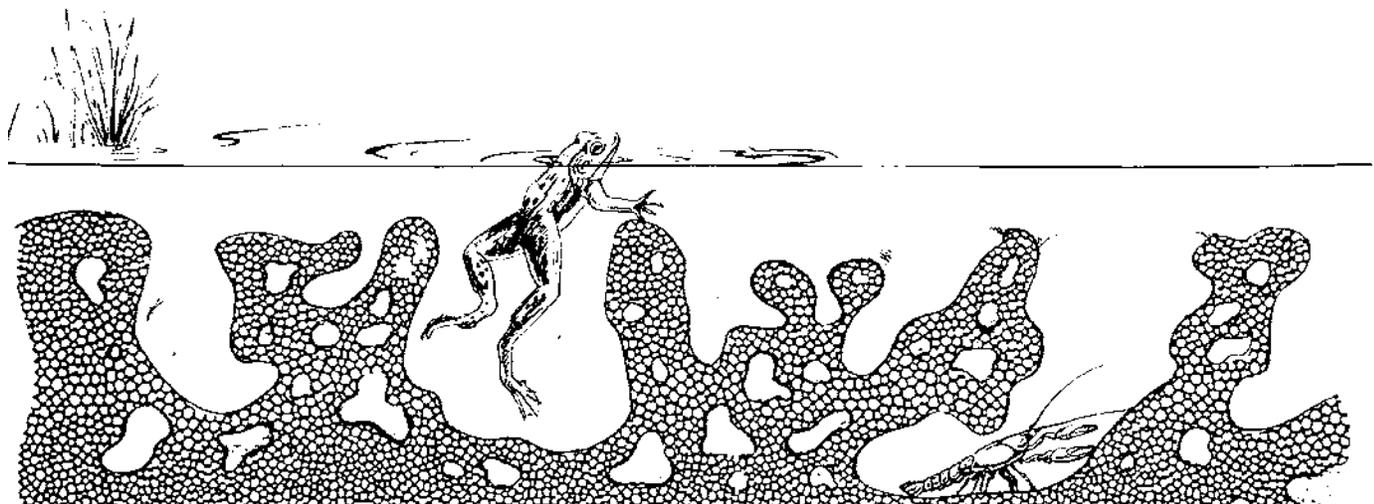


GEOLOGY

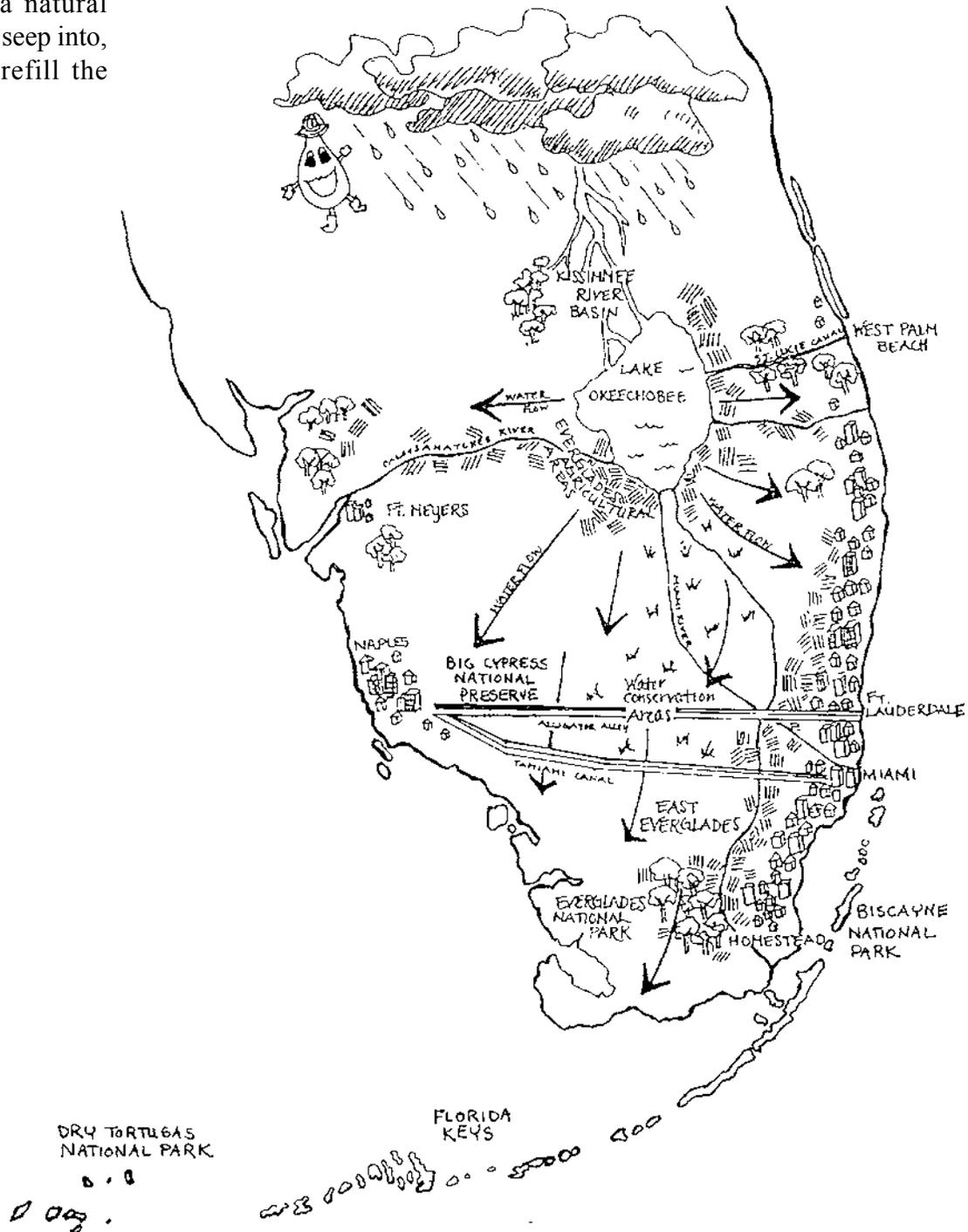
Geology is the scientific study of the origin, history, and structure of the earth. Geology includes the study of the layers of soil, rock, and minerals that make up the earth's crust. South Florida's rock formations are some of the youngest in the country, dating only to about six million years ago.

The flatness of South Florida reflects the fact that through most of its days a shallow sea has covered it. Over the last few million years, as global climates changed and glaciers advanced and retreated, Florida has been alternately submerged and exposed with the changes in sea level. At one point about 100,000 years ago, a 25-foot-deep sea covered South Florida! Underneath this sea, the coral reefs of the Keys and the limestone beneath Miami and much of Everglades National Park were being formed. Limestone is largely made from accumulations of shells and other skeletal materials of marine organisms. Examination of a limestone rock pile may yield shells from this once ancient sea.

