



**CEDAR KEY SCRUB  
STATE RESERVE**  
Park Chapter

GULF COAST REGION

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Cedar Key Scrub State Reserve

Park Chapter

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## Cedar Key Scrub State Reserve

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**Planning Region:** Gulf Coast

**County:** Levy

**Lease/Management Agreement Number:** 4523

**Overview:** Cedar Key Scrub State Reserve protects numerous natural communities, including scrub, sandhill, scrubby flatwoods, mangrove swamp, and saltmarsh. Imperiled species such as the gopher tortoise, scrub jay, and various wading birds are often observed by hikers, cyclists, and equestrians while enjoying the reserve's 12 miles of trails. As a state reserve, hunting opportunities are provided during the annual hunting season.

**Total Acreage:** 6,784.31

<b>Natural Communities</b>	<b>Acres</b>
Mesic Flatwood	879.87
Sandhill	4.30
Scrub	136.84
Scrubby Flatwoods	837.75
Basin Marsh	786.15
Basin Swamp	523.73
Depression Marsh	95.95
Hydric Hammock	531.38
Mangrove Swamp	5.64
Salt Marsh	1599.26
Blackwater Stream	0.27
Estuarine Composite Substrate	791.60
Estuarine Mollusk Reef	39.86

<b>Altered Land Cover</b>	<b>Acres</b>
Artificial Pond	4.90
Canal/Ditch	0.68
Clearing/Regeneration	1.58
Developed	4.35
Pine Plantation	432.22
Spoil Area	1.89

**Acquisition:** Cedar Key Scrub State Reserve was initially acquired on December 27, 1978 with funds from Environmentally Endangered Lands (EEL) program. Currently, the reserve comprises 6,784.31 acres.

### Resource Management Component

#### Hydrology

- Assess the reserve's hydrological restoration needs.
- Restore hydrological conditions to approximately 1,217 acres combined acres of hydric hammock, basin swamp, and salt marsh.

## Cedar Key Scrub State Reserve

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### **Natural Communities**

- Maintain 2,500 acres within the optimum fire return interval.
- Conduct natural community restoration activities on 432 acres.
- Conduct natural community improvement activities on 500 acres.
- Conduct natural community/habitat improvement activities on 106 acres of clearcut pine plantation.

### **Imperiled Species**

- Update baseline imperiled species occurrence list
- Monitor and document 6 selected imperiled animal species in the park.
  - scrub-jay, indigo snake, gopher tortoise, salt marsh vole, Scott's seaside sparrow and Marian's marsh wren.
- Monitor and document 1 selected imperiled plant species in the park.

### **Invasive and Nuisance Species**

- Annually treat 4 gross acres of invasive plant species.
- Implement control measures on 1 invasive animal species.
  - Feral hogs

### **Cultural Resources**

- Assess 10 of 11 recorded cultural resources.
- Compile reliable documentation for all recorded historic and archaeological resources.
- Bring 1 of 10 recorded cultural resources into good condition.

## Land Use Component

### **Conceptual Land Use**

#### *State Road 24 Trailhead*

- Remove defunct restroom.
- Stabilize parking area.

#### *County Road 347 Trailhead*

- Stabilize parking area.
- Construct a picnic pavilion in conjunction with higher visitation.

#### *Trail System*

- Reconfigure trail system.
- Improve wayfinding with trail markers.
- Revise trail maps.

#### *Panther Ridge South Entrance (Trailhead)*

- Add checkpoint.
- Develop parking.

## Cedar Key Scrub State Reserve

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### *Panther Ridge Trail System*

- Design and develop a 6-mile singletrack trail system.
- Install interpretive elements to facilitate wayfinding.

### *Support Area*

- Renovate and/or update existing residences.
- Build new pole barn.
- Remove unused structures as needed.

### **Optimum Boundary**

The optimum boundary for Cedar Key Scrub State Reserve encompasses several areas. Uplands along State Road 24 were initially purchased with plans for development are now included within the Gulf Coast Mitigation Bank. After restoration, credits can be sold and transferred into public ownership. Inholdings are home to several natural communities which include scrubby flatwoods, hydric hammock, and salt marsh. Complete incorporation of these parcels would permit a nearly continuous band of protected land spanning from the Big Bend region of the Gulf Coast to Yankeetown. Furthermore, imperiled species such as the salt marsh vole and scrub jays would receive greater protection upon potential acquisition.



# CEDAR KEY SCRUB STATE RESERVE

LEVY COUNTY, FLORIDA

0 0.5 1 Miles

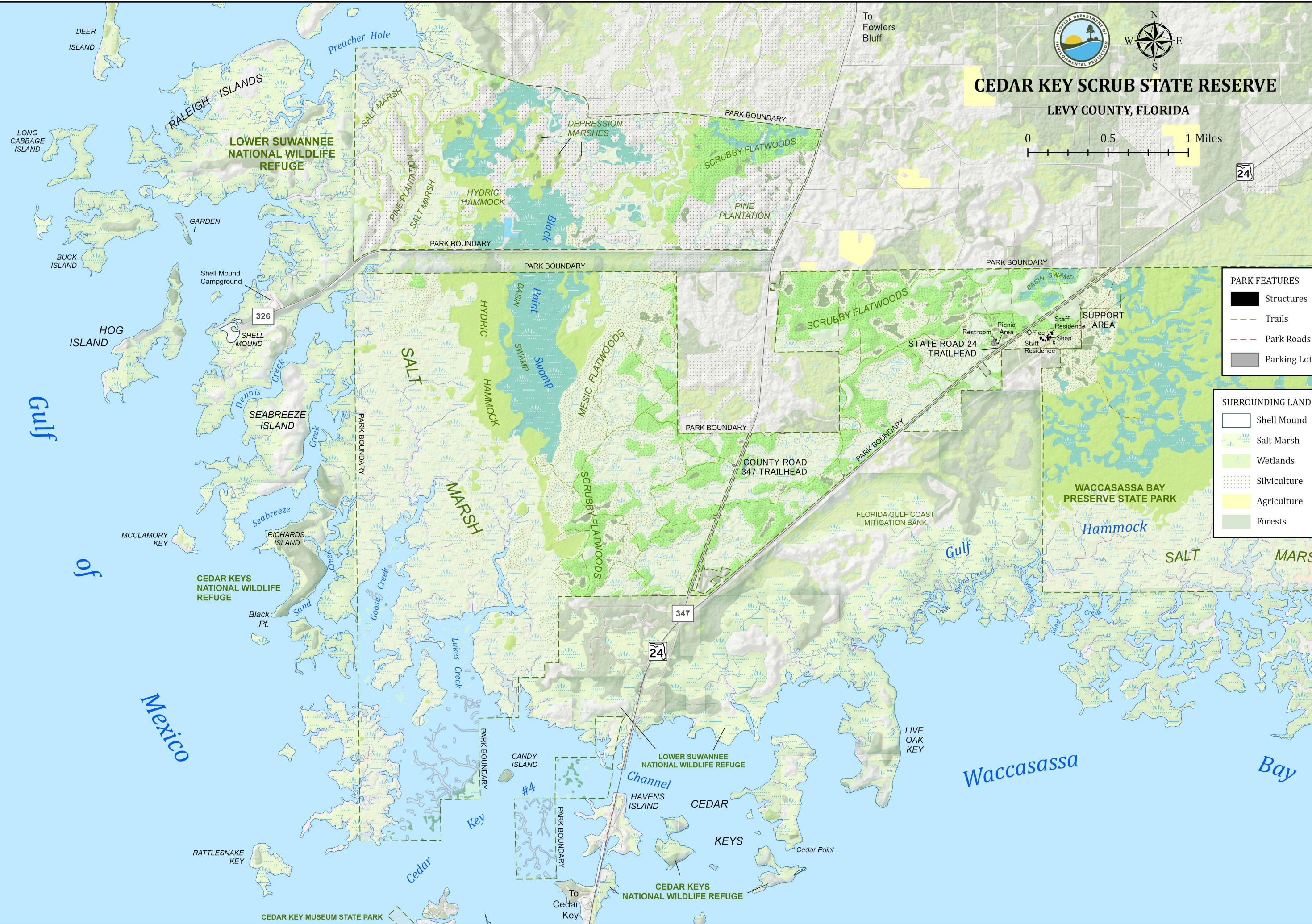


### PARK FEATURES

- Structures
- Trails
- Park Roads
- Parking Lots

### SURROUNDING LAND COVER

- Shell Mound
- Salt Marsh
- Wetlands
- Silviculture
- Agriculture
- Forests



DEER ISLAND

LONG CABBAGE ISLAND

RALEIGH ISLANDS

LOWER SUWANNEE NATIONAL WILDLIFE REFUGE

GARDEN I.

BUCK ISLAND

HOG ISLAND

Shell Mound Campground

326

SHELL MOUND

SEABREEZE ISLAND

MCCLAMORY KEY

CEDAR KEYS NATIONAL WILDLIFE REFUGE

Black Pt.

Mexico

RATTLESNAKE KEY

CEDAR KEY MUSEUM STATE PARK

Preacher Hole

SALT MARSH

PINE PLANTATION

HYDRIC HAMMOCK

DEPRESSION MARSHES

SCRUBBY FLATWOODS

PINE PLANTATION

PARK BOUNDARY

HYDRIC HAMMOCK

SALT MARSH

Point Basin

Swamp

MESIC FLATWOODS

SCRUBBY FLATWOODS

MARSH

PARK BOUNDARY

COUNTY ROAD 347 TRAILHEAD

PARK BOUNDARY

FLORIDA GULF COAST MITIGATION BANK

LIVE OAK KEY

STATE ROAD 24 TRAILHEAD

Restroom

Picnic Area

Office

Staff Residence

Shop

WACCASASSA BAY PRESERVE STATE PARK

Hammock

SALT MARSH

24

347

Channel

HAVENS ISLAND

CEDAR KEYS

CEDAR KEYS NATIONAL WILDLIFE REFUGE

Cedar Point

To Cedar Key

To Fowlers Bluff

To Otter Creek

## **INTRODUCTION**

### **LOCATION AND ACQUISITION HISTORY**

Cedar Key Scrub State Reserve is located in Levy County. Access to the main entrance is from State Road 24. The Gulf Coast Region Map reflects significant land and water resources existing near the reserve.

Cedar Key Scrub State Reserve was initially acquired on Dec. 27, 1978, with funds from the Environmentally Endangered Lands (EEL) program. Currently, the reserve comprises 6,784.31 acres. The Board of Trustees of the Internal Improvement Trust Fund (Trustees) hold fee simple title to the reserve and in 2014 the Trustees leased (Lease No. 4523) the property to the Division of Recreation and Parks (DRP) under a 50-year lease. The current lease will expire on July 10, 2064.

Cedar Key Scrub State Reserve is designated single-use to provide public outdoor recreation and conservation. There are no legislative or executive directives that constrain the use of this property (see appendix). A legal description of the reserve property can be made available upon request to the Florida Department of Environmental Protection (DEP).

### **SECONDARY AND INCOMPATIBLE USES**

In accordance with 253.034(5) F.S., the potential of the reserve to accommodate secondary management purposes was analyzed. These secondary purposes were considered within the context of DRP's statutory responsibilities and resource values. This analysis considered the reserve's natural and cultural resources, management needs, aesthetic values, visitation, and visitor experiences. It was determined that timber management activities approved by the DRP could be accommodated in a manner that would be compatible and not interfere with the primary purpose of resource-based outdoor recreation and conservation.

DRP has determined that uses such as water resource development projects, water supply projects, stormwater management projects, linear facilities and sustainable agriculture and forestry (other than those management activities specifically identified in this plan) would not be consistent with the management purposes of the reserve.

In accordance with 253.034(5) F.S., the potential for generating revenue to enhance management was also analyzed. Visitor fees and charges are the principal source of revenue generated by the reserve. It was determined that timber harvesting for the express purpose of natural community restoration and management is appropriate as an additional source of revenue for land management since it is compatible with the reserve's primary purpose of outdoor recreation and conservation. Generating revenue from consumptive uses or from activities that are not expressly related to resource management and conservation is not under consideration.

### **PURPOSE AND SIGNIFICANCE**

#### **Park Purpose**

Cedar Key Scrub State Reserve protects a variety of natural communities ranging from xeric uplands to coastal hammocks that provide important wildlife habitat and help protect the water quality of adjacent

estuaries. The reserve provides opportunities for outdoor recreation such as hiking, equestrian, nature appreciation and seasonal hunting.

### **Park Significance**

- Ancient sand dunes foster the scrub, which is among the rarest of natural communities in the state and provides habitat for imperiled species such as the Florida scrub-jay, gopher tortoise and manatee.
- Important wetland natural communities, such as hydric hammock, serve to attenuate and filter large pulses of stormwaters and gradually release them to the adjacent estuary.
- More than 13 miles of multiuse trails provide resource-based recreation. A portion of the Florida Circumnavigational Saltwater Paddling Trail is adjacent to the park.
- Designated as a reserve, this park is one of two units in the Florida State Parks system to provide seasonal hunting opportunities.

### **Central Park Theme**

Where tidal marshes meet towering pines, Cedar Key Scrub State Reserve nurtures one of Florida's most imperiled landscapes, the scrub.

Cedar Key Scrub State Reserve is classified as a state reserve in the DRP unit classification system. In the management of a state reserve, preservation and enhancement of natural conditions is all important. Resource considerations are given priority over user considerations and development is restricted to the minimum necessary for ensuring its protection and maintenance, limited access, user safety and convenience, and appropriate interpretation. Permitted uses are primarily of a passive nature, related to the aesthetic, educational and recreational enjoyment of the preserve, although other compatible uses are permitted in limited amounts. Program emphasis is placed on interpretation of the natural and cultural attributes of the preserve.

### **OTHER DESIGNATIONS**

The unit is not within an Area of Critical State Concern as defined in section 380.05; Florida Statutes and is not presently under study for such designation. The reserve is a component of the Florida Greenways and Trails System, administered by the DEP Office of Greenways and Trails.

All waters within the reserve have been designated as Outstanding Florida Waters, pursuant to Chapter 62-302, Florida Administrative Code. Surface waters in this park are also classified as Class II or Class III waters by DEP. The reserve is adjacent to the Big Bend Seagrass Aquatic Preserve as designated under the Florida Aquatic Preserve Act of 1975 (Section 258.35, Florida Statutes).

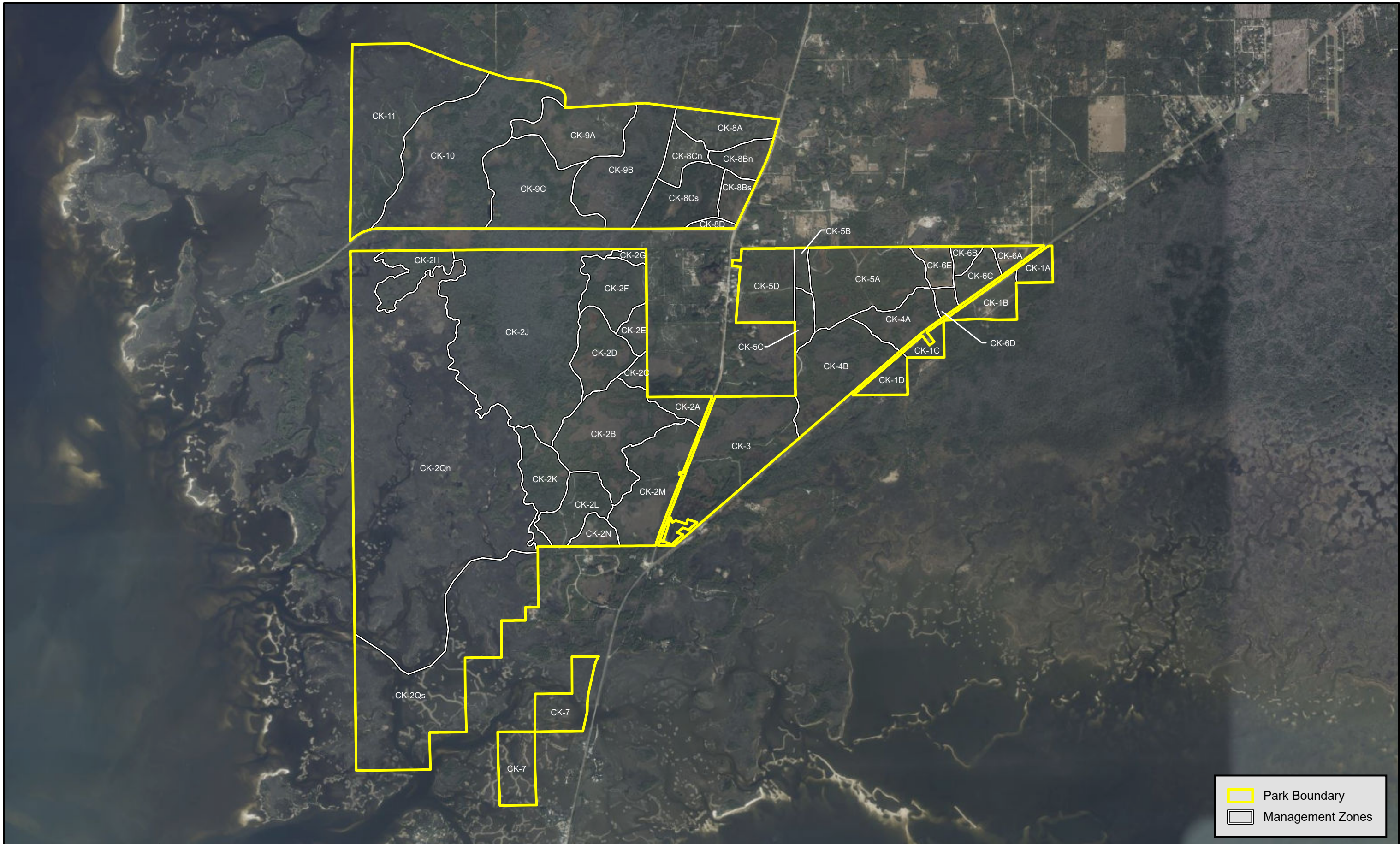


## **PARK ACCOMPLISHMENTS**

- Widened fire lines for safer burning.
- Cooperated with the Florida Fish and Wildlife Conservation Commission (FWC) on an ongoing long-term bat monitoring study.
- Participated in Florida Scrub Jay Watch program with Florida Audubon.
- Completed timber assessment of Panther Ridge addition.
- Replaced trail markers on side A of the reserve.

