

## World Heritage Sites

### Protected Areas and World Heritage



## EVERGLADES NATIONAL PARK UNITED STATES OF AMERICA

*This unique marshland on the southern tip of Florida has been called a river of grass. It is a shallow sheet of water flowing imperceptibly southeast across the vegetation of southern Florida. Its exceptional variety of habitats has made it a sanctuary for great numbers of birds and reptiles, and for threatened species such as the manatee.*

*Threats to the Site: Between 1993 and 2007 the site's ecology was endangered by urban growth, pollution by fertilisers, poisoning of fish and wildlife by mercury, falling water levels due to flood protection measures and by hurricane damage to Florida Bay. Inscription on the list of World Heritage in Danger led to increased federal funding for the restoration of the site. By 2007 rehabilitation was considered sufficient to remove the Park from endangered status for the celebration of the 60th anniversary of its opening, but its status reverted to endangered in 2010.*

### COUNTRY

United States of America

### NAME

Everglades National Park

### NATURAL WORLD HERITAGE SITE IN DANGER

1979: Inscribed on the World Heritage List under Natural Criteria vii and viii.

1993-2007: Listed as a World Heritage site in Danger due to major degradation of the water regime.

2010: Again listed in Danger because of serious and continuing degradation of its aquatic ecosystem.

### STATEMENT OF OUTSTANDING UNIVERSAL VALUE

The UNESCO World Heritage Committee issued the following statement at the time of inscription:

#### Statement of Significance

Everglades National Park is the largest designated sub-tropical wilderness reserve on the North American continent. Its juncture at the interface of temperate and sub-tropical America, fresh and brackish water, shallow bays and deeper coastal waters creates a complex of habitats supporting a high diversity of flora and fauna. It contains the largest mangrove ecosystem in the Western Hemisphere, the largest continuous stand of sawgrass prairie and the most significant breeding ground for wading birds in North America.

**Criterion (viii):** The Everglades is a vast, nearly flat, seabed that was submerged at the end of the last Ice Age. Its limestone substrate is one of the most active areas of modern carbonate sedimentation.

(ix) The Everglades contains vast subtropical wetlands and coastal/marine ecosystems including freshwater marshes, tropical hardwood hammocks, pine rocklands, extensive mangrove forests, saltwater marshes, and seagrass ecosystems important to commercial and recreational fisheries. Complex biological processes range from basic algal associations through progressively higher species and ultimately to primary predators such as the alligator, crocodile, and Florida panther; the food chain is superbly evident and unbroken. The mixture of subtropical and temperate wildlife species is found nowhere else in the United States.

**Criterion (x)** Everglades National Park is a noteworthy example of viable biological processes. The exceptional variety of its water habitats has made it a sanctuary for a large number of birds and reptiles and it provides refuge for over 20 rare, endangered, and threatened species. These include the Florida panther, snail kite, alligator, crocodile, and manatee. It provides important foraging and breeding habitat for more than 400 species of birds, includes the most significant breeding grounds for wading birds in North America and is a major corridor for migration.

## **INTERNATIONAL DESIGNATIONS**

- 1976: The Everglades and Dry Tortugas recognised as a Biosphere Reserve under the UNESCO Man & Biosphere Programme (636,411 ha).
- 1987: Designated a Wetland of International Importance under the Ramsar Convention (566,143 ha).

## **IUCN MANAGEMENT CATEGORY**

II National Park

## **BIOGEOGRAPHICAL PROVINCE**

Everglades (8.12.04) / Austroriparian (1.6.5)

## **GEOGRAPHICAL LOCATION**

On the southern tip of Florida, 40km south west of Miami city. Bounded on the west by the Gulf of Mexico, on the north by the Tamiami Canal and Big Cypress Nature Reserve, and to the south by the Florida Keys across Florida Bay which is within the Park. Located between 24° 50' to 25° 55'N and 80° 20' to 81° 30'W.

