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The Everglades: environmental threats and problems

A wilderness
under pressure

Everglades National Park
Florida, USA



Summer '98

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*** Personal note**

This is a 'vaktechnisch verslag' or technical paper about a subject very important for the Everglades. It has been written in the Everglades during an internship. This intership was an adventurous one. I like to thank Gordon Anderson for his great mentorship, and for maintaining a good deal....and yes, it's fucking political.

D.Mol

*** Introduction**

This is a paper about the Everglades, and the National Park, and its problems and threats. It consists of a section which introduces the geology, hydrology and vegetation of South Florida and the Everglades. Also, it describes the problems and threats which the Everglades has to deal with, concerning water, flora and fauna. Finally, there's a evaluation of the problems. It has been written as a internship-paper at the park.

"There are no other Everglades in the world.

They are, they have always been, one of the unique regions of the earth, remote, never wholly known. Nothing anywhere else is like them: their vast glittering openness, wider than the enormous visible round of the horizon, the racing free saltiness and sweetness of their massive winds, under the dazzling blue heights of space. They are unique also in the simplicity, the diversity, the related harmony of the forms of life they enclose. The miracle of the light pours over the green and brown expanse of saw grass and of water, shining and slow-moving below, the grass and water that is the meaning and the central fact of the Everglades of Florida. It is a river of grass. "

Marjory Stoneman Douglas, 1947

The Everglades: River of Grass

Everglades National Park

Everglades National Park is one of more than 360 areas of the National Park Service. The National Park Service (N.P.S.) has the world's best and largest collection of parks, monuments, historic sites, recreational areas, etc. The N.P.S. originated when Yosemite became a protected area in 1864. In 1872 Yellowstone became the second National Park. Since then more areas became protected. The parks however were managed by different departments. In 1916 a bill was accepted that the N.P.S. as part of the Department of the Interior would preserve, protect and manage all the areas of the National Park system. Through a variety of programs, the National Park Service accomplishes two primary functions:

- To conserve the natural and cultural resources;
 - To provide the public with recreation, inspiration and educational experiences.
- National Park originated in 1947 when Daniel B. Beard, first superintendent of Everglades National Park, Accepted the Royal Palm State Park as a gift from the Florida Federation of Womens Clubs. Since the start the park has grown from 4,000 acres to 1.5 million acres (800,000 hectares). The park was founded to protect the last part of a vast swamp area that covered a large portion of Florida. The protection of this area is important because there is no other park with ecosystems like the Everglades in the world.