## RESOURCE MANAGEMENT COMPONENT

Cedar Key Scrub State Reserve Management Zones			
Management Zone	Acreage	Managed with Prescribed Fire	Contains Known Cultural Resources
CK-1a	28.20	Y	Y
CK-1b	54.03	Y	Y
CK-1c	24.33	Y	Y
CK-1d	36.44	Y	Y
CK-2a	31.67	Y	N
CK-2b	230.83	Y	N
CK-2c	19.09	Y	N
CK-2d	103.12	Y	Y
CK-2e	29.10	Y	N
CK-2f	103.95	Y	N
CK-2g	12.80	Y	N
CK-2h	73.60	Y	N
CK-2j	625.25	Y	Y
CK-2k	98.29	Y	Y
CK-2l	90.02	Y	Y
CK-2m	182.80	Y	N
CK-2n	32.16	Y	N
CK-2qn	1454.17	Y	Y
CK-2qs	542.99	Y	N
CK-3	286.12	Y	N
CK-4a	82.65	Y	N
CK-4b	194.17	Y	Y
CK-5a	215.74	Y	N
CK-5b	18.85	Y	N
CK-5c	30.93	Y	N
CK-5d	123.60	Y	N
CK-6a	23.08	Y	Y
CK-6b	18.17	Y	N
CK-6c	43.48	Y	N
CK-6d	16.39	Y	N
CK-6e	37.15	Y	N
CK-7	160.15	Y	Y
CK-8a	87.54	Y	N
CK-8bn	48.63	Y	N
CK-8bs	38.67	Y	N
CK-8cn	47.85	Y	N
CK-8cs	118.13	Y	N
CK-8d	11.54	Y	N
CK-9a	152.74	Y	N
CK-9b	211.25	Y	N
CK-9c	220.28	Y	N
CK-10	430.11	Y	N
CK-11	384.26	Y	N



Park Boundary  
 Management Zones



**CEDAR KEY SCRUB STATE RESERVE**  
Management Zones



Sources: ESRI; Florida Department of Environmental Protection  
 This graphical representation is provided for informational purposes and should not be considered authoritative for navigational, engineering, legal, and other uses.

## **TOPOGRAPHY**

Cedar Key Scrub State Reserve (Cedar Key Scrub) is located within the Gulf Coastal Lowlands of Florida's mid-peninsular physiographic zone (White 1970). This western Levy County coastal reserve lies squarely within the heart of an expansive wilderness called Florida's Big Bend region (Hine et al. 1988; Davis 1997). The Big Bend coastline spans an eight-county wide area on Florida's west coast from the Ochlockonee River in Wakulla County southward to the Anclote River in Pasco County. Florida's Big Bend remains relatively undeveloped from Levy County northward except for small, scattered tourist and fishing towns, such as the village of Cedar Key.

Much of the Big Bend coastline, including Waccasassa Bay to the south of the reserve and Suwannee Sound to the north, is also part of a Coastal Swamp subregion that is characterized by low elevation coastal wetlands and a drowned karst topography (Hine et al. 1988; Wolfe et al. 1990). The Coastal Swamps are also a major discharge zone for the Floridan aquifer, which will be discussed further below under hydrology (SRWMD 2006; Raabe et al. 2010).

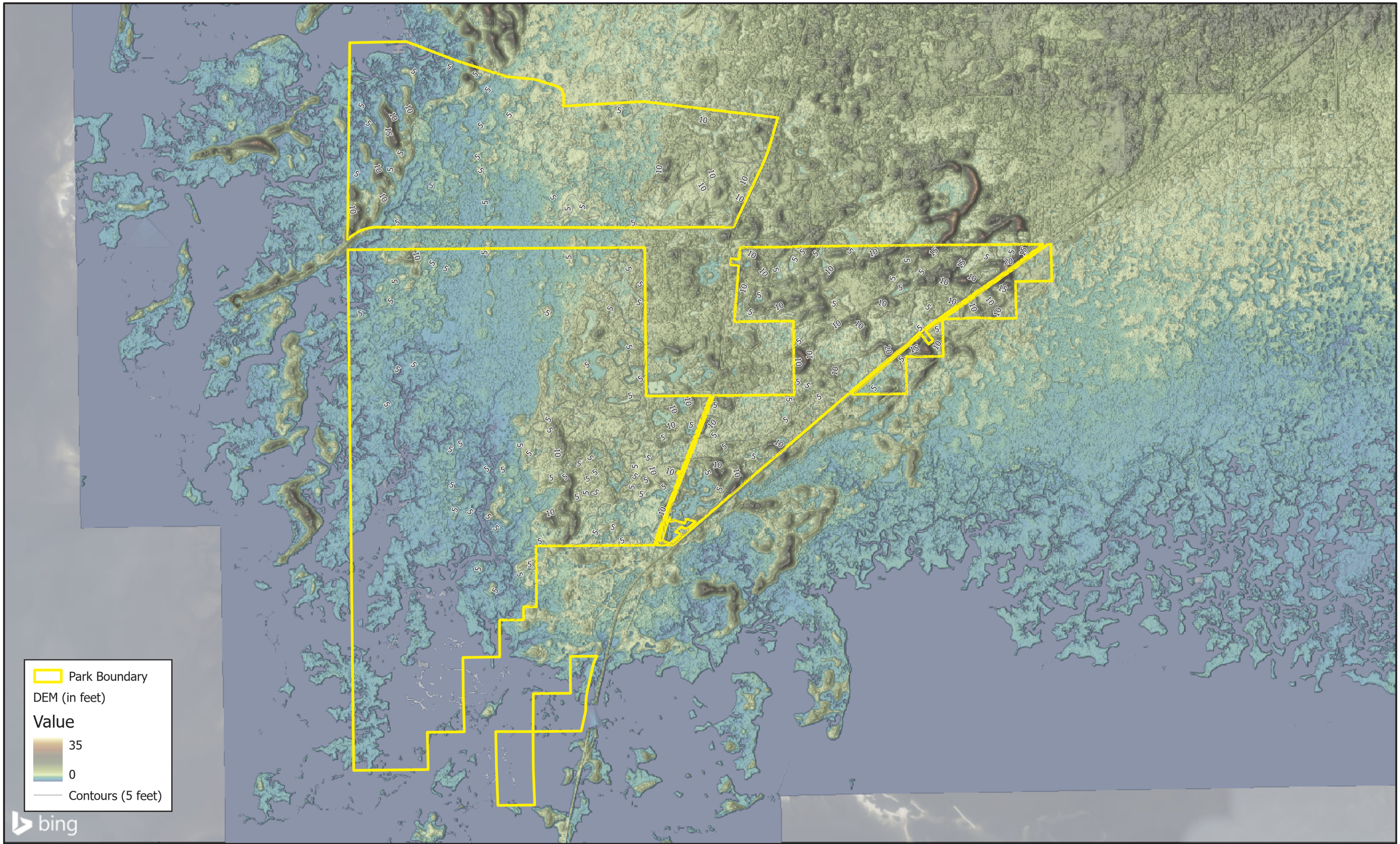
Cedar Key Scrub is unique in that it is part of an ancient dune field that formed sometime around the end of the Pleistocene epoch when the coastline was roughly 100 miles further to the west (McFadden and Palmiotto 2013). These relict paleodunes, including numerous offshore islands in the vicinity of Cedar Key, are predominately underlain by an ancient limestone escarpment and capped by substantial deposits of wind-blown quartz sand sediment of varying thicknesses. These deposits accumulated over the geologic past during a period of lowered sea levels (Vernon 1951; Faught and Carter 1998; Bryan et al. 2008). Elevations at Cedar Key Scrub can range from below mean sea level (msl) within the tidal flats along the reserves western boundary up to 32 feet at some of the largest dunes in the northeast portion of the park. Drainage is primarily towards the Gulf of Mexico through the numerous tidal creeks and marshes that extend into the reserve. In the interior of the reserve are numerous shallow depressions that vary widely in size and vegetative structure.


Several high elevation sand ridges are bisected by State Road 24 as it cuts through the reserve. Other topographic alterations include service roads, abandoned logging-tram beds, firebreaks, and ditches. Fire plow lines were cut during wildfire suppression activities on several occasions over the past fifty years. The most recent major fire suppression occurred in May 2009. While the long-term effects of fire plow scars on the topography and hydrology of the reserve are not yet understood, there is definitely cause for concern.

Given the low elevation nature of this park, potential impacts of sea level rise to the property's natural and cultural resources are an important management concern (Scavia et al. 2002; Ellis et al. 2004; Dean et al. 2004).

## **SOILS**


There are nine soil types present within Cedar Key Scrub State Reserve (Slabaugh et al. 1996). These soil types range from well-drained sandy soils in the uplands to poorly drained, frequently flooded, mucky soils in areas of tidal marsh (see Soils Map). The appendix contains a complete list and descriptions of these soils.




 Park Boundary

DEM (in feet)

Value

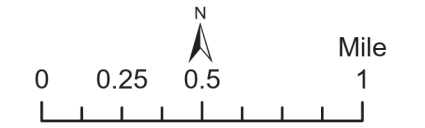
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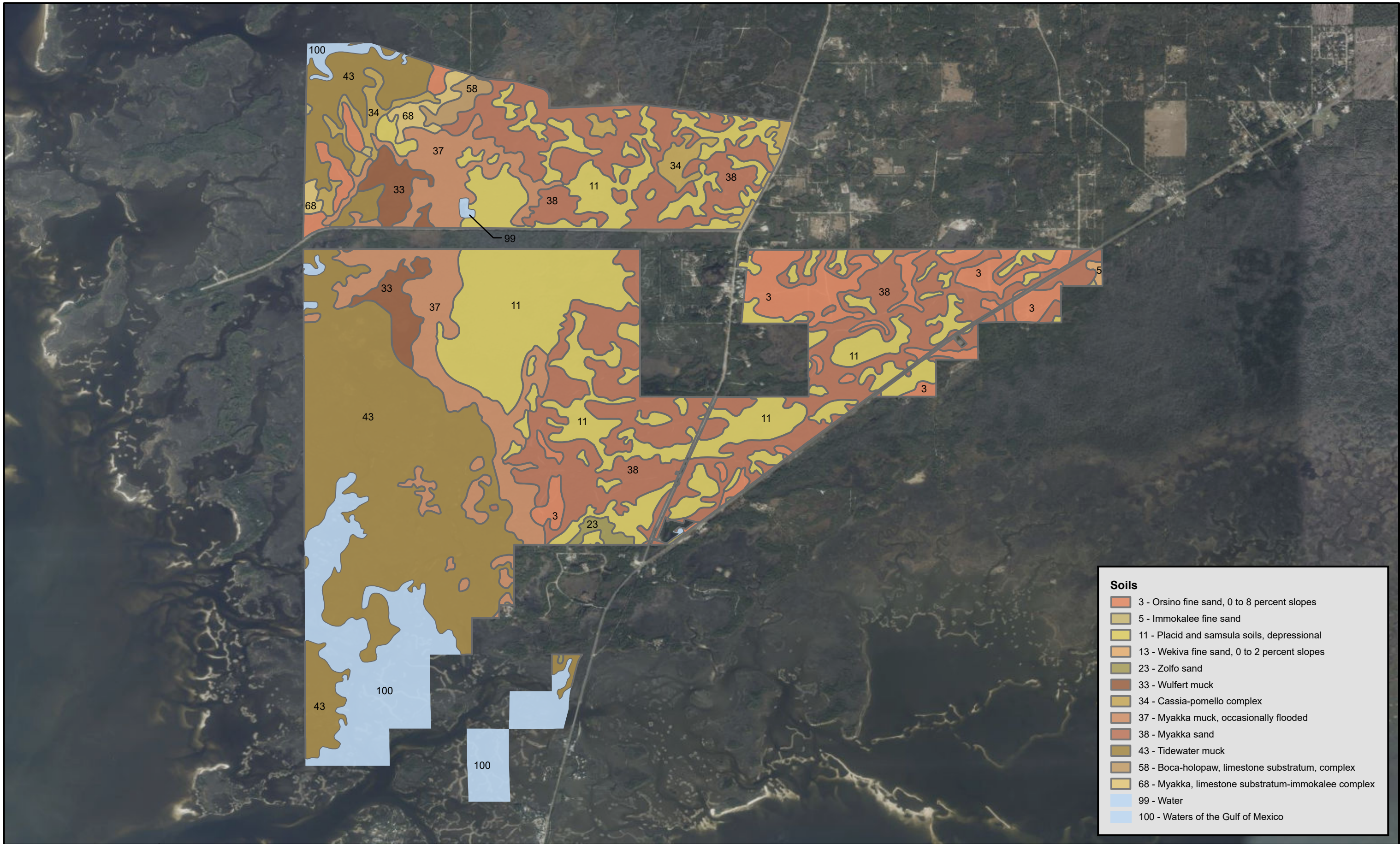
 Contours (5 feet)



CEDAR KEY SCRUB STATE RESERVE  
Topography



Sources: ESRI; Florida Department of Environmental Protection  
This graphical representation is provided for informational purposes and should not be considered authoritative for navigational, engineering, legal, and other uses.



**Soils**

- 3 - Orsino fine sand, 0 to 8 percent slopes
- 5 - Immokalee fine sand
- 11 - Placid and samsula soils, depressional
- 13 - Wekiva fine sand, 0 to 2 percent slopes
- 23 - Zolfo sand
- 33 - Wulfert muck
- 34 - Cassia-pomello complex
- 37 - Myakka muck, occasionally flooded
- 38 - Myakka sand
- 43 - Tidewater muck
- 58 - Boca-holopaw, limestone substratum, complex
- 68 - Myakka, limestone substratum-immokalee complex
- 99 - Water
- 100 - Waters of the Gulf of Mexico



**CEDAR KEY SCRUB STATE RESERVE**  
Soils



Sources: ESRI; Florida Department of Environmental Protection  
This graphical representation is provided for informational purposes and should not be considered authoritative for navigational, engineering, legal, and other uses.

Several areas within the reserve have experienced some degree of soil erosion. Where service roads run along the edges of stabilized dunes and where State Road 24 slices deeply through the dunes, sands tend to destabilize, and the dunes become more prone to erosion.

Illegal foot and vehicular access to the dune ridges traversed by State Road 24 have caused some slumping of the cut edges of the dunes. Some soil disturbance has also occurred where service roads intersect wetland sites.

Lastly, and most significantly, fire plow scars remaining from several wildfire suppression events have impacted soils within the reserve. While the older plow lines are relatively stable and have become somewhat restored with the passage of time, some of the more recent ones may require additional re-contouring. On the other hand, most of the regular firebreaks installed in the reserve under nonemergency conditions do not appear to be causing impacts to soil or water resources. Management activities will follow generally accepted best management practices to minimize or prevent soil erosion and to conserve soil and water resources on site.

## **HYDROLOGY**

In addition to being part of the Big Bend region, Cedar Key Scrub State Reserve is also positioned at the northern extent of a unique karst-dominated landscape called the Springs Coast (Wolfe 1990). In its southern reaches, the Springs Coast hosts some of the largest springs groups in the state (Spechler and Schiffer 1995). Although there are no major spring-run streams found in the reserve, there are at least three significant groundwater discharge points associated with two of Cedar Key Scrub State Reserve's western tidal systems, namely Lukens and Goose creeks (Raabe and Bialkowska-Jelinska 2010). The most prominent hydrological features of the reserve are the diverse freshwater wetlands, coastal hydric hammocks, brackish ecosystems containing portions of five major tidal creeks, and the above-mentioned submarine groundwater discharge (SGD) fractures (Xinya et al. 2009).

These SGD fractures that are scattered throughout the Big Bend region, as well as the numerous well-known spring-fed rivers within the Springs Coast, are all embedded within a large matrix of coastal hydric hammock, salt marsh, mangrove swamp, seagrass and other nearshore habitats that provide a constant source of fresh water to a relatively stable estuarine environment (Zieman and Zieman 1989; Raabe and Stumpf 1996). The origin, density and locations of important underground fracture traces in western Levy County have been documented and discussed (Vernon 1951; Raabe and Bialkowska-Jelinska 2010; Lines et al. 2012). The aforementioned SGD limestone features formed as a result of extensive chemical erosion that occurred over geologic time that was associated with sea level changes and freshwater discharges, and is closely aligned with regional geology of fractures and faults. (Raabe and Bialkowska-Jelinska 2010). It is important to understand that the SGD fractures are directly connected to the Floridan aquifer system (Vernon 1951; Hine et al. 1988).

Scientists who have worked in the Big Bend region over the past three decades have also documented that Florida's west coast shorelines have been undergoing a dramatic natural community transformation from previously dominated freshwater systems to one that is predominately salt water (Casteneda and Putz 2007). It is unknown how many freshwater wetlands in the Cedar Key region have converted into brackish systems as a result of lowered aquifer levels from significant historic droughts, increased groundwater demand or changes associated with global sea level rise (Johnston and Bush 1988; Williams et al. 1999; Raabe et al. 2004; Knight 2015; Williams et al. 2003).

Technically, Cedar Key Scrub State Reserve lies within the Waccasassa River drainage basin (Suwannee River Water Management District 2006). Due to the close proximity of the Gulf of Mexico, however, no surface water from the reserve actually enters the Waccasassa River or its tributaries. The reserve's ancient paleodunes occupy a very distinct topographically elevated area between the lower Suwannee River and the Waccasassa River drainage basins. Within the reserve, surface water is part of a matrix of freshwater wetlands that gradually drain toward the estuarine ecosystems.

Big Bend Sea Grasses Aquatic Preserve lies adjacent to and shares a common boundary with the western portion of Cedar Key Scrub State Reserve. This aquatic preserve is Florida's most significant publicly managed estuary and contains the largest seagrass beds in the state (Mattson et al. 2007; DEP 2014). All the freshwater wetlands in the reserve are considered Class III waters, while the estuarine areas are classified as Class II waters, although there are restrictions on shellfish harvesting (DEP 2014). The tidal creeks and adjacent estuarine areas within the reserve are classified as either Conditionally Restricted or Conditionally Approved shellfish harvesting areas.

Cedar Key Scrub State Reserve has five primary wetland types including basin marshes with predominantly sawgrass (*Cladium jamaicense*), basin swamps containing cypress (*Taxodium ascendens*) with one locally known as Black Point Swamp, hydric hammocks and depression marshes within flatwoods, as well as brackish tidal marshes and creeks. There are six major tidal creeks (Lukens, Goose, Seabreeze, Sand, Dennis and Clark) that intermingle with the westernmost areas of the reserve and capture surface water flow from hydric hammocks and SGD seepage.

The coastal hydric hammock natural community, which occurs inland from the salt marsh, has a significant impact on hydrologic processes within the landscape (Wharton et al. 1977; Vince et al. 1989). During periods of heavy rainfall, hydric hammocks often flood. Surface water travels through this community as sheetflow, eventually entering tidal creeks that connect to estuarine waters. Through the temporary storage of surface water, hydric hammock improves water quality and attenuates freshwater pulses into estuarine systems (Vince et al. 1989; Wolfe 1990). For at least 25 years, sea level rise has played a pivotal role in the conversion of several hydric hammock stands just south of Cedar Key Scrub State Reserve, within the Waccasassa Bay and Crystal River preserves into salt-dominated communities (e.g., salt marsh/mangrove) (Williams 2003; Ellis et al. 2004).

The quality of surface water within the reserve is generally considered good. Relatively few impacts to wetland systems have been observed. Nevertheless, protection of surface waters and wetlands within the reserve is critical for the preservation of water quality within down-gradient salt marsh and estuarine systems.

Groundwater resources in the reserve include the Floridan aquifer and localized surficial aquifers. In some areas, particularly in flatwoods and certain isolated wetlands, localized development of hardpans or impermeable organic layers may occur, creating perched water tables. These function as surficial aquifers that are connected to the Floridan aquifer. Surface waters may freely enter either of these aquifers. Additionally, during periods of low groundwater levels, salt water from the Gulf of Mexico may flow inland through SGD fracture channels and mix with the Upper Floridan aquifer in a process called reverse flow (Tihansky 2004). It is unknown what contribution of groundwater resources are shared between the SGD fractures of the western marshes of the reserve and the groundwater connections with the Waccasassa River. A minimum flows and levels (MFL) determination was set for the Waccasassa River in 2006 (Suwannee River Water Management District 2006).

