2008): Paved and unpaved roads other than levees.
Rutchey et al. (5/22/2007): Paved and unpaved roads other than levees.



920090 Seawall

Ruiz et al. (2008): A wall or embankment to protect the shore from erosion or to act as a breakwater.



920110 Trail

Ruiz et al. (2008): A marked or established path or route designed to be followed.



920120 Spoil

Ruiz et al. (2008): Earth and rock excavated or dredged.

Rutchey et al. (5/22/2007): Areas such as power lines and abandoned agricultural areas.



920130 Walkway

Ruiz et al. (2008): A path, passage, etc. for pedestrians.



922000 Building

Ruiz et al. (2008): A roofed and walled structure built for permanent use.



922010 Commercial

Ruiz et al. (2008): A building or complex housing retail business.



922050 Lighthouse

Ruiz et al. (2008): A tower or structure designed to emit light and aid in navigation.



922070 Residential

Ruiz et al. (2008): A building or complex used as a permanent dwelling.



Appendix E. Species Names from Field Training Points

Species Names	Common Names	Field sheet names
Andropogon glomeratus	Bushy Bluestem	Andropogon glomeratus
Andropogon sp	Broomsedge	Andropogon sp., Andropogon
Avicennia germinans	Black Mangrove	Black Mangrove, black, aviger, b
Baccharis halimifolia	Groundsel Tree, Sea Myrtle	Baccharis
Batis maritima	Saltwort	batis, Batis maritima, batcar
Bidens alba var. radiata	Beggerticks, Romerillo	Bidens pilosa
Borrichia frutescens	Bushy Seaside Oxeye	borfru, bor, Borrichia
Bursera simaruba	Gumbo Limbo	bursim
Caesalpinia bundoc	Nickerbean	Nickerbean
Casuarina equisetifolia	Australian pine	casuarina, casurina, Australian pine, casequ, cass
Coccoloba diversifolia	Pigeon Plum	cocdiv
Coccoloba uvifera	Seagrape	cocuvi (cocui?), seagrape
Colubrina asiatica	Latherleaf	Colubrina asiatica
Conocarpus erectus	ButtonWood	ButtonWood, butt, conere (coere)
Dalbergia brownei	Coin Vine, Browne's Indian Rosewood	Dalbergia brownei
Dicliptera sexangularis	Sixangle Foldwing	dicsex
Dipholis salicifolia	Willow Bustic	Willow Bustic
Distichlis spicata	Saltgrass	disspi, dis, dist
Eugenia foetida	Spanish stopper	eaufot
Eupatorium capillifolium	Dogfennel	dog fennel
Ficus aurea	Strangler Fig	Ficus aurea
Fimbristylis spadicea	Marsh Fimbry	Fimbristylis

Species Names	Common Names	Field sheet names
Genipa clusiifolia	Sevenyear Apple	7yapple
Guapira discolor	Blolly, Beeftree	blolly, Guapira discolor
Hymenocallis latifolia	Mangrove Spiderlilly, Perfumed Spiderlilly	Hymenocallis, hamilicalis
Ipoemea indica	Oceanblue Morning-Glory	Ipoemea indica
Ipomoea pes-caprae	railroad vine	railroad vine
Ipomoea sp	Morning Glory	ipomoea sp
Jacquinia keyensis	Joewood	joewood
Juncus roemerianus	Black Rush	juncus
Laguncuaria racemosa	White Mangrove	White Mangrove, White, lagrac, w
Lantana involucrata	Lantana, Button sage, Wild sage,	latana
Leucaena leucocephala	White Leadtree, Tan Tan	Lead tree
Lycium carolinianum	Christmasberry, Carolina Desert-Thorn	lyccar
Metopium toxiferum	Poisonwood	mettox
Morinda royoc	Redgal, Cheeseshrub	Morinda royoc
Neyraudia reynaudiana	Burmareed, Silkreed	Burma Reed
Pithecellobium keyense	Florida Keys Blackbead, Blackbead	pitgua
Rhizophora mangle	Red Mangrove	Red Mangrove, red, rhiman, r
Salicornia bigelovii	Annual Glasswort, Dwarf Glasswort	Salicornia bigelovii
Salicornia spp.	Glasswort	salicornia
Salix caroliniana	Willow	salcar
Sarcocornia perennis	Perennial Glasswort, Virginia Glasswort	Salvir, salmar
Scaevola plumieri	Beachberry, Inkberry, Gullfeed	Scaevola

Species Names	Common Names	Field sheet names
Schinus terebinthifolius var. raddianus	Brazillian Peppertree	schter, schinus
Sesuvium portulacastrum	Sea Purslane	sespor, Sea Purslane
Spartina spp.	Cordgrass	spartina, spabac
Suriana maritima	Bay Cedar	Suriana, bay cedar
Thespesia populnea	Seaside Mahoe	thepop, Mahoe

Appendix F. Maps

All maps shown are at Level 3 (54 classes) of the classification instead of Level 6 (100 classes) as the nearly double number of map classes at Level 6 becomes difficult to differentiate on a printed map and many are at such a fine resolution, the polygons themselves are difficult to discern and are primarily useful in digital format or when printed at very high resolutions.

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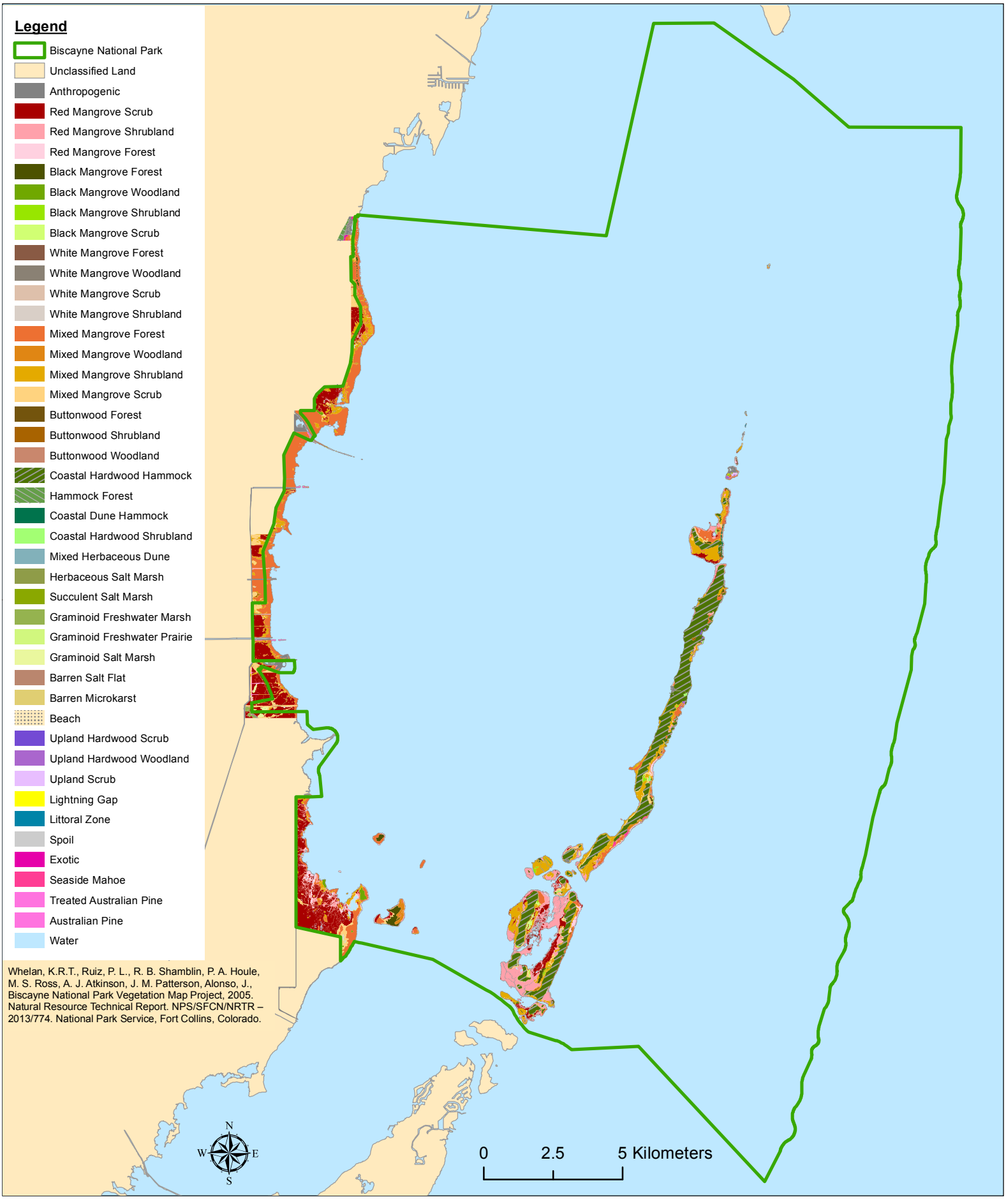
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Biscayne National Park
Vegetation Map

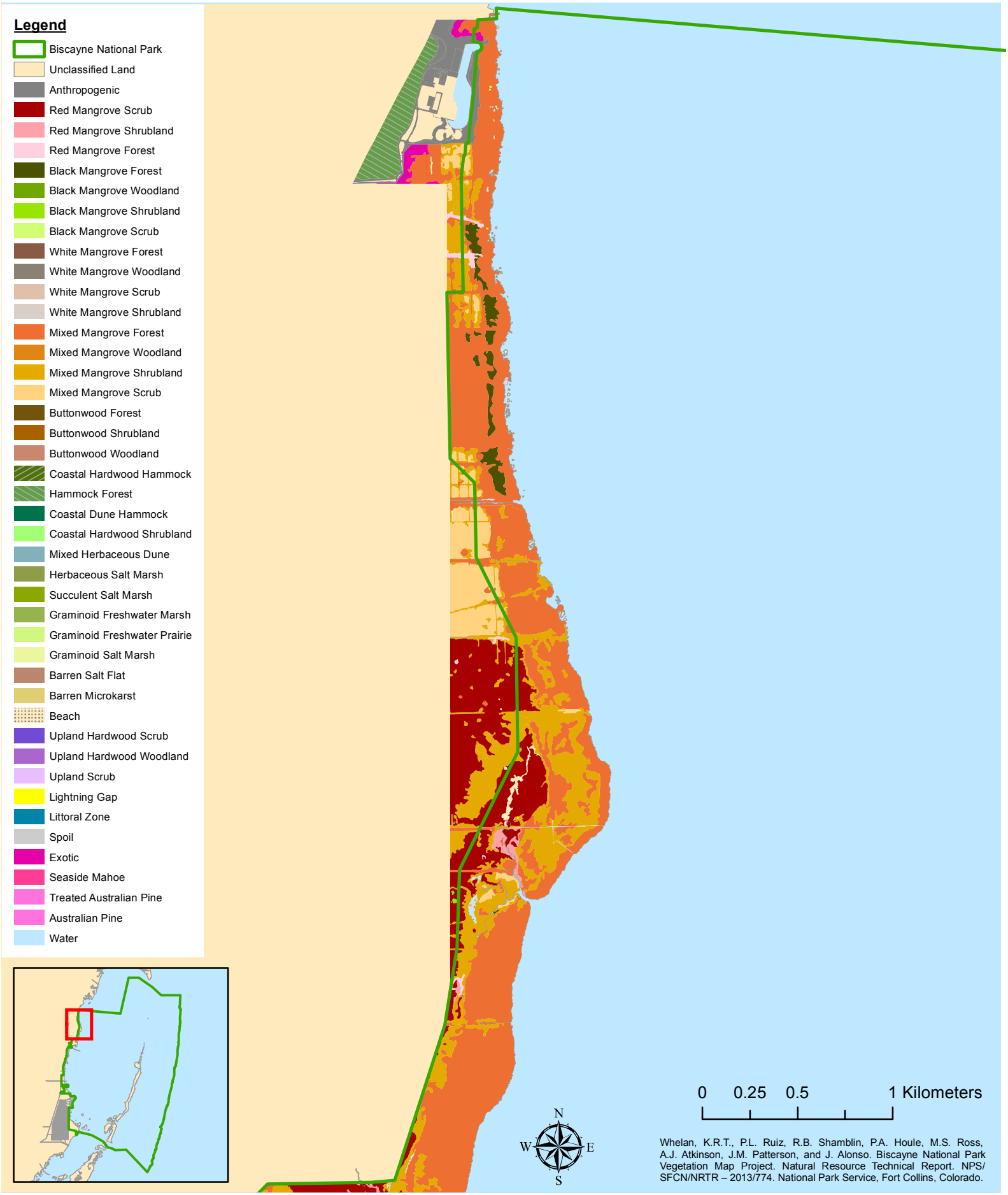
National Park Service
U.S. Department of the Interior



Whelan, K.R.T., Ruiz, P. L., R. B. Shamblin, P. A. Houle, M. S. Ross, A. J. Atkinson, J. M. Patterson, Alonso, J., Biscayne National Park Vegetation Map Project, 2005. Natural Resource Technical Report. NPS/SFCN/NRTR – 2013/774. National Park Service, Fort Collins, Colorado.

Biscayne National Park - Mainland (North) Vegetation Map

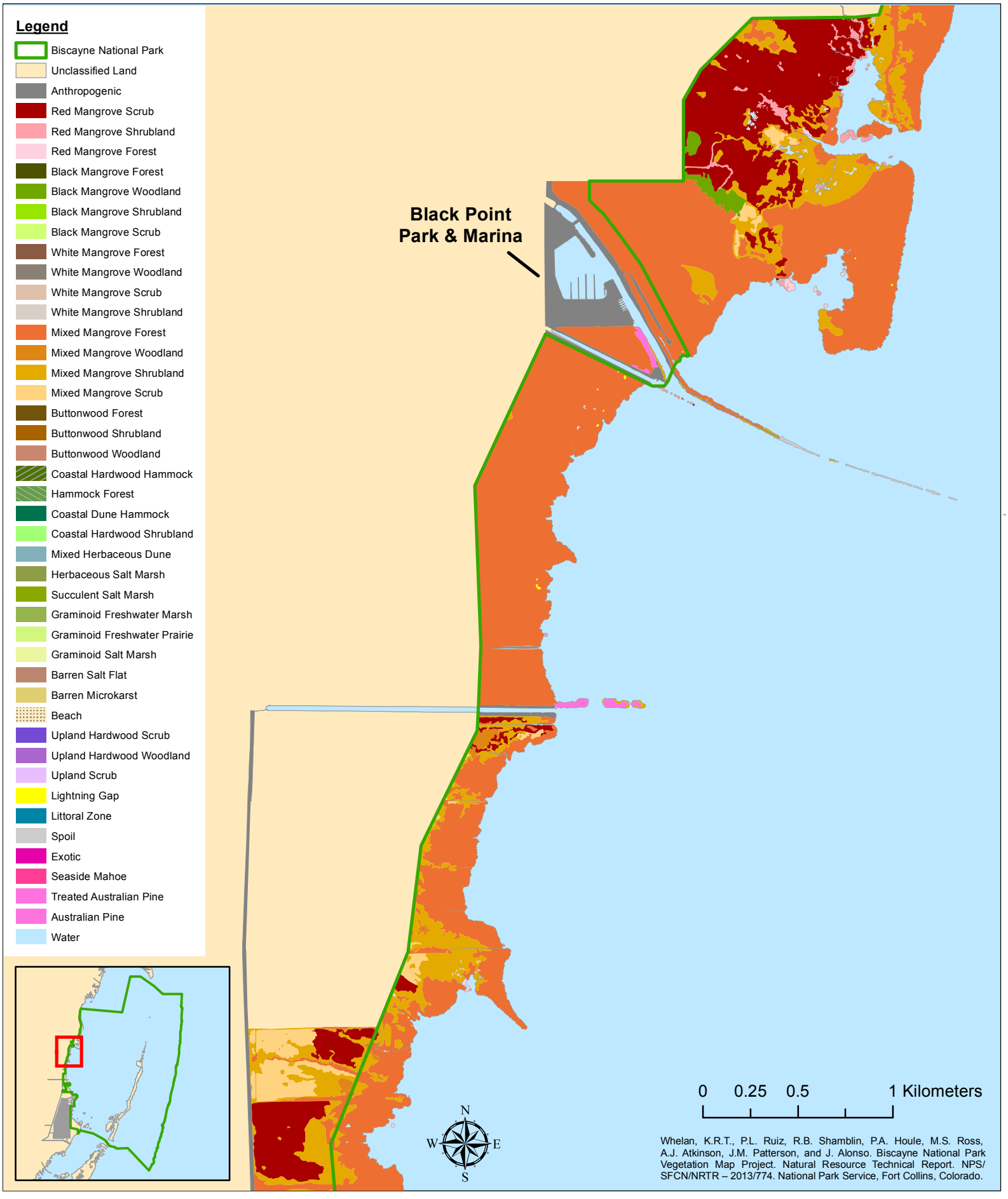
National Park Service
U.S. Department of the Interior



Whelan, K.R.T., P.L. Ruiz, R.B. Shamblin, P.A. Houle, M.S. Ross, A.J. Atkinson, J.M. Patterson, and J. Alonso. Biscayne National Park Vegetation Map Project. Natural Resource Technical Report. NPS/SFCN/NRTR – 2013/774. National Park Service, Fort Collins, Colorado.

Biscayne National Park - Mainland (Black Point) Vegetation Map

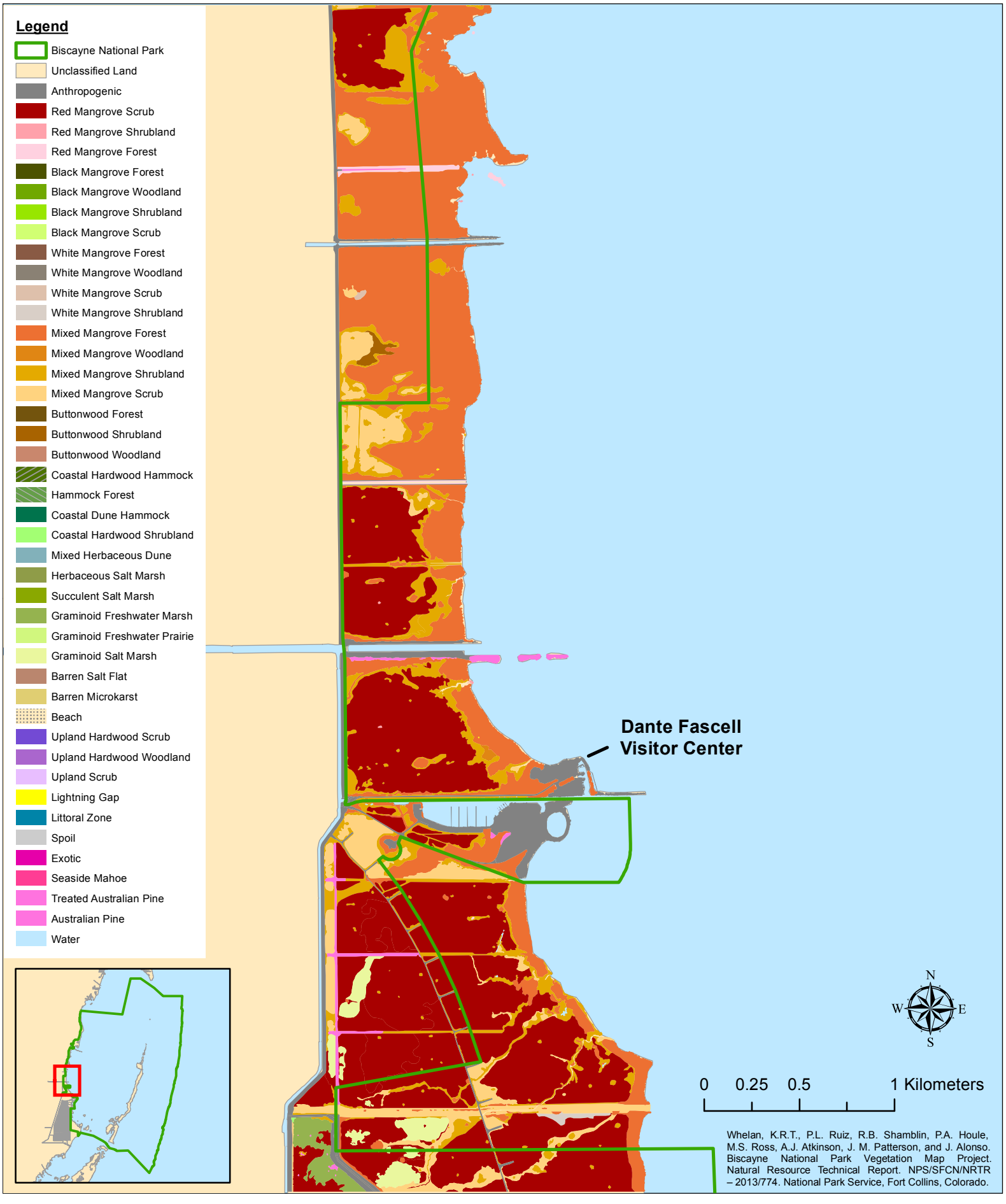
National Park Service
U.S. Department of the Interior



Whelan, K.R.T., P.L. Ruiz, R.B. Shamblin, P.A. Houle, M.S. Ross, A.J. Atkinson, J.M. Patterson, and J. Alonso. Biscayne National Park Vegetation Map Project. Natural Resource Technical Report. NPS/SFCN/NRTR – 2013/774. National Park Service, Fort Collins, Colorado.

Biscayne National Park - Mainland (Convoy Point) Vegetation Map

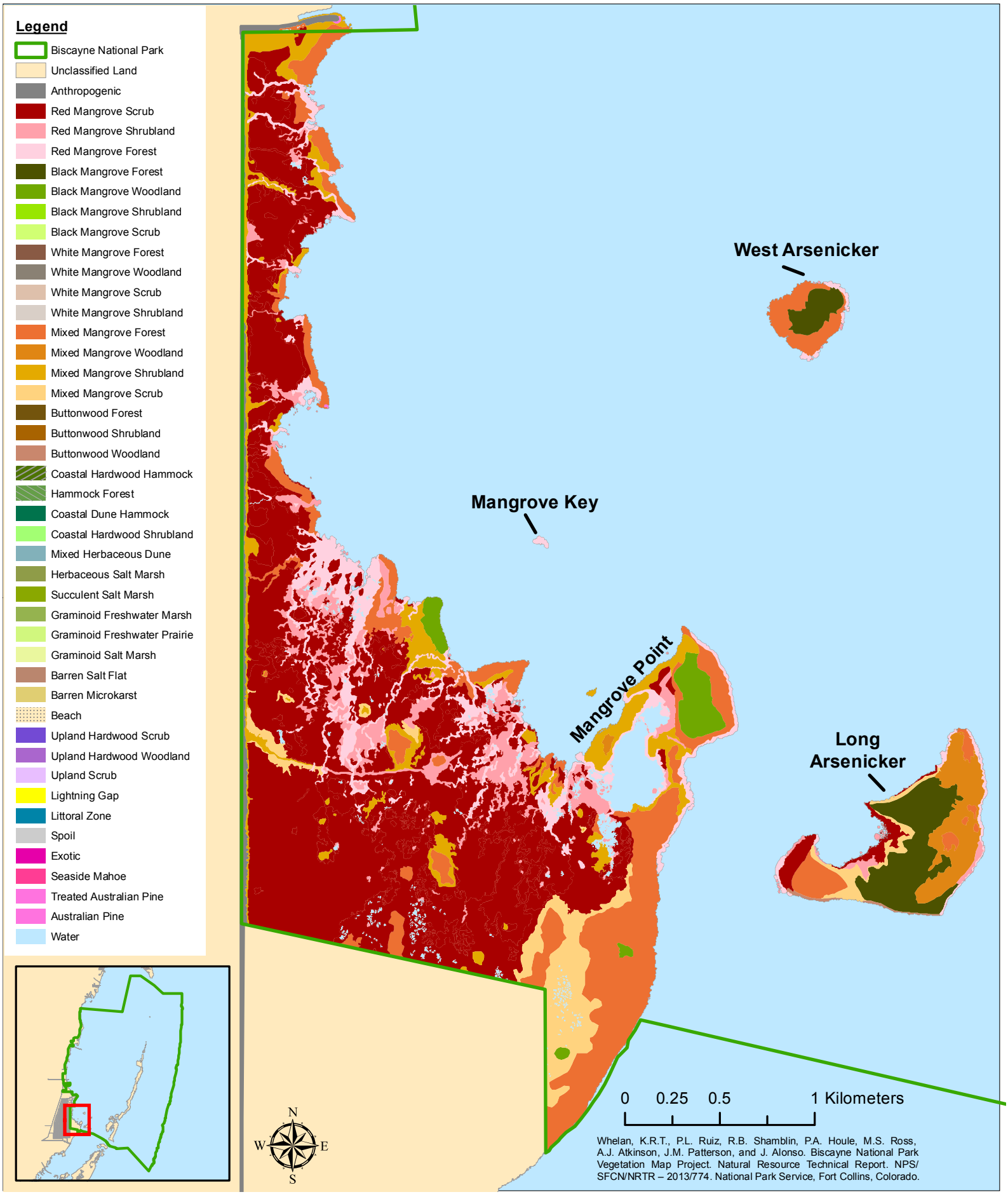
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Whelan, K.R.T., P.L. Ruiz, R.B. Shamblin, P.A. Houle, M.S. Ross, A.J. Atkinson, J. M. Patterson, and J. Alonso. Biscayne National Park Vegetation Map Project. Natural Resource Technical Report. NPS/SFCN/NRTR – 2013/774. National Park Service, Fort Collins, Colorado.

