
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


Queensland, Australia


Moluccas


Venezuela

Mangrove Forests

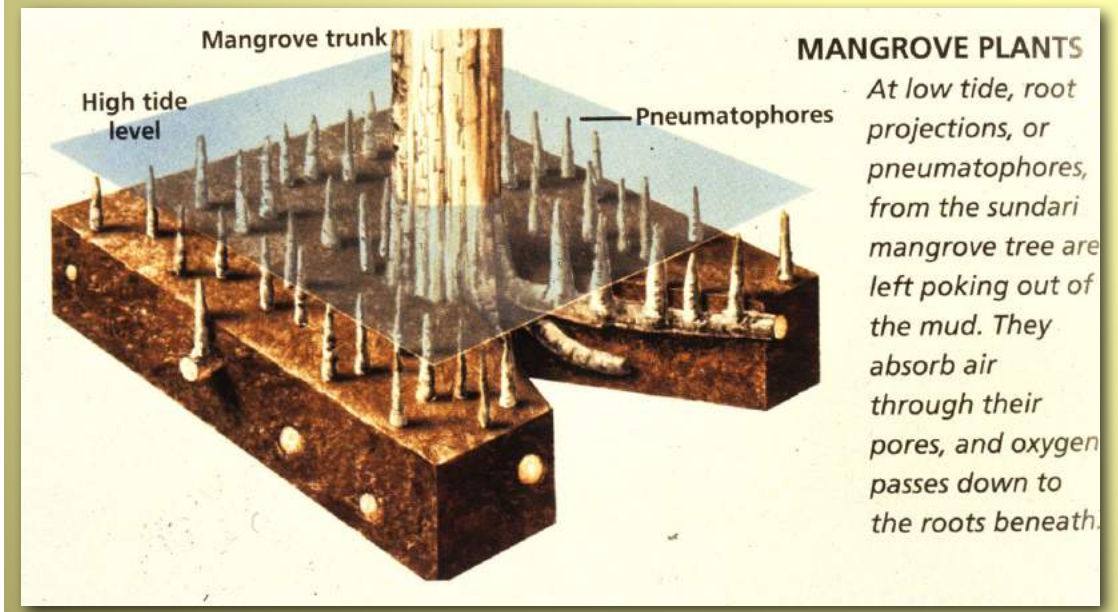
- stilt roots - support

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 O_2 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

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

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

Avicennia nitida (black mangrove, Acanthaceae)