Due to these circumstances, the potential for localized groundwater contamination may be high at times. Within western Levy County, the direction of groundwater movement through the maze of



underground fractures and faults (i.e., preferential flow pathways) can be from both northeast to southwest or northwest to southeast (Lines et al. 2012). The primary mechanism of Floridan aquifer recharge is by rainfall that percolates through the permeable sands of the northwestern and eastern portions of Levy County. The coastal hydric hammock, tidal marshes and exposed limestone flats of the western portions of the reserve all serve as potential SGD sites for groundwater discharge since the Floridan aquifer system lies at or near the surface, especially where limestone rock is visible (Slabaugh et al. 1996; Raabe et al. 2011).

Saltwater encroachment along Florida's coasts, including the Big Bend region, has long been recognized as a threat to groundwater quality (Fairchild and Bentley 1977; Fretwell 1983). The drinking water wells that supply the town of Cedar Key are located at two sites within or adjacent to the reserve. One well is located on County Road 347 about 0.5 miles north of the intersection of County Road 347 and State Road 24, while the other is located about 1.2 miles northeast of the same intersection along State Road 24.

Generally, the water quality of the Floridan aquifer is good. However, in the Springs Coast region, including Cedar Key Scrub State Reserve, a natural saltwater wedge that diminishes in thickness landward extends inland from the Gulf, intruding into the Floridan aquifer. The depth of the saline wedge ranges from zero at the coast to around 250 feet inland (Fernald and Purdum 1998; Guvanasekera et al. 2011). Boundaries of the zone of transition from saltwater (19,000 milligrams per liter chloride) to freshwater (25 milligrams per liter chloride) can fluctuate in response to changes in aquifer recharge and discharge (Fretwell 1983).

During the statewide drought of 2010-12, drinking water wells in Cedar Key were significantly impacted by saltwater intrusion. Similarly, during the major drought of 1998-2002, water managers were equally concerned about the significant human-induced influence on surface and groundwater resources statewide (Copeland et al. 2011). It is highly probable that saltwater encroachment within the Floridan aquifer contributes to the brackish nature of surface waters within the reserve, and that this phenomenon may alter the water chemistry of freshwater ponds over time.

Freshwater systems in the western half of the reserve have certainly been partially compromised by service roads that cross narrow wetland linkages between basin marshes. In the spring of 1996, one concrete bridge and two concrete fording mats were installed to minimize road impacts and to provide consistent, all-weather access for service vehicles and fire equipment. Funding for the project was provided through the state's Pollution Recovery Trust Fund. Additional wetland crossings are still required for all-weather access, particularly in the flatwoods west of County Road 347.

Some of the freshwater wetlands have also been impacted by partial impoundment, when State Road 24, County Road 347 and County Road 326 were constructed. Other impacts include fire plow lines installed during emergency wildfire suppression activities. Many of the more recent plow lines have been re-contoured, but certain areas may still require additional work.

According to DEP basin status reports, the water quality of some estuary waters along the western edge of the reserve were labeled as potentially impaired in 2003 because of excessive nutrients and mercury in fish tissue (Silvanima et al. 2008; DEP 2003; DEP 2013a). Based on the Impaired Waters Rule (IWR), the U.S. Environmental Protection Agency (EPA) in 2003 verified that those waterbodies were indeed impaired, which meant that their surface waters did not meet applicable state water quality standards (IWR, Chapter 62-303 F.A.C). This designation triggered a long chain of mandatory requirements that Florida would have to accomplish to achieve compliance with EPA regulations concerning polluted waterbodies. For some coastal estuary portions of the reserve, the compliance process started in 2013

with the assignment of a TMDL Numeric Nutrient Criteria (DEP 2013b) and the initiation of a Basin Management Action Plan (BMAP). As of 2019, the BMAP for these coastal estuarine waters had not been completed.

### **Assessment of Needs**

#### **Objective: Assess the reserve's hydrological restoration needs.**

##### *Actions:*

- Continue to cooperate with other agencies and independent researchers in hydrological research and monitoring programs.
- Continue to monitor and track surface and groundwater quality issues within the region, especially concerning natural and cultural resource impacts associated with sea level rise.
- Continue to monitor land-use or zoning changes in the region and offer comments as appropriate.
- Conduct dye trace studies to determine groundwater sources for karst features within the reserve.
- Continue to cooperate with the SRWMD to allow minimum flows and levels (MFL) implementation in order to ensure maintenance of historic groundwater levels.

Significant hydrological features in Cedar Key Scrub State Reserve include coastal hydric hammocks, brackish ecosystems containing portions of five major tidal creeks, and the several submarine groundwater discharge karst fractures. Preservation of surface water and groundwater quality, and control of erosion and sedimentation into the reserve's freshwater wetlands, estuarine creek systems and karst features, will remain top priorities for DRP. The following are hydrological assessment actions recommended for the reserve.

DRP will continue its tradition of close cooperation with state and federal agencies and independent researchers engaged in hydrological research and monitoring programs within the reserve and the adjacent coastal resources, and it will encourage and facilitate additional research in those areas. Agencies such as the SRWMD, U.S. Geological Survey (USGS) and DEP will be relied upon to keep DRP apprised of any declines in surface water quality or any suspected contamination of groundwater in the region. DRP staff will continue to monitor and document any potential changes within hydric hammock or coastal forest communities, as well as any known archeological resources that might be impacted by sea level rise. DRP staff will continue to monitor Environmental Resource Permit (ERP) and Water Use Permit (WUP) requests for the region in order to provide timely and constructive comments that promote protection of the preserve's water resources. Additional cooperative efforts may include facilitating the review and approval of research permits and providing researchers with assistance in the field. Recommendations derived from the monitoring and research activities will be essential to the decision-making process during management planning.

The proximal sources of flow from the Floridan aquifer to SGD karst features in the reserve are still unknown. To remedy that, DRP should continue to encourage hydrological studies that are designed to understand their sources (as discussed in the *Hydrology* section above). Previous dye trace studies in Florida have provided DRP staff with invaluable information about the various sources of springs and the timing of surface to groundwater interactions that potentially affect important surface water bodies. In order for water managers to protect water quality and potentially restore groundwater levels to their historic levels, they will need to know the extent of these sources.

Staff will continue to monitor land-use or zoning changes within lands bordering the reserve. Major ground disturbances on neighboring properties or inadequate treatment of runoff into local streams could ultimately cause significant degradation of resources in the reserve. When appropriate, District 2 staff will provide comments to other agencies regarding proposed changes in land use or zoning that may affect the reserve. In addition, District 2 staff will closely monitor major mining operations in the watershed upstream of the reserve and watch for significant changes that may adversely affect resources in the reserve.

DRP will continue to work closely with the SRWMD to ensure that MFLs developed for the Waccasassa River are implemented conscientiously and that historic groundwater flows are protected.

### **Restoration**

**Objective: Restore hydrological conditions to approximately 1,217 combined acres of hydric hammock, basin swamp and salt marsh.**

#### **Actions:**

- Conduct an assessment and evaluate the hydrological impacts in the reserve including drainage ditches and areas where natural sheetflow has been interrupted.
- Develop a hydrological restoration plan with prioritized projects for the reserve.
- Implement installation of low water crossings in necessary areas to improve wetland sheetflow.

Staff will initiate hydrological restoration measures for natural systems in the reserve wherever wetland communities have been artificially impounded or ditched and where ecological functions have been disrupted. If DRP staff determines that roads passing through wetland communities are significantly altering natural hydrological regimes, then DRP, using best management practices, will initiate corrective actions such as installing low water crossings or culverts in appropriate locations. In some cases, complete removal of above-grade roads may be warranted, especially if they no longer serve a useful purpose. These roads should be abandoned and elevations restored to the historic grade of the adjacent natural landscape.

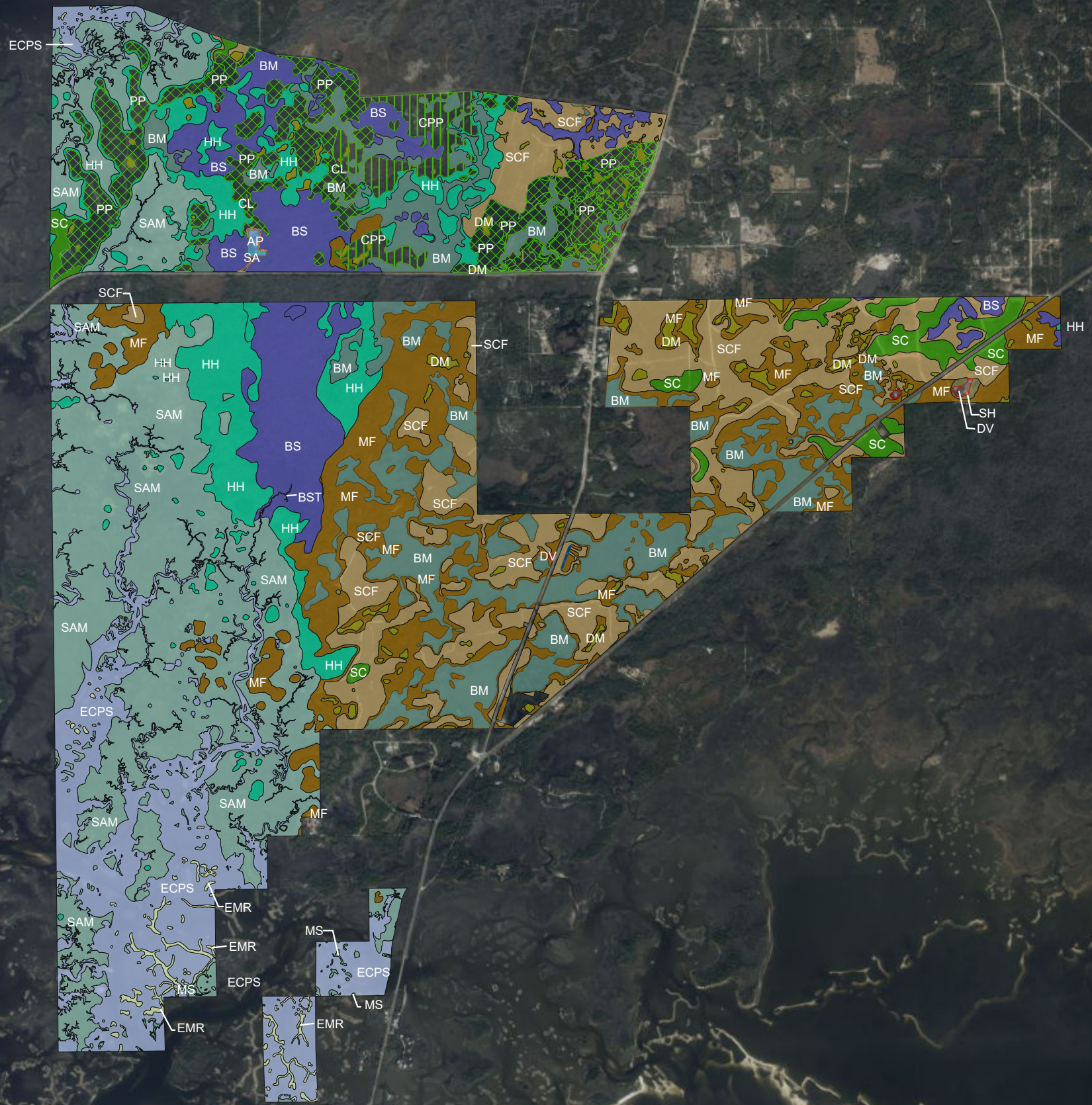
### **NATURAL COMMUNITIES**

The reserve contains 15 distinct natural communities as well as altered landcover types (see Natural Communities Map). A list of known plants and animals occurring in the reserve is contained in the Plant and Animal List Appendix.

#### **Mesic Flatwoods**

The mesic flatwoods natural community occurs at slightly lower elevations than the scrub and scrubby flatwoods communities and often borders basin marsh or other wetland communities. The distinctions among mesic flatwoods, scrubby flatwoods and scrub are based not only on differences in topographic elevation, but also on soil characteristics and, to some extent, on the fire history of a site.

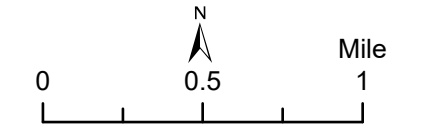
Both longleaf pine (*Pinus palustris*) and slash pine (*Pinus elliottii*) occur within the mesic flatwoods at Cedar Key Scrub State Reserve, but slash pines predominate in most areas. Selective removal of longleaf pines during past logging operations may have encouraged proliferation of the slash pine, which normally is found on wetter sites within the mesic flatwoods. The logging and turpentine activities that took place before establishment of the reserve undoubtedly altered not only the species composition of the mesic flatwoods but other basic characteristics as well.



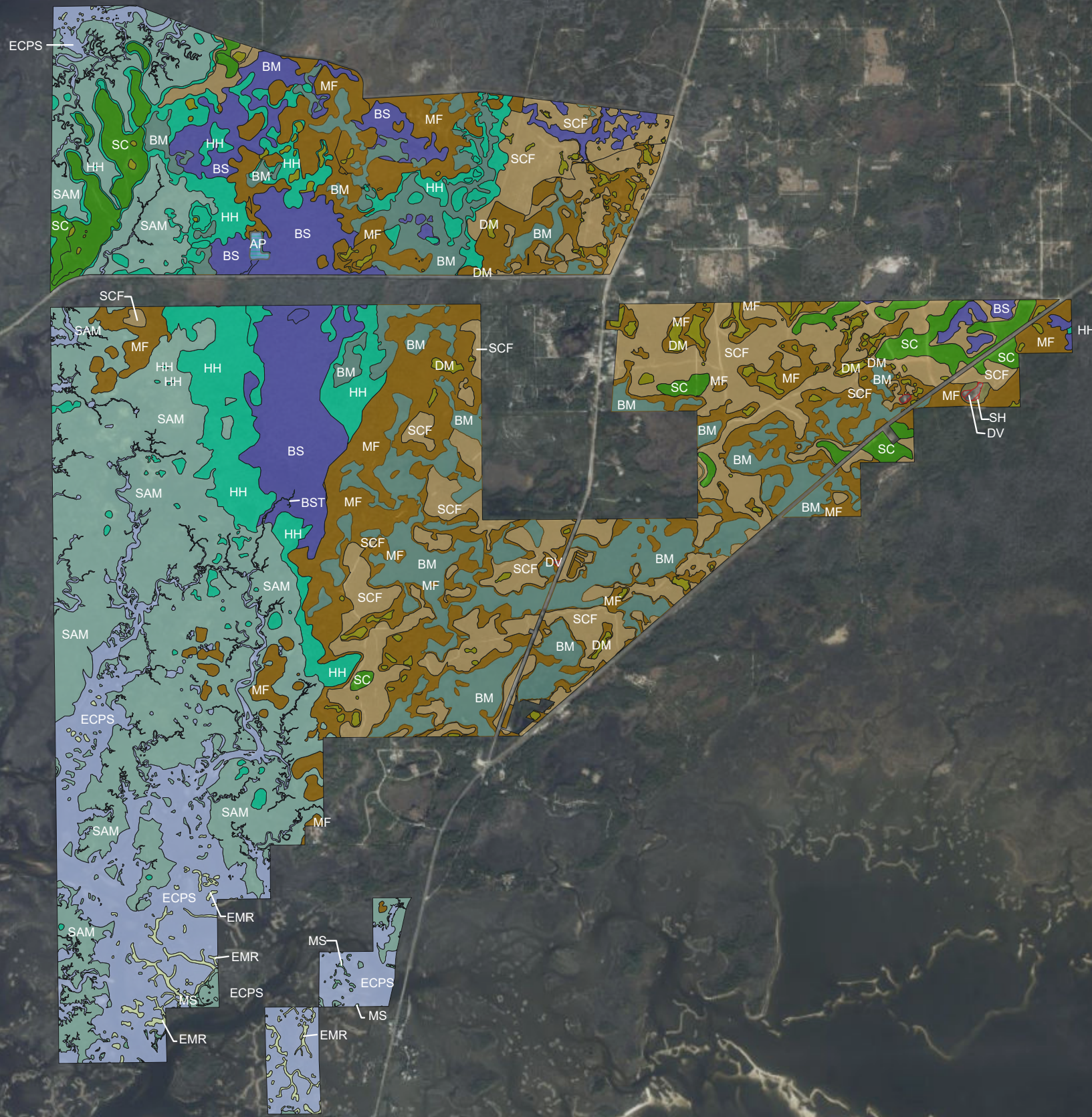
Natural Communities (in Acres)	
	MF - Mesic Flatwoods - 879.87
	SH - Sandhill - 4.30
	SC - Scrub - 136.84
	SCF - Scrubby Flatwoods - 837.75
	BM - Basin Marsh - 786.15
	BS - Basin Swamp - 523.73
	DM - Depression Marsh - 95.95
	HH - Hydric Hammock - 531.38
	MS - Mangrove Swamp - 5.64
	SAM - Salt Marsh - 1599.26
	BST - Blackwater Stream - 0.27
	ECPS - Estuarine Composite Substrate - 791.60
	EMR - Estuarine Mollusk Reef - 39.86
	AP - Artificial Pond - 4.90
	CD - Canal/ditch - 0.68
	CPP - Clearcut Pine Plantation - 106.08
	CL - Clearing/Regeneration - 1.58
	DV - Developed - 4.35
	PP - Pine Plantation - 432.22
	SA - Spoil Area - 1.89



**CEDAR KEY SCRUB STATE RESERVE**  
 Natural Communities - Existing Conditions



Sources: ESRI; Florida Department of Environmental Protection  
 This graphical representation is provided for informational purposes and should not be considered authoritative for navigational, engineering, legal, and other uses.

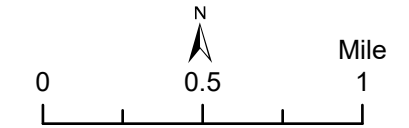


**Natural Communities**

- MF - Mesic Flatwoods
- SH - Sandhill
- SC - Scrub
- SCF - Scrubby Flatwoods
- BM - Basin Marsh
- BS - Basin Swamp
- DM - Depression Marsh
- HH - Hydric Hammock
- MS - Mangrove Swamp
- SAM - Salt Marsh
- BST - Blackwater Stream
- ECPS - Estuarine Composite Substrate
- EMR - Estuarine Mollusk Reef
- AP - Artificial Pond
- DV - Developed



**CEDAR KEY SCRUB STATE RESERVE**  
**Natural Communities - Desired Future Conditions**



Sources: ESRI; Florida Department of Environmental Protection  
 This graphical representation is provided for informational purposes and should not be considered authoritative for navigational, engineering, legal, and other uses.

The most serious threat to the mesic flatwoods community is fire exclusion. The mesic flatwoods tend to burn whenever the surrounding scrubby flatwoods and scrub burn. However, the scrubby flatwoods and scrub communities have much longer fire return intervals and only burn during more extreme fire weather conditions. Presumably, the mesic flatwoods in the reserve would burn more frequently and under more moderate conditions than the scrub and scrubby flatwoods, often when the latter would not have even ignited. Past fire suppression activities and the intrinsic difficulty of conducting prescribed fires in adjacent scrub and scrubby flatwoods combine to foster the accumulation of heavy fuel loads in many areas of mesic flatwoods within the reserve. Recent prescribed fires have significantly reduced fuel loads in several of these areas. Condition of the mesic flatwoods in the reserve ranges from fair to good.