Biscayne National Park - Mainland (South) Vegetation Map

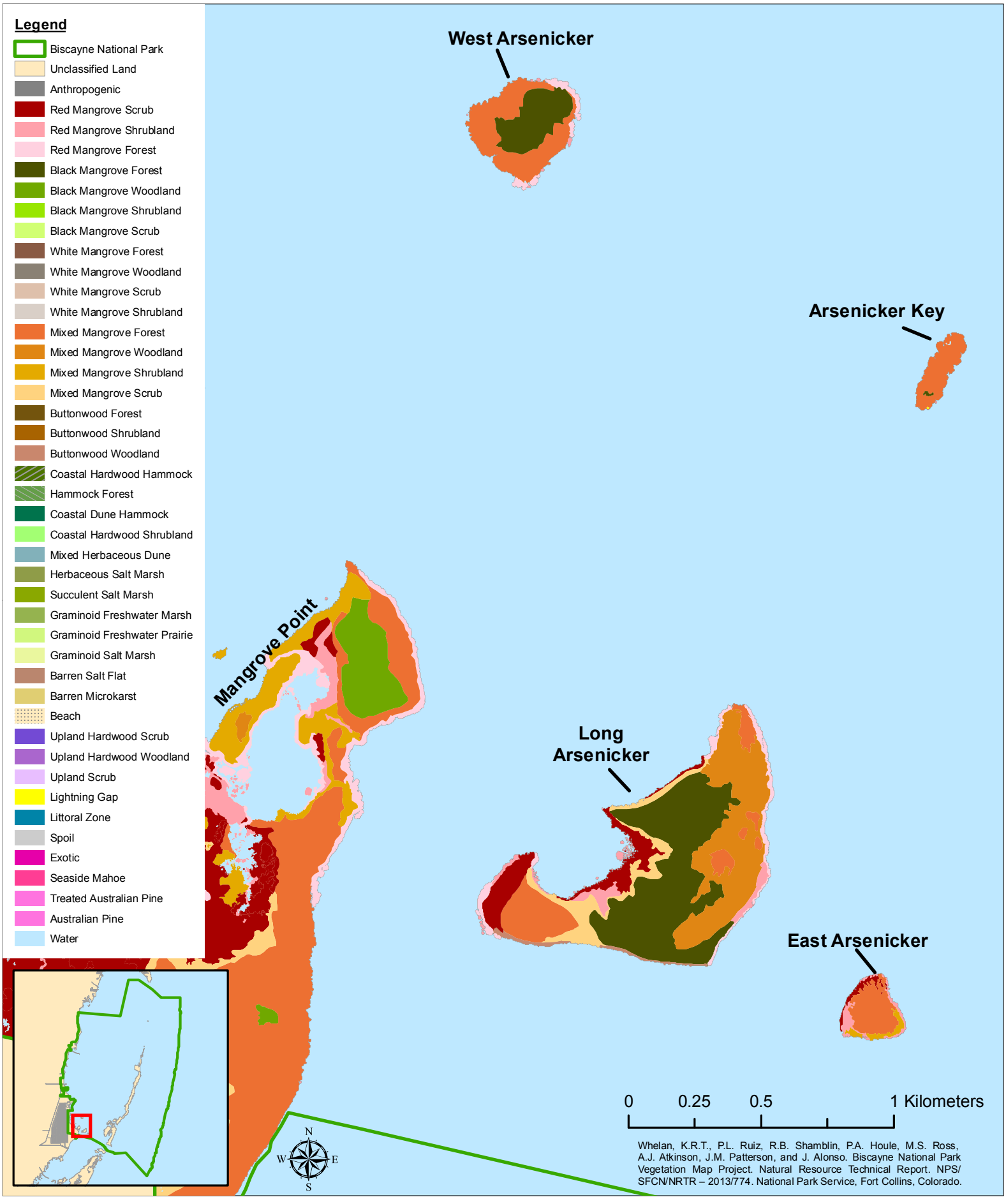
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Biscayne National Park - Southwest Islands Vegetation Map

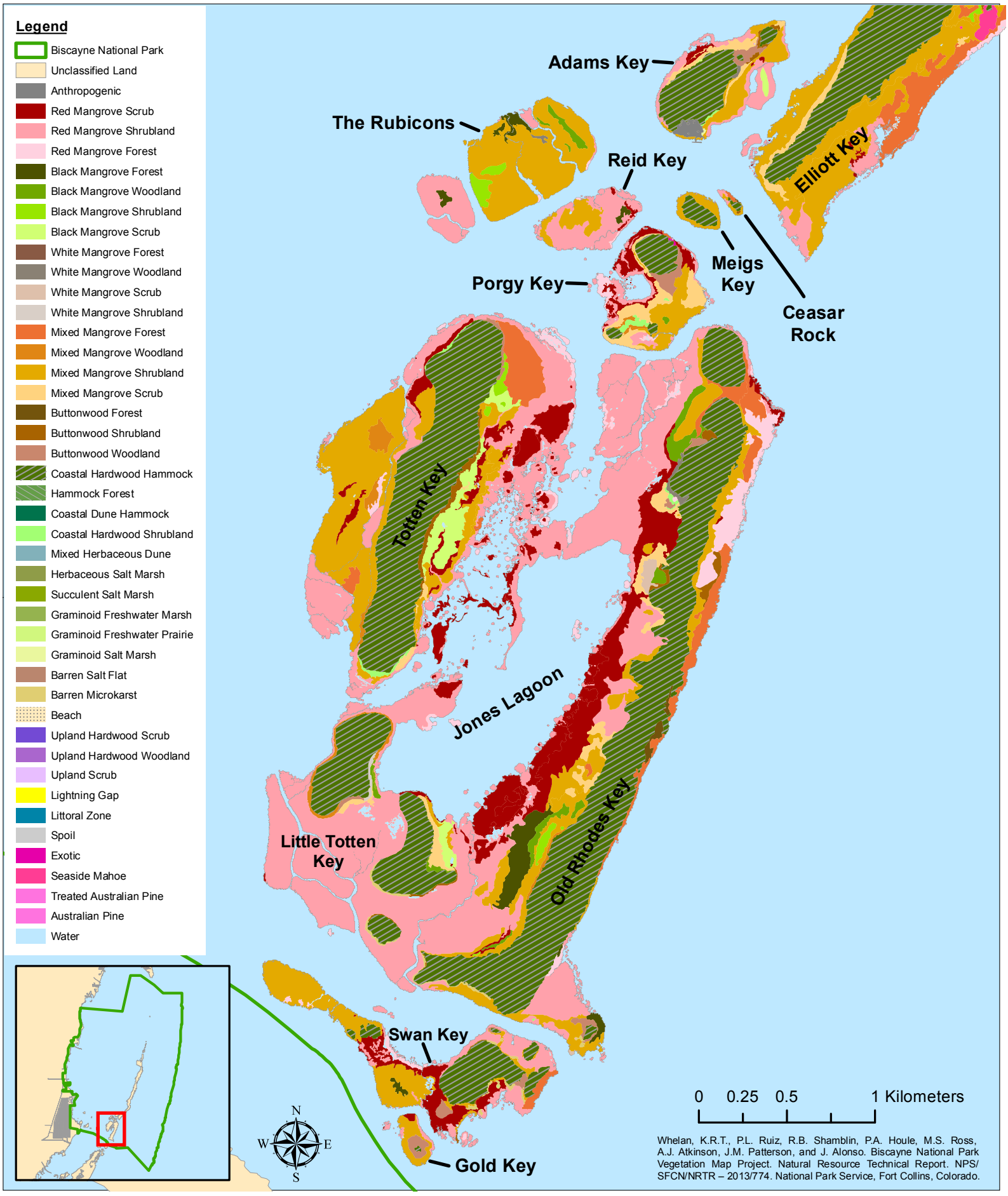
National Park Service
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Whelan, K.R.T., P.L. Ruiz, R.B. Shamblin, P.A. Houle, M.S. Ross, A.J. Atkinson, J.M. Patterson, and J. Alonso. Biscayne National Park Vegetation Map Project. Natural Resource Technical Report. NPS/SFCN/NRTR – 2013/774. National Park Service, Fort Collins, Colorado.

Biscayne National Park - Southeast Islands Vegetation Map

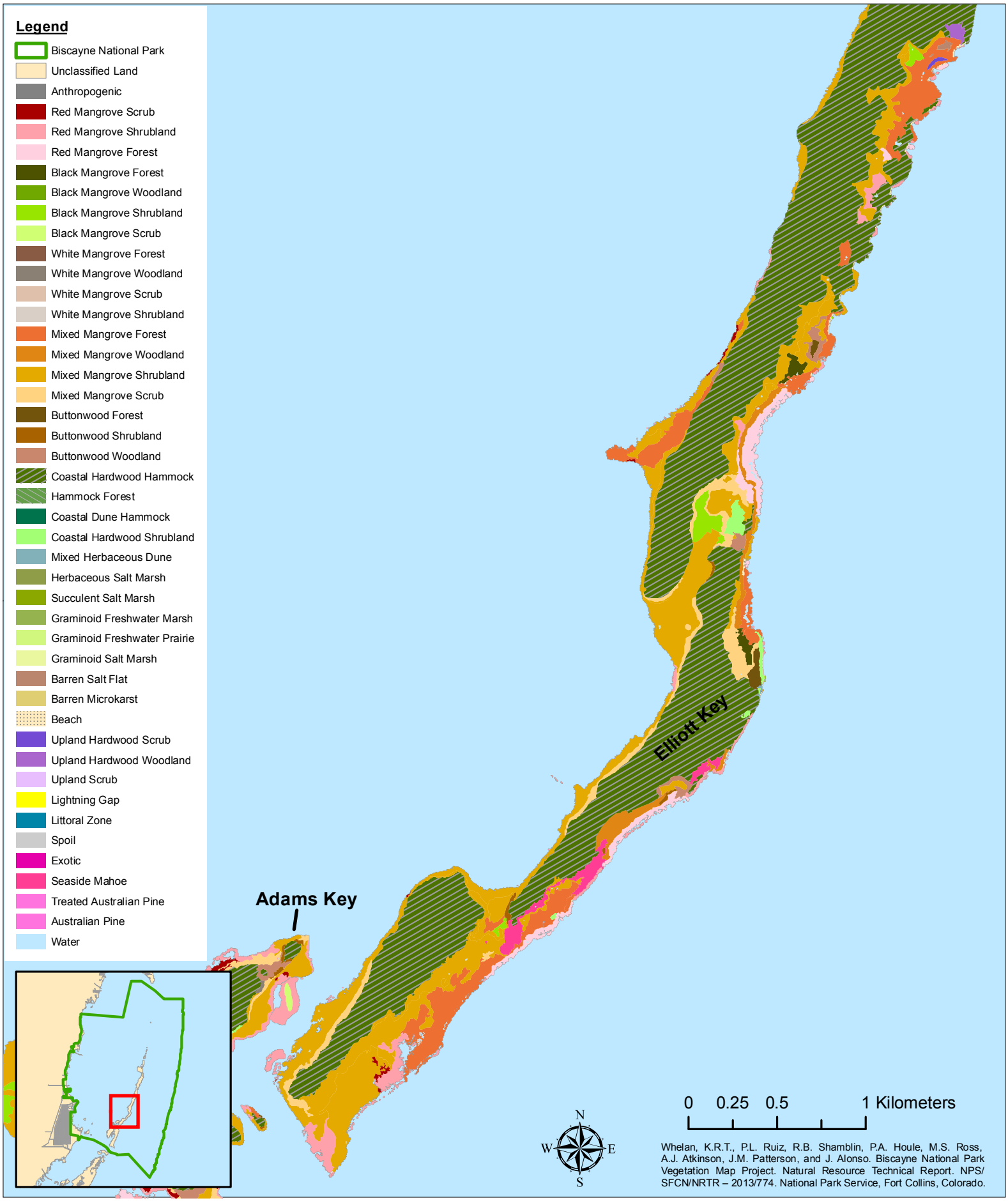
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Whelan, K.R.T., P.L. Ruiz, R.B. Shamblin, P.A. Houle, M.S. Ross, A.J. Atkinson, J.M. Patterson, and J. Alonso. Biscayne National Park Vegetation Map Project. Natural Resource Technical Report. NPS/SFCN/NRTR – 2013/774. National Park Service, Fort Collins, Colorado.

Biscayne National Park - Elliott Key (South) Vegetation Map

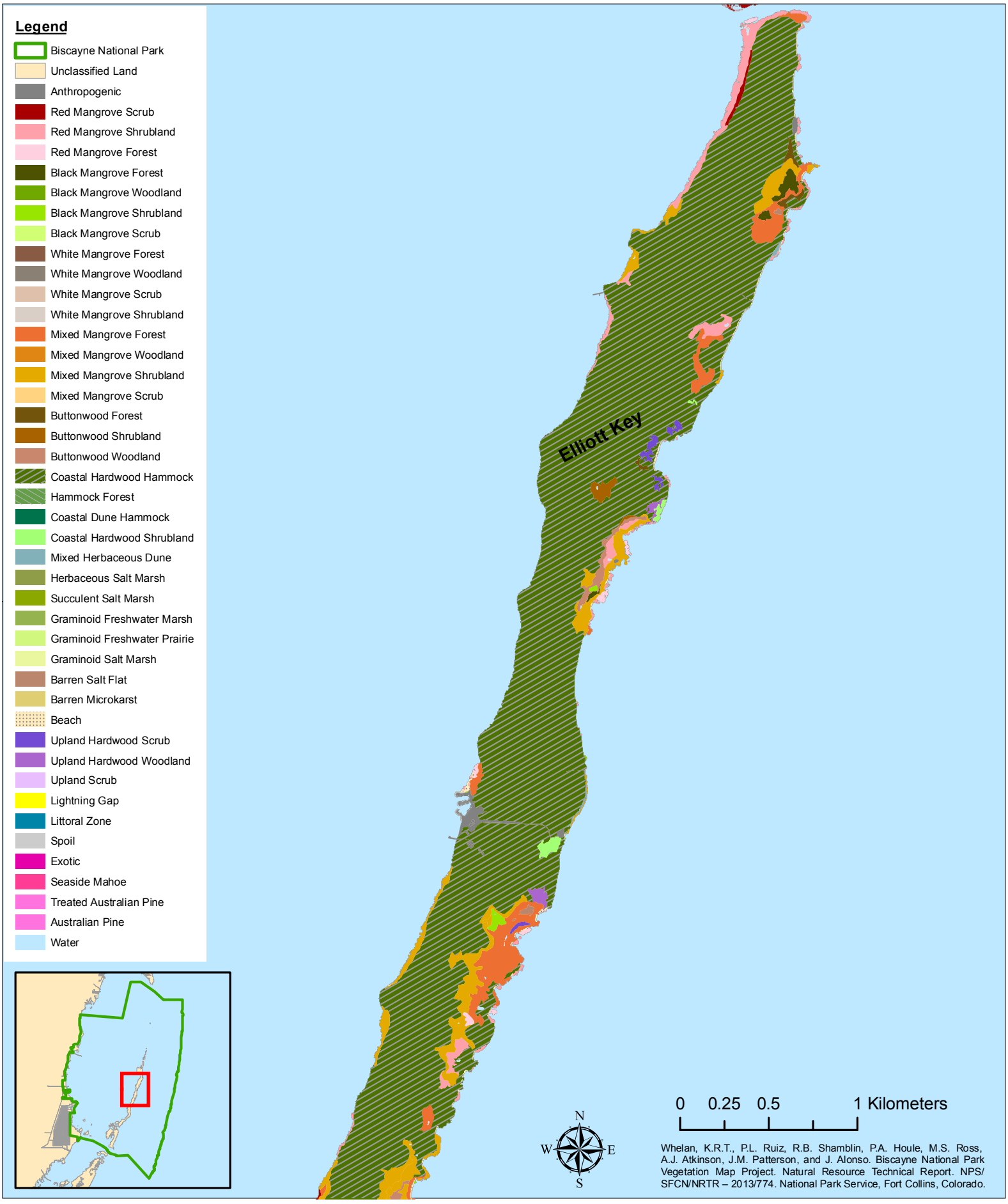
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Biscayne National Park - Elliott Key (North)
Vegetation Map

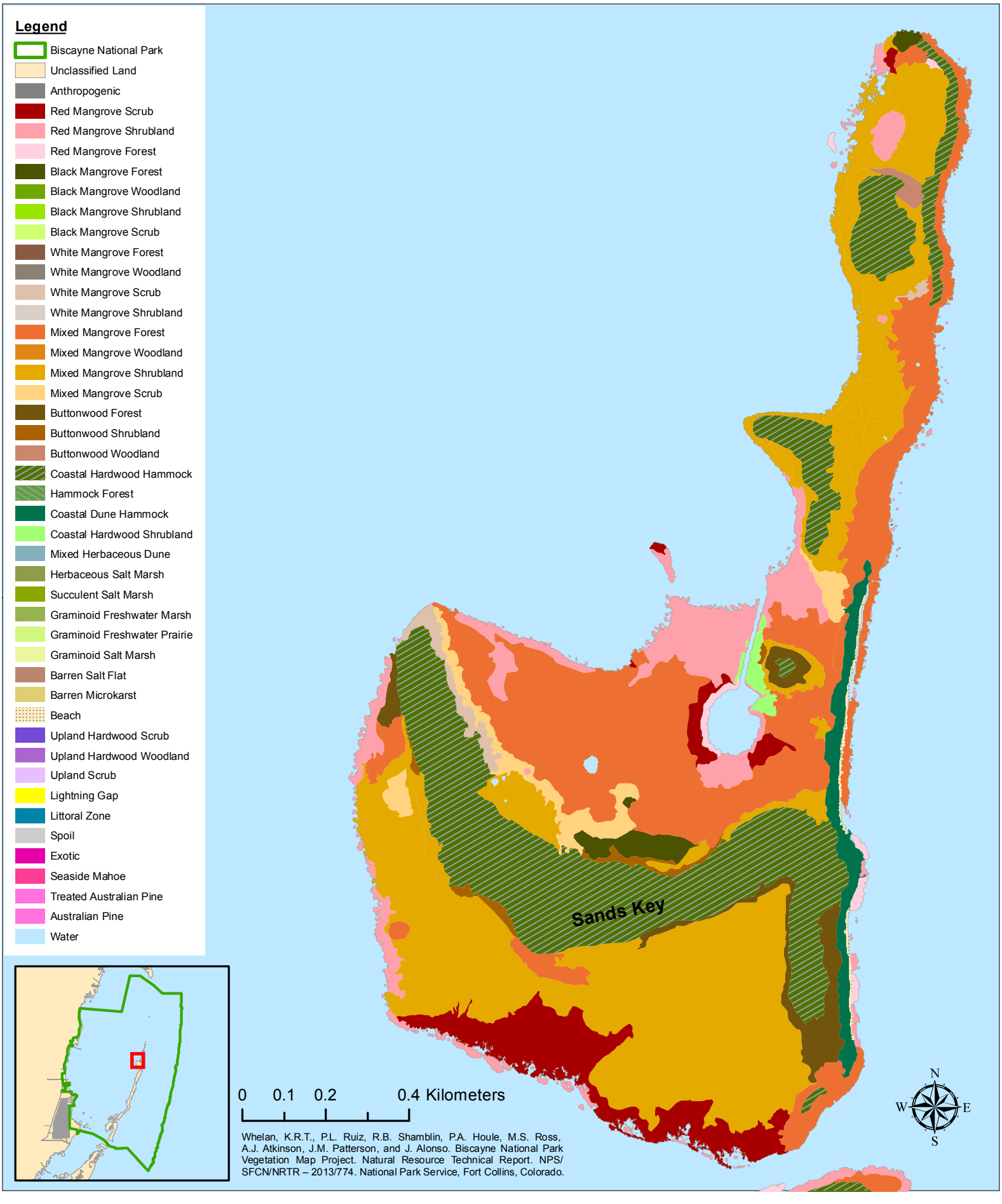
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Biscayne National Park - Sands Key Vegetation Map

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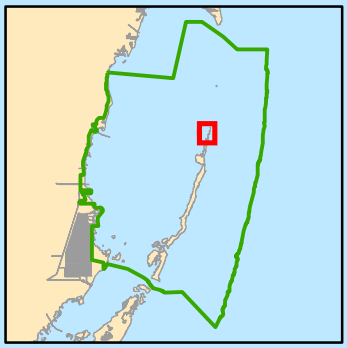
Biscayne National Park - Boca Chita and the Ragged Keys Vegetation Map

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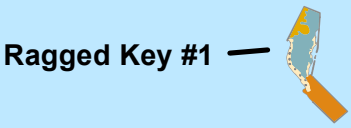


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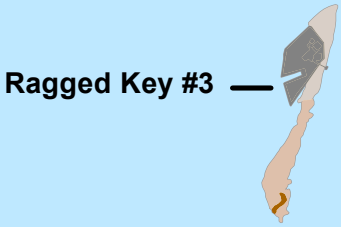
- Biscayne National Park
- Unclassified Land
- Anthropogenic
- Red Mangrove Scrub
- Red Mangrove Shrubland
- Red Mangrove Forest
- Black Mangrove Forest
- Black Mangrove Woodland
- Black Mangrove Shrubland
- Black Mangrove Scrub
- White Mangrove Forest
- White Mangrove Woodland
- White Mangrove Scrub
- White Mangrove Shrubland
- Mixed Mangrove Forest
- Mixed Mangrove Woodland
- Mixed Mangrove Shrubland
- Mixed Mangrove Scrub
- Buttonwood Forest
- Buttonwood Shrubland
- Buttonwood Woodland
- Coastal Hardwood Hammock
- Hammock Forest
- Coastal Dune Hammock
- Coastal Hardwood Shrubland
- Mixed Herbaceous Dune
- Herbaceous Salt Marsh
- Succulent Salt Marsh
- Graminoid Freshwater Marsh
- Graminoid Freshwater Prairie
- Graminoid Salt Marsh
- Barren Salt Flat
- Barren Microkarst
- Beach
- Upland Hardwood Scrub
- Upland Hardwood Woodland
- Upland Scrub
- Lightning Gap
- Littoral Zone
- Spoil
- Exotic
- Seaside Mahoe
- Treated Australian Pine
- Australian Pine
- Water



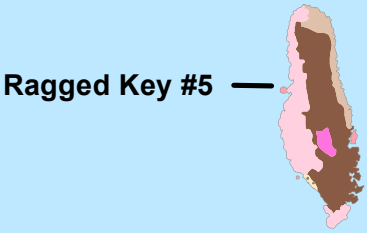


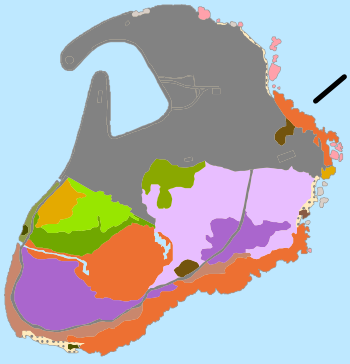














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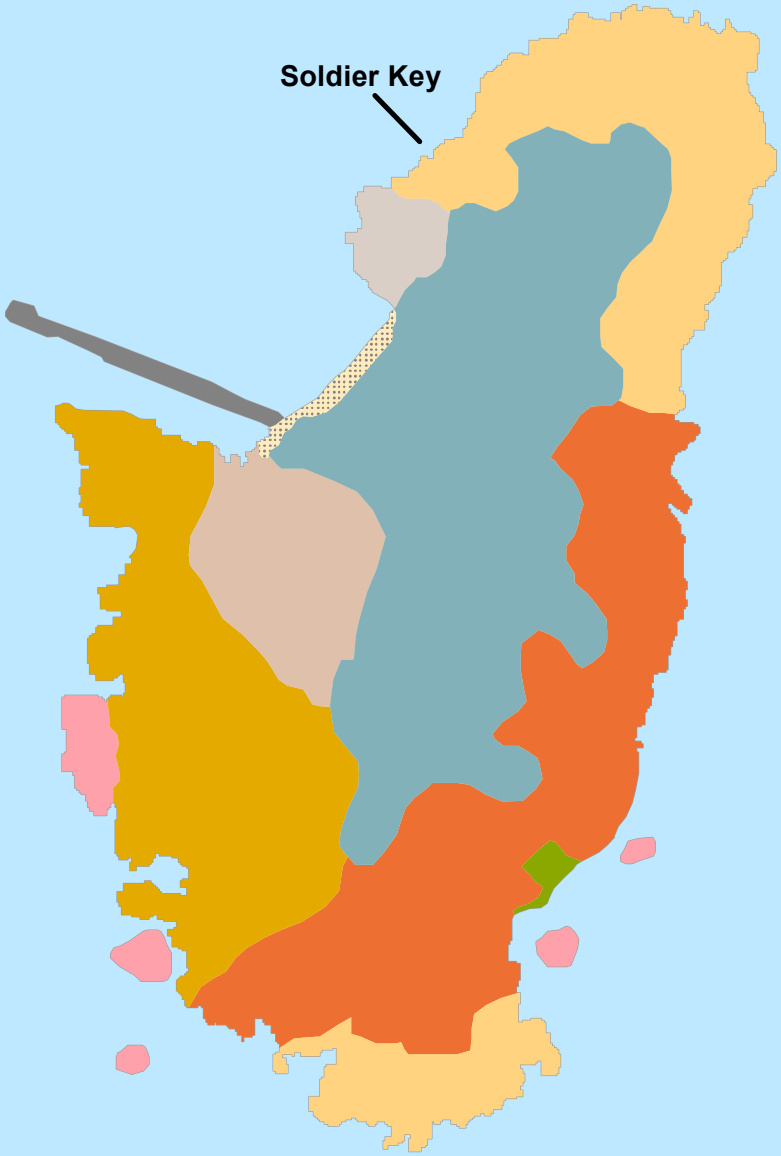
Biscayne National Park - Soldier Key Vegetation Map

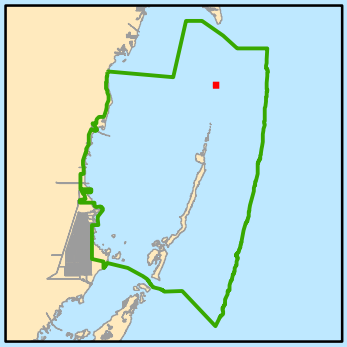
National Park Service
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Legend

- Biscayne National Park
- Unclassified Land
- Anthropogenic
- Red Mangrove Scrub
- Red Mangrove Shrubland
- Red Mangrove Forest
- Black Mangrove Forest
- Black Mangrove Woodland
- Black Mangrove Shrubland
- Black Mangrove Scrub
- White Mangrove Forest
- White Mangrove Woodland
- White Mangrove Scrub
- White Mangrove Shrubland
- Mixed Mangrove Forest
- Mixed Mangrove Woodland
- Mixed Mangrove Shrubland
- Mixed Mangrove Scrub
- Buttonwood Forest
- Buttonwood Shrubland
- Buttonwood Woodland
- Coastal Hardwood Hammock
- Hammock Forest
- Coastal Dune Hammock
- Coastal Hardwood Shrubland
- Mixed Herbaceous Dune
- Herbaceous Salt Marsh
- Succulent Salt Marsh
- Graminoid Freshwater Marsh
- Graminoid Freshwater Prairie
- Graminoid Salt Marsh
- Barren Salt Flat
- Barren Microkarst
- Beach
- Upland Hardwood Scrub
- Upland Hardwood Woodland
- Upland Scrub
- Lightning Gap
- Littoral Zone
- Spoil
- Exotic
- Seaside Mahoe
- Treated Australian Pine
- Australian Pine
- Water





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0 0.025 0.05 Kilometers

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Appendix G. Map Statistics Summary Tables

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Table G-1. Summary of vegetation map class area (hectares), number of polygons, number of accuracy assessment points and number of field points. ……..……G-2

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Table G-3. Alternate summary of vegetation map area (hectares) with groupings by main vegetation type (i.e. Hammock, Mangroves, Freshwater Marsh, Saltwater Marsh, Dune, Exotic, Other Natural, Anthropogenic) and by island and mainland areas. …….……G-10

Table G-1. Summary of vegetation map class area (hectares), number of polygons, number of accuracy assessment points and number of field points.

