Florida Fish and Wildlife Conservation Commission

Fish and Wildlife Research Institute

MANGROVES

Florida's Walking Trees

Mangroves are woody plants that prefer protected, low-energy shorelines in estuaries and lagoons. They are found along virtually every coast that has a tropical or subtropical climate. Worldwide, there are more than 35 species of mangroves. Florida has three mangrove species and another that is considered to have mangrove affinities. Their common names are Red Mangrove, Black Mangrove, White Mangrove, and Buttonwood (also called Button Mangrove). Each species occupies a particular elevation zone along the shoreline, although well-defined zones are usually apparent only on undisturbed shores with gentle slopes. Mangroves grow on a wide range of soils, from shelly sand bars and peats to rocky marls of the Caribbean and the Florida Keys.

Mangroves are remarkable plants because they tolerate salt water. The ability of mangroves to deal with salt is crucial because it allows them to flourish in areas that most other woody plants cannot tolerate. They perform this feat by blocking the absorption of salt at their roots and by expelling salt through pores on the surfaces of their leaves. Mangrove leaves are often covered with salt during long, dry periods. This salt-water lifestyle reduces competition from other plants and also benefits mangroves by making them relatively unpalatable to many plant eaters and disease organisms. The bumps at the base of White Mangrove and Buttonwood leaves were once misinterpreted to be salt glands, but in reality they are nectar glands that secrete sugars. Plants with functional nectar glands on the leaves often form relationships with ants, which, in return for the sugar, protect the plant from plant eaters. This relationship may be poorly developed in White Mangroves and Buttonwoods.

fast FACT

Mangroves contain 10 to 100 times more salt than uplands and freshwater wetlands plants do.

Mangroves form fruit-like propagules (seedlings), which develop while still attached to the parent tree. At maturity, they drop into the water at the base of the trees and hitchhike on currents to new shores. Mangrove seedlings can form a thick carpet and completely cover some shorelines, but most will die. As they mature, mangroves form dense forests. A doctor who served with Christopher Columbus on his 1492 voyage to the Americas described the mangrove forests he saw as "so thick that a rabbit could scarcely walk through." Wading through these tangled masses of roots and limbs is made even more difficult by the soft muds in which mangroves often grow.

Range and Distribution

Compared to mangroves elsewhere, Florida's mangroves live "on the edge," because this is the highest latitude worldwide in which they survive. The warmth of the Gulf of Mexico and the Gulf Stream allows mangroves to persist in these climes. Only scattered stands are found north of Pinellas County on the gulf coast and Brevard County on the Atlantic coast. Because of their precarious existence amid a highly variable climate, even the tallest Florida mangroves are smaller than those in more tropical regions. The majority of the state's mangrove forests are concentrated in south Florida, but occasional freezes and devastating hurricanes make even this region a stressful sanctuary. Although south Florida mangroves are generally taller and more robust than those elsewhere in the state, some dwarf "forests" in the Florida Keys are an exception. The hard, low-nutrient, limestone substrate underlying the Keys makes it difficult for mangroves to gain a toehold, and those that do survive are usually stunted, unless they grow in deeper peat depressions or thick, marly muds.

Estimates of the extent of mangrove coverage in Florida vary, but scientists generally agree that 400,000–600,000 acres currently fringe the state, most of these in the Ten Thousand Islands and Everglades National Park. In years with warm winters, the range of mangroves may extend farther north. Conversely, severe freezes can shrink their range southward and kill or stress thousands of acres of trees. Each species tolerates freezing in different ways. Black Mangroves are the least cold sensitive; only freezes affect Black Mangroves and rarely kill them outright. White Mangroves are the most directly sensitive species but regrow rapidly from root and trunk sprouts. Red Mangroves are intermediate in direct sensitivity to cold but are more readily killed because regrowth is severely limited. Buttonwoods are similar to White Mangroves in their response to freezing.

Descriptions of Mangroves

Red Mangrove (*Rhizophora mangle*)

The name *Rhizophora* is derived from “rhizo” meaning “root” and “phora” meaning “carrier” or “bearer.” “*Mangle*” (pronounced main'-glee) is the Arawak Indian tribe’s name for the plant. Red Mangroves may reach 100 feet tall, although they are usually shorter in the higher latitudes; in Tampa Bay, for instance, they rarely exceed 30 feet tall. Red Mangrove is usually the most seaward of the four Florida species and the most easily recognized. It has shiny, deep-green leaves with slightly paler-green undersides.

Red Mangrove can be readily distinguished by its tangled, reddish aerial roots and prop roots that arch into the sediment from the branches and trunks. Prop roots support the plant in unstable muck and have pores, called lenticels, on their surfaces that allow gas exchange with the buried roots. Because the roots and branches grow laterally, they actually “walk” forward into deeper waters. Hence, Red Mangroves have been dubbed “walking trees.”