Larger deposits of limestone were laid along the east coast of Florida, forming a higher "rim." This rim is known as the Atlantic coastal ridge and extends into Everglades National Park. Over time, South Florida's landscape was shaped into something that resembles a saucer, slightly tilted to the south and west. This tilt or slope is no more than a few inches to the mile, yet it played an important role in channeling the water flow more or less toward the southwest. All of this set the scene for the development of the freshwater wetlands we know as the Everglades, which once occupied the width of southern Florida. This shallow marshy river drifted slowly in a southwest pattern for 120 miles from Lake Okeechobee to the sea. The Everglades were created by the flat, tilted shape of the land, along with the abundant rainfall (about 60 inches/year) and the presence of slightly impermeable soils. Decaying algae and marsh grasses formed marl and peat soils which, in some places, filled pockets and accumulated on the rock. These soils slowed down the water seepage into the limestone, leaving standing water during much of the year. Water seepage into the limestone is very important as it is the source of our drinking water. Although the majority of water flowed to the southwest, to form the Everglades, there were also dozens of natural outlets to the east. These outlets were in the form of open rivers such as the Miami River; high-water rivers like the South Dade finger glades and underground "rivers" in the limestone which bubbled up in Biscayne Bay. Many canals dug in the 1950s by the U.S. Corps of Engineers followed the courses of these former streams which emptied into the Atlantic.



The limestone of South Florida has many small holes which allow water to move through it. When it rains, the water seeps downward into the rock, until all the air spaces are saturated (filled with water). The upper surface level of this underground water is called a table - the water table. This surface level, or table, can rise or fall depending on the amount of rainfall seeping in to fill the rock. Fresh water wells in South Florida need to be drilled deep enough to reach this water. If we have a dry season, the water table may go down, and the wells can go dry (no longer reach the lower water). This can also happen if we use too much water. The underground rock mass that holds water is called an aquifer. The limestone rock underneath South Florida which contains water is called the Biscayne Aquifer. It is the source of fresh water for all of South Florida and the Keys. The Everglades provides a natural way for rainfall to seep into, and recharge or refill the aquifer.



HYDROLOGY (South Florida's Water Story)

Hydrology is the science dealing with the properties, distribution, and circulation of water on the surface of the land, in the soil and underlying rocks, and in the atmosphere.

Past Everglades

To understand the Everglades today, you must first understand what it was like in the past - before humans changed it. Most people do not realize that the Everglades is actually a river system. Marjory Stoneman Douglas, a famous Florida environmentalist tried to teach people this concept in her book, The Everglades: River of Grass. She called it the river of grass because throughout much of the shallow river grew an unusual plant called sawgrass. In some areas, you could barely see the water because the sawgrass was so dense.

The story of the Everglades river begins near Orlando. There, the rainfall and springs filled lakes and creeks. The water emptied into the Kissimmee River, which in turn, emptied into Lake Okeechobee. When Lake Okeechobee was filled, water flowed out into small streams at the south end of the lake. It spread across the wide open flat land in a shallow sheet of slow moving water that traveled ¼ mile per day. The Everglades river was born! The Everglades river was a few inches deep, but up to 50 miles wide and 100 miles long, ending its journey in the Gulf of Mexico. There, the shallow, fresh water river mixed with salt water to create a brackish estuary, rich with marine life such as shrimp, lobster, crab, and fish. The Everglades river, or wetland, was once home to millions of creatures. It was perhaps best known as the home of the American alligator and huge flocks of wading birds (by some accounts numbering up to 2.5 million at one time). Fish, turtles, alligators, and other water species were abundant. They provided a source of food for the Seminole and Miccosukee people who lived in the Everglades. Because their population was small, what they harvested from the Everglades had little impact.

Present Day Everglades

Today, the Everglades is no longer a free-flowing river. The only part that truly resembles this “original Everglades river” is found within the boundaries of Everglades National Park and Big Cypress National Preserve, and is only 1/10 the size of the original wetland.

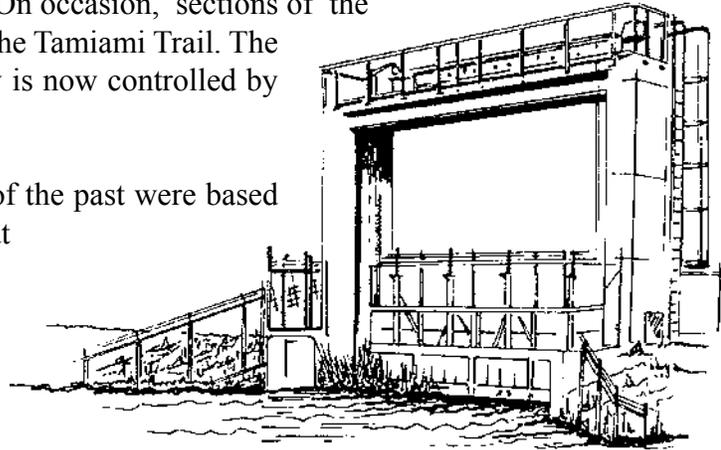
A levee (dike) now holds back the waters of Lake Okeechobee. The levee and canal system were originally built in the 1930's as flood protection for the people living south of the lake. Prior to the levee construction, thousands of people died and homes were destroyed from hurricanes and subsequent flooding. With the levee around the lake providing flood protection, not only were homes safe but it was also discovered that the area was composed of rich, muck soils ideal for agriculture. Here, thousands of acres of sugar cane and sod are now grown annually.

Not only has flood protection changed the water flow, but when European settlers first came to South Florida, they viewed the Everglades as a wasteland. They did not understand its importance to the region's watershed and wildlife. They began to drain the land to create dry areas for farming and for their homes. As more people moved here, more areas were drained. Today, five million people live in South Florida, and 1800 miles of canals drain most of the shallow river. This increase in population had another affect: on the high ground areas along the Atlantic Coast, pinelands and hammocks were destroyed to make room for

houses, and to grow tomatoes and other crops. Cities sprang up, requiring water for the people and water for irrigation to grow food. This increased demand accelerated the depletion of freshwater in the limestone aquifer - our source of drinking water! In Florida, when fresh water volumes underground are reduced, salt water seeps into wells, contaminating them.

Three huge reservoirs, or “human-made” lakes, called water conservation areas were constructed in the mid-1950s to trap most of the Everglades water and store it in the form of shallow lakes, rather than a river of grass. Levees and floodgates were built along the edge of these areas to move water in time of drought, and to prevent flooding. The water conservation areas also recharge the limestone aquifer as the river had done in the past. Some of the water from the water conservation areas is allowed to flow into Everglades National Park. On occasion, sections of the levees called “flood gates,” are opened along the Tamiami Trail. The amount, timing and distribution of water flow is now controlled by people, not nature.

Remember, the water management practices of the past were based on the limited knowledge of the resource at that time. As the knowledge grows, so too does the understanding of the resource and the ability to better manage water practices. The scientific community of South Florida is trying to recreate conditions of the original Everglades river. They want to restore the water flow across the land into Florida Bay and the Gulf of Mexico as closely as possible to its historic pattern. There are many challenges to achieving this goal.