## **DATES AND HISTORY OF ESTABLISHMENT**

- 1934: Designated a National Park by Act of Congress;
- 1947: National Park declared open to the public;
- 1974: Big Cypress Swamp declared a National Preserve;
- 1976: Designated a UNESCO Biosphere Reserve, with Dry Tortugas National Park 200 km southwest;
- 1987: Designated a Ramsar Wetland site;
- 1989: The area of the Park increased by the Everglades Expansion & Protection Act to 609,681 ha by addition of the northeast area of Shark River Slough (44,112 ha); Restoration of the natural water regimen begun by the Modified Water Deliveries Project;
- 1992: Dry Tortugas National Park established, incl. Fort Jefferson National Monument, designated 1935;
- 1993: Listed as an endangered site because of urban encroachment, pollution, lowered water levels, declining waterbird populations, invasion by exotic species and hurricane damage. Added to the Montreux Record of wetlands in danger.
- 2000: The Comprehensive Everglades Restoration Plan initiated to restore a natural ecological regime.
- 2010: Listed in Danger because of serious and continuing degradation of the aquatic ecosystem.

## **LAND TENURE**

Federal Government. Administered by the National Park Service (NPS) of the Department of the Interior.

## **AREA**

World Heritage Site: 592,920 ha. The Park is bordered by the Big Cypress National Preserve (21,198 ha) to the north, and Key Largo National Marine Sanctuary (32,388 ha) to the southeast. Nearby are Biscayne National Park, ten National Wildlife Refuges and the Florida Keys National Marine Sanctuary.

## **ALTITUDE**

From sea level to 2.5m.

## **PHYSICAL FEATURES**

The Everglades National Park is a shallow drainage basin comprising the inland and coastal zones of a vast water-covered limestone plain drained by the Shark River Slough depression, covered by freshwater prairies with forested islets, with coastal saltmarshes, mangrove swamps, estuaries,

beaches and shallows. The basin is tilted to the south-west, draining south Florida in a slow-moving sheet of water 40-80 km wide, depending on rainfall. It averages 150mm deep, though the major drainage way, the Shark River Slough, can be up to a meter deep in the centre. It flows to a coastline of estuaries along the Gulf of Mexico and into the shallow Florida Bay. It is all that remains of the water sheet which used to flow south annually from the Kissimee river and Lake Okeechobee in the centre of the state 140 km to the north, before the construction of some 400 miles of diversion canals and levees which have reduced the flow by about 70%. The Park is a major source of fresh water for the city of Miami and south-east Florida, a vital recharge area for the Biscayne aquifer and barrier against saltwater infiltration. The area is underlain by extensive Pleistocene limestones with oolitic and bryozoan facies, overlaid by variable thicknesses of marl and peat, a thin porous crust which filters the surface water percolating to the aquifer.

Florida Bay is about 2,240 sq.km in area, has an average depth of one meter and a maximum depth of 3 meters. It encloses hundreds of islands. Its substrate is composed of a network of mudbanks and unconsolidated calcareous sediments over limestones and is one of the most active areas of modern carbonate sedimentation. The Park lies at the interface between temperate and subtropical biomes, between fresh and brackish water, shallow bays and deeper coastal waters, and protects a complex of habitats which support a high diversity of wildlife. The area of transition from freshwater glades to saltwater mangrove swamps is a highly productive zone that nurses great numbers of commercially valuable crustacea. The Dry Tortugas is a cluster of coral reefs and shoals at the end of the Florida Keys.

## CLIMATE

The Everglades is dry, mild and pleasant from December through April with average minimum and maximum temperatures of 12°C and 25°C, and rare frosts. Summers are hot and humid, with temperatures between 23°C and 34°C and over 90% humidity. Annual rainfall averages 1,520mm, falling mostly from May to October. Afternoon thunderstorms are then common and mosquitoes abundant. Hurricanes can occur between June and November. These can be disastrous like hurricane Andrew in 1992 and hurricanes Wilma and Katrina in 2005, and a future rise in temperature may intensify such storms. Any resulting fast rise in sea level would be disastrous for most of the mangroves, seagrasses, turtle beaches, tree islands, the fisheries and coastal fresh waters of Florida Bay (South Florida Natural Resources Center, 2005).

