

## **II. Purpose of the Ecosystem Plan**

The Service has embarked on an agency-wide reorganization that recognizes “ecosystems” or “watersheds” as a basis for management operations. The South Florida Ecosystem Plan (Plan) defines the Service’s geographic boundaries of the South Florida Ecosystem, identifies the trust resources and national interest lands contained within, and lists the responsibilities of the Service for the restoration of this remarkable ecosystem, as assigned by the South Florida Ecosystem Restoration Initiative’s Interagency Task Force. The purpose of this Plan is to provide a document that: Service managers and Interagency Task Force members can utilize as a working guide, Service partners can use as a reference, and U.S. citizens and their legislators can utilize to learn about and evaluate the ecosystem restoration efforts of the Service.

The Plan has seven goals. Each has been established by the ecosystem team members to accomplish the tasks identified by the Interagency Task Force. Also, the goals recognize refuges and other national interest lands as cornerstones/models of an ecosystem approach to resource conservation and management. *Service land managers will consider landscapes beyond their respective boundaries and focus on the overall environmental health and biological integrity of the ecosystem.*

- Goal 1. Protect and manage National Wildlife Refuge System units and other national interest lands.
- Goal 2. Protect migratory birds and protect, restore, and manage their habitats.
- Goal 3. Protect, restore, and manage candidate, threatened, and endangered species and their habitats.
- Goal 4. Protect, restore, and manage wetlands and other freshwater habitats.
- Goal 5. Protect, manage, and restore fish and other aquatic species, and their habitats.
- Goal 6. Protect, restore, and enhance coastal and estuarine habitats.
- Goal 7. Protect, restore, and manage for biodiversity.

This Plan is to be a living document. It must grow and change as the base of knowledge and comprehension about the ecosystem grows and changes. Federal land managers, “partners”, and citizens are encouraged to read this Plan and to make inquires and suggest changes for the direct benefit of the habitat, wildlife, and people of the South Florida Ecosystem.

## **III. Federal Trust Resources of the South Florida Ecosystem**

Florida possesses a wealth of natural resources, much of it in South Florida. Diverse habitats support a rich and unique flora and fauna – – habitats including the seagrass beds of Florida Bay, mangrove swamps of the Ten Thousand Islands Region, the Everglades’ sawgrass prairies, Lake Wales Ridge oak scrub, Miami region pine rocklands, and the Florida Keys’ tropical hardwood hammocks. Most of these resources have been and will continue to be managed by agencies of the State of Florida, county, and local governments. At the same time, federal statutes establish a federal interest, or trust, in a wide variety of these natural resource issues in the South Florida Ecosystem. These interests include:

- (1) national interest lands managed by the Service, National Park Service (NPS), National Oceanic and Atmospheric Administration (NOAA), and Department of Defense (DOD);
- (2) migratory birds protected by the Migratory Bird Treaty Act and several international treaties and conventions;

- (3) species that have been listed as threatened or endangered under the Endangered Species Act of 1973;
- (4) waters of the U.S., including freshwater and coastal wetlands that are protected under the Clean Water Act;
- (5) fish that use water bodies common to two or more political boundaries or under management by two or more government entities (interjurisdictional fisheries); and
- (6) coastal resources protected under such federal mandates as the Coastal Zone Management Act, Coastal Barriers Resources Act, Estuary Protection Act, Marine Mammal

Protection Act, Magnuson Fisheries Conservation and Management Act, Florida Keys National Marine Sanctuary and Protection Act, and the National Estuary Program.

#### **A. National Interest Lands**

The South Florida Ecosystem has over 20 land areas that are managed by the federal government (not including the Brighton, Miccosukee, and Seminole Indian Reservations). These lands are managed by the Service, NPS, National Marine Fisheries Service (NMFS), NOAA, and DOD.

It is the intent of the Service that refuges will acquire and subsequently provide the quantity and quality of habitat that supports America's diverse wildlife heritage. Also, refuges will serve as the cornerstone of an ecosystem approach to resource conservation that considers landscapes beyond boundaries and focuses on environmental health and biological integrity.

### **1. National Wildlife Refuges (NWRs)**

#### ***1.a. Archie Carr NWR***

The Archie Carr NWR was established in 1989 to protect globally significant sea turtle nesting habitat and is administered as a satellite of the Merritt Island NWR. The refuge spans a 20-mile section of coast in Brevard and Indian River Counties. The refuge proposes to acquire 9.3 miles of beach and surrounding barrier island ecosystem (approximately 1,200 acres). This stretch of coastline supports the largest concentration of sea turtle nests in the U.S. and is recognized as the second most important loggerhead nesting site in the world. Up to 20,000 sea turtle nests are made within the refuge annually, representing approximately 25 percent of all loggerhead and 35 percent of all green turtle nests in the U.S. The coastal waters also support hundreds of fish species, many of interjurisdictional concern such as red drum and spotted seatrout.

The refuge is an excellent example of how a successful partnership can work. Since the first parcel was purchased in 1989, land acquisition has been a combined effort of federal, state, local, and private interests. Collectively, the multi-party coalition has acquired 4.7 miles of beach (51 percent of total) at a cost of more than \$91 million. The federal share amounts to about 10 percent of this total (\$8.9 million).

An ecosystem approach to coastal resource protection is being employed to link the beach and dune habitats, maritime forests, wetlands, and estuarine systems. As proposed, the refuge would protect four segments of Atlantic beach and dunes, totaling 9.3 miles. In addition to the federal effort to protect nesting habitat for four federally listed species of sea turtles, other partners are acquiring habitat that would support the threatened Florida scrub-jay, southeastern beach mouse, eastern indigo snake, and several listed plants.

The most pressing management issues relate to human population growth and to conflicting uses of the barrier island landscape. Development of the barrier island for single-family homes continues to fragment the habitat

and will create long-term lighting problems for sea turtles. Shoreline armoring is already a major issue, particularly along the southern third of the refuge (south of Sebastian Inlet), where homes are threatened by shoreline erosion. The recovery of the Florida scrub-jay and southeastern beach mouse present additional challenges for the refuge. Escalating residential and commercial development have eliminated some of the best habitat. Today, approximately 34 percent of the proposed refuge remains to be acquired.

### ***1.b. Arthur R. Marshall Loxahatchee NWR***

The Arthur R. Marshall Loxahatchee NWR in Palm Beach County is composed of 147,368 acres of Everglades habitat. The refuge is part of a large freshwater storage area connected by a series of canals and levees built by the U. S. Army Corps of Engineers (COE). In 1949, this area was placed under the jurisdiction of what is now the SFWMD. An agreement between SFWMD and the Service in 1951 established the refuge under the Migratory Bird Conservation Act of 1929 for the purpose of protecting and managing the unique northern Everglades habitat and all of its associated flora and fauna. Loxahatchee NWR consists partially of the 143,116-acre Water Conservation Area (WCA) 1 and the 1,595-acre Strazzula Marsh, leased from the State of Florida through a Cooperative License-Lease Agreement with SFWMD. The Service owns 2,550 acres in fee title, which is subdivided into five compartments: A, B, C, and the cypress swamp unit are located on the east side of the refuge in the headquarters area; D is on the western boundary, just north of the confluence of the L-7 and L-39 canals.

Loxahatchee NWR is the largest remaining part of the northern Everglades. To the west of the refuge is the Everglades Agricultural Area (EAA) which includes large sugarcane farms, winter vegetable and sod farms, and cattle ranches. Immediately east of the refuge lies a conglomerate of urban communities. To the south and southwest of the refuge lie the other large remaining portions of Everglades: WCA's 2 and 3, and Everglades National Park. Approximately 100,000 people visit the refuge each year. Popular activities are birding, fishing, photography, and canoeing.

The limestone bottom of this vast freshwater marsh is covered with a varying layer of peat up to 12 feet thick. The underlying aquifer provides water to nearby coastal communities. A 57-mile levee and associated inside borrow canal defines the perimeter of WCA 1. A 400-acre cypress swamp, the largest remaining section of the strand that once stretched from Lake Okeechobee to Ft. Lauderdale, is located in the Headquarters area. Typical Everglades vegetation of wet prairies, sloughs, sawgrass marshes, and tree islands ranging in size from less than 1 acre to over 300 acres, comprises approximately 85 percent of the refuge.

The primary trust resources dependent on the refuge are the snail kite, wood stork, peregrine falcon, American alligator, eastern indigo snake, tropical curly-grass fern, and numerous wading birds and waterfowl. Historically, interjurisdictional fish species such as tarpon and mullet used the area, but the presence of water control structures has long since restricted their access.

