Tropical Coastal Forests & Tropical Deciduous Forests

Mangrove Forests
- confined to tropical and subtropical ocean tidal zones
- water temperature must exceed 75°F or 24°C in warmest month
- unique adaptations to harsh environment - convergent

Mangrove and beach forests
- confined to tropical and subtropical zones at the interface of terrestrial and saltwater

Unique adaptations to harsh environment - convergent

Tropical Coastal Communities

Relationships to other tropical forest systems — specialized swamp forests:

Mangrove and beach forests

- stilt roots - support

Rhizophora mangle - red mangrove

Queensland, Australia

Moluccas

Venezuela
Mangrove Forests

- stilt roots - support
- pneumatophores - erect roots for O₂ exchange
- salt glands - excretion

*Rhizophora mangle* - red mangrove

- 80 species in 30 genera (20 families)
- 60 species OW & 20 NW
  (Rhizophoraceae - red mangrove - most common in Neotropics)

*Avicennia* - black mangrove; inner boundary of red mangrove, better drained

*Avicennia nitida* (black mangrove, Acanthaceae)
Four mangrove families in one Neotropical mangrove community

- *Avicennia* - Acanthaceae
- *Rhizophora* - Rhizophoraceae
- *Laguncularia* - Combretaceae
- *Maytenus* - Celastraceae

Mangrove Forests

- 80 species in 30 genera (20 families)
- 60 species OW & 20 NW

Beach Forests

- salt and sand - species often seen in mangrove community

- *Hibiscus tiliaceus*
- *Terminalia catappa*
- *Cocos nucifera*

Beach Forests

- salt and sand - species often seen in mangrove community

- *Hippomane* (Euphorbiaceae) - machaneel
Beach Forests
- woody climbers or runners

*Coccoloba uvifera*  
(Polygonaceae) - seaside grape

Beach Forests
- woody climbers or runners

*Ipomoea pes-caprae*  
(Convolvulaceae) - morning glory  
Polihaele State Park  
western Kauai

Beach Forests
- woody climbers or runners

*Scaevola*  
(Goodeniaceae)

*Solanum*  
(Solanaceae)

*Chamaesyce*  
(Euphorbiaceae)

Tropical Deciduous Forests
Tropical Deciduous Forests
or Rain/Summer Green Forests
Climate . . .
- wet-dry seasonal alternation
- equatorial trough OR subtropical high climate

Tropical Deciduous Forests
or Rain/Summer Green Forests
Climate . . . find this moving away from tropics
- Gradient evident in dry winter season from tropics to subtropics
- Also found in leeward sides of mountains - west Madagascar . . .
- and monsoon climate areas

Tropical Deciduous Forests
or Rain/Summer Green Forests
Climate . . . find this moving away from tropics

Tropical Deciduous Forests
or Rain/Summer Green Forests
Locations . . .
- South America - N & S of Amazon, Central America & W. Indies
Tropical Deciduous Forests
or Rain/Summer Green Forests

Locations . . .
- W Africa & W Madagascar
- Southern Africa
- India, Indochina,
- Australia

Vegetation
- Canopy closed in wet summer, but more open than tropical rainforest
- Canopy opens up in dry winter as some or many deciduous trees drop leaves - adaptation to xeric conditions

Santa Rosa, Costa Rica dry forest, summer

. . . and winter

Tropical Deciduous Forests

Vegetation
- Canopy closed in wet summer, but more open than tropical rainforest
- Canopy often has same families or genera of evergreen tropical forests – but different species

Santa Rosa, Costa Rica dry forest, summer

Esterelobium (Fabaceae) canopy

Tropical Deciduous Forests

Vegetation
- Forests closer to Tropics of Cancer and Capricorn have more pronounced dry winter season - and more pronounced deciduousness

Alamos, Mexico (27º N)
Summer green, winter dry
Vegetation

- Understory more developed - better light
- Green (photosynthetic) stems common - no leaves during winter

*Hildegardia barteri* - Malvaceae, Africa

*Bursera* - Burseraceae, Mexico

**Tropical Deciduous Forests**

Vegetation

**Tropical Deciduous Forests**

Vegetation

- Flowering occurs at end of dry season when leafless

*Ipomoea arborea* (Convolvulaceae - Mexico)

**Tropical Deciduous Forests**

Vegetation

- Flowering occurs at end of dry season when leafless

*Cochlospermum* (Cochlospermaceae - Panama)

**Tropical Deciduous Forests**

Vegetation

- Flowering occurs at end of dry season when leafless

*Tabebuia* (Bignoniaceae)
Vegetation

- Spines (anti-herbivory) common on stems

*Pachira*- Malvaceae, Mexico

*Ceiba* (kapok, Malvaceae), Brazil

Vegetation

- “Bottle” trees - water storage

*Adansonia* (Malvaceae)