## VEGETATION

The Everglades is a unique, complex and fragile permanent floodplain ecosystem with a great diversity of habitats and flora. The subtropical vegetation of southern Florida is unique in the United States. Taxonomic affinities show that many of its species migrated from tropical regions and are closer to tropical than to temperate ecotypes. Of over 1,600 species of vascular plants in Dade, Monroe and Collier counties, 60-70% have tropical affinities. This fascinating vegetation was a main reason for establishing the Park. A total of about 950 vascular plant species has been recorded in the Park, including 120 species of trees, 60 of them endemic, many bromeliads and epiphytes, 25 species of orchid, about half of the species endemic to southern Florida and several rare plants. Local endemism is rather high. Some 65 taxa are south Florida endemics and of these about 25 are found only within the small area of slash pine forest in south-eastern Florida. A small area of the site (268 ha) is classified within the Nearctic zone. Human interference with the natural system of the Everglades has led to the proliferation of invasive species such as the Australian melaleuca *Melaleuca quinquinervia*, sprinkled as seed from aircraft to absorb excessive water and now displacing native hammock species, and cat-tail *Typha latifolia* swamps, now displacing the sawgrass meadows.

There are five main terrestrial communities: hardwood hammocks or low tree islands (1.43% of the Park's area), pinelands (1.5%), sawgrass prairies (0.57%), bayheads (1.79%) and mangrove and cypress swamp forests (16.43%), and three main aquatic ecotypes: freshwater rivers, including flood savannas, ponds, brackish marshes (33%), coastal marshes (7.2%), and seagrass beds (38.1%). Hammock islands are dominated by both tropical and temperate hardwood species such as mahogany *Swietenia mahagoni*, gumbo limbo *Bursera simaruba* and cocoplum *Chrysobalanus icaco* alongside live oak *Quercus virginiana*, red maple *Acer rubrum* and hackberry *Celtis laevigata* providing habitat for larger mammals and a diversity of wildlife. Pinelands are a fire-adapted ecosystem dominated by slash pine *Pinus elliotti* var. *densa* and the understorey contains a large number of endemics. There are some arid coastal lowlands with halophytic vegetation. Coastal prairies and sloughs are often dominated by sawgrass *Cladium jamaicensis*, a type of sedge, muhley grass

*Muhlenbergia filipes*, or cordgrass *Spartina* spp. in coastal areas. The sawgrass marshes may be the largest in the world, but following pollution by nutrient-rich run-off especially from sugarcane farms, they are being invaded by cat-tail. Bayheads contain isolated stands of willow *Salix caroliniana* on slight elevations or swamp cypress *Taxodium distichum* in depressions filled with organic matter. The mangrove forests are very extensive. They contain red *Rhizophora mangle*, black *Avicennia nitida*, and white mangrove *Laguncularia racemosa*. Florida Bay's hard bottom is covered with a rich variety of marine vegetation. The dominant seagrasses are turtle grass *Thalassia testudinum*, manatee grass *Syringodium filiforme* and shoal grass *Halodule wrightii*. But these are being overrun by calcareous green algae of the *Codiaceae* family in the shallows and by pea-soup alga *Caulerpa taxifolia* in deeper water. Exotic pest plants such as melaleuca, Brazilian pepper *Schinus terebinthifolia* and Australian pine *Casuarina equisetifolia* have invaded natural areas, choking out native plants and altering habitats.