Map Class (Level 6)	Area (ha)				Counts		
	Total	Avg	Min	Max	Polygons	AA Points	Field Points
FOREST							
Black Mangrove Forest	43.9	1.3	0.01	19.1	36	18	24
Buttonwood Forest	8.0	0.5	0.02	3.0	15	4	16
White Mangrove Forest	1.1	0.6	0.01	1.1	2	2	6
Red Mangrove Forest	78.1	0.4	0.003	14.8	194	30	55
Mixed Mangrove Forest	640.4	2.8	0.01	93.4	249	27	106
Black Mangrove-Buttonwood Forest	0.9	0.9	0.9	0.9	1	0	0
Black Mangrove-White Mangrove Forest	0.1	0.1	0.1	0.1	1	0	1
Black Mangrove-Red Mangrove Forest	96.7	4.8	0.1	42.0	22	6	17
Buttonwood-White Mangrove Forest	0.1	0.1	0.1	0.1	1	0	0
Hammock Forest	8.9	8.9	8.9	8.9	1	1	0
Coastal Hardwood Hammock	708.7	19.7	0.1	227.2	36	31	42
Coastal Dune Hammock	3.4	3.4	3.4	3.4	1	1	1
WOODLAND							
Black Mangrove Woodland	20.2	1.3	0.1	7.3	17	6	14
Black Mangrove Woodland-Succulent	1.0	0.5	0.4	0.5	2	0	3
Black Mangrove Woodland-Saltwort	0.4	0.4	0.4	0.4	1	0	0
Buttonwood Woodland	11.0	0.6	0.1	1.8	20	5	26
Buttonwood Woodland-Succulent	2.0	1.0	0.5	1.6	2	0	3
White Mangrove Woodland	1.0	0.3	0.2	0.7	3	3	2
Mixed Mangrove Woodland	29.0	1.6	0.1	13.5	19	6	24
Buttonwood-White Mangrove Woodland-Herbaceous	0.1	0.1	0.1	0.1	1	0	5
Upland Hardwood Woodland	2.7	0.4	0.03	1.0	6	5	5
SHRUBLAND							
Black Mangrove Shrubland	7.0	0.3	0.002	2.6	21	6	16
Black Mangrove Shrubland-Saltwort	1.2	0.6	0.4	0.8	2	0	6
Buttonwood Shrubland	8.0	0.3	0.01	2.1	26	17	18
Buttonwood Shrubland-Saltwort	1.6	0.5	0.2	1.1	3	1	4
White Mangrove Shrubland	1.9	0.1	0.000001	1.0	14	4	5
Red Mangrove Shrubland	300.9	0.2	0.0002	43.2	1887	29	138
Mixed Mangrove Shrubland	418.9	0.9	0.0004	35.5	471	21	151
Mixed Mangrove Shrubland-Succulent	20.3	1.7	0.1	6.3	12	3	21
Black Mangrove-White Mangrove Shrubland	0.0	0.0	0.01	0.01	2	0	1
Black Mangrove-White Mangrove Shrubland-Succulent	1.3	1.3	1.3	1.3	1	0	4
Black Mangrove-Red Mangrove Shrubland	31.7	2.1	0.03	9.9	19	3	14
Buttonwood-White Mangrove Shrubland	7.4	1.5	0.03	6.7	5	3	8

Map Class (Level 6)	Area (ha)				Counts		
	Total	Avg	Min	Max	Polygons	AA Points	Field Points
Buttonwood-White Mangrove Shrubland-Succulent	7.3	7.3	7.3	7.3	1	0	13
Buttonwood-White Mangrove Shrubland-Cordgrass	2.4	2.4	2.4	2.4	1	0	7
Buttonwood-Red Mangrove Shrubland	0.1	0.1	0.1	0.1	1	0	0
White Mangrove-Red Mangrove Shrubland	11.3	0.8	0.01	6.5	17	0	3
Upland Shrubland	0.3	0.3	0.3	0.3	1	1	1
Nicker Bean Shrubland	0.05	0.05	0.05	0.05	1	0	0
Coastal Hardwood Shrubland	6.2	0.3	0.01	1.4	20	4	28
SCRUB							
Black Mangrove Scrub	8.7	2.2	0.03	6.7	4	3	7
Black Mangrove Scrub-Saltwort	1.2	1.2	1.2	1.2	1	1	2
White Mangrove Scrub	0.8	0.1	0.0001	0.4	10	4	5
White Mangrove Scrub-Succulent	1.3	0.7	0.1	1.2	2	0	1
White Mangrove Scrub-Saltwort	1.2	0.6	0.1	1.2	2	1	3
White Mangrove Scrub-Glasswort	0.1	0.1	0.1	0.1	1	0	1
Red Mangrove Scrub	469.7	1.0	0.0001	60.8	497	21	70
Red Mangrove Scrub-Sawgrass/Black Rush	1.8	1.8	1.8	1.8	1	0	0
Red Mangrove Scrub-Sawgrass	3.5	1.8	0.4	3.1	2	0	0
Red Mangrove Scrub-Fimbry	22.7	7.6	4.6	11.8	4	3	0
Red Mangrove Scrub-Black Rush	30.7	2.4	0.05	8.9	17	1	0
Red Mangrove Scrub-Open Marsh	164.6	1.3	0.01	49.4	122	5	3
Red Mangrove Scrub-Subtidal	14.8	0.9	0.01	5.0	17	1	1
Mixed Mangrove Scrub	89.6	1.1	0.01	20.9	94	22	16
Mixed Mangrove Scrub-Black Rush	1.4	1.4	1.4	1.4	1	0	1
Mixed Mangrove Scrub-Succulent	13.1	1.3	0.2	2.9	10	4	18
Black Mangrove-White Mangrove Scrub	0.5	0.2	0.03	0.2	3	0	3
Black Mangrove-White Mangrove Scrub-Saltwort	1.2	1.2	1.2	1.2	1	0	1
Black Mangrove-Red Mangrove Scrub	12.9	0.6	0.04	3.6	30	1	8
Buttonwood-White Mangrove Scrub-Cordgrass	1.0	1.0	1.0	1.0	1	0	0
Buttonwood-White Mangrove Scrub-Succulent	1.4	1.4	1.4	1.4	1	1	1
Buttonwood-White Mangrove Scrub-Glasswort	0.1	0.1	0.1	0.1	1	0	6
Buttonwood-Red Mangrove Scrub	8.3	1.7	0.2	4.4	7	2	0
Buttonwood-Red Mangrove Scrub-Sawgrass/Black Rush	1.6	0.8	0.2	1.4	2	0	0
Buttonwood-Red Mangrove Scrub-Sawgrass	1.1	1.1	1.1	1.1	1	0	0

Map Class (Level 6)	Area (ha)				Counts		
	Total	Avg	Min	Max	Polygons	AA Points	Field Points
White Mangrove-Red Mangrove Scrub	3.9	0.4	0.1	1.4	10	0	0
Upland Scrub	1.8	0.9	0.7	1.1	2	2	4
Upland Hardwood Scrub	1.5	0.4	0.2	0.6	4	4	4
MARSH							
Graminoid Salt Marsh	0.0	0.0	0.05	0.05	1	0	0
Black Rush	9.3	1.0	0.1	2.6	11	4	0
Cordgrass	0.1	0.1	0.1	0.1	1	1	0
Herbaceous Salt Marsh	0.1	0.1	0.1	0.1	1	1	1
Succulent Salt Marsh	0.4	0.2	0.1	0.3	2	2	2
Saltwort	0.0	0.0	0.004	0.004	1	1	1
Sawgrass	5.4	5.4	5.4	5.4	1	1	0
DUNE							
Mixed Herbaceous Dune	0.9	0.2	0.1	0.3	5	5	15
EXOTIC							
Exotic	2.3	0.5	0.1	1.4	6	5	0
Australian Pine	4.0	0.3	0.003	3.2	14	5	1
Treated Australian Pine	3.4	0.3	0.021	0.7	13	5	0
Seaside Mahoe	4.9	1.2	0.017	4.1	4	4	15
OTHER							
Barren Salt Flat	0.4	0.1	0.019	0.3	3	3	0
Beach	2.2	0.0	0.001	0.3	68	20	8
Littoral Zone	0.2	0.2	0.2	0.2	1	0	2
Lightning Gap	0.2	0.0	0.002	0.04	18	5	0
Water	25.5	0.1	0.001	10.7	462	5	0
Barren Microkarst	2.0	0.1	0.01	0.5	15	5	1
Anthropogenic	85.3	6.6	0.01	30.1	17	0	1
Building	0.5	0.0	0.001	0.2	22	0	2
Campground	6.2	1.0	0.001	4.8	6	0	2
Commercial	2.0	2.0	2.0	2.0	1	0	0
Dock	0.1	0.0	0.001	0.03	38	0	0
Lawns & Landscaping	14.7	0.4	0.002	5.4	45	0	2
Lighthouse	0.0	0.0	0.009	0.01	1	0	0
Parking Lot	0.6	0.3	0.2	0.4	2	0	0
Residential	0.0	0.0	0.003	0.02	3	0	1
Road	5.4	0.8	0.02	2.7	10	0	0
Seawall	0.3	0.0	0.0002	0.2	8	0	0
Spoil	0.6	0.0	0.002	0.2	18	5	0
Trail	0.5	0.1	0.01	0.2	5	0	0
Walkway	0.9	0.1	0.002	0.3	10	0	0

Map Class (Level 6)	Area (ha)				Counts		
	Total	Avg	Min	Max	Polygons	AA Points	Field Points
Grand Total	***3524.1***	***0.8***	***0.000001***	***227.2***	***4796***	***390***	***997***

Table G-2. Summary of vegetation map class area (hectares) by island and mainland areas. Small unnamed mangrove islands lumped with nearest named island or mainland.

MAP CLASS (Level 6)	Raster ID	Mainland (inside park)	Mainland (outside park)	Adams Key	Boca Chita	Elliott Key	Little Totten Key	Long Arse-nicker Key	Old Rhodes Key	Sands Key	Swan Key	Totten Key	Other islands	Grand Total
FOREST		***575.65***	***105.78***	***13.02***	***2.19***	***510.85***	***29.80***	***27.22***	***129.39***	***80.83***	***14.96***	***70.60***	***29.94***	***1590.2***
Black Mangrove Forest	111000	5.71	0.02		0.02	3.67		19.10	6.80	1.71	0.40		6.41	43.86
Buttonwood Forest	112000				0.10	2.51			1.10	4.12			0.17	8.01
White Mangrove Forest	113000				0.01								1.09	1.11
Red Mangrove Forest	114000	44.78	1.80			9.81	0.61	2.16	10.74	0.83	0.95	3.72	2.72	78.12
Mixed Mangrove Forest	115000	461.09	94.81		1.18	18.98		5.95	7.90	28.42	1.09	8.91	12.09	640.42
Black Mangrove-Buttonwood Forest	115100				0.87									0.87
Black Mangrove-White Mangrove Forest	115200	0.09												0.09
Black Mangrove-Red Mangrove Forest	115300	63.90	0.31			21.11			3.31	8.07				96.69
Buttonwood-White Mangrove Forest	115400	0.08												0.08
Hammock Forest	130000		8.85											8.85
Coastal Hardwood Hammock	131000			13.02		454.77	29.18		99.54	34.26	12.51	57.96	7.45	708.70
Coastal Dune Hammock	137000									3.43				3.43
WOODLAND		***16.13***	***0.45***	***1.14***	***2.25***	***13.18***	***2.67***	***14.21***	***7.79***	***0.46***	***0.97***	***3.47***	***4.74***	***67.47***
Black Mangrove Woodland	211000	13.42	0.00003		0.36		0.33		4.69				1.35	20.15
Black Mangrove Woodland-Succulent	211030						0.44		0.55					0.98
Black Mangrove Woodland-Saltwort	211031	0.43												0.43
Buttonwood Woodland	212000			0.98	0.43	4.76	0.32	0.70	1.33		0.97	0.57	0.98	11.05
Buttonwood Woodland-Succulent	212030									0.46			1.59	2.05
White Mangrove Woodland	213000			0.16					0.68				0.20	1.04
Mixed Mangrove Woodland	215000	2.29	0.45			7.22	1.59	13.51	0.54			2.90	0.48	28.98
Buttonwood-White Mangrove Woodland-Herbaceous	215420												0.14	0.14
Upland Hardwood Woodland	233000				1.46	1.20								2.65

MAP CLASS (Level 6)	Raster ID	Mainland (inside park)	Mainland (outside park)	Adams Key	Boca Chita	Elliott Key	Little Totten Key	Long Arse-nicker Key	Old Rhodes Key	Sands Key	Swan Key	Totten Key	Other islands	Grand Total
SHRUBLAND		***210.51***	***46.51***	***11.45***	***0.77***	***124.19***	***67.80***	***1.77***	***118.54***	***67.38***	***24.04***	***87.91***	***66.90***	***827.77***
Black Mangrove Shrubland	311000		0.08			3.74			1.00			0.25	1.97	7.04
Black Mangrove Shrubland-Saltwort	311041				0.41							0.84		1.25
Buttonwood Shrubland	312000		1.24	0.31		2.06	0.43		0.39	1.03	0.15	2.31	0.06	7.97
Buttonwood Shrubland-Saltwort	312041			0.16					1.45					1.61
White Mangrove Shrubland	313000	0.97			0.04	0.00	0.45						0.45	1.91
Red Mangrove Shrubland	314000	40.85	0.08	5.38	0.09	18.94	66.29	1.77	85.47	11.62	8.46	39.58	22.34	300.88
Mixed Mangrove Shrubland	315000	161.69	31.50	5.49	0.24	54.96	0.63		25.69	42.66	15.08	39.74	41.17	418.85
Mixed Mangrove Shrubland-Succulent	315040					10.56				8.85	0.33	0.52		20.26
Black Mangrove-White Mangrove Shrubland	315200					0.02								0.02
Black Mangrove-White Mangrove Shrubland-Succulent	315210					1.30								1.30
Black Mangrove-Red Mangrove Shrubland	315300	1.18	8.09			12.37			4.26	1.91		3.85		31.65
Buttonwood-White Mangrove Shrubland	315500					6.69				0.56			0.13	7.37
Buttonwood-White Mangrove Shrubland-Succulent	315510					7.30								7.30
Buttonwood-White Mangrove Shrubland-Cordgrass	315521					2.39								2.39
Buttonwood-Red Mangrove Shrubland	315600		0.11											0.11
White Mangrove-Red Mangrove Shrubland	315700	5.81	5.38										0.12	11.32
Upland Shrubland	340000					0.26								0.26
Nicker Bean Shrubland	341000					0.05								0.05
Coastal Hardwood Shrubland	342000		0.04	0.11		3.55			0.27	0.75	0.01	0.83	0.67	6.23

MAP CLASS (Level 6)	Raster ID	Mainland (inside park)	Mainland (outside park)	Adams Key	Boca Chita	Elliott Key	Little Totten Key	Long Arse-nicker Key	Old Rhodes Key	Sands Key	Swan Key	Totten Key	Other islands	Grand Total
SCRUB		***556.72***	***169.05***	***3.52***	***1.82***	***14.91***	***5.27***	***9.02***	***43.58***	***14.75***	***6.63***	***23.62***	***11.60***	***860.49***
Black Mangrove Scrub	411000			0.50			1.47					6.69		8.66
Black Mangrove Scrub-Saltwort	411041											1.20		1.20
White Mangrove Scrub	413000		0.18										0.59	0.77
White Mangrove Scrub-Succulent	413040									1.34				1.34
White Mangrove Scrub-Saltwort	413041								1.17				0.07	1.24
White Mangrove Scrub-Glasswort	413042								0.07					0.07
Red Mangrove Scrub	414000	322.14	81.36	0.76		1.38	1.49	4.77	25.66	9.58	6.63	10.86	5.07	469.69
Red Mangrove Scrub-Sawgrass/Black Rush	414010		1.85											1.85
Red Mangrove Scrub-Sawgrass	414011		3.53											3.53
Red Mangrove Scrub-Fimbry	414014	0.36	22.29											22.66
Red Mangrove Scrub-Black Rush	414015	12.63	18.11											30.74
Red Mangrove Scrub-Open Marsh	414030	164.58												164.58
Red Mangrove Scrub-Subtidal	414051						0.07		10.69			4.01		14.78
Mixed Mangrove Scrub	415000	50.19	24.12	2.25		4.44	0.57		4.79			0.39	2.89	89.64
Mixed Mangrove Scrub-Black Rush	415015		1.39											1.39
Mixed Mangrove Scrub-Succulent	415040					5.21	1.67			3.33			2.86	13.07
Black Mangrove-White Mangrove Scrub	415200											0.47		0.47
Black Mangrove-White Mangrove Scrub-Saltwort	415241								1.20					1.20
Black Mangrove-Red Mangrove Scrub	415300	2.79	5.35					4.26		0.50				12.90
Buttonwood-White Mangrove Scrub-Cordgrass	415417					0.97								0.97
Buttonwood-White Mangrove Scrub-Succulent	415440					1.44								1.44
Buttonwood-White Mangrove Scrub-Saltwort	415441												0.13	0.13

MAP CLASS (Level 6)	Raster ID	Mainland (inside park)	Mainland (outside park)	Adams Key	Boca Chita	Elliott Key	Little Totten Key	Long Arse-nicker Key	Old Rhodes Key	Sands Key	Swan Key	Totten Key	Other islands	Grand Total
Buttonwood-Red Mangrove Scrub	415500	0.16	8.17											8.33
Buttonwood-Red Mangrove Scrub-Sawgrass/Black Rush	415510		1.59											1.59
Buttonwood-Red Mangrove Scrub-Sawgrass	415511		1.10											1.10
White Mangrove-Red Mangrove Scrub	415700	3.86												3.86
Upland Scrub	430000				1.82									1.82
Upland Hardwood Scrub	431000					1.48								1.48
MARSH		***3.41***	***11.38***	***0.05***	***0.33***	***0.00***	***0.08***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***15.25***
Graminoid Salt Marsh	511000			0.05										0.05
Black Rush	511200	3.41	5.94											9.34
Cordgrass	511400		0.05											0.05
Herbaceous Salt Marsh	512000				0.05									0.05
Succulent Salt Marsh	514000				0.28		0.08							0.36
Saltwort	514100												0.004	0.004
Sawgrass	522100		5.39											5.39
DUNE		***0.00***	***0.00***	***0.00***	***0.00***	***0.40***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.48***	***0.88***
Mixed Herbaceous Dune	623000					0.40							0.48	0.88
EXOTIC		***3.14***	***6.41***	***0.00***	***0.00***	***4.94***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.12***	***14.61***
Exotic	800000	0.17	2.03										0.06	2.26
Australian Pine	803000	0.74	3.21										0.06	4.02
Treated Australian Pine	804000	2.22	1.17											3.39
Seaside Mahoe	833000					4.94								4.94
OTHER		***40.02***	***88.94***	***1.33***	***5.59***	***5.40***	***1.68***	***0.00***	***1.31***	***0.60***	***1.10***	***0.67***	***0.78***	***147.42***
Barren Salt Flat	910010					0.40								0.40
Beach	910020				0.13	1.53				0.45			0.07	2.18
Littoral Zone	910030												0.17	0.17

MAP CLASS (Level 6)	Raster ID	Mainland (inside park)	Mainland (outside park)	Adams Key	Boca Chita	Elliott Key	Little Totten Key	Long Arse-nicker Key	Old Rhodes Key	Sands Key	Swan Key	Totten Key	Other islands	Grand Total
Lightning Gap	910050	0.15	0.01										0.01	0.16
Water	910120	17.38	4.12	0.02	0.05	0.85	0.99		0.72	0.15	0.39	0.67	0.13	25.49
Barren Microkarst	910130						0.68		0.59		0.71			1.98
Anthropogenic	920000	18.55	66.73										0.01	85.29
Building	922000		0.17	0.07	0.05	0.19								0.46
Commercial	922010		1.96											1.96
Lawns & Landscaping	920040	1.83	10.67			1.94							0.24	14.68
Parking Lot	920060		0.60											0.60
Road	920080	1.56	3.89											5.45
Walkway	920130		0.79		0.05	0.01							0.02	0.87
Dock	920030			0.02		0.08							0.002	0.11
Lighthouse	922050				0.01									0.01
Residential	922070												0.03	0.03
Campground	920010			1.22	4.94									6.16
Seawall	920090				0.16	0.09							0.10	0.35
Spoil	920120	0.54				0.07								0.60
Trail	920110				0.20	0.25								0.45
GRAND TOTAL		***1405.6***	***428.5***	***30.5***	***13.0***	***673.9***	***107.3***	***52.2***	***300.6***	***164.0***	***47.7***	***186.3***	***114.6***	***3524.1***

Table G-3. Alternate summary of vegetation map area (hectares) with groupings by main vegetation type (i.e. Hammock, Mangroves, Saltwater Marsh, Freshwater Marsh, Dune, Exotic, Beach, Other Natural, Anthropogenic) and by island and mainland areas. Small unnamed mangrove islands lumped with nearest named island or mainland.

Map Class (Level 6)	Raster ID	Mainland (inside)	Mainland (outside)	Adams Key	Boca Chita	Elliott Key	Little Totten Key	Long Arse-nicker Key	Old Rhodes Key	Sands Key	Swan Key	Totten Key	Other Islands	Grand Total
HAMMOCK		***0.00***	***8.89***	***13.13***	***1.46***	***461.00***	***29.18***	***0.00***	***99.81***	***38.44***	***12.52***	***58.79***	***8.12***	***731.35***
Coastal Dune Hammock	137000									3.43				3.43
Coastal Hardwood Hammock	131000			13.02		454.77	29.18		99.54	34.26	12.51	57.96	7.45	708.70
Coastal Hardwood Shrubland	342000		0.04	0.11		3.55			0.27	0.75	0.01	0.83	0.67	6.23
Hammock Forest	130000		8.85											8.85
Upland Hardwood Scrub	431000					1.48								1.48
Upland Hardwood Woodland	233000				1.46	1.20								2.65
MANGROVES		***1359.01***	***312.91***	***16.00***	***3.76***	***201.82***	***76.35***	***52.22***	***199.49***	***124.98***	***34.09***	***126.81***	***105.06***	***2612.5***
Black Mangrove Forest	111000	5.71	0.02		0.02	3.67		19.10	6.80	1.71	0.40		6.41	43.86
Black Mangrove Scrub	411000			0.50			1.47					6.69		8.66
Black Mangrove Scrub-Saltwort	411041											1.20		1.20
Black Mangrove Shrubland	311000		0.08			3.74			1.00			0.25	1.97	7.04
Black Mangrove Shrubland-Saltwort	311041				0.41							0.84		1.25
Black Mangrove Woodland	211000	13.42	0.00003		0.36		0.33		4.69				1.35	20.15
Black Mangrove Woodland-Saltwort	211031	0.43												0.43
Black Mangrove Woodland-Succulent	211030						0.44		0.55					0.98
Black Mangrove-Buttonwood Forest	115100				0.87									0.87
Black Mangrove-Red Mangrove Forest	115300	63.90	0.31			21.11			3.31	8.07				96.69
Black Mangrove-Red Mangrove Scrub	415300	2.79	5.35					4.26		0.50				12.90
Black Mangrove-Red Mangrove Shrubland	315300	1.18	8.09			12.37			4.26	1.91		3.85		31.65
Black Mangrove-White Mangrove Forest	115200	0.09												0.09

Map Class (Level 6)	Raster ID	Mainland (inside)	Mainland (outside)	Adams Key	Boca Chita	Elliott Key	Little Totten Key	Long Arse-nicker Key	Old Rhodes Key	Sands Key	Swan Key	Totten Key	Other Islands	Grand Total
Black Mangrove-White Mangrove Scrub	415200											0.47		0.47
Black Mangrove-White Mangrove Scrub-Saltwort	415241								1.20					1.20
Black Mangrove-White Mangrove Shrubland	315200					0.02								0.02
Black Mangrove-White Mangrove Shrubland-Succulent	315210					1.30								1.30
Buttonwood Forest	112000				0.10	2.51			1.10	4.12			0.17	8.01
Buttonwood Shrubland	312000		1.24	0.31		2.06	0.43		0.39	1.03	0.15	2.31	0.06	7.97
Buttonwood Shrubland-Saltwort	312041			0.16					1.45					1.61
Buttonwood Woodland	212000			0.98	0.43	4.76	0.32	0.70	1.33		0.97	0.57	0.98	11.05
Buttonwood Woodland-Succulent	212030									0.46			1.59	2.05
Buttonwood-Red Mangrove Scrub	415500	0.16	8.17											8.33
Buttonwood-Red Mangrove Scrub-Sawgrass	415511		1.10											1.10
Buttonwood-Red Mangrove Scrub-Sawgrass/Black Rush	415510		1.59											1.59
Buttonwood-Red Mangrove Shrubland	315600		0.11											0.11
Buttonwood-White Mangrove Forest	115400	0.08												0.08
Buttonwood-White Mangrove Scrub-Cordgrass	415417					0.97								0.97
Buttonwood-White Mangrove Scrub-Saltwort	415441												0.13	0.13
Buttonwood-White Mangrove Scrub-Succulent	415440					1.44								1.44
Buttonwood-White Mangrove Shrubland	315500					6.69				0.56			0.13	7.37

Map Class (Level 6)	Raster ID	Mainland (inside)	Mainland (outside)	Adams Key	Boca Chita	Elliott Key	Little Totten Key	Long Arse-nicker Key	Old Rhodes Key	Sands Key	Swan Key	Totten Key	Other Islands	Grand Total
Buttonwood-White Mangrove Shrubland-Cordgrass	315521					2.39								2.39
Buttonwood-White Mangrove Shrubland-Succulent	315510					7.30								7.30
Buttonwood-White Mangrove Woodland-Herbaceous	215420												0.14	0.14
Mixed Mangrove Forest	115000	461.09	94.81		1.18	18.98		5.95	7.90	28.42	1.09	8.91	12.09	640.42
Mixed Mangrove Scrub	415000	50.19	24.12	2.25		4.44	0.57		4.79			0.39	2.89	89.64
Mixed Mangrove Scrub-Black Rush	415015		1.39											1.39
Mixed Mangrove Scrub-Succulent	415040					5.21	1.67			3.33			2.86	13.07
Mixed Mangrove Shrubland	315000	161.69	31.50	5.49	0.24	54.96	0.63		25.69	42.66	15.08	39.74	41.17	418.85
Mixed Mangrove Shrubland-Succulent	315040					10.56				8.85	0.33	0.52		20.26
Mixed Mangrove Woodland	215000	2.29	0.45			7.22	1.59	13.51	0.54			2.90	0.48	28.98
Red Mangrove Forest	114000	44.78	1.80			9.81	0.61	2.16	10.74	0.83	0.95	3.72	2.72	78.12
Red Mangrove Scrub	414000	322.14	81.36	0.76		1.38	1.49	4.77	25.66	9.58	6.63	10.86	5.07	469.69
Red Mangrove Scrub-Black Rush	414015	12.63	18.11											30.74
Red Mangrove Scrub-Fimbry	414014	0.36	22.29											22.66
Red Mangrove Scrub-Open Marsh	414030	164.58												164.58
Red Mangrove Scrub-Sawgrass	414011		3.53											3.53
Red Mangrove Scrub-Sawgrass/Black Rush	414010		1.85											1.85
Red Mangrove Scrub-Subtidal	414051						0.07		10.69			4.01		14.78
Red Mangrove Shrubland	314000	40.85	0.08	5.38	0.09	18.94	66.29	1.77	85.47	11.62	8.46	39.58	22.34	300.88
White Mangrove Forest	113000				0.01								1.09	1.11
White Mangrove Scrub	413000		0.18										0.59	0.77
White Mangrove Scrub-Glasswort	413042								0.07					0.07
White Mangrove Scrub-Saltwort	413041								1.17				0.07	1.24
White Mangrove Scrub-Succulent	413040									1.34				1.34

Map Class (Level 6)	Raster ID	Mainland (inside)	Mainland (outside)	Adams Key	Boca Chita	Elliott Key	Little Totten Key	Long Arse-nicker Key	Old Rhodes Key	Sands Key	Swan Key	Totten Key	Other Islands	Grand Total
White Mangrove Shrubland	313000	0.97			0.04	0.001	0.45						0.45	1.91
White Mangrove Woodland	213000			0.16					0.68				0.20	1.04
White Mangrove-Red Mangrove Scrub	415700	3.86												3.86
White Mangrove-Red Mangrove Shrubland	315700	5.81	5.38										0.12	11.32
SALTWATER MARSH		***3.41***	***5.99***	***0.05***	***0.33***	***0.00***	***0.08***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.004***	***9.86***
Black Rush	511200	3.41	5.94											9.34
Cordgrass	511400		0.05											0.05
Graminoid Salt Marsh	511000			0.05										0.05
Herbaceous Salt Marsh	512000				0.05									0.05
Saltwort	514100												0.004	0.004
Succulent Salt Marsh	514000				0.28		0.08							0.36
FRESHWATER MARSH		***0.00***	***5.39***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	**5.39**
Sawgrass	522100		5.39											5.39
HERBACEOUS DUNE		***0.00***	***0.00***	***0.00***	***0.00***	**0.40**	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	**0.48**	**0.88**
Mixed Herbaceous Dune	623000					0.40							0.48	0.88
EXOTIC		***3.14***	***6.41***	***0.00***	***0.00***	***4.94***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.12***	***14.61***
Australian Pine	803000	0.74	3.21										0.06	4.02
Exotic	800000	0.17	2.03										0.06	2.26
Seaside Mahoe	833000					4.94								4.94
Treated Australian Pine	804000	2.22	1.17											3.39
BEACH		***0.00***	***0.00***	***0.00***	***0.13***	***1.53***	***0.00***	***0.00***	***0.00***	***0.45***	***0.00***	***0.00***	***0.07***	***2.18***
Beach	910020				0.13	1.53				0.45			0.07	2.18
OTHER-NATURAL		***17.53***	***4.13***	***0.02***	***1.87***	***1.55***	***1.68***	***0.00***	***1.31***	***0.15***	***1.10***	***0.67***	***0.31***	***30.33***
Barren Microkarst	910130						0.68		0.59		0.71			1.98
Barren Salt Flat	910010					0.40								0.40
Lightning Gap	910050	0.15	0.01										0.01	0.16

Map Class (Level 6)	Raster ID	Mainland (inside)	Mainland (outside)	Adams Key	Boca Chita	Elliott Key	Little Totten Key	Long Arse-nicker Key	Old Rhodes Key	Sands Key	Swan Key	Totten Key	Other Islands	Grand Total
Littoral Zone	910030												0.17	0.17
Nicker Bean Shrubland	341000					0.05								0.05
Upland Scrub	430000				1.82									1.82
Upland Shrubland	340000					0.26								0.26
Water	910120	17.38	4.12	0.02	0.05	0.85	0.99		0.72	0.15	0.39	0.67	0.13	25.49
ANTHROPOGENIC		***22.48***	***84.81***	***1.31***	***5.41***	***2.63***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.40***	***117.03***
Anthropogenic	920000	18.55	66.73										0.01	85.29
Building	922000		0.17	0.07	0.05	0.19								0.46
Campground	920010			1.22	4.94									6.16
Commercial	922010		1.96											1.96
Dock	920030			0.02		0.08							0.00	0.11
Lawns & Landscaping	920040	1.83	10.67			1.94							0.24	14.68
Lighthouse	922050				0.01									0.01
Parking Lot	920060		0.60											0.60
Residential	922070												0.03	0.03
Road	920080	1.56	3.89											5.45
Seawall	920090				0.16	0.09							0.10	0.35
Spoil	920120	0.54				0.07								0.60
Trail	920110				0.20	0.25								0.45
Walkway	920130		0.79		0.05	0.01							0.02	0.87
GRAND TOTALS		***1405.57***	***428.52***	***30.51***	***12.95***	***673.87***	***107.30***	***52.22***	***300.62***	***164.02***	***47.71***	***186.27***	***114.57***	***3524.1***

Appendix H. Accuracy Assessment Summary Matrix for Biscayne National Park.