The three major sources of water for WCA 1 are rainfall (58 percent), the S-5A pump station at Twenty-Mile Bend (32 percent), and the S-6 pump station near the confluence of the Hillsboro and L-7 canals (10 percent). Approximately 75 percent of the water pumped onto the refuge is drained from agricultural lands north and west of the refuge. High nutrient runoff from agricultural lands is one of the most serious issues facing the refuge as it allows proliferation of cattails and other undesirable plant species that negatively affect the ecosystem balance. Another major issue is the spread

of exotic plants such as *Melaleuca*, Brazilian pepper, and Old World climbing fern that displace native plants. Other issues arise from the proposal of incompatible land use projects, adjacent to the refuge associated with the large urban area to the east.

Water levels in WCA 1 are managed following a schedule derived through a cooperative agreement between COE, SFWMD, and the Service. The schedule was designed to achieve the following objectives: (1) maintain water storage capacity on the refuge during the hurricane season; (2) store water for irrigating nearby cropland during the fall, winter, and early spring; (3) prevent saltwater intrusion into the Biscayne aquifer by storing water for release into coastal canal systems during the fall, winter, and spring; (4) maintain the health of refuge vegetation types by flooding all wetlands during the summer and fall; and (5) enhance feeding opportunities for waterfowl and wading birds by lowering water levels in the spring so that water is concentrated in sloughs and shallow ponds during the nesting season.

### **1.c. Caloosahatchee NWR**

The Caloosahatchee NWR, administered as a satellite of the J.N. "Ding" Darling NWR, is located in Lee County, adjacent to the City of Ft. Myers. On July 1, 1920, President Woodrow Wilson signed an executive order establishing the refuge as "preserves and breeding grounds for native birds." Originally, the refuge consisted of several small mangrove islands located in the Caloosahatchee River. Shoreline development, dredging of the Caloosahatchee River, and the construction of the I-75 bridge has changed the physical arrangement and appearance of the refuge islands. Today, Caloosahatchee NWR totals approximately 40 acres of mangrove shorelines and upland habitat. The refuge is located adjacent to the Florida Power and Light Company's Orange River Power Plant at the confluence of the Orange and Caloosahatchee Rivers. The warm water outflow of the power plant is a major wintering area for the endangered West Indian manatee and the nearshore and riverine areas provide interjurisdictional fish species habitat.

### **1.d. Crocodile Lake NWR**

Crocodile Lake NWR, operating as a satellite of the National Key Deer Refuge, is located on upper Key Largo in Monroe County, and was established under the following authorities: Land and Water Conservation Fund Act of 1965 (as amended in 1976) and the Endangered Species Act of 1973 (as amended). The refuge was established in April 1980 with the proposed purchase of approximately 6,800 acres.

The purpose of the refuge is to protect critical habitat, including prime feeding and nesting areas of the American crocodile. In the U.S., this species is found only in extreme southern Florida. A breeding population exists only in southern parts of Everglades National Park, on northern Key Largo, and at nearby Turkey Point. Ironically, would-be developers inadvertently created the sole crocodile nesting areas on the refuge. Spongy peat soil dredged to form canals became an ideal substrate, easily worked by nesting crocodiles. Habitat for several other endangered species also is found on the refuge. These species include the endemic Key Largo woodrat, Key Largo cotton mouse, and Schaus swallowtail butterfly – each found nowhere else in the world. Topography is similar to that described under National Key Deer Refuge, but it is geologically much younger. The vegetation is primarily mangrove wetlands and tropical West Indian hardwood hammock. This portion of Upper Key Largo is the largest undeveloped hammock in the Florida Keys.

Management initiatives on the refuge include exotic plant removal and habitat protection. The refuge is closed to public access to protect critical habitat. A casual visitor might think that Key Largo is little more than a highly developed, tourist-oriented island. However, much of north Key Largo has been set aside as a natural area for the protection of endangered

species and their habitats. Acre-for-acre, few places on earth harbor more threatened and endangered plants and animals than Crocodile Lake NWR and the adjacent Key Largo Hammocks State Botanical Preserve.

### ***1.e. Florida Panther NWR***

Florida Panther NWR was established in 1989 by the authority of the Endangered Species Act to protect 23,380 acres of important Florida panther habitat. With the addition of lands from the Collier Land Exchange on December 18, 1996, the refuge has grown to approximately 26,400 acres. The refuge forms the core of several panthers' home ranges and also provides them a travel corridor between the northern regions of Big Cypress National Preserve and the Fakahatchee Strand State Preserve. During any given month, the refuge may be visited by 5 to 11 different panthers. Several female panthers have had litters and raised kittens on the refuge in recent years.

The refuge is part of a vast watershed that originates with the Corkscrew Regional Ecosystem Watershed and Okaloacoochee Slough systems to the north. After water flows through the refuge, it passes through the Fakahatchee and Picayune Strand systems and finally is deposited into the Ten Thousand Islands Estuary. The refuge encompasses the northern origin of the Fakahatchee Strand, which is the largest cypress strand in the Big Cypress Drainage Basin. Orchids and other rare swamp plants grow within the swamp's interior. The refuge contains a diverse mix of pine forests, cypress domes, marl (fossiliferous limestone shallowly overlain with soil) prairies, hardwood hammocks, and lakes surrounded by swamps.

In addition to the panther, 24 other animals with state or federal listings as endangered, threatened, or species of special concern are found in the refuge vicinity. The Florida black bear, American alligator, wood stork, roseate spoonbill, limpkin, swallow-tailed kite, eastern indigo snake, Florida grasshopper sparrow, Everglades mink, and Big Cypress fox squirrel are examples. Other resident wildlife include white-tailed deer and feral hogs, which are important panther prey species. Turkey and bobwhite quail can also be found on the refuge.

The Florida Panther NWR's mission is to: (1) provide optimum habitat conditions for Florida panthers and other endangered/threatened species through protection and habitat management; (2) conduct studies and wildlife inventories to monitor endangered/threatened populations and document management program impacts; and (3) maintain suitable habitat for a wide variety of South Florida wildlife and plants. Because of its mission to protect endangered species habitat, the refuge is closed to all public access and use. Refuge staff give environmental education programs at local schools and other public events. In addition, occasional swamp buggy tours of the refuge are given to small groups. Prescribed burning is used as the primary refuge management tool to maintain native plant communities. Exotic plants are controlled to protect native habitats.

### ***1.f. Great White Heron NWR***

Great White Heron NWR was established in 1938 with an executive order signed by President Franklin D. Roosevelt. The refuge is operated as a satellite of the National Key Deer Refuge. As its name implies, the refuge was created to provide a haven for great white herons (now considered a color morph of the great blue heron). The protection of many other avian species and their habitats also was an important consideration.

Accessible only by boat, the refuge consists of a series of islands in the lower Florida Keys (locally called the 'backcountry') totaling 7,408 acres extending over 264 square miles of open water. Only an examination of a small-scale map (e.g., 1:24,000) will reveal the vast complex of tiny, isolated

keys that comprise the refuge. The habitat consists mostly of pristine, low mangroves. Examples of berm hammocks, low hardwood hammocks, and salt marsh habitat are also found throughout the islands. The refuge is home to myriad avifauna, including a small population of nesting bald eagles. In addition to the upland acreage, the refuge also manages 185,086 acres of open water and submerged lands through a cooperative agreement with the State of Florida.

In recent years, there has been an explosion of public use in the backcountry with ever increasing numbers of boaters. Offsetting this to some extent was implementation of the Backcountry Management Plan in 1993 which included numerous provisions aimed at managing public use activities that affect wildlife. In essence, the plan allows refuge management to prohibit the use of personal watercraft, airboats, and hovercraft; the landing of seaplanes; and waterskiing within the administrative boundaries of the refuge.

### ***1.g. Hobe Sound NWR***

Hobe Sound NWR, administered as a satellite of the Arthur R. Marshall Loxahatchee NWR, was established September 30, 1969. This coastal refuge consists of two separate tracts, comprising 967 acres, located 20 miles north of West Palm Beach in Martin County. The beach tract provides some of the most productive sea turtle nesting in the U.S. Most of the approximately 60,000 people who visit the refuge annually enjoy beach activities.

The refuge consists of three distinct plant communities: 1) coastal sand dune, 2) mangrove swamps on the 735-acre Jupiter Island tract, and 3) sand pine-scrub oak forest on the 232-acre mainland tract. The mainland tract habitat is composed of sand pine with an understory of Chapman oak, sand live oak, and myrtle oak. A devastating fire in the early 1970's set back succession and the naturally poor soil conditions have resulted in a very slow recovery. Although the tract is small, its value is magnified by the fact that over 90 percent of this community type in South Florida has been lost to development. Sand pine scrub is restricted to Florida and an adjacent Alabama county.