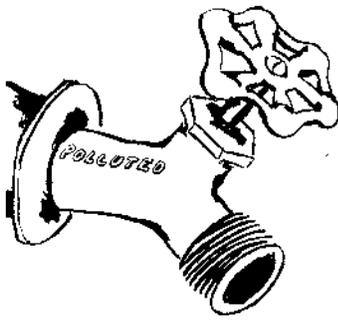


Water Quantity, Timing, and Distribution

The Everglades river or wetland provides water, food, shelter, and space for all of the creatures that live there. These creatures have evolved over thousands of years to survive in this shallow river. During the winter dry season, the river slows to a trickle. Many areas dry up except for the alligator holes and the deeper water channels (sloughs). In the gator holes and sloughs, large numbers of fish become concentrated during the dry season - providing rather easy meals for alligators and birds. This is the time of year when many birds nest because food is plentiful for their young.

Since the early 1960s, however, human release of water into the park has not always copied what “mother nature” would have done. The quantity, timing, and distribution of water releases can have serious consequences for humans and wildlife. To reduce flooding, much of the fresh water in South Florida is diverted by the canal system and ends up being dumped into the Atlantic Ocean. This reduces the amount available for use by the growing population. Dumping fresh water to tide also reduces the amount of water recharge to the aquifer, which increases saltwater intrusion into our source of drinking water. Finally, it reduces the sheet flow through Everglades National Park - not only affecting plants and wildlife here, but also reducing the amount of fresh water which enters Florida Bay. On the other hand, too much water released into the park during the winter dry season, can flood nests and make it difficult for wildlife to find the seasonally concentrated food sources they depend on.

Water Quality



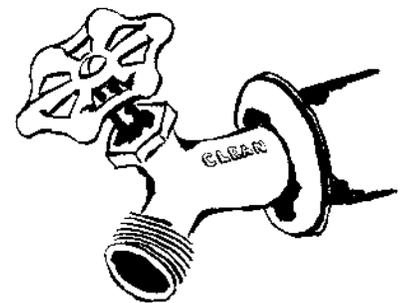
Scientists and rangers at Everglades National Park are also concerned with the quality of the water being let into the park from water conservation areas. These areas contain water that has flowed through large agricultural areas. This water can have high amounts of fertilizer, which contain nutrients like nitrogen and phosphorus. Increased amounts of these nutrients can change the types of plants living in the Everglades and, ultimately, the food chains found here. There is serious concern that polluted (nutrient loaded) water entering Everglades National Park could cause periphyton and sawgrass to be replaced by other plants, thus altering this last natural remnant of the original Everglades. Efforts by farmers, private and government agencies, and local citizens to restore the water to its original quality must be continued.

Future Everglades - Why Should You Care?

The Everglades “ain’t what it used to be” as old timers might say, and neither is Florida. With the human population increasing at a rate of over 800 people a day, and the current concerns about water quantity, timing, distribution, and quality, one of the greatest threats to the survival of Everglades National Park is the increasing demand placed on a limited supply of fresh, clean water. Today, only a small fragment of the natural system exists within Big Cypress National Preserve and Everglades National Park. Unless these park areas get the water they need, this last remnant of natural Florida will not survive. Water conservation, better water management, and control of urban growth, appear as three logical solutions to this problem. If the proposed solutions are not practiced, we could expect to lose several things:

1. We would lose a natural recharge system for water wells serving South Florida and the Florida Keys. Salt water will pollute wells as it seeps into them from the ocean. Drinkable fresh water will become more difficult and more costly to find.
2. Marine species may not survive in Florida Bay. If the bay becomes too salty because of a lack of fresh water, shrimp, lobster, crab, and fish populations may decline dramatically throughout South Florida and the Florida Keys. The cost for scarce seafood would skyrocket and the fishing industry would suffer.
3. Without water for the Everglades, many species will abandon the area or die out. This would make our lives unstable, and a little less rich. Each time a species becomes extinct, we lose a source of potential medicine, food, beauty, inspiration, and a fellow passenger of spaceship earth.

Three ways we can all help is by paying attention to our water use, by not polluting, and by educating others. Conserving and not wasting water will mean there is more to go around. Similarly, if we keep the water clean, we will have more for everyone to use. Simply by reducing our use of harsh chemical cleansers we can reduce the chance of polluting the water system. For more information on ways to conserve water, or keep it clean, see the references and agency contacts in the “Resources” section. Finally, by teaching others about this unique Everglades ecosystem which we all depend on, we can help spread the word for its protection.



Follow-up

South Florida National Parks are presently working with many partners throughout Florida: the Miccosukee Tribe, U.S. Army Corps of Engineers, South Florida Water Management District, Dade County Department of Environmental Resource Management, Florida Department of Environmental Protection, National Marine Sanctuaries, the Governor's Office, and environmental groups, to name a few. Their goal is to return the water flow to its historic patterns of quality, quantity, timing, and distribution.

To fully explain the Everglades water system or hydrology in a few pages is impossible. Please refer to the resource materials and bibliography in Appendix E to supplement this complicated story. The publication entitled, "Dade County Environmental Story" has an excellent section about the Everglades ("When the Well Runs Dry").

SOUTH FLORIDA HABITATS



A habitat is an animal's home. It can be any size as long as it provides enough food, water, shelter, and space in the proper arrangement, for the animal to survive. Since food, water, shelter, and space are determined by the association between the plants and the amount of water available in an area, the habitats described here correspond to the "ecosystems" on the national park map, which have been labeled as separate ecological units in terms of their plant communities and hydrology. Many animals in South Florida use more than one of these ecosystems (habitats).

The interior land mass of South Florida is known as "the Everglades" and the "river of grass" because much of the southern part of the state was covered by a slow moving river of water dominated by sawgrass. However, this freshwater, grassy wetland contains much more than just sawgrass, and South Florida contains much more than just wetlands. South Florida has a combination of habitats unique in the world. It includes: sawgrass prairies, freshwater sloughs, cypress communities, bay heads, hardwood hammocks, and pinelands. In addition, where the freshwater river flows into the sea, there is a vast estuary with mangrove forests and seagrass beds. Extending off the coast of South Florida are tropical islands and a marine environment which includes one of the largest coral reef systems in the world. All of these habitats make up the mosaic of South Florida, and examples of them are preserved within our four national parks: Everglades National Park, Big Cypress National Preserve, Biscayne National Park and Dry Tortugas National Park. Following is a brief description of the freshwater wetland, high ground, and saltwater communities that students should be familiar with.

Freshwater Wetlands

Often called "the glades" and referred to by Marjorie Stoneman Douglas as "the river of grass," at one time were fifty miles wide and extended from Lake Okeechobee to the mangrove estuary. This area was covered by water flowing in a southwesterly pattern at about 1/4 mile per day. Today, less than half of these wetlands remain. Included in these wetlands were sawgrass prairies, freshwater sloughs and cypress communities.