Error matrix (contingency table) for Biscayne National Park vegetation map at Level 3 of the vegetation classification. The design of the accuracy assessment was conducted at Level 3 as this was the original plan for the project. However the photo-interpreter occasionally mapped to greater detail, often up to level 6 in the hierarchical vegetation classification. Wherever an accuracy assessment point fell within a polygon that was classified to greater detail (i.e., Level 4-6 of the classification), the field point was evaluated at that level. Only 1 additional point was deemed unacceptable at this more detailed level. For details of accuracy assessment please see Appendix B of report.

Accuracy Assessment Class (Field Data)

Map Class	Australian Pine	Barren Microkarst	Barren Salt Flat	Beach	< Big Dead Tree >	Black Mangrove Forest	Black Mangrove Scrub	Black Mangrove Shrubland	Black Mangrove Woodland	Buttonwood Forest	Buttonwood Shrubland	Buttonwood Woodland	Coastal Dune Hammock	Coastal Hardwood Hammock	Coastal Hardwood Shrubland	Coastal Hardwood Woodland	Exotic	Graminoid Freshwater Marsh	Graminoid Freshwater Prairie	Graminoid Salt Marsh	Hammock Forest	Herbaceous Salt Marsh	Lightning Gap	Mixed Herbaceous Dune	Mixed Mangrove Forest	Mixed Mangrove Scrub	Mixed Mangrove Shrubland	Mixed Mangrove Woodland	Red Mangrove Forest	Red Mangrove Scrub	Red Mangrove Shrubland	Seaside Mahoe	Spoil	Succulent Salt Marsh	Treated Australian Pine	Upland Hardwood Scrub	Upland Hardwood Shrubland	Upland Hardwood Woodland	Upland Scrub	Water	White Mangrove Forest	White Mangrove Scrub	White Mangrove Shrubland	White Mangrove Woodland	Samples	Correct	Acceptable	Raw Accuracy	Adusted Accuracy	Lower 90% CL of Adj. Accuracy	Upper 90% CL of Adj. Accuracy
Australian Pine	5																																										5	5	5	100%		55%	100%
Barren Microkarst		5																																									5	5	5	100%		55%	100%
Barren Salt Flat			3																																							3	3	3	100%		37%	100%
Beach				20																																							20	20	20	100%		86%	100%
Black Mangrove Forest						8			2*																10																			20	8	10	40%	50%	30%	70%
Black Mangrove Scrub							4																						1															5	4	4	80%		34%	99%
Black Mangrove Shrubland								3																						2															5	3	3	60%		19%	92%
Black Mangrove Woodland									3																					2															5	3	3	60%		19%	92%
Buttonwood Forest										4				1																															5	4	4	80%		34%	99%
Buttonwood Shrubland								1		1*	13	1*															1			2												1		20	13	15	65%	75%	54%	90%
Buttonwood Woodland											1*	2															1																	4	2	3	50%	75%	25%	99%
Coastal Dune Hammock													1																															1	1	1	100%		5%	100%
Coastal Hardwood Hammock														29																							1*								30	29	30	97%	100%	90%	100%
Coastal Hardwood Shrubland								1						1*	2	1*																													5	2	4	40%	80%	34%	99%
Coastal Hardwood Woodland																																														0		NA	NA	NA	NA
Exotic																	5																												5	5	5	100%		55%	100%
Graminoid Freshwater Marsh																		1																												1	1	1	100%		5%	100%
Graminoid Freshwater Prairie																			2																											2	2	2	100%		22%	100%
Graminoid Salt Marsh																				4					1																				5	4	4	80%		34%	99%
Hammock Forest																					1																								1	1	1	100%		5%	100%
Herbaceous Salt Marsh																						1																								1	1	1	100%		5%	100%
Lightning Gap					1*																		4																							5	4	5	80%	100%	55%	100%
Mixed Herbaceous Dune																								4													1									5	4	4	80%		34%	99%
Mixed Mangrove Forest						1			1																26***		1*																1			30	26***	27	87%	90%	76%	97%
Mixed Mangrove Scrub									1																	13	2*			10	4															30	13	15	43%	50%	34%	66%
Mixed Mangrove Shrubland									2 (1*)		2														2 (1*)		21			3															30	21	23	70%	77%	61%	89%
Mixed Mangrove Woodland																												5																	5	5	5	100%		55%	100%
Red Mangrove Forest																									3				24		3 (2*)														30	24	26	80%	87%	72%	95%
Red Mangrove Scrub																														26	4*														30	26	30	87%	100%	90%	100%
Red Mangrove Shrubland						1		1																			1		4*		22												1		30	22	26	73%	87%	72%	95%
Seaside Mahoe																																4													4	4	4	100%		47%	100%
Spoil																																	5												5	5	5	100%		55%	100%
Succulent Salt Marsh																																		3**												3	3	3	100%		37%	100%
Treated Australian Pine																																			5										5	5	5	100%		55%	100%
Upland Hardwood Scrub																																				3	1*								4	3	4	75%	100%	47%	100%
Upland Hardwood Shrubland																																														0		NA	NA	NA	NA
Upland Hardwood Woodland																																						5							5	5	5	100%		55%	100%
Upland Scrub												1																																		1	0	0	0%		0%	95%
Water																																							5						5	5	5	100%		55%	100%
White Mangrove Forest																																								1					1	1	1	100%		5%	100%
White Mangrove Scrub							1																																		3	1*			5	3	4	60%	80%	34%	99%
White Mangrove Shrubland								1							1																										1		2		5	2	2	40%		8%	81%
White Mangrove Woodland									1			2*															1*																		4	0	3	0%	75%	25%	99%
Samples	5	5	3	20	1	10	5	7	10	5	16	6	1	31	3	1	5	1	2	4	1	1	4	4	42	13	28	5	28	37	42	4	5	3	5	4	2	5	0	5	4	3	4	0								
Correct	5	5	3	20		8	4	3	3	4	13	2	1	29	2	0	5	1	2	4	1	1	4	4	26	13	21	5	24	26	22	4	5	3	5	3	0	5	NA	5	1	3	2	NA								
Acceptable	5	5	3	20	1	8	4	3	6	5	14	5	1	30	2	1	5	1	2	4	1	1	4	4	27	13	25	5	28	26	28	4	5	3	5	3	2	5	NA	5	1	3	3	NA								
Raw Accuracy	100%	100%	100%	100%	NA	80%	80%	43%	30%	80%	81%	33%	100%	94%	67%	0%	100%	100%	100%	100%	100%	100%	100%	100%	62%	100%	75%	100%	86%	70%	52%	100%	100%	100%	100%	75%	0%	100%	NA	100%	25%	100%	50%	NA								
Adjusted Accuracy	100%	100%	100%	100%	NA	80%	80%	43%	60%	100%	88%	83%	100%	97%	67%	100%	100%	100%	100%	100%	100%	100%	100%	100%	64%	100%	89%	100%	100%	70%	67%	100%	100%	100%	100%	75%	100%	100%	NA	100%	25%	100%	75%	NA								
Lower 90% CL	55%	55%	37%	86%	NA	49%	34%	13%	30%	55%	66%	42%	5%	86%	14%	5%	55%	5%	22%	47%	5%	5%	47%	47%	50%	79%	75%	55%	90%	56%	53%	47%	55%	37%	55%	25%	22%	55%	NA	55%	1%	37%	25%	NA								
Upper 90% CI	100%	100%	100%	100%	NA	96%	99%	77%	85%	100%	98%	99%	100%	100%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	77%	100%	97%	100%	100%	82%	79%	100%	100%	100%	100%	99%	100%	100%	NA	100%	75%	100%	99%	NA								

Overall Accuracy	# Points	Accu-racy	Lower 90% CL
Total field points	390		
Level 3: Raw Correct	297	76.2%	73.2%
Map Class: Raw Correct	295	75.6%	72.6%
Level 3: Acceptable	326	83.6%	80.9%
Map Class: Acceptable	325	83.3%	80.7%
Kappa Index		82.6%	

* Points that were declared "Acceptable" despite a different field classification, usually because the vegetation height, density, or composition was on a boundary between the two categories and either would be acceptable

** At the full level 6 map class evaluation level, the only additional point determined to be an unacceptable match between the map class annotation and the field accuracy assessment data was a site classified as Succulent Salt Marsh-Glasswort that was in the field determined to be Succulent Salt Marsh-Saltwort.

*** At the full level 6 map class evaluation level, the map class annotation was Black Mangrove-Red Mangrove Forest (Level 4) and the field accuracy assessment classification was Mixed Mangrove Forest (Level 3) and the map annotation was deemed acceptable.

Appendix I. Microsoft ACCESS Database Table Field Descriptions

Table: **tVegHierarchy**
Description: Vegetation classification hierarchy and class descriptions from the project photointerpreter and the corresponding Rutchey et al. class description. Level 6 is the "Map Class" level. Alt_Classification provides an alternative way of displaying the map by physiognomic type (e.g. Mangroves, Hammocks, etc.) that may occasionally be useful.

Field Name	Data Type	Description
ObjectID	AutoNumber	Internal feature number
Map_Raster_ID	Number	Unique vegetation classification identification number corresponding to map class names and definitions
Map_Class_Name	Text	Mapping classification name most detailed identified level in photointerpreter's vegetation classification hierarchy
New_Map_Class	Text	Yes or no depending on whether is a new class to the Rutchey et al. vegetation classification (v.5/22/2007)
Classification_Level	Number	Map class level in photointerpreter's vegetation classification hierarchy
Alternate_Rutchey_Raster_ID	Number	Vegetation classification Raster ID in Rutchey et al. classification (v5/22/2007)
Photointerpreter_Map_Class	Text	Concise photointerpreter's map class description for Biscayne Vegetation Map project
Rutchey_Class_Description	Memo	Rutchey et al. (v.5/22/2007) map class description; sometimes differ slightly from photointerpreter's description
Rutchey_Class_Location_Description	Memo	Rutchey et al. (v.5/22/2007) map class location information
Level_1	Text	Level 1 of photointerpreter's veg. classification hierarchy for assoc. map class, e.g., Forest, Woodland, Shrubland, Scrub, Marsh, Exotic
Level_2	Text	Level 2 of photointerpreter's veg. classification hierarchy for assoc. map class, e.g., Mangrove Forest, Hammock Forest
Level_3	Text	Level 3 of photointerpreter's veg. classification hierarchy for assoc. map class, e.g., Red Mangrove Forest, White Mangrove Forest
Level_4	Text	Level 4 of photointerpreter's veg. classification hierarchy for assoc. map class, e.g., Black Mangrove-Buttonwood Forest
Level_5	Text	Level 5 of photointerpreter's veg. classification hierarchy for assoc. map class, e.g.,Buttonwood-White Mangrove Shrubland-Graminoid
Level_6	Text	Level 6 of photointerpreter's veg. classification hierarchy for assoc. map class, e.g., Buttonwood-White Mangrove Shrubland-Cordgrass
Alt_Classification	Text	Alternative classification by physiognomic type, e.g. Mangrove, Hammock, Anthropogenic, Exotic, Freshwater Marsh, Beach

Table: **BISC_VegPolys**

Description: Vegetation polygons with names at all 6 levels in the vegetation classification hierarchy, alternate classification name, island name, and map class raster ID.

Field Name	Data Type	Description
ObjectID	AutoNumber	Internal feature number
Shape	OLE Object	Feature geometry
Author	Text	Person responsible for the creation or last edit of that record
Raster_ID	Number	Numeric string representing the mapped vegetation at the lowest level of the classification
L1	Text	Level 1 of photointerpreter's veg. classification hierarchy for assoc. map class, e.g., Forest, Woodland, Shrubland, Scrub, Marsh, Exotic
L2	Text	Level 2 of photointerpreter's veg. classification hierarchy for assoc. map class, e.g., Mangrove Forest, Hammock Forest
L3	Text	Level 3 of photointerpreter's veg. classification hierarchy for assoc. map class, e.g., Red Mangrove Forest, White Mangrove Forest
L4	Text	Level 4 of photointerpreter's veg. classification hierarchy for assoc. map class, e.g., Black Mangrove-Buttonwood Forest
L5	Text	Level 5 of photointerpreter's veg. classification hierarchy for assoc. map class, e.g.,Buttonwood-White Mangrove Shrubland-Graminoid
L6	Text	Level 6 of photointerpreter's veg. classification hierarchy for assoc. map class, e.g., Buttonwood-White Mangrove Shrubland-Cordgrass
Map_Class	Text	Mapping classification name most detailed identified level in photointerpreter's vegetation classification hierarchy
Alt_Classification	Text	Alternative classification by physiognomic type
Island	Text	Common name of the island where polygon resides; if not on an island, mainland is specified
Shape_Length	Number	Length of feature in meters
Shape_Area	Number	Area of feature in meters squared

Table: **BISC_Shoreline_Boundary**

Description: BISC shoreline polygons with western project boundary included in mainland shoreline polygon. Islands and mainland polygons identified by name.

Field Name	Data Type	Description
ObjectID	AutoNumber	Internal feature number
Shape	OLE Object	Feature geometry
Island	Text	Island name
Shape_Length	Number	Length of feature in meters
Shape_Area	Number	Area of feature in meters squared

Table: **BISC_VegPoints_Training**

Description: Training points gathered by the photointerpreter, frequently with SFCN assistance. Fields are not used consistently. However main purpose was to gather data sufficient to enable photointerpreter to know what map class occurred at each point.

Field Name	Data Type	Description
ObjectID	AutoNumber	Internal feature number
Shape	OLE Object	Feature geometry
Date_	Text	date point was visited
Point_X	Number	UTM Easting coordinate (meters)
Point_Y	Number	UTM Northing coordinate (meters)
Device	Text	GPS device name used to collect point
L1	Text	Observed L1 vegetation class
L2	Text	Observed L2 vegetation class
L3	Text	Observed L3 vegetation class
Species_1	Text	Species observed; most common
Species_2	Text	Species observed; 2nd most common
Species_3	Text	Species observed; 3rd most common
Misc	Text	Other notes
Height	Text	Estimated vegetation height (meters)
Cover	Text	Percent cover of vegetation

Table: **BISC_VegPoints_AA**

Description: Accuracy assessment point locations, type of point, decision, comments.

Field Name	Data Type	Description
ObjectID	AutoNumber	Internal feature number
Shape	OLE Object	Feature geometry
AA_ID	Text	Accuracy assessment point name
AA_Date	Text	Date the accuracy assessment point was visited
AA_Time	Text	Time the accuracy assessment point was visited (optional)
AA_Type	Text	Type of accuracy assessment point (point or polygon)
AA_Observer	Text	Initials of SFCN staff who visited the accuracy assessment point
AA_Decision	Text	Does the accuracy assessment classification match the draft vegetation map classification exactly?
AA_Comment	Text	Any comments from the accuracy assessment
AA_Accepted	Text	After additional review, does the aa classification match the draft classification enough to consider them a match?
Location	Text	The area of the park where the accuracy assessment point was located
Xcoord	Number	UTM Easting coordinate (meters) of the accuracy assessment point
Ycoord	Number	UTM Northing coordinate (meters) of hte accuracy assessment point
Lon	Number	Longitude of the accuracy assessment point
Lat	Number	Latitude of the accuracy assessment point
Map_Annotation_Level6	Text	Draft map classification at the accuracy assessment point
Accuracy_Assessment_Field_Class	Text	Field accuracy assessment classification at the accuracy assessment point

Table: **BISC_Park_Boundary**

Description: Biscayne Park Boundary

Field Name	Data Type	Description
ObjectID	AutoNumber	Internal feature number
Shape	OLE Object	Feature geometry
Parkname	Text	Name of the park unit
Shape_Length	Number	Length of feature in meters
Shape_Area	Number	Area of feature in meters squared

Table: **BISC_PhotoIndex**

Description: Imagery photo index.

Field Name	Data Type	Description
ObjectID	AutoNumber	Internal feature number
Shape	OLE Object	Feature geometry
Name	Text	File name of the image
Path	Text	File path of the image
Format	Text	File type of the image
Bands	Number	Number of image bands
Pixel_Type	Text	Pixel bit depth
SP_Ref	Text	Spatial reference
Unit	Text	Length unit
TileName	Text	Tile name
Shape_Length	Number	Length of feature in meters
Shape_Area	Number	Area of feature in meters squared

Appendix J. Vegetation Classification System for South Florida Natural Areas (ver. 5/22/2007) – *REFERENCE ONLY*

The Rutchey et al. (2007) vegetation classification key is provided for reference purposes only. Please refer to Appendix C for the Vegetation Classification and Hierarchical Key used for the Biscayne National Park map.

Citation:

Rutchey, K., T.N. Schall, R.F. Doren, A. Atkinson, M.S. Ross, D.T. Jones, M. Madden, L. Vilchek, K.A. Bradley, J.R. Snyder, J.N. Burch, T. Pernas, B. Witcher, M. Pyne, R. White, T.J. Smith, J. Sadle, C.S. Smith, M.E. Patterson, and G.D. Gann. 2006 (ver. 5/22/2007). Vegetation Classification for South Florida Natural Areas. USGS Open File Report 2006-1240, Saint Petersburg, Florida.

Class ID	Raster ID	Name	Level	Description	Location
F	100000	Forest	1	High-density stands of trees (≥50% tree canopy cover) with heights greater than five meters. Tree canopy cover from 50% - 60% will be considered Forest unless specifically described in the Woodland section of this classification system.	Found throughout Florida.
FM	110000	Mangrove Forest	2	Regularly flooded forests that are typically found along saltwater shorelines, including Black Mangrove (*Avicennia germinans*), White Mangrove (*Laguncularia racemosa*), Red Mangrove (*Rhizophora mangle*), and Buttonwood (*Conocarpus erectus*).	Found along coastal Florida.
FMa	111000	Black Mangrove Forest	3	Black Mangrove (*Avicennia germinans*) dominant forest. Black mangrove is distinguishable from other mangrove species by leaves with grayish undersurfaces, by green, flattened "lima bean-like" fruits, by dark to blackish bark, and by the presence of numerous short breathing roots projecting vertically from the ground below and around the tree.	Found along coastal Florida. Predominates in the upper part of the intertidal zone and into the irregularly flooded higher elevations; common forest fringing Florida Bay along Snake Bite in ENP; sometimes found on higher drier soils than the red or white mangrove. However, it can be found amongst any of the other Mangrove communities.
FMc	112000	Buttonwood Forest	3	Buttonwood (*Conocarpus erectus*) dominant forest with variable understory composition.	Generally coastal in distribution, normally found along the landward edge of the mangrove zone and along the edges of hammocks bordering the transition zone between freshwater and saltwater environments; thriving in areas that are only occasionally subjected to tidal washing (e.g., elevated ridges in or near the tidal zone); southern Florida and the Keys; more specifically found along the Buttonwood ridge in ENP and around Coot Bay. However, it can be found amongst any of the other Mangrove communities.
FMl	113000	White Mangrove Forest	3	White Mangrove (*Laguncularia racemosa*) dominant forest.	Found along coastal Florida. Occurs throughout the intertidal zone, but predominatley in the irregularly flooded higher portions of the swamp. However, it can be found amongst any of the other Mangrove communities.
FMr	114000	Red Mangrove Forest	3	Red Mangrove (*Rhizophora mangle*) dominant forest.	Found along coastal Florida primarily in the middle and lower portions of the intertidal and upper subtidal zone. However, it can be found amongst any of the other Mangrove communities.
FMX	115000	Mixed Mangrove Forest	3	Mix of mangrove species with no particular species of dominance.	
FMXac	115100	Black Mangrove-Buttonwood Forest	4	Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and Buttonwood (*Conocarpus erectus*) trees.	
FMXal	115200	Black Mangrove-White Mangrove Forest	4	Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) trees.	
FMXar	115300	Black Mangrove-Red Mangrove Forest	4	Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) trees.	
FMXcl	115400	Buttonwood-White Mangrove Forest	4	Co-dominant mix (60/40% or 40/60% split) of Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) trees.	
FMXcr	115500	Buttonwood-Red Mangrove Forest	4	Co-dominant mix (60/40% or 40/60% split) of Buttonwood (*Conocarpus erectus*) and Red Mangrove (*Rhizophora mangle*) trees.	
FMXlr	115600	White Mangrove-Red Mangrove Forest	4	Co-dominant mix (60/40% or 40/60% split) of White Mangrove (*Laguncularia racemosa*) and Red Mangrove (*Rhizophora mangle*) trees.	
FS	120000	Swamp Forest	2	Seasonally to semi-permanently flooded freshwater forests.	Found throughout Florida.
FSa	121000	Red Maple Forest	3	Red Maple (*Acer rubrum*) dominant forest.	Common to wet areas and moist woods throughout system southward to about Tamiami Trail.
FSc	122000	Paurotis Palm Forest	3	Paurotis Palm (*Acoelorrhaphe wrightii*) dominant forest.	Commonly found landward of the mangrove zone from around US 1 west to Flamingo; also common to the Fakahatchee Strand State Preserve and can be a common understory component of swamp forests, including portions of Everglades tree islands.
FSaf	123000	Pond Apple-Pop Ash Forest	3	Co-dominant mix (60/40% or 40/60% split) of Pond Apple (*Annona glabra*) and Pop Ash (*Fraxinus caroliniana*) trees, generally including a diverse epiphytic assemblage.	Commonly inundated 9-12 months a year and occurring in the center of large cypress domes and strands, such as in Barnes Strand in BICY; also common to Florida Panther NWR.
FSB	124000	Bayhead Forest	3	Mix of Swamp Bay (*Persea palustris*), Red Bay (*Persea borbonia*), Cocoplum (*Chrysobalanus icaco*), Dahoon Holly (*Ilex cassine*), Willow (*Salix caroliniana*), Wax Myrtle (*Myrica cerifera*), Sweetbay (*Magnolia virginiana*), Cypress (*Taxodium* spp.), Pond Apple (*Annona glabra*), and occasionally Buttonwood (*Conocarpus erectus*).	Typical of tree islands in Shark River Slough, C-111, and the WCAs; commonly inundated 4-10 months a year.