Past fire suppression activities have possibly impacted the mesic flatwoods more than any other community in the reserve. Numerous fire plow lines, which are discernible in historical aerial photographs, remain today. Although most plow scars have re-vegetated, their effects on local topography remain. Old scars may continue to cause problems, particularly in wetter areas of the mesic flatwoods. Some channeling of runoff and localized de-watering may occur where old plow lines function as ditches.

Significant areas of mesic flatwoods on the Panther Ridge tract have been cleared, bedded and planted with slash pines one or more times. These areas are predominantly mapped as pine plantation or clearcut pine plantation. Some of these areas retain native groundcovers and shrubs, but other sites may lack nearly all native vegetation due to past site preparation techniques or herbicide applications. Fortunately, none of these areas appear to have ever been windrowed. In 2021, 170 acres of planted slash pine in the southeast portion of the Panther Ridge tract was fifth-row thinned in an offset pattern to research a basal area closer to 50 to 60 square feet per acre. The harvested area was a combination of former mesic and scrubby flatwoods.

Frequent use of prescribed fire and longleaf pine plantings are critical to continuing the restoration process in the mesic flatwoods. In some of the flatwoods, the presence of a dense saw palmetto and gallberry understory may require the use of chemical or mechanical site preparation in order to facilitate the establishment of planted longleaf pines. Portions of the reserve may need additional removal of offsite hardwoods, planting of longleaf pines and enhancement plantings of native groundcover, particularly within the newest Panther Ridge tract.

#### Sandhill

The small amount of sandhill in the reserve is located south of State Road 24. This happens to be the area selected in the past for the construction of facilities such as staff residences, the administrative office, and a shop complex. The sandhill in this area has certainly been impacted by the development, but representative plant species remain, and the site is still managed as a natural area. The condition of this community is poor.

Off-site hardwoods and long-term fire exclusion in the small section of sandhill is obvious. These areas will require additional hardwood reduction and prescribed fire to release suppressed herbaceous species and encourage longleaf pine recruitment. Continued use of frequent prescribed fire will be essential to maintaining community structure and ecological integrity of this remnant community as a demonstration/interpretation site.

#### Scrub

The scrub community at the reserve is considered the northernmost example of peninsular sand pine scrub on the Gulf Coast (Myers 1990). Most of the scrub habitats at Cedar Key Scrub State Reserve occur

on Orsino fine sand. These scrub communities are strongly associated with the crests and slopes of ancient dune ridges that are composed of deep infertile sand deposits. The largest expanses of continuous scrub habitat are located in the eastern portion of the reserve. However, intermediate-sized patches of scrub are scattered within the central and western areas of the reserve, including areas at the new Panther Ridge parcel in the northwest corner.

Because of the geologic history of Cedar Key, the scrub community in this west coastal region is relatively young compared to other peninsular scrubs, such as Florida's largest contiguous complex in Ocala National Forest. Generally speaking, these young coastal scrubs have not yet had a chance to develop the diversity of rare plant species like those that evolved within older inland ridge systems that underwent long periods of geologic isolation. Cedar Key Scrub State Reserve, however, does support populations of rare animal species that require sand pine scrub or scrubby flatwoods habitat, such as the gopher tortoise, eastern indigo snake, Florida mouse and Florida scrub-jay. The Florida scrub-jay population found in the Cedar Key region is an important but declining group in the northern limit of this species range (Cox et al. 1994). See below under *Imperiled Species* section for more information on this population of the Florida scrub-jay.

Unlike most fire-maintained natural communities in Florida, peninsular sand pine scrub is adapted to longer fire return intervals and catastrophic fires. Such fires usually kill all sand pines and kill the aboveground portions of the scrubby shrubs, which subsequently re-sprout. The sand pines typically only recolonize burned sites from seed.

The only recorded large catastrophic scrub fire in the Cedar Key region occurred on June 8, 1955 (Peeples 1976). A first-hand account states: "The fire consumed about 20,000 acres in one 8-mile run to the east. The run ended in the only true fire storm which I have ever observed." The fire that day likely consumed all of the sand pine scrub east of what is now County Road 347. A solid all was reported to have crossed County Road 345 near the Rosewood fire tower. During the previous three days, the fire had burned much of the flatwoods and coastal areas west of County Road 347 (Peeples 1976).

Since the state acquired the reserve in 1978, there have been numerous arson or lightning strike wildfires within Cedar Key Scrub State Reserve that have burned into scrub communities, but generally speaking, suppression activities have limited their size to small patches. Historical aerial photos reveal that multiple fire lines were plowed in response to some of these wildfires during the 1970s and 1980s, primarily in mesic flatwoods, scrubby flatwoods and smaller areas of sand pine scrub.

Some of the initial prescribed burns in scrub communities (mostly west of County Road 347) occurred from 1981 through 1990. Management zone CK-4a was the first unit in the eastern sections of the reserve to received prescribed fire by park staff. Tree ring cores were collected in 1990 from four stands of sand pines in the eastern half of the reserve to estimate the ages of the sand pines. The adult trees ranged from 17 to over 36 years, with most trees between 23 and 27 years of age at that time. Considering all the complexities associated with treating scrub habitat with prescribed fire, park staff learned quickly that management of these areas with fire alone would be a challenging task.

As a result of lessons learned by DRP staff in the 1980s and 1990s, a series of restoration efforts have been implemented in scrub communities to mechanically reduce fuel heights to assist with safer prescribed fire operations. Some of the initial treatments occurred as early as 1985, when DRP staff mechanically widened fire lines and utilized various mowing techniques in adjacent shrubby fuels. In 1995-96, the U.S. Fish and Wildlife Service (USFWS) provided grant funding for scrub habitat improvement to assist DRP staff in preparing firebreaks and producing a Habitat Improvement Plan for

the reserve. The funding was specifically targeted for habitat restoration and monitoring activities that would benefit imperiled species such as Florida scrub-jays, Florida mice and gopher tortoises.

The first major scrub restoration efforts at the reserve were implemented in fall 2000 with a mature sand pine harvest within a majority of the scrub habitat east of County Road 347 (management zones CK-1b, 1c, 4a, 5a, 6a, 6b, 6c and 6e). A total of about 85 acres of sand pine were harvested. The sand pines were removed to allow the scrub areas to be burned under less hazardous fuel conditions. During the logging of the sand pines, much of the shrub layer was crushed, creating a more available fuel source closer to the ground surface. In 2001, staff conducted prescribed fires in two of the resource management zones where sand pines had been harvested.

In June 2002, 34 acres of mixed scrub and scrubby flatwoods (zone CK-3) were mowed under contract and an additional 49 acres of scrub and scrubby flatwoods were roller-chopped by park staff in preparation for fire. In January 2003, a 475-acre prescribed aerial ignition burned all the mowed and roller-chopped areas, as well as much of the standing scrubby flatwoods. Two of the remaining stands of mature sand pines in the reserve did not ignite during the fire. In October 2003, another 85 acres of overgrown scrub and scrubby flatwoods (zones CK-2L, 2M, 2B) were mowed under contract and much of this area was then burned in March 2004.

In 2005, about 200 acres of overgrown scrub and scrubby flatwoods were again mechanically treated by mowing (zones CK-1A, 1B, 1C, 1D, 4B, 5A, 5D). This contracted restoration effort was possible because of a habitat restoration grant from USFWS. Prescribed fire was subsequently applied to several of these treated zones.

In the spring of 2013, a large-scale restoration timber harvest project was conducted at Cedar Key Scrub State Reserve as a combined effort from several partners, including DRP, USFWS, FWC and the Florida Forest Service (FFS). Prior to implementation of this project, these partners conducted an analysis of historic tree density from 1961 to 2008. In summary, tree density in Florida scrub-jay scrub habitat had significantly increased several-fold during this 40-plus year time period. The final 125-acre timber harvest contract was managed through the Florida Forest Service (zones CK-4A, 4B, 5A, 5B, 5C, 5D, 6D and 6E) following specific management recommendations that were aimed at reducing tree density in scrub, as well as targeting fire shadows adjacent to many freshwater wetlands within this matrix. All of these zones were subsequently treated with prescribed fire from 2014-16.

The scrub ridges on the western end of the Panther Ridge addition were planted with slash pines at least twice. The last harvest and replanting occurred prior to 2010. These areas are currently mapped as pine plantations. The cutting and subsequent bedding activities reduced the shrub densities and increased the amount of bare sand onsite. The site retains a dense planting of young slash pines on deep and well drained sands. While the scrub community is still in good condition, continued successful restoration of this ecosystem will need to rely upon management tools.

There is no doubt that the series of restoration and habitat improvement projects that have been implemented within the reserve have greatly improved the condition of the scrub community. A long-term continuous effort with multiple partners will be needed at Cedar Key Scrub State Reserve in order to restore the scrub communities and hold them in a historic maintenance condition. The complexity of properly managing this highly pyrogenic landscape will make for a never-ending experiment. Mechanical treatment is highly recommended to help knock down fuel heights and produce spatial openings that are characteristic of a healthy scrub. Mowing and cutting could be the best options to achieve desired results, but treatments such as these should always be followed by prescribed fire.



It would be preferable to maintain a number of different “age classes” or successional stages of scrub within the reserve to maximize habitat diversity for plant and animal species, particularly imperiled species. Given the wide range of fire-return intervals for scrub (5 to 40-plus years) (Florida Natural Areas Inventory (FNAI) 2010), it would be prudent to maintain some limited areas of mature scrub.

Restoration of the scrub ridges on the western side of the Panther Ridge addition will only require removal of the young off-site slash pines mechanically or with prescribed fire. It is expected that these ridges will be in good condition once the pines are removed, with scattered scrub oaks and an appropriate amount of bare sand areas.

#### Scrubby Flatwoods

The scrubby flatwoods community is often described as a transition zone between the mesic flatwoods occurring at slightly lower elevations and the true scrub that tends to occupy the higher elevations. Species composition seems to be intermediate between the two, although the same shrub species that dominate the scrub also dominate the scrubby flatwoods in the reserve. The sand pine overstory is lacking, however. Scrubby flatwoods have a fire return interval intermediate between mesic flatwoods and scrub, typically eight to 15 years (FNAI 2010). Scrubby flatwoods typically have a sparse canopy of either longleaf pine or slash pine, but these pines are historically relatively uncommon in the scrubby flatwoods at Cedar Key Scrub State Reserve. This may be due to the site’s history of wildfire, logging and/or a regional variation of this coastal scrub community type.

Most scrubby flatwoods zones that have received prescribed fire since the state acquired the property are in significantly better condition than those areas where fire has not yet been able to penetrate. In some limited areas within the reserve, the scrubby flatwoods are trending toward senescence and therefore have begun to succeed to xeric hammock, with a resultant loss of bare sand patches and an increase in canopy closure. Previous scrubby flatwoods restoration actions within the reserve are detailed in the “Scrub” description above.

Significant areas of scrubby flatwoods were converted in the past to pine plantations on the newly acquired Panther Ridge parcel. The clearing and bedding during site preparation has not impacted the loose sand of the scrubby flatwoods as much as in the mesic flatwoods. Herbicide use and extensive site preparation efforts may have reduced the oak densities below optimal levels.

As with the scrub community, scrubby flatwoods in the reserve provide critical habitat for several imperiled species, including the gopher tortoise, eastern indigo snake, Florida mouse and the Florida scrub-jay. The early regeneration stages of scrub and scrubby flatwoods are the preferred habitat for Florida scrub-jays. A fire return interval of eight to twenty years is considered optimal for Florida scrub-jays (Fitzpatrick et al. 1991), with sand pine scrub burning somewhat less frequently on average than scrubby flatwoods. Presumably gopher tortoises, eastern indigo snakes and Florida mice also prefer these younger successional stages due to the openness of the vegetation structure.

The series of restoration and habitat improvement projects that have been implemented within the reserve have greatly improved the condition of the scrubby flatwoods community. Nonetheless, continued efforts from multiple stakeholders will be necessary to maintain community structure in perpetuity for this ecosystem.

A long-term continuous effort will be needed at Cedar Key Scrub State Reserve to restore its scrubby flatwoods and hold them in a historic maintenance condition. Mechanical treatment is highly recommended to help knock down fuel heights and produce spatial openings that are characteristic of

healthy scrubby flatwoods. Mowing and cutting could be the best options to achieve desired results, but nonetheless treatments such as these should always be followed by prescribed fire.

On the Panther Ridge addition, pine plantations that are identified with a desired future condition of scrubby flatwoods should be thinned as soon as possible to begin reducing the slash pine density. Restoration of a natural fire regime will not be possible until the slash pines are removed, and the scrub oak understory is allowed to recover.

#### Basin Marsh

Sawgrass, a very flammable grass, dominates these marshes. Many of the basin marshes are hydrologically connected and many extend across the reserve boundary onto private lands. The marshes normally burn when the surrounding mesic flatwoods burn. During prescribed fires, problems may arise as marshes can easily carry fire across the boundaries of the reserve. The basin marshes are generally in good condition, although some have been impacted by service roads or by fire plow lines.

Basin marshes should be protected from unnatural disturbances. Additionally, it is important to allow fires conducted in adjacent fire maintained natural communities to burn through the ecotone periodically, under conditions appropriate for restoring the natural transition zone and maintaining the natural fire regime. Removal of feral hogs would be beneficial. Staff will regularly monitor the basin marshes for the appearance of invasive plants and will remove any found.

#### Basin Swamp

The basin swamps in the eastern side of the reserve tend to be relatively small and are dominated by cypress. The large basin swamp in the western half of the reserve, Black Point Swamp, is dominated by sabal palms (*Sabal palmetto*) and by hardwood species such as swamp tupelo, swamp bay (*Persea palustris*), sweetbay, dahoon holly and red maple. Although the eastern basin swamps have at times been identified as cypress domes (Amoroso 1993), their irregular shape, geological origins and topographic situation would seem to indicate that basin swamp would be a more appropriate classification (FNAI 2010).

The basin swamps within the reserve are generally in good condition, although past impacts included selective harvesting of cypress and hardwoods. Impacts that are more recent include fire plow lines near the perimeter of Black Point Swamp and service roads along perimeters of some of the eastern cypress swamps.

Prescribed fires should be allowed to burn into the edges of basin swamps to maintain the natural ecotone between them and surrounding habitats. Park staff should monitor basin marshes for the appearance of invasive plants and remove any that are found.

#### Depression Marsh

While some of these marshes have considerable overlap floristically with basin marshes, depression marshes tend to be smaller and are often more regular in shape. Typically, these small wetlands will carry fire during periods of low water or when emergent grassy fuels are continuous over standing water. Depression marshes that dry out during extended droughts act as ephemeral wetlands that are critical breeding sites for many invertebrate and amphibian species whose larvae cannot coexist with fish in more permanent wetlands (Moler and Franz 1987). The gopher frog, which spends its non-breeding life in nearby scrub and scrubby flatwoods, is one such species.

Invasion of the depression marshes by woody plant species is normally kept in check by prescribed fire and natural flooding. However, adaptable invaders such as slash pine remain in some of the depression

marshes despite the application of fire. In some cases, the ability of trees and shrubs to compete is enhanced by ditching along roads or some other artificial manipulations that prevent the marsh from maintaining a higher water level that would help to exclude these species. Reductions in the regional water table may also lead to more frequent droughts and additional incursions by hardwoods and may eventually encourage succession of some marshes. The depression marshes at the reserve are currently in good condition.

Where appropriate, the reserve should apply prescribed fire to depression marshes at the same time as adjacent fire-type natural communities. Maintenance of a natural ecotone is important, as is keeping the marshes free of invasive species.

#### Hydric Hammock

The hydric hammock in the reserve lies along the upland edge of the tidal marsh and in scattered locations near Black Point Swamp. The hydric hammock occupies transitional areas between Black Point Swamp and the tidal marsh and between mesic flatwoods and the tidal marsh. Although hydric hammock is much more common to the south along the coast of Waccasassa Bay, its extent within Cedar Key Scrub State Reserve is limited due to the structure of the overlying sediments in this part of the Big Bend coastline.

Hydric hammocks play a critical role in the regional hydrology (Simons et al. 1989). They serve the important function of temporarily storing water in high rainfall periods but typically retain scattered small pockets of standing water up to 70 days per year. Hydric hammocks occur on a variety of sand to muck soils but are always low lying and situated over a limestone substratum that occasionally projects above ground as exposed outcrops or bare rock areas. Soil depth can be as little as 20 centimeters in these areas. Over the past 25 years, researchers have documented the gradual recession of the hydric hammock to salt-dominated communities along the Big Bend coastline (Ellis et al. 2004). The western edge of the hydric hammock and the isolated islands within the salt marsh are showing the effects of salt damage from rising sea levels within the reserve.

A general reduction of feral hog numbers within the reserve would greatly benefit the hydric hammock. Staff will continue to monitor hydric hammocks for the presence of invasive plants and any changes in hydric hammock community that might be related to sea level rise. Staff should continue to allow fires to burn into the fringes of the hydric hammock in order to push its boundaries back to historic limits.

#### Mangrove Swamp

Within the reserve, this community type occurs primarily south of Lukens Creek. Cedar Key is near the northern limit for this system on the Gulf Coast. Mangroves are common in the area of Cedar Key but uncommon in areas further to the east to the Waccasassa River and south to Turtle Creek. Why this occurs is unknown, but the prevailing ocean currents or salinity levels may be responsible. Black mangrove may grow in relatively dense stands or as scattered individuals in tidal marsh. Hard freezes can damage black mangrove, so its dominance in the salt marsh can vary with the severity of recent winters. The mangrove swamp appears to be in excellent condition.

Over the past 20 years there has been a tremendous expansion of mangroves within the salt marsh and tidal creeks in the region. Comparison of aerial photography from 1994 to 2016 shows an order of magnitude increase in mangrove density, but not range. The mangroves have expanded along the seaward margins of the salt marsh and along the tidal creeks that flow through the salt marsh.

The primary threat to the mangrove swamp is Brazilian pepper, which like mangroves, is expanding its range northward. Fortunately, Brazilian pepper is limited by salinity and may not be able to germinate or

survive in mangrove swamps in areas of higher salinity. Surveys for Brazilian pepper in these remote areas are difficult and time consuming. Staff will continue to monitor locations of Brazilian peppers for treatment.

#### Salt Marsh

Salt marsh represents the seaward extent of the reserve on its western boundary. As with the other estuarine natural communities, salt marsh ecosystems are very sensitive to contaminants associated with stormwater runoff from adjacent uplands. Salt marsh systems at Cedar Key Scrub State Reserve are linked to adjacent upland areas by a band of hydric hammock and basin swamp that function in such a way as to modify the quantity, timing, and quality of some freshwater inputs to the marsh (Vince et al. 1989). Additional freshwater inputs have been recently described as submarine groundwater discharges, and they occur in at least three locations within the reserve as described above in the *Hydrology* section.

If the quantity, quality or timing parameters of freshwater inputs rapidly change, this consequence can greatly modify the structure and productivity of a tidal community. Specifically, significant fluctuations of salinity outside of an extremely narrow water quality range could negatively impact this sensitive estuarine tidal community, which acts as a nursery for numerous invertebrate and fish species. The overall quality of the coastal salt marsh community appears to be in excellent condition. In general, salt marsh communities are quite resilient and require very little active management.

#### Blackwater Stream

A short stretch of blackwater stream flows out of the southern end of Black Point Swamp and merges with the tidally-influenced upper reach of Lukens Creek. The blackwater stream is considered to be in good condition. Maintenance of the natural hydrology of Black Point Swamp should suffice to protect the blackwater stream.