## FAUNA

The terrestrial and aquatic plant and animal communities of the Everglades have adapted over millennia to the rhythm of wet summers and dry winters and to each other. But today, 50% of south Florida's original wetlands no longer exist and entire populations of animals are disappearing. The Park protects 800 species of land and water vertebrates including 14 nationally threatened species (NPS, 2007). There are 40 mammal species in the Park. Twenty-five native mammals occur including mangrove fox squirrel *Sciurus niger avicennia*, southern flying squirrel *Glaucomys volans*, round-tailed muskrat *Neofiber alleni*, Everglades mink *Neovison vison evergladensis*, grey fox *Urocyon cinereoargenteus*, Florida black bear *Ursus americanus floridanus* and the native Florida panther *Puma concolor coryi* (CR) of which there may be only 80 left in the entire state and less than 10 in the Park. 77 have been killed on roads in the state since 1997 (Cox, 2007). The isolated population was reinforced by panthers *Puma concolor concolor* from Texas in the 1990s and Wilson & Reader (2005) consider it no longer a separate subspecies. The number of manatee *Trichechus manatus latirostris* (VU) in the Park was estimated at 3,142 animals in 2006 compared with 2,520 in 2004 (UNESCO, 2006).

366 bird species, many of limited distribution in the USA, were recorded in 2003. However, nesting waders have declined by 90% since the 1930s, and 68 species are nationally threatened or endangered (NPS, 2003). Notable species present include great white heron *Casmerodius albus*, roseate spoonbill *Platalea ajaja*, Rothschild's magnificent frigatebird *Fregata magnificens rothschildi*, reddish egret *Egretta rufescens*, wood stork *Mycteria americana*, osprey *Pandion haliaetus*, southern bald eagle *Haliaeetus leucocephalus*, short-tailed hawk *Buteo brachyurus*, crested caracara *Caracara cheriway*, peregrine falcon *Falco peregrinus* and Everglades snail kite *Rostrhamus sociabilis plumbeus*, Florida sandhill crane *Grus canadensis pratensis*, American oystercatcher *Haematopus palliatus*, Cuban snowy plover *Charadrius alexandrinus tenuirostris*, roseate tern *Sterna dougallii*, least tern *Sterna albifrons*, white-crowned pigeon *Patagioenas leucocephala*, mangrove cuckoo *Coccyzus minor*, red-cockaded woodpecker *Dendrocopos borealis*, Florida scrub jay *Aphelocoma coerulescens coerulescens*, Florida grasshopper sparrow *Ammodramus savannarum floridanus*, and many species typical of the Caribbean region. The population of the Cape Sable seaside sparrow *Ammodramus maritima mirabilis*, was estimated at 3,104 birds in the 2005 breeding season (3,584 in 2004; 3,216 in 2003, and 2,704 in 2002) (UNESCO, 2006). This population is a key indicator of the biological recovery of the area. The ivory-billed woodpecker *Campephilus principalis*, once present, is considered to exist by some American ornithologists but is probably extinct.

There are 60 known species of reptiles and amphibians, notably the American alligator *Alligator mississippiensis*, American crocodile *Crocodylus acutus* (VU), hawksbill turtle *Eretmochelys imbricata* (CR), green turtle *Chelonia mydas* (EN) and loggerhead turtle *Caretta caretta* (EN). 23 species of snake are recorded, including the eastern indigo snake *Drymarchon corais couperi*. Alligator wallows become dry season oases for many freshwater species. The introduced very large Burmese python *Python molurus bivittatus*, now reproducing throughout the area, rivals the alligator as top predator.

More than 275 species of fishes are known from the Everglades, most inhabiting the marine and estuarine waters where the water balance is being altered by freshwater pumping. Several are important game fish that attract thousands of anglers to the park, especially in Florida Bay. Species such as blue and spotted tilapia *Oreochromis aureus* and *Tilapia mariae*, oscar *Astronotus ocellatus* and Mayan cichlids *Cichlasoma urophthalmus* have become ineradicable. Bahama swallowtail butterfly *Papilio ardraemon bonhotei* and Schaus swallowtail butterfly *P. aristodemus ponceanus* are threatened insects.

## **CONSERVATION VALUE**

The Everglades National Park is a wilderness of exceptional conservation value which preserves over half of what remains of the Everglades ecosystem. This is the only subtropical reserve in North America, the largest continuous stand of sawgrass prairie in the country, the largest mangrove ecosystem in the western hemisphere, the most significant breeding grounds for tropical wading birds in North America and the habitat of 14 nationally endangered species. It lies within a Conservation International-designated Conservation Hotspot, within two WWF Global 200 Eco-regions, freshwater and marine, in a WWF/IUCN Centre of Plant Diversity and overlaps both a Ramsar wetland and a UNESCO Biosphere Reserve.