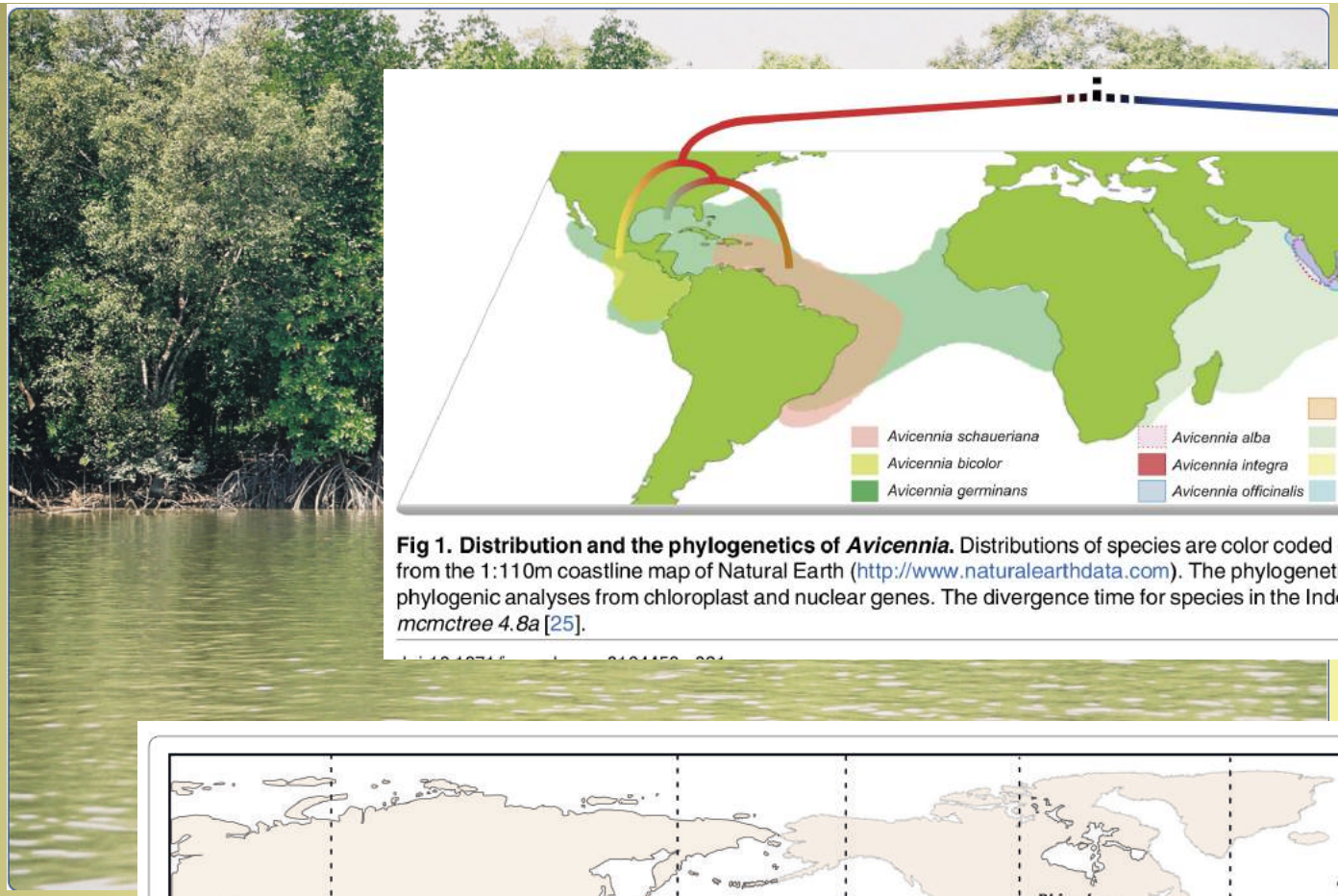


Fig 1. Distribution and the phylogenetics of *Avicennia*. Distributions of species are color coded on the map (modified from [34]). The map was modified from the 1:110m coastline map of Natural Earth (http://www.naturalearthdata.com). The phylogenetic relationship between species is based on the phylogenic 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].

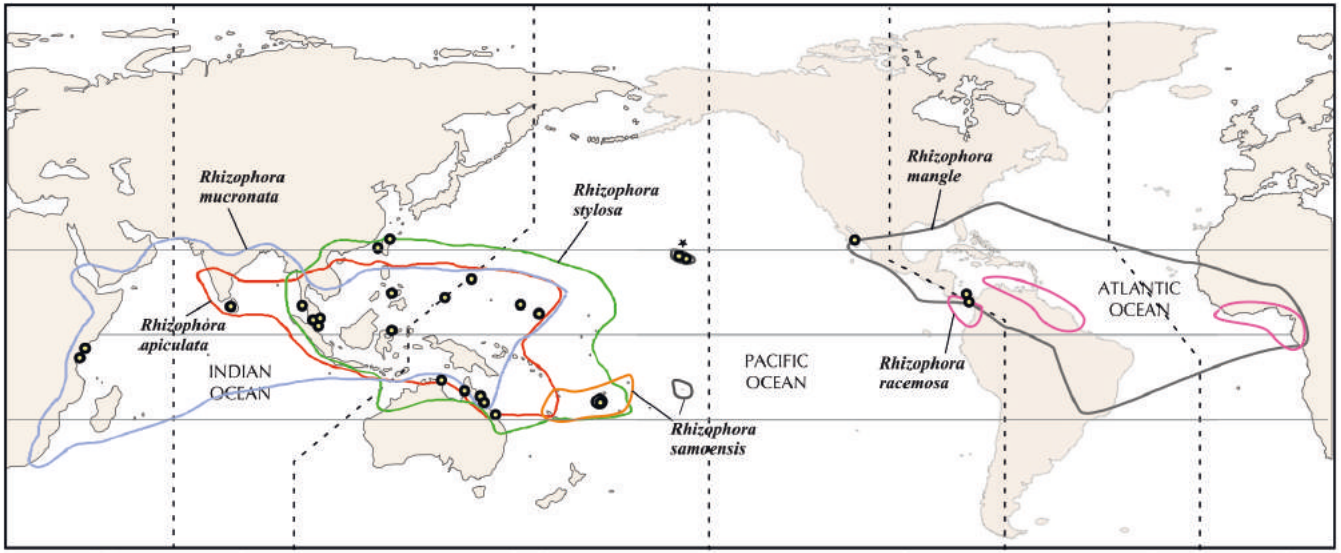


Figure 1 Map showing distribution range of *Rhizophora* species in the Indo-West and Atlantic-East Pacific. Dots indicate the collection sites included in this study and locality information are presented in Table 1. Asterisk indicates introduction occurrence.