#### Estuarine Composite Substrate

Estuarine composite substrates will consist of a combination of natural communities that may include small patches of consolidated and unconsolidated substrate with or without sessile floral and faunal populations. Composite substrates may also be dominated by any combination of flora, fauna or mineral substrate such as mollusk reefs or seagrass beds that are situated within the subtidal, intertidal and supratidal zones along the reserve's western boundary. Because of the potential combination of community types in composite substrate ecosystems, species diversity is often greater than the surrounding habitats.

Due to the difficulties of mapping subtidal and intertidal natural communities individually, several are lumped as estuarine composite substrate for mapping purposes. The estuarine communities are listed separately below to identify the specific community types found within the reserve, including estuarine consolidated substrate, estuarine mollusk reef, estuarine seagrass bed and estuarine unconsolidated substrate. Where possible, estuarine mollusk reefs have been mapped separately. Estuarine composite substrates are found along tidal creeks, salt marshes and coastal shore habitats of the western portions of Cedar Key Scrub State Reserve. These substrates are important since shellfish, particularly oysters, and seagrasses often colonize them.

Any contaminant disturbance to this natural community such as heavy metals, oils, pesticides or high nutrient inputs can become problematic and impact the local food web. Significant amounts of pollutant compounds in the sediments can be detrimental at multiple organismal scales, but especially can kill infaunal organisms, thereby eliminating a food source for certain fishes, birds and other vertebrates.

### Estuarine Consolidated Substrate

Estuarine limestone or shell-based substrates are found along tidal creeks, salt marshes and coastal shore habitats of the western portions of Cedar Key Scrub State Reserve. These substrates are important since shellfish, particularly oysters, and seagrass beds often colonize them. Where this community type is observed, it appears to be in good condition. However, the full extent of this community within the reserve is still unknown at this time (Raabe and Bialkowska-Jelinska 2010). Trends associated with significant historic droughts and increased human consumption of groundwater have been particularly visible in the Cedar Key region (Copeland et al. 2011).

Like salt marshes, this community is fairly resilient and requires little active management other than periodic checks for damage from storms or human activity. It is important to continue to locate and map new occurrences of limestone outcrops.

### Estuarine Mollusk Reef

Mollusk reef communities occur at scattered locations within the tidal creeks and estuary of the reserve. Where possible, they have been mapped as a distinct estuarine community type, although some examples may not be distinguishable and are included within the estuarine composite substrate.

Mollusk reefs that are exposed during low tides, including those that occur in the western portions of Cedar Key Scrub State Reserve, are frequented by a multitude of shorebirds, wading bird, and other vertebrates. One of the largest wintering populations of American oystercatchers in the United States is located in the Cedar Key region (Schulte et al. 2007).

In the Big Bend region, including the five major tidal creeks of the reserve, research has shown a 66% net loss of oyster bar area (306.7 acres), with losses concentrated offshore (88%), followed by nearshore (61%), and inshore bars (50%) between 1982 and 2011 (Seavey et al. 2011). Evidence suggests that increasing human uses of fresh water inland may be an important factor resulting in habitat loss. This rapid loss is due to a decreased freshwater input, thus causing existing bars to be vulnerable to increased wave action and higher estuarine salinities.

Mollusks are filter feeders, filtering up to 100 gallons of water a day. In addition to filtering food, they also filter and accumulate toxins from polluted waters (Guequen et al. 2011). In 2009, scientists estimated that there had been an 85% reduction in global oyster reef communities from historic times (Beck et al. 2009). Given these unprecedented declines and the fact that oysters are extremely efficient bioaccumulators of pollutants and toxins, including the large-scale algae blooms occurring in Florida's Gulf Coast, scientists place this natural community among the world's most endangered ecosystems (Seavey et al. 2011; Griffith et al. 2013).

It is important to locate and map individual occurrences of mollusk reef structures and periodically monitor them for damage from storms or human activity. Any contaminant disturbance to these mollusk reef structures such as heavy metals, oils, pesticides or high nutrient inputs can become problematic and impact the local food web. Significant amounts of pollutant compounds in the sediments can be detrimental at multiple organismal scales but especially can kill infaunal organisms, thereby eliminating a food source for certain fishes, birds, and other vertebrates.

### Estuarine Seagrass Bed

Seagrass beds occur at scattered locations within estuarine tidal creeks of the reserve but have not yet been mapped, so acreage figures are unavailable. Therefore, this community is combined for mapping purposes within estuarine composite substrate. The waters in the western tidal creeks of the reserve and around the Cedar Key region tend to be brownish in color and therefore do not effectively transmit

sunlight. Due to decreased water clarity and shallow bathymetry, the seagrasses in this area are predominantly sparse grass beds of shoalweed, which tend to be more tolerant of low light conditions than other seagrasses (DEP 2014). Turtle grass beds can also be found in the waters around Cedar Key on shallow flats and shoals, where the light attenuation is less due to shallow neritic waters (FWC 2015). The full extent of the seagrass beds community within the reserve is unknown at this time.

This estuarine ecosystem is critically important for wildlife such as marine turtles that may use the reserve as nursery grounds (Schmid 1998). Additionally, when these areas are tidally inundated, they can be used as resting/feeding grounds for other wildlife such as ornate diamond-backed terrapins (*Malaclemys terrapin macrospilota*) and gulf salt marsh snakes (*Nerodia clarkii clarkii*).

The estuarine seagrass bed community found in the western estuarine areas at Cedar Key Scrub State Reserve has not yet been mapped. It is important to locate and map individual occurrences of seagrass beds and periodically monitor them for damage from storms or human activity. Any contaminant disturbance to these seagrass beds such as heavy metals, oils, pesticides or high nutrient inputs can become problematic and impact the local food web. Significant amounts of pollutant compounds in the sediments can be detrimental at multiple organismal scales, but especially can kill infaunal organisms, thereby eliminating a food source for certain fishes, birds, and other vertebrates.

#### Estuarine Unconsolidated Substrate

Due to the difficulties of mapping these estuarine tidal ecosystems individually, this community is combined within estuarine composite substrate for mapping purposes. Estuarine unconsolidated substrates are found along tidal creeks, salt marshes and nearby coastal habitats of the western portions of Cedar Key Scrub State Reserve. Most of the estuarine tidal creeks within the reserve have mud bottoms and many have extensive supratidal mud flats that are important feeding areas for wading birds and shorebirds. Although some areas of estuarine unconsolidated substrate may have limited amounts of sand deposition derived from adjacent uplands, mud deposits are usually more dominant along this low energy coastline. Where this community type is observed, it appears to be in good condition.

Like salt marshes, this community is fairly resilient and requires little active management other than periodic checks for damage from storms or human activity. Any contaminant disturbance within these unconsolidated substrates such as heavy metals, oils, pesticides or high nutrient inputs from nearby upland development or distant interconnected watersheds in the reserve can become problematic and impact the local food web. Significant amounts of pollutant compounds in the sediments can be detrimental at multiple organismal scales, but especially can kill infaunal organisms, thereby eliminating a food source for certain fishes, birds, and other vertebrates.

### **Altered Land Cover Types**

#### Artificial Pond

A large borrow area used to provide fill for road construction of Shell Mound Road is located just north of the road in the Panther Ridge parcel. The borrow area was dug prior to 1961. This borrow area is water-filled and classified as an artificial pond. The pond provides open freshwater habitat and there are no plans to restore it due to the high costs and potentially low return on investment.

#### Canal/Ditch

A short ditch lies within the reserve in zone CK-3 alongside County Road 347. It was apparently dug during fill removal for road construction. The borrow area to the east of the ditch was scraped and the

fill was used in construction of County Road 347. This area now supports mesic flatwoods vegetation and is mapped as such, although it is likely that it was formerly scrubby flatwoods. The ditch will need a hydrological assessment before it can be determined if restoration efforts are necessary.

#### Clearcut Pine Plantation

Several areas of planted slash pines on the Panther Ridge parcel were clearcut just prior to state acquisition. Most of these areas appear to have been mesic flatwoods and retain many species of native groundcover and shrubs. Restoration to mesic flatwoods will require periodic prescribed fires and replanting with longleaf pines. Most of the clearcuts retain about four slash pines per acre. Staff will monitor the Florida Invasive Species Council (FISC) Category I and II invasive plant species in these disturbed areas. These areas should be burned on a fire return interval of two to four years.

#### Clearing/Regeneration

Several small clearings occur on the Panther Ridge addition within the mesic flatwoods. These grassing clearings may have been used as food plots and are adjacent to service roads. These areas should be burned with the surrounding mesic flatwoods and allowed to naturally regenerate slash or longleaf pines.

#### Developed

There are no current plans to convert any of the developed areas back to their original natural community. Resource management in the developed areas will focus on removal of all priority invasive plants (FISC Category I and II species) and replacing landscaping with native species where possible. Other management measures will include maintenance of proper stormwater and wastewater management facilities and the designing of future development so that it is compatible with prescribed fire management in adjacent natural areas.

#### Pine Plantation

Pine plantations are located on the recently acquired Panther Ridge parcel. The pine plantations have a desired future condition of mesic flatwoods, scrubby flatwoods or scrub. In most cases, these pine plantations were site prepped by clearing and bedding, and possibly root raking in some cases. Some areas may also have received herbicide applications. Some areas were harvested and replanted, and most of the mature plantations have been thinned at least once. The result is that these areas are dominated by dense stands of small to mature slash pines on moderately raised beds. The native groundcover and shrub layers are highly variable depending on the site preparation methods used. Some areas retain a normal density of shrubs with some groundcover remnants, while limited areas lack remnant vegetation.

Restoration of pine plantations to mesic flatwoods will require extensive thinning of the slash pines and planting with scattered longleaf pines. Groundcover restoration needs will be assessed after a prescribed fire program is initiated on the new acquisition. The scrubby flatwoods restoration will require removal of slash pines down to a density of no more than one tree per acre. Scrub restoration will require the removal of all slash pines. In most areas, remnant scrub oaks and *Lyonia* species persist onsite. Bedding and site preparation activities have helped to create more open sandy areas in scrubby flatwoods and scrub areas. Removal of the planted slash pines coupled with prescribed fire may be all that is necessary to restore high quality habitat patches for the Florida scrub-jay, Florida mouse and gopher tortoise. The pine plantations should be burned with a fire return interval of two to eight years depending on fuel loading and desired future condition. In some cases, prescribed fires may not be

possible until the slash pines have been thinned or, in the case of scrub and scrubby flatwoods, removed to very low densities.

Control of priority invasive plant species is particularly important in these areas since many invasive species take advantage of disturbed areas. Further information about restoration of altered landcover types will be discussed in the *Resource Management* section below.

Spoil Area

Limited spoil areas are located in association with the artificial pond on the Panther Ridge parcel and the ditch in zone CK-3. Staff will monitor for FISC Category I and II invasive plant species in these disturbed areas.

**Prescribed Fire**

**Objective: Maintain 2,500 acres within the optimum fire return interval.**

*Actions:*

- Develop/update annual prescribed fire plan.
- Conduct prescribed fire on 455-1,340 acres annually.

The table below contains a list of all fire-dependent natural communities found within the reserve, their associated acreage and optimal fire return interval, and the annual average target for acres to be burned.

<b>Prescribed Fire Management</b>		
<b>Natural Community</b>	<b>Acres</b>	<b>Optimal Fire Return Interval (Years)</b>
Sandhill	4	1-3
Mesic Flatwoods	880	2-4
Scrubby Flatwoods	838	5-15
Scrub	137	8-15
Depression Marsh	96	2-10
Basin Marsh	786	2-10
Pine Plantation	432	2-8
Clearcut Pine Plantation	106	2-4
Annual Target Acreage	455 - 1340	

Cedar Key Scrub State Reserve has six types of fire adapted natural communities, with the greatest acreages represented by mesic flatwoods, freshwater marshes, and scrubby flatwoods. The marshes include basin marshes and depression marshes, many of which are dominated by sawgrass. There are also ridges of sand pine scrub and sandhill, both requiring fire application to maintain optimum ecosystem health. Between 455 and 1,340 acres should be burned annually to restore and maintain the fire dependent communities in the reserve.

Prescribed fire is the most important and critical natural resource management tool at the reserve. The primary goal of the prescribed fire program is to restore a natural fire regime to the natural communities within the reserve. Most of the fire zones in the reserve consist of a complex mosaic of



sand pine scrub, scrubby and mesic flatwoods, and freshwater marshes and basin swamps. The wide community diversity within each zone, as well as the overall zone size, can greatly complicate a manager's ability to implement burns on this property since each community type has a different set of optimal conditions. This, coupled with the extreme fire behavior that is characteristic of scrub and scrubby flatwoods fires, makes Cedar Key Scrub State Reserve a very challenging place to apply prescribed fires.

The mesic flatwoods community has a natural fire return interval ranging from two to four years, while the scrubby flatwoods may burn as frequently as every five to 15 years, with sand pine scrub burning every eight to 15 years (FNAI 2010). Rosemary bald areas (a variant of scrub) within the reserve, however, typically have a longer fire return interval that can be between 10 to 40 years. Ideally, fire return intervals should fluctuate within what is considered the natural range for a community type in order to maximize habitat diversity at any one time. Although short fire return intervals in sand pine scrub obviously benefit the Florida scrub-jay, there are other species in the community that require longer intervals between fires. The sand pine scrub community should be treated at varying intervals within the natural range. The fringes of sand pine scrub areas that are adjacent to scrubby and mesic flatwoods will likely burn more frequently than the interiors of the larger scrub patches. Scrubby flatwoods, which provide most of the habitat for Florida scrub-jays at Cedar Key Scrub State Reserve, will be treated on a shorter interval, with most areas receiving fire every five to 15 years to maximize acorn production and maintain optimal scrub-jay breeding habitat.

Fires in the reserve can be very intense because of the volatile nature of fuel types within scrub and flatwood communities. Additionally, the naturally uneven aged fuels and often high fuel loads across the landscape can elevate the complexity within individual fire zones. These conditions often make it very difficult to isolate zones effectively and to prevent prescribed fires from escaping into adjacent fire zones or onto neighboring private lands. One simple example of this issue are basin marshes that straddle the reserve boundary. These marshes have light, flashy fuels that are relatively inaccessible to fire equipment due to standing water or hydric soils. There are multiple examples of wildland urban interface (WUI) issues at Cedar Key Scrub State Reserve, including State Road 24 on the south boundary and numerous residential houses to the north and east.

It is for this reason that DRP management has solicited a great deal of funding to apply a variety of restoration treatments to these fire-type communities to reduce the fuel loading and more safely use prescribed fire. In more complex blocks, wide fire lines need to be established between fire zones and some form of mechanical treatment can be used to reduce fuel loads and facilitate burning. In the past, emphasis has been placed on mowing scrub vegetation adjacent to mineral soil fire lines as well as fuel reduction mowing within zones prior to a planned fire. This combination of mechanical treatment followed by prescribed fire will undoubtedly continue to be an integral process in managing the upland communities at Cedar Key Scrub State Reserve. Please see above under the *Natural Communities Scrub* description for details of past restoration activities at the reserve.

Wildfires are common at Cedar Key Scrub State Reserve. Several small wildfires, most less than 10 acres, occur annually at the reserve. Reserve staff work directly with the Florida Forest Service (FFS) during wildfire suppression activities, and in 2016 a lightning strike wildfire within the Panther Ridge tract was expanded into a prescribed fire with a quick response strike team that burned out a 194-acre area (zone CK-9A). When possible and safe to do these types of burnout operations, managers of Cedar Key Scrub State Reserve should take advantage of this option. Another similar lightning strike occurred in 2008 in CK-2B, where the reserve manager was allowed to conduct a burnout operation of this 230-acre zone.

On at least two separate occasions, one in 1996 and the other in 2009, reserve staff have conducted a prescribed fire that ultimately led to a large-scale escape from the zone of intent. In 1996, a prescribed fire on the western side of the reserve spotted across a basin marsh, escaped from the zone and burned a total of 269 acres of basin marsh, mesic flatwoods and scrubby flatwoods. Similarly, in 2009, a prescribed fire on the same west side of the reserve burned a total of 210 acres of basin marsh, mesic flatwoods and scrubby flatwoods. Unfortunately, the 2009 wildfire also escaped off the DRP-managed lands onto adjacent private timberland. Despite the uncontrolled nature of these fires, both did provide an ecologically beneficial effect to the affected natural communities. Fortunately, there were no negative consequences to humans or structures from either escaped fire. Many other smaller-scale (50 acres or less) escapes during prescribed fires have occurred throughout the reserve.

In January 2003, reserve managers used aerial ignition to apply prescribed fire to zones CK-3 and CK-4B for a total area of 475 acres. Other than the new Panther Ridge tract, CK-3 is the largest burn unit of the reserve and is located between two highways as well as being adjacent to a WUI residential area on its north side. Zones CK-6A, CK- 6B and CK-6C are all composed of mainly sand pine scrub with embedded basin swamps and are also adjacent to WUI.

Zone CK-5A is also one of the more challenging and complicated large burn units in the reserve. This burn unit is perhaps one of the most ecologically diverse areas of the reserve since it contains five different natural communities including scrub, scrubby and mesic flatwoods as well as depression and basin marshes. A great deal of mechanical treatment has been done in this zone over the years, and the zone received its first prescribed fire in 2016. Zone CK-2D, which is situated in area west of County Road 347, has received the most prescribed fire of any unit within the reserve. All zones in the reserve have had at least one prescribed fire since 1985 with the exception of the Panther Ridge addition.

Fire dependent wildlife species in the reserve include the gopher tortoise, indigo snake, Florida mouse, gopher frog, eastern diamondback rattlesnake (*Crotalus adamanteus*) and Florida scrub-jay. All these species favor areas that support vegetation and prey that are enhanced by regular fire. The lack of a natural fire regime can impact plant and animal species that are adapted to scrub and scrubby flatwoods communities, most notably the Florida scrub-jay that requires early successional stages of scrub habitats.

## Restoration

**Objective: Conduct natural community restoration activities on 432 acres.**

### *Actions:*

- Develop/update site-specific restoration plan for the Panther Ridge parcel.
- Implement restoration plan.
- Monitor the progress of restoration, including native groundcover and shrub layers.

The pine plantations associated with the new Panther Ridge parcel may need substantial restoration efforts including herbicide treatments to control hardwoods in mesic flatwoods areas. Staff will initiate habitat restoration measures where ecological functions have been disrupted by this altered landscape. The highest priorities for restoration actions will be those areas identified as former scrub and scrubby flatwoods.

Restoration of the scrub and scrubby flatwoods areas will eventually require removal of nearly all the planted slash pines. All slash pines will be harvested, or in some cases burned or mowed, on the scrub ridges. In the scrubby flatwoods the pines will be harvested in stages down to less than one tree per

acre. Depending on the density of scrub oaks and other native shrubs, logging equipment can be encouraged to crush the scrub vegetation to reduce fuel height for subsequent prescribed fires. Where oak densities are too low due to previous herbicide treatments or site preparation, logging equipment should avoid damaging the remaining oaks and pines will be thinned in stages to preserve a fuel source for prescribed fire during restoration.

The mesic flatwoods areas will need varying amounts of overstory slash pine thinning to bring the area back to historic pine densities (about 30-40 basal area). Fortunately, in some areas the groundcover appears to have only undergone partial disturbance and the seed bank may be intact. Longleaf pine seedlings will have to be planted to restore the appropriate overstory component on most of the pine plantation after thinning. Native groundcover reintroduction, off-site hardwood removal and possibly some loblolly pine removal may be needed in the ongoing restoration. Some areas may need a substantial amount of mechanical and chemical treatment of off-site hardwood species such as laurel oak, sweetgum, and others.

