THE MANGROVE STORY

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Those of us who have spent any time in Charlotte Harbor or any other coastal system supporting mangroves, have already realized the benefits of these special plants. Rather than focusing on what you already know, I've attempted to summarize some of the less visible and less known attributes of mangroves.

Mangroves are woody plants which are found along almost every coast that has a tropical or subtropical climate. Worldwide, there are approximately 50 species of mangroves. The most diverse location for mangroves is the Indo-Pacific region, containing approximately 40 different species. Somewhat less diverse are the mangrove regions of West Africa, the Caribbean, and the Americas, containing around eight different mangrove species. Three true species of mangroves comprise the Florida mangrove forests, along with a forth mangrove associate, the buttonwood *Conocarpus erecta*. Florida's mangrove species, which are described in detail in the following paragraphs, are the red mangrove *Rhizophora mangle*, the black mangrove *Avicennia germinans*, and the white mangrove *Laguncularia racemosa*.

The mangrove environment is characterized by unstable, anaerobic (without oxygen) sediments, fluctuating water levels, and waters high in salt concentrations. In order to survive in these harsh environments, mangroves have evolved adaptations to their root systems to deal with the anaerobic soils, mechanisms for maintaining salt balance, and reproductive dispersal strategies. Interestingly, individual species have evolved different solutions to these same problems.

Florida Mangroves

Rhizophora mangle, the red mangrove is generally found closest to the water and is probably best known for its "walking" prop roots. Prop roots support the plant in mucky anaerobic (without oxygen) sediments and have pores, called lenticels which allow gas exchange with the buried roots. The red mangrove separates fresh water from salt water by salt exclusion in a process known as nonmetabolic ultra-filtration (similar to reverse osmosis). Red mangroves produce yellow flowers. After pollination, a small fruit, and a 12–18 inch propagule is formed. The propagule is an embryo which begins germina-

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tion and development while still attached to the tree in a process known as vivipary. Once the propagule breaks away from the tree, it floats freely for up to a year, before being washed ashore, developing roots and becoming a new mangrove plant.

Avicennia germinans, the black mangrove is most easily recognized by its system of shallow aerial roots, called pneumatophores, which extend like fingers perpendicular to the sediments. These pneumatophores provide oxygen to the buried root system. Black mangroves occupy a slightly higher elevation than red mangroves. In these higher soils, salt deposits accumulate; therefore, black mangroves excrete more salt than any other mangrove. Black mangroves excrete salt through the use of salt glands on the leaf surface (if you lick a leaf it's very salty). The leaves of this mangrove are dull green to gray, and the flowers are a creamy white and form clusters at the branch tips. These flowers produce a fruit resembling a lima bean which functions as its propagule. Like the red mangrove, black mangroves utilize vivipary and propagule dispersal reproductive strategies.

Laguncularia racemosa, the white mangrove usually grows more inland behind the red and black mangroves. White mangroves are the smallest of the three Florida mangrove species, rarely reaching 50 feet in height. White mangroves have yellowish green leaves that contain two small nodules at the leaf stalk, which serve as sugar glands. White mangroves typically do not exhibit aerial roots, however in deeper or stagnant waters; some may express roots similar in appearance and function to the black mangrove pneumatophores. White mangroves use the same salt excreting and reproduction strategies as exhibited by their black mangrove counterparts.

Mangrove soils have a characteristic black color and nose-turning smell. Because mangrove soils are perpetually water logged, there is not much free oxygen available. Aerobic bacteria (oxygen using bacteria) use up any available free oxygen fairly quickly. Anaerobic bacteria (bacteria in soils without oxygen) proceed to liberate nitrogen gas, soluble iron, inorganic phosphates, sulfides, and methane, which help contribute to a mangrove's particularly pungent odor and also make it a hostile environment to most plants.

Mangrove distribution and the extent of mangrove ecosystem development are limited by five principal factors: climate, salt water, water fluctuation, runoff of terrestrial nutrients, and substrate and wave energy. Mangrove distribution is limited by temperature to areas with an annual average temperature greater than 19˚C. Mangroves favor salt water, although not necessary for their survival, because it reduces ecological competition from freshwater plant species. Water fluctuations due to tidal cycles and freshwater inflow help transport propagules, nutrients and clean water, while flushing away hydrogen sulfide (that nasty smell) and accumulated salt from the sediments. Finally depositional sediments and low wave energy allow propagules to become established, protect the shallow root system, and allow for the accumulation of fine anaerobic sediments, an environment in which few plants are adapted for.

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