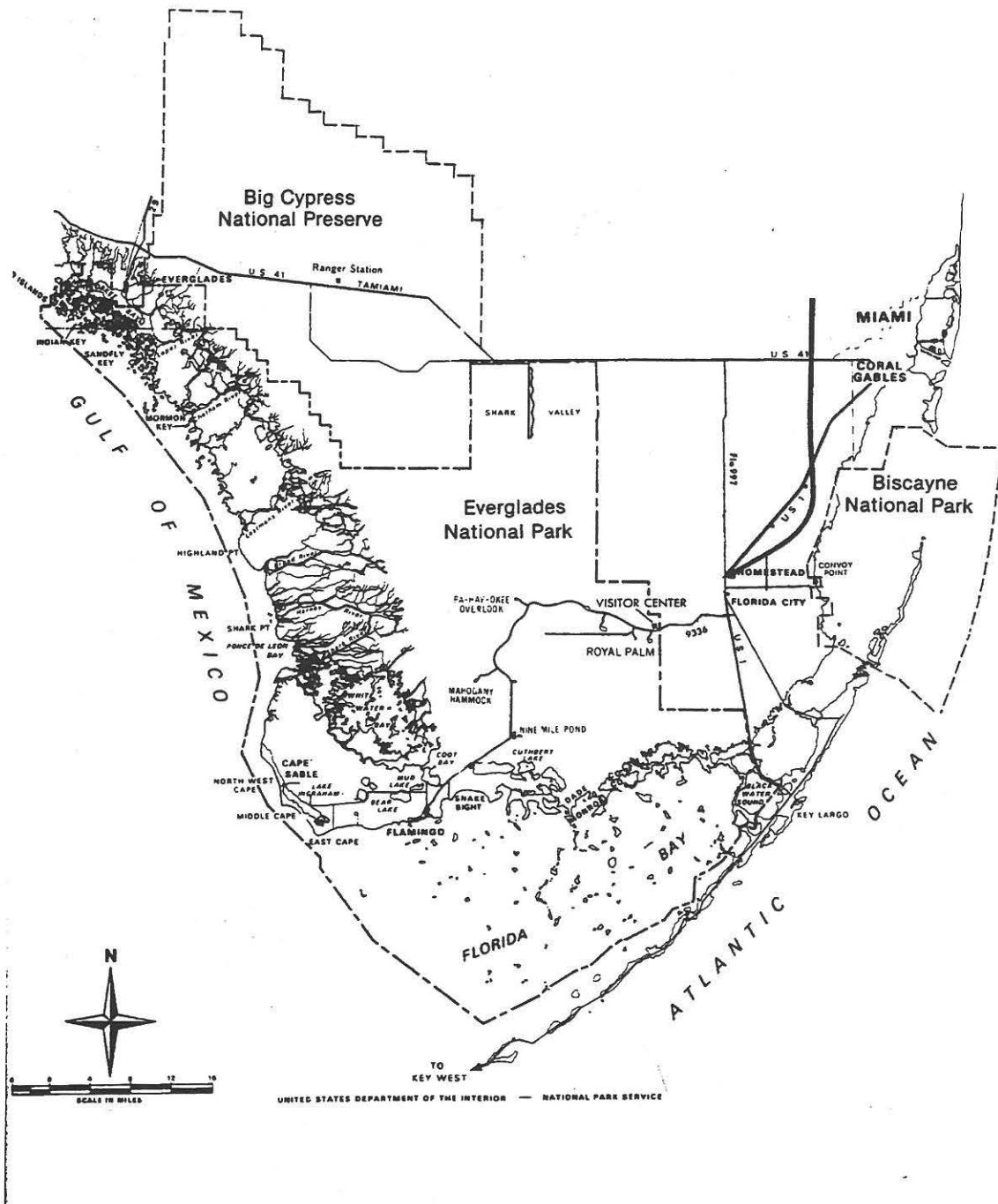
The research center

To be able to protect the Everglades research has to be done to understand the ecosystems and relationships between ecosystems and the environment, especially the water quantity and - quality. This research is done by about 50 people working at the South Florida Research Center. Results of the research are being used to adapt the management in the park, but also to show visitors how the Everglades ecosystems work, which threats there are and what can be done about it.

- Map 1 : De Nationale Parken in Zuid-Florida



- Map 2: The Everglades National Park in South Florida



1 - INTRODUCTION TO SOUTH FLORIDA

General

The state of Florida is known as the Sunshine State. Florida is one of America's premier travel destinations. Every year many tourists travel to Florida to visit Disney World, other amusement parks near Orlando and the beaches. But not only tourists invade this state. South Florida has one of the highest growth rates of the United States. Many retirees move to South Florida because of the warm climate and low taxes. To many political refugees from the Caribbean it is also the gateway to freedom.

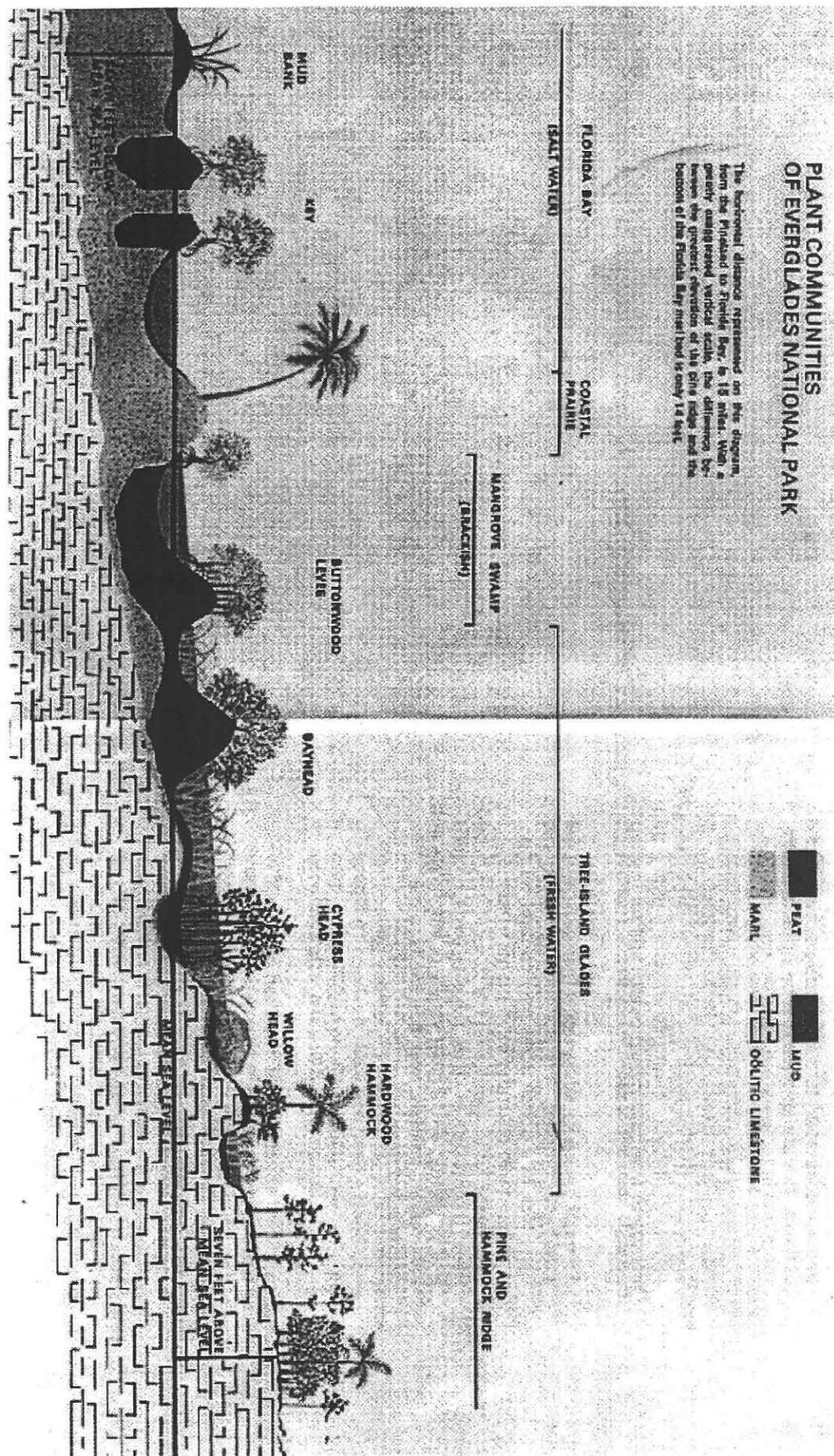
South Florida is to a lot of people synonymous to Miami and the Everglades. The first one is a big metropole with, including its numerous suburbs, about five million people. The other is known for its extensive sawgrass prairies, pine forest, dense hardwood hammocks and the mangrove estuaries (Lonely Planet, 1997). This situation of a metropole leaning next to a vast stretch of wilderness is a situation that is bound to give problems.