Mangrove Forests

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

Four mangrove families in one Neotropical mangrove community

Avicennia - Acanthanceae

Rhizophora - Rhizophoraceae

Laguncularia - Combretaceae

Maytenus - 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

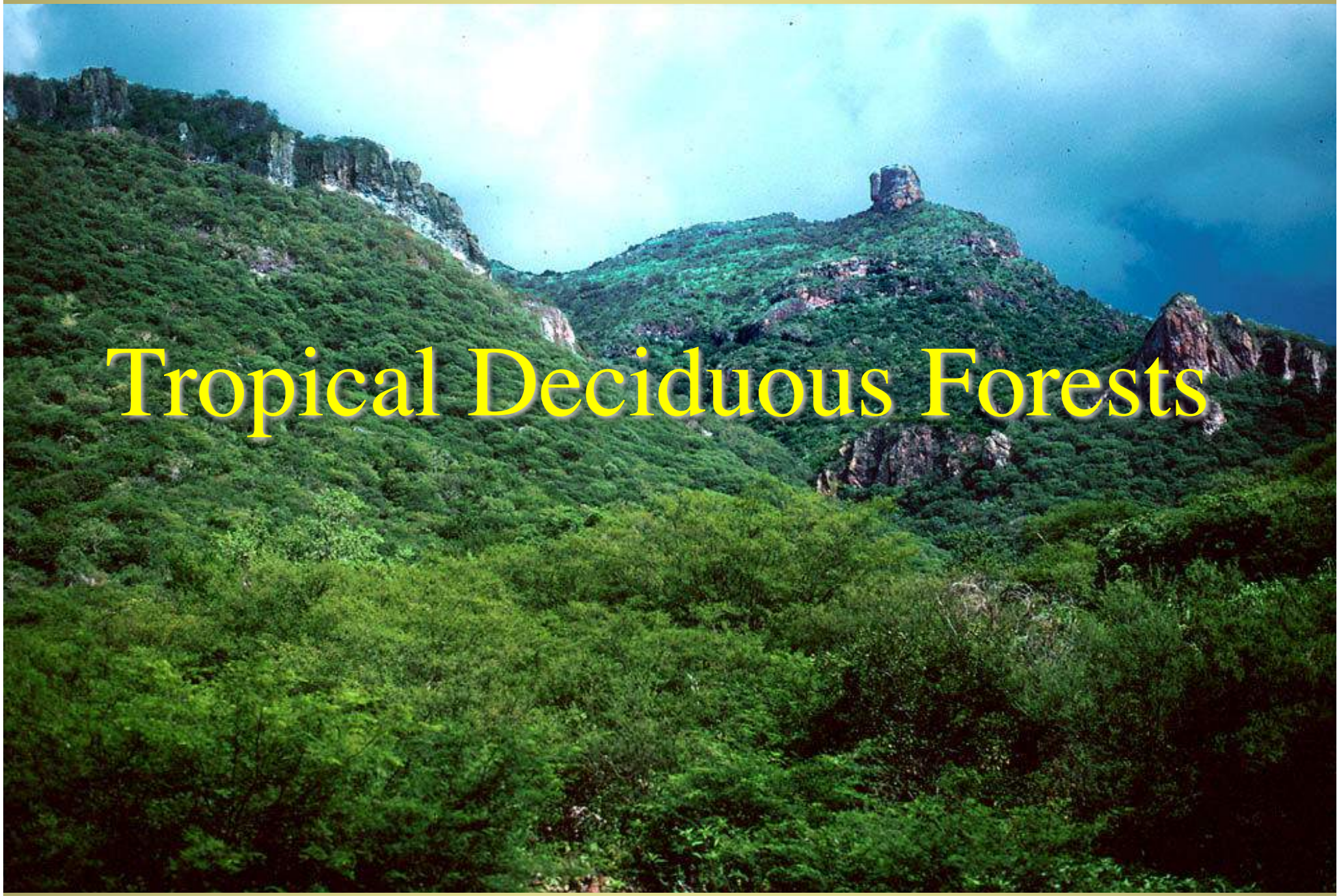
Beach Forests

- woody climbers or runners

Scaevola (Goodeniaceae)

Chamaesyce (Euphorbiaceae)

Solanum (Solanaceae)

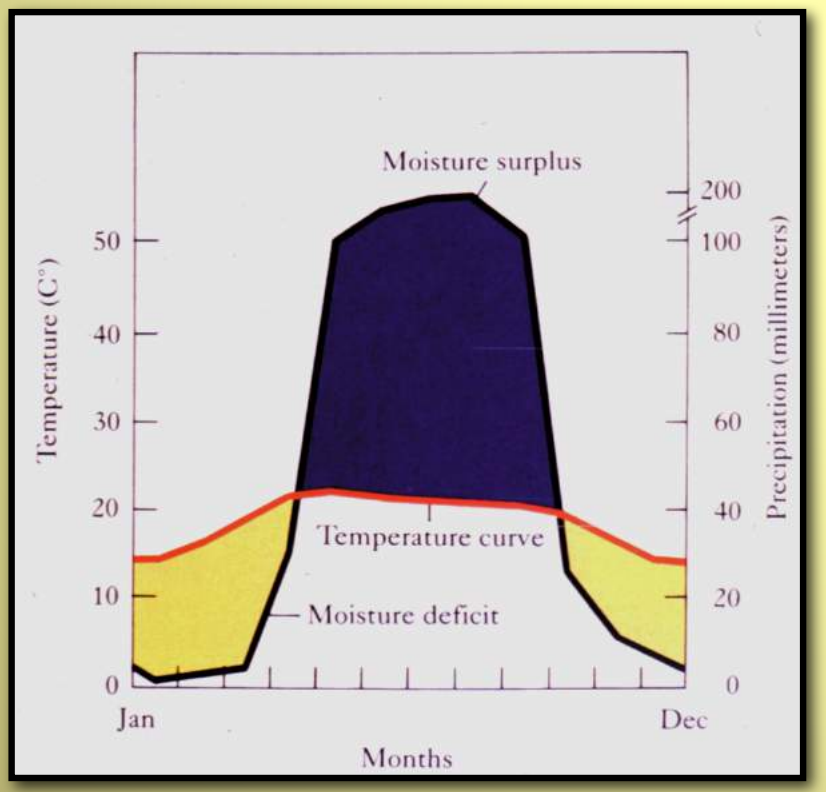

Tropical Deciduous Forests

Tropical Deciduous Forests

or Rain/Summer Green Forests

Climate . . .