The Jupiter Island tract is divided into mangrove swamp, located next to the Intracoastal Waterway, and the coastal sand dune along the Atlantic Ocean. In the regularly flooded, undisturbed mangrove swamps, vegetation is primarily red mangrove with scattered white and black mangroves. The coastal sand dunes consist of the fore dunes bordering the beach, and the more protected back dunes. On the fore dunes, normally only pioneer plants such as sea oats, sea purslane, and railroad vine are able to maintain themselves in the harsh environment of shifting sand and salt spray. The back dunes are characterized by such woody plants as sea grape, wax myrtle, saw palmetto, and occasional scrub oaks.

The primary trust species are the loggerhead, green, and leatherback sea turtles on the barrier island; Florida scrub-jays and gopher tortoises on the mainland tract; and interjurisdictional fish species. The endangered Lakela's mint has been experimentally established on the refuge in two sites. A major issue is the control of numerous exotic plants, the most serious being the Australian-pine that severely impacts the nesting of sea turtles on the barrier island and dominates the shoreline of the Intracoastal Waterway on the mainland tract. A major control program was initiated in 1983. Also of special concern are the exotic Brazilian pepper and Old World climbing fern. Coastal erosion has prompted beach renourishment projects on the length of Jupiter Island.

## **1.h. Island Bay NWR**

Island Bay NWR, administered as a satellite of the J.N. “Ding” Darling NWR, is located in the Cape Haze area of Charlotte Harbor, Charlotte County, 23 miles northwest of Ft. Myers. On October 23, 1908, President Theodore Roosevelt signed an executive order establishing the refuge “as a preserve and breeding ground for native birds.” The Island Bay NWR consists of six roadless, undeveloped islands totaling 20 acres. Located in a vast complex of mangrove islands and brackish bays, the refuge lands include Gallagher Key, Bull Key, and two unnamed keys located between Bull and Turtle Bays. Also, two smaller refuge tracts, Cash and John Quiet Mounds, are located on the edge of Turtle Bay and are of historical interest. On both of these sites, the dominating feature is a large Native American midden. These mounds, which date back hundreds of years, were built by the Calusa Indians who inhabited the coastal area of South Florida. On October 23, 1970, President Richard Nixon signed a public law establishing Island Bay NWR as a Wilderness Area.

### **1.i. J.N. “Ding” Darling NWR**

The J.N. “Ding” Darling NWR is located on Sanibel Island in Lee County. Sanibel Island is a subtropical barrier island, lying along the Gulf of Mexico. It is connected to the mainland by a three-mile causeway. The refuge was established on December 1, 1945, under the authority of the Migratory Bird Conservation Act, as the Sanibel NWR. The refuge was originally administered by the former Everglades NWR which is now known as Everglades National Park. The name of the refuge was changed in 1967 to the J.N. “Ding” Darling NWR as a lasting memorial to Jay Norwood Darling, a noted editorial cartoonist, pioneer conservationist, and the first director of the U.S. Biological Survey (the forerunner of the Service).

The refuge is comprised of approximately 6,300 acres of several habitat types: estuarine habitat consisting of open water, sea grass beds, mud flats and mangrove islands; and interior freshwater habitats consisting of ponds, *Spartina* swales, and West Indian hardwood hammocks/ridges. Two brackish-water impoundments, totaling 800 acres, are managed for mosquito control, waterfowl, and wading birds. Potential exists for interjurisdictional fisheries management. Part of the refuge (2,825 acres) has been designated as a Wilderness Area.

Several endangered and threatened species benefit from the refuge habitats: eastern indigo snakes, American alligators, American crocodiles, bald eagles, wood storks, peregrine falcons, West Indian manatees, interjurisdictional fish species, and loggerhead sea turtles. The refuge hosts a large species diversity – approximately 238 bird species have been observed on the refuge, as well as 51 species of reptiles and amphibians and 32 species of mammals.

Wildlife observation, sport fishing, sightseeing, nature photography, and canoeing are well-established recreational uses of the refuge. The refuge has a 5-mile Wildlife Drive that gives visitors access to the mangrove community and impoundments. During the winter months, such birds as common, reddish, snowy, and cattle egrets; great blue, little blue, tricolored, and green herons; black-crowned and yellow-crowned night-herons; wood storks; white ibises; brown and white pelicans; and numerous waterfowl can be seen easily along Wildlife Drive. A visitor center is located at the entrance to Wildlife Drive. One hundred and fifty volunteers assist the approximately 700,000 visitors each year.

### **1.j. Key West NWR**

Key West NWR was established by an executive order signed by President Theodore Roosevelt in 1908. The refuge was the first NWR established in the Florida Keys. It is operated as a satellite of the National Key Deer Refuge and was created to preserve the habitat of colonial nesting birds. The feathers of species such as great egrets were worth their weight in gold

to milliners in the early 1900's. The refuge protects habitat for a wide variety of birds including nesting and/or wintering populations of terns, magnificent frigatebirds, white-crowned pigeons, ospreys, and great white herons. Wading birds were threatened with extinction before this refuge began providing a safe haven for them and for other threatened plant and animal species. Also, the sandy beaches are nesting habitat for the threatened loggerhead and endangered green and hawksbill sea turtles.

Accessible only by boat and west of Key West, the refuge consists of the Marquesas Keys and 13 other keys, comprising 2,019 acres scattered over 375 square miles of open water. In addition to the upland acreage, the refuge also manages 206,289 acres of open water within the refuge as part of the Backcountry Management Plan through a cooperative agreement with the State. Boca Grande, Marquesas, and Woman Keys contain beaches used by three species of sea turtles. Woman Key is also an important wintering area for piping plovers.

Boat and low-level air traffic are increasing and sometimes disruptive to birds at nesting and feeding areas. The only frigatebird colony in the U.S. was in the Marquesas until 1988, when the colony abandoned the site after 20 years of nesting activity due to disruptive human activity. Management practices undertaken on the refuge include exotic plant eradication, litter removal, sea turtle nest monitoring and law enforcement. Patrolling these areas is warranted to reduce disturbance to nesting turtles and to eliminate illegal camping and resulting litter and habitat destruction on Marquesas, Woman, and Boca Grande Keys. These three keys have sandy shorelines, a rarity in the Florida Keys, and thus are alluring to beachcombers and campers.

The primary, long term threat to the biota of the Keys in general, and endangered species in particular, is the widespread elimination of upland habitat and freshwater wetlands for the development of residential and commercial use. Associated with this are the many indirect effects that cumulatively impact wildlife and their habitat. The pressure for this development is so great, and developable land so scarce, that it appears likely that areas not in public ownership will eventually be developed.

#### ***1.k. Lake Wales Ridge NWR***

Lake Wales Ridge NWR, administered as a satellite of the Merritt Island NWR, is the first refuge designated primarily to preserve flora. It protects 26 rare plants (13 listed and 13 candidate species), 4 federally listed vertebrates, and more than 40 rare, endemic invertebrate species. The refuge was authorized in November, 1993, and acquisition of the proposed 19,630-acre refuge began in 1994. The Lake Wales Ridge is an ancient beach and sand dune system that rises sharply along the western edge of the Kissimmee River Drainage Basin in Central Florida. The Ridge was once part of an archipelago formed 25 million years ago when the Everglades was covered by a shallow sea. Today, this 100-mile long string of sand islands acts as a sponge, absorbing copious amounts of rainfall and gradually releasing it to the thirsty Everglades.

This habitat, the oldest ecosystem in the southeast, has been disappearing faster than any other in the U.S. It is estimated that about 80,000 acres of Lake Wales Ridge scrub existed before the arrival of European settlers. Today, about 85 percent of the ridge has been lost to citrus groves and residential and commercial development. Many of the endemic plants, found nowhere else on earth, face extinction. The refuge represents an unprecedented opportunity to protect not only a number of endangered and threatened plants and animals, but also one of the rarest and most severely threatened ecosystems in North America.

This project is a joint venture between the State of Florida, The Nature Conservancy, the Archbold Biological Station, and the Service. As envisioned, all sites would be protected and managed as part of the NWR System in a coordinated manner, under cooperative management agreements. The most pressing management issues are habitat fragmentation and isolation of the genetic material necessary for plant

recovery. In some cases, the plants exist in only one or two locations. Other threats include off-road vehicles and trash dumping, which further degrade the sites. All these impacts have pushed many of the remaining scrub plants to the brink of extinction and this ancient ecosystem to a crossroads.