In this part of the continental United States tropical life from the Caribbean and Central and South-America blend with the life from the more northern temperate zones, resulting in a rich mixture of plants and wildlife. This is possible because of the climate in south Florida. Officially south Florida belongs to the temperate zone. South Florida however knows four seasons as states in the temperate zones. In south Florida there are just seasons, like countries in the tropical regions; a dry and a wet season (De Golia, 1988).

The wet season starts late May or at the beginning of June and ends in October. About 80% of the annual rainfall of 55 inches falls during this time of the year. Every afternoon there are thundershowers. In this time of the year the maximum temperature can reach over 90 degrees F and the humidity is between 70 and 90 %. The wet season is also the season of the hurricanes and mosquitos, making south Florida a very unpleasant place to stay. In the dry season however the temperature will primarily be between 65 and 80 degrees. The humidity is also lower than in the wet season, about 60 till 85 % (Fernald and Patton (ed.), 1984). In this time of the year coldfronts coming from the north may bring occasional frost, pruning back some of the tropical plant life and limiting its northern reach (De Golia, 1988). This is the time of the year with an abundant wildlife in Everglades National Park and other parks in south Florida.

South Florida is a place where tropical flora and fauna mingle with flora and fauna from the temperate zone. Some parts of Everglades National park look much like the West Indies, but you can also find animals and plants that grow in the more northern parts of the U.S.A. The south part of Florida is a very flat area. Small variations from the absolute level therefore play a major role in determining the landscape. The buildup areas, like Miami, are built on the higher grounds. Sites, with elevation differences of no more than a few inches, may present altogether different conditions for plant growth. Sites with a small difference in elevation can therefore have total different vegetation-types. Next to the elevation the vegetation is mainly determined by inland penetration of salt water, fires, hurricanes and occasional spells of freezing weather. There are five types of vegetation in Everglades N.P. (Robertson, 1988): sawgrass, mangrove

This picture shows
The ecosystems
of the Everglades
(from right to left:
going from
the mainland to
the see)



swamp, hammocks, pinelands and bayheads. The largest area of Everglades N.P. is covered with vegetation types of the lower land; the sawgrass marsh and the mangrove swamp. The pineland, hammocks and bayheads are found on the higher land. These three vegetation types cover much less area than either the sawgrass or the mangrove.

Biotic/non-biotic factors

Geology

The Florida peninsula is a great flat sponge of porous limestone. During millions of years Florida has alternately been submerged and exposed beyond its present shores, when the sea was rising and falling. In times the land was submerged, limestone was deposited. The present topography of Florida is made during the Pleistocene ice ages. During interglacial periods the waterlevels were higher and Florida was completely submerged by shallow seas and limestone beds were deposited. One of the limestone beds deposited about 100,000 years ago is the Miami limestone or the Miami oolite. This limestone is formed by oolites. Oolites are limestone grains formed by accumulation of calcium carbonate (limestone) around tiny grains of sand. The oolites were deposited in a loosely piled ridge.

The Miami limestone makes up the east coast ridge of the mainland, dips to provide a floor for the southern Everglades and Florida Bay and emerges again forming the islands south of Florida's mainland. Along both coast the land is slightly elevated (Robertson, 1988).

In the east is the Atlantic Coastal ridge. When this ridge was exposed above sea level about 100,000 years ago, it was washed by fresh rainwater, which dissolved some of the calcareous grains. As the rainwater evaporated, it deposited limestone in the place between the oolites, cementing them together and fusing them to the land below. This ridge is the base Miami is built on (De Golia, 1988).

In the west is no well defined ridge but a wide area of somewhat higher land. Both higher areas enclose an interior basin now occupied by the Everglades. The whole basin is slightly dipped toward the southwest. The seaward slope is no more than a few inches to a mile. Over the limestone is only a thin layer of marl and peat providing a soil for rooting plants. This special setup is the base for the unique ecosystem of the Everglades.

Soil

Vast portions of the Everglades and coastal swamps and marshes of southern Florida are consistent of (< 5000 year old) plant-derived, organic sediments called peat and muck. They occur to thicknesses of as much as 20 feet, but are generally less than 13 feet thick. In the dryer agricultural areas we find brown peat.

A unique feature of these organic soils in the Everglades is that they are subject to subsidence and surface loss. It is a very light peat.

Hydrogeology

Florida is underlain by several aquifers. The principal aquifer is the Floridan Aquifer. This aquifer consist of limestones and dolostones with minor amounts of clay, sand and marl. The aquifer is in south Florida about 3000 feet thick. The top of the aquifer reaches about 900 feet below sea level. This aquifer is overlain by several aquifers, depending on the area in Florida. In south and southeast Florida is the Floridan aquifer overlain by the Biscayne aquifer. This aquifer is mainly composed of the marine Miami Oolite. This aquifer is highly permeable. The aquifer is primarily recharged locally by rainwater that percolates directly from the surface.

Because the aquifer is highly permeable it is an important source of fresh water. About 44% of the ground water used for public supplies is supplied by the Biscayne aquifer. However because the aquifer highly permeable and it is situated close to the surface, it is also very vulnerable for contamination (Fernald and Patton (ed.), 1985).

