Mangroves.

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Mangrove is used to refer both to the tree and to the ecosystem. (Another term common in Latin root languages is mangal.)

Mangroves are halophytic trees found in tidal zones with saturated soils. Mangroves are found basically in the regions between the Tropics of Cancer and Capricorn. They cannot tolerate frost. If there are 3 to 4 days of frost, the whole mangrove will die (with exception of *Rhizophora* because it is a bit more cold tolerant). There are two big groupings of mangroves with only one common species. The Western Hemisphere or New World group has only 8 species, and the Eastern group (or Old World) includes 40 species. In the west, the most common species are *Avicennia germinaus, Rhizophora mangal, Rhizophora racemosa*, and *Laguncularia racemosa*. In the east, the most common are *Avicennia marina, Rhizophora mucronata, and those in the genera Lumitzera, and Nypa*.

Laurasia was the center of origin for the mangroves, around 150 million years ago. When the continents divided few made it to the west. The speciation of mangroves is similar to that seen in seagrasses and corals. Distribution happened 70 - 135 million years ago in the Cretaceous period. Today nearly all of the species are found in the east.

Often mangrove vegetation grows so thickly that little else can grow underneath them. Mangrove fern is found in some cases and *Caulerpa* and a few other algae is another exception.

Historically mangrove swamps were cleared because:
1) they were thought to contain and spread diseases like malaria, (actually due to mosquitoes)
2) they were thought to harbor other dangerous creatures
3) wood could be harvested for fuel or construction materials
4) cleared to widen navigation channels and to provide access to inland locations.

Four Types of Mangrove Ecosystems:
1) Fringe mangroves: usually, narrow, only flushed with seawater, 39o/oo. Normally found along protected coastlines and in locations where salinity increases the further you move inland from the coast (60o/oo). Trees can grow 13 m in height. In North America, mostly found in Mexico, Texas, and Florida.
2) Riverine Type: freshwater influence. Trees can grow more than 20 m tall. Most productive of all mangroves. Tidal rivers. Salinity decreases because of freshwater flushing.
3) Basin Mangroves: Trees can grow 10 m in height. Dwarf stands: grow like shrubs,

with bare spaces in between them. Found in areas with occasional tidal flooding.
4) Overwash: In Ten Thousand Islands, in Florida. *Rhizophora* sit atop a high that is completely uncovered during low tide, but only the vegetative parts of the trees stick out during high tide.

In the Americas, Each type of magrove system often contains spp. of *Rhizophora (*red*), Avicennia* (black), and *Laguncularia*(white).
Red most seaward and Black and White more inland.

Salinity: Has a major effect on the distribution of vegetation. Do not require salt, but they will tolerate it (they grow even better in freshwater, but salinity keeps out competing species.

Transfer O_2 with leticels and prop roots.
Dissolved O_2: Most soil O_2 comes from what the plants make or transfer themselves.
Acidity (sulfides high): This is not a problem for mangroves because they have an aerobic zone around their roots where the acidity builds up. (Can not use this soil if mangrove swamp is cleared. Soil is called "Cat Clays"- not very useful soil, very acidic. Many people built shrimp farms in mangrove areas in Ecuador and Thailand in the 1980's early 1990's. After few years pond yields decreased and disease increased. Realized that mangroves were worst places to build farms. Many were then abandoned. Some have been replanted, other recolonize on their own.
Ecosystem Structure: Canopy- 3 to 4 spp. at most, often just 1 or 2 spp.

Understory - almost no plants because the canopy grows so thickly. One species call the mangrove fern, *Acrostichum*, can grow under here, one species common in Puerto Rico. There are only a few spp. of this genus.
Zonation: It was thought that mangroves were actually building land seaward. There is no real evidence that planting these will build up the land (old theory). Most likely has a cyclic process. *Rhizophora* seedling will germinate and grow right on the tree. It will then drop off into the seawater. Where ever they land, they drop roots and grow).

Mangroves appeared in Hawaii after WWII, probably brought in by Navy ships from South Pacific. On Molokai, Hawaii, sugar planters planted *Rhizophora mangle* because they thought it would build up the coast, and they would have more coast for planting sugar. They ended up spreading a real pest species. It overpopulated and grew extremely dense. The native Hawaiians hate the tree and want to cut the down to restore fishponds. The U.S. Corps Engineers say they cannot do this. Corps wants to protect all coastal vegetation.

Productivity: 10 % of grass salt marshes, 1 to 5 tons/ hectare/ year of dry matter
Values: The mangroves stabilize and protect the shoreline. It provides habitats and nursery areas. They also create sinks for nutrients. In many developing countries it still provides firewood and material for light construction.
Adaptations: They must be salt tolerant. Plants take up salt, just enough NaCl so that they can balance outside salinity. Interesting Study: Scholander points out that *Rhizophora*

does not have any salt glands and therefore must exclude salt. However, *Avicennia* does have salt glands on the back of its leaves so it can therefore excrete salt. In reality: 99.9% of salt is withheld from plant, let a little bit in to make inside more salty than outside to let them osmotically adjust. Some do have salt glands or drop their leaves in order to rid of excess salts.
Viviparous seeds: seeds germinate/grows on parent because it is hard to grow in seawater. *Rhizophora* propagule can float in seawater for months (air tight). As soon as it touches ground, it grows roots.