Sawgrass Prairie or Marsh

In fact, sawgrass is not a grass at all, but rather a sedge that gets its name from the tiny sharp saw-like teeth attached to the grass blade. The sawgrass prairie, approximately two feet deep, begins a slow drying process in the late fall and throughout the winter. Sawgrass prairies are usually dominated by sawgrass, but contain a mix of other wetland plants depending on the length the area is underwater each year (hydroperiod). The prairie refloods each summer during the rainy season. When the water level rises, an algal mat (periphyton) begins to grow. Once the periphyton begins to float, it supports many complex food webs. Also important to the food webs in the sawgrass prairie is detritus; the decaying layer of stems and leaves of aquatic plants. Tiny creatures feed on the algae mat and detritus. In turn, small fish and frogs feed on these creatures. The fish and frogs are then food for birds, mammals, reptiles, and larger fish. The decaying algae and plants form marl and peat soils, which slow down the water seepage into the limestone, leaving standing water above ground. As the water level drops during the winter dry season, small pools of water remain in the river of grass, trapping thousands of fish and aquatic invertebrates. These small pools provide an excellent feeding area for migratory birds that spend the winter in South Florida.



Freshwater Slough

The wide, deeper channels of water within the “river of grass” are called sloughs (pronounced *slew*). Sloughs are the main avenues for water flow through the Everglades, and form deeper marsh communities. Water lilies float on the surface. Anhingas swim in the dark waters. Sloughs are special places in the Everglades and Big Cypress landscape because they hold water even during the South Florida winter dry season (except during extremely dry years). In the dry season, animals swim, crawl, walk or fly from other habitats to be near the life-sustaining waters of the slough. There are two major sloughs in Everglades National Park. The largest is Shark River Slough, which empties into the Gulf of Mexico and Florida Bay. The smaller Taylor Slough empties directly into Florida Bay. Historically, the rising wet season water levels in the two sloughs caused their waters to meet and flow together (overland sheet flow). Today, because canals divert the water, that connection no longer exists. One of the goals of Everglades restoration is to re-introduce the natural sheet flow.



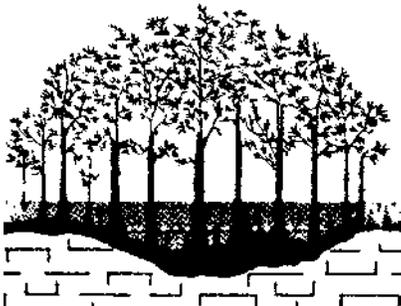
anhinga

Cypress Communities

The cypress tree is a deciduous (shedding its needles each fall) conifer, closely related to the redwood and sequoia trees of California. The seeds grow in muddy areas, but as they become trees, they can survive in standing water. The base of the tree, called a buttress, can be as much as six feet across. This helps the tree’s root system support itself in the somewhat shallow soil in which it grows. This tree has “knees”! The knees are actually a part of the root system extending above the water near the base of the tree. Scientists are unsure of their function, but theorize that they help with structural support of the tree.

Cypress trees can be found in several areas. Growing in the open sawgrass prairie, the trees appear to be dwarfed, but may, indeed, be older than much larger trees growing in different areas. Sometimes a group of trees take the shape of a “cypress dome.” These domes have a slightly lower elevation and are almost circular in shape. The larger trees grow in the center, creating a “dome.” The greatest concentration of cypress trees occurs in the cypress slough. These large channels contain deeper and perhaps richer soil. Large cypress sloughs are found in the Big Cypress National Preserve. The water in the sloughs flows from the north to the southwest. During the summer wet season, the water may be three feet deep. These deep cypress sloughs are home to giant trees that are well-adapted for life in the water. Wood from these giants was prized for its durability and was harvested in the 1930s and 40s. What remains today is second growth. The cypress trees in Everglades National Park and Big Cypress National Preserve are now protected. Miccosukee people are the only group harvesting the cypress tree in Big Cypress National Preserve, using the tree trunks for constructing their homes and for the business of building traditional chickees.

Wherever cypress trees are found, you are likely to see bromeliads, orchids, and other epiphytes (air plants) attached to their bark. These plants do not harm the tree. They are able to gather nourishment from the air and only use the tree bark as an anchoring place. Many of the same animals that inhabit the sawgrass marsh and the slough use the cypress communities. Alligators and Florida gar fish swim in their waters, vultures perch on their branches, black bears claw crayfish from the sloughs, and an occasional Florida panther leaves impressive paw marks in the wet marl. In the winter dry season, the cypress sloughs provide food for wading birds- herons, egrets, ibis, limpkins, and wood storks. If you are lucky, you may see a mink, wild turkey, deer, or a bald eagle.

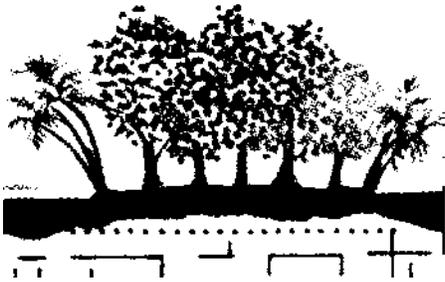


High Ground Communities

Scattered throughout the freshwater wetlands are tree islands. In addition, along both east and west coasts of South Florida are elevated ridges. These high ground areas are typically drier for longer periods of the year than the adjoining wetland, and are usually described by the dominant type of tree (see below) in them. Tree islands and ridges add value to the surrounding wetlands by adding habitat diversity. They provide dry resting places and protective cover for wildlife. They may also serve as roosting and nesting sites for birds.

Bay Heads

Bay heads are the most common type of tree island seen in the Shark River Slough. Trees growing in the bay heads primarily include: red bay, which has an aromatic smell and can be used as a spice; sweet bay magnolia, which has a pretty cream-colored flower; cocoplum, which has rounded leaves and an edible fruit; and wax myrtle, whose berries have a waxy coating that when melted down, can produce fragrant candles. Bay heads occur on mounds of peat (decayed organic matter) soil that are one to three feet above the surrounding marsh. Often this peat soil fills depressions or cavities in the limestone bedrock. The origin of bay heads is a mystery, but some may have been started by alligators. When alligators dig holes in the muck, over the years wetland trees can take root where the alligator has piled up soil. From the air, the trees would look like a ring around a central pond.



On the perimeter of bay heads are shallow moats. It is thought that acids from decaying plants dissolved away the encircling limestone, creating a deeper and less densely vegetated area of marsh. It could also be that alligators patrolling the edges of the tree island, keep the area clear of soil and vegetation. In any case, if a fire were to come through the marsh, the moat would help keep the fire from entering the tree island. Alligators seem to be closely associated with wetland tree islands - whether they helped create the island, or are just using

one for a den or nest. Alligator holes are often located within tree islands and provide a refuge in the dry season for fish, snails, turtles, and other animals. In turn, birds, river otters, and snakes will come to the alligator hole to find food. (Note: Another type of tree that takes root in disturbed areas like alligator holes are willows - which prefer lower and wetter elevations than the bay head plants. This type of tree island would be called a “willow head.”)

Hardwood Hammocks

The word hammock is used to describe a dense, jungle-like forest with a variety of trees. Hardwood refers to the prevalence of broad-leaved trees (versus pines, which are softer wood). North of Miami, hardwood hammocks are dominated by temperate species like live oak, red maple, and hackberry. South of Miami, hammocks are predominantly tropical species such as mahogany, gumbo limbo, coco-plum, and wild tamarind (see the end of this section for descriptions of four of the interesting trees of the hammock). Seeds or spores of tropical plants arrived upon Florida’s shores in the currents of the Gulf Stream, on the winds of hurricanes, or in the bellies of birds from the Caribbean. Hardwood hammocks occur on elevations that seldom flood during the summer rainy season. In South Florida, hammocks can be found within marshes, pinelands, mangrove swamps, and on the Florida Keys.