Hydrology

Kissimmee River system

The origin of the Everglades lies north of Lake Okeechobee, in the Kissimmee River system. The Kissimmee River system is comprised of the Kissimmee chain of lakes and the Kissimmee River. This system is a major source of surface water flow into Lake Okeechobee. In the 1960s the Corps of Engineers changed the 9-mile-long, shallow meandering river to a 50-mile-long, 30-foot-deep channel. Because of the stabilization of the waterlevels and the effect of overdrainage the vegetation in the floodplains deteriorated. Also the water of the lower reach of the Kissimmee River and Lake Okeechobee became trophic. This was caused by nutrient enriched runoff from adjacent pasture and dairy farms. Investigations have been done to handle these problems. One result of these investigations is a project to restore the original meanders of the Kissimmee River (Fernald and Patton (ed.), 1984). The water from the Kissimmee River System flows into Lake Okeechobee.

Lake Okeechobee

Lake Okeechobee is the second largest natural fresh-water lake in the conterminous United States. It covers an area of 681 square miles at a stage of 14 feet. One of the largest water sources of Lake Okeechobee is the Kissimmee River System, the lake is 'fed' by the river system. The lake also receives much water by rainfall. Because of the large surface area of the lake much of the water is lost to evaporation. During the wet season, when the natural waterlevel would be high, the waterlevel is kept at 15.5 feet above mean sea level. This is done to have a storage capacity for excessive rainfall and to prevent flooding of the surrounding areas. At the end of the wet season the waterlevel is set to the maximum of 17.5 feet in order to store water for the dry season. In the past Lake Okeechobee has functioned as a reservoir for storage of water for agricultural use. Partly because of backpumping of excess flood and drainage water from the Everglades Agricultural Area, south of the lake, the water in the lake became very trophic (Fernald and Patton (ed.), 1984).

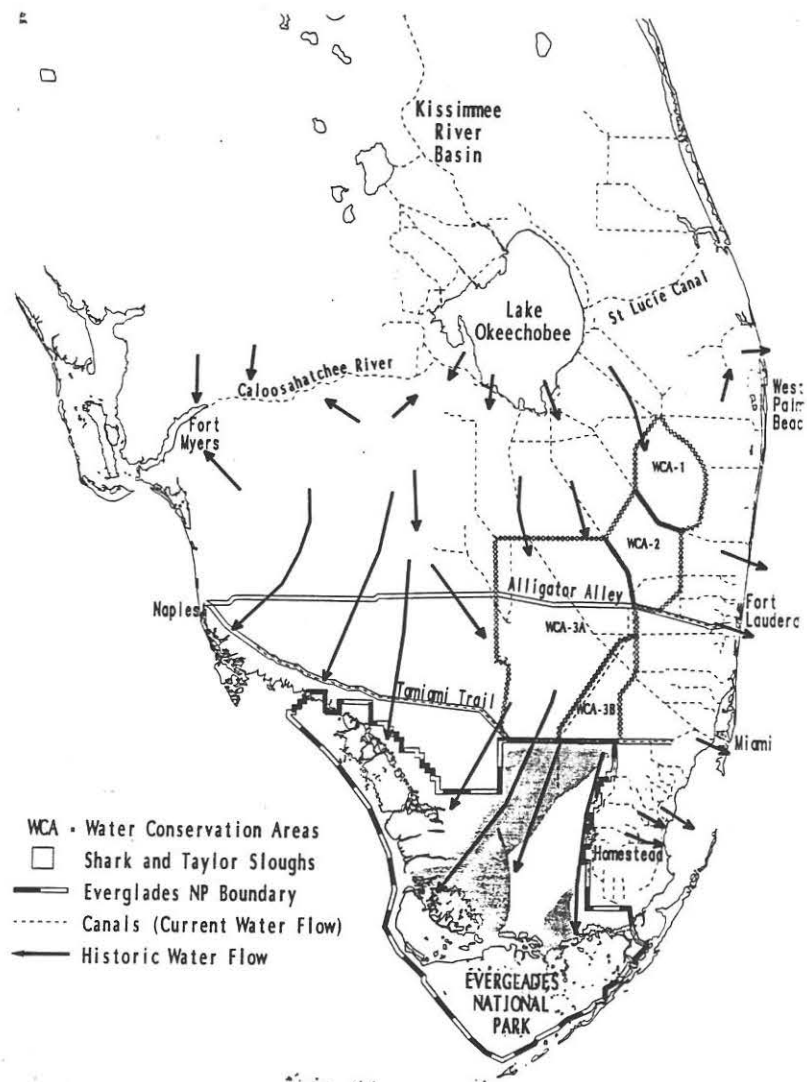
The Everglades

Historically the Everglades covered most of southeastern Florida. The term Everglades refers to a vast system of marshes, sloughs, tree islands and cypress forests. The original Everglades has been called a river of grass because water flowed from north to south across the marshlands as a continuous sheet during wet periods. As the level of lake Okeechobee rose during the rainy season, water spilled over its low southern shore and into the Everglades where it continued to flow southward in a broad swath, eventually to be in part evapotranspired and in part to reach the estuaries of Florida Bay and the Ten Thousand Islands.

During the dry periods the marshes dried. Historically the wetlands of the Everglades were a source of groundwater recharge and surface water flow to the coastal basins. Under present conditions, however, the wetlands are forced to compete with urban and agricultural uses for the available water.