## **CULTURAL HERITAGE**

Palaeo- and Archaic Indian cultures have been traced from 10,000 years ago. In historic times, five tribes numbering about 20,000 were known before contact with westerners reduced them. The Seminole and Miccosukee Indians took refuge in the Everglades during the 19th century but were overcome in the Seminole wars. However, a rich record of settlements, farming and fishing remains in some 200 known archaeological sites. Two archaeological districts with 62 and 70 sites have been submitted to the National Register of Historic Places and five separate sites have been listed for their individual significance. Western pioneers settled mainly on the coast. Fort Jefferson, built between 1846 and 1876 on an island in Dry Tortugas National Park but now abandoned, is the largest brick fortification in the western hemisphere.

## **LOCAL HUMAN POPULATION**

Although the area was settled relatively late, changes occurred very rapidly in the early decades of the 20th century. During the past fifty years it has been under continual stress from the rapid urbanisation of south Florida the population of which has grown from under 500,000 in 1945 to more than six million today and is forecast to reach 10.2 million during the next 40 years. This will exert serious pressure on the Park's waters and bordering lands (SFNRC, 2007). 30-50 Park staff and 50-100 concession personnel live in the Park. The Miccosukee tribe has traditional rights on the eastern Shark River Slough. Retention of a 50 ha site along the northern boundary is being confirmed to them by Congress under a special use permit for development of its tribal headquarters, visitor centre, housing and businesses.

## **VISITORS AND VISITOR FACILITIES**

The development of visitor facilities respects the original aim of preserving the Park's wilderness. Nevertheless there were 954,022 visitors to the Everglades in 2005 and 1,233,837 in 2006. Visitor facilities are adequate. Facilities include five visitors' centres, 10 walks, 6 hiking trails, 3 km of boardwalks, 8 canoe trails, 130 km of roads, 250 km of nature trails, 3 campgrounds, 43 backcountry campsites, 6 marinas or boat launches, a 24 km paved loop road for tram and bicycle tours one motel and 7 restaurants. Use of the Everglades is devoted to natural and cultural resource interpretation, environmental education, recreational fishing, boating, and boat tours, hiking and wilderness exploration. 15,000 students attend guided tours every year (NPS, 2007).

## **SCIENTIFIC RESEARCH AND FACILITIES**

Extensive research has been carried out especially since 1976, by scientists from the Park's South Florida Natural Resources Center (SFNRC) and academic institutions. Its size, complexity, and the number of ways the Park is impacted require continual work. There is a research and resource management staff of about 60 scientists, technicians, resource specialists and administrative assistants which between 1975 and 1988 produced over 60 technical reports. Water flow, ecosystem response indicators, pollutants and the effects of water on wildlife, estuarine fisheries and vegetation communities have been subjects of major research; also marine ecology, the effects of fire and exotic plants on the native vegetation, and archaeological resources. There is continuous monitoring of hammocks, wading birds, freshwater marshes, fish and invertebrates, seagrasses and benthic habitat. The federally financed Critical Ecosystem Studies Initiative has made useful scientific input. However, a recent challenge to the Fish & Wildlife Service has accentuated the pressure to support research uninfluenced by political considerations (PEER, 2004). The Everglades Regional Collection Centre houses some 50,000 biological and cultural museum artefacts and archives, and a library with 10,000 volumes.