### ***1.l. Matlacha Pass NWR***

Matlacha Pass NWR, administered as a satellite of the J.N. "Ding" Darling NWR, is located within the Matlacha Pass Estuary in Lee County, 10 miles west-northwest of Ft. Myers. On September 26, 1908, President Theodore Roosevelt signed an executive order establishing three small islands in Matlacha Pass "as a preserve and breeding ground for native birds." Since that time the refuge has grown to 23 islands comprising approximately 512 acres. The most recent addition to the refuge was on April 10, 1991. Through a public land order 312.92 acres of public lands were withdrawn from surface entry and mining for 40 years and trusted to the Service as an addition to the Matlacha Pass NWR.

The refuge has several islands that are used by 1,000 to 2,500 wading and water birds as roosting and nesting sites. Common, reddish, snowy, and cattle egrets; great blue, little blue, tricolored, and green herons; black-crowned and yellow-crowned night-herons; wood storks; white ibises; brown pelicans; and magnificent frigatebirds can be commonly found on and around these islands.

### ***1.m. National Key Deer Refuge***

The establishment of the National Key Deer Refuge in the lower keys of Monroe County in 1957 resulted from conservation efforts begun in the 1940's to protect about 50 Key deer. These deer are a diminutive subspecies of the Virginia white-tailed deer. The refuge is the product of three legislative actions: (1) the Interior Department Appropriation Act, of February 1, 1954, which provided authority for the leasing and management of lands for Key deer; (2) a public law on August 22, 1957, which established the National Key Deer Refuge with the stipulation that as many as 1,000 acres could be acquired in two townships; and (3) a public law on October 15, 1966, which authorized the Secretary of the Interior to acquire land by purchase, lease, exchange, or donation.

Today, the refuge consists of 8,151 acres. The topography is flat and the maximum elevation above sea level is 10 feet. The refuge is underlain primarily by exposed oolitic Miami limestone derived from the deposition and hardening of small organisms called ooids, and secondarily by Key Largo limestone, the fossilized remains of massive Pleistocene-age coral reefs. A very thin layer of topsoil covers parts of the Keys and consists primarily of disintegrated rock mixed with decayed organic matter, shell fragments, and sand.

The purpose of the refuge was to protect and preserve the Key deer and other wildlife resources of the Florida Keys. Other animal species of concern found within the refuge include American alligators and silver rice rats. Management on the refuge primarily focuses on the Key deer, with issues ranging from road mortalities, illegal feeding, and habitat loss, but also including issues such as wetland restoration, exotic plant removal, and law enforcement.

### ***1.n. Pelican Island NWR***

Pelican Island NWR, approximately 30 miles south of Melbourne, bears the distinction of being the nation's first refuge. Administered as a satellite of the Merritt Island NWR, it was established on March 14, 1903, through an executive order issued by President Theodore Roosevelt. In 1968, the refuge was enlarged to approximately 5,000 acres through a lease with the State of Florida. The lease provides only limited authority to manage the waters and islands around Pelican Island. Attempts to strengthen the lease have been unsuccessful. The refuge has also been declared a National Historic Landmark and the waters recognized as Wetlands of International Importance.

The most serious threats facing Pelican Island NWR are changing land use and increasing public use. Since the late 1980's, several new subdivisions have developed, replacing citrus groves along the refuge boundary. The Disney Corporation has also established a beach resort just south of the refuge. These changes in land use have begun to affect the refuge through increased public use. Since 1989, the refuge has been requesting funds to acquire an upland buffer along the eastern shore to insulate the refuge from several residential subdivisions. To date, 48 acres of uplands have been acquired, and Indian River County has contributed more than 100 acres of wetlands.

Boating, fishing, and jet ski use have increased dramatically. Boat wakes have caused extensive erosion to the island, resulting in the loss of nesting habitat. Use of the island by colonial nesting birds has declined over the last decade, however several new colonies have been established off the refuge. Declining water quality and loss of foraging habitat has diminished nesting success. The nearshore and coastal waters also provide habitat to interjurisdictional fish species.

A major management project will be the restoration of wetlands on lands acquired recently. These wetlands will provide additional foraging areas for the 12 species of colonial birds nesting at Pelican Island, including the wood stork. Halting erosion and enhancing nest and roost substrate are other important ongoing management projects. The establishment of public use facilities, which would allow the public to enjoy Pelican Island, is another high priority. The goal is to have these facilities for the NWR System's 100th anniversary in 2003.

#### ***1.o. Pine Island NWR***

Pine Island NWR, administered as a satellite of the J.N. "Ding" Darling NWR, is located within the Pine Island Sound Estuary in Lee County, 14 miles west-northwest of Ft. Myers. On September 15, 1908, President Theodore Roosevelt signed an executive order, establishing two small, unsurveyed islands "as a preserve and breeding ground for native birds." Since that time, the refuge has grown to 17 islands comprising approximately 548 acres. The most recent addition to the refuge was on April 10, 1991, through a public land order. This withdrew 98.86 acres of public lands from surface entry and mining for 40 years for use by the Service as an addition to the Pine Island NWR.

The refuge has several islands that are used by over 2,000 wading and water birds as roosting and nesting sites. Common, reddish, snowy, and cattle egrets; great blue, little blue, tricolored, and green herons; black-crowned and yellow-crowned night-herons; wood storks; white ibises; brown pelicans; and magnificent frigatebirds can be commonly found on and around these islands.

#### ***1.p. Ten Thousand Islands NWR***

The 1988 Florida/Arizona Land Exchange Act authorized the conveyance of 19,650 acres of Collier County lands to the Service. The Ten Thousand Islands NWR is located south of Marco Island in Collier County, on the southwest coast of Florida and includes the extensive Ten Thousand Islands Estuary. This refuge was established on December 18, 1996, to protect the important mangrove habitats, the rich diversity of native wildlife, and the endangered species of this area.

Ten Thousand Islands NWR represents a variety of coastal habitats with hydrologic inputs from the freshwater outflows of the Fakahatchee and Picayune Strands. The northern third of the refuge encompasses a vast freshwater marsh system, with freshwater ponds interspersed. Marsh plants are common including cattails, bulrushes, various grasses, ferns, and sedges. Small hammocks in the marsh are home to oaks, cabbage palms, gumbo limbos, and seagrapes. Saltwater marshes that contain black needlerush and marsh cordgrass occur occasionally at tidal interfaces. Southern tidal areas have open water habitats such as saltwater bays,

interconnected embayments, lagoons, and associated brackish creeks. Seagrasses, predominately shoal grass with sparse manatee and turtle grasses, are modestly distributed in refuge waters near the Gulf.

The most prominent habitat type on the refuge is mangrove forest along the tidal fringes. Three mangrove species occur in the refuge: red, black, and white. The red mangroves generally dominate the middle and lower portions of the intertidal and upper subtidal zones, while the black predominates in the upper intertidal zone and the irregularly flooded tidal areas. White mangroves are few and patchy in their distribution. The mangrove ecosystem is also used for public recreational activities including sportfishing, boating, birdwatching, camping, and nature appreciation. A few slightly elevated barrier islands lie along the Gulf of Mexico and have small beaches and low forest-shrub vegetation. Some of the refuge islands have shell mounds that are mostly kitchen middens and refuse sites of the Calusa.

The varied habitats of Ten Thousand Islands NWR prove valuable for a wide range of invertebrates, fishes, amphibians, reptiles, birds, and mammals. Roughly 86 species of fish have been documented at nearby Rookery Bay National Estuarine Reserve and the seagrass beds and mangrove bottoms serve as vital nursery areas for fish and invertebrates (polychaetes, crustaceans, and mollusks). Common reptiles and amphibians include mud and sea turtles, water and rat snakes, green anoles, alligators, and various frogs. Over 80 birds use the refuge at some time during the year. Prominent bird groups include wading birds, shorebirds, diving water birds, and raptors. Common mammals found in this area include raccoons, bobcats, river otters, and bottlenosed dolphins. Minks are also present. The refuge and adjacent islands support several notable threatened and endangered species such as the American crocodile, West Indian manatee, bald eagle, peregrine falcon, wood stork, as well as loggerhead, green, and Kemp's ridley sea turtles.

## **2. National Park Service Lands**

### ***2.a. Big Cypress National Preserve***

Big Cypress National Preserve, authorized in 1974, consists of a total of 716,000 acres. It is an ancestral home of the Seminole and Miccosukee Indians. The preserve adjoins the northwest section of Everglades National Park and provides a freshwater supply crucial to the park's survival. Rains flood the cypress strands and prairies before flowing slowly to the south through the park. This gradual drainage extends the wet season by two or three months after rainfall decreases in October, and provides a steady mixture of fresh and saltwater in the estuaries along the coast of Everglades National Park. This, in turn, provides essential habitat for a variety of threatened and endangered plants and wildlife, and supports marine animals important to Florida's fishing industry. The preserve also provides water for several southwest Florida cities.