Madagascar & Africa & Australia

Vegetation

- Same vegetation - different flora

*Flacourtia* (Flacouriaceae, Thailand)

*Acacia* (Fabaceae, Mexico)

*Deckenia*, palm cabbage, Seychelles

*Astrocaryum* (palm, Mexico)

Vegetation

- “Bottle” trees - water storage: different genera in different areas

*Cola* (silk cotton tree, Malvaceae), Peru

*Brachychiton* (Malvaceae, Australia)
Tropical Deciduous Forests

Vegetation
- parasites common

Mistletoe (Loranthaceae - Venezuela)

Mistletoe (Loranthaceae - Mexico)

Tropical Deciduous Forests

Vegetation
- epiphytes or lianas rare

Rhipsalis baccifera (Cactaceae - Africa)

Stemona (Stemonaceae - Thailand)

Thorn Forests/Scrub

- Open forest with small deciduous trees or shrubs heavily protected by thorns

Thorn forest in Venezuela (exact area unclear)
Top: rainy season, August
Bottom: dry season, May

Thorn Forests/Scrub

- Location in subtropical latitudes between dry forests and deserts

Thorn forest in Venezuela (exact area unclear)
Top: rainy season, August
Bottom: dry season, May
Thorn Forests/Scrub

- Location in subtropical latitudes between dry forests and deserts or on elevational gradient below tropical deciduous forests

- Open forest with small deciduous trees or shrubs heavily protected by thorns

- *Acacia* - legume - worldwide

*Acacia* - spines for protection also house ants that patrol plant

- Floristic differences pronounced

- Cactaceae Mexico

*Alluaudia* and relatives (Didiereaceae) southern Madagascar

- Floristic differences pronounced

*Senecio* (Asteraceae) Canary Islands

*Euphorbia* (Euphorbiaceae) Ethiopia

Euphorbia (Euphorbiaceae) Ethiopia
Thorn Forests/Scrub
- Low scrub vegetation grading into deserts; convergence of leafless, green-stemmed shrubs with heavy spines
- *Opuntia* (Cactaceae) from south Texas

Tropical Savanna Woodland
- Tall grasslands with widely scattered trees and shrubs
- Seasonal drought and fire combine to favor perennial grasses and limit tree growth

Venezuelan llanos
Tropical Savanna Woodland

- Tall grasslands with widely scattered trees and shrubs
- Seasonal drought and fire combine to favor perennial grasses and limit tree growth

Termites and fire go together in savanna

Queensland, Australia

Specialized soil types can produce tropical savannas

- Calcium carbonate hardpan

Vegetation:
- small trees, crowns umbrella-like
- trunks thick and rough
- leaves xeromorphic or are shed in dry season

Serengeti hardpan with *Acacia* (Fabaceae)

Byrsomima (Malpighiaceae), llanos
Tropical Savanna Woodland

Vegetation:
- small trees, crowns umbrella-like
- trunks thick and rough
- leaves xeromorphic or are shed in dry season

South African savanna leaf convergence (white rhinoceros diet)

Tropical Savanna Woodland

- xylopodia ("wooden feet") in Brazilian cerrados

Tropical Savanna Woodland

- xylopodia ("wooden feet") in Madagascar savanna

"Dufflepuds" – Voyage of the Dawn Treader

Asteraceae – sunflower family

Tropical "Dry Forest" Flora & Fauna Relationships

Recent assembly of the Cerrado, a neotropical plant diversity hotspot, by in situ evolution of adaptations to fire

- When did the Cerrado originate?
- Did the Cerrado species come in via dispersal of dry adapted species? (niche conservatism)
- Did the Cerrado species arise in situ from surrounding wet adapted tropical forest species? (adaptive radiation)
• Cerrado species arose in last 10my
• All arose in situ from surrounding wet adapted species
• Convergent evolution for arid, fire system in many groups! — adaptive radiations!

Tropical “Dry Forest” Flora & Fauna Relationships

• red-fronted brown lemur in Madagascar dry forests – nocturnal & derived from wet tropical forest lemur lineages
  • nocturnal & small rodents elsewhere
  • lizards account for up to 40% species in Neotropical dry forest fauna - Anolis
  • Myrmicinae ant radiations (Atta)

• cat evolution more complicated
• cat species are well adapted to both tropical dry forests (and temperate) but also to tropical wet forests

• National Geographic – Feb 2017

Tropical “Dry Forest” Flora & Fauna Relationships

• biogeography?
• tropical wet or dry origin?