Class ID	Raster ID	Name	Level	Description	Location
FSBT	141000	Transitional Bayhead Forest	3	Mix of trees characterized by Buttonwood (*Conocarpus erectus*), Red Mangrove (*Rhizophora mangle*), Cocoplum (*Chrysobalanus icaco*), Wax Myrtle (*Myrica cerifera*), Mahogany (*Swietenia mahagoni*), Poisonwood (*Metopium toxiferum*), and occasionally Swamp Bay (*Persea palustris*), Red Bay (*P. borbonia*), Sweetbay (*Magnolia virginiana*), and Dahoon Holly (*Ilex cassine*). The presence of Buttonwood and Red Mangrove set this class apart from the Bayhead Forest class. Signatures for Buttonwood and Dahoon Holly (*Ilex cassine*) are often confused in regions where the two species co-exist, leaving Red Mangrove as the distinguishing component between the Transitional Bayhead and Bayhead classes in regions where both classes are likely to be found.	Typically occurring in a several kilometer wide band in the southern reaches of Taylor Slough and the Southeast Saline Everglades, extending west to Mahogany Hammock in ENP, and forming a transitional forest between the exclusively freshwater Bayhead forests to the north and the coastal Buttonwood and Mangrove forests to the south. Most often associated with tree islands within the scrub Red Mangrove zone.
FSf	142000	Pop Ash Forest	3	Pop Ash (*Fraxinus caroliniana*) dominant forest.	Found in Florida Panther NWR.
FSH	125000	Hardwood Swamp Forest	3	Mix of lowland hardwood trees such as Laurel Oak (*Quercus laurifolia*), Red Maple (*Acer rubrum*), Cabbage Palm (*Sabal palmetto*), Pop Ash (*Fraxinus caroliniana*), Swamp Bay (*Persea palustris*), Red Bay (*P. borbonia*), and Sweetbay (*Magnolia virginiana*).	Found in Gator Hook Strand and East Crossing Strand in BICY, and in the Florida Panther NWR
FSt	127000	Cypress Forest	3	Pond Cypress (*Taxodium ascendens*) and/or Bald Cypress (*T. distichum*) dominant forest with common understory vegetation consisting of Pond Apple (*Annona glabra*), Wax Myrtle (*Myrica cerifera*), Pop Ash (*Fraxinus caroliniana*), Cocoplum (*Chrysobalanus icaco*), and Leather Fern (*Acrostichum danaeifolium*).	Common in EVER, BICY, western WCA3, Strazzulla property adjacent to eastern Loxahatchee NWR, JW Corbett and Pal-Mar WMA; found throughout Florida, except in the southernmost peninsula and the Keys.
FStD	127100	Cypress Forest-Dome	4	Pond Cypress (*Taxodium ascendens*) and/or Bald Cypress (*T. distichum*) dominant forest typically found in a pond-like depression.	Common in EVER, BICY, western WCA3, JW Corbett and Pal-Mar WMA.
FStS	127300	Cypress Forest-Strand	4	Pond Cypress (*Taxodium ascendens*) and/or Bald Cypress (*T. distichum*) dominant forest typically found in an elongated slough-like or open ended depression.	Common in EVER, BICY, western WCA3.
FStH	128000	Cypress-Hardwood Forest	3	Co-dominant mix (60/40% or 40/60% split) of Cypress (*Taxodium* spp.) with lowland hardwood trees such as Red Maple (*Acer rubrum*) and Laurel Oak (*Quercus laurifolia*). Common understory vegetation often consists of Pond Apple (*Annona glabra*), Wax Myrtle (*Myrica cerifera*), Pop Ash (*Fraxinus caroliniana*), Cocoplum (*Chrysobalanus icaco*), and Leather Fern (*Acrostichum danaeifolium*).	Common in Sweetwater Strand in BICY and Florida Panther NWR.
FStp	129000	Cypress-Pine Forest	3	Mix of Cypress (*Taxodium* spp.) with Slash Pine (*Pinus elliottii var. densa*). Common understory vegetation can include mixed hardwood shrubs or various graminoids.	Common in BICY and Florida Panther NWR.
FH	130000	Hammock Forest	2	Briefly flooded forests	Found throughout Florida.
FHC	131000	Coastal Hardwood Hammock	3	Most common species are Pigeon Plum (Coccoloba diversifolia), False Mastic (Sideroxylon foetidissimum), Gumbo Limbo (Bursera simaruba), Strangler Fig (Ficus aurea), and White Stopper (Eugenia axillaris) but can potentially have many of the same species found in the Tropical Hardwood Hammock (FHS) category. However, it must also include some of the following in species as well: Jamaican Dogwood (Piscidia piscipula), Spanish Stopper (Eugenia foetidia), Mahogany (Swietenia mahagoni), Cabbage Palm (Sabal Palmetto), Wild Lime (Zanthoxylum fagara),] Blackbead (Pithecellobium keyense), Spanish Bayonet (Yucca aloifolia), Catclaw Blackbead (Pithecellobium unguis-cati), Triangle Cactus (Acanthocereus tetragonus), Prickly Pear (Opuntia stricta), Wild Cinnamon (Canella winterana), Sea Grape (Coccoloba uvifera), Buttonwood (Conocarpus erectus), Geiger Tree (Cordia Sebestena), Milk Bark (Drypetes lateriflora), Seven Year Apple (Genipa clusiifolia), Crabwood (Gymnanthes lucida), Mancinella (Hippomane mancinella), Joewood (Jacquinia keyensis), and Thrinax (Thrinax morrissii, Thrinax. radiata).	Found in lower Gulf and Florida Bay coastal areas.
FHa	132000	Cabbage Palm Hammock	3	Cabbage Palm (*Sabal palmetto*) dominated forest with sparse, generally less than 25%, Laurel Oak (*Quercus laurifolia*), Live Oak (*Q. virginiana*), Strangler Fig (*Ficus aurea*), and Swamp Fern (*Acrostichum* spp.) as a common understory component.	Common in BICY and Florida Panther NWR.

Class ID	Raster ID	Name	Level	Description	Location
FHM	135000	Tropical Hardwood Shell Mound	3	Mix of Gumbo Limbo (*Bursera simaruba*), Strangler Fig (*Ficus aurea*), False Mastic (*Sideroxylon foetidissimum*), Jamaican Dogwood (*Piscidia piscipula*), Cabbage Palm (*Sabal Palmetto*), Inkwood (*Exothea paniculata*), Black Ironwood (*Krugiodendron ferreum*), and occasionally Royal Palm (*Roystonea regia*) with plants of ethnobotanical importance such as White Stopper (*Eugenia axillaris*), Spanish Stopper (*Eugenia foetidia*), Wild Coffee (*Psychotria nervosa*), Marlberry (A*rdisia escallonioides*), Pigeon Plum (*Coccoloba diversifolia*), Indigoberry (*Randia aculeata*), Milkberry (*Chiococca alba*), Citrus (*Citrus* spp.), Guava (*Psidium* guajava), Soapberry (*Sapindus saponaria*), Papaya (*Carica papaya*), False Sisal (*Agave decipiens*), among others. This class is distinguished from other Hardwood Hammock classes by the presence of many plants introduced by early human inhabitants to the region as well as being specifically located on shell mounds.	Found throughout the Ten Thousand Islands area.
FHS	133000	Tropical Hardwood Hammock	3	Mix of Live Oak (Quercus virginiana), False Tamarind (Lysiloma latisiliquum), Gumbo Limbo (Bursera simaruba), Poisonwood (Metopium toxiferum), Pigeon Plum (Coccoloba diversifolia), and White Stopper (Eugenia axillaris). May also contain Strangler Fig (Ficus aurea), Swamp Bay (Persea borbonia), Dahoon Holly (Ilex Cassine), Sugarberry (Celtis laevigata), False Mastic (Sideroxylon foetidissimum), Wax Myrtle (Myrica cerifera), and Myrsine (Myrsine floridana), Willow Bustic (Sideroxylon salicifolium), Water Oak (Quercus nigra), Red Maple (Acer rubrum), Laurel Oak (Quercus laurifolia) and Lancewood (Nectandra coriacea). Canopy heights often exceed 8 meters, except in the Keys where the canopy is typically shorter.	Found in interor regions of the Atlantic Coastal Ridge, Big Cypress, Shark Slough and adjacent prairies, Taylor Slough and Southeast Everglades
FHT	134000	Temperate Hardwood Hammock	3	Mix of Laurel Oak (*Quercus laurifolia*), Live Oak (*Q. virginiana*), Cabbage Palm (*Sabal palmetto*), and occasionally Strangler Fig (*Ficus aurea*), Red Mulberry (*Morus rubra*), Hackberry (*Celtis laevigata*), Common Persimmon (*Diospyros virginiana*), and/or Saw Palmetto (*Serenoa repens*).	Commonly found north of US 41 and on sandy substrates with a dense organic layer. Common to BICY, especially Bear Island, and JW Corbett WMA.
FHp	136000	Hardwood Hammock - Pine Forest	3	A co-dominate mix (40/60 to 60/40) of Slash Pine (*Pinus elliottii var. densa*) with Laural Oak (*Quercus laurifolia*), Live Oak (*Q. virginiana*), and/or Cabbage Palm (*Sabal palmetto*). Common understory vegetation can include mixed hardwood shrubs Red Mulberry (*Morus rubra*), Hackberry (*Celtis laevigata*), Common Persimmon (*Diospyros virginiana*), and/or Saw Palmetto (*Serenoa repens*).	
W	200000	Woodland	1	Specific described communities of low-density stands of trees (10 - 60% tree canopy cover) with heights greater than five meters in a matrix of shrubs, graminoids, and/or herbaceous vegetation.	Found throughout Florida.
WM	210000	Mangrove Woodland	2	Regularly flooded woodlands that are typically found along saltwater shorelines.	Found along coastal Florida.
WMa	212000	Black Mangrove Woodland	3	Black Mangrove (*Avicennia germinans*) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.	
WMaG	212010	Black Mangrove-Graminoid	5	Black Mangrove (*Avicennia germinans*) in a matrix composed predominately of graminoids.	
WMaO	212020	Black Mangrove Woodland-Open Marsh	5	Black Mangrove (*Avicennia germinans*) in a matrix composed predominately of Open Marsh.	
WMaS	212030	Black Mangrove Woodland-Succulent	5	Black Mangrove (*Avicennia germinans*) in a matrix composed predominately of succulents.	
WMc	211000	Buttonwood Woodland	3	Buttonwood (*Conocarpus erectus*) in a matrix composed of salt marsh graminoids, herbs, and/or succulents.	Generally coastal in distribution, normally found along the landward edge of the mangrove zone and along the edges of hammocks bordering the transition zone between freshwater and saltwater environments; thriving in areas that are only occasionally subjected to tidal washing (e.g., elevated ridges in or near the tidal zone); southern Florida and the Keys; more specifically found along the Buttonwood ridge in ENP and around Coot Bay. However, it can be found amongst any of the other Mangrove communities.
WMcB	211040	Buttonwood Woodland-Broadleaf	5	Buttonwood *(Conocarpus erectus)* in a matrix composed predominately of broadleaf emergents.	
WMcBa	211041	Buttonwood Woodland-Leather Fern	6	Buttonwood *(Conocarpus erectus)* in a matrix composed predominately of Golden Leather Fern (*Acrostichum aureum*) and/or Giant Leather Fern (*A. danaeifolium*).	
WMcG	211010	Buttonwood Woodland-Graminoid	5	Buttonwood *(Conocarpus erectus)* in a matrix composed predominately of graminoids.	
WMcO	211020	Buttonwood Woodland-Open Marsh	5	Buttonwood *(Conocarpus erectus)* in a matrix composed predominately of Open Marsh. Mangroves can occur in both salt and freshwater dominated marshes.	

Class ID	Raster ID	Name	Level	Description	Location
WMcS	211030	Buttonwood Woodland-Succulent	5	Buttonwood *(Conocarpus erectus)* in a matrix composed predominately of succulents.	
WS	220000	Swamp Woodland	2	Seasonally to semi-permanently flooded freshwater woodlands.	Found throughout Florida.
WSp	221000	Pine Lowland	3	Slash Pine (*Pinus elliottii var. densa*) in a matrix composed of marsh graminoids, herbs, and/or shrubs. Also known as hydric pine flatwoods.	Common to EVER and BICY.
WSpG	221010	Pine Lowland-Graminoid	5	Slash Pine (*Pinus elliottii var. densa*) in a matrix composed predominately of graminoids, such as Sawgrass (*Cladium jamaicense*), Muhly Grass (*Muhlenbergia capillaris*), Panicgrass (*Panicum* spp.), Paspalum (*Paspalum* spp.), Little Bluestem (*Schizachyrium scoparium*), Flatsedge (*Cyperus* spp.), Spikerush (*Eleocharis* spp.), Fimbry (*Fimbristylis* spp.), Beaksedge (*Rhynchospora* spp.), Bulrush (*Scirpus* spp.), Nutrush (*Scleria* spp.), Yelloweyed Grass (*Xyris* spp.), Bluestem (*Andropogon* spp.), Threeawn (*Aristida* spp.), Witchgrass (*Dichanthelium* spp.), Lovegrass (*Eragrostis* spp.), Dropseed (*Sporobulus* spp.), and Hairsedge (*Bulbostylis* spp.).	
WSpS	221030	Pine Lowland-Shrub	5	Slash Pine (*Pinus elliottii var. densa*) in a matrix composed predominately of shrubs and small trees, such as Wax Myrtle (Myrica cerifera), Cabbage Palm (*Sabal palmetto*), Dahoon Holly (*Ilex cassine*), Red Bay (*Persea palustris*), Buttonbush (*Cephalanthus occidentalis*), and other hardwood swamp species.	
WSpX	221040	Pine Lowland-Mixed	5	Slash Pine (*Pinus elliottii var. densa*) in a matrix composed of a co-dominant mix (60/40% or 40/60% split) of lowland graminoids and shrubs.	
WSs	223000	Cabbage Palm Lowland	3	Cabbage Palm (*Sabal palmetto*) in a matrix composed of marsh graminoids, herbs, and/or shrubs.	
WSsG	223010	Cabbage Palm Lowland-Graminoid	5	Cabbage Palm *(Sabal palmetto)* in a matrix composed predominately of marsh graminoids, such as Sawgrass (*Cladium jamaicense*), Muhly Grass (*Muhlenbergia capillaris*), among others.	
WSsGc	223011	Cabbage Palm Lowland-Sawgrass	6	Cabbage Palm *(Sabal palmetto)* in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).	
WSsS	223020	Cabbage Palm Lowland-Shrub	5	Cabbage Palm *(Sabal palmetto)* in a matrix composed predominately of marsh shrubs, such as Buttonwood (*Conocarpus erectus*), Wax Myrtle (*Myrica cerifera*), among others.	
WSsX	223030	Cabbage Palm Lowland-Mixed	5	Cabbage Palm (*Sabal palmetto*) in a matrix composed of a co-dominant mix (60/40% or 40/60% split) of marsh graminoids and shrubs.	
WSt	222000	Cypress Woodland	3	Bald Cypress (T*axodium distichum*) and/or Pond Cypress (*T. ascendens*) in a matrix composed of Open Marsh, graminoids, herbs, and/or shrubs.	
WStG	222010	Cypress Woodland-Graminoid	5	Bald Cypress (*Taxodium distichum*) and/or Pond Cypress (*T. ascendens*) in a matrix composed predominately of graminoids, such as Sawgrass (*Cladium jamaisense*), Switchgrass (*Panicum vergatum*), Maidencane (*P. hemitomon*), among others.	
WStO	222020	Cypress Woodland-Open Marsh	5	Bald Cypress (*Taxodium distichum*) and/or Pond Cypress (*T. ascendens*) in a matrix composed predominately of Open Marsh.	
WStS	222030	Cypress Woodland-Shrub	5	Bald Cypress (*Taxodium distichum*) and/or Pond Cypress (*T. ascendens*) in a matrix composed predominately of shrubs, such as Wax Myrtle (*Myrica cerifera*), Pond Apple (*Annona glabra*), and/or Cocoplum (*Chrysobalanus icaco*).	
WSh	224000	Hardwood Swamp Woodland	3	Mix of lowland hardwood trees such as Laural Oak (Quercus laurifolia), Red Maple (Acer rubrum), Cabbage Palm (Sabal palmetto), Pop Ash (Fraxinus caroliniana), Swamp Bay (Persea palustris), Red Bay (P. borbonia), and Sweetbay (Magnolia virginiana).	
WU	230000	Upland Woodland	2	Briefly flooded woodlands	Found throughout Florida.
WUp	231000	Pine Upland	3	Slash Pine (*Pinus elliottii var. densa*) in a matrix composed of upland graminoids, herbs, and/or shrubs. Also known as a mesic pine flatwoods.	
WUpG	231010	Pine Upland-Graminoid	5	Slash Pine (*Pinus elliottii var. densa*) in a matrix composed predominately of graminoids, such as Broomgrass (*Andropogon longiberis*), Gamagrass (*Tripsacum* spp.), Threeawn (*Aristida* spp.), Lovegrass (*Eragrostis* spp.), Witchgrass (*Dichanthelium* spp.), Panicgrass (*Panicum* spp.), among others.	

Class ID	Raster ID	Name	Level	Description	Location
WUpS	231020	Pine Upland-Shrub	5	Slash Pine (*Pinus elliottii var. densa*) in a matrix composed predominately of shrubs and small trees, such as Wax Myrtle (*Myrica cerifera*), Saw Palmetto (*Serenoa repens*), Cabbage Palm (*Sabal palmetto*), Fetterbush (*Lyonia lucida*), Tarflower (*Bejaria racemosa*), Rusty Staggerbush (*Lyonia ferruginea*), St. John's Wort (*Hypericum* spp.), and other upland hardwood species.	
WUpSs	231021	Pine Upland-Saw Palmetto	6	Slash Pine (*Pinus elliottii var. densa*) in a matrix composed predominately of Saw Palmetto (*Serenoa repens*).	
WUpX	231030	Pine Upland-Mixed	5	Slash Pine (*Pinus elliottii var. densa*) in a matrix composed of a co-dominant mix (60/40% or 40/60% split) of upland graminoids and shrubs.	
WUpO	231040	Pine Upland-Open Prairie	5	Slash Pine (*Pinus elliottii var. densa*) in a matrix composed predominately of Open Prairie.	
WUpR	231100	Pine Rockland	4	Pine Upland found on low ridges of oolitic limestone.	Found on the Miami rock ridge, in the Florida Keys, EVER, and in BICY.
WUpRG	231110	Pine Rockland-Graminoid	5	Pine Rockland in a matrix composed predominately of graminoids, such as Broomgrass (*Andropogon longiberis*), Gamagrass (*Tripsacum* spp.), Threeawn (*Aristida* spp.), Lovegrass (*Eragrostis* spp.), Witchgrass (*Dichanthelium* spp.), Panicgrass (*Panicum* spp.), among others.	
WUpRS	231120	Pine Rockland-Shrub	5	Pine Rockland in a matrix composed predominately of shrubs and small trees, such as Wax Myrtle (*Myrica cerifera*), Saw Palmetto (*Serenoa repens*), Cabbage Palm (*Sabal palmetto*), Fetterbush (*Lyonia lucida*), Tarflower (*Bejaria racemosa*), Rusty Staggerbush (*Lyonia ferruginea*), St. John's Wort (*Hypericum* spp.), and other upland hardwood species.	
WUpRSs	231121	Pine Rockland-Saw Palmetto	6	Pine Rockland in a matrix composed predominately of Saw Palmetto (*Serenoa repens*).	
WUpRX	231130	Pine Rockland-Mixed	5	Pine Rockland in a matrix composed of a co-dominant mix (60/40% or 40/60% split) of upland graminoids and shrubs.	
WUpRO	231140	Pine Rockland-Open Prairie	5	Pine Rockland in a matrix composed predominately of Open Prairie.	
WUpF	231200	Pine Flatwoods	4	Pine Upland found on moderately to well-drained sandy soils.	
WUpFG	231210	Pine Flatwoods - Graminoid	5	Pine Flatwoods in a matrix composed predominately of graminoids, such as Broomgrass (*Andropogon longiberis*), Gamagrass (*Tripsacum* spp.), Threeawn (*Aristida* spp.), Lovegrass (*Eragrostis* spp.), Witchgrass (*Dichanthelium* spp.), Panicgrass (*Panicum* spp.), among others.	
WUpFS	231220	Pine Flatwoods - Shrub	5	Pine Flatwoods in a matrix composed predominately of shrubs and small trees, such as Wax Myrtle (*Myrica cerifera*), Saw Palmetto (*Serenoa repens*), Cabbage Palm (*Sabal palmetto*), Fetterbush (*Lyonia lucida*), Tarflower (*Bejaria racemosa*), Rusty Staggerbush (*Lyonia ferruginea*), St. John's Wort (*Hypericum* spp.), and other upland hardwood species.	
WUpFSs	231221	Pine Flatwoods - Saw Palmetto	6	Pine Flatwoods in a matrix composed predominately of Saw Palmetto (*Serenoa repens*).	
WUpFX	231230	Pine Flatwoods - Mixed	5	Pine Flatwoods in a matrix composed of a co-dominant mix (60/40% or 40/60% split) of upland graminoids and shrubs.	
WUpFO	231240	Pine Flatwoods - Open Prairie	5	Pine Flatwoods in a matrix composed predominately of Open Prairie.	
WUs	232000	Cabbage Palm Upland	3	Cabbage Palm (*Sabal palmetto*) in a matrix composed of upland graminoids, herbs, and/or shrubs.	Common in and around Florida Panther NWR and near the intersection of I-75 and State Route 29.
WUsG	232010	Cabbage Palm Upland-Graminoid	5	Cabbage Palm *(Sabal palmetto)* in a matrix composed predominately of upland graminoids.	
WUsS	232020	Cabbage Palm Upland-Shrub	5	Cabbage Palm *(Sabal palmetto)* in a matrix composed predominately of upland shrubs, such as Saw Palmetto (*Serenoa repens*).	
WUsSs	232021	Cabbage Palm Upland-Saw Palmetto	6	Cabbage Palm *(Sabal palmetto)* in a matrix composed predominately of Saw Palmetto (*Serenoa repens*).	
WUsX	232030	Cabbage Palm Upland-Mixed	5	Cabbage Palm (*Sabal palmetto*) in a matrix composed of a co-dominant mix (60/40% or 40/60% split) of upland graminoids and shrubs.	

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WUh	233000	Upland Woodland	3	Mix of Live Oak (Quercus virginiana), False Tamarind (Lysiloma latisiliquum), Gumbo Limbo (Bursera simaruba), Poisonwood (Metopium toxiferum), Pigeon Plum (Coccoloba diversifolia), and White Stopper (Eugenia axillaris). May also contain Strangler Fig (Ficus aurea), Swamp Bay (Persea borbonia), Dahoon Holly (Ilex Cassine), Sugarberry (Celtis laevigata), False Mastic (Sideroxylon foetidissimum), Wax Myrtle (Myrica cerifera), and Myrsine (Myrsine floridana), Willow Bustic (Sideroxylon salicifolium), Water Oak (Quercus nigra), Red Maple (Acer rubrum), Laural Oak (Quercus laurifolia) and Lancewood (Nectandra coriacea), Laural Oak (Quercus laurifolia), Cabbage Palm (Sabal palmetto), Red Mulberry (Morus rubra), Hackberry (Celtis laevigata), and Common Persimmon (Diospyros virginiana).	
S	300000	Shrubland	1	High-density stands of small trees and/or shrubs (≥50% tree/shrub canopy cover) with heights less than five meters. Exception: Mangrove shrubs less than or equal to 2 meters are scrub - see scrub section; Willow shrublands can be greater than 5 meters.	Found throughout Florida.
SM	310000	Mangrove Shrubland	2	Regularly flooded shrublands that are typically found along saltwater shorelines, including Black Mangrove (*Avicennia germinans*), White Mangrove (*Laguncularia racemosa*), Red Mangrove (*Rhizophora mangle*), Buttonwood (*Conocarpus erectus*), and Sea-Oxeye (*Borrichia* spp). Canopy heights are generally less than five meters and greater than two meters.	Found along coastal Florida.
SMa	311000	Black Mangrove Shrubland	3	Black Mangrove (*Avicennia germinans*) dominant shrubland. Black mangrove is distinguishable from other mangrove species by leaves with grayish undersurfaces, by green, flattened “lima bean-like” fruits, by dark to blackish bark, and by the presence of numerous short breathing roots projecting vertically from the ground below and around the tree.	Found along coastal Florida. Predominates in the upper part of the intertidal zone and into the irregularly flooded higher elevations; common forest fringing Florida Bay along Snake Bite in ENP; sometimes found on higher drier soils than the red or white mangrove. However, it can be found amongst any of the other Mangrove communities.
SMb	312000	Sea-Oxeye Shrubland	3	Sea-Oxeye (*Borrichia arborescens*) dominant shrubland.	Typically found in coastal areas of BISC and southern EVER where tidal flooding is common.
SMc	313000	Buttonwood Shrubland	3	Buttonwood (*Conocarpus erectus*) dominant shrubland.	Generally coastal in distribution, normally found along the landward edge of the mangrove zone and along the edges of hammocks bordering the transition zone between freshwater and saltwater environments; thriving in areas that are only occasionally subjected to tidal washing (e.g., elevated ridges in or near the tidal zone); southern Florida and the Keys; more specifically found along the Buttonwood ridge in ENP and around Coot Bay. However, it can be found amongst any of the other Mangrove communities.
SMl	314000	White Mangrove Shrubland	3	White Mangrove (*Laguncularia racemosa*) dominant shrubland.	Found along coastal Florida. Occurs throughout the intertidal zone, but predominatley in the irregularly flooded higher portions of the swamp. However, it can be found amongst any of the other Mangrove communities.
SMr	315000	Red Mangrove Shrubland	3	Red Mangrove (*Rhizophora mangle*) dominant shrubland.	Found along coastal Florida primarily in the middle and lower portions of the intertidal and upper subtidal zone. However, it can be found amongst any of the other Mangrove communities.
SMX	316000	Mixed Mangrove Shrubland	3	Mix of mangrove species with no particular species of dominance.	
SMXac	316100	Black Mangrove-Buttonwood Shrubland	4	Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and Buttonwood (*Conocarpus erectus*) shrubs.	
SMXal	316200	Black Mangrove-White Mangrove Shrubland	4	Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) shrubs.	
SMXar	316300	Black Mangrove-Red Mangrove Shrubland	4	Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) shrubs.	
SMXcc	316400	Buttonwood-Cocoplum Shrubland	4	Co-dominant mix (60/40% or 40/60% split) of Buttonwood (*Conocarpus erectus*) and Cocoplum (*Chrysobalanus icaco*) shrubs.	Commonly found in the transition zone between freshwater and tidal environments within EVER.
SMXcl	316500	Buttonwood-White Mangrove Shrubland	4	Co-dominant mix (60/40% or 40/60% split) of Buttonwood (*Conocarpus erectus*) or White Mangrove (*Laguncularia racemosa*) shrubs.	
SMXcr	316600	Buttonwood-Red Mangrove Shrubland	4	Co-dominant mix (60/40% or 40/60% split) of Buttonwood (*Conocarpus erectus*) and Red Mangrove (*Rhizophora mangle*) shrubs.	
SMXlr	316700	White Mangrove-Red Mangrove Shrubland	4	Co-dominant mix (60/40% or 40/60% split) of White Mangrove (*Laguncularia racemosa*) and Red Mangrove (*Rhizophora mangle*) shrubs.	