Big Cypress, as its name reflects, is about one-third covered with cypress trees, although they are mostly the dwarf pond-cypress variety. The giant bald-cypress was nearly eradicated during the lumbering era; this preserve protects the remaining specimens. Planning, research, and management in the preserve provide for off-road vehicle recreation, hunting, grazing, mineral extraction, and Native American occupancy while protecting natural resources. External threats to the environment include degradation of water quality and decrease in water quantity due to land conversion to citrus and urban development.

Research efforts focus on hydrology and fire as major components of the South Florida Ecosystem, on deer as prey for the Florida panther and recreational hunter, and on eradication of exotic plants. Resource programs emphasize long-term monitoring of hydrology, wildlife, vegetation, and human population growth. Big Cypress National Preserve has one of the largest fire management programs in the National Park system with 75,000 to 100,000 acres treated annually.

## **2.b. Biscayne National Park**

This national park was authorized as the Biscayne National Monument in 1968 and redesignated and enlarged to 181,500 acres in 1980. It was established by public law to preserve and protect "...a rare combination of terrestrial, marine, and amphibious life in a tropical setting of great natural beauty..." In doing so, the U.S. recognized the national significance of the park's interrelated ecosystems.

Biscayne Bay, at the southeast corner of the state, is protected from the deeper waters of the Florida Straights and the Atlantic Ocean by a string of emerald green islands, the northern extent of the Florida Keys. These islands, composed of hardwood forests ringed by mangroves, preserve for the future some of the last undeveloped Florida Keys. The largest island, Elliott Key, is 7 miles long. The best known and most spectacular ecosystem in the park is the coral reefs that lie offshore of the islands. These are the northernmost living coral reefs in North America. They host a diversity of life second only to the world's rainforests and provide a kaleidoscope of color.

The mangrove forest ecosystem along the shoreline of Biscayne Bay provides food and shelter to myriad marine organisms and shelter for diverse avian life. Biscayne National Park protects the longest stretch of mangrove shoreline left on the east coast of the U.S. The shallow protected waters of Biscayne Bay support clear waters and lush seagrass beds that serve as an important nursery for marine life, providing food and shelter to larvae and juveniles.

These ecosystems provide habitat for a number of endangered, threatened, and protected species, including the hawksbill, green, and leatherback sea turtles; bald eagles; wood storks; peregrine falcons; West Indian manatees; American crocodiles; and Schaus swallowtail butterflies. Approximately 500,000 people visit Biscayne National Park each year, with 80 to 85 percent of those being local recreational boaters.

In addition to the diverse natural resources, a rich cultural heritage is preserved in Biscayne National Park. Archeological sites of the Tequesta native peoples are found in the park, as are remains of both the homesteaders of the late 19th and early 20th centuries and the playgrounds and retreats of the wealthy. Offshore lie the remains of an equally rich cultural heritage: shipwrecks dating back to the days of the Spanish treasure fleets rest beneath the calm surface of the park's waters.

The park lies in the shadow of the Greater Miami metropolitan area. Threats to the resources include impacts to the water and ocean floor by boats, contaminants leaching from landfills into the water, water quantity and quality from canal runoff, and the proximity to Turkey Point nuclear power facility.

## **2.c. Dry Tortugas National Park**

The Dry Tortugas National Park was originally established as Fort Jefferson National Monument in 1935, then redesignated and renamed in 1992. Located about 70 miles west of Key West, the Dry Tortugas are composed of a cluster of seven coral islands accessible only by boat or seaplane. The park consists of 64,700 acres, with a land area of only 39.28 acres. Fort Jefferson was built between 1846-1866 to help control shipping in the Florida Straits. Although it was never completed, it is the largest all-masonry fortification in the western world. During the Civil War, the Fort became a prison for army deserters, as well as a focal point for a blockade of Confederate shipping. Its most infamous prisoner was Dr. Samuel Mudd, accused of conspiring to assassinate President Lincoln.

The islands are along the flyway for birds that migrate between North and Central or South America. During the spring and fall, thousands of birds land on the islands to rest and feed, in preparation for continuing their long overseas journeys. The islands also support nesting birds. Up to 100,000

sooty terns, brown noddies, and roseate terns may nest in March and April. Boobies, frigatebirds, and shorebirds may be found at any time of the year. The extraordinary variety of bird life attracts numerous birders each year.

The clear, shallow waters are perfect for the growth of corals and associated reef fish. Lobsters, conchs, urchins, sea stars, crabs, shrimps, and sea cucumbers proliferate. Many visitors view the park underwater by diving or snorkeling.

## ***2.d. Everglades National Park***

This 1,506,500-acre national park was established in 1947 to preserve the southern portion of the Everglades and most of Florida Bay. In 1976, Everglades National Park was designated a Biosphere Reserve. In 1979, it was designated a World Heritage Site and in 1987, it was designated a Wetland of International Importance. Only two other sites in the world have been placed on all three lists. This park is the largest remaining U.S. subtropical wilderness.

The park provides habitat for more than 400 species of birds, 25 species of mammals, 60 species of amphibians and reptiles, 125 species of fish from 45 families, more than 120 tree species, 1,000 species of seed bearing plants, and numerous epiphytic plant species including 24 different orchids. Fourteen of these plant and animal species are listed as federally threatened or endangered.

Everglades National Park is working in cooperation with other federal agencies, the State of Florida, and private groups to restore the Everglades ecosystem. They are developing management programs to perpetuate the natural distribution and abundance of the endangered Florida panther and the ecosystem on which it depends. Specific examples are the prescribed fire program and the exotic vegetation removal program. The Everglades National Park prescribed burning program began in 1959. It is the first such ecosystem management effort in the NPS and is the oldest burning program on public lands in South Florida. More than 184,000 acres were burned in the 1980's and usually 12,000 to 17,000 acres are burned annually. The exotic vegetation removal program has cleared two million *Melaleuca* trees from over 91,000 acres. A 4-mile-wide *Melaleuca*-free buffer zone has been established in the East Everglades acquisition area. This will help prevent intrusion into the interior of the park and subsequent loss of potential panther habitat.

## **3. National Marine Sanctuaries**

### ***3.a. Florida Keys National Marine Sanctuary***

Few places in the U.S. compare to the Florida Keys in terms of natural beauty and natural resources. These assets, in turn, are the foundation for two of the region's most important industries: tourism and commercial fishing. The waters off Key Largo alone receive one million tourists a year, generating more than \$50 million annual local revenue. More than 2.5 million visitors travel to the Florida Keys every year to enjoy the tropical environment. The protected waters provide a secure habitat for endangered species, shelter historically significant shipwrecks and prehistoric artifacts, and promote rich biodiversity.

Although the best known feature of the Keys marine environment is the coral reefs, the shallow waters near the shore are in fact composed of a series of interconnecting -- and interdependent -- natural habitats. These include mangrove forests and seagrass meadows as well as hardbottom regions, patch reefs, and bank reefs, all of which support a wealth of marine life. To protect the diverse marine ecosystem of the Florida Keys, the Florida Keys National Marine Sanctuary (FKNMS) and Protection Act was passed by Congress and signed into law by President Bush on November 16, 1990. The FKNMS Management Plan was approved by the Florida Governor and Cabinet on January 28, 1997. Congressional approval of the plan was obtained April 16, 1997.

The FKNMS encompasses both state and federal waters, and in recognition of this fact, is managed in a cooperative relationship with the Florida Department of Environmental Protection. The FKNMS boundaries extend from a stretch of the reef tract east of Biscayne Bay, around the entire Florida Keys, and westward to surround, but not include, Dry Tortugas National Park. Although it overlaps four NWR boundaries, the FKNMS encompasses approximately 2,800 nautical square miles and is now the second largest of its kind in the U.S.

The main purpose of the FKNMS is to protect the unique marine habitats of the Florida Keys, including the most extensive living coral reef system in North American waters and the third largest reef system in the world. The Key Largo and Looe Key National Marine Sanctuaries, established in 1975 and 1981 respectively, are also found within its boundaries.

#### **4. Department of Defense Conservation Lands**

##### ***4.a. Avon Park Air Force Range***

The Avon Park Air Force Range (APAFR) is bordered on the east by the Kissimmee River and on the west by the Lake Wales Ridge. Originally comprised of 218,881 acres; it was acquired for DOD use by condemnation, lease, or license between 1942 and 1959. Between 1946 and 1966, the U.S. disposed of all but 106,110 acres. Today, the installation is operated by the 56th Combat Support Squadron to provide a realistic environment for training Tactical Air Command aircrews and other military units. There are no plans to purchase additional land.