The tall trees inside the hammock create a shaded wonderland, allowing small patches of sunlight to filter through the canopy. The high humidity and shade of this environment provide the perfect growing atmo-

sphere for ferns and air plants. The ground underfoot is soft and spongy from the accumulation of decades of fallen leaves. Native people, including the Calusas who lived here long ago, often set up camp in the cool, shady hammocks. The habitat is an attractive one for people. Many of the hammocks that once dotted the Atlantic Coastal Ridge have been destroyed by humans, who changed the vegetation as the city grew.

A further threat to hammocks is fire. Fire may help other plant communities in the Everglades, but it can destroy a hammock. Luckily, the high humidity and low level of understory fuels can help prevent fires from entering the hammock. Hammocks which occur as tree islands in the Everglades marshes are protected by a natural moat - made by acids from decaying plants dissolving the limestone. The moats hold some moisture during the dry season, which helps protect the hammock plants from fire.

Just as the trees are tropical, so are some of the animals found in South Florida hammocks. Zebra butterflies patrol the air. Tree snails, close relatives of snail species that live in Cuba, thrive here. In addition to the tropical animals, hammocks provide habitat for bobcats, panthers, raccoons, mice, rabbits, foxes, owls, lizards, snakes, and song birds. There may also be plenty of insects, including mosquitoes!

Interesting trees to look for in the hammock:

Gumbo limbo tree- A bright red, peeling, smooth bark gives this tree excellent identification marks. It is sometimes called the “tourist tree” since the red peeling bark resembles a sunburned visitor, unaccustomed to the intense South Florida sunshine. The dark green leaves are in compound sets of five. It extends its root system into the limestone sink-holes of hammocks, where it grows. When strong winds, like those of a hurricane, topple the tree, it will often resprout from a broken branch that has fallen onto the ground. It is especially widespread and common in the West Indies and it also grows in Central America. There, the cut limbs are used as fence posts, which often start growing into a living fence!

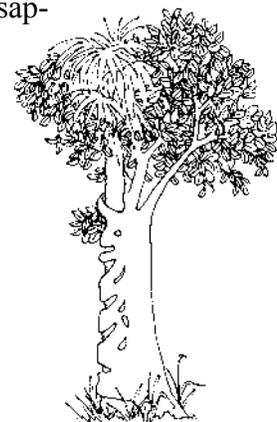


gumbo limbo



Sabal palm- This palm is the state tree of Florida and is also called the cabbage palm. It gets its name from the center, or heart, of the palm. When harvested and cooked, it tastes like cabbage but it should be noted that this practice kills the tree. It was survival food for many early Florida pioneers. The palm fronds are woven and used as roofing materials for traditional Miccosukee homes called chickees. Raccoons, opossums, and birds feed on the palm seeds. Today many of the Sabal palms are disappearing from the wild because developers are digging them up to use for urban landscaping.

Lysiloma- Lysiloma is a smooth-barked tree with light green, compound leaves. The greenish-yellow, powder-puff flowers that appear in the summer provide food for a number of flying insects, while the lichen growing on the tree’s bark is food for the liguus tree snail.



strangler fig

Strangler fig- Life for this tree begins like most trees, as a seed. After the red fruit is eaten, it is carried away in the belly of a bird and digested. After digestion the seeds

are usually deposited in the crevice of another tree, not on the ground. The strangler fig seed sprouts in the crevice and sends out a thread-like root that travels down the trunk of its host, eventually making it to the rich, nourishing earth below. The strangler fig starts to grow, eventually squeezing the host tree out of the way and taking over its spot in the limited space of the hammock. The dark green leaves are alternate, and the fruit, originally green, ripens to red. White sap oozes from the leaves and branches when cut.

Royal palm- This majestic tree grows to 100 feet tall. Its gray trunk resembles a cement pillar. Pileated woodpeckers drill holes in its trunk and use it for nesting. The park's most visited area was named for this giant, and is the best area to view the trees. You may also see them planted along streets and medians. The royal palm is one of eight tree size palms native to South Florida, where they are protected from the killing effects of northern Florida's occasional freezing temperatures. Although not native to the Florida Keys, many royal palms have also been planted there.

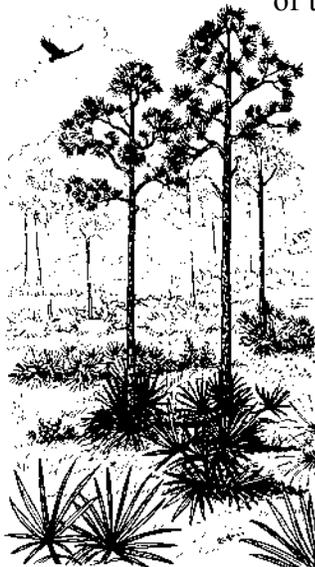


royal palm

Pinelands

Historically, pinelands covered the elevated, limestone ridge along the east coast of South Florida, where Ft. Lauderdale and Miami are today. Due to habitat destruction, pinelands remain on only a small percentage of the total mainland area of South Florida, and are considered an endangered ecosystem. Today, pinelands can be found along the main park road through Everglades National Park and on elevated patches of limestone in Big Cypress National Preserve. Pineland elevations vary from being underwater 2-3 months of the year, to being dry year round. The terrain of the pinelands is rough and rugged where years of erosion have unevenly shaped the limestone bedrock with holes and cavities, making walking difficult. Throughout the jagged surface are small pockets of soil where the pines are rooted.

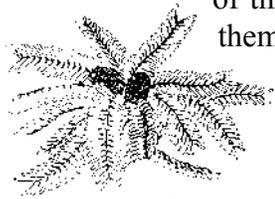
Pinelands contain a high diversity of plant species, but the dominant plant in the pinelands is the slash pine. Slash pine got its name from the once common practice of extracting sap from the trees by cutting diagonal slash marks in the trunk. Sap draining from the cuts was collected in buckets (similar to maple sap collecting to make syrup) and used to make turpentine and other products. In Dade County, a common name for the special variety of slash pine growing here is the Dade County pine. Most of the pine trees in Everglades National Park are second growth. The original trees were harvested in the 1930s for use in the booming construction industry. Many of the older homes in Dade County (Miami area) were made from this lumber. The large amount of resins stored in the older trees made the wood very dense so it is termite resistant and difficult to drive a nail into.



One condition essential to the survival of the pine forest is fire. Fire gives life to the pineland community by removing the hardwood trees that would shade out the pine seedlings. Pines produce cones each year. High up in the branches, the cones open each fall to release seeds. Pine seeds have a papery wing attached to them that allows for wider distribution by the wind. They flutter down from the parent tree and if deposited in an open space, will germinate and begin a new life. Historically, the regularly occurring wild fires in the Everglades limited the amount of hardwood trees growing in pinelands. The hardwood trees cannot survive a fire (they are fire intolerant). The pine on the other hand, is able to

survive a fire. It is a fire tolerant species. Its thick, multi-layered bark provides built-in protection. When fire comes through the forest, it burns only the outer layer of the pine tree bark. Plus, the needles and cones of the pine are held high up in the tree, away from the heat of the low spreading flames. Without fire to control the spread of hardwoods, pinelands would eventually become hardwood hammocks.