## MANAGEMENT

The Park's boundaries enclose the southern end of a 150 km drainage system from Lake Okeechobee in central Florida southwards which was until the second half of the 20th century regarded by many as worthless swamp, requiring reclamation. From 1948 the South Florida Project, the successor Central & Southern Florida Flood Control Project and South Florida Water Management District of the Army Corps of Engineers, over many years of large scale drainage and development schemes, converted much of the area to other uses. Half the original Everglades was diverted and drained and water to the National Park segment was controlled through canals and floodgates. This compartmentalised the ecosystem, creating major changes in water flow patterns across the southern end of the state. The Park now protects only a fifth of the historic Everglades. In the mid 1960s water was held back from the system for four years to fill reservoirs until in 1970 Congress authorised a 20% restoration of the original flow. Three adjoining watershed sources, which are essential to the system, but in various stages of preservation and control, lie outside the Park. These are Big Cypress Swamp on the northern boundary, 93% federal property since designation as a National Preserve in 1974; the Shark River Slough watershed, which is supplied by a large number of water conservation areas managed by the state plus to their north, a large agricultural area formed from the northern Everglades; and the small Taylor Slough watershed which empties into north-east Florida Bay. It originates on private lands and passes through the Park supporting exceptional seasonal wildlife displays on the Anhinga Trail.

Official restoration of the region's natural water regimen started from concern with the impact of the Flood Control Project on the Park. In 1989 Congress stated in the Everglades Expansion & Protection Act that the ecosystem had suffered major adverse effects and should be restored. In 1990 an Act of Congress authorised the purchase of 44,112 ha in the East Everglades Expansion Area along the northeast boundary of the Park to increase the protection of Shark River Slough. Control of this area along with infrastructural changes in the water management system began to allow the Park to restore natural hydro-patterns without flooding private land; this was aided by a massive budget for land purchase and ecosystem research of \$31.4 million. 95% of this area is now incorporated (UNESCO, 2002). In 1992, the Corps of Engineers was directed to review the Project in order to restore and enhance the water flow.

Inclusion of the Everglades on the List of World Heritage in Danger in 1993 coincided with greatly increased federal funding for its rehabilitation. In 1993, the Department of the Interior established an interagency task force of 22 federal, state, tribal and local government agencies to co-ordinate restoration. In 1994, the Governor of Florida established the Governor's Commission for a Sustainable South Florida. These forces converged in a plan to restore the area's natural hydrological system and meet the water supply and flood control needs of adjacent municipalities. This included developing a federal, state and private sector cost-sharing partnership for environmental and water quality improvements (the Everglades Forever Act of 1994); new federal legislation to authorise and guide the Army Corps of Engineers' restoration work (the Water Resource Development Act of 1996); funding for accelerated land acquisition to purchase and protect key parcels of land not in public ownership (the Farm Bill of 1996); and increased scientific research into adaptive environmental management (the Dep't of the Interior's South Florida Science Initiative, 1997) (UNESCO, 2004).

The Everglades National Park now protects the region's major source of fresh water and fosters environmentally based tourism. Where between 1993 and 2007 the site's ecology was still endangered by urban growth, pollution and falling water levels due to flood protection measures, now, structural changes in the water management system have begun to restore the water level and legal negotiation and action have begun to reduce pollution from fertilisers and farm wastes. 93% of the Park is federally designated as wilderness within which strict natural, managed natural, and developed zones have been defined. A series of preservation zones by Metropolitan Dade County and the State of Florida help to protect the Park's north and east boundaries from encroaching urbanisation. Development and encroachments are kept to a minimum. On nomination only about 0.1% of the Park was developed and only limited upgrading and replacement of ageing facilities was planned. Prescribed burning was successfully pioneered in the Everglades as a National Park Service management tool to perpetuate the native ecosystems. The Fire Management Plan (1990) and Statement for Management (1989) state current management goals and objectives.