The natural plant communities found on APAFR include 82,393 acres of natural plant communities, including mesic and wet flatwoods, dry and wet prairies, floodplains marsh, scrub, and seepage slope. Pine plantations account for 19,728 acres, and tame grass pasture covers 1,790 acres. The remaining 3,989 acres include the improved and semi-improved grounds of the cantonment area and the airfield. Of APAFR's 106,110 acres, a total of 95,801 is leased for cattle.

About 400 Florida scrub-jays inhabit the base, as well as Audubon's crested caracaras, red-cockaded woodpeckers, and grasshopper sparrows. The military status of the land allows for protection of these habitats, although limited public use is permitted. The public has access to all of the habitats, but use is restricted to certain trails and campgrounds. Natural resource programs include hunting, cattle grazing, forest management, wildlife habitat management, and endangered species conservation. Prescribed burning is the primary management tool used to enhance and maintain native plant communities. Other habitat management activities are mowing, roller-chopping, and discing.

##### **B. Migratory Birds**

Other states may claim species and subspecies of birds not found elsewhere in the U.S. Other regions may claim enormous communal gatherings, or attract great winter populations, or lie along important lanes of migration, but no one state -- except Florida -- has all of these distinctive features within its boundaries. The South Florida Ecosystem is located along one of the primary migratory routes for bird species that breed in temperate North America and winter in the tropics of the Caribbean and South America. More than 116 species of neotropical migrants have been recorded in the South Florida Ecosystem. In 1995, the Service prepared a list of migratory nongame birds of management concern in the U.S. (FWS 1995) to stimulate a coordinated effort by Federal, State, and private agencies to develop and implement comprehensive and integrated approaches for the management of these selected species. The South Florida Ecosystem supports many of these species. Large numbers of species like the bobolink, a species of management concern, migrate through the South Florida Ecosystem as they fly from their breeding grounds in southern Canada and the northern Great Plains on their way to the marshes of Argentina and Brazil. Virtually the entire North American population of blackpoll warblers, another species of management concern, migrates to South

America along a route that passes through Florida to the West Indies. Other migratory species like the tanagers, chimney swifts, tree swallows, nighthawks, royal terns, and blue-winged teal also have major migratory pathways through the South Florida Ecosystem.

More than 129 bird species migrate to the South Florida Ecosystem to overwinter. Another 132 bird species breed in the South Florida Ecosystem. Because the South Florida Ecosystem lies near Cuba and the West Indies, it draws Caribbean species that rarely appear elsewhere in North America. Examples of these species include the smooth-billed ani, mangrove cuckoo, white-crowned pigeon, and black-whiskered vireo. The South Florida Ecosystem has an endemic race of the yellow warbler and contains the majority of the nesting locations for the great white heron, reddish egret, roseate spoonbill, swallow-tailed kite, and short-tailed hawk in the U.S.

Fifteen species of herons, storks, and ibises nest in the South Florida Ecosystem and are considered ecological indicators because of their wide foraging ranges, relatively narrow food requirements, and relatively specific habitat requirements. Their breeding success reflects the health of the wetland and coastal habitats of the South Florida Ecosystem. Wading bird populations in the South Florida Ecosystem have undergone declines far greater than the declines of their nesting habitats. According to current estimates, breeding populations of wading birds in South Florida have declined by more than 90 percent as their habitats have been reduced by 50 percent (Ogden 1994). Of the 15 species of wading birds that breed in the South Florida Ecosystem, the wood stork, great egret, snowy egret, tricolored heron, and white ibis have declined by an estimated 75 to 80 percent between the 1930's and the late 1970's. The wood stork has undergone the most serious population decline (Ogden 1994). Habitat destruction and loss have reduced the supply of fish and other food items, thus contributing to the overall decline of wading birds.

The coastal area of the South Florida Ecosystem, like the rest of Florida, provides important breeding and wintering areas for shorebirds. The beaches provide nesting habitat for 13 species of shorebirds and support one of the two largest concentrations of wintering shorebirds in Florida. The South Florida Ecosystem also contains important wintering habitat, including portions of the Key West NWR, for the endangered piping plover.

Land conversion for residential housing has significantly reduced the amount and quality of nesting and wintering habitat for migratory birds in the South Florida Ecosystem. Very few bird habitats in South Florida have been protected from the effects of this land conversion (see Section III. D. "Freshwater and Freshwater Wetlands" and III. E. "Marine and Coastal Resources" below). Although the response of breeding and wintering populations of migratory birds to habitat losses in South Florida is uncertain, the magnitude of the habitat loss is certain to adversely affect migratory bird species. For example, Charlotte Harbor once supported large numbers of nesting black skimmers, snowy plovers, American oystercatchers, royal terns, and sandwich terns. Because of habitat loss in Charlotte Harbor, these species now concentrate along the coast of the Panhandle and the northeast coast of Florida (Cox et al. 1994).

### **C. Endangered and Threatened Species**

The high degree of endemism among South Florida's plants, animals, and biotic communities -- combined with extensive land conversion and habitat degradation by humans -- have imperiled many of the region's species. The South Florida Ecosystem supports 68 federally threatened or endangered species (Appendix D). Seven of the federally listed species that occur in the South Florida Ecosystem require enough special attention to warrant Service species coordinators: Florida panther, West Indian manatee, and five species of sea turtles.

The Florida panther is one of the most endangered mammals in the world. The South Florida Ecosystem supports the only known remaining wild population. This precariously small population, only 30 to 50 adults, is teetering on the brink of extinction. The Florida panther possibly utilizes as

wide a variety of native land-based habitats as any of South Florida's fauna. Panthers utilize all available native landscapes from upland pine flatwood and hardwood hammock forests to wetland systems dominated by sawgrass flats and swamp forests. Therefore, the panther serves as a "barometer" species for the vast majority of other non-marine plant and animal species endemic to South Florida. Preservation and proper management of habitats for the panther benefit vast numbers of other species indigenous to the ecosystem. Major threats to the panther include the loss/fragmentation of habitat and the eroding health and genetic viability likely associated with inbreeding in a small population. Recovery focuses on actions to: (1) protect and enhance the existing wild population and associated habitats, (2) restore genetic health to the population, and (3) reestablish populations elsewhere within the panthers' historic range.

The West Indian manatee in Florida represents the northernmost and largest remaining component of a manatee population once found throughout the Caribbean basin. Physically isolated from its counterparts, the manatee in Florida has historically been viewed as rare and declining in number. Because of this perception, the manatee was first afforded protection by the state of Florida in 1893. The manatee is now protected through the State of Florida's Manatee Sanctuary Act of 1978, the Endangered Species Act of 1973 (as amended), and the Marine Mammal Protection Act of 1972 (as amended). Manatees are considered an "indicator species," indicative of the health of the ecosystem in which they live. Manatees depend on seagrass beds and other submerged aquatic vegetation for their survival. As the rapid expansion of the human population in Florida continues, subsequent development and associated human-related threats to manatees and their habitats also grow. Historically, human activities have accounted for about one-third of the known manatee deaths each year. In 1995, 201 manatees died. Of this total, 42 deaths were watercraft-related and 13 more died of other human-related causes. Recovery efforts are guided by the manatee recovery program, through the revised Florida Manatee Recovery Plan of 1996. This plan coordinates manatee recovery activities conducted by private organizations and federal, state, and local agencies. Recovery activities are based on the following objectives outlined in the recovery plan: (1) to identify and minimize causes of manatee disturbance, injury, and mortality; (2) to protect essential manatee habitat; (3) to determine and monitor the status of manatee populations and essential habitat; (4) to coordinate, monitor, and evaluate the progress of recovery activities; and (5) to update and revise the recovery plan. A model statewide partnership has evolved with governments (federal, state, and local), corporations, non-profit organizations, and private citizens -- all contributing collectively what no single party could manage alone.

Five species of sea turtles nest on the beaches or inhabit the waters of South Florida. Loggerhead sea turtles nest in the greatest numbers, particularly along the South Atlantic coast of Florida. In fact, the southeastern U.S. contains the second largest loggerhead nesting aggregation in the world and is of significant importance to the survival of the species. Green and leatherback sea turtles also regularly nest in South Florida, but in smaller numbers than loggerheads. Occasionally, hawksbill sea turtles also nest here, and a few stray Kemp's ridley nests have been reported. Juvenile and subadult sea turtles use the Indian River Lagoon and Florida Bay as feeding grounds and developmental habitats, and offshore waters also support important feeding and resting habitats. Sea turtles have been negatively impacted by humans in a number of ways, such as commercial exploitation, incidental catch in commercial fishing operations, development of coastal nesting habitat including an increase in artificial lighting, and ocean pollution. Of particular concern is the high incidence of a disease known as fibropapillomatosis being observed to the greatest extent in green sea turtles. This disease is characterized by the presence of internal and external tumors, which can be severely debilitating and often fatal. High incidence rates of the disease have been observed in the Indian River Lagoon and Florida Bay, and researchers speculate that environmental contaminants may play a role by suppressing the immune systems of turtles.