The original Everglades is now divided in three different kind of areas. Directly south

- Historic waterflow pattern in the Everglades



from Lake Okeechobee is the Everglades Agricultural Area, covering about 1,000 square miles. To protect this area from flooding a dam was built on the south shore of Lake Okeechobee. Also a lot of drainage canals are built to lower the water levels for agricultural use (primarily the culture of sugarcane). The excess water of the Everglades Agricultural Area is received by Water Conservation Area 1. This is the most northern area of the three Water Conservation Areas, covering about 1,34 square miles in total. These areas are used to detain flood waters during periods of excessive rainfall and as water supply reservoirs to store water for use during dry periods. The Water Conservation Areas also serve a vital function in the recharge of the Biscayne aquifer, which is the principal source of drinking water supply in south Florida. The water from the Everglades Agricultural Area finally reaches the Water Conservation Area 3 where it is discharged to the most southern part of the original Everglades, Everglades National Park or released through the coastal canals. Since about 1970 the management of the Water Conservation Areas is changed in favour of Everglades National Park. The urban development since then takes its toll, along with the overuse of fertilizers in the farming area under Lake Okeechobee.

Vegetation

Pineland

The pineland grows on the higher ground in the east part of the park. The pineland in the park is a small part that didn't disappear to make way for housing and farming. The pineland grows in areas of bare rock where the Miami limestone reaches the surface. Because fires frequently burn these forests there is not much ground cover. The trees therefore seem to spring from the solid rock. Without the fires however seedlings wouldn't get a chance to get fullgrown, because the young pine-trees would get completely overgrown by the groundcover. Instead of an open pineland there would be a dense wood.

The fire is a natural part of the pinelands that keeps the forest alive.

Hammocks

A hammock is a certain kind of mature hardwood forest. In south Florida the forest contains a great variety of broad-leaved trees and shrubs. In areas with higher rainfall the hammocks are dense, moist forests rich in mosses and ferns. The trees grow large and on the branches are many epiphytic orchids, ferns and bromeliads (also known as airplants).

In areas with lower rainfall (more southwestward) the trees are smaller and more trees drop their leaves during the winter. The forests are more open and there are not as many plants.

The hammocks are found at sites that are so high they are seldom flooded. The surface is raised with a foot or two above the land-natural elevation, like limestone outcrops, shell ridges and marl ridges. Hammocks are found as islands in the sawgrass and the pineland. To be able to grow to a mature hammock, the sites also have had a certain kind of protection against fires. As soon as the hammocks are mature the area within the forest is so moist that only very hot intensive fires can burn a complete hammock.

Sawgrass

The sawgrass grows in the interior fresh water sections of the park and is normally overflowed during at least part of the year. During the summer the sawgrass is flooded.

In the winter, the dry season, the water level drops and the sawgrass may get completely dry. In this time of the year the sawgrass sometimes gets swept with fire. Scattered in the

sawgrass are higher and lower grounds. The islands with higher grounds are grown with trees. The ponds and the deeper channels in the sawgrass hold permanent water (except maybe for the driest years). In the dry season these lower grounds are refuge areas for small fish, snails and crayfish. Because these are the places with a large concentration of food, animals (like alligators, egrets and herons) that feed on them also concentrate in these areas. The alligator ponds can easily be seen in the sawgrass plain, because they are marked by a ring of willow trees growing around the deeper water.

Bayheads

The marshy sawgrass area is dotted with hundreds of tree islands. The islands mark the location of small topographic variations on the general level of the sawgrass plain. As mentioned before the higher grounds are covered with hammocks. Bayheads cover the slightly elevated areas of peat soils and Cypress heads mark the shallow ponds.

Mangrove

The mangrove is also during at least a part of the year overflowed. The mangroves however are found more near the coastal areas, where there is brackish or salt water. The mangrove swamp in Everglades N.P. is the only major area with mangroves in North America. They are under the influence of tidal water; mudflats submerge during low tide.

2 – MANAGEMENT

2.1 Water

South Florida Water Management Division

The South Florida water system is controlled and regulated by the South Florida Water Management Division. It is a very important institution for South Florida cause of the Everglades being a estuarium, and millions of people are involved with decisions being made by them. The area they manage stretches from the Kissimee Lakes down to the Keys. Their work is to satisfy the three biggest groups that are involved with water in the Everglades: the farmers (who want water for agricultural uses), the urban area (who wants drinking water) and the lobby that is in favor of the park (who want the historic water flow restored).

2.2 Vegetation

Type of management

The Everglades vegetation has preservation as the main type of management means that the area is being left alone to go its natural way, and protected from outside threats, such as groups of people who are claiming the land for their purposes. Given the fact that the Everglades are next to a 4 million-people urban area, there are numerous such cases.

3 – THREATS/PROBLEMS

3.1 General

A wetland that stretched from Lake Okeechobee to Florida Bay, the Everglades extended across four million acres of Florida's landscape as recently at the turn of the century. During the wet season, water could slowly make its way from the Kissimmee River System to Lake Okeechobee, spill over the lake's southern shore and replenished by rainfall along the way--move in giant sheets like a liquid glacier down the state to Florida Bay. Wading birds, water fowl and other wetland wildlife knew the ebb and flow of the seasons and life depended on it. Today, urban and agricultural sprawl replace half the sawgrass wetlands. The Arthur R. Marshall Loxahatchee National Wildlife Refuge in Palm Beach County (also known as Water Conservation Area 1), Water Conservation Areas 2 and 3 in Broward and Dade counties, and Everglades National Park comprise the remnant Everglades. In the legislation, this two million-acre region is known as the "Everglades Protection Area."