In 2021, the initial thinning of 170 acres of planted pine on former mesic and scrubby flatwoods brought the basal area down to 50-60. These stands will be burned and thinned a second time in the future to reduce the basal area further in the mesic flatwoods and remove nearly all the slash pines in the areas mapped with a desired future condition of scrubby flatwoods.

DRP staff will need to monitor the progress of the pine thinning and hardwood treatment efforts. Supplemental chemical and mechanical treatments will occur as needed to achieve effective control of the off-site hardwoods. Monitoring requirements will include checking for native groundcover survival and for the re-establishment of off-site hardwoods. Hardwood sprouts will likely require retreatment. Prescribed fire is an integral part of this restoration project, particularly growing season fire.

### **Improvement**

#### **Objective: Conduct natural community improvement activities on 500 acres.**

##### *Actions:*

- Use mechanical treatment to mow scrub vegetation in the interior of zones prior to prescribed fires.

Prescribed fire is the most important and critical natural resource management tool at the reserve. The primary goal of the prescribed fire program is to restore a natural fire regime to the natural communities within the reserve.

A combination of mechanical treatment followed by prescribed fire will undoubtedly continue to be an integral necessary process to effectively manage the upland communities at Cedar Key Scrub State Reserve. Staff will carry out the necessary habitat improvement measures for natural systems in the reserve in order to implement prescribed fire safely and successfully.

Prescribed fire enhancement program grant funds from the FFS were used to successfully widen firebreaks within the Panther Ridge addition and establish a secure perimeter firebreak in 2017. During the timber sale in 2021, logging crews cleared an additional 3,500-foot stretch of mature timber along the northern boundary of Panther Ridge to complete the northern firebreak.

**Objective: Conduct natural community/habitat improvement activities on 106 acres of clearcut pine plantation.**

**Actions:**

- Conduct initial prescribed fires on Panther Ridge clearcuts.
- Plant longleaf pines in Panther Ridge clearcuts.

The mesic flatwoods clearcuts on the Panther Ridge addition will need to be treated with prescribed fire and then hand planted with longleaf pine seedlings. Some off-site hardwood control may also be required.

**IMPERILED SPECIES**

Ten imperiled plant species and 20 imperiled animal species have been recorded at Cedar Key Scrub State Reserve (see Table 2 below). Given the wide variety of natural communities in the reserve, from coastal salt marsh to fire-maintained scrub habitat, it is not surprising that this property contains a high diversity of imperiled floral and faunal species. Cedar Key Scrub State Reserve was purchased under the Environmentally Endangered Lands program in part to protect the endangered, threatened, rare and unique species that occur on the site. A focus of the reserve is the protection and management of imperiled species, as well as the natural communities in which they occur.

Several of the reserve's rare plant species were documented during an early-1990s floristic study (Amoroso 1993). Many of these imperiled plants are orchids or carnivorous plant species. Two of Cedar Key Scrub State Reserve's notable imperiled orchids are many-flowered grasspink (*Calopogon multiflorus*) and bearded grasspink (*C. barbatus*). These plants are a fire-maintained species with populations that generally consist of only a few plants. Continued use of prescribed fire, maintenance of natural hydroperiods and protection of wetlands from impacts are all vital tools for conserving these and several other imperiled plants in the reserve, including yellow-flowered butterwort (*Pinguicula lutea*), blueflower butterwort (*Pinguicula caerulea*), gypsy-spikes (*Platanthera flava*) and rose pogonia (*Pogonia ophioglossoides*).

The prescribed fire program at Cedar Key Scrub State Reserve should benefit both imperiled plant and animal species that inhabit the fire-maintained communities at the reserve, including several scrub-associated invertebrates such as red widow spider (*Latrodectus bishopi*), scrub tiger beetle (*Cincindela scabrosa*) and moustached tiger beetle (*Ellipsoptera hirtilabris*). The specific effects of fire on these species are largely unknown, but the retention of unburned refugia within suitable habitats and adjustments to the frequency and seasonality of prescribed fires are likely critical elements for continued survival of imperiled species such as these invertebrates (Schweitzer et al. 2011).

Several imperiled or rare reptiles occur within the reserve, including gulf salt marsh snake (*Nerodia clarki clarki*), ornate diamond-backed terrapin (*Malaclemys terrapin macrospilota*), eastern indigo snake (*Drymarchon couperi*), gopher tortoise (*Gopherus polyphemus*), and three marine turtle species discussed below.

The gulf salt marsh snake has been observed within the estuarine communities along the western boundary of the reserve. This species is known to have a wide zone of intergradation throughout Citrus and Levy counties with a southern form known as the mangrove water snake. The ornate diamond-backed terrapin is another important and highly vulnerable species of greatest conservation need that resides within estuarine habitats of the reserve and the adjacent aquatic preserve (FWC 2012).

The eastern indigo snake is a federally listed upland species that is becoming increasingly rare throughout its range due to loss and fragmentation of its critical habitat (Enge et al. 2013). Indigo snakes, which are often found in association with gopher tortoises, have historically been observed more frequently in the reserve as compared to other areas within its range. They are known to utilize tortoise burrows as refugia and for thermoregulation, especially during periods of cold weather. Anecdotal observations, or lack of observations, indicate that the indigo snake population within the reserve and the Gulf Hammock region has declined (Godley and Moler 2013).

The gopher tortoise is one of the better-known imperiled reptiles in Florida. These terrestrial turtles and the deep burrows they construct typically are found in well-drained sandy soils of the reserve including scrub, scrubby flatwoods, sandhill and mesic flatwoods. Gopher tortoises are generally less common in scrubby flatwoods and sand pine scrub than in open sandhills, however tortoises thrive in the early regeneration stages of scrubby flatwoods and scrub where the required open areas and herbaceous growth are present. Scrub in later stages of regeneration may become too shady or overgrown, even under a natural fire regime. Like other pyric community species, prescribed fire is a vital tool used by managers to maintain tortoise habitat. In the absence of frequent fire, hardwood trees invade upland communities and shade out herbaceous plants required by tortoises for forage. It is likely that much of the gopher tortoise population at Cedar Key Scrub State Reserve persists in habitat that is less than ideal due to the relative infrequency of fire in the landscape. A typical response of tortoises to lack of fire in an area is to locate burrows along roadsides or utility easements where the shrub or tree canopy is more open (McCoy and Mushinsky 1991).

Gopher tortoises are recognized as a keystone species of critical importance because hundreds of commensal species, mostly invertebrates, utilize their burrows as refugia (Jackson and Milstrey 1994). Because of its keystone status, the gopher tortoise is considered an indicator of upland natural community health. FWC has adopted a statewide protocol for monitoring gopher tortoises based on a line transect distance sampling method (LTDS) (Smith et al. 2009). In January 2018, FNAI, under contract with FWC, conducted a gopher tortoise LTDS pilot survey at Cedar Key Scrub State Reserve (FNAI 2018). The purpose of this pilot survey was to calculate the effort required for a full survey to reliably estimate population size. The survey resulted in only two occupied gopher tortoise burrows along 5,737.3 meters of transect, indicating Cedar Key Scrub State Reserve has a low-density gopher tortoise population that is likely not currently viable.

Based on these results, a full population survey was not warranted at this time. FWC recommends repeating this pilot survey in five to 10 years, or following habitat management, to determine if a full LTDS survey is warranted in the future.

Three species of marine turtle occur within the waters of the Gulf of Mexico that utilize the adjacent estuaries on Cedar Key Scrub State Reserve's western boundary, namely Kemp's ridley (*Lepidochelys kempii*), loggerhead (*Caretta caretta*) and green turtle (*Chelonia mydas*). It is well known that nearshore estuarine habitats adjacent to the reserve are important as an "early-age" feeding ground for these species. The estuarine resources of the Big Bend region are exceptionally diverse, with lush beds of submerged aquatic vegetation (SAV) and highly productive benthic macroinvertebrate communities that attract young marine turtles year-round. The constant pulses of freshwater into estuaries that characterize this region are critical to maintaining natural hydrology and sustaining water quality and quantity in the lush SAV and benthic communities.

Marian's marsh wren (*Cistothorus palustris marianae*) and Scott's seaside sparrow (*Ammospiza maritimus peninsulae*) are two imperiled salt marsh habitat-dwelling birds known to occur at Cedar Key Scrub State Reserve. The population status of these two species is still relatively unknown (Post et al.

1983; Kale 1996; Sauer et al. 2014). A biological review of Marian's marsh wren and Scott's seaside sparrow conducted by avian experts and FWC concluded that increased monitoring efforts were needed because of ongoing threats to salt marsh habitat along the Gulf Coast and a trend of declining marsh wren populations in the area (FWC 2011; FWC 2013a). In 2016, FWC research staff collected updated observations within the Big Bend region, including at Cedar Key Scrub State Reserve.

To varying degrees, the natural communities and the imperiled species at Cedar Key Scrub State Reserve have suffered from fire exclusion both within the reserve and on surrounding private lands over several decades. The early successional stages of both scrub and scrubby flatwoods are the preferred breeding and foraging habitat for Florida scrub-jays, as well as several other imperiled species including gopher tortoises, Florida mice and an entire assemblage of scrub-associated invertebrates (Woolfenden and Fitzpatrick 1984; Jackson and Milstrey 1994). The Florida scrub-jay is one species found at the reserve that has received a large amount of management attention because of its rarity, small population size and significantly declining numbers.

The Florida scrub-jay is one of the most iconic imperiled species in the state. The Florida scrub-jay is endemic to Florida, and the population at the reserve is one of 21 designated population groups throughout its range (Stith 1999a). Recent work on Florida scrub-jay genetic structure has delineated the Cedar Key Scrub State Reserve metapopulation as one of 10 genetically different groups (Coulon et al. 2008). This distinct isolated Cedar Key group is considered to be the northwesternmost metapopulation in the state.

In 1999, avian research experts conducted a statewide metapopulation viability analysis (MVA) for the Florida scrub-jay, one that ultimately resulted in a recognition of a significant vulnerability of the Cedar Key group to extinction (Stith 1999b). This metapopulation was given an extinction vulnerability (i.e. fifth in state) that ranked it as the No. 2 priority within the state, with some experts even suggesting that it should be ranked as the top priority if it is to be recovered (USFWS 1990; Stith et al. 1996; Stith 1999a; Coulon et al. 2008; Boughton and Bowman 2011). According to the MVA report, acquisition and restoration of more than 30% of the remaining scrub-jay habitat will be required to remove the threat of extinction from the Cedar Key metapopulation. However, increases in residential development in this area continue to threaten, destroy and fragment large tracts of remnant scrub habitat before it can be protected. Even if all existing scrub habitats in the reserve were restored to optimal condition, the Cedar Key scrub-jay metapopulation may still be vulnerable to extinction (Cox et al. 1994). However, the Cedar Key group does have a strong potential for improvement given the existing undeveloped scrub habitat that remains adjacent to and nearby to the reserve. Avian experts strongly agree that there is an overwhelming need to acquire additional scrub-jay habitat and to accelerate restoration of existing public lands within the Cedar Key region (Boughton and Bowman 2011; Coulon et al. 2008). Acquisition of the Panther Ridge addition to Cedar Key Scrub State Reserve in 2015 added a significant number of acres of scrub and scrubby flatwoods to the reserve. Although the majority of these areas were planted with slash pines, removal of the slash pines, coupled with fire and mechanical treatment, should restore the natural vegetation structure and increase the available habitat for scrub-jays.

If sufficient scrub-jay habitat can be acquired, restored and maintained in proper condition on public lands in the Cedar Key Scrub State Reserve area, consideration should be given to translocation of scrub-jays to the reserve to augment the declining population. FWC has discussed the possibility of translocating scrub-jays from healthy populations, most likely from Ocala National Forest.

As mentioned above, there have been many restoration and monitoring activities associated with recovering the Cedar Key Scrub State Reserve Florida scrub-jay metapopulation. DRP is sincerely indebted to numerous stakeholders for their integral support of scrub habitat restoration and scrub-jay

management in the Cedar Key region, including FWC, USFWS, the U.S. Marshals Service, FFS, the Nature Conservancy, the Florida Museum of Natural History, Florida Audubon Jay Watch, Dr. Karl Miller, Vic Doig, and many volunteers. Below is a synopsis of DRP's multiple stakeholder scrub restoration management approach at the reserve.

The earliest recorded Florida scrub-jay metapopulation assessment in the Cedar Key region was in 1979-1981 (Cox 1981; Cox 1987). This was also the earliest documented Christmas Bird Count (CBC) data obtained for the reserve. A complete listing of other Cedar Key Scrub State Reserve CBCs can be accessed from the eBird website (eBird 2016). During this 1979-1981 work, the total size of Cedar Key Scrub State Reserve's scrub-jay population was estimated to be around 100 individuals. This early assessment consisted of several surveys, of which the highest number of scrub-jay individuals counted at any one time was 21 on the reserve and 35 on private lands (Cox 1981).

Besides the scrub-jays at the reserve, the Cedar Key metapopulation consisted of several other family territories or groups located on private lands, including areas to the north of the reserve along County Road 347 and others near the town of Rosewood on County Road 345, about 5 miles northeast of the reserve. In 1992-93, an updated statewide scrub-jay survey and mapping effort estimated a total of eight family groups within the entire Cedar Key metapopulation (Fitzpatrick et al. 1994). In 1997-2003, researchers documented as many as four family groups within the Rosewood area, as many as four groups adjacent to the reserve along or nearby to County Road 347, and as many as four groups in the reserve (DEP 1997; DEP 1998; Miller et al 2003). In May 2004, the entire Cedar Key metapopulation was estimated to include a minimum of 32 known birds in eight family groups.

Florida scrub-jay reproductive success studies have also been conducted on the Cedar Key metapopulation since 1997 (Miller et al. 2001; Miller et al 2003). During this period, researchers marked as many as 55 Florida scrub-jays with unique color-coded leg bands and analyzed territory movements, family recruitment and fledgling dispersal (DEP 1998; Miller et al 2001; Miller et al 2003). Interestingly, the birds at Cedar Key Scrub State Reserve apparently do not exhibit as strong of a territorial behavior as compared to scrub-jays from other metapopulations that have higher densities (DEP 1998).

The Cedar Key Scrub Jay Working Group formed in 2008 with multiple agency and stakeholder involvement. From 2004-09, Cedar Key Scrub State Reserve staff and volunteers implemented an intensive effort to survey all known scrub-jays within and adjacent to the reserve several times each month (District 2 files). Beginning in 2009, the Florida Park Service cooperated with Florida Audubon Society Jay Watch to implement a statewide annual assessment at all known Florida scrub-jay state park sites, including the birds in the Cedar Key metapopulation (Audubon Jay Watch 2016).

Florida scrub-jays continued to decline within the reserve and surrounding areas. An extensive survey in 2009 by FWC on private lands failed to detect any scrub-jays in the surrounding areas. Annual surveys by Jay Watch have shown a decline in the number of birds. As of present, no family groups are known to be breeding inside the reserve or on adjacent lands. A single bird is occasionally sighted along County Road 346 within the reserve, and rarely are two birds reported at that location. The status of scrub-jays on private lands in the Rosewood area is unknown.

Below is a brief synopsis of other salient Florida scrub-jay monitoring activities at the reserve:

- 1995-96 USFWS Habitat Improvement Grant (HIG) to monitor scrub-jays, Florida mice and gopher tortoises.
- From 1997-2009, banding study of Cedar Key scrub-jay metapopulation.

- 1997-98 USFWS HIG for Dr. Tom Webber to monitor and band scrub-jays (funds also included monitoring projects for Florida mice, gopher tortoises and eastern indigo snakes).
- In 2000, FWC funded Dr. Karl Miller to conduct monitoring and band scrub-jays as part of a reproductive success study.
- In 2008, formation of the Cedar Key Scrub Jay Working Group.
- In 2006, FWC developed a scrub-jay database.
- In 2009, FWC/DRP conducted the scrub-jay bio-blitz Habitat Restoration, Improvement, and Acquisition.

Please see above under the *Scrub Natural Communities* section for additional details about habitat restoration/improvement activities at the reserve. Below is a brief synopsis of other salient scrub habitat restoration activities at the reserve:

- In 1995-96, USFWS HIG; mow/disk for fire line improvement and produce Cedar Key Scrub Habitat Improvement Plan.
- In 2000, FFS timber harvest of 100 acres of sand and slash pine.
- In 2001, park staff roller-chopped 49 acres of scrub and fire lines.
- In 2002, DEP Resource Restoration \$12,000; mowed 34 acres of scrub.
- In 2003, DEP Resource Restoration \$25,000; Kershaw mowed 87 acres of scrub.
- In 2005, USFWS grant \$30,000; Gyro-Track mowed 275 acres of scrub.
- In 2009, TNC scrub-jay grant; mowing and disking for fire line improvement.
- In 2009, FFS/DEP federal stimulus funds; roller-chop and fire line improvement.
- In 2009, TNC acquisition of DeCarlo parcel (CK-5D) from U.S. Marshals Service; subsequently donated to state.
- In 2012, FWC/DRP conducted a tree density analysis from 1961-2008. Result suggested significantly increased tree density in scrub habitats and adjacent mesic flatwoods.
- In 2013, FFS/DRP/FWC implemented timber harvest to reduce tree density.
- In 2015, DEP acquired Panther Ridge with Florida Forever funds.

Historical data on the Florida mouse population at Cedar Key Scrub State Reserve are available from research conducted by Dr. Jim Layne. Layne began monitoring small mammals at the reserve in 1957, subsequent to the catastrophic fire of 1955. He trapped a site in the northeast corner of the reserve, known as Levy 10, intermittently for more than 40 years. The Levy 10 Florida mouse population underwent a major decline about 10 years post-burn, although the mice have persisted at the site (Layne 1990).

FWC and DRP also trapped Florida mice in the reserve during 1995-97. FWC began a multiyear project in 1995, just prior to DRP receipt of the USFWS Habitat Improvement Grant. Multiple locations within the reserve were surveyed for Florida mice, with almost all areas of appropriate habitat discovered to support a robust population of Florida mice (Morgan 1998). In 2012, researchers implemented a statewide genetic analysis study for the Florida mouse that included Cedar Key Scrub State Reserve (FWC 2013b).

One animal species that occupies estuarine salt marsh habitat is the Florida salt marsh vole. This species has both state and federal listed status, and FNAI ranks it as critically imperiled within Florida. The Florida salt marsh vole has been a challenging small mammal for researchers to study, primarily due to the inaccessibility of their preferred habitat, namely salt marsh (Woods et al. 1982). This genetically distinct subspecies of the common meadow vole is currently only known from three disjunct areas



within the Big Bend region, including Lower Suwannee National Wildlife Refuge, Cedar Key Scrub State Reserve and Waccasassa Bay Preserve State Park (Hotaling et al., 2010; Austin et al. 2014). In 2009, University of Florida researchers discovered a novel monitoring technique (camera trap) that can effectively be used to study the distribution and demography of this endangered mammal. In addition, researchers are successfully documenting another rare mammal, the Gulf salt marsh mink (*Neovison vison halilimnetes*) within the same estuarine habitats.