Red Mangroves have wind-pollinated, yellowish-green, waxy flowers. After pollination, the Red Mangrove flower produces a 1-inch long, conical fruit from which grows a 12- to 18-inch propagule that resembles a string bean. This propagule is actually a self-contained seedling (mostly root) that breaks away from the fruit—which remains on the tree—and floats in the water for up to a year. When the propagule washes onto shore, smaller roots extend from the brown, pointed root tip and gradually lift it into an upright position.

The Red Mangrove propagule was considered an aphrodisiac by ancient Persians, and the tannins in the tree’s bark and roots were widely used by early Floridians to tan and dye leather goods red. Red Mangroves also have antimicrobial properties that may one day prove useful.

Black Mangrove (*Avicennia germinans*)

Named in honor of the 10th-century Persian physician Avicenna, Black Mangroves occupy a slightly higher elevation along the shore than Red Mangroves do. Black Mangroves may reach heights of 60 feet but in Florida are generally shorter. Black Mangroves have aerial roots, called pneumatophores, which jut up from the soil like gnarled fingers. They—like Red Mangrove prop roots—provide oxygen to the buried root system. In stagnant water, Black Mangroves may produce aerial and prop roots similar to those of Red Mangroves.

Black Mangroves have elliptical, bluntly pointed leaves that are dull green with gray-green to whitish undersides; they dry black with white backs. The leaf blades have tiny pores through which the plant excretes salt. The Black Mangrove excretes more salt than any other Florida mangrove does, and these salt crystals are often visible on its leaves in dry weather. Sodium chloride (table salt) makes up about 95% of the salt on Black Mangrove leaves.

The Black Mangrove has clusters of yellow-throated, creamy-white flowers at the ends of its branches from midsummer to early fall. These flowers produce one-inch-wide, lima-bean-like fruits that drop into the water when mature. Unlike Red Mangrove, the entire fruit of Black Mangrove functions as its propagule. As it floats in the water, the fruit cover sloughs off, and the propagule unfolds into a butterfly-like, fleshy seedling that extends a main root covered with hairs. Small roots arise from the main root and anchor the seedling to the shore.

Early Spanish colonists used salt-laden mangrove leaves to flavor soups and stews, while later settlers ground the bark into a tea that was used to treat ulcers, hemorrhoids, and tumors. Some south Florida bee-keepers still produce honey from Black Mangrove flower nectar; consequently, Black Mangrove is also known as the “Honey Mangrove.” Black Mangroves contain natural mosquito repellents, but the wood may irritate the skin with repeated contact. Like Red

Mangrove, Black Mangrove is high in tannins and has been used to tan leather.

White Mangrove (*Laguncularia racemosa*)

Named for a type of Roman bottle or jug called a "laguncula"—whose shape the White Mangrove fruit resembles—this species usually grows more inland behind Red Mangroves and Black Mangroves. The smallest of the three Florida species, White Mangroves top out at about 40 to 50 feet in south Florida but usually do not exceed 25 feet in the northern parts of its range. White Mangrove has yellow-green, oval leaves, which often contain notched tips. Unlike its counterparts, the White Mangrove usually has no visible aerial roots. When growing in deeper or stagnant water, White Mangroves may express an aerial root system similar to the Black Mangrove's. Its small, fragile pneumathodes—which arise from buried, bulbous peg roots—usually do not emerge above the sediment and so are rarely seen.

White Mangroves produce nondescript, greenish-white flowers pollinated by insects. Its propagule is a three-quarter-inch, pear-shaped, flattened fruit that is dispersed when it falls from the tree into the water. After floating in the water for several days, the White Mangrove propagule exerts a shiny-green root from one end and roots when tides strand it on the shore.

Like the Black Mangrove, White Mangrove flowers produce nectar and are used to produce honey. A bark extract has antitumor properties, and the tannin content makes it useful for tanning leather. In Brazil, it is used extensively in the leather industry.

Buttonwood or Button Mangrove (*Conocarpus erectus*)

Buttonwoods are named for their button-shaped or cone-like fruit clusters. The buttons disintegrate when they ripen, releasing the small fruit segments, which are conveyed by water or wind to a suitable site where they can sprout. Buttonwoods are often shrubby, especially in areas that freeze often, and rarely attain a height over 15 to 20 feet. The trees have lance-shaped, green leaves with two obliquely arranged nectar glands at the base of the blade. One variant (var. *sericeus*) is covered with fine hairs, giving the leaves a silvery-gray sheen. Unlike the other mangroves, which usually have leaves arranged opposite each other, Buttonwood has alternately arranged leaves.