- wet-dry seasonal alternation
- equatorial trough OR subtropical high climate



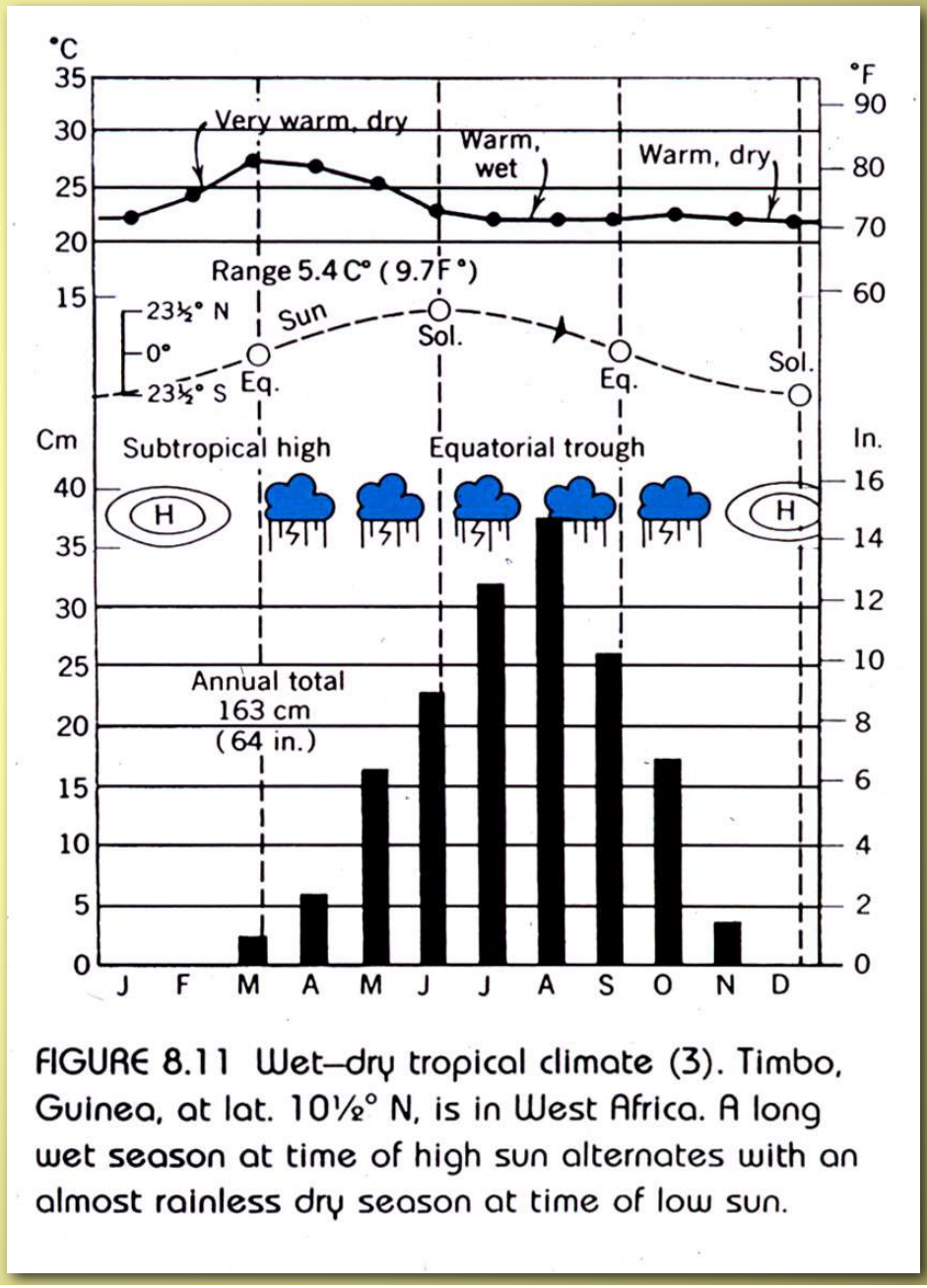


FIGURE 8.11 Wet–dry tropical climate (3). Timbo, Guinea, at lat. 10½° N, is in West Africa. A long wet season at time of high sun alternates with an almost rainless dry season at time of low sun.