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SMXrc	316800	Red Mangrove-Cocoplum Shrubland	4	Co-dominant mix (60/40% or 40/60% split) of Red Mangrove (*Rhizophora mangle*) and Cocoplum (*Chrysobalanus icaco*) shrubs.	Found in the transition zone between freshwater and tidal environments within EVER.
SS	320000	Swamp Shrubland	2	Seasonally to semi-permanently flooded freshwater shrublands.	Found throughout Florida. Some of these shrublands can be found in coastal areas along the transition zone between tidal and freshwater environments.
SSaf	333000	Pond Apple-Pop Ash Shrubland	3	Co-dominant mix (60/40% or 40/60% split) of Pond Apple (*Annona glabra*) and Pop Ash (*Fraxinus caroliniana*) shrubs.	
SSa	321000	Pond Apple Shrubland	3	Pond Apple (*Annona glabra*) dominant shrubland.	Commonly found on the banks of freshwater ponds and streams and wet hammocks; from about Brevard County southward; sparsely distributed in the Keys, especially on Big Pine and Lignum Vitae Keys.
SSr	322000	Falsewillow Shrubland	3	Broombush Falsewillow (*Baccharis dioica*), Silverling (*B. glomeruliflora*), and/or Groundsel Bush (*B. halimifolia*) dominant shrubland.	Found throughout Florida along the edges of freshwater and brackish marshes, wet coastal hammocks, shores of estuaries and bays, and various disturbed places, both wet and dry.
SSB	323000	Bayhead Shrubland	3	Mix of Swamp Bay (*Persea palustris*), Red Bay (*Persea borbonia*), Cocoplum (*Chrysobalanus icaco*), Dahoon Holly (*Ilex cassine*), Willow (*Salix caroliniana*), Wax Myrtle (*Myrica cerifera*), Sweetbay (*Magnolia virginiana*), Cypress (*Taxodium* spp.), Pond Apple (*Annona glabra*), and occasionally Buttonwood (*Conocarpus erectus*).	Typical of tree islands within WCA2 and Loxahatchee NWR where tree heights rarely exceed 5 meters.
SSBT	332000	Transitional Bayhead Shrubland	3	Mix of shrubs characterized by Buttonwood (*Conocarpus erectus*), Red Mangrove (*Rhizophora mangle*), Cocoplum (*Chrysobalanus icaco*), Wax Myrtle (*Myrica cerifera*), Mahogany (*Swietenia mahagoni*), Poisonwood (*Metopium toxiferum*), and occasionally Swamp Bay (*Persea palustris*), Red Bay (*P. borbonia*), Sweetbay (*Magnolia virginiana*), and Dahoon Holly (*Ilex cassine*). The presence of Buttonwood and Red Mangrove set this class apart from the Bayhead Shrub class. Signatures for Buttonwood and Dahoon Holly (*Ilex cassine*) are often confused in regions where the two species co-exist, leaving Red Mangrove as the distinguishing component between the Transitional Bayhead and Bayhead classes in regions where both classes are likely to be found.	Typically occurring in a several kilometer wide band in the southern reaches of Taylor Slough and the Southeast Saline Everglades, extending west to Mahogany Hammock in ENP, and forming a transitional forest between the exclusively freshwater Bayhead forests to the north and the coastal Buttonwood and Mangrove forests to the south. Most often associated with tree islands within the scrub Red Mangrove zone.
SSc	324000	Buttonbush Shrubland	3	Buttonbush (*Cephalanthus occidentalis*) dominant shrubland.	Commonly found in wet areas and sites with standing water, such as swamps, sloughs, stream banks, depressions, marshes, and edges of ponds and lakes; throughout Florida except in the Keys.
SSy	325000	Cocoplum Shrubland	3	Cocoplum (*Chrysobalanus icaco*) dominant shrubland.	Found in low hammocks, beaches, sand dunes, cypress heads, and other wet habitats, primarily along the coast but occasionally in inland swamps; Brevard and Charlotte Counties southward and throughout the Keys; common component of tree islands within Loxahatchee NWR and of the tidal-freshwater transition zone within EVER.
SSf	326000	Pop Ash Shrubland	3	Pop Ash (*Fraxinus caroliniana*) dominant shrubland.	Commonly found in areas of prolonged deep inundation; riverine swamps and flood plains, wooded sloughs, wet depressions in flatwoods, ponds; distributed throughout northern Florida, southward to about the Tamiami Trail on the west coast, Martin and Palm Beach counties on the east coast.
SSi	327000	Dahoon Holly Shrubland	3	Dahoon Holly (*Ilex cassine*) dominant shrubland.	Occurring close to the coast in the Panhandle of Florida but found throughout the peninsula, south nearly to Flamingo in Monroe County and to the Ten Thousand Islands in Collier County, not present in the Keys; often associated with Cypress ponds, flatwoods, and tree islands of the Water Conservation Areas.
SSl	328000	Primrosewillow Shrubland	3	Peruvian Primrosewillow (*Ludwigia peruviana*) dominant shrubland and occasionally Angelstem Primrosewillow (*L. leptocarpa*) and Mexican Primrosewillow (*L. octovalvis*).	Commonly found in in shallow water of ditches, canals (along the interior side of the bounding canals of the WCAs between the canal edge and the bounding Willow stands), marshes, and adjacent to alligator holes; throughout Florida but much more common in central and southern Florida from about Gainesville southward.
SSm	329000	Wax Myrtle Shrubland	3	Wax Myrtle (*Myrica cerifera*) dominant shrubland.	Found in a wide variety of habitats throughout Florida including the Keys; common component of tree islands throughout the WCAs; one of the State's most widespread plants.
SSs	331000	Willow Shrubland	3	Willow (*Salix caroliniana*) dominant shrubland with sparse Leather Fern (*Acrostichum danaeifolium*), Cattail (*Typha* spp.), Sawgrass (*Cladium jamaicense*), Arrowhead (*Sagittaria* spp.), and other freshwater marsh species as possible understory components. Willow shrublands can be greater than 5 meter in height.	Typically found throughout the WCAs in monotypic stands adjacent to canals.
SU	340000	Upland Shrubland	2	Briefly flooded shrublands	Found throughout Florida.

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SUa	341000	Nicker Bean Shrubland	3	Nicker Bean (*Caesalpinia bundoc*) dominant shrubland.	Found primarily in coastal areas along western BISC, Flamingo, and the islands of the Gulf of Mexico and the Keys; does well in disturbed areas.
SUC	342000	Coastal Hardwood Shrubland	3	Mix of Sea Grape (*Coccoloba uvifera*), Gumbo Limbo (*Bursera simaruba*), Mahogany (*Swietenia mahagoni*), Spanish Stopper (*Eugenia foetida*), Poisonwood (*Metopium toxiferum*), Willow Bustic (*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.	Commonly found along coastal South Florida and especially in the Florida Keys.
SUr	343000	Indigoberry Shrubland	3	Indigoberry (*Randia aculeata*) dominant shrubland.	Found in a variety of habitats in southern Florida and the Keys, especially in unburned pinelands and along the margins of coastal hammocks; more specifically found along the margins and as an understory component of the Jamaican Dogwood dominated coastal hammocks along Snake Bite in EVER.
SUs	344000	Saw Palmetto Shrubland	3	Saw Palmetto (*Serenoa repens*) dominant shrubland.	Typically located in sandy prairies, dunes, flatwoods, scrub oak ridges, and Cabbage Palm (*Sabal palmetto*) hammocks. Commonly found within BICY.
SUT	345000	Temperate Hardwood Shrubland	3	Mix of Laurel Oak (*Quercus laurifolia*), Live Oak (*Q. virginiana*), Cabbage Palm (*Sabal palmetto*), and occasionally Strangler Fig (*Ficus aurea*), Red Mulberry (*Morus rubra*), Hackberry (*Celtis laevigata*), Common Persimmon (*Diospyros virginiana*), and Saw Palmetto (*Serenoa repens*).	Found north of US 41; often associated with recovering lands.
SUH	346000	Tropical Hardwood Shrubland	3	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 (*Myrica cerifera*), and Myrsine (*Myrsine floridana*); similar to Tropical Hardwood Hammock (FHS) except canopy heights are less than 5 meters.	
C	400000	Scrub	1	Specific described communities of dwarf trees or low density shrubs typically in a matrix of graminoids, and/or herbaceous vegetation. Canopy cover ranges from 10% to 50% but can be as much as 100% for Mangrove and Cypress classes. Canopy heights are less than 5 meters with the exception being for Mangrove which is less than or equal to 2 meters.	Found throughout Florida.
CM	410000	Mangrove Scrub	2	Regularly flooded dwarf trees that are typically found along saltwater shorelines and especially in the transition zone between freshwater and saltwater dominated environments. Mangrove scrub includes dwarf Black Mangrove (*Avicennia germinans*), dwarf White Mangrove (*Laguncularia racemosa*), dwarf Red Mangrove (*Rhizophora mangle*), and/or dwarf Buttonwood (*Conocarpus erectus*) with canopy heights less than two meters. Canopy densities are generally from 10% - 50% but can be as high as 100%.	Found along coastal Florida.
CMG	410010	Mangrove Scrub-Graminoid	5	Mangrove scrub in a matrix composed predominately of graminoids.	
CMGc	410011	Mangrove Scrub-Sawgrass	6	Mangrove scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).	
CMGd	410012	Mangrove Scrub-Saltgrass	6	Mangrove scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).	
CMGe	410013	Mangrove Scrub-Spikerush	6	Mangrove scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).	
CMGf	410014	Mangrove Scrub-Fimbry	6	Mangrove scrub in a matrix composed predominately of Marsh Frimbry (*Fimbristylis spadicea*).	
CMGj	410015	Mangrove Scrub-Black Rush	6	Mangrove scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).	
CMGm	410016	Mangrove Scrub-Keysgrass	6	Mangrove scrub in a matrix composed predominately of Keysgrass (*Monanthocloe littoralis*).	
CMGs	410017	Mangrove Scrub-Cordgrass	6	Mangrove scrub in a matrix composed predominately of Cordgrass (*Spartina* spp.).	
CMGp	410018	Mangrove Scrub-Dropseed	6	Mangrove scrub in a matrix composed predominately of Seashore Dropseed (*Sporobulus virginicus*).	
CMGt	410019	Mangrove Scrub-Cattail	6	Mangrove scrub in a matrix composed predominately of Cattail (*Typha* spp.).	
CMH	410020	Mangrove Scrub-Herbaceous	5	Mangrove scrub in a matrix composed predominately of herbaceous vegetation.	
CMO	410030	Mangrove Scrub-Open Marsh	5	Mangrove scrub in a matrix composed predominately of Open Marsh or Open Salt Marsh. Mangroves can occur in both salt and freshwater dominated marshes.	

Class ID	Raster ID	Name	Level	Description	Location
CMS	410040	Mangrove Scrub-Succulent	5	Mangrove scrub in a matrix composed predominately of succulents.	
CMSb	410041	Mangrove Scrub-Saltwort	6	Mangrove scrub in a matrix composed predominately of Saltwort (*Batis maritima*).	
CMSs	410042	Mangrove Scrub-Glasswort	6	Mangrove scrub in a matrix composed predominately of Glasswort (*Salicornia* spp.).	
CMD	410050	Mangrove Scrub-Dominant	5	Greater than 50% areal coverage of Mangrove scrub.	
CMa	411000	Black Mangrove Scrub	3	Black Mangrove (*Avicennia germinans*) dominant scrub.	Found along coastal Florida. Predominates in the upper part of the intertidal zone and into the irregularly flooded higher elevations; common forest fringing Florida Bay along Snake Bite in ENP; sometimes found on higher drier soils than the red or white mangrove. However, it can be found amongst any of the other Mangrove communities.
CMaG	411010	Black Mangrove Scrub-Graminoid	5	Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of graminoids.	
CMaGd	411011	Black Mangrove Scrub-Saltgrass	6	Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).	
CMaGf	411012	Black Mangrove Scrub-Fimbry	6	Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of Marsh Frimbry (*Fimbristylis spadicea*).	
CMaGj	411013	Black Mangrove Scrub-Black Rush	6	Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).	
CMaGm	411014	Black Mangrove Scrub-Keysgrass	6	Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of Keysgrass (*Monanthocloe littoralis*).	
CMaGs	411015	Black Mangrove Scrub-Cordgrass	6	Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of Cordgrass (*Spartina* spp.).	
CMaGp	411016	Black Mangrove Scrub-Dropseed	6	Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of Seashore Dropseed (*Sporobulus virginicus*).	
CMaH	411020	Black Mangrove Scrub-Herbaceous	5	Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of herbaceous vegetation.	
CMaO	411030	Black Mangrove Scrub-Open Marsh	5	Black Mangrove (Avicennia germinans) scrub in a matrix composed predominately of Open Salt Marsh.	
CMaS	411040	Black Mangrove Scrub-Succulent	5	Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of succulents.	
CMaSb	411041	Black Mangrove Scrub-Saltwort	6	Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of Saltwort (*Batis maritima*).	
CMaSs	411042	Black Mangrove Scrub-Glasswort	6	Black Mangrove (*Avicennia germinans*) scrub in a matrix composed predominately of Glasswort (*Salicornia* spp.).	
CMaD	411050	Black Mangrove Scrub-Dominant	5	Greater than 50% areal coverage of Black Mangrove (*Avicennia germinans*) scrub.	
CMc	412000	Buttonwood Scrub	3	Buttonwood (*Conocarpus erectus*) dominant scrub; occasionally mixed with sparse Cocoplum (*Chrysobalanus icaco*), Wax Myrtle (*Myrica cerifera*), and/or Red Mangrove (*Rhizophora mangle*).	Generally coastal in distribution, normally found along the landward edge of the mangrove zone and along the edges of hammocks bordering the transition zone between freshwater and saltwater environments; thriving in areas that are only occasionally subjected to tidal washing (e.g., elevated ridges in or near the tidal zone); southern Florida and the Keys; more specifically found along the Buttonwood ridge in ENP and around Coot Bay. However, it can be found amongst any of the other Mangrove communities.
CMcG	412010	Buttonwood Scrub-Graminoid	5	Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of graminoids.	
CMcGc	412011	Buttonwood Scrub-Sawgrass	6	Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).	
CMcGd	412012	Buttonwood Scrub-Saltgrass	6	Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).	
CMcGe	412013	Buttonwood Scrub-Spikerush	6	Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).	
CMcGf	412014	Buttonwood Scrub-Fimbry	6	Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of Marsh Frimbry (*Fimbristylis spadicea*).	
CMcGj	412015	Buttonwood Scrub-Black Rush	6	Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of Rush (*Juncus roemerianus*).	
CMcGm	412016	Buttonwood Scrub-Keysgrass	6	Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of Keysgrass (*Monanthocloe littoralis*).	
CMcGs	412017	Buttonwood Scrub-Cordgrass	6	Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of Cordgrass (*Spartina* spp.).	
CMcGp	412018	Buttonwood Scrub-Dropseed	6	Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of Seashore Dropseed (*Sporobulus virginicus*).	
CMcGt	412019	Buttonwood Scrub-Cattail	6	Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of Cattail (*Typha* spp.).	

Class ID	Raster ID	Name	Level	Description	Location
CMcH	412020	Buttonwood Scrub-Herbaceous	5	Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of herbaceous vegetation.	
CMcO	412030	Buttonwood Scrub-Open Marsh	5	Buttonwood (Conocarpus erectus) scrub in a matrix composed predominately of Open Marsh or Open Salt Marsh. Buttonwood can occur in both salt and freshwater dominated marshes.	
CMcS	412040	Buttonwood Scrub-Succulent	5	Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of succulents.	
CMcSb	412041	Buttonwood Scrub-Saltwort	6	Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of Saltwort (*Batis maritima*).	
CMcSs	412042	Buttonwood Scrub-Glasswort	6	Buttonwood (*Conocarpus erectus*) scrub in a matrix composed predominately of Glasswort (*Salicornia* spp.).	
CMcD	412050	Buttonwood Scrub-Dominant	5	Greater than 50% areal coverage of Buttonwood (*Conocarpus erectus*) scrub.	
CMl	413000	White Mangrove Scrub	3	White Mangrove (*Languncularia racemosa*) dominant scrub.	Found along coastal Florida. Occurs throughout the intertidal zone, but predominatley in the irregularly flooded higher portions of the swamp. However, it can be found amongst any of the other Mangrove communities.
CMlG	413010	White Mangrove Scrub-Graminoid	5	White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of graminoids.	
CMlGc	413011	White Mangrove Scrub-Sawgrass	6	White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).	
CMlGd	413012	White Mangrove Scrub-Saltgrass	6	White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).	
CMlGf	413013	White Mangrove Scrub-Fimbry	6	White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of Marsh Frimbry (*Fimbristylis spadicea*).	
CMlGj	413014	White Mangrove Scrub-Black Rush	6	White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).	
CMlGm	413015	White Mangrove Scrub-Keysgrass	6	White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of Keysgrass (*Monanthocloe littoralis*).	
CMlGs	413016	White Mangrove Scrub-Cordgrass	6	White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of Cordgrass (*Spartina* spp.).	
CMlGp	413017	White Mangrove Scrub-Dropseed	6	White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of Seashore Dropseed (*Sporobulus virginicus*).	
CMlH	413020	White Mangrove Scrub-Herbaceous	5	White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of herbaceous vegetation.	
CMlO	413030	White Mangrove Scrub-Open Marsh	5	White Mangrove (Languncularia racemosa) scrub in a matrix composed predominately of Open Salt Marsh.	
CMlS	413040	White Mangrove Scrub-Succulent	5	White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of succulents.	
CMlSb	413041	White Mangrove Scrub-Saltwort	6	White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of Saltwort (*Batis maritima*).	
CMlSs	413042	White Mangrove Scrub-Glasswort	6	White Mangrove (*Languncularia racemosa*) scrub in a matrix composed predominately of Glasswort (*Salicornia* spp.).	
CMlD	413050	White Mangrove Scrub-Dominant	5	Greater than 50% areal coverage of White Mangrove (*Languncularia racemosa*) scrub.	
CMr	414000	Red Mangrove Scrub	3	Red Mangrove (*Rizophora mangle*) dominant scrub; occasionally mixed with sparse Cocoplum (*Chrysobalanus icaco*), Wax Myrtle (*Myrica cerifera*), and/or Buttonwood (*Conocarpus erectus*).	Found along coastal Florida primarily in the middle and lower portions of the intertidal and upper subtidal zone. However, it can be found amongst any of the other Mangrove communities.
CMrG	414010	Red Mangrove Scrub-Graminoid	5	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of graminoids.	
CMrGc	414011	Red Mangrove Scrub-Sawgrass	6	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).	
CMrGd	414012	Red Mangrove Scrub-Saltgrass	6	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).	
CMrGe	414013	Red Mangrove Scrub-Spikerush	6	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).	
CMrGf	414014	Red Mangrove Scrub-Fimbry	6	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Marsh Frimbry (*Fimbristylis spadicea*).	
CMrGj	414015	Red Mangrove Scrub-Black Rush	6	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).	
CMrGm	414016	Red Mangrove Scrub-Keysgrass	6	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Keysgrass (*Monanthocloe littoralis*).	
CMrGs	414017	Red Mangrove Scrub-Cordgrass	6	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Cordgrass (*Spartina* spp.).	
CMrGp	414018	Red Mangrove Scrub-Dropseed	6	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Seashore Dropseed (*Sporobulus virginicus*).	
CMrGt	414019	Red Mangrove Scrub-Cattail	6	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Cattail (*Typha* spp.).	

Class ID	Raster ID	Name	Level	Description	Location
CMrH	414020	Red Mangrove Scrub-Herbaceous	5	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of herbaceous vegetation.	
CMrO	414030	Red Mangrove Scrub-Open Marsh	5	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Open Marsh or Open Salt Marsh. Red Mangrove can occur in both salt and freshwater dominated marshes.	
CMrS	414040	Red Mangrove Scrub-Succulent	5	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of succulents.	
CMrSb	414041	Red Mangrove Scrub-Saltwort	6	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Saltwort (*Batis maritima*).	
CMrSs	414042	Red Mangrove Scrub-Glasswort	6	Red Mangrove (*Rizophora mangle*) scrub in a matrix composed predominately of Glasswort (*Salicornia* spp.).	
CMrD	414050	Red Mangrove Scrub-Dominant	5	Greater than 50% areal coverage of Red Mangrove (*Rizophora mangle*) scrub.	
CMX	415000	Mixed Mangrove Scrub	3	Mix of mangrove species with no particular species of dominance.	Found along coastal Florida.
CMXG	415010	Mixed Mangrove Scrub-Graminoid	5	Mixed mangrove scrub in a matrix composed predominately of graminoids.	
CMXGc	415011	Mixed Mangrove Scrub-Sawgrass	6	Mixed mangrove scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).	
CMXGd	415012	Mixed Mangrove Scrub-Saltgrass	6	Mixed mangrove scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).	
CMXGe	415013	Mixed Mangrove Scrub-Spikerush	6	Mixed mangrove scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).	
CMXGf	415014	Mixed Mangrove Scrub-Fimbry	6	Mixed mangrove scrub in a matrix composed predominately of Marsh Frimbry (*Fimbristylis spadicea*).	
CMXGj	415015	Mixed Mangrove Scrub-Black Rush	6	Mixed mangrove scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).	
CMXGm	415016	Mixed Mangrove Scrub-Keysgrass	6	Mixed mangrove scrub in a matrix composed predominately of Keysgrass (*Monanthocloe littoralis*).	
CMXGs	415017	Mixed Mangrove Scrub-Cordgrass	6	Mixed mangrove scrub in a matrix composed predominately of Cordgrass (*Spartina* spp.).	
CMXGp	415018	Mixed Mangrove Scrub-Dropseed	6	Mixed mangrove scrub in a matrix composed predominately of Seashore Dropseed (*Sporobulus virginicus*).	
CMXGt	415019	Mixed Mangrove Scrub-Cattail	6	Mixed mangrove scrub in a matrix composed predominately of Cattail (*Typha* spp.).	
CMXH	415020	Mixed Mangrove Scrub-Herbaceous	5	Mixed mangrove scrub in a matrix composed predominately of herbaceous vegetation.	
CMXO	415030	Mixed Mangrove Scrub-Open Marsh	5	Mixed mangrove scrub in a matrix composed predominately of Open Marsh or Open Salt Marsh. Mangroves can occur in both salt and freshwater dominated marshes.	
CMXS	415040	Mixed Mangrove Scrub-Succulent	5	Mixed mangrove scrub in a matrix composed predominately of succulents.	
CMXSb	415041	Mixed Mangrove Scrub-Saltwort	6	Mixed mangrove scrub in a matrix composed predominately of Saltwort (*Batis maritima*).	
CMXSs	415042	Mixed Mangrove Scrub-Glasswort	6	Mixed mangrove scrub in a matrix composed predominately of Glasswort (*Salicornia* spp.).	
CMXD	415050	Mixed Mangrove Scrub-Dominant	5	Greater than 50% areal coverage of Mixed Mangrove scrub.	
CMXac	415100	Black Mangrove-Buttonwood Scrub	4	Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and Buttonwood (*Conocarpus erectus*) scrub.	
CMXacG	415110	Black Mangrove-Buttonwood Scrub-Graminoid	5	Black Mangrove-Buttonwood Scrub in a matrix composed predominately of graminoids.	
CMXacGc	415111	Black Mangrove-Buttonwood Scrub-Sawgrass	6	Black Mangrove-Buttonwood Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).	
CMXacGd	415112	Black Mangrove-Buttonwood Scrub-Saltgrass	6	Black Mangrove-Buttonwood Scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).	
CMXacGe	415113	Black Mangrove-Buttonwood Scrub-Spikerush	6	Black Mangrove-Buttonwood Scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).	
CMXacGf	415114	Black Mangrove-Buttonwood Scrub-Fimbry	6	Black Mangrove-Buttonwood Scrub in a matrix composed predominately of Marsh Frimbry (*Fimbristylis spadicea*).	
CMXacGj	415115	Black Mangrove-Buttonwood Scrub-Black Rush	6	Black Mangrove-Buttonwood Scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).	
CMXacGm	415116	Black Mangrove-Buttonwood Scrub-Keysgrass	6	Black Mangrove-Buttonwood Scrub in a matrix composed predominately of Keysgrass (*Monanthocloe littoralis*).	

Class ID	Raster ID	Name	Level	Description	Location
CMXacGs	415117	Black Mangrove-Buttonwood Scrub-Cordgrass	6	Black Mangrove-Buttonwood Scrub in a matrix composed predominately of Cordgrass (*Spartina* spp.).	
CMXacGp	415118	Black Mangrove-Buttonwood Scrub-Dropseed	6	Black Mangrove-Buttonwood Scrub in a matrix composed predominately of Seashore Dropseed (*Sporobulus virginicus*).	
CMXacH	415120	Black Mangrove-Buttonwood Scrub-Herbaceous	5	Black Mangrove-Buttonwood Scrub in a matrix composed predominately of herbaceous vegetation.	
CMXacO	415130	Black Mangrove-Buttonwood Scrub-Open Marsh	5	Black Mangrove-Buttonwood Scrub in a matrix composed predominately of Open Salt Marsh.	
CMXacS	415140	Black Mangrove-Buttonwood Scrub-Succulent	5	Black Mangrove-Buttonwood Scrub in a matrix composed predominately of succulents.	
CMXacSb	415141	Black Mangrove-Buttonwood Scrub-Saltwort	6	Black Mangrove-Buttonwood Scrub in a matrix composed predominately of Saltwort (*Batis maritima*).	
CMXacSs	415142	Black Mangrove-Buttonwood Scrub-Glasswort	6	Black Mangrove-Buttonwood Scrub in a matrix composed predominately of Glasswort (*Salicornia* spp.).	
CMXacD	415150	Black Mangrove-Buttonwood Scrub-Dominant	5	Greater than 50% areal coverage of Black Mangrove-Buttonwood Scrub.	
CMXal	415200	Black Mangrove-White Mangrove Scrub	4	Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and White Mangrove (*Laguncularia racemosa*) scrub.	
CMXalG	415210	Black Mangrove-White Mangrove Scrub-Graminoid	5	Black Mangrove-White Mangrove Scrub in a matrix composed predominately of graminoids.	
CMXalGc	415211	Black Mangrove-White Mangrove Scrub-Sawgrass	6	Black Mangrove-White Mangrove Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).	
CMXalGd	415212	Black Mangrove-White Mangrove Scrub-Saltgrass	6	Black Mangrove-White Mangrove Scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).	
CMXalGe	415213	Black Mangrove-White Mangrove Scrub-Spikerush	6	Black Mangrove-White Mangrove Scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).	
CMXalGf	415214	Black Mangrove-White Mangrove Scrub-Fimbry	6	Black Mangrove-White Mangrove Scrub in a matrix composed predominately of Marsh Frimbry (*Fimbristylis spadicea*).	
CMXalGj	415215	Black Mangrove-White Mangrove Scrub-Black Rush	6	Black Mangrove-White Mangrove Scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).	
CMXalGm	415216	Black Mangrove-White Mangrove Scrub-Keysgrass	6	Black Mangrove-White Mangrove Scrub in a matrix composed predominately of Keysgrass (*Monanthocloe littoralis*).	
CMXalGs	415217	Black Mangrove-White Mangrove Scrub-Cordgrass	6	Black Mangrove-White Mangrove Scrub in a matrix composed predominately of Cordgrass (*Spartina* spp.).	
CMXalGp	415218	Black Mangrove-White Mangrove Scrub-Dropseed	6	Black Mangrove-White Mangrove Scrub in a matrix composed predominately of Seashore Dropseed (*Sporobulus virginicus*).	
CMXalH	415220	Black Mangrove-White Mangrove Scrub-Herbaceous	5	Black Mangrove-White Mangrove Scrub in a matrix composed predominately of herbaceous vegetation.	
CMXalO	415230	Black Mangrove-White Mangrove Scrub-Open Marsh	5	Black Mangrove-White Mangrove Scrub in a matrix composed predominately of Open Salt Marsh.	
CMXalS	415240	Black Mangrove-White Mangrove Scrub-Succulent	5	Black Mangrove-White Mangrove Scrub in a matrix composed predominately of succulents.	
CMXalSb	415241	Black Mangrove-White Mangrove Scrub-Saltwort	6	Black Mangrove-White Mangrove Scrub in a matrix composed predominately of Saltwort (*Batis maritima*).	
CMXalSs	415242	Black Mangrove-White Mangrove Scrub-Glasswort	6	Black Mangrove-White Mangrove Scrub in a matrix composed predominately of Glasswort (*Salicornia* spp.).	
CMXalD	415250	Black Mangrove-White Mangrove Scrub-Dominant	5	Greater than 50% areal coverage of Black Mangrove-White Mangrove Scrub.	