Despite many years of effort, more than half of these threatened and endangered species are still declining because of habitat loss and alteration. Most of the threatened and endangered species in the South Florida Ecosystem are victims of patterns of habitat destruction, degradation, and fragmentation that also affect other species that occupy the same habitats. For example, the status of 29 federally-listed plants and animals that are endemic to the oak scrub communities of the Lake Wales and Atlantic Coastal Ridges reflect patterns of the habitat destruction and degradation that have imperilled at least 122 other endemic plant and animal species. The five plants that were listed because of the destruction and degradation of the pine rockland communities of Dade County and of the Florida Keys are indicative of conditions that imperil another 55 species endemic to those communities. The endangerment of the wood stork is indicative of the degradation of estuarine conditions in Florida Bay and the hydrologic alterations that threaten the ecology of South Florida. The continued decline of the Florida panther in South Florida coincides with the pattern of habitat destruction, degradation, and fragmentation.

### **1. Law Enforcement for Trust Species**

The Division of Law Enforcement maintains two field offices within the South Florida Ecosystem. The southwestern Florida law enforcement office is located on Sanibel Island at the J.N. "Ding" Darling NWR. The southeastern Florida law enforcement office is located in Miami. Special Agents assigned to these offices are highly skilled criminal investigators. They provide the environmental law enforcement capability that is critical to the success of ecosystem management in South Florida.

Special Agents routinely assist NWR Managers, Refuge Officers, Endangered Species Coordinators, and concerned citizens by investigating crimes on both public and private lands. They offer proactive solutions to resolving conflicts between people and the environment. The Division of Law Enforcement in partnership with other Ecosystem Team members is responsible for protecting a vast diversity of species and habitats, many unique to the South Florida Ecosystem. An ever-increasing number of complex environmental laws and regulations, necessary for addressing the human component of the ecosystem, challenge the Special Agents. In an effort to maintain biodiversity within the ecosystem, Special Agents employ specialized law enforcement equipment and techniques which include land, air, and marine surveillance; undercover operations; use of informants; and interagency task forces.

Special Agents devote considerable effort each year to the apprehension of persons involved in serious migratory game and non-game bird hunting violations. South Florida hosts some of the nation's finest duck and dove hunting. Lake Okeechobee and other components of the Kissimmee River drainage are heavily hunted and numerous commercial guides and outfitters, as well as sport hunting opportunities are available. Also, although fully protected, wading birds, sea turtles, and manatees have historically been killed for sport and food in South Florida. Special Agents patrol the remote areas where these animals are vulnerable to frequent poaching activity.

A cadre of wildlife inspectors and agents stationed in the Miami office also provide an important function in regulating the international transport of wildlife. Many South Florida species, especially reptiles, are rare and thus highly valuable in the international wildlife market. This high value results in extensive exploitation of these species, contributing to their scarcity and possible endangerment. The Miami office also monitors the importation of potentially disease carrying exotic wildlife, that if allowed to escape into the wild, may have disastrous ecological results. These exotic animals (including mammals, reptiles, fish, etc.) lack natural predators or other controls and may run amok -- thus out competing, displacing, or consuming native species.

### **D. Freshwater and Freshwater Wetlands**

Florida has more surface water area than any other southeastern state. The South Florida Ecosystem encompasses slightly more than 50 percent

of Florida's surface water, and the 5,950 square miles of surface water in the South Florida Ecosystem equals the combined surface water area in Alabama, Georgia, South Carolina, and Tennessee. Water unites the South Florida Ecosystem. It is the common component that connects land uses in Polk County with fish production in Charlotte Harbor. It is the thread that connects the expansion of residential communities in Broward and Dade Counties with the health of wood stork and pink shrimp populations in Florida Bay. Water is the web that connects alongshore transport off of St. Lucie Inlet with seagrass beds in Caloosahatchee Bay.

The most significant natural freshwater bodies in the South Florida Ecosystem are Lake Okeechobee, Lake Kissimmee, Lake Istokpoga, Kissimmee River, Caloosahatchee River, Peace River, and Myakka River. The more than 1,364 miles of canals, levees, and aqueducts that are

ubiquitous in the South Florida Ecosystem are as significant to the ecosystem as the natural water bodies. These canals and levees allow the SFWMD and the COE to manage water throughout the South Florida Ecosystem. The canals and levees, combined with the five water conservation areas, facilitate water removal during the wet season and water delivery during the dry season. These canals and levees made the South Florida Ecosystem habitable and facilitated the human occupation of the lower east coast of Florida and the Florida Keys. The Biscayne Aquifer provides potable water through an aqueduct from Homestead to the Florida Keys and allows the Keys to support its current population.

Wetlands are another of Florida's riches. Originally covering more than half of Florida, wetlands now cover more than 30 percent of the state (Frayer and Hefner 1991, Shaw and Fredine 1971). Forested wetlands cover fifteen percent of Florida's land area; predominantly in North Florida. There are significant forested wetlands in the South Florida Ecosystem however, concentrated in areas like the Upper St. John's River Basin, Six-mile Cypress Swamp, Corkscrew Swamp, Big Cypress Swamp, and Fakahatchee Strand.

Freshwater emergent wetlands, or marshes, are the second-most abundant wetland type in Florida (Frayer and Hefner 1991), the majority occurring in the South Florida Ecosystem (Kushlan 1990). The most significant freshwater marshes in the South Florida Ecosystem are the Upper St. John's River marshes, Kissimmee Marsh, Indian Prairie, Fisheating Creek Marshes, Loxahatchee Slough, Big Cypress, Taylor Slough, and the Everglades.

Florida is the primary location of mangrove communities in the U.S. Mangrove communities cover approximately 692,000 acres in the U.S., 98 percent in Florida. Mangrove communities are most abundant along the coast of the South Florida Ecosystem from Charlotte Harbor through the Florida Keys and Florida Bay. Ninety percent of the mangroves in Florida occur in Collier, Dade, Lee, and Monroe Counties, although small areas of mangrove swamps also occur in the Indian River Lagoon north of Fort Pierce Inlet and in Tampa Bay, Mosquito Lagoon, and the Ponce de Leon Inlet areas of the North Florida Ecosystem (Odum and McIvor 1990). Virtually all of the mangrove communities of the U.S. dominated by red and white mangroves are restricted to the South Florida Ecosystem.

It would be impossible to discuss wetlands in the South Florida Ecosystem without discussing the Everglades. This wetland ecosystem, which has no comparison in North America, once covered more than 2.9 million acres of southern Florida from Lake Okeechobee to Florida Bay (Davis et al. 1994). The historic Everglades comprised 7 types of wetlands, including 148,266 acres of forested wetlands, 768,512 acres of a sawgrass plain-tree island-wetland slough mosaic, and 588,122 acres of sawgrass plains.

In the past 50 years, more than half of the wetlands in the South Florida Ecosystem have been destroyed or degraded by drainage, alteration of flow patterns, nutrient loading due to agricultural runoff, and/or conversion for agriculture and residential housing. The canals and levees have been

constructed to drain the wetlands, to retain water for agricultural and urban use, or to prevent flooding in South Florida. As a result of this alteration, 1.35 million acres of wetlands have been lost from the Everglades, including most of the peripheral wet prairie, cypress forests, and all of the pond-apple forests that were associated with the historic Everglades (Davis et al. 1994). In addition, 200,159 acres of wetlands have been lost from the upper basin of the St. Johns River, and 299,003 acres of wetlands have been lost from the Kissimmee River Basin (Kushlan 1990).

## **E. Marine and Coastal Resources**

### ***1. Fisheries***

Estuarine and marine fish are integral in the ecology and economy of South Florida reflecting, to a large extent, the health of aquatic systems and the whole ecosystem. For example, Florida Bay fish populations are critical to the health of the wading bird colonies along the northern edge of the bay. Also, anglers spend millions of dollars annually while in Florida fishing for such species as red drum, spotted seatrout, tarpon, snook, jacks, snappers, groupers, sharks, spiny lobsters, and stone crabs. To further highlight the importance of such species to humans and the relevance of the South Florida Ecosystem to fish, consider that more than one third of the fish and shellfish landed in Florida's coastal waters were caught by vessels originating from South Florida ports. In 1991, these vessels landed more than 23.3 million pounds of fish and 9.9 million pounds of shellfish.