Tropical Deciduous Forests

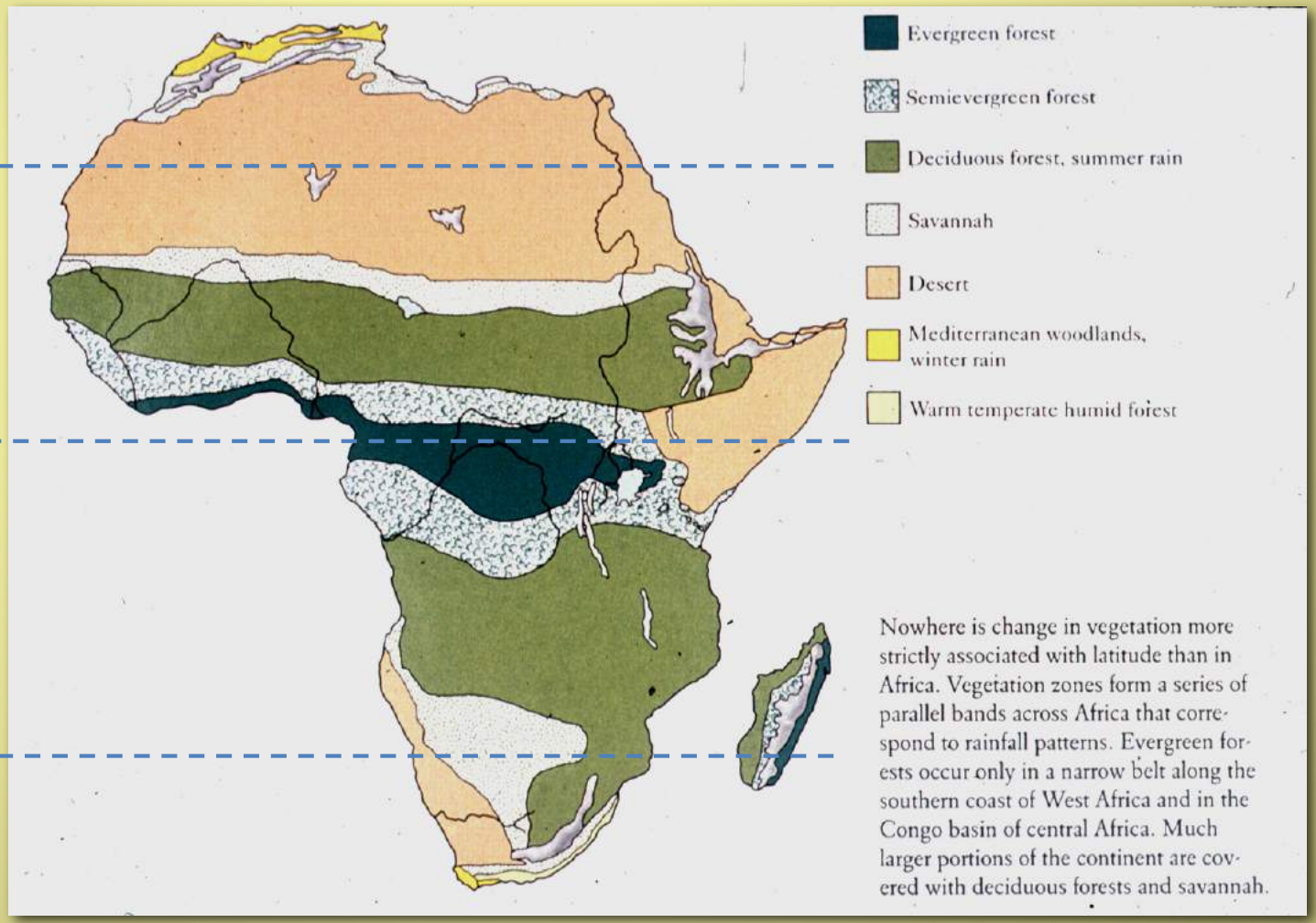
or Rain/Summer Green Forests

Climate . . . find this moving away from tropics

23N°

0°

23S°

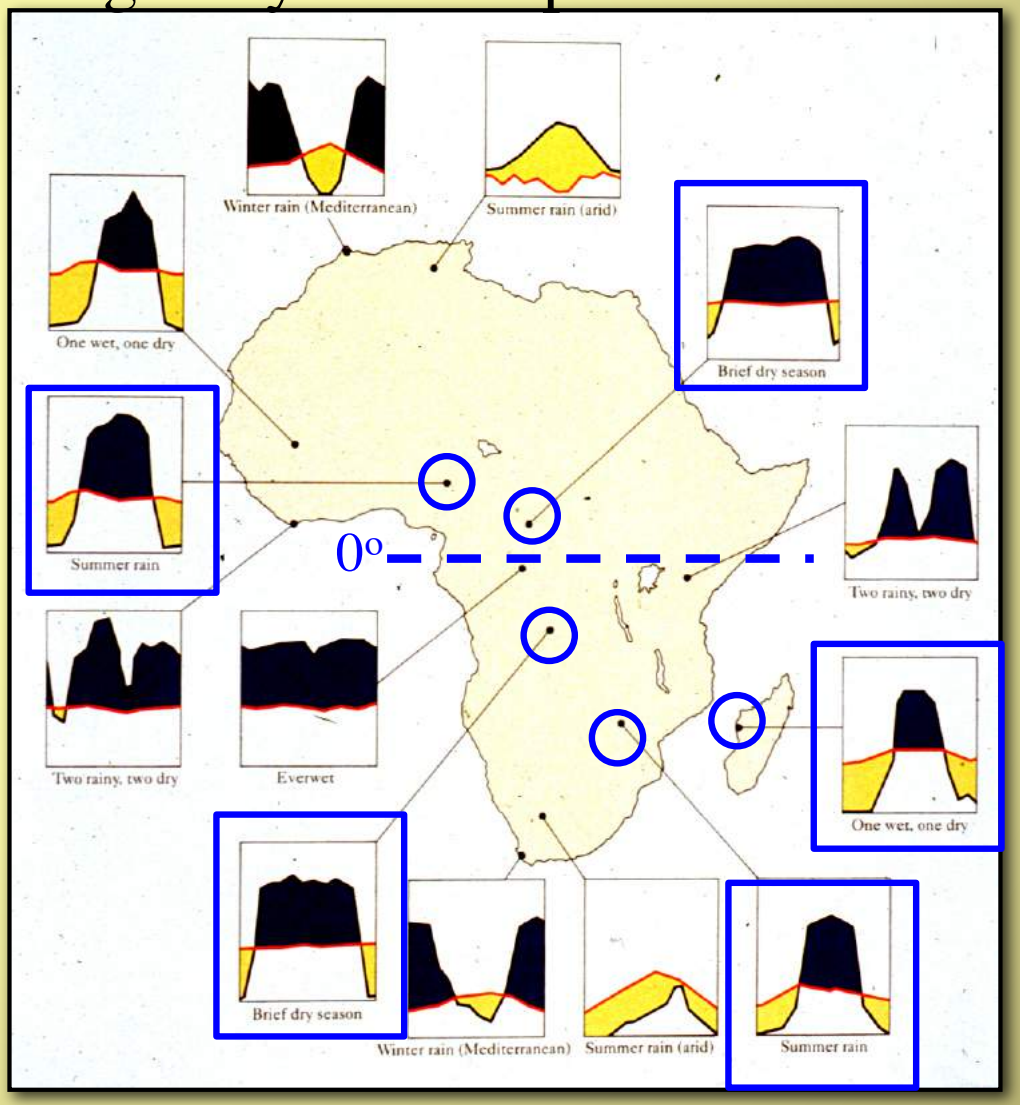


