MANGROVES

Mangrove refers to: a) plant species
b) woody plant formation
(mangal , mangrove swamp)

Mangrove swamp, mangal –
association of halophytic trees, shrubs and other plants growing in brackish to saline tidal waters

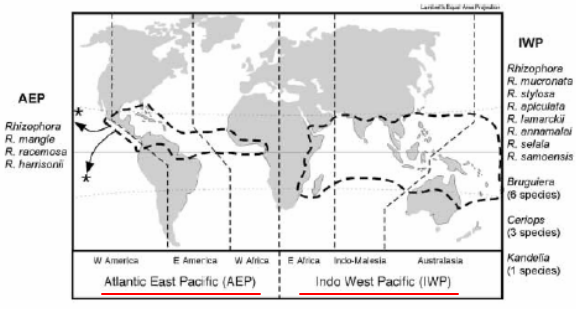
Geographic distribution - 25ºN-25ºS

- "Old World" (Eastern) mangroves - greater species diversity, Indo-Malaysian region center of distribution
- "New World" and West Africa (Western) mangroves - low species diversity

West coast of South America only 5ºS- no suitable landforms

Mangal reaches its maximum development and greatest luxuriance in parts **of SE Asia, Malaya, Sumatra and parts of Borneo**

This area , or SW to N Australia was probably the center of evolution of mangrove flora.



Specis diversity: Low (4 spp) High (30-40 spp.)

Geomorphology and Hydrology - protected environment: bays, estuaries, lagoons

- intertidal

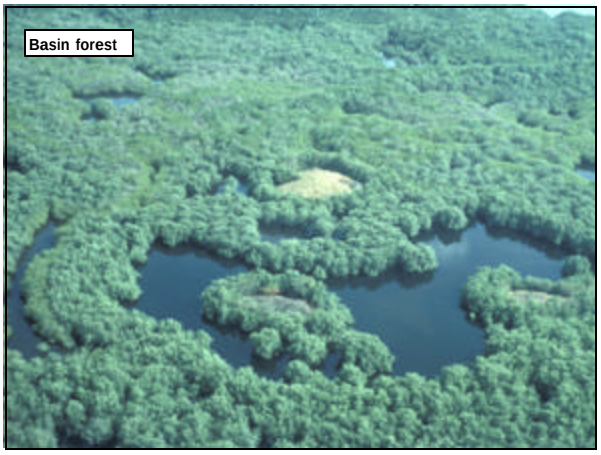
classification

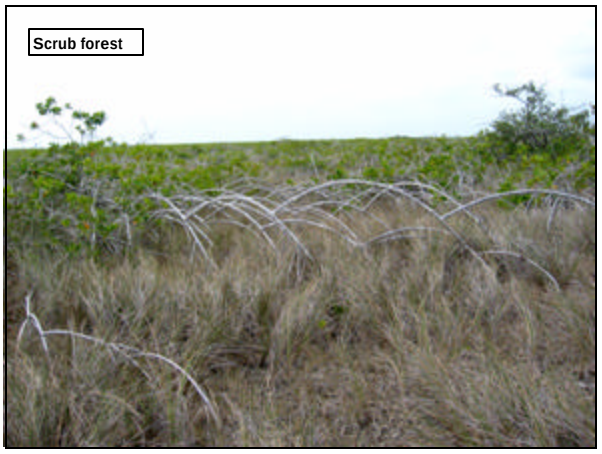
A) Fringe forest - fringes along protected shorelines and islands; sediment trapping, wind exposed, debris, salinity close to sea water; less nutrients than riverine

B) Riverine forest - tall floodplain forests along tidal rivers and creeks, sometimes behind fringe forest, low salinity, high water, high nutrients; highest degree of structural development

C) Basin forest - inland along drainage depressions usually P>ET, when P<ET or strongly seasonal, basin mangroves suffer die-backs during dry period, hypersaline lagoons develop

D) Scrub forest - nutrient poor, sandy soil or limestone marl





Mangroves in river dominated environment

1) River dominated of low tidal range multiple branching distributaries (Orinoco delta)

2) River setting with high tidal range (Klang delta in W. Malaysia)

3) Low amount of river discharge, sometimes closed by beach ridges (many rivers on the Pacific coast of Central America)

4) Combination of high wave energy and high river discharge (Purari delta of Papua New Guinea)

5) Drowned river valley complex (valley systems flooded by rising seal level)

Chemistry

Salinity - wide range (not necessary)

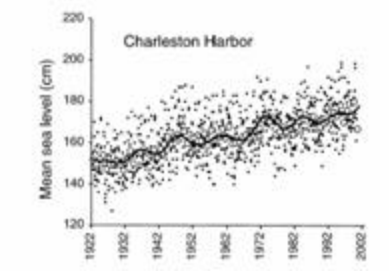
- higher in interstitial water than in surface water

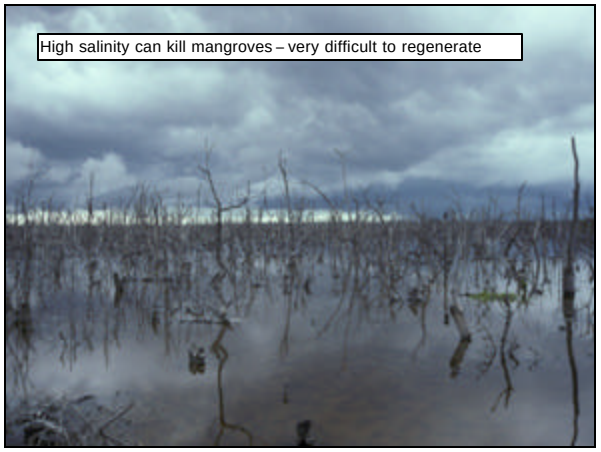
Oxygen - anoxic when flooded

Stress - sea level rising (1.5mm/year) depends on the type of shore

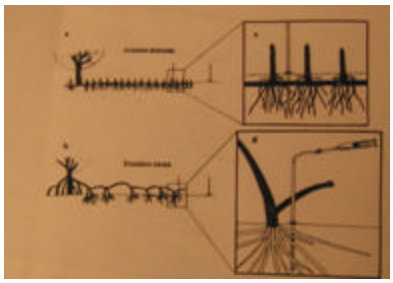
- salinity
- anoxia
- tropical cyclones
- man-induced changes (oil spills, draining, shrimp farms, sewage)