Growing among the pines are many other fire tolerant plants including sabal (cabbage) palms, saw palmettos, small shrubs, and an array of wildflowers. The fern-like coontie plant is one of the more famous residents of the pinelands. The Miccosukees and early settlers collected the roots and processed them into starch for bread making. Coontie is the only plant on which the endangered atala butterfly will lay its eggs. Pinelands provide habitat for many other invertebrates - scorpions, beetles, ants - as well as animals such as mice, rabbits, raccoons, panthers, deer, snakes, lizards, foxes, bobcats, hawks, woodpeckers, owls, and song birds.



coontie

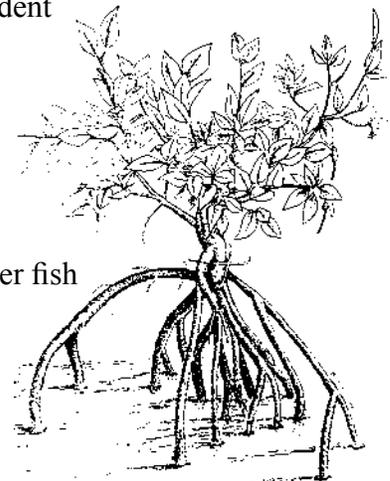
Saltwater Communities

A significant percentage of South Florida national parks are under saltwater. Much of that area includes shallow inshore waters such as Florida Bay, Chokoloskee Bay, and Biscayne Bay, as well as the shallow salt waters surrounding the Dry Tortugas. Florida Bay, the largest of the bays, is an 850 square mile shallow (average depth is 4-5 feet) estuary south of the Florida Peninsula, where the Everglades “river” drains into the ocean. It contains a rich environment diverse with life, and is an important “nursery” for many marine species. The saltwater communities of South Florida may contain mangrove forests, coastal prairies or coral reefs.

Mangrove Forest

The mangrove forest gets its name from its three most common residents - the red, black, and white mangrove trees, which tend to grow in zones from the saltwater inland. On the forest’s outer fringes are the water-loving red mangrove. It is easily recognized by its “walking” stilt-like roots. It can survive growing in saltwater because of two important adaptations: its salt tolerance, and the ability of its seeds to germinate and begin to grow while still on the parent tree. It has small, yellow, waxy flowers and produces seeds that look like miniature cigars. These seedlings float, and then lodge themselves and take root at the first opportunity, whether it be directly under, or miles away from, the parent tree. Black mangroves tend to grow inland from the red mangroves and have root projections called pneumatophores that must be exposed to air. Therefore, these trees are best suited to areas with a tidal change that allows for their roots to breathe. The white mangrove is found toward the interior of the mangrove forest where the ground is higher and drier. Even further inland, but not called a mangrove, is another common resident of the mangrove forest - the buttonwood tree.

Mangrove leaves play an important part in the nutrient cycle of the estuary. When a mangrove leaf falls into the water, within forty-eight hours it becomes part of the underwater food chain. As bacteria, fungi, protozoans, or nematodes consume the leaves, a byproduct called detritus is formed. In turn, fish, shrimp, lobster, and snails feed on the detritus. Of course, larger fish and shellfish then feed on these small fish and snails. At the top of such a food chain are some truly impressive creatures, including sharks, tarpon, and crocodiles. In addition to being a critical food source, the mangrove estuary system is a valuable nursery ground for shrimp, fish, and other sea life as the mangrove roots and seagrass beds provide cover and food for



mangrove

their young. The estuary also provides a mix of fresh and saltwater which many juvenile marine organisms require before being able to move out into the higher salt concentrations of the ocean. The productivity of the system depends on the right amount of fresh water flowing from the interior Everglades.

During the drying winter months, thousands of wading birds come to South Florida to feed on the concentrated abundance nature has to offer. It is here, in the mangroves, that many of these birds find suitable roosting and nest sites, flying in to the drying marshes to feed. Since the mid-1970s, the wading bird population has declined in the park. The reasons for the decline lie, in part, with human changes to the hydrologic system. Increased water in the dry season will disperse the fish that the birds so desperately depend on to feed their young. Reduced amounts of fresh water in the wet season raises the salinity levels of the estuary to detrimental levels.

Some of the other animals that live in the mangrove estuary include Atlantic bottlenose dolphin, who hunt for schools of silver or striped mullet; the American crocodile, who feeds on fish along the mangrove shorelines, and like the loggerhead turtle, lays its eggs on the beaches and on shell mounds; as well as some of the more unusual marine organisms like sponges, pipefishes, seahorses, sea cucumbers, horseshoe crabs, conchs, and oysters.



Coastal Prairie

Mixed in with the mangrove forests are open areas of grasses, shrubs, or scattered trees. These openings in the mangroves are usually from some sort of disturbance - hurricane, fire or human-made. Still saline, they are mostly open and sunny areas which might contain sparse mangrove and buttonwood trees, and low growing plants such as saltwort (a yellow-green, ground cover), sea daisy, glasswort, and/or sea purslane.

Seagrass Beds

Vast meadows of seagrasses, most notably turtle grass, carpet the bottom of the inshore waters surrounding the tip of South Florida, as well as the shallow waters at Dry Tortugas. They are not primitive algae like the seaweeds, but are more advanced flowering plants. Turtle grass, for example, produces dainty, cream-colored, pink-spotted flowers, which develop into pea-sized fruit.



Seagrass beds are important to marine ecosystems in many ways. Some creatures, like green sea turtles and manatees, feed directly on seagrasses. Most animals, however, are more dependent on the dozens of species of algae which grow on seagrass blades. The algae are eaten by tiny marine organisms, which in turn are consumed by larger predators. Like the mangroves, as seagrasses decompose, detritus is formed and is eaten by shrimp, lobsters, crabs, mollusks, worms, and small fish. These are then eaten by even larger predators.

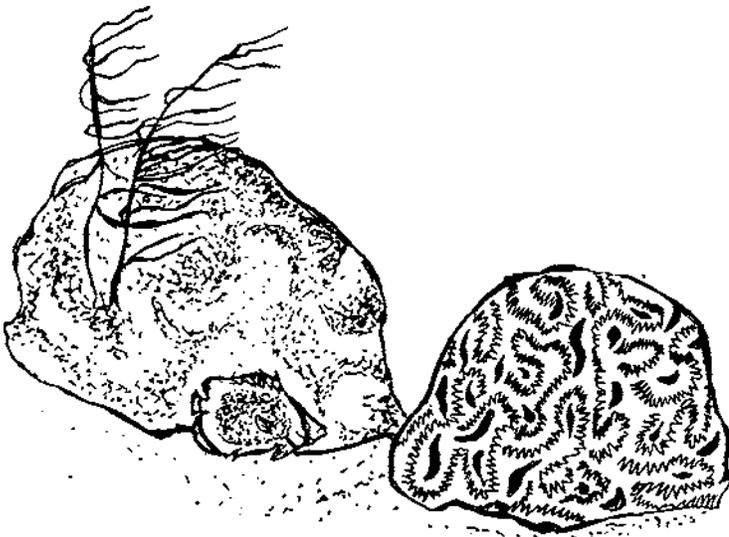
Park researchers are concerned because thousands of acres of seagrass have died in Florida Bay. This die off has seriously affected other members of the food chain. Increased salinity of the bay caused by diverting fresh water from the Everglades is suspected of weakening the seagrass, making it susceptible to invasion by a fungus. Hypersalinity is also suspected of decreasing reproductive success in some marine animals. Restoring the Everglades fresh water may be a key to preserving these marine species. Our efforts to preserve the quality of these waters will ensure the survival of the diverse life that makes seagrass beds so magnificent.