Stormwater runoff from phosphorus-enriched agricultural areas, non-native plant infestation and mercury contamination are major threats to the the Everglades. The biggest however is interrupted water flows.

3.2 Water

The changes in the natural waterflow have caused problems in the natural environment, related to four major types of effects (Fernald and Patton (ed.), 1984):

3.2.1 Overdrainage, which results in loss of aquatic habitats and invasion of wetland plant communities by other species. During a drought in the winter months, which is very common in the last years, the water consumption of Miami and suburbs gets the priority above the water supply to the park. On the other hand, in the summer months plume of water on flooded farmlands is released into the park. So, the controlled waterflow to the park causes a lack of adequate fresh water in the winter and an excess of freshwater in wet conditions, into a 52 miles long and a 300 feet wide canal.

3.2.2 Stabilization of water levels, resulting in constant flooding of wetlands and degradation or destruction of habitats that require periodic or seasonal drying.

3.2.3 Interruption of the north-south sheet waterflow through the marshes, causing a lack of adequate freshwater delivery to the Everglades National Park in dry periods and an excess of freshwater flow during wet conditions.

massive water control system built midcentury to provide water to south Florida residents during periods of drought and to relieve flooding after generous rainfalls has altered the amount, timing, and distribution of water flow to the Everglades. The results are fragmented flow patterns and degraded flora and fauna.

A nursery for hundreds of marine species, they bay is now experiencing algal blooms, fish population declines, and seagrass and sponge die-offs. Also, when too little water enters the park, large parts of the park cannot produce the small aquatic organisms that anchor the food web.

3.2.4. Degradation of water quality due to discharge of agricultural and urban runoff into the wetlands.

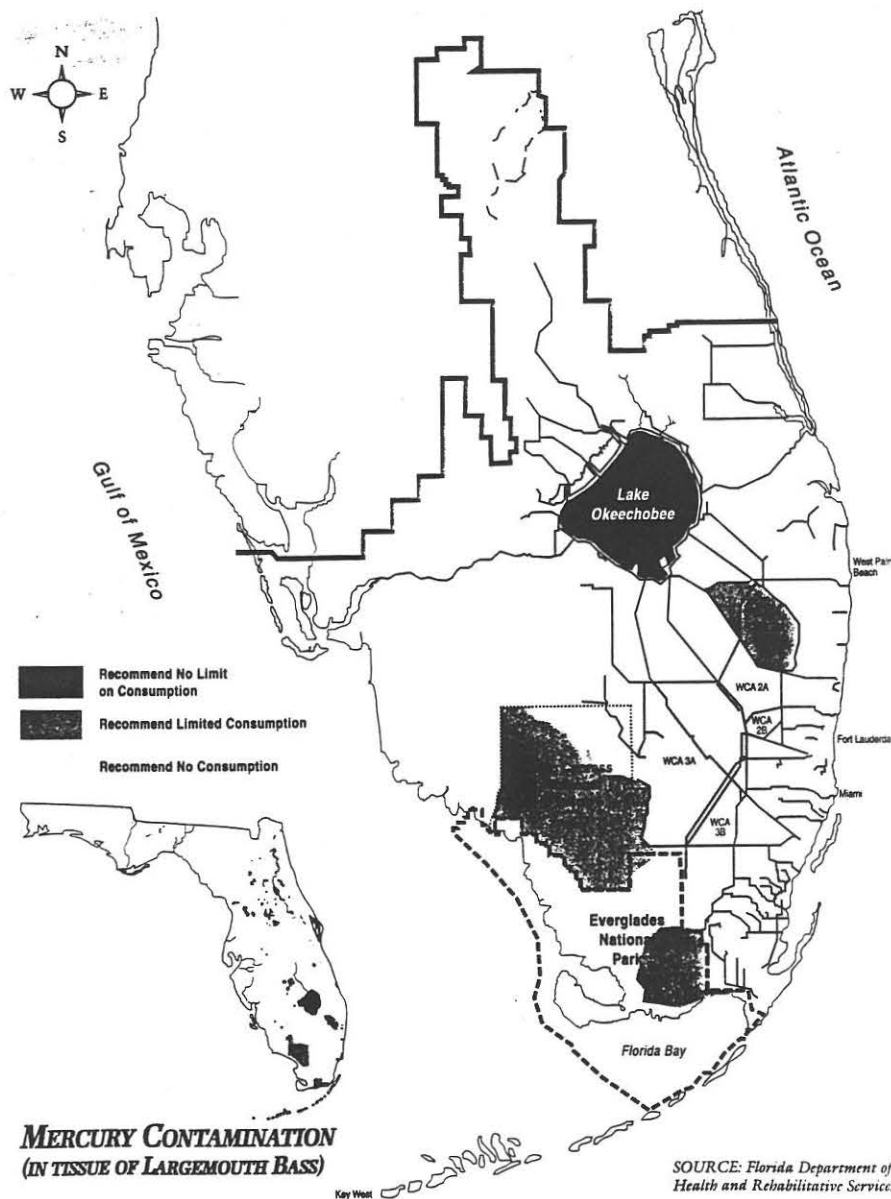
The phosphor problem is one of the culprits which threatens the ecosystem's natural balance is runoff discharged to the Everglades from farming operations lying north.

A telltale sign is abundant cattails (*Typha Latifolia*) that thrive on the phosphorus-rich runoff and crowd out other native species. Much of the phosphorus entering the Everglades comes from the Everglades Agricultural Area (EAA), a region sandwiched between Lake Okeechobee and water conservation areas (see map....,page..)