Completion of important acquisition projects to ensure preservation of the remaining unprotected Cedar Key Scrub State Reserve habitat is vital to restore and sustain the populations of the local scrub-jay and salt marsh vole, as well as the remaining imperiled species. More about essential acquisition projects is discussed under the *Land Use Component*.

Imperiled Species Inventory						
Common and Scientific Name	Imperiled Species Status				Management Actions	Monitoring Level
	FWC	USFWS	FDACS	FNAI		
<b>PLANTS</b>						
Bearded grass pink <i>Calopogon barbatus</i>			LT			Tier 1
Manyflowered grasspink <i>Calopogon multiflorus</i>			LT	G2, G3, S2, S3	1, 10, 13	Tier 1
Pantropical widelipped orchid <i>Liparis nervosa</i>			LE		4	Tier 1
Angle pod <i>Gonolobus suberosus</i>			LT			Tier 1
Cardinalflower <i>Lobelia cardinalis</i>			LT		4	Tier 1
Erect pricklypear <i>Opuntia stricta</i>			LT			Tier 1
Blueflower butterwort <i>Pinguicula caerulea</i>			LT		1, 4	Tier 1
Yellow-flowered butterwort <i>Pinguicula lutea</i>			LT		1, 4	Tier 1
Gypsy-spikes <i>Platanthera flava</i>			LT		1, 4	Tier 1
Rose pogonia <i>Pogonia ophioglossoides</i>			LT		1, 4	Tier 1
<b>INVERTEBRATES</b>						
Red widow spider <i>Latrodectus bishop</i>				G2, G3, S2, S3		Tier 1
<b>AMPHIBIANS</b>						
Gopher frog <i>Lithobates capito</i>		UR		G2, G3, S3	1, 4	Tier 1

Imperiled Species Inventory						
Common and Scientific Name	Imperiled Species Status				Management Actions	Monitoring Level
	FWC	USFWS	FDACS	FNAI		
<b>REPTILES</b>						
American alligator <i>Alligator mississippiensis</i>	FT (S/A)	T (S/A)		G5, S4	4, 10, 13	Tier 1
Loggerhead turtle <i>Caretta caretta</i>	FT	LT		G3, S3	4, 13	Tier 1
Green turtle <i>Chelonia mydas</i>	FT	LT		G3, S2, S3	4, 13	Tier 1
Eastern indigo snake <i>Drymarchon couperi</i>	FT	LT		G3, S3	1, 7, 10, 13	Tier 1
Gopher tortoise <i>Gopherus polyphemus</i>	ST	C		G3, S3	1, 7, 10, 13	Tier 2
Kemp's ridley turtle <i>Lepidochelys kempii</i>	FE	LE		G1, S1	4, 13	Tier 1
Gulf salt marsh snake <i>Nerodia clarkii clarkii</i>				G4, T3, S2	4	Tier 1
<b>BIRDS</b>						
Scott's seaside sparrow <i>Ammodramus maritimus peninsulae</i>	ST			G4, T3, S3	2, 4, 13	Tier 2
Florida scrub-jay <i>Aphelocoma coerulescens</i>	FT	LT		G2, S2	1, 3, 6, 7, 13	Tier 3
Short-tailed hawk <i>Buteo brachyurus</i>				G4, G5, S1	4, 13	Tier 1
Marian's marsh wren <i>Cistothorus palustris marianae</i>	ST			G5, T3, S3	2, 4, 13	Tier 2
Little blue heron <i>Egretta caerulea</i>	ST			G5, S4	4, 10, 13	Tier 1
Tricolored heron <i>Egretta tricolor</i>	ST			G5, S4	4, 10, 13	Tier 1
Swallow-tailed kite <i>Elanoides forficatus</i>				G5, S2	4	Tier 1
American oystercatcher <i>Haematopus palliatus</i>	ST			G5, S2	4, 10, 13	Tier 2
Wood stork <i>Mycteria americana</i>	FT	LT		G4, S2	4, 10, 13	Tier 1
<b>MAMMALS</b>						
Salt marsh vole	FE	LE		G5, T1, S1	4	Tier 2

Imperiled Species Inventory						
Common and Scientific Name	Imperiled Species Status				Management Actions	Monitoring Level
	FWC	USFWS	FDACS	FNAI		
<i>Microtus pennsylvanicus dukecambelli</i>						
West Indian manatee <i>Trichechus manatus latirostris</i>	FT	LT		G2, S2	4, 10, 13	Tier 1

**Management Actions**

1. Prescribed Fire
2. Exotic Plant Removal
3. Population Translocation/Augmentation/Restocking
4. Hydrological Maintenance/Restoration
5. Nest Boxes/Artificial Cavities
6. Hardwood Removal
7. Mechanical Treatment
8. Predator Control
9. Erosion Control
10. Protection from visitor impacts (establish buffers)/law enforcement
11. Decoys (shorebirds)
12. Vegetation planting
13. Outreach and Education
14. Other

**Monitoring Level**

Tier 1.

Non-Targeted Observation/Documentation: includes documentation of species presence through casual/passive observation during routine park activities (i.e. not conducting species-specific searches). Documentation may be in the form of Wildlife Observation Forms, or other district specific methods used to communicate observations.

Tier 2.

Targeted Presence/Absence: includes monitoring methods/activities that are specifically intended to document presence/absence of a particular species or suite of species.

Tier 3.

Population Estimate/Index: an approximation of the true population size or population index based on a widely accepted method of sampling.

Tier 4.

Population Census: A complete count of an entire population with demographic analysis, including mortality, reproduction, emigration, and immigration.

Tier 5.

Other: may include habitat assessments for a particular species or suite of species or any other specific methods used as indicators to gather information about a particular species.

## Inventory

### **Objective: Update baseline imperiled species occurrence list.**

#### *Actions:*

- Develop imperiled species occurrence inventory for the Panther Ridge addition to Cedar Key Scrub State Reserve.
- Update imperiled species occurrence inventory for Cedar Key Scrub State Reserve.

## Fauna

### **Objective: Monitor and document six selected imperiled animal species in the reserve.**

#### *Actions:*

- Develop monitoring protocols for six selected imperiled animal species.
- Implement monitoring protocols for six imperiled animal species, including Florida scrub-jay, indigo snake, gopher tortoise, salt marsh vole, Scott's seaside sparrow and Marian's marsh wren.

The reserve has a long history of monitoring imperiled animal species due to its unique habitats and disjunct location. Monitoring of Florida scrub-jays will continue in cooperation with FWC, Audubon Jay Watch and volunteers. Documentation of sightings of eastern indigo snakes will provide important information about the status of this species in the reserve. Any sightings of indigo snakes will be reported to FWC and the Florida Museum of Natural History. Monitoring of Scott's seaside sparrow and Marian's marsh wren will be conducted through cooperative survey efforts with FWC. Any additional monitoring of the salt marsh vole will be conducted by FWC and the University of Florida in cooperation with USFWS.

As upland natural community restoration and improvement projects proceed, particularly prescribed burning, it will be increasingly important to track Florida scrub-jay and gopher tortoise abundance. If staff and equipment funding are available, future gopher tortoise surveys should utilize GPS and burrow camera-based LTDS methods.

Cedar Key Scrub State Reserve will continue to serve as one of the primary monitoring locations for the annual National Audubon Christmas Bird Count (CBC) in the Cedar Key region.

## Flora

### **Objective: Monitor and document 1 selected imperiled plant species in the reserve.**

#### *Actions:*

- Develop monitoring protocols for one selected imperiled plant species.
- Implement monitoring protocols for one imperiled plant species.

The many flowered grasspink (*Calopogon multiflorus*) is the only known FNAI tracked imperiled plant species in the reserve. Specific protocols will be developed and implemented for this species in cooperation with FNAI.

## INVASIVE SPECIES

Cedar Key Scrub Reserve has four known invasive plant species present, Brazilian pepper (*Schinus terebinthifolius*), torpedograss (*Panicum repens*), cogongrass (*Imperata cylindrica*) and Chinese brake fern (*Pteris vittata*). Each presents its own difficulties. Due to the difficulty in the surveying the area, the extent of Brazilian pepper in the reserve is not known. Torpedograss is known to be present only on roadsides or where logging activity has occurred in the past. A thorough survey for the extent of Brazilian pepper is needed before complete treatment can occur. Cogongrass has been documented in two locations within the Panther Ridge addition. Chinese brake fern tends to grow on lime rock and can be found on lime rock roads, dirt piles and structures. The remnant habitat of the gulf hammock contains many natural lime rock outcroppings. Control of the brake fern in Cedar Key Scrub State Reserve may benefit the remaining gulf hammock habitat. Invasive plant surveys are needed for all the newly designated resource management zones in the new addition.

Invasive Plant Species			
Species Name <i>Scientific Name</i> - Common Name	FISC Category	Distribution	Zone ID
<i>Imperata cylindrica</i> - Cogongrass	I	Single Plant or Clump, Scattered Dense Patches	CK-11, CK-6B, UnMapped
<i>Panicum repens</i> - Torpedograss	I	Single Plant or Clump, Scattered Plants or Clumps	CK-1A, CK-1B, CK-1C, CK-1D, CK-2A, CK-2M, CK-3, CK-4A, CK-6A, CK-6C, CK-6D
<i>Pteris vittata</i> - Chinese brake fern	II	Linearly Scattered	CK-6B
<i>Schinus terebinthifolius</i> - Brazilian pepper	I	Scattered Plants or Clumps, Scattered Dense Patches	CK-2H, CK-2K, CK- 2Qn, CK-2J

Feral hogs occur within the reserve and are hunted during the regularly scheduled hunting periods administered by FWC. Should feral hogs cause unacceptable damage to natural or cultural resources, staff will investigate additional control measures in addition to the FWC hunts.

In 2002, the red bay ambrosia beetle (*Xyloborus glabratus*) was first detected in the United States in southeast Georgia. The beetle carries the fungal pathogen (*Raffaelea lauricola*) which it transmits to red bay trees (*Persea borbonia*) and other species in the Lauraceae family, causing laurel wilt disease and death. The beetle and its associated pathogen spread rapidly, and by 2005 it had appeared in Duval County. In 2010, the disease was discovered in Levy County. The beetle (and laurel wilt) has now spread throughout most of Florida and into many neighboring states. Although most of the adult red bays have been top killed, the trees continue to re-sprout from their roots. Staff should continue to restrict the movement of firewood into and out of the preserve and educate visitors about the issue.

## **Invasive Plant Treatment**

**Objective: Annually treat 4 gross acres of invasive plant species.**

*Actions:*

- Annually treat 4 gross acres of invasive plant species.
- Implement annual work plan by annually treating 4 gross acres in park and continuing maintenance and follow-up treatments as needed.

A survey of the coastal portions of park for Brazilian pepper is needed. A plan to implement a thorough treatment of Brazilian pepper should be developed and implemented. Treatment of torpedograss should continue annually. A complete survey of the new Panther Ridge addition is needed to document any additional invasive species and their locations.

## **Invasive and Nuisance Animal Control**

**Objective: Implement control measures on one invasive animal species in the reserve.**

*Action:*

- Control feral hogs as needed.

Cedar Key Scrub State Reserve has a minimal problem with invasive animals at this time. Feral hogs are present and are hunted during the limited hunting periods administered by FWC. If feral hog damage reaches unacceptable levels, staff will pursue actions to reduce the population in accordance with DRP policies.

## **CULTURAL RESOURCES**

### **Prehistoric and Historic Archaeological Sites**

The reserve has nine recorded archaeological sites and one resource group that falls into two broad periods: prehistoric and 1821 to mid-20<sup>th</sup> century. In addition, it is part of the National Historic Register's Cedar Keys Historic and Archaeological District (LV244). Many of the prehistoric sites cannot be allocated to a particular period. Two sites (LV528 and LV536) have been designated as Deptford and Weeden Island, respectively.

Other cultural sites in the reserve fall into the territorial, early statehood and early-20<sup>th</sup> century periods that represent development activities during European colonization in Florida. Key among those are the Fernandina to Cedar Key Railroad (LV228) and the indicators of the logging and naval stores industry (LV534).

Two known but unrecorded cultural sites exist in the reserve. One is a linear resource group that is discussed in the predictive model for the reserve. It is a portion of a corduroy road or log road discovered during a prescribed fire. It is probably associated with the 19<sup>th</sup>-century Tilghman Logging Company that had a mill in the area. This site should be located and recorded with the Florida Master Site File (FMSF).

The second site was also discovered during a prescribed fire and exists close to the corduroy road. It appears to be an unmarked cemetery, as evidenced by regular sunken areas. The location of this site

needs to be recorded and a file submitted to the FMSF. The site should also be protected from ground disturbance. The reserve should develop a protocol to alert staff and possibly other agencies, so it is not disturbed during any fire activities.

A predictive model has been completed for the reserve (Collins et al. 2012).

Archaeological sites within the Cedar Key and Waccasassa Bay coastal region are usually situated in cabbage palm hammock islands, on limestone highs around artesian sources, and on relict dunes and tidal bars. Because most of the Big Bend region is undergoing rapid change due to sea level rise, land subsidence and wave/tidal action, it is expected that landscape modifications in the form of hammock and upland loss and scouring of limestone islands may cause a future loss of archaeological sites at Cedar Key Scrub State Reserve.

All sites are in good condition with the exception of LV125, which was destroyed at some point, perhaps during the widening of State Road 24, and LV528, which was discovered while establishing a fire break, all sites are in good condition.

All sites should be protected from soil disturbance associated with prescribed fire and wildfire. Cultural sites should be monitored annually, and the Division of Historical Resource's (DHR) management procedures should be consulted and followed prior to any ground disturbing activities or facility development.

<b>Cultural Sites Listed in the Florida Master Site File</b>					
<b>Site Name and FMSF #</b>	<b>Culture/Period</b>	<b>Description</b>	<b>Significance</b>	<b>Condition</b>	<b>Treatment</b>
8LV125 Hunter's Ridge	Prehistoric	Archaeological Site	NE	P	P
8LV274 Eureka Island	Prehistoric	Archaeological Site	NE	G	P
8LV522 Cappuccio	20 <sup>th</sup> Century American	Archaeological Site	NE	NE	NE
8LV528 Pierson's Cut Midden	Deptford Prehistoric	Archaeological Site	NE	G	P
8LV533 Spinach Patch	Prehistoric, possibly Archaic	Archaeological Site	NE	G	P
8LV534 Herty	Early 20 <sup>th</sup> Century – 1940s Historic/ Naval stores	Archaeological Site	NE	G	P
8LV535 Rusted Car Knoll	Early 20 <sup>th</sup> Century Historic refuse/Dump	Archaeological Site	NE	G	P
8LV536 Cedar Key Scrub	Weeden Island	Archaeological Site	NE	G	P
8LV753 Gulf Hammock 6	Prehistoric	Archaeological Site	NE	NE	P
8LV244 Cedar Keys Historic and Archaeological District	Prehistoric and Historic	National Register District Resource Group	NR	G	P
8LV228 Fernandina Cedar - Key Railroad	1821 to present	Resource Group	NE	G	P

Significance:

NRL-	National Register Listed
NRE-	National Register Eligible
LS-	Locally Significant
NE-	Not Evaluated
NS-	Not Significant

Condition:

G-	Good
F-	Fair
P-	Poor

Recommended Treatment:

RS-	Restoration
RH-	Rehabilitation
ST-	Stabilization
P-	Preservation
R-	Removal

### Condition Assessment

**Objective: Assess 10 of 11 recorded cultural resources in the reserve.**

*Action:*

- Complete 10 assessments of archaeological sites.

All cultural sites should have a baseline assessment against which site changes can be documented. The exception to this is LV244, which includes that town of Cedar Key. Impacts from fire line preparation and other disturbances should be noted.

Archaeological sites along this coastline region are currently subject to greater wave action, higher tidal surges, and unknown changes due to sea level rise. As the threat of significant disturbance from these factors at Cedar Key Scrub State Reserve increases, additional precautions may be needed, including more intensive archaeological evaluation.

No Historic Structure Reports are needed because there are no historic structures.

### Documentation of Recorded Sites

**Objective: Compile reliable documentation for all recorded historic and archaeological resources.**

*Actions:*

- Record the log corduroy road, the presumed unmarked cemetery and any future sites that are encountered with the FMSF.
- Follow DHR Matrix and Compliance and Review where ground disturbing activities are planned.
- Develop and adopt a Scope of Collections Statement.

Two unrecorded sites, the old corduroy road and an unmarked cemetery, need to be recorded with the FMSF. The road should be recorded as a linear resource group. If possible, supporting documentation should be compiled on the history of these sites to submit with the site descriptions.

According to the predictive model completed in 2012, 38% of Cedar Key Scrub State Reserve has a high probability of archaeological sites. The DRP matrix should be followed for any area where ground disturbing activities are planned. DHR compliance and review will be triggered by the level of disturbance identified in the DHR Matrix for ground disturbing activities.

Develop a brief written Scope of Collections Statement indicating that the reserve does not have any collections and that they are not appropriate for the reserve.



## Preservation Measures

**Objective: Bring one of 10 recorded cultural resources into good condition.**

*Actions:*

- Monitor all cultural sites on an annual basis.
- Consult and follow DHR's management procedures prior to any ground disturbing activities or facility development.

Cultural sites should be visited and monitored on a regular basis. Develop and implement a program to monitor all sites at least once every two years or after a prescribed fire or wildfire. Park staff will keep a record of each site and any impacts affecting each site.

Sites that previously have been impacted by fire line construction should be evaluated for methods to reduce these impacts. Options such as reduced depth of soil disturbance or relocating a section of fire line may be appropriate. Sensitive areas should be designated on maps and made available to equipment operators.

## **SPECIAL MANAGEMENT CONSIDERATIONS**

### **Arthropod Control Plan**

All DRP lands are designated as “environmentally sensitive and biologically highly productive” in accordance with Ch. 388 and Ch. 388.4111 Florida Statutes. If a local mosquito control district proposes a treatment plan, the DRP works with the local mosquito control district to achieve consensus. By policy of DEP since 1987, aerial adulticiding is not allowed, but larviciding and ground adulticiding (truck spraying in public use areas) is typically allowed. The DRP does not authorize new physical alterations of marshes through ditching or water control structures.

Cedar Key Scrub State Reserve does not have an Arthropod Control Plan. Mosquito control plans temporarily may be set aside under declared threats to public or animal health, or during a Governor’s Emergency Declaration.

## **LAND USE COMPONENT**

### **VISITATION**

Cedar Key Scrub State Reserve exhibits a wide range of environments for outdoor recreational pursuits. The reserve's 12 natural communities are the backdrop for hiking, horseback riding, cycling and seasonal hunting, and they are a haven for visitors looking for the natural beauty of "the real Florida."

Equestrians, hikers and cyclists can enjoy the extensive network of multiuse trails. Cedar Key Scrub State Reserve is one of only two units within the Florida State Parks system classified with the internal designation of "reserve," which means that seasonal hunting activities are permitted. Permits are issued for hunting season, which locally runs from October through January.

All visitors enjoy Cedar Key Scrub State Reserve for its unspoiled natural areas, which include scrubby pinelands, coastal hammock, and mangroves. The reserve's unique geographic position results in high species richness due to its location between subtropical peninsular and temperate continental zones. The reserve's wildlife population draws visitors hoping to encounter species such as the gopher tortoise, Florida scrub jay, swallow-tail kite, wading birds and white-tail deer.