Coral Reefs

The actual builders of these fringing reefs are small primitive animals called polyps. Over centuries, polyps

accumulate in living colonies that form the reef's rigid structures so often misconstrued as rocks. The reef complex supports a wealth of marine life. Multicolored sea fans sway gently in the currents. Sea anemones thrust their rose and lavender tentacles upward in search of food. Lobsters, anticipating danger, wave their antennae. Sponges dot sandy bottoms, and staghorn coral clusters simulate underwater forests. Most obvious among coral reef inhabitants are the colorful reef fishes. Vivid, boldly-patterned reds, yellows, greens, and blues work as camouflage, identity, warning, and courtship messages. Predatory fish include amberjacks, groupers, wahoos, tarpon, sharks, and barracudas.

Not only are reefs colorful, supportive ecosystems, they are also very fragile. Fish and animals can be injured and killed by trash in the water. Illegal fishing removes key breeding stock from the population. Boats running aground on coral reefs can destroy years of polyp development. Touching coral may open the way for disease. Some of our actions can cause great damage - park managers enforce regulations to ensure a balanced ecosystem for future generations. Please use forethought and care to help preserve and protect our fragile reef systems.



FIRE & HURRICANE

The natural Everglades was shaped not only by the geology and hydrology of South Florida, but also by natural disturbances like fire and hurricanes. Park managers and scientists study the effects of disturbance on the ecosystems of South Florida to better understand how they effect the plants and wildlife.

Fire in the Everglades

In 1960, there was a true story circulated about a little bear cub who survived a forest fire in New Mexico. While fire raged below him and destroyed his forest home, the cub survived by clinging to a treetop, from which he was rescued. Although badly burned, he was nursed back to health and named “Smokey.” Soon “Smokey Bear” became the national symbol to stop all fires from burning on wildlands.

Today, most scientists agree that the “Smokey Bear” approach to wildfire isn’t entirely correct. Not all fires on wildlands are harmful. Although fire can change the landscape, it is also a natural part of a healthy ecosystem. For example, in the Everglades lightning causes dozens of wildfires annually, but only a few become large fires. Before humans lived in South Florida, wildfires would burn until rain put them out, or until the fire ran out of good dry fuel. A fire starting in sawgrass will burn away layers of dead and living grass until it reaches the edge of a wet slough or stream. The ashes from the dead grass become a type of fertilizer, adding nutrients to the soil. This fertilizer helps new sprouts of sawgrass grow from underground roots that were protected from the fire. Young sprouts of sawgrass are tasty treats for deer and other animals.

In pineland areas, many plants, are fire-resistant. The slash pines are protected by layers of insulating bark. Under tall pine trees, the fire removes other “invading” plants that shade out young pine trees. Fire opens up areas to receive the sunlight necessary for the young pines to sprout and grow. Without carefully managed wildfires, some species of plants would die, and so would the animals that depend on them. When natural fires do not occur frequently enough and “invading” plants shade out the young pines, rangers come in and intentionally set fire to certain areas to allow new growth to take place. These carefully controlled, intentionally set fires are called prescribed burns.

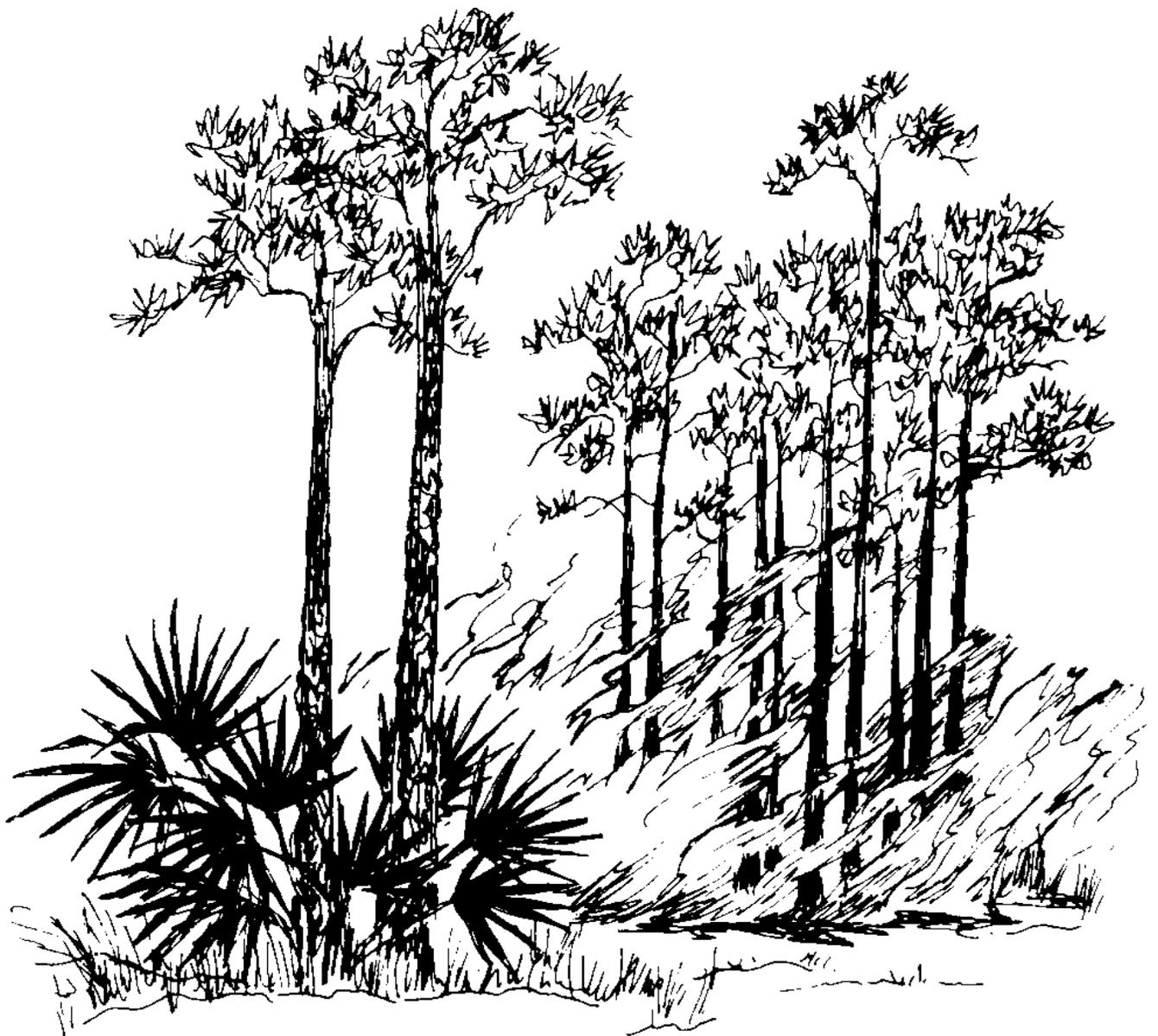
Fire is as natural as lightning or thunder, when it is started by nature and not by careless humans. Fires started by careless humans, or wildfires threatening lives or property, are usually put out. Any fire, no matter the origin, whether it be caused by lightning, prescribed burn, arson, or accidental fire, can do a lot of good, a lot of harm, or neither. It depends on many factors. Scientists studying fire and its affects on the environment are trained to make informed decisions. Always remember, as Smokey said, “Don’t Play With Fire,” and “Be Careful With Fire.” Only you can prevent unwanted wildfires!