Sea level rise – mangroves have nowhere to go





Anoxia



From McKee, J. Ecol. 81: 477, 1993

	Eh, mV	Sulfide, mM
Avicennia pneumatophores	-92	0.53
Rhizophora prop roots	-90	0.33
Bare substrate	-168 to –172	1.1 to 1.44

Tropical cyclones and hurricanes

Damage to mangroves at the island of Guanaja, Honduras, 15 months after Hurricane Mitch

Man-induced changes (logging, oil spills, draining, shrimp farms, sewage)

Felling mangrove logs for charcoal production, peninsular Malaysia. Photo: E.J. Farnsworth.

Farnsworth & Ellison, Ambio 26:329, 1997

Vegetation

- main species of New World mangal:

Rhizophora mangle (Rhizophoraceae) - red mangrove

Avicennia germinans (Avicenniaceae) - black mangrove

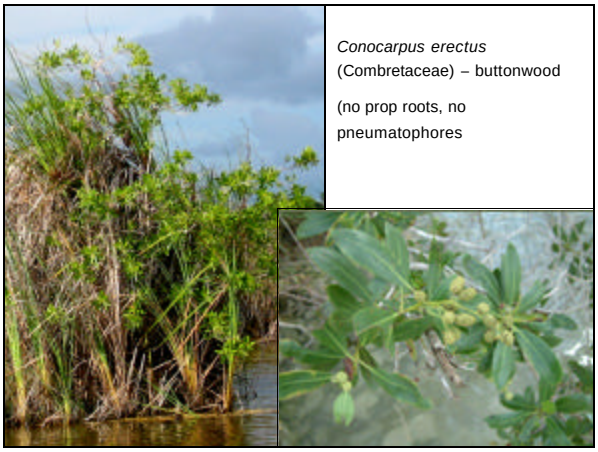
Laguncularia racemosa (Combretaceae)

- white mangrove

Conocarpus erectus (Combretaceae)

- buttonwood

Rhizophora mangle



Conocarpus erectus (Combretaceae) – buttonwood

(no prop roots, no pneumatophores

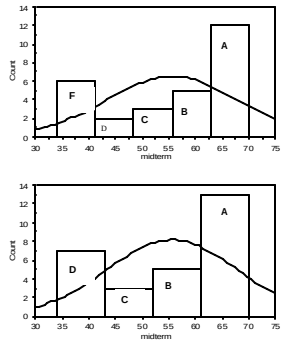
Old World mangal (30-40 species):

Sonneratia spp., *Bruguiera* spp.,

Pollination – mostly by animals, very diverse pollinators:

- bats, *Sonneratia* - Batu caves by Kuala Lumpur, bats fly > 50km, nocturnal

Sonneratia trees are important on a local scale in Malaysia and Indonesia, comprising a major component of the mangrove flora of Southeast Asia and Australia. Their showy, nocturnal flowers are pollinated by three small flying foxes, the Dawn bat (*Eonycteris spealea*, which also pollinates durian), the Common long-tailed bat (*Macroglossus minimus*), and the Lesser short-nosed fruit bat (*Cynopterus brachyotis*). Mangroves also serve as the major roosting sites of two of the world's largest flying foxes, the Common flying fox (*Pteropus vampyrus*) and the Island flying fox, (*P. hypomelanus*).



Pollination –

- by birds, *Bruguiera* - red calyx, attractive to birds
- by bees, *Avicennia* ("mangrove honey" in South Florida)
- by wind, some *Rhizophora* spp.
- self-pollinated *Lumnitzera* spp., some *Rhizophora* spp.


Selenocereus testudo

Epiphytes

- orchids, bromelias, cacti


orchid


bromelias

Viviparous seedlings

Rhizophora- true vivipary, the embryo has no dormancy but grows first out of the seed coat and then out of the fruit while still attached to the parent plant; the propagating organ is not a seed, but a seedling!!

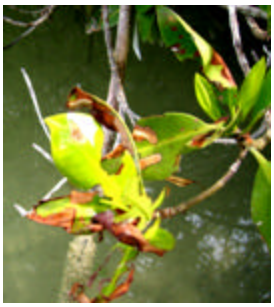

hypocotyl

Salt extruders - *Avicennia*

x

salt excluders - *Rhizophora*

different fauna Rhizophora - more herbivory



Fauna - filter feeders: barnacles, oysters, - attached to prop roots

Predaceous gastropod (Menongena) prays on barnacles improves tree growth

- fiddler crabs
- vertebrates: alligators, crocodiles, turtles, snails

Functions

-<u>primary production</u> - highest inriverine mangroves

-difficult to measure, substitute data, e.g., litter fall

- decomposition relatively fast

-about 50% litter exported to adjacent systems

-(Rhizophora C3 x CAM shifting plant, CO_2 during the day, fixation of CO_2 released by respiration during the night)

Nutrient flux

- <u>income</u>: rainfall, tides, freshwater runoff, N fixation, mineralization,

N important in rainfall,

- <u>output</u>: tidal transport, denitrification and volatilization

Microbacterial mats