Last year, harvests from this fertile area included 470,000 acres of sugar cane and 60,000 acres of vegetables.

Smaller citrus and cattle grazing operations just west of the EAA also contribute to the nutrient runoff. The results of this nutrification are: algal blooms, fish population declines, and seagrass and sponge die-offs.

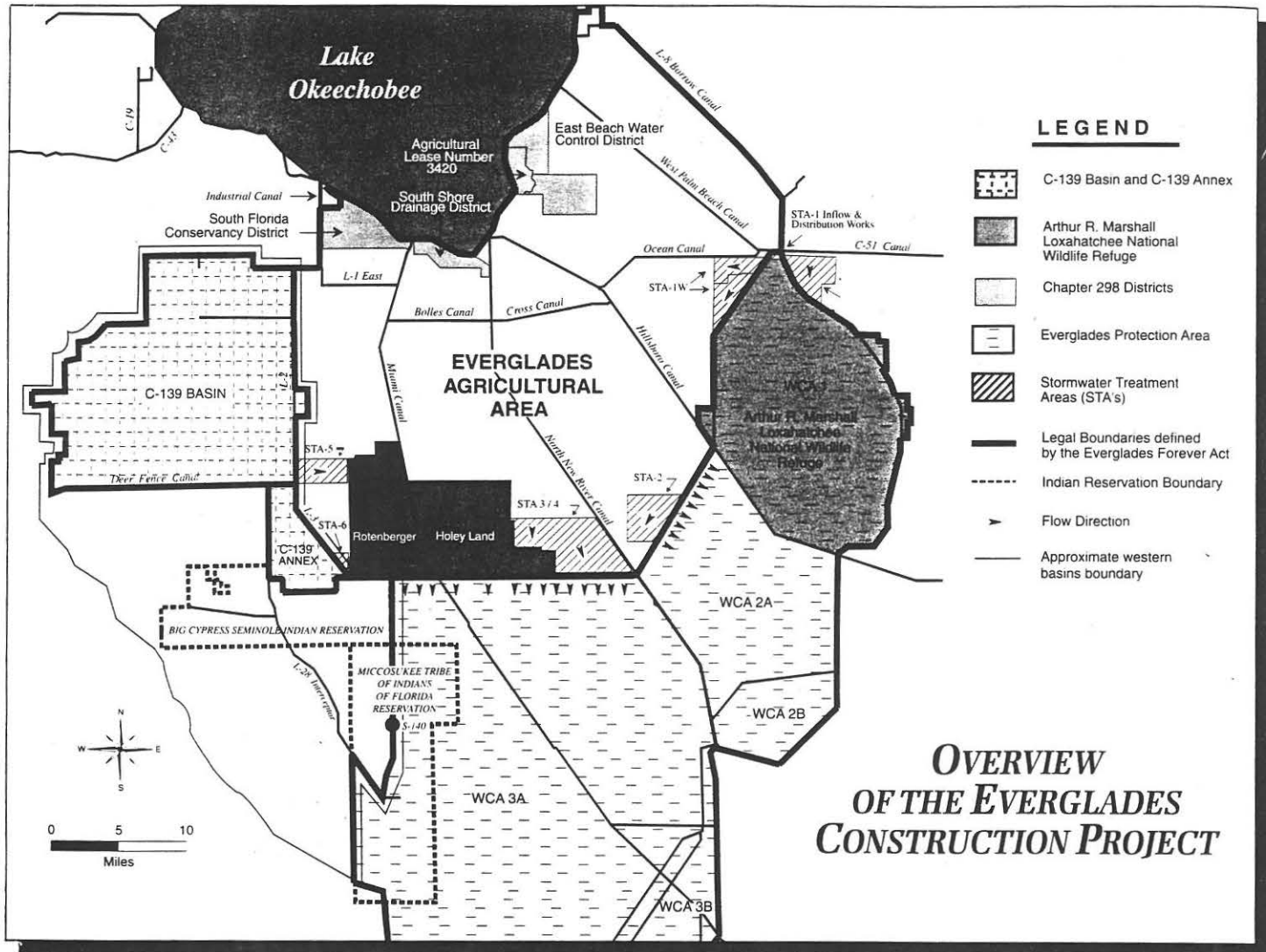
Mercury pollution from unknown sources is a growing problem. High levels of mercury were first detected in Everglades freshwater fish in early 1989. Although mercury occurs naturally in the environment, it is also a dangerous pollutant. Test show that the park raccoons and alligators have high levels of this toxic metal in their systems. A panther found dead in December 1989 had levels of mercury that would be lethal to humans.



Measures

The state of Florida passed the "Everglades Forever Act" to initiate restoration of the Everglades and Florida Bay, the 700-square-mile estuary at its southern tip.

Components of the Act dovetail with the state's initiative to restore two Everglades remnants--the Rotenberger and Holey Land tracts, which lie along the southern edge of the EAA. This is called the Everglades Construction Project (see map below).



Stormwater will be naturally treated (by nutrient-consuming plants) in STAs (Stormwater Treatment Area's) before delivery to the waterconservation area's: the construction of more than 40,000 acres of wetlands to remove phosphorus and other pollutants from agricultural stormwater runoff, which will be strategically located between agricultural fields and the Everglades.

The treatment areas become long-term "sinks" where the phosphorus-rich plants grow and die naturally in their constructed wet environment. The dead plants fall into the sediment and

become trapped.

The Everglades Forever Act also outlines an extensive research and monitoring program to evaluate water quality standards

Water quality constituents (pollutants), including phosphorus, that violate state standards or are detrimental to the health of the Everglades will be identified. Existing water quality standards for the Everglades Protection Area and EAA canals are being evaluated.