Hurricanes

As with fire, hurricanes are a natural element in the shaping of South Florida’s landscape. The season for hurricanes is from June - November (the wet season), with the peak being between mid-August and November. Hurricanes bring salt water inland over coastal shorelines. They also can bring heavy rains and winds, causing flooding and snapping off tree tops. Although the effects of hurricanes on wildlife and plants is still being studied, it is believed that the rains and the storm’s high tide may “flush” out shallow inshore waters, carrying away accumulated sand and debris. Trees like the gumbo limbo seem to be adapted to hurricanes,

since their branches can break off and resprout when they fall to the ground. Animals seem to have many ways to survive the storm- burying into the ground, flying out of the area, or taking cover.

Just as with fire, hurricanes have been occurring in South Florida for thousands of years and the plants and animals living here are adapted to survive in a hurricane-prone environment.



Native Peoples



South Florida has been inhabited by people for thousands of years. Village and encampment remains of the Tequesta and Calusa peoples have been found along the major rivers, as well as the coastal islands. Unfortunately, little is known about these people and their descendents. Native peoples currently living in South Florida are the Miccosukee and the Seminole. The story of their journey to the Everglades is told here.

The Miccosukee originated from the Lower Creeks of the Georgia and Alabama region. The Lower Creeks were a group of various tribes that lived together in peace and spoke *Mikasuki*. The tribes lived in their ancestral lands until the Europeans arrived in the 1500s. With the arrival of the English, French, and the Spanish came diseases and greed for the land. The Miccosukee's world as they knew it was about to be destroyed.

To escape contact with the Europeans, the Miccosukee moved down into Florida. They were familiar with Florida due to previous hunting adventures. The tribe was able to settle down within the Apalachee Bay region. Here the tribe lived in a large "family" village. The tribe grew corn and hunted. They were able to live in peace until the beginning of the 1800s with the ending of the American Revolution.

White settlers looking for the land of plenty pushed their way into Florida. In 1821, the United States was able to convince Spain to sell Florida. The tribes of Florida now had to deal with the United States, which at that time believed Native Americans were "in the way of progress." Fighting soon began with the new settlers. The various tribes that moved into Florida got together to fight the intruders. This grouping of tribes which included the Miccosukee later became known as the Seminoles. The Seminoles also adopted runaway slaves, which did not help their relations with the slave owners of the South.

Due to increasing fighting between the native peoples and the settlers, the United States sent in soldiers to negotiate a treaty. The U.S. wanted to centrally locate all the native peoples into one area which resulted in the treaty of "Moultrie Creek." The Seminoles did not give their consent for the treaty to be signed. They viewed this as an act of trickery which led to the famous "Seminole Wars."

The Miccosukee and the Seminoles fought two wars with the United States. The First Seminole War was in 1822-23, with the treaty of "Moultrie Creek." This war was about being forced out of their lands and being made to live on a reservation in Central Florida. The Second Seminole War dealt with increased settlement within and around the reservation and the Indian Removal Act. By the 1830s, there was not enough "free" land left to be settled. What was termed "free" land was being used by the native peoples of that region. The United States devised a plan that would solve the "Indian problem." The Indian Removal Act of 1830 was passed by Congress as a way to rid the East of Native Americans. The Act stated that all Native Americans had to move west of the Mississippi River. The Seminoles and the Miccosukees were not going to leave and stayed to fight for their land. The Second Seminole War lasted from 1835 to 1842. From 1855 to 1958, the Seminoles fought deportation to the West and loss of land and tribal unity. The Miccosukees hid from soldiers within the Everglades, which prevented them from being deported.

Adaptation was the key to the Miccosukees' survival. They had to learn to live in small family units instead of large villages. The various families within the tribe lived in hammocks and traveled throughout the Everglades in dugout cypress canoes. Corn, their main staple, was hard to grow, so they relied on native fruits such as the coontie and the cabbage palm. The men still continued to hunt game like the white-tailed deer and gar fish and bass. The women planted pumpkin and squash.

The family structure is one of a matrilineal society. This means that name and property belong to the mother's side of the family. The boys played with canoes and bow and arrows. The girls played with canoes and dolls. The dolls would be made out of palmetto fibers. The aunts and uncles on the mothers side helped to raise the children. Storytelling was done by the elders as a means to teach the children the morals of the tribe and to explain the ways of nature. This was also a time to bring families together.

The Miccosukee People lived in chickees. There would be a cooking chickee, a chickee for sleeping, a chickee for socializing and a chickee for eating. The design of the chickees was open-sided with a raised platform that protects the Miccosukee from flooding. Cypress trees were used to make the poles while the roof was thatched with palmetto fronds. Each village would have a small garden. Cooking utensils were carved out of wood, and baskets were woven out of native vegetation such as sweet grass, willow and palmetto fiber.

The women would make clothes for their families. Men wore long shirts and the women wore long skirts, shirts, and capes over their shoulders to protect them from mosquitoes. With the introduction of the sewing machines from the early settlers, the Miccosukee women began to sew wonderful designs. Each design represented some aspect of their environment such as an alligator, frog, fire, and many more. Miccosukee designs are well know within the Indian community. Modern day designs show the creativity of the designer by mixing traditional designs with new fabrics.

In 1962 the Miccosukee became a federally recognized tribe. This gives the tribe the right to be self governing. The tribe does have a reservation with its own governing body called the Miccosukee General Council. This Council is responsible for making laws, insuring traditional values, and establishing working relations with local, state, and federal governments.

Today, there are still tribal members who live in traditional villages and men who wear long shirts. Other members mix modern-day conveniences with tradition, such as men wearing the latest jeans style with a traditional native shirt. The women still wear their long skirts but insect repellent has replaced the cape. The Miccosukee children are taught English as well as *Mikasuki*. This enables the tribe to keep their native tongue alive, which in turn keeps tradition alive. Miccosukees are a prime example of one tribe's ability to survive any situation that presents itself: from European invaders - to hiding out in the Everglades to escape deportation to the West. The Miccosukee Tribe has always tried to stay true to their beliefs.