The Comprehensive Everglades Restoration Plan, the world's largest environmental restoration project, was adopted in 2000. It aims to re-establish natural water flows to the greater Everglades ecosystem over the next 30-40 years in 68 projects at an estimated cost of \$10.5 billion, plus \$1.1

billion for pollution cleanup. But restoration progresses very slowly. The Everglades Coalition, an alliance of 45 conservation and environmental NGOs, met in 2006 to emphasise the importance of securing the land needed for restoration which is threatened by urban development; it also helped to persuade Congress to authorize in the Water Resources Development Act of 2007 two restoration projects, Indian River Lagoon-South and Picayune Strand, which will restore over 60,000 ha of wetlands, to start in 2006 and cost \$375 million. Research into the water flow and its biological effects on wild plants and animals has been done to design, modify and revise hydrological management of the Park (UNESCO, 2006). Already, the structural changes in the water management system have begun to restore water levels in the area though the level is less than 60% of its historic levels (SFNRC, n.d.). Major projected improvements in the water quality included lowering the phosphorous in water flowing into Shark River Slough and the Taylor Slough/Coastal Basin areas by late 2008, and increasing the Park's law enforcement, monitoring and the education of boaters in Florida Bay. As a result the populations of endangered species were expected to begin to stabilize (UNESCO, 2006).

Recent improvements were considered sufficient to remove the Park from endangered status in June 2007 in time for the celebration of the 60th anniversary of its opening (UNESCO Press Release 2007-72), and in January 2008 the State Party submitted a report on the progress in implementing nine corrective measures (benchmarks) developed while the property was on the List of World Heritage in Danger. These addressed five threats: water flow, flood protection, water supply for urban and agricultural growth, nutrient pollution from agriculture, and protection and management of Florida Bay. The report detailed programs for the completion of several projects: the East Everglades land acquisition, land exchanges, the Water Control Plan, water channels and detention areas, roads and bridges, and reduction of water phosphorus levels. However, several interconnected projects were delayed and it was admitted that the benefits of improved water flows to Shark Slough and Florida Bay were not expected for several decades. (IUCN, 2008)

## MANAGEMENT CONSTRAINTS

More than most parks, the Everglades depends on the larger ecosystem of which it is part, but today 50% of south Florida's original wetland areas no longer exist and the neighbouring towns are still expanding. The impacts of urban growth on the biodiversity of the Park have been massive: There has been a 93% decline in the number of wading birds since the early 1900s, 20 threatened or endangered species (out of 68 in the region), the spread of invasive exotic species, mercury contamination in fish and predator species, seawater infiltration of aquifers from excessive freshwater drawdown, dry season embayment salinity, and the decline of the productiveness of Florida Bay, now covered by pea-soup alga. The increase in salinity due to the reduced freshwater inflow may be a factor in the decline of commercially fished species, the spread of algal blooms and the consequent mass sponge mortality in southwestern Florida Bay. Entire populations of animals, including the manatee, the Cape Sable seaside sparrow, the Miami blackheaded snake, the wood stork and the Florida panther, are at risk of disappearing. Massive die-offs of seagrass beds in Florida Bay have been followed by the extensive losses of wading birds, fish, shrimp, and mangroves. Six exotic fish species, including walking catfish *Clarias batrachus*, compete with native species for habitat. The deterioration has continued, through urbanisation, drainage, deliberate and accidental burning, and pollution from oil developments, agricultural fertilisers, mercury and other run-off. In 2001 land was being lost to the Everglades at the rate of 1-2 hectares a day (EMS, 2001). These many indicators warn of a system under assault and in danger of collapse. Unless the plans for restoring the condition of this aquatic ecosystem are implemented, the property's integrity will be irretrievably lost (UNESCO, 2010)

Water manipulations have been the second largest environmental threat to the ecosystem: 60% of the water flowing into the property has been reduced by diversions for agricultural and urban developments upstream. The quality, timing, amounts, and distribution of canal releases into the Park affect the natural system that controls the vegetation and wildlife populations. Congressional action aimed to ensure a minimum annual supply of water, but the timing and manner of delivery were not specified. Irregular releases over many years has disrupted the wildlife which is dependent on a predictable regime of alternating wet and dry seasons or a predictable water level. The plant communities of southern Florida have proved extremely vulnerable to disturbance from human activities. During droughts in the early 1960s and late 1980s lowered water levels due to flood control measures and the lack of sheet run-off from the north noticeably reduced the breeding of wading birds. The population of the Everglades snail kite has also been reduced by reducing the habitat of its main prey. The increase in salinity due to the reduced freshwater inflow is a factor in the decline of commercially fished species, the spread of algal blooms and mass sponge mortality in southwestern