Class ID	Raster ID	Name	Level	Description	Location
CMXar	415300	Black Mangrove-Red Mangrove Scrub	4	Co-dominant mix (60/40% or 40/60% split) of Black Mangrove (*Avicennia germinans*) and Red Mangrove (*Rhizophora mangle*) scrub.	
CMXarG	415310	Black Mangrove-Red Mangrove Scrub-Graminoid	5	Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of graminoids.	
CMXarGc	415311	Black Mangrove-Red Mangrove Scrub-Sawgrass	6	Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).	
CMXarGd	415312	Black Mangrove-Red Mangrove Scrub-Saltgrass	6	Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).	
CMXarGe	415313	Black Mangrove-Red Mangrove Scrub-Spikerush	6	Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).	
CMXarGf	415314	Black Mangrove-Red Mangrove Scrub-Fimbry	6	Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of Marsh Frimbry (*Fimbristylis spadicea*).	
CMXarGj	415315	Black Mangrove-Red Mangrove Scrub-Black Rush	6	Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).	
CMXarGm	415316	Black Mangrove-Red Mangrove Scrub-Keysgrass	6	Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of Keysgrass (*Monanthocloe littoralis*).	
CMXarGs	415317	Black Mangrove-Red Mangrove Scrub-Cordgrass	6	Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of Cordgrass (*Spartina* spp.).	
CMXarGp	415318	Black Mangrove-Red Mangrove Scrub-Dropseed	6	Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of Seashore Dropseed (*Sporobulus virginicus*).	
CMXarH	415320	Black Mangrove-Red Mangrove Scrub-Herbaceous	5	Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of herbaceous vegetation.	
CMXarO	415330	Black Mangrove-Red Mangrove Scrub-Open Marsh	5	Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of Open Salt Marsh.	
CMXarS	415340	Black Mangrove-Red Mangrove Scrub-Succulent	5	Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of succulents.	
CMXarSb	415341	Black Mangrove-Red Mangrove Scrub-Saltwort	6	Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of Saltwort (*Batis maritima*).	
CMXarSs	415342	Black Mangrove-Red Mangrove Scrub-Glasswort	6	Black Mangrove-Red Mangrove Scrub in a matrix composed predominately of Glasswort (*Salicornia* spp.).	
CMXarD	415350	Black Mangrove-Red Mangrove Scrub-Dominant	5	Greater than 50% areal coverage of Black Mangrove-Red Mangrove Scrub.	
CMXcl	415400	Buttonwood-White Mangrove Scrub	4	Co-dominant mix (60/40% or 40/60% split) of Buttonwood (*Conocarpus erectus*) and White Mangrove (*Laguncularia racemosa*) scrub.	
CMXclG	415410	Buttonwood-White Mangrove Scrub-Graminoid	5	Buttonwood-White Mangrove Scrub in a matrix composed predominately of graminoids.	
CMXclGc	415411	Buttonwood-White Mangrove Scrub-Sawgrass	6	Buttonwood-White Mangrove Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).	
CMXclGd	415412	Buttonwood-White Mangrove Scrub-Saltgrass	6	Buttonwood-White Mangrove Scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).	
CMXclGe	415413	Buttonwood-White Mangrove Scrub-Spikerush	6	Buttonwood-White Mangrove Scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).	
CMXclGf	415414	Buttonwood-White Mangrove Scrub-Fimbry	6	Buttonwood-White Mangrove Scrub in a matrix composed predominately of Marsh Frimbry (*Fimbristylis spadicea*).	
CMXclGj	415415	Buttonwood-White Mangrove Scrub-Black Rush	6	Buttonwood-White Mangrove Scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).	
CMXclGm	415416	Buttonwood-White Mangrove Scrub-Keysgrass	6	Buttonwood-White Mangrove Scrub in a matrix composed predominately of Keysgrass (*Monanthocloe littoralis*).	

Class ID	Raster ID	Name	Level	Description	Location
CMXclGs	415417	Buttonwood-White Mangrove Scrub-Cordgrass	6	Buttonwood-White Mangrove Scrub in a matrix composed predominately of Cordgrass (*Spartina* spp.).	
CMXclGp	415418	Buttonwood-White Mangrove Scrub-Dropseed	6	Buttonwood-White Mangrove Scrub in a matrix composed predominately of Seashore Dropseed (*Sporobulus virginicus*).	
CMXclH	415420	Buttonwood-White Mangrove Scrub-Herbaceous	5	Buttonwood-White Mangrove Scrub in a matrix composed predominately of herbaceous vegetation.	
CMXclO	415430	Buttonwood-White Mangrove Scrub-Open Marsh	5	Buttonwood-White Mangrove Scrub in a matrix composed predominately of Open Salt Marsh.	
CMXclS	415440	Buttonwood-White Mangrove Scrub-Succulent	5	Buttonwood-White Mangrove Scrub in a matrix composed predominately of succulents.	
CMXclSb	415441	Buttonwood-White Mangrove Scrub-Saltwort	6	Buttonwood-White Mangrove Scrub in a matrix composed predominately of Saltwort (*Batis maritima*).	
CMXclSs	415442	Buttonwood-White Mangrove Scrub-Glasswort	6	Buttonwood-White Mangrove Scrub in a matrix composed predominately of Glasswort (*Salicornia* spp.).	
CMXclD	415450	Buttonwood-White Mangrove Scrub-Dominant	5	Greater than 50% areal coverage of Buttonwood-White Mangrove Scrub.	
CMXcr	415500	Buttonwood-Red Mangrove Scrub	4	Co-dominant mix (60/40% or 40/60% split) of Buttonwood (*Conocarpus erectus*) and Red Mangrove (*Rhizophora mangle*) scrub.	
CMXcrG	415510	Buttonwood-Red Mangrove Scrub-Graminoid	5	Buttonwood-Red Mangrove Scrub in a matrix composed predominately of graminoids.	
CMXcrGc	415511	Buttonwood-Red Mangrove Scrub-Sawgrass	6	Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).	
CMXcrGd	415512	Buttonwood-Red Mangrove Scrub-Saltgrass	6	Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).	
CMXcrGe	415513	Buttonwood-Red Mangrove Scrub-Spikerush	6	Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).	
CMXcrGf	415514	Buttonwood-Red Mangrove Scrub-Fimbry	6	Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Marsh frimbry (Fimbristylis spadicea).	
CMXcrGj	415515	Buttonwood-Red Mangrove Scrub-Black Rush	6	Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).	
CMXcrGm	415516	Buttonwood-Red Mangrove Scrub-Keysgrass	6	Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Keysgrass (*Monanthocloe littoralis*).	
CMXcrGs	415517	Buttonwood-Red Mangrove Scrub-Cordgrass	6	Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Cordgrass (*Spartina* spp.).	
CMXcrGp	415518	Buttonwood-Red Mangrove Scrub-Dropseed	6	Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Seashore Dropseed (*Sporobulus virginicus*).	
CMXcrGt	415519	Buttonwood-Red Mangrove Scrub-Cattail	6	Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Cattail (*Typha* spp.).	
CMXcrH	415520	Buttonwood-Red Mangrove Scrub-Herbaceous	5	Buttonwood-Red Mangrove Scrub in a matrix composed predominately of herbaceous vegetation.	
CMXcrO	415530	Buttonwood-Red Mangrove Scrub-Open Marsh	5	Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Open Marsh or Open Salt Marsh. Buttonwood and Red Mangrove can occur in both salt and freshwater dominated marshes.	
CMXcrS	415540	Buttonwood-Red Mangrove Scrub-Succulent	5	Buttonwood-Red Mangrove Scrub in a matrix composed predominately of succulents.	
CMXcrSb	415541	Buttonwood-Red Mangrove Scrub-Saltwort	6	Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Saltwort (*Batis maritima*).	
CMXcrSs	415542	Buttonwood-Red Mangrove Scrub-Glasswort	6	Buttonwood-Red Mangrove Scrub in a matrix composed predominately of Glasswort (*Salicornia* spp.).	
CMXcrD	415550	Buttonwood-Red Mangrove Scrub-Dominant	5	Greater than 50% areal coverage of Buttonwood-Red Mangrove Scrub.	

Class ID	Raster ID	Name	Level	Description	Location
CMXlr	415600	White Mangrove-Red Mangrove Scrub	4	Co-dominant mix (60/40% or 40/60% split) of White Mangrove (*Laguncularia racemosa*) and Red Mangrove (*Rhizophora mangle*) scrub.	
CMXlrG	415610	White Mangrove-Red Mangrove Scrub-Graminoid	5	White Mangrove-Red Mangrove Scrub in a matrix composed predominately of graminoids.	
CMXlrGc	415611	White Mangrove-Red Mangrove Scrub-Sawgrass	6	White Mangrove-Red Mangrove Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).	
CMXlrGd	415612	White Mangrove-Red Mangrove Scrub-Saltgrass	6	White Mangrove-Red Mangrove Scrub in a matrix composed predominately of Saltgrass (*Distichlis spicata*).	
CMXlrGe	415613	White Mangrove-Red Mangrove Scrub-Spikerush	6	White Mangrove-Red Mangrove Scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).	
CMXlrGf	415614	White Mangrove-Red Mangrove Scrub-Fimbry	6	White Mangrove-Red Mangrove Scrub in a matrix composed predominately of Marsh frimbry (Fimbristylis spadicea).	
CMXlrGj	415615	White Mangrove-Red Mangrove Scrub-Black Rush	6	White Mangrove-Red Mangrove Scrub in a matrix composed predominately of Black Rush (*Juncus roemerianus*).	
CMXlrGm	415616	White Mangrove-Red Mangrove Scrub-Keysgrass	6	White Mangrove-Red Mangrove Scrub in a matrix composed predominately of Keysgrass (*Monanthocloe littoralis*).	
CMXlrGs	415617	White Mangrove-Red Mangrove Scrub-Cordgrass	6	White Mangrove-Red Mangrove Scrub in a matrix composed predominately of Cordgrass (*Spartina* spp.).	
CMXlrGp	415618	White Mangrove-Red Mangrove Scrub-Dropseed	6	White Mangrove-Red Mangrove Scrub in a matrix composed predominately of Seashore Dropseed (*Sporobulus virginicus*).	
CMXlrH	415620	White Mangrove-Red Mangrove Scrub-Herbaceous	5	White Mangrove-Red Mangrove Scrub in a matrix composed predominately of herbaceous vegetation.	
CMXlrO	415630	White Mangrove-Red Mangrove Scrub-Open Marsh	5	White Mangrove-Red Mangrove Scrub in a matrix composed predominately of Open Salt Marsh.	
CMXlrS	415640	White Mangrove-Red Mangrove Scrub-Succulent	5	White Mangrove-Red Mangrove Scrub in a matrix composed predominately of succulents.	
CMXlrSb	415641	White Mangrove-Red Mangrove Scrub-Saltwort	6	White Mangrove-Red Mangrove Scrub in a matrix composed predominately of Saltwort (*Batis maritima*).	
CMXlrSs	415642	White Mangrove-Red Mangrove Scrub-Glasswort	6	White Mangrove-Red Mangrove Scrub in a matrix composed predominately of Glasswort (*Salicornia* spp.).	
CMXlrD	415650	White Mangrove-Red Mangrove Scrub-Dominant	5	Greater than 50% areal coverage of White Mangrove-Red Mangrove Scrub.	
CS	420000	Swamp Scrub	2	Freshwater marsh communities with dwarf trees or low density (10% - 49%) shrubs. Canopy cover ranges from 10% to 50% but can be as much as 100% for some classes (e.g., Hardwood Swamp Scrub and Cypress Scrub).	Found throughout Florida. Some of these scrubs can be found in coastal areas along the transition zone between tidal and freshwater environments.
CSE	420010	Swamp Scrub-Emergent	5	Swamp scrub in a matrix composed predominately of broadleaf emergent vegetation.	
CSG	420020	Swamp Scrub-Graminoid Marsh	5	Swamp scrub in a matrix composed predominately of Freshwater Graminoid Marsh.	
CSGc	420021	Swamp Scrub-Sawgrass	6	Swamp scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).	
CSGe	420022	Swamp Scrub-Spikerush	6	Swamp scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).	
CSGa	420023	Swamp Scrub-Panicgrass	6	Swamp scrub in a matrix composed predominately of Panicgrass (*Panicum* spp.).	
CSGt	420024	Swamp Scrub-Cattail	6	Swamp scrub in a matrix composed predominately of Cattail (*Typha* spp.).	
CSGP	420030	Swamp Scrub-Graminoid Prairie	5	Swamp scrub in a matrix composed predominately of Freshwater Graminoid Prairie.	
CSGPm	420031	Swamp Scrub-Muhly Grass	6	Swamp scrub in a matrix composed predominately of Muhly Grass (*Muhlenbergia capillaris var. filipes*).	
CSH	420040	Swamp Scrub-Herbaceous	5	Swamp scrub in a matrix composed predominately of herbaceous vegetation.	
CSO	420050	Swamp Scrub-Open Marsh	5	Swamp scrub in a matrix composed predominately of Open Marsh.	
CSD	420060	Swamp Scrub-Dominant	5	Greater than 50% areal coverage of Swamp scrub.	

Class ID	Raster ID	Name	Level	Description	Location
CSW	421000	Hardwood Swamp Scrub	3	Mix of dwarf trees and/or shrubs such as Red Bay (*Persea borbonia*), Sweet Bay (*Magnolia virginiana*), Myrsine (*Myrsine floridana*), Buttonwood (*Conocarpus erectus*), Willow (*Salix caroliniana*), Wax Myrtle (*Myrica cerifera*), Dahoon Holly (*Ilex cassine*), and/or Cocoplum (*Chrysobalanus icaco*) in a matrix of grasses, herbs, and, at times, including various species of vines. Canopy density will range from 10% - 49%. Canopy heights can vary according to the composition of hardwoods.	Often associated with flooded out or otherwise disturbed tree islands.
CSWE	421010	Hardwood Swamp Scrub-Emergent	5	Hardwood Swamp Scrub in a matrix composed predominately of broadleaf emergent vegetation.	
CSWG	421020	Hardwood Swamp Scrub-Graminoid Marsh	5	Hardwood Swamp Scrub in a matrix composed predominately of Freshwater Graminoid Marsh.	
CSWGc	421021	Hardwood Swamp Scrub-Sawgrass	6	Hardwood Swamp Scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).	
CSWGe	421022	Hardwood Swamp Scrub-Spikerush	6	Hardwood Swamp Scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).	
CSWGa	421023	Hardwood Swamp Scrub-Panicgrass	6	Hardwood Swamp Scrub in a matrix composed predominately of Panicgrass (*Panicum* spp.).	
CSWGt	421024	Hardwood Swamp Scrub-Cattail	6	Hardwood Swamp scrub in a matrix composed predominately of Cattail (*Typha* spp.).	
CSWGP	421030	Hardwood Swamp Scrub-Graminoid Prairie	5	Hardwood Swamp Scrub in a matrix composed predominately of Freshwater Graminoid Prairie.	
CSWGPm	421031	Hardwood Swamp Scrub-Muhly Grass	6	Hardwood Swamp scrub in a matrix composed predominately of Muhly Grass (*Muhlenbergia capillaris var. filipes*).	
CSWH	421040	Hardwood Swamp Scrub-Herbaceous	5	Hardwood Swamp Scrub in a matrix composed predominately of herbaceous vegetation.	
CSWO	421050	Hardwood Swamp Scrub-Open Marsh	5	Hardwood Swamp Scrub in a matrix composed predominately of Open Marsh.	
CSWD	421060	Hardwood Swamp Scrub-Dominant	5	Greater than 50% areal coverage of Hardwood Swamp Scrub.	
CSm	422000	Wax Myrtle Scrub	3	Wax Myrtle (*Myrica cerifera*) characterized by canopy densities from 10% - 49% in a matrix of graminoids and/or herbaceous vegetation.	
CSmE	422010	Wax Myrtle Scrub-Emergent	5	Wax Myrtle (*Myrica cerifera*) scrub in a matrix composed predominately of broadleaf emergent vegetation.	
CSmG	422020	Wax Myrtle Scrub-Graminoid Marsh	5	Wax Myrtle (*Myrica cerifera*) scrub in a matrix composed predominately of Freshwater Graminoid Marsh.	
CSmGc	422021	Wax Myrtle Scrub-Sawgrass	6	Wax Myrtle (*Myrica cerifera*) scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).	
CSmGe	422022	Wax Myrtle Scrub-Spikerush	6	Wax Myrtle (*Myrica cerifera*) scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).	
CSmGa	422023	Wax Myrtle Scrub-Panicgrass	6	Wax Myrtle (*Myrica cerifera*) scrub in a matrix composed predominately of Panicgrass (*Panicum* spp.).	
CSmGt	422024	Wax Myrtle Scrub-Cattail	6	Wax Myrtle (*Myrica cerifera*) scrub in a matrix composed predominately of Cattail (*Typha* spp.).	
CSmGP	422030	Wax Myrtle Scrub-Graminoid Prairie	5	Wax Myrtle (*Myrica cerifera*) scrub in a matrix composed predominately of Freshwater Graminoid Prairie.	
CSmGPm	422031	Wax Myrtle Scrub-Muhly Grass	6	Wax Myrtle (*Myrica cerifera*) scrub in a matrix composed predominately of Muhly Grass (*Muhlenbergia capillaris var. filipes*).	
CSmH	422040	Wax Myrtle Scrub-Herbaceous	5	Wax Myrtle (*Myrica cerifera*) scrub in a matrix composed predominately of herbaceous vegetation.	
CSmO	422050	Wax Myrtle Scrub-Open Marsh	5	Wax Myrtle (Myrica cerifera) scrub in a matrix composed predominately of Open Marsh.	
CSs	423000	Willow Scrub	3	Willow (*Salix caroliniana*) characterized by canopy densities from 10% - 49% in a matrix of graminoids and/or herbaceous vegetation.	
CSsE	423010	Willow Scrub-Emergent	5	Willow (*Salix caroliniana*) scrub in a matrix composed predominately of broadleaf emergent vegetation.	
CSsG	423020	Willow Scrub-Graminoid Marsh	5	Willow (*Salix caroliniana*) scrub in a matrix composed predominately of Freshwater Graminoid Marsh.	

Class ID	Raster ID	Name	Level	Description	Location
CSsGc	423021	Willow Scrub-Sawgrass	6	Willow (*Salix caroliniana*) scrub in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).	
CSsGe	423022	Willow Scrub-Spikerush	6	Willow (*Salix caroliniana*) scrub in a matrix composed predominately of Spikerush (*Eleocharis* spp.).	
CSsGa	423023	Willow Scrub-Panicgrass	6	Willow (*Salix caroliniana*) scrub in a matrix composed predominately of Panicgrass (*Panicum* spp.).	
CSsGt	423024	Willow Scrub-Cattail	6	Willow (*Salix caroliniana*) scrub in a matrix composed predominately of Cattail (*Typha* spp.).	
CSsH	423030	Willow Scrub-Herbaceous	5	Willow (*Salix caroliniana*) scrub in a matrix composed predominately of herbaceous vegetation.	
CSsO	423040	Willow Scrub-Open Marsh	5	Willow (*Salix caroliniana*) scrub in a matrix composed predominately of Open Marsh.	
CSt	424000	Cypress Scrub	3	Dwarf Pond Cypress (*Taxodium ascendens*) and/or dwarf Bald Cypress (*T. distichum*) trees with canopy heights generally below five meters. Canopy densities are generally from 10% - 49% but can be as high as 100%.	
CStE	424010	Cypress Scrub-Emergent	5	Dwarf Cypress (*Taxodium* spp.) in a matrix composed predominately of broadleaf emergent vegetation.	
CStG	424020	Cypress Scrub-Graminoid Marsh	5	Dwarf Cypress (*Taxodium* spp.) in a matrix composed predominately of Freshwater Graminoid Marsh.	
CStGc	424021	Cypress Scrub-Sawgrass	6	Dwarf Cypress (*Taxodium* spp.) in a matrix composed predominately of Sawgrass (*Cladium jamaicense*).	
CStGe	424022	Cypress Scrub-Spikerush	6	Dwarf Cypress (*Taxodium* spp.) in a matrix composed predominately of Spikerush (*Eleocharis* spp.).	
CStGa	424023	Cypress Scrub-Panicgrass	6	Dwarf Cypress (*Taxodium* spp.) in a matrix composed predominately of Panicgrass (*Panicum* spp.).	
CStGs	424024	Cypress Scrub-Gulfdune Paspalum	6	Dwarf Cypress (*Taxodium* spp.) in a matrix composed predominately of Gulfdune Paspalum (*Paspalum monostachyum*).	
CStGt	424026	Cypress Scrub-Cattail	6	Dwarf Cypress (*Taxodium* spp.) in a matrix composed predominately of Cattail (*Typha* spp.).	
CStGP	424030	Cypress Scrub-Graminoid Prairie	5	Dwarf Cypress (*Taxodium* spp.) in a matrix composed predominately of Freshwater Graminoid Prairie.	
CStGPm	424031	Cypress Scrub-Muhly Grass	6	Dwarf Cypress (*Taxodium* spp.) scrub in a matrix composed predominately of Muhly Grass (*Muhlenbergia capillaris var. filipes*).	
CStGPs	424032	Cypress Scrub-Little Bluestem	6	Dwarf Cypress (*Taxodium* spp.) in a matrix composed predominately of Little Bluestem (*Schizachyrium* scoparium).	
CStH	424040	Cypress Scrub-Herbaceous	5	Dwarf Cypress (*Taxodium* spp.) in a matrix composed predominately of herbaceous vegetation.	
CStO	424050	Cypress Scrub-Open Marsh	5	Dwarf Cypress (Taxodium spp.) in a matrix composed predominately of Open Marsh.	
CStD	424060	Cypress Scrub-Dominant	5	Greater than 50% areal coverage of Dwarf Cypress (*Taxodium* spp.).	
CU	430000	Upland Scrub	2	Upland graminoid and/or herbaceous dominant communities with dwarf trees and/or shrubs.	Found throughout Florida.
CUG	430010	Upland Scrub-Graminoid Prairie	5	Upland scrub in a matrix of graminoids.	
CUH	430020	Upland Scrub-Herbaceous	5	Upland scrub in a matrix of herbaceous vegetation.	
CUW	431000	Upland Hardwood Scrub	3	Mix of dwarf trees and/or shrubs such as Live Oak (*Quercus virginiana*), Poisonwood (*Metopium toxiferum*), Red Bay (*Persea borbonia*), Sweet Bay (*Magnolia virginiana*), Myrsine (*Myrsine floridana*), Wax Myrtle (*Myrica cerifera*), Dahoon Holly (*Ilex cassine*), Buttonwood (*Conocarpus erectus*), Cocoplum (*Chrysobalanus icaco*), Varnish Leaf (*Dodonaea viscosa*), and/or Trema (*Trema* spp.) in a matrix of grasses, herbs, and, at times, including various species of vines. Canopy density will range from 10% - 49%. Canopy heights can vary according to the composition of hardwoods.	Often associated with burned out hammocks.
CUWG	431010	Upland Hardwood Scrub-Graminoid Prairie	5	Upland Hardwood Scrub in a matrix of graminoids.	
CUWH	431020	Upland Hardwood Scrub-Herbaceous	5	Upland Hardwood Scrub in a matrix of herbaceous vegetation.	
M	500000	Marsh	1	Graminoid and/or herbaceous emergent or floating vegetation in shallow water that stands at or above the ground surface for much of the year.	Found throughout Florida.
MS	510000	Salt Marsh	2	A marsh consisting of salt tolerant graminoid and/or herbaceous vegetation.	Found along coastal Florida.
MSG	511000	Graminoid Salt Marsh	3	Graminoid dominated salt marsh.	Found along coastal Florida.
MSGd	511100	Saltgrass	4	Saltgrass (*Distichlis spicata*) dominated salt marsh.	Found in salt marshes and flats, brackish habitats and wet marl near the coast; frequent to common, throughout coastal Florida.

Class ID	Raster ID	Name	Level	Description	Location
MSGj	511200	Black Rush	4	Black Rush (*Juncus roemerianus*) dominated salt marsh.	Commonly found in tidal marshes; typical of southwest BICY and southern mainland BISC.
MSGm	511300	Keysgrass	4	Keysgrass (*Monanthocloe littoralis*) dominated salt marsh.	Found in salty shores, tidal flats and salt marshes; frequent, coastal south, central, and north Florida.
MSGs	511400	Cordgrass	4	Sand Cordgrass (*Spartina bakeri*) and/or Gulf Cordgrass (*S. spartinae*) dominated salt marsh.	Commonly found in tidal marshes. However, *Spartina bakeri* can also be found in freshwater marshes.
MSGp	511500	Dropseed	4	Dropseed (*Sporobulus* spp.) dominated salt marsh.	Common throughout coastal Florida.
MSH	512000	Herbaceous Salt Marsh	3	Herbaceous dominated salt marsh.	Found along coastal Florida.
MSO	513000	Open Salt Marsh	3	Open water 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.).	Found along coastal Florida.
MSS	514000	Succulent Salt Marsh	3	Succulent dominated salt marsh.	Found along coastal Florida.
MSSb	514100	Saltwort	4	Saltwort (*Batis maritima*) dominated salt marsh	Found bordering salt ponds, marshes, salt flats and fringes of mangrove mud; common along Snake Bite in EVER.
MSSs	514200	Glasswort	4	Glasswort (*Salicornia* spp.) dominated salt marsh.	Found in salt and brackish marshes and flats; throughout coastal regions of Florida; common along Snake Bite in EVER.
MSSe	514300	Sea Purslane	4	Sea Purslane (*Sesuvium* spp.) dominated salt marsh.	Found on beaches, dunes, marshes and marsh banks, salt flats and meadows, mangrove fringes, and other wet open places; throughout coastal Florida.
MF	520000	Freshwater Marsh	2	Freshwater graminoid and/or herbaceous marsh.	Found throughout Florida.
MFB	521000	Broadleaf Emergent Marsh	3	Broadleaf emergent dominated freshwater marsh.	Found throughout Florida.
MFBa	521100	Leather Fern	4	Golden Leather Fern (*Acrostichum aureum*) and/or Giant Leather Fern (*A. danaeifolium*) dominated marsh.	Found in freshwater, brackish, salt marshes, coastal hammocks, and mangrove swamps; Golden Leather Fern is found in southwestern coastal Florida from Manatee Co. south; Giant Leather Fern is widely distributed both coastally and inland in central and south Florida.
MFBp	521200	Pickerelweed	4	Pickerelweed (*Pontederia cordata*) dominated marsh.	Frequent throughout Florida in marshes, streams, ditches, and shallow water of lakes and ponds.
MFBs	521300	Arrowhead	4	Lanceleaf Arrowhead (*Sagittaria lancifolia*) and/or Broadleaf Arrowhead (*S. latifolia*) dominated marsh.	Found throughout Florida in marshes, ditches, swamps, and lake margins.
MFBt	521400	Alligator Flag	4	Alligator Flag (*Thalia geniculata*) dominated marsh.	Found throughout south Florida in depression marshes, riverine marshes, open ponds in cypress sloughs, ditches, and canal margins with extended periods of deep inundation.
MFG	522000	Graminoid Freshwater Marsh	3	Graminoid dominated freshwater marsh.	Found throughout Florida.
MFGc	522100	Sawgrass	4	Sawgrass (*Cladium jamaicense*) dominated marsh.	Found in swamps, marshes, shores of lakes, and coastal marshes; dominant plant of the Greater Everglades system, including EVER and the WCAs.
MFGcS	522110	Sawgrass-Short	5	Sawgrass (*Cladium jamaicense*) dominated marsh with average height less than 2.5 meters.	
MFGcT	522120	Sawgrass-Tall	5	Sawgrass (*Cladium jamaicense*) dominated marsh with average height greater than 2.5 meters.	
MFGe	522200	Spikerush	4	Coastal Spikerush (*Eleocharis cellulosa*), Slim Spikerush (*E. elongata*), and/or Knotted Spikerush (*E. interstincta*) dominated marsh.	Found in marshes, swamps, rivers, streams, lakes, ponds, ditches, canals, and floodplains; common throughout the Greater Everglades system, including ENP and the WCAs.
MFGj	522300	Soft Rush	4	Soft Rush (*Juncus effusus*) dominated marsh.	Typically found in Central Florida and the Kissimmee River.
MFGa	522400	Panicgrass	4	Maidencane (*Panicum hemitomon*) and/or Redtop Panicum (*P. rigidulum*) dominated marsh.	Generally located in shallow water of ponds, lakes, marshes, ditches, and canals; found sporadically throughout the Greater Everglades system.
MFGh	522500	Common Reed	4	Common Reed (*Phragmites australis*) dominated marsh.	Found in all types of wet habitats and adjoining banks; found throughout Florida and more frequent in south Florida; commonly located along the canals of the WCAs.
MFGpa	528100	Gulfdune Paspalum	4	Gulfdune Paspalum (*Paspalum monostachyum*) dominated marsh. Paspalum found in the substantial presence (> 10%) of Little Bluestem (*Schizachyrium scoparium*) and/or Muhly Grass (*Muhlenbergia capillaris var. filipes*) is characteristic of a Graminoid Freshwater Prairie (MFGP).	
MFGr	522900	Beakrush	4	Beakrush (*Rynchospora* spp.) dominated marsh. Found commonly growing with low stature Sawgrass (Cladium jamaicense). Beakrush found in the substantial presence (> 10%) of Little Bluestem (Schizachyrium scoparium) and/or Muhly Grass (Muhlenbergia capillaris var. filipes) is characteristic of a Graminoid Freshwater Prairie (MFGP).	