At one time, the yellow-brown heartwood of Buttonwood was an important source of charcoal in the Florida Bay area, where the remains of charcoal kilns can still be found. Like the other mangroves, Buttonwood contains a high level of tannins and has been used to tan leather. The silver-leaved variety is used in landscapes in south Florida.

Although closely related to the White Mangrove, the Buttonwood is often not considered a "true" mangrove because it lacks reproductive and root characters typical of most mangroves. Buttonwoods are frequently associated with mangroves, however, and can grow in the upper range of tides. Because they often grow above the tide range, they are not afforded the same state protections that the other mangroves are.

Why Mangroves Are Important

Once considered fetid, mosquito-ridden wastelands, mangroves are now recognized as a vital component of estuarine shores. Mangroves provide the two most basic requirements for animal survival: food and shelter. The food comes from the rich "marine compost" produced by insect (frass) and bird droppings and leaf and twig litter that fall from mangrove canopies into the water and are consumed by microorganisms. This processed organic material, called detritus, fuels a complex food web that begins with algae, fungi, and bacteria and transfers energy to larger organisms all the way to top-level predators such as snook, tarpon, and humans. Shelter is provided by the concealment afforded by the tangled prop roots and pneumatophores that extend below the water line. Animals also find shelter in the thick canopy, which shades the shoreline waters with dense, overhanging branches.

fast FACT

As many as 217 species of fish and 200 species of insects have been collected from mangrove areas in south Florida.

Mangroves are important as nurseries for juveniles and as habitats for a wide variety of adult fish and shellfish. As many as 95% of all commercially important fish in south Florida spend some parts of their life cycles in mangroves. A short list of creatures that use mangroves includes snappers, snook, mullet, seatrout, redfish, shrimp, oysters, and blue crabs. Above the water, mangrove tree crabs scurry along the trunks and branches, and diamondback terrapins bask on the prop roots. Mangroves are a critical habitat for the

American crocodile, which is found only in south Florida.

Many migratory birds (for example, warblers) depend on mangrove canopies for food and shelter during their migrations. A variety of diving and wading birds, including the brown pelican and many herons and egrets, nest and roost in mangrove canopies. Insects flit about and consume large quantities of the foliage, helping to encourage leaf turnover, which benefits the underwater inhabitants of the system. Birds and spiders feed on insects as they feed on the leaves and pollinate the flowers of mangroves. Some insects are so linked to mangroves that they have evolved to look like mangrove twigs and leaves.

In addition to their values as habitat, mangroves also perform other functions. They stabilize sediments beneath their roots and trunks, a process that also captures pollutants, preventing them from contaminating nearby waters. In addition, they serve as windscreens to buffer the effects of storms on coastal areas and buffer waves that would suspend shoreline sediments in the water. Therefore, water quality is improved and maintained by nutrient uptake and immobilization, filtration, and wave attenuation.

Threats to Mangroves

Around the world, mangrove destruction continues at an alarming pace, especially to create huge ponds for shrimp farming and other aquaculture. The benefits of sacrificing mangroves to aquacultural interests are usually short-lived. In Florida in the past, the major threat came from dredging and filling associated with coastal development. Most of the destruction occurred prior to the 1970s, however, before the state enacted regulations to protect mangroves. Waterfront development and construction of dikes around mangroves to control mosquito breeding have destroyed much of the mangroves in the Indian River Lagoon.

Oil spills may kill or stress mangroves by plugging the airways of prop roots and pneumatophores, causing the plant to suffocate. One study in Tampa Bay suggests that a severe oil spill may inhibit mangrove regrowth and productivity for 10 to 50 years. Attempts to remedy oil-spill damage may actually further harm the plant and community functions.

Mangrove trimming on private and state-owned lands is guaranteed by state law so that landowners can view the water. Nevertheless, excessive trimming impairs the habitat value of mangroves and often kills them. What effect trimming has on system productivity remains unknown. Mangrove-trimming violations add to the losses from other causes, making mature mangroves the most threatened marine habitat in Florida.

fast FACT

Worldwide, humans have destroyed more acres of mangroves than any other type of coastal ecosystem.

Marine-wetlands restoration projects—which create intertidal elevations, return tidal flows to shorelines, and encourage the growth of mangroves—are helping to offset historical destruction. Additionally, developers are required, through mitigation projects, to create new mangrove wetlands to compensate for those lost during a construction project. Despite mitigation requirements, mangrove losses continue to accumulate because creation of specific mangrove habitats has remained difficult. Often mitigation permits do not even require mangroves to be planted.

Research in mangrove ecology and restoration with regard to habitat quality needs to be supported so that this system, so critical to the high quality of life in Florida, can be conserved for future generations.

May 2006