Tropical Deciduous Forests

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 . . .

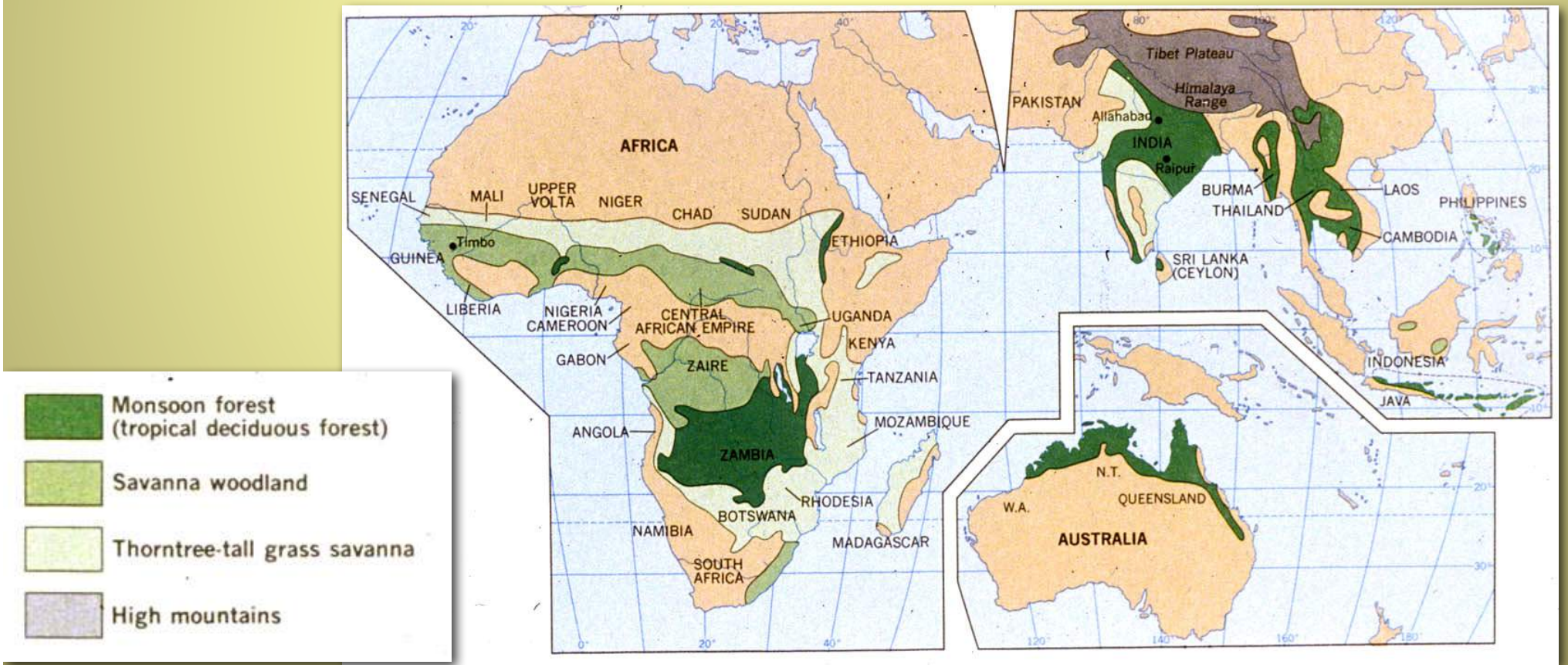
- South America - N & S of Amazon, Central America & W. Indies

