Tropical Coastal Forests & Tropical Deciduous Forests
Tropical Coastal Communities

Relationships to other tropical forest systems — specialized swamp forests:

**Mangrove and beach forests**

- confined to tropical and subtropical zones at the interface of terrestrial and saltwater
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 Forests

- stilt roots - support

*Rhizophora mangle* - red mangrove
Mangrove Forests

- stilt roots - support
- pneumatophores - erect roots for \( O_2 \) exchange
- salt glands - excretion

*Rhizophora mangle* - red mangrove
Mangrove Forests

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

*Rhizophora mangle* - red mangrove
*Xylocarpus* (Meliaceae) & *Rhizophora*
Mangrove Forests

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

(Rhizophoraceae - red mangrove - most common in Neotropics)

Rhizophora mangle - red mangrove  
Xylocarpus (Meliaceae) & Rhizophora
Mangrove Forests

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

Avicennia nitida (black mangrove, Acanthaceae)
Fig 1. Distribution and the phylogenetics of *Avicennia*. Distributions of species are color coded on the map (modified from [34]). The map was modified from the 1:11m coastline map of Natural Earth (http://www.naturalearthdata.com). The phylogenetic relationship between species is based on the phylogenetic analyses from chloroplast and nuclear genes. The divergence time for species in the Indo-Western Pacific (IWP) region was calibrated by *mcmctree 4.8a* [25].
Mangrove Forests

- 80 species in 30 genera (20 families)
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Four mangrove families in one Neotropical mangrove community

Avicennia - Rhizophora -
Acanthanceae   Rhizophoraceae

Laguncularia - Maytenus -
Combretaceae   Celastraceae
Beach Forests

- salt and sand - species often seen in mangrove community

**Hibiscus tiliaceus**

**Cocos nucifera**

**Terminalia catappa**
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

Polihale 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

**FIGURE 8.11** Wet-dry tropical climate (3). Timbo, Guinea, at lat. 10½° N, is in West Africa. A long wet season at time of high sun alternates with an almost rainless dry season at time of low sun.
Tropical Deciduous Forests

or Rain/Summer Green Forests

Climate . . . find this moving away from tropics

Nowhere is change in vegetation more strictly associated with latitude than in Africa. Vegetation zones form a series of parallel bands across Africa that correspond to rainfall patterns. Evergreen forests occur only in a narrow belt along the southern coast of West Africa and in the Congo basin of central Africa. Much larger portions of the continent are covered with deciduous forests and savannah.
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

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
Tropical Deciduous Forests

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

Enterlobium (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 (27° N)
Summer green, winter dry
Tropical Deciduous Forests

Vegetation

- Understory more developed
  - better light

- **Green (photosynthetic)** stems common - no leaves during winter

*Bursera* - Burseraceae, Mexico

*Hildegardia barteri* - Malvaceae, Africa
Vegetation

- Flowering occurs at end of dry season when leafless

*Ipomoea arborea*  
(Convolvulaceae - Mexico)
Vegetation

- Flowering occurs at end of dry season when leafless

*Tabebuia* (Bignoniaceae)
Tropical Deciduous Forests

Vegetation

- Flowering occurs at end of dry season when leafless

*Cochlospermum* (Cochlospermaceae - Panama)
Tropical Deciduous Forests

Vegetation

- **Spines** (anti-herbivory)
  common on stems

*Pachira* - Malvaceae, Mexico

*Ceiba* (kapok-Malvaceae), Brazil
Tropical Deciduous Forests

Same vegetation - different flora

*Flacourtia* (Flacouriaceae, Thailand)

*Acacia* (Fabaceae, Mexico)

*Deckenia*, palm cabbage, Seychelles

*Astrocaryum* (palm- Mexico)
Tropical Deciduous Forests

Vegetation

- “Bottle” trees - water storage

*Adansonia* (Malvaceae)
Madagascar & Africa & Australia
Tropical Deciduous Forests

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

*Stemona* (Stemonaceae - Thailand)

*Rhipsalis baccifera* (Cactaceae - Africa)
Thorn Forests/Scrub

- Open forest with small deciduous trees or shrubs heavily protected by thorns
Thorn Forests/Scrub

- Location in subtropical latitudes between dry forests and deserts
Thorn Forests/Scrub

- Location in subtropical latitudes between dry forests and deserts...
- or on elevational gradient below tropical deciduous forests
Thorn Forests/Scrub

- 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
Thorn Forests/Scrub

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

*Euphorbia* (Euphorbiaceae) Ethiopia

*Cactaceae* Mexico

*Senecio* (Asteraceae) Canary Islands
Thorn Forests/Scrub

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

*Alluaudia* and relatives (Didiereaceae) southern Madagascar
Thorn Forests/Scrub

- Low scrub vegetation grading into deserts; convergence of leafless, green-stemmed shrubs with heavy spines

- Rutaceae, Mexico
- Oleaceae, south Texas
- Opuntia (Cactaceae) south Texas
- Koeberlinia (Koberliniaceae) Mexico
Tropical Savanna Woodland

- Tall grasslands with widely scattered trees and shrubs
- Low to intermediate elevations where seasonal drought and fire combine to favor perennial grasses and limit tree growth
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- Seasonal **drought** and **fire** combine to favor perennial grasses and limit tree growth
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Tropical Savanna Woodland

- Termites and fire go together in savanna regions.

Queensland, Australia

Venezuelan llanos
Tropical Savanna Woodland

- Specialized soil types can produce tropical savannas
- Calcium carbonate hardpan

Serengeti hardpan with *Acacia* (Fabaceae)
Vegetation:
- small trees, crowns umbrella-like
- trunks thick and rough
- leaves xeromorphic or are shed in dry season
Tropical Savanna Woodland

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- 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
When did the Cerrado originate?

Did the Cerrado species come in via dispersal of dry adapted species? (niche conservatism)

Did the Cerrado species arise \textit{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*)
Tropical “Dry Forest” Flora & Fauna Relationships

- 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?