An estimated 96 percent (98 percent Gulf of Mexico and 94 percent southeast Atlantic) by weight of commercially and recreationally important marine fish species in South Florida are dependent upon estuarine habitats for critical life processes (Chambers 1991). The coastal, estuarine, and nearshore ecosystems of South Florida provide a nursery for a wide variety of fish and shellfish species supporting offshore fisheries in the South Atlantic and Gulf of Mexico. However, the habitats that historically supported South Florida fish populations have declined significantly in area and quality over the past 50 years. The alteration of freshwater flows to the estuaries along the southern and southwestern coasts of Florida has reduced water quality of the estuarine habitats of the region. Florida Bay is a key nursery area for various marine species including spotted seatrout, bonefish, red drum, tarpon, pink shrimp, and spiny lobster. However, a 90 percent reduction in freshwater inflow and increased levels of nutrient and pesticides have contributed to an increase of algal blooms, lost seagrass beds, sponge mortality, and salinity increases. These changes have caused increased incidences of fish kills and serious losses of mangroves -- all of which are directly linked to land use or land misuse in areas surrounding the Everglades as well as to South Florida's water management regime.

Even with the habitat degradation occurring, South Florida has a great diversity of fish species. Some 217 fish species have been collected from various marine and estuarine mangrove communities of South Florida, including sport and commercial fish and invertebrates such as the spiny lobster, pink shrimp, mullet, tarpon, and mangrove snapper (Lewis et al. 1985). Over 600 species of fish have been noted from the Indian River Lagoon region (IRLNEP 1996). A total of 246 fish species have been reported from the estuarine ecosystem of Charlotte Harbor, including 18 commercially important species and 5 species that are important for recreational fisheries (Taylor 1974). Also, Charlotte Harbor is the southern range of the threatened Gulf sturgeon. The status of Gulf sturgeon in Charlotte Harbor is unclear; however, information indicates that juvenile sturgeon have been collected by commercial fishermen in the 1990's (Parauka, personal communication 1996).

An April 1996 workshop, "Identification of Potentially Endangered Species in the Gulf of Mexico and Determination of Research Needs for These Species," held at the Gulf Coast Research Laboratory in Ocean Springs, Mississippi, identified the following species of concern within the contiguous areas of the South Florida Ecosystem: opossum pipefish, mangrove rivulus, mangrove gambusia, blue croaker, sea lamprey, striped

bass, key silverside, small tooth sawfish, and some sharks. Many of these species are tropical peripherals, following the Gulf Stream and other currents into the South Florida area. The opossum pipefish and many gobies depend on oligohaline areas (e.g., the mouth of the St. Lucie River) for reproduction, although opossum pipefish have been found in Lake Okeechobee (Gilmore, personal communication 1996). These species are especially sensitive to blockages in rivers, such as dikes, dams, or weirs, that impede their movements; and they also are flushed out by instantaneous and unramped water releases. Many vegetative species targeted for herbiciding, such as panicum grass, are used by these species. Although their ecosystem roles are not fully understood or appreciated, the fact that they are diminishing signals other system imbalances.

Freshwater fish may not be faring any better than marine and estuarine species. Human health advisories are in place due to the mercury content of such fish as largemouth bass, bowfin, gar, Mayan cichlid, spotted sunfish, warmouth, and yellow bullhead catfish in approximately 12 rivers and 17 lakes in South Florida, as well as in the Savannahs Marsh, Big Cypress Preserve, Arthur R. Marshall Loxahatchee NWR, Everglades Water Conservation Areas 2a and 3, and Everglades National Park (Florida Department of Health and Rehabilitative Services 1993).

The Service's Southeastern Region Strategic Plan for Fisheries and Aquatic Resources (FWS 1997) outlines ten roles: 1) recovering threatened and endangered species; 2) restoring depleted nationally significant fish species; 3) cooperatively managing interjurisdictional fishes (those that use water bodies common to two or more political boundaries or under management by two or more government entities); 4) mitigating damages to fishery resources caused by federal or federally-authorized activities; 5) managing ecosystems and watersheds on which healthy fisheries depend in partnership with states, tribes, and other political entities; 6) managing fisheries on federal lands; 7) assisting with management, habitat protection, and restoration on Tribal lands; 8) administering the Federal Aid in Sport Fish Restoration Program; 9) enforcing federal laws and regulations; and 10) performing aquatic resource education and outreach.

The South Florida Ecosystem's fishery resources are subject to many threats. The South Atlantic Fishery Management Council's Habitat and Environmental Protection Advisory Panel listed major fishery habitat concerns for Florida as:

- impacts of beach renourishment;
- dredge and fill operations;
- water pollution;
- seagrass die offs; and
- extensive coastal development and related problems.

All of these issues, from species diversity to habitat loss, from contamination to reduced freshwater inflow, combine to limit the potential of South Florida's aquatic systems. The Service's roles and strategic plan for fisheries and aquatic resources in the South Florida Ecosystem can address these issues and support the ecosystem in regaining its integrity and natural productivity.

## **2. Estuaries**

Estuaries are critically important as nursery, breeding, staging, and resting areas for fish, shellfish, reptiles, birds, and mammals. Their value as national resources has formed the foundation for a large number of federal statutes, including the Migratory Bird Treaty Act, Coastal Zone Management Act, Estuary Protection Act, Atlantic Coastal Fisheries Cooperative Management Act, Magnuson-Stevens Fishery Conservation and Management Act, Clean Water Act, Fish and Wildlife Coordination Act,

and Coastal Barrier Resources Act. The South Florida Ecosystem contains numerous coastal resources, some of which are found nowhere else in North America. The South Florida Ecosystem includes several major estuarine ecosystems: southern Indian River Lagoon, Lake Worth Lagoon and Biscayne Bay on the east coast; Florida Bay on the southern coast; and the Ten Thousand Islands region, Estero Bay, Caloosahatchee River, Charlotte Harbor, and Sarasota Bay on the Gulf Coast.

### **3. Reefs**

Reefs are a prominent coastal resource in the South Florida Ecosystem, which contain several different kinds of coastal reef assemblages: ivory tree coral reefs, worm reefs, vermetid reefs, and the coral reef of the Florida Keys. The Keys coral reef complex consists of a tract of semi-continuous offshore bank reefs that make up the third largest barrier reef in the world and more than 6,000 inshore patch reefs. As such, the Keys' reef constitutes the only coral assemblages of any significance in the continental U.S. In addition, coral reefs hold unparalleled marine diversity and are likened to the tropical rainforests of the sea. The Florida Keys coral reef is the most visited, most heavily used reef in the world, hosting millions of users annually. Use, overuse, and the impacts of a burgeoning population in South Florida have severely impacted the health of the reef community. Hundreds of boat groundings each year crush the fragile animals that make up the reef; declining water quality overly stresses the marine community; unknowing or uncaring visitors damage corals by coming in direct physical contact with them underwater; overharvesting of fish species alters reef maintenance; coral diseases are more prevalent and unknown diseases are frequently appearing; and coral cover, species diversity, and species abundance on the reef has dramatically dropped.

### **4. Seagrasses**

Of the 3,860 square miles of seagrasses in the U.S. portion of the Gulf of Mexico, more than 85 percent occur in Florida waters (Iverson and Bittaker 1986). More than 2,124 square miles of seagrass beds occur in the shallow waters of Florida Bay and the adjacent reef tract alone; seagrasses cover 80 percent of the submerged lands between Cape Sable, north Biscayne Bay, and the Dry Tortugas (Jaap and Hallock 1990). Seagrass meadows improve water quality by removing nutrients, by dissipating the effects of waves and currents, and by stabilizing bottom habitats -- thereby reducing suspended solids. The seagrass communities of South Florida have experienced substantial declines in acreage and quality in recent years. An estimated 30 percent of the seagrass communities have been destroyed in Florida's estuaries since the 1940's. Indian River Lagoon and Charlotte Harbor have each lost about 30 percent of their seagrass beds. Since 1987, more than 59,306 acres of seagrasses have been affected by several factors including degraded water quality, dredging from boat propellers, freshwater management of the Everglades flow, severe temperature variability, and others; resulting in a massive die-off (Haddad and Sargent 1994). In fact, it is estimated that over 64,200 acres of seagrasses have been moderately or severely damaged by propellers alone (Haddad and Sargent 1994). Seagrass beds in Monroe, Lee, Dade, and Charlotte Counties have experienced the most heavy damages from propellers.

### **5. Mangroves**

The extent and importance of the mangrove communities that line much of the coast of the South Florida Ecosystem have been discussed previously. As coastal resources, mangrove ecosystems and the waters they occupy support highly diverse animal communities. More than 220 fish species, 24 reptile and amphibian species, 18 mammal species, and 181 bird species have been reported from the mangrove ecosystems of South Florida. Mangrove wetlands have undergone great losses, for example, Lake Worth Lagoon lost an estimated 87 percent of its mangrove wetlands between 1940 and 1975 (Harris et al 1983).