In addition, efforts to find the source of mercury contamination in fish and other wildlife will be documented. December 2001 is the deadline for all research to be completed to determine the concentration of phosphorus that can enter the Everglades without causing an imbalance in the ecosystem.

All water entering the Everglades Protection Area must not exceed this standard by the end of the year 2006. This means that any modification or development of regulatory programs or any changes to the Everglades Construction Project (filtering marshes) must also be in place. In addition to treating agricultural runoff and mercury-poisoning monitoring, the STAs will also receive water previously directed into Lake Okeechobee and coastal estuaries. The water will be rerouted south and filtered through the STAs before discharging into the Everglades Protection Area. More high quality freshwater will flow into the Everglades and less untreated water will go to Lake Okeechobee and the estuaries.

An eastern park addition will be inundated to increase wildlife food sources.

3.3 Flora

3.4.1 Takeover of exotics

Maleleuca is an exotic species that was imported from Australia over a hundred years ago to help drain swampy south Florida. Its spongelike trunk did its job all too well; the species spread throughout the region without any encouragement.

Brazilian Pepper has been introduced in the past as a ornamental. He's been spreading out and proved to be a strong species.

3.3.2 Habitat destruction

The invasion of exotic flora and the nutrient- runoff from the EAA lead to loss of native habitats. These habitats now get more precipitive for exotic species.

Typha Latifolia (cattail) is an exotic bio-indicator. It shows the disturbance in the nutriënt-situation: there is too much phosphor in the water.

Measures

The Everglades Forever Act also prescribes a plan for exotic species control.

The Act requires the South Florida Water Management District to establish a biological monitoring network throughout the Everglades Protection Area and prepare a survey of exotic species coverage.

Additionally, the legislation directs the South Florida District to coordinate with federal, state and other governments in the control and removal of these plants.

The 'Hole in the Donut' project is part of the natural restoration plan and means the physical removal of exotic plants to restore the original vegetation.

Also, manuel removal of these exotics and aerial herbicide applications are being used.

3.4 Fauna

3.4.1 Takeover of exotics

Not long ago a new ealspecies has been seen in the the Everglades waters. The Asian swamp eal is an aggressive eal that feeds on just about anything, and it has no real natural enemy. This is a concern for the other species. The eal eats a lott and takes over habitats of other fish. It is very difficult to catch.

Animals like armadillo and raccons are exotic animals who live in the park. They also take over habitats of native animals. When they are caught, they are killed.

3.4.2 Extinction threat

The Manatee, who lives in the southside (Florida Bay) of the park, is a large, non-aggressive animal who grazes the ocean floor looking for seagrass. They have no natural enemy. Sometimes they are hit by boates, because they don't pay attention to them, and boates don't see them. There number is declining and they are threatened by extinction. The mercury levels aren't doing them much good; there might be a bio-accumulation of mercury appearent in manatees.

Because of all the changes in the park in his history and the large killing of wadingbird in the 1920's, birdspecies have declined over the years. Recent study shows that the number of birdspecies correlate to the abundance of sensitive birdhabitats. These are declining because of the interruption in the natural waterflow of the park.

Measures

In the park there are a number of research programs to monitor and restore wildlife. There is a 'Manetee Resque Team' active in Florida who also look after the manatees in the park. There number are being watched by researchers who collect sightings.

3.5 Evaluation of the problems

The restauration of the waterflow seems to be the key to the health of the Everglades, apart from the water quality, which can not be altered by changing the the waterflow.

The timing, distribution, and flow of water--hydropattern--are the elements to the waterflow.

All the (native)life in the Everglades seems to be depended on this.

Restauration of the historic waterflow is therefore the right measure for the problems that do not involve waterquality.

The mercuryproblem doesd not seem to have a solution at this time, since there is no good understanding what the source is of this problem.

However, where the real problem lies, is something different altogether. Wat are the the causes of the change of the waterflow? These are the drainage of the water by urban area's and the flow of the water that leads trough the agricultural area, enriching the water in its way. This is being done because the urban people need to be fed.

Restauration of the Everglades is therefore not so much a problem of environmental issues, as well an POLITICAL issue. It has been mentioned that the Miami agglomeration of 4 million

people is situated next to a delicate swamp/marine estuarium. This a situation that is bound to give problems.

Serious efforts for restauration cannot be included without dealing these political and community problems. South Florida has been (populational) a very fast growing area the last 50 years. This rapid growth has taken its toll.

If you look at the problem o a practical basis-- 1) urban drainage and 2) waterflow through agricultural area's-- you get a situation where the agglomeration of Miami should get there everyday needs (partly) from somewhere else. Also, a measure including halting the spread of the city and the rising population, has to be included in this solution.

Technically it should not be impossible to mimic the historic flow of the water with canals etc. The drainage could, to a certain point, continue, if this does not endangers the historic waterflow-simulation.

The STA's could work well filtering the enriched water from the EAA, but one has to admit that it is not a permanent solution, but a temperal one. Farmers should be aloud to farm there lands, as long as this does not enrich the water.

Of course, this is a very big step for the urban area, and really a more political issue then environmental or technical. If there has to be a compromise, it has to come from the people of Miami.

4 – MISCELLANEOUS

4.1 Demands for existence

The hydropattern--the timing, distribution, and flow of water--and the quality of the water is the key to the health of the Everglades and his problems. Everything depends on it, from the wildlife and vegetation to the people in the urban area's.

4.2 Literature

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