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

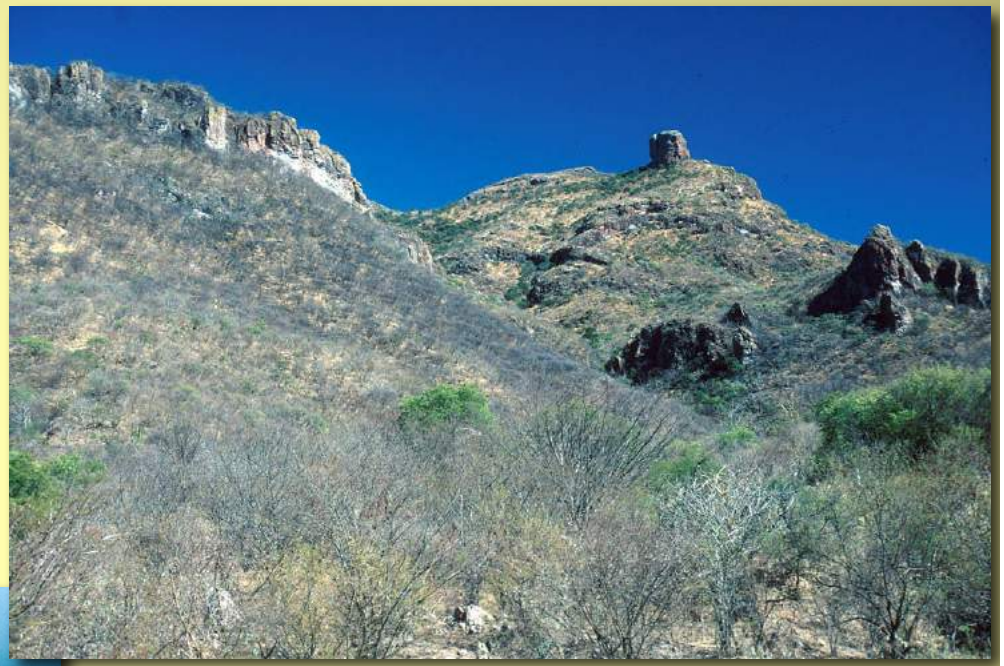
Santa Rosa, Costa Rica dry forest, summer