### **Trends**

Between 2009 to 2019, visitation to Cedar Key Scrub State Reserve followed a seasonal pattern of higher and lower visitation. Trends included an evident increase in visitation in the winter and spring months, specifically, February, March and April. July also featured high visitation. While a seasonal trend for "off season" may not be apparent, visitation is traditionally at its lowest in September, October, and December.

### **Economic Impacts**

Regionally, the Cedar Key area, including Cedar Key Museum State Park, recorded 10,308 visitors in FY 2022/2023. By DRP estimates, the FY 2022/2023 visitors contributed \$1,321,505 in regional economic impact, the equivalent of adding 19 jobs to the local economy (FDEP 2023).

### **EXISTING FACILITIES AND INFRASTRUCTURE**

The reserve's facilities are divided into four recreation and use areas, including a State Road 24 Trailhead, a County Road 347 Trailhead, the trail system and the support area.

The State Road 24 Trailhead is the primary entrance point to the "Side A," eastern regions of the reserve and its extensive trail network. A large sign marks this entrance point. It is here, among the scrub, pine and powder white sand that visitors make their first impressions of the reserve. Visitor infrastructure includes a stabilized parking area, a barbecue grill, a covered picnic pavilion and two interpretive kiosks. There is a composting restroom that is non-operational and permanently closed.

The County Road 347 Trailhead is the entry point to the western areas of the reserve, referred to as "Side B." The trailhead area is comprised of a grass field for parking, enclosed by a wooden fence and scrub. An interpretive kiosk displays information for individuals using the trails and includes plastic containers that are used to store trail maps and other printed materials. A gate prohibits car access to

the west-facing trail entrance. West of the kiosk, a picnic table is available. Presently, there are no restroom facilities at the County Road 347 “Side B” trailhead.

The reserve contains an extensive 12-mile trail network. The trail system is supported by two trailheads. Four miles of trails are located on Side A, and 8 miles of trails are located on Side B. County Road 347 separates the two segments of the reserve. The trails mostly follow fire breaks and support roads. The trail system generally passes through or near scrub, hydric hammock, depression marsh, basin marsh, scrubby flatwoods, mesic flatwoods, and other exceptional natural communities.

The Panther Ridge parcel is an addition to the reserve. The land was acquired in 2015 and encompasses 1,500 acres. There are plans to formally incorporate the Panther Ridge parcel in the broader park for recreational use, specifically for hunters.

Maintenance at the reserve is largely dedicated to trail maintenance and management of natural communities. Maintenance efforts are facilitated by a shared support complex for Cedar Key Scrub State Reserve and Waccasassa Bay Preserve State Park. The support area is located on the south side of State Road 24 and contains two ranger residences, an office and several sheds and pole barns. This support area is located on the grounds of Cedar Key Scrub State Reserve.

### Facilities Inventory

<i>State Road 24 Trailhead</i>	
Entrance Sign	1
Main Park Entrance	1
Picnic Pavilion	1
Parking Area	1
Picnic Table	2
Restroom	1
Barbecue Grille	1
Interpretive Kiosk	1
<i>County Road 347 Trailhead</i>	
Entrance Sign	1
Park Entrance	1
Parking area	1
Picnic Table	1
Interpretive Kiosk	1
<i>Trail System</i>	
Trails Mileage	12
<i>Support Area</i>	
Pumphouse	1
Shop	1
Residence	2
Breakroom Building	1
Well	1
Flammable Shed	1
Carport	2
Office	1

Residence Sheds	2
Storage Sheds	4

## **CONCEPTUAL LAND USE PLAN**

### **Trail System**

***Objective: Modify and enhance the existing trail system to provide a seamless experience for users.***

*Actions:*

- Reconfigure trail system.
- Improve wayfinding with trail markers.
- Revise trail maps.

The classic single-track hiking trail that meanders through a variety of natural areas is absent from this unit. Any reconfiguration, redevelopment, or expansion of the trail network should strive to include this type of trail design and user experience.

Therefore, the network of trails should be reconfigured and/or expanded to extend access to more of the reserve. An assortment of new interpretive elements is needed to improve wayfinding. Maps should be updated to reflect these changes. Trail markers should be installed to aid visitors in wayfinding and avoid misdirection. Information should be added regarding low water crossings. Interpretive and informative elements should be replaced/updated as the current signs are sun-bleached and widely scattered.

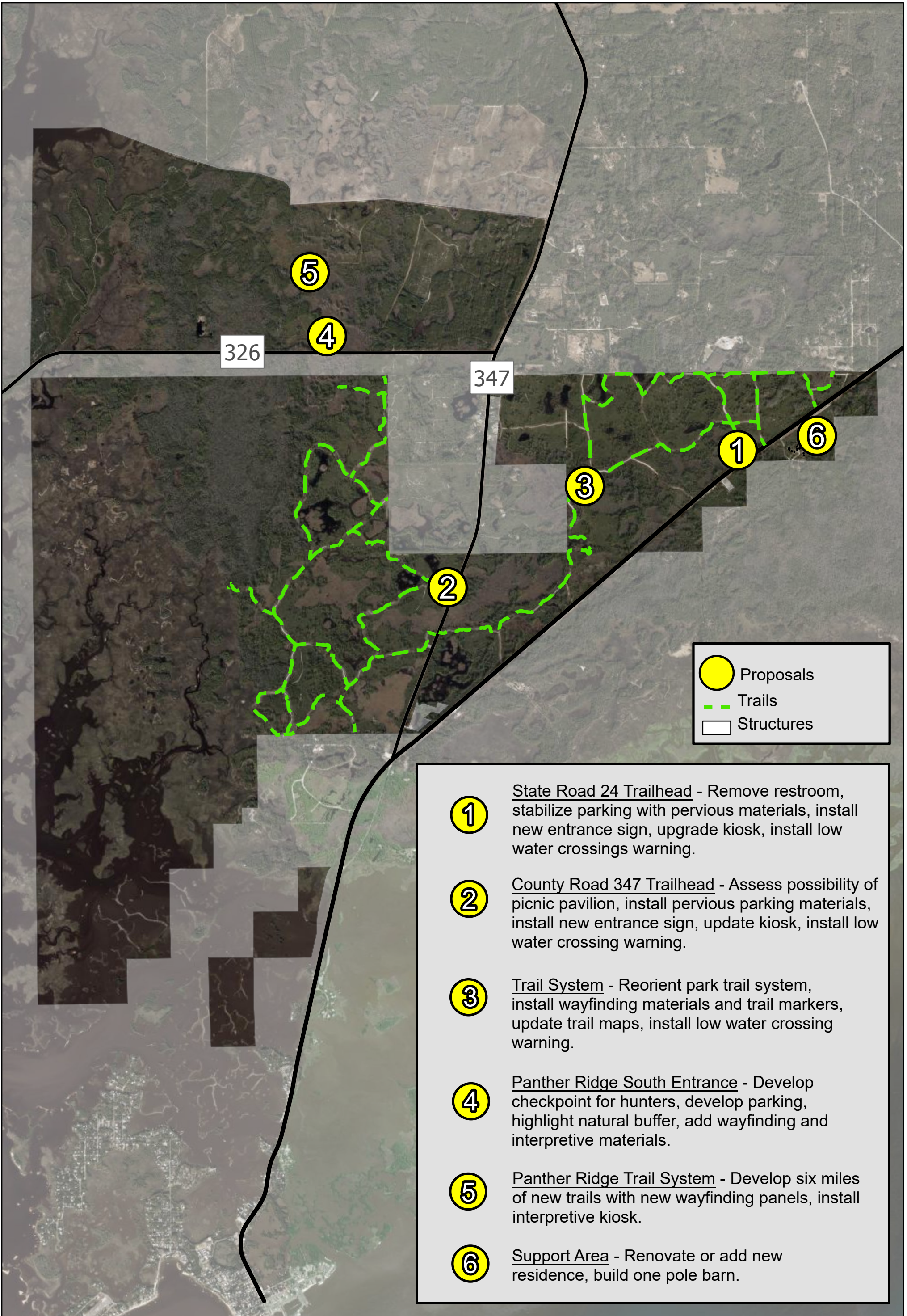
### **State Road 24 Trailhead**


***Objective: Improve function of and interpretation at the trailhead.***







*Actions:*

- Remove defunct restroom.
- Stabilize parking area.

In order to optimize the function of the trailhead, a double-sided entrance sign should be installed so that it is readable to travelers in both directions on State Road 24. Language on signage should be changed to the unit's proper designation of "reserve." Additionally, the non-functioning restroom should be removed. A replacement restroom is unwarranted due to low visitation. Use area parking, access loop roads and other low-lying areas should be stabilized with previous, durable materials such as crushed lime rock. Low visitation does not merit paved parking. Finally, the kiosk should be updated with emergency contact information, park rules, natural communities, and messaging about the reserve's important role in habitat conservation and water quality protection. Any low water crossings that trail users will encounter should be delineated on the comprehensive trail map, along with clear interpretation that these areas may hold water at any time throughout the year.



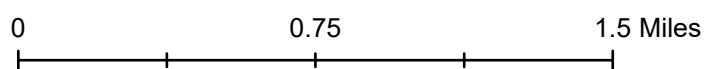
 Proposals  
 Trails  
 Structures

-  **1** State Road 24 Trailhead - Remove restroom, stabilize parking with pervious materials, install new entrance sign, upgrade kiosk, install low water crossings warning.
-  **2** County Road 347 Trailhead - Assess possibility of picnic pavilion, install pervious parking materials, install new entrance sign, update kiosk, install low water crossing warning.
-  **3** Trail System - Reorient park trail system, install wayfinding materials and trail markers, update trail maps, install low water crossing warning.
-  **4** Panther Ridge South Entrance - Develop checkpoint for hunters, develop parking, highlight natural buffer, add wayfinding and interpretive materials.
-  **5** Panther Ridge Trail System - Develop six miles of new trails with new wayfinding panels, install interpretive kiosk.
-  **6** Support Area - Renovate or add new residence, build one pole barn.



# Cedar Key Scrub State Reserve

## Conceptual Land Use Plan Map



## County Road 347 Trailhead

**Objective: Improve the function and interpretation of the park trailhead.**

*Actions:*

- Stabilize parking area.
- Construct a picnic pavilion in conjunction with higher visitation.

Parking, access loop roads and low areas should be stabilized with pervious, durable material such as crushed lime rock. The current sign should be replaced with a sign that displays the correct designation of “reserve.” The interpretive kiosk may need to be replaced. Regardless of whether it is replaced or renovated, it should be updated with similar information discussed at the “State Road 24 Trailhead”, including a comprehensive trail map with low water crossing delineations.

Currently, visitation is relatively sparse. If visitation and demand increases, a small picnic pavilion should be considered to offer trail users a shaded spot to rest and eat upon returning to their vehicles.

## Panther Ridge South Entrance (Trailhead)

**Objective: Establish an access point for the Panther Ridge parcel of the reserve.**

*Actions:*

- Add checkpoint.
- Develop parking.

The Panther Ridge parcel will feature a southern entrance, located off County Road 326 or Southwest 78th Place, which will serve as an access point trailhead for hunters and other trail users. FWC will regulate hunting. This entry point should be developed into a formal trailhead for both hunters and other trail users outside of hunting season. As a trailhead for hunters, this area would require a checkpoint station coordinated with FWC oversight. An active wildlife management plan has been developed in coordination with FWC and is in place for this parcel.

## Panther Ridge Trail System

**Objective: Improve the trail system within the reserve by converting to single-track and installing interpretive elements.**

*Actions:*

- Design and develop a 6-mile single-track trail system.
- Install interpretive elements to facilitate wayfinding.

A trail system is planned for the parcel. The new trail system should be designed as a singletrack that meanders through a maximum number of upland natural communities and passes close by wetlands. The design objective should be to immerse trail users deep into the mosaic of distinctly different natural areas, thus showcasing the reserve’s remarkable diversity. Sweeping vistas across the natural landscape are key elements that should be incorporated into trail design. The target length of the trail should be 6 miles. This new trail should only incorporate sections of existing service roads where necessary to

traverse wetlands or avoid impacts to sensitive areas. Wayfinding systems and interpretive elements may be placed at key points to guide users and interpret significant natural processes that have shaped the landscape and biota encountered along the trail.

### **Support Area**

**Objective: Improve function and optimize spatial efficiency of residence and maintenance facilities.**

*Actions:*

- Renovate and/or update existing residences.
- Build new pole barn.
- Remove unused structures as needed.

Improvements include replacing the current single-wide staff mobile home with a new permanent staff residence. Alternatively, if it is decided that renovating the structure is the preferred action, a new roof should be given priority. A 3-bay pole barn should also be built. This should replace the previous structures and should utilize one of the existing footprints. The serviceability and function of the various storage buildings in the support area should be evaluated for potential consolidation and elimination of unnecessary structures.

### **OPTIMUM BOUNDARY**

Lands adjacent to or near the reserve are largely rural. Agricultural production and timber harvesting take place on the reserve's northern boundary. The designation of rural residential/forestry is defined for the lands surrounding the reserve. Forestry is vital to the local economy and protecting this land use against other uses is imperative. Therefore, low-density residential and commercial forestry interests exist at present.

A narrow band of uplands exists between the southern edge of the city of Cedar Key, Cedar Key Scrub State Reserve and Waccasassa Bay Preserve State Park, encompassing an area of some 400 acres of upland communities. There is a lack of proper land suited for development expanding northward from Cedar Key due to this narrow zone. One development company had plans for a platted subdivision with single family homes. This was despite efforts by the state to purchase the property. However, conservation efforts were put forth. The reserve's unique environments can be impacted by development outside its boundary due to the exceptional characteristics within these regions. Most of the upland areas are included within the optimum boundaries for both the reserve and Waccasassa Bay Preserve State Park.

Parcels designated in the optimum boundary south of State Road 24 were initially purchased for development and are now included in the Florida Gulf Coast Mitigation Bank. These properties can be restored and credits sold, making it likely that the lands will transfer into public ownership for management in the time to come. Further acquisitions may increase the chance of a continuous linkage of public land that would connect Yankeetown to the Big Bend region of the Gulf Coast. This would help expand conservation lands, particularly those in this fragile ecosystem.

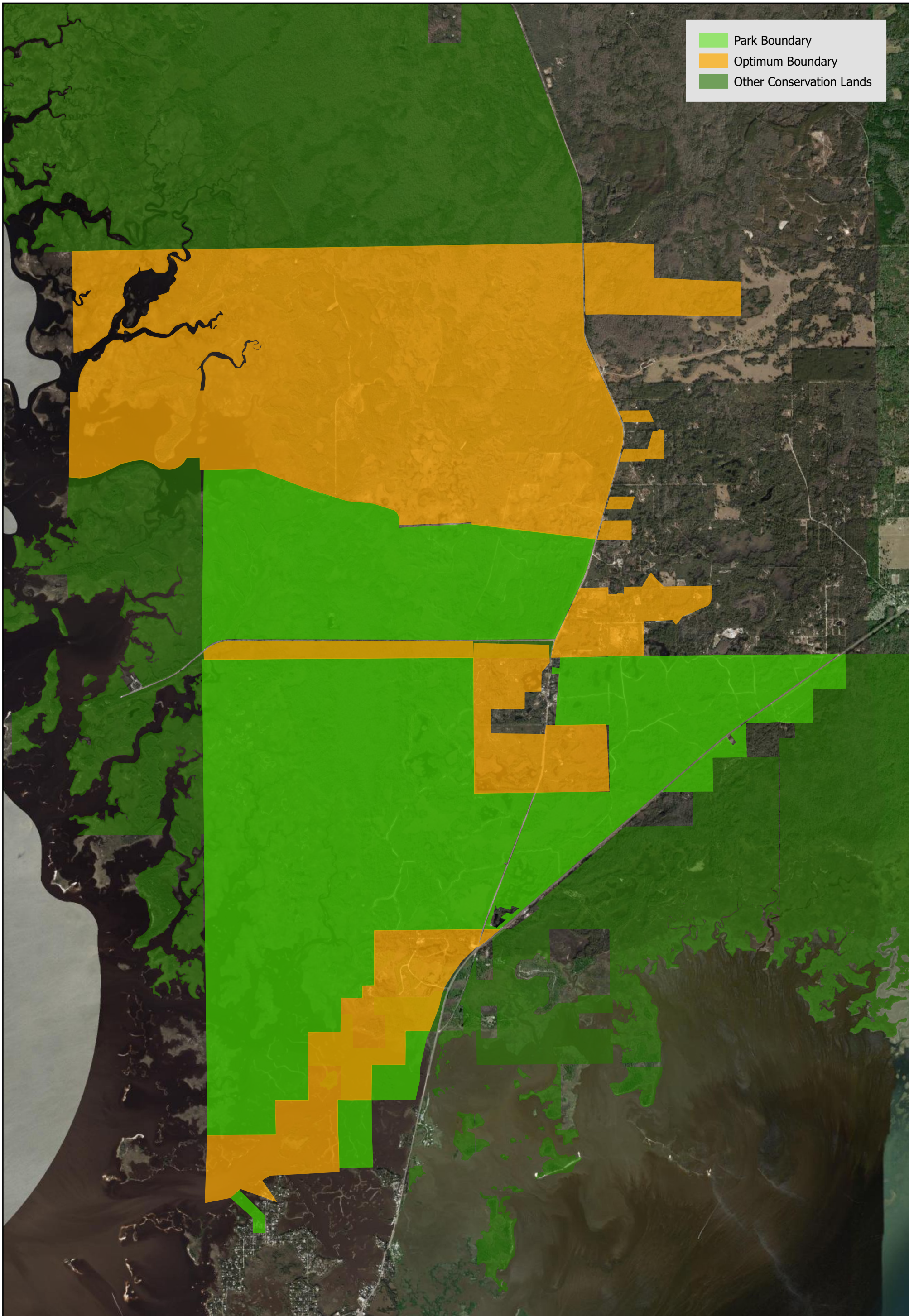
Several natural communities including scrub, scrubby flatwoods, hydric hammock, and salt marsh would be encompassed in state lands for the additions and inholdings parcels. These communities,




representing Cedar Key Scrub State Reserve and Gulf Hammock, have been recognized as one of the state's highly unique ecosystems. The area attracts much research interest because of the geographic isolation of its wildlife populations and its abundance of rare and threatened plant and animal species. Completion of these acquisitions would ensure preservation of the remaining unprotected Cedar Key Scrub State Reserve habitat so vital to the local scrub-jay population, and it would save unspoiled salt marshes that provide the last refuge for the endangered salt marsh vole.

Furthermore, three archeological sites which have been registered in the Florida Master Site File would receive protection. The acquisition of these various parcels would allow more land to be treated utilizing prescribed fire. Prescribed fires on the existing land would be made safer after obtaining adjacent land. In conclusion, the long-term preservation of the existing reserve and all of its components depends on the future protection and preservation of the entire ecosystem within. Development and destruction of lands surrounding the scrub could irreparably harm one of Florida's major remaining natural assets.

There are no existing Florida Forever projects boundaries that overlap with the optimum boundary, and there are no parcels that are considered surplus to the needs of the reserve.





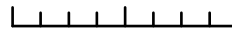
-  Park Boundary
-  Optimum Boundary
-  Other Conservation Lands



**CEDAR KEY SCRUB STATE RESERVE**  
Optimum Boundary



0 2,000 4,000 Feet



Sources: ESRI, Florida Department of Environmental Protection, Florida Natural Areas Inventory.  
This graphical representation is provided for informational purposes only and should not be considered authoritative for navigational, engineering, legal, or other uses.