Florida Bay. The forecast doubling of the area's population in the next 40 years has ensured the attention of conservationists to the activities of the Army Corps of Engineers and the South Florida Water Management District. The local chapter of the Sierra Club opposed the \$10.5 billion Comprehensive Everglades Restoration Plan for removing barriers to water flow and its plans to divert water from wildlife habitats into new reservoirs over a 30-40 year period from 2000. There were also objections from other government departments to the permission granted by the Corps of Engineers for 5,409 acres of limestone quarrying within the Everglades which would destroy wildlife habitat and could contaminate local drinking water (IUCN, 2003; Todd, 2003). In 2009, a project to raise the Tamiami Trail road by 2013 will require additional bridging to prevent a new impediment to water flow and to divert inflows to increase the water flow in the northeast Shark River Slough (UNESCO, 2010).

Invasion by exotic plants is a third great threat to Everglades ecosystems. There are at least 221 species of introduced plants in the Park. These can be categorised by their distribution, their potential to spread and invade native vegetation, and the corresponding management approach for each group of species. The most significant category is of species such as Brazilian pepper tree *Schinus terebinthifolius* that are widespread in the Park or southern Florida and invade undisturbed native plant communities. A second category is of species like cat-tail or the small-leaf climbing fern *Lygodium microphyllum* from the orient that can naturalise and outcompete native vegetation. The latter has infested more than 50,000 ha of southern Florida wetlands in the past fifteen years. It grows fast in smothering mats killing other vegetation, climbs trees, engulfing tree islets and promotes the spread of fire (Hutchinson *et al.*, 2004). A third category is of species such as cajeput or Australian pine *Melaleuca* spp. which was seeded from the air in order to absorb flood water. Such species are now widespread in southern Florida, forming dense monospecific populations, primarily on disturbed sites like roadsides, canal embankments and agricultural lands (Whiteaker & Doren, 1989). Extraordinary financial and political investments have been committed to combat these pests though there is no assurance of success.

Hurricanes are an intermittent but persistent serious threat to the infrastructure and shoreline. Hurricane Andrew in 1993 felled many hammock trees, devastating and altering the ecology of Florida Bay where it destroyed a visitor centre. There were three consecutive hurricanes in the autumn of 2004 and Katrina hit hard at Flamingo, 40 km southwest of Park headquarters. Employee housing, the sewer system, the concessions marina and the boat fleet suffered much damage. Other effects of the storm included erosion of shore lines, floating and submerged debris, shifting of bottom sands and missing navigational signs, all making recreational boating and fishing hazardous. This danger might increase in the future (UNESCO, 2005). Although the Park was declared out of danger in 2007, the World Heritage Centre and IUCN remained concerned about the quantity and quality of water entering the Park from the north, the continued urban growth on the Park's eastern boundary, and delays to the land acquisitions, water control plans and constructions necessary to the recovery of a more balanced ecology (UNESCO, 2006). The resulting ongoing degradation of the site's values and integrity was evident. In mid 2008 the IUCN still considered the property to be in danger (IUCN, 2008).

## **STAFF**

In 2007 there were about 260 full time permanent employees (NPS, 2007). In 2001 50% of 17,430 hours of volunteer service by full time and part time employees came from female or minority groups (NPS, 2001).

## **BUDGET**

The budget for 2001 was US\$14,295,000 for administration, protection, resource management, research, interpretation and maintenance. For 2002, US\$31,400,000 of increased appropriations for land purchases were made and \$4.1 million was allocated to improve wastewater management (UNESCO, 2002). \$8 million was granted for ecosystem research in 2005. In 2006, federal appropriations for key ecosystem restoration projects totalled \$221 million (UNESCO, 2006).

## **LOCAL ADDRESS**

The Superintendent, Everglades National Park, 40001 State Road, Homestead, Florida 33030. U.S.A.

## **REFERENCES**

The principal source for the above information was the original nomination for World Heritage status.

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