

## Everglades

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The Everglades are often called a river of grass: "grass" is actually sawgrass, a sedge, *Cladium jamaicensis*. This area is almost completely monospecific. The restoration of the Florida Everglades has created a lot of jobs in hydrology and environmental fields. The cause of the problem is the 5 million people living around the area, and agricultural developments. The soil in the Everglades took over 5000 years to develop, and has depleted in less than 100. This natural ecosystem has developed around Lake Okeechobee and runs all the way down to Florida Bay. The Big Cypress Swamp National Preserve takes in the west portion of the "ecological" Everglades.

The Everglades ecosystem occupies an area of 10,000 km<sup>2</sup> (1 million hectares). The grade going south on the peninsula is 3cm/km. The soil is peat over limestone. The peat is made up of decomposing sawgrass and was piled 20 feet high over the Everglades. This accumulating of peat began 5,000 years ago.

### Modern History

1881-Governor Bloxhaun 1st to decide that the Everglades needed to be cleared

- sold \$4 million of land along Kissimmee River to Hamilton Disston

- Hamilton cleared 50,000 to farm but a huge storm came and flooded his plans

1905-Governor Napoleon Bon Broward won the election on his campaign of "Drain the Everglades"

- started after the 1903 floods in the Florida Bay (the same ones that destroyed Disston's plans)

- developed the cut-n-dry method: drained water from the Kissimmee River through the Atlantic Coastal Ridge.

1926-1928-More floods came, but now people were living there so 2,500 people drowned

- Army Corp of Engineers called in to do it right: lowered lake level, built a 10 ft. levee all the way around it, built the St. Lucie Canal and kept canals open.

- started an agricultural boom with 500,000 acres farmed (300,000 are sugarcane)

1934-Sugar Act: protects the price of sugar and protects the expansion of sugar

1947-Floods again. Made a big mess, Army Corp Engineers came up with 20 year master plan: took charge to protect against flooding

- divided area into EAA (Everglades Agricultural Area), WCA (Water Conservation Area - pump water into the when floods came, able to hold the extra water. Built with huge dikes around them with collector canals draining out to sea), and then Everglades Park.

1970's-Environmental disasters questioned during this time, meanwhile 5 million people have moved into this area (recreational value).

1981-Governor Graham ran on the campaign of "Save our Everglades" and won. Put Restoration into the hands of the Army Corp of Engineers

1983-El Nino Floods: overtook WCA, massive outlets through Everglades Park

Major concerns: Water conservation areas are not really conserving water ( 90% of the water went to the Atlantic, 10% went to the Everglades). Flows needed adjustment, phosphorus in WCA from decomposing soils in agriculture areas and phosphorus runoff from sugarcane farmers, vegetation changing in WCA's and in the Everglades Park (*Typha* replacing *Cladium*). Base of food chain, Periphyton (mat of algae and bacteria: pond scum), first disappeared or changed to blue-green algae. Why? Blue green algae uses nitrogen better (can fix nitrogen from the air). Soil being depleted from the EAA, causing doubt for the agri future. The WCA's are no longer good wetlands, don't even support wading birds anymore. The canal banks invaded by Australian tree *Melaluca* colonizing flats. In the dry season, there are intense fires. Florida Bay has seagrasses and corals but it is becoming hypersaline (50-80 ppt) because it is a shallow evaporation basin, not receiving freshwater anymore. There has been large scale die offs of mangroves. 1980's die offs of seagrasses, which decreases food and habitat for endangered species: manatees, birds, and crocodiles.

### **Vegetation in the Everglades**

There are 830 species in all the ecological Everglades (not just in the Park). 8% of these are endemics (about 51 species). 17% are exotics. The plants are being introduced here from the tropics like the Caribbean and from the temperate regions. The three big groups of plants found here are grasses, cypress spp., and orchids.

1) Hammock (Upland) species = 1 to 2 meters above surrounding area

A) Slash Pine Forest: *Pinus elliottii*

-High understory (subcanopy) with pines, etc.

-Low understory (mostly endemics)

B)Tropical Hardwoods: Carribbean tropical type flora

2) Wetland Species

A) Aquatic Trees - ones that grow right in the water such as Bayheads, Willowheads, Cypress heads, Pond Apple. A large quantity of organic matter accumulates here, get a small island where soil forms.

B) Sawgrass Marsh - (*Cladium jamaicensis*) grows through open parts of the Everglades with a cycle of approximately five years by fire. (Note: sawgrass range is from Virginia to Texas.) The *Melaluca* plant has started to invade this area ( it was introduced in the 1920's from Australia). The *Melaluca* sucks up an enormous amount of water. The Brazilian pepper, an ornamental plant, has started to invade as well.

3) Sloughs = drainage channels

A) submerged plants: find manatees, alligators, tend to be more common in the South

Periphyton is the base of the food chain. Submerged plants are collecting points for silt and algae, which stick to plant stems to create periphyton. Periphyton is a mixture of algae and bacteria that floats in large mats. This is the key to productivity because little fish feed on the mats, which are eaten by big fish, zooplankton, etc. Larger species like birds and crocodiles are disappearing because periphyton is not able to grow. Periphyton can now only be found in the wettest areas.

Disturbances:

#### 1) Nutrients: Phosphorus and Nitrogen

Extra Phosphorus from sugarcane farms - original conditions were oligotrophic.

P= 0.03 ppm (P = phosphorus) Phosphorus was naturally low here so most is fixed in plants.

Historically, in WCA, P input came from rain (118 tons/yr.), and overland (11 tons/yr.) for a total of 129.

Presently, in WCA, P input still 118 from rain, but overland runoff gives 258 tons/yr for a total of 376 tons/yr. (most runoff from sugarcane farms).

Phosphorous is picked up by the soil and stored; this is bad because it promotes continued vegetation change for many, many years into the future. Phosphorous promotes cattail growth and eliminates periphyton mats. Cattail has now penetrated into the canals to Everglades Park.

#### Eutrophication: Nitrogen

Historically, in the Everglades, input from rain was 78 t/y and only 10 t/y for a total of 88 t/y.

Currently, rain = 78 t/y  
overland = 11 t/y  
total = 89 t/y

This has only increased a small amount.

2) Hydrology - The water is not managed the same way. Sheet flows are diverted to canals and releases do not follow natural cycles anymore.

3) Fire - Sawgrass is killed by intense fires and open water areas are created.

#### 4) Exotic plants Fauna problems:

- Upland animals are suffering from water fluxes (panthers, deer).
- Small fish are giving way to larger fish in Water Conservation areas; this is hard for wading birds that feed on small fish.
- Snail kite (bird) has had good luck in the Water Conservation areas. There are perfect conditions for this endangered species.
- Wading birds have suffered a nesting decline due to loss of periphyton mats.

### Restoration of The Everglades (job offerings)

- 1) Fixing Hydrology: adjust flow rate and how and where it goes through, instead of draining to ocean, allow it to drain through the park.
- 2) Fire: controlled burns, stop suppression of fires: let them burn
- 3) Control Exotic Plants: stop importation of anything new (control Melaluca)
- 4) Restore depth patterns
  - Natural Hydrology Model: took into account - rainfall patterns, sheet flow dynamics, and connections to hydrology
- 5) change agriculture
  - A) BMP's (Best Management Practices)
  - B) Sugar subsidies
  - C) Switch to aquatic plants- grow more things like rice and field crops
    - cut subsidies
    - aquaculture - fish farms
    - ornamental plant industry: aquarium plants

### Real Problems, Starting Solutions

Endangered manatees and panther from boats, cars, habitat destruction. Large animals, big home ranges, need lots of food.