Class ID	Raster ID	Name	Level	Description	Location
MFGs	522600	American Cupscale	4	American Cupscale (*Sacciolepis striata*) dominated marsh.	Found in mostly still water or along banks and shores of canals, marshes, lakes, floating islands, streams, ditches, rivers, glades, pastures, swamps, wet fields, ponds, low pinelands, and wet hammocks; common throughout Florida; occasionally found in disturbed areas along the canals and levees of the WCAs.
MFGt	522700	Cattail	4	Southern Cattail (*Typha domingensis*) and/or Broadleaf Cattail (*T. latifolia*) dominated marsh.	Found throughout Florida; common throughout the greater Everglades in eutrophic soils.
MFGtM	522710	Cattail Monotypic	5	Greater than or equal to 90% areal coverage of Cattail.	
MFGtD	522720	Cattail Dominant	5	50% to 89% areal coverage of Cattail.	
MFGtS	522730	Cattail Sparse	5	10% to 49% areal coverage of Cattail.	
MFGz	522800	Giant Cutgrass	4	Giant Cutgrass (*Zizaniopsis miliacea*) dominated marsh.	
MFGP	523000	Graminoid Freshwater Prairie	3	Short hydroperiod marsh characterized by a mix of graminoids that includes low-stature sawgrass (*Cladium jamaicense*), Muhly Grass (*Muhlenbergia capillaris var. filipes*), Little Bluestem (*Schizachyrium scoparium*), and Black Sedge (S*choenus nigricans*), among others.	
MFGPc	523100	Sawgrass Prairie	4	Sawgrass (*Cladium jamaicense*) dominated wet prairie with average height less than 1.5 meters.	Typical component of marl wet prairies.
MFGPm	523500	Muhly Grass	4	Muhly Grass (*Muhlenbergia capillaris var. filipes*) dominated wet prairie. Found commonly growing with low stature Sawgrass (*Cladium jamaicense*)	Typical component of marl wet prairies. Also found on sandy or rocky soils of ridges, flatwoods, low woods, swales, saline flats, beaches and dunes; frequent throughout Florida.
MFGPs	523600	Little Bluestem	4	Little Bluestem (*Schizachyrium scoparium*) dominated wet prairie. Found commonly growing with low stature Sawgrass (Cladium jamaicense)	Typical component of marl wet prairies. Also found in open glades, wet prairies and along margins and open areas of limestone pine rocklands; restricted to south Florida from Miami southward to Big Pine Key, including the Everglades Keys.
MFGPh	523700	Black Sedge	4	Black Sedge (*Schoenus nigricans*) dominated wet prairie.	Found in marshes, wet calcareous pinelands and prairies, and limestone outcrops; in south Florida from Pasco Co. to Broward Co. southward to the Keys.
MFF	524000	Floating Emergent Marsh	3	Floating emergent dominated freshwater marsh.	Found throughout Florida.
MFFl	524100	Duckweed	4	Duckweed (*Lemna* spp.) dominated marsh.	
MFFn	524200	Spatterdock	4	Spatterdock (*Nuphar lutea subsp. advena*) dominated marsh.	
MFFy	524300	Waterlily	4	Waterlily (*Nymphaea odorata*) dominated marsh.	Common throughout Florida in ponds, lakes, canals, ditches, sloughs, and swamps.
MFFs	524400	Water Spangles	4	Water Spangles (*Salvinia minima*) dominated marsh.	
MFH	525000	Herbaceous Freshwater Marsh	3	Herbaceous dominated freshwater marsh.	Found throughout Florida.
MFHc	525100	Water Hemlock	4	Water Hemlock (*Cicuta mexicana*) dominated marsh.	Found throughout Florida along marshy shores, in floating mats of vegetation, swamps, springs, streams and ditches.
MFHi	525200	Morning Glory	4	Morning Glory (*Ipomoea* spp.) dominated marsh.	Occasionally found in highly disturbed areas along canals and levees of the WCAs.
MFHm	525300	Hempvine	4	Hempvine (*Mikania* spp.) dominated marsh.	
MFHp	525400	Smartweed	4	Smartweeds (*Polygonum* spp.) dominated marsh.	Found throughout Florida in swamps, marshes, flood plains, and moist hammocks.
MFO	526000	Open Marsh	3	Open water dominated freshwater marsh often with a mix of sparse graminoids, herbaceous, and/or emergent freshwater vegetation, such as Spikerush (*Eleocharis* spp.), Panicgrass (*Panicum* spp.), low stature 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.	Typical of slough or remnant slough areas found throughout the Everglades and WCAs.
MFPO	527000	Open Prairie	3	Open ground, exposed rock, and/or open water dominated short hydroperiod marsh often with a mix of sparse graminoids and/or herbaceous vegetation, such as Muhly Grass (*Muhlenbergia capillaris var. filipes*), low stature Sawgrass (*Cladium jamaicense*), Gulfdune Paspalum (*Paspalum monostachyum*), Little Bluestem (*Schizachyrium scoparium*), among others.	
D	600000	Dune	1	Beach-dune associated graminoids and/or herbaceous vegetation.	Found along coastal Florida.
DG	610000	Graminoid Dune	2	Graminoid dominated dune.	Found along coastal Florida.
DGc	611000	Sandbur	3	Sandbur (*Cenchrus* spp.) dominated dune.	Found on open sandy soil and dunes.
DGu	612000	Sea Oats	3	Sea Oats (*Uniola paniculata*) dominated dune.	Generally found in dunes elevated above the tide line.
DH	620000	Herbaceous Dune	2	Herbaceous dominated dune.	Found along coastal Florida.
DHi	621000	Railroad Vine	3	Railroad Vine (*Ipomoea pes-caprae*) dominated dune.	Generally found on shifting sand prior to colonization by other plants.
DHv	622000	Seacoast Marshelder	3	Seacoast Marshelder (*Iva imbricata*) dominated dune.	Found on coastal dunes on both the Atlantic and Gulf Coasts of Florida, including the Keys.

Class ID	Raster ID	Name	Level	Description	Location
A	700000	Submerged Aquatic Vegetation	1	Vegetation that has evolved the ability to carry out their entire life cycle completely submerged in an aquatic environment.	
AM	710000	Marine Aquatic Vegetation	2	Place holder for future development of marine SAV classes.	
AMA	711000	Marine Algae	3	Place holder for future development of marine SAV classes.	
AMS	712000	Seagrass	3	Place holder for future development of marine SAV classes.	
AF	720000	Freshwater Aquatic Vegetation	2	Place holder for future development of freshwater SAV classes.	
E	800000	Exotic	1	Non-native and often invasive vegetation.	
Ea	801000	Shoebutton	2	*Ardisia elliptica*	Reported in Broward, Dade, Monroe, Palm Beach, and St. Lucie counties; found in hammocks, disturbed wetlands, tree islands, cypress understories, and mangrove areas.
EaM	801100	Shoebutton Monotypic	3	Greater than or equal to 90% areal coverage of Shoebutton.	
EaD	801200	Shoebutton Dominant	3	50% to 89% areal coverage of Shoebutton.	
EaS	801300	Shoebutton Sparse	3	10% to 49% areal coverage of Shoebutton.	
EaT	802000	Treated Shoebutton	2	Treated *Ardisia elliptica* .	
EaMT	802100	Treated Shoebutton Monotypic	3	Greater than or equal to 90% areal coverage of treated Shoebutton.	
EaDT	802200	Treated Shoebutton Dominant	3	50% to 89% areal coverage of treated Shoebutton.	
EaST	802300	Treated Shoebutton Sparse	3	10% to 49% areal coverage of treated Shoebutton.	
Ec	803000	Australian Pine	2	River Sheoak (*Casuarina cunninghamiana*), Australian Pine (*C. equisetifolia*), and Suckering Australian Pine (*C. glauca*).	Occurs throughout south Florida, from Orlando south, on sandy shores, pinelands, filled wetlands, road shoulders, cleared land, and undeveloped lots.
EcM	803100	Australian Pine Monotypic	3	Greater than or equal to 90% areal coverage of Australian Pine.	
EcD	803200	Australian Pine Dominant	3	50% to 89% areal coverage of Australian Pine.	
EcS	803300	Australian Pine Sparse	3	10% to 49% areal coverage of Australian Pine.	
EcT	804000	Treated Australian Pine	2	Treated River Sheoak (*Casuarina cunninghamiana*), Australian Pine (*C. equisetifolia*), and Suckering Australian Pine (*C. glauca*).	
EcMT	804100	Treated Australian Pine Monotypic	3	Greater than or equal to 90% areal coverage of treated Australian Pine.	
EcDT	804200	Treated Australian Pine Dominant	3	50% to 89% areal coverage of treated Australian Pine.	
EcST	804300	Treated Australian Pine Sparse	3	10% to 49% areal coverage of treated Australian Pine.	
Eo	805000	Wild Taro	2	*Colocasia esculenta*	Dense to scattered populations reported throughout Florida; found sporadically in highly disturbed areas along the canals and levees of the WCAs.
EoM	805100	Wild Taro Monotypic	3	Greater than or equal to 90% areal coverage of Wild Taro.	
EoD	805200	Wild Taro Dominant	3	50% to 89% areal coverage of Wild Taro.	
EoS	805300	Wild Taro Sparse	3	10% to 49% areal coverage of Wild Taro.	
EoT	806000	Treated Wild Taro	2	Treated *Colocasia esculenta* .	
EoMT	806100	Treated Wild Taro Monotypic	3	Greater than or equal to 90% areal coverage of treated Wild Taro.	
EoDT	806200	Treated Wild Taro Dominant	3	50% to 89% areal coverage of treated Wild Taro.	
EoST	806300	Treated Wild Taro Sparse	3	10% to 49% areal coverage of treated Wild Taro.	
Eu	807000	Latherleaf	2	*Colubrina asiatica*	Found in coastal areas of Florida from Key West north to Hutchinson Island in St. Lucie County and in EVER, including Ten Thousand Islands northwest into Collier County; invades the coastal ridges just above the high tide line, in tropical hammocks, buttonwood and mangrove forests, tidal marshes, and disturbed coastal areas.

Class ID	Raster ID	Name	Level	Description	Location
EuM	807100	Latherleaf Monotypic	3	Greater than or equal to 90% areal coverage of Latherleaf.	
EuD	807200	Latherleaf Dominant	3	50% to 89% areal coverage of Latherleaf.	
EuS	807300	Latherleaf Sparse	3	10% to 49% areal coverage of Latherleaf.	
EuT	808000	Treated Latherleaf	2	Treated *Colubrina asiatica* .	
EuMT	808100	Treated Latherleaf Monotypic	3	Greater than or equal to 90% areal coverage of treated Latherleaf.	
EuDT	808200	Treated Latherleaf Dominant	3	50% to 89% areal coverage of treated Latherleaf.	
EuST	808300	Treated Latherleaf Sparse	3	10% to 49% areal coverage of treated Latherleaf.	
Ee	809000	Water Hyacinth	2	*Eichhornia crassipes*	Found throughout Florida; often found choking out canals or other calm bodies of water.
EeM	809100	Water Hyacinth Monotypic	3	Greater than or equal to 90% areal coverage of Water Hyacinth.	
EeD	809200	Water Hyacinth Dominant	3	50% to 89% areal coverage of Water Hyacinth.	
EeS	809300	Water Hyacinth Sparse	3	10% to 49% areal coverage of Water Hyacinth.	
EeT	810000	Treated Water Hyacinth	2	Treated *Eichhornia crassipes.*	
EeMT	810100	Treated Water Hyacinth Monotypic	3	Greater than or equal to 90% areal coverage of treated Water Hyacinth.	
EeDT	810200	Treated Water Hyacinth Dominant	3	50% to 89% areal coverage of treated Water Hyacinth.	
EeST	810300	Treated Water Hyacinth Sparse	3	10% to 49% areal coverage of treated Water Hyacinth.	
EG	811000	Giant Grasses	2	Napier Grass (*Pennisetum purpureum*) and Silkreed *(Neyraudia reynaudiana*).	Silkreed is currently found in Collier, Monroe, Dade, Broward, Palm Beach, and Highland counties; Napier Grass is located in 29 Florida counties, most commonly in central and south Florida.
EGM	811100	Giant Grasses Monotypic	3	Greater than or equal to 90% areal coverage of Giant Grasses.	
EGD	811200	Giant Grasses Dominant	3	50% to 89% areal coverage of Giant Grasses.	
EGS	811300	Giant Grasses Sparse	3	10% to 49% areal coverage of Giant Grasses.	
EGT	812000	Treated Giant Grasses	2	Treated Napier Grass (*Pennisetum purpureum*) and Silkreed *(Neyraudia reynaudiana*).	
EGMT	812100	Treated Giant Grasses Monotypic	3	Greater than or equal to 90% areal coverage of treated Giant Grasses.	
EGDT	812200	Treated Giant Grasses Dominant	3	50% to 89% areal coverage of treated Giant Grasses.	
EGST	812300	Treated Giant Grasses Sparse	3	10% to 49% areal coverage of treated Shoebutton.	
Ei	813000	Cogongrass	2	*Imperata cylindrica*	Reported in dry to moist areas, such as pinelands, in all parts of Florida; found within EVER.
EiM	813100	Cogongrass Monotypic	3	Greater than or equal to 90% areal coverage of Cogongrass.	
EiD	813200	Cogongrass Dominant	3	50% to 89% areal coverage of Cogongrass.	
EiS	813300	Cogongrass Sparse	3	10% to 49% areal coverage of Cogongrass.	
EiT	814000	Treated Cogongrass	2	Treated *Imperata cylindrica* .	
EiMT	814100	Treated Cogongrass Monotypic	3	Greater than or equal to 90% areal coverage of treated Cogongrass.	
EiDT	814200	Treated Cogongrass Dominant	3	50% to 89% areal coverage of treated Cogongrass.	
EiST	814300	Treated Cogongrass Sparse	3	10% to 49% areal coverage of treated Cogongrass.	
Eip	815000	Water Spinach	2	*Ipomoea aquatica*	Occasionally found in highly disturbed areas along canals and levees of WCA2.
EipM	815100	Water Spinach Monotypic	3	Greater than or equal to 90% areal coverage of Water Spinach.	

Class ID	Raster ID	Name	Level	Description	Location
EipD	815200	Water Spinach Dominant	3	50% to 89% areal coverage of Water Spinach.	
EipS	815300	Water Spinach Sparse	3	10% to 49% areal coverage of Water Spinach.	
EipT	816000	Treated Water Spinach	2	Treated *Ipomoea aquatica*.	
EipMT	816100	Treated Water Spinach Monotypic	3	Greater than or equal to 90% areal coverage of treated Water Spinach.	
EipDT	816200	Treated Water Spinach Dominant	3	50% to 89% areal coverage of treated Water Spinach.	
EipST	816300	Treated Water Spinach Sparse	3	10% to 49% areal coverage of treated Water Spinach.	
El	817000	Lygodium	2	Japanese Climbing Fern (*Lygodium japonicum*) and Old-world Climbing Fern (*L. microphyllum*).	Found in Broward, Collier, DeSoto, Hardee, Highlands, Lee, Martin, Palm Beach, Polk, and Sarasota counties; found throughout tree islands of Loxahatchee NWR.
ElM	817100	Lygodium Monotypic	3	Greater than or equal to 90% areal coverage of Lygodium.	
ElD	817200	Lygodium Dominant	3	50% to 89% areal coverage of Lygodium.	
ElS	817300	Lygodium Sparse	3	10% to 49% areal coverage of Lygodium.	
ElT	818000	Treated Lygodium	2	Treated Japanese Climbing Fern (*Lygodium japonicum*) and Old-world Climbing Fern (*L. microphyllum*).	
ElMT	818100	Treated Lygodium Monotypic	3	Greater than or equal to 90% areal coverage of treated Lygodium.	
ElDT	818200	Treated Lygodium Dominant	3	50% to 89% areal coverage of treated Lygodium.	
ElST	818300	Treated Lygodium Sparse	3	10% to 49% areal coverage of treated Lygodium.	
Em	819000	Melaleuca	2	*Melaleuca quinquenervia*	Reported in 16 counties in central and southern Florida; common on lands adjacent to the WCAs and EVER; also found throughout Loxahatchee NWR.
EmM	819100	Melaleuca Monotypic	3	Greater than or equal to 90% areal coverage of Melaleuca.	
EmD	819200	Melaleuca Dominant	3	50% to 89% areal coverage of Melaleuca.	
EmS	819300	Melaleuca Sparse	3	10% to 49% areal coverage of Melaleuca.	
EmT	820000	Treated Melaleuca	2	Treated *Melaleuca quinquenervia*.	
EmMT	820100	Treated Melaleuca Monotypic	3	Greater than or equal to 90% areal coverage of treated Melaleuca.	
EmDT	820200	Treated Melaleuca Dominant	3	50% to 89% areal coverage of treated Melaleuca.	
EmST	820300	Treated Melaleuca Sparse	3	10% to 49% areal coverage of treated Melaleuca.	
Ep	821000	Torpedo Grass	2	*Panicum repens*	Occurs naturalized in 75% of Florida; generally found in areas of disturbed marsh along canals and ditches.
EpM	821100	Torpedo Grass Monotypic	3	Greater than or equal to 90% areal coverage of Torpedo Grass.	
EpD	821200	Torpedo Grass Dominant	3	50% to 89% areal coverage of Torpedo Grass.	
EpS	821300	Torpedo Grass Sparse	3	10% to 49% areal coverage of Torpedo Grass.	
EpT	822000	Treated Torpedo Grass	2	Treated *Panicum repens*.	
EpMT	822100	Treated Torpedo Grass Monotypic	3	Greater than or equal to 90% areal coverage of treated Torpedo Grass.	
EpDT	822200	Treated Torpedo Grass Dominant	3	50% to 89% areal coverage of treated Torpedo Grass.	
EpST	822300	Treated Torpedo Grass Sparse	3	10% to 49% areal coverage of treated Torpedo Grass.	
Epi	823000	Water Lettuce	2	*Pistia stratiotes*	Found throughout peninsular Florida; generally found along the margins of canals or in other areas of mostly still, open water.
EpiM	823100	Water Lettuce Monotypic	3	Greater than or equal to 90% areal coverage of Water Lettuce.	
EpiD	823200	Water Lettuce Dominant	3	50% to 89% areal coverage of Water Lettuce.	

Class ID	Raster ID	Name	Level	Description	Location
EpiS	823300	Water Lettuce Sparse	3	10% to 49% areal coverage of Water Lettuce.	
EpiT	824000	Treated Water Lettuce	2	Treated *Pistia stratiotes* .	
EpiMT	824100	Treated Water Lettuce Monotypic	3	Greater than or equal to 90% areal coverage of treated Water Lettuce.	
EpiDT	824200	Treated Water Lettuce Dominant	3	50% to 89% areal coverage of treated Water Lettuce.	
EpiST	824300	Treated Water Lettuce Sparse	3	10% to 49% areal coverage of treated Water Lettuce.	
Eh	825000	Sugar Cane	2	*Saccharum officinarum*	Often found in recovering agricultural areas or in the margins of natural areas adjacent to agricultural fields.
EhM	825100	Sugar Cane Monotypic	3	Greater than or equal to 90% areal coverage of Sugar Cane.	
EhD	825200	Sugar Cane Dominant	3	50% to 89% areal coverage of Sugar Cane.	
EhS	825300	Sugar Cane Sparse	3	10% to 49% areal coverage of Sugar Cane.	
EhT	826000	Treated Sugar Cane	2	Treated *Saccharum officinarum* .	
EhMT	826100	Treated Sugar Cane Monotypic	3	Greater than or equal to 90% areal coverage of treated Sugar Cane.	
EhDT	826200	Treated Sugar Cane Dominant	3	50% to 89% areal coverage of treated Sugar Cane.	
EhST	826300	Treated Sugar Cane Sparse	3	10% to 49% areal coverage of treated Sugar Cane.	
Es	827000	Brazilian Pepper	2	*Schinus terebinthifolius*	Found in Florida as far north as Levy and St. Johns counties and as far west as Santa Rosa County; commonly located in disturbed areas, along canals and levees, road shoulders, and on disturbed tree islands.
EsM	827100	Brazilian Pepper Monotypic	3	Greater than or equal to 90% areal coverage of Brazilian Pepper.	
EsD	827200	Brazilian Pepper Dominant	3	50% to 89% areal coverage of Brazilian Pepper.	
EsS	827300	Brazilian Pepper Sparse	3	10% to 49% areal coverage of Brazilian Pepper.	
EsT	828000	Treated Brazilian Pepper	2	Treated *Schinus terebinthifolius* .	
EsMT	828100	Treated Brazilian Pepper Monotypic	3	Greater than or equal to 90% areal coverage of treated Brazilian Pepper.	
EsDT	828200	Treated Brazilian Pepper Dominant	3	50% to 89% areal coverage of treated Brazilian Pepper.	
EsST	828300	Treated Brazilian Pepper Sparse	3	10% to 49% areal coverage of treated Brazilian Pepper.	
En	829000	Tropical Soda Apple	2	*Solanum viarum*	Now a common weed in fields and groves, along roadsides, in pinelands, and hammock edges as far north as the panhandle of Florida.
EnM	829100	Tropical Soda Apple Monotypic	3	Greater than or equal to 90% areal coverage of Tropical Soda Apple.	
EnD	829200	Tropical Soda Apple Dominant	3	50% to 89% areal coverage of Tropical Soda Apple.	
EnS	829300	Tropical Soda Apple Sparse	3	10% to 49% areal coverage of Tropical Soda Apple.	
EnT	830000	Treated Tropical Soda Apple	2	Treated *Solanum viarum* .	
EnMT	830100	Treated Tropical Soda Apple Monotypic	3	Greater than or equal to 90% areal coverage of treated Tropical Soda Apple.	
EnDT	830200	Treated Tropical Soda Apple Dominant	3	50% to 89% areal coverage of treated Tropical Soda Apple.	
EnST	830300	Treated Tropical Soda Apple Sparse	3	10% to 49% areal coverage of treated Tropical Soda Apple.	
Ey	831000	Java Plum	2	*Syzygium cumini*	Found mostly in wet pinelands, hammocks, and well drained uplands of south Florida, including Palm Beach, Collier, and Lee counties.
EyM	831100	Java Plum Monotypic	3	Greater than or equal to 90% areal coverage of Java Plum.	
EyD	831200	Java Plum Dominant	3	50% to 89% areal coverage of Java Plum.	
EyS	831300	Java Plum Sparse	3	10% to 49% areal coverage of Java Plum.	

Class ID	Raster ID	Name	Level	Description	Location
EyT	832000	Treated Java Plum	2	Treated *Syzygium cumini*.	
EyMT	832100	Treated Java Plum Monotypic	3	Greater than or equal to 90% areal coverage of treated Java Plum.	
EyDT	832200	Treated Java Plum Dominant	3	50% to 89% areal coverage of treated Java Plum.	
EyST	832300	Treated Java Plum Sparse	3	10% to 49% areal coverage of treated Java Plum.	
Et	833000	Seaside Mahoe	2	*Thespesia populnea*	Now a common constituent of low wave action beaches and mangroves of south Florida.
EtM	833100	Seaside Mahoe Monotypic	3	Greater than or equal to 90% areal coverage of Seaside Mahoe.	
EtD	833200	Seaside Mahoe Dominant	3	50% to 89% areal coverage of Seaside Mahoe.	
EtS	833300	Seaside Mahoe Sparse	3	10% to 49% areal coverage of Seaside Mahoe.	
EtT	834000	Treated Seaside Mahoe	2	Treated *Thespesia populnea*.	
EtMT	834100	Treated Seaside Mahoe Monotypic	3	Greater than or equal to 90% areal coverage of treated Seaside Mahoe.	
EtDT	834200	Treated Seaside Mahoe Dominant	3	50% to 89% areal coverage of treated Seaside Mahoe.	
EtST	834300	Treated Seaside Mahoe Sparse	3	10% to 49% areal coverage of treated Seaside Mahoe.	
N	900000	Non-Vegetative	1	Non-vegetative areal coverage.	
BCH	901000	Beach	2	Sand covered ground adjacent to lakes, bays, oceans, or other large bodies of water.	
HI	902000	Human Impacted	2	Areas impacted by human disturbance.	
AG	902010	Agriculture	3	Agriculture areas such as nurseries, crops, grazing areas, and farms.	
AB	902120	Airboat Trail	3	Airboat trail.	
CA	902020	Canal	3	Water bodies specifically designed to direct water from one location to another.	
CO	902030	Commercial	3	Commercial areas such as malls, parking lots, and factories.	
FC	902050	Fish Camp	3	Camp site, generally with a building(s), and its associated disturbed area.	
HID	902130	Hole-in-the-Donut	3	Restoration and recovery of the Hole-in-the-Donut area to a marl prairie wetland vegetative community.	
LEV	902060	Levee	3	Elevated berm, generally with an access road, utilized to contain a body of water such as a lake or marsh	
ORV	902070	ORV Trail	3	Off-road vehicle trail.	
PS	902040	Pump Station	3	Structure used to move water through canals.	
QUA	902080	Quarry	3	Area used for mining rocks, minerals, or other natural resources.	
RES	902090	Residential	3	Residential areas such as subdivisions, lawns, and playgrounds.	
RD	902100	Road	3	Paved and unpaved roads other than levees.	
SP	902110	Spoil	3	Areas such as power lines and abandoned agricultural areas.	
MUD	903000	Mud	2	Moist or dry open ground.	
OW	904000	Open Water	2	Open water areas such as ponds, lakes, rivers, bays, and estuaries.	
O	905000	Other	2	Describes vegetation or non-vegetation cover other than some vegetation of particular interest. On a cattail map, for example, Other (**O**) would be used to indicate all vegetation and non-vegetation cover except for cattail, the vegetation of particular interest.	
REF	906000	Refugia	2	An alligator hole or refuge.	
SF	907000	Barren Salt Flat	2	Barren, generally hypersaline, flats exposed at low tide.	
UNK	908000	Unknown	2	Unknown vegetation or other land cover.	
n/a	1000	Modifiers	n/a	Additional attributed information.	
I	1001	Tree Island	n/a	To be used as a modifier to indicate the presence, greater than 10%, of tree island structure within a given cell. This label will be used in addition to the label for the actual community or species comprising the majority of the cell. For example, a cell containing 89% Open Marsh (MFO) and 11% Bayhead Forest (FSB) in the form of a tree island structure, pop-up or strand island, will be labeled as MFO,I. The bayhead component in the previous example can be replaced with willow, wax myrtle, cocoplum, and so forth and the “I” will still be still be necessary if the woody vegetation is in the form of a tree island.	Found throughout the Everglades.
P	1002	Periphyton	n/a	To be used as a modifier to indicate the presence of floating and submergent periphyton species.	

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

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