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

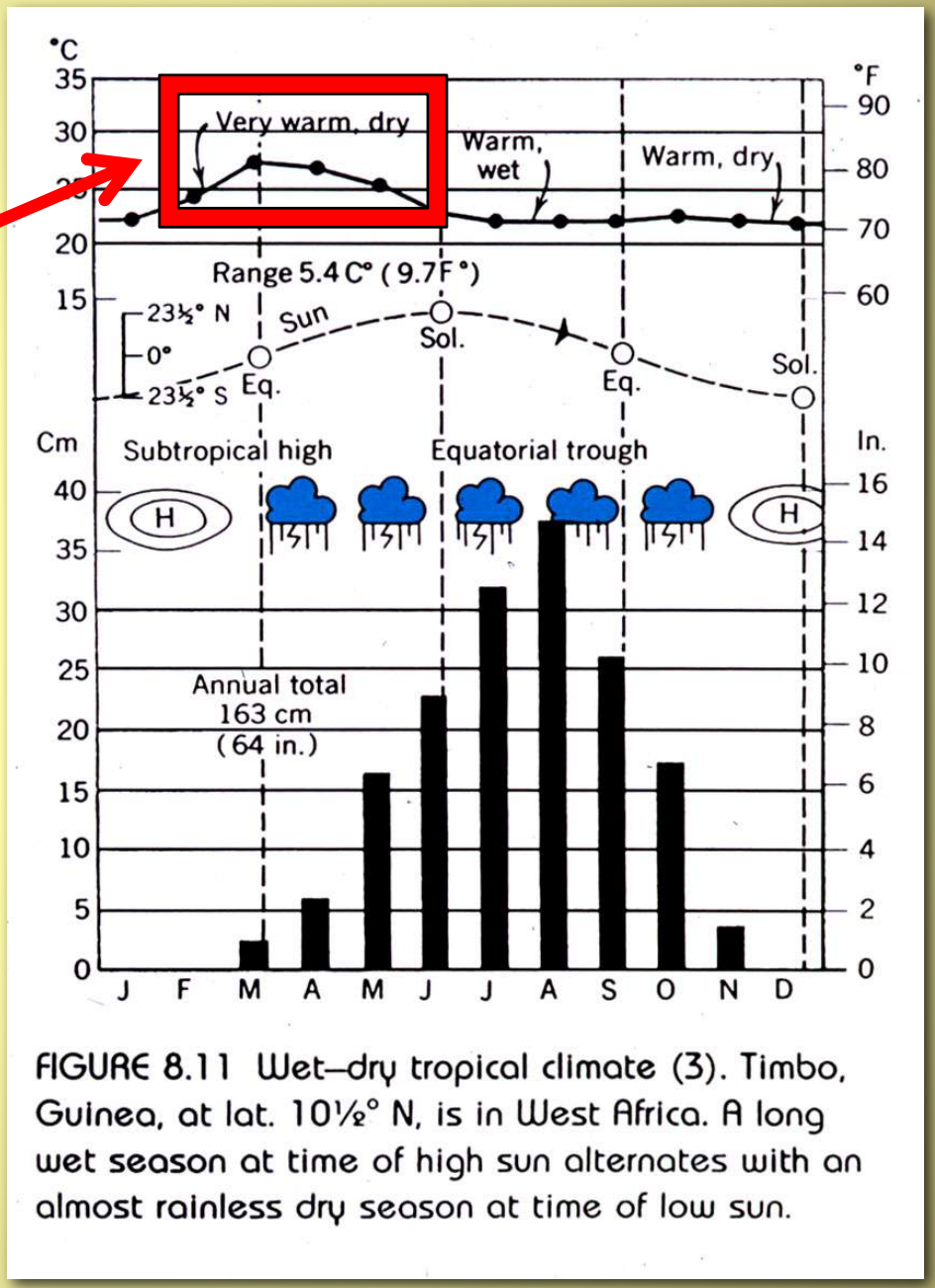
Hildegardia barteri - Malvaceae, Africa

Tropical Deciduous Forests

Vegetation

- Flowering occurs at end of dry season when leafless

Ipomoea arborea
(Convolvulaceae - Mexico)



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Tropical Deciduous Forests

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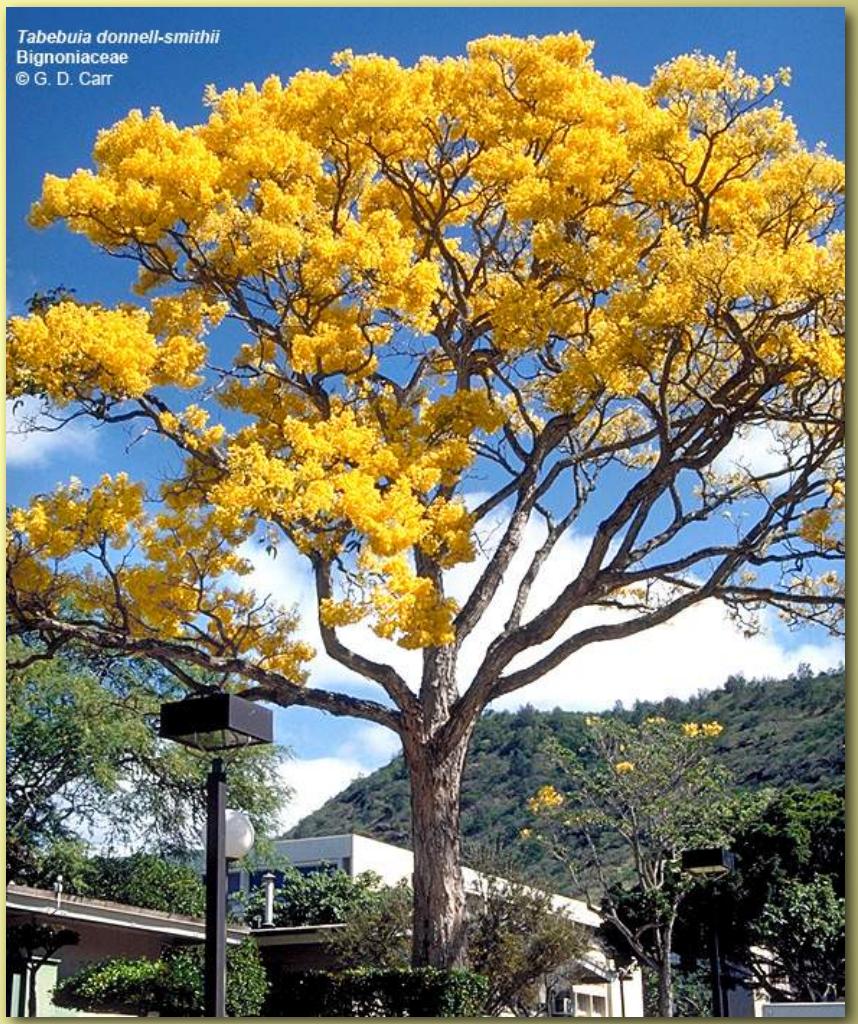


Tabebuia (Bignoniaceae)

Tropical Deciduous Forests

Vegetation

- Flowering occurs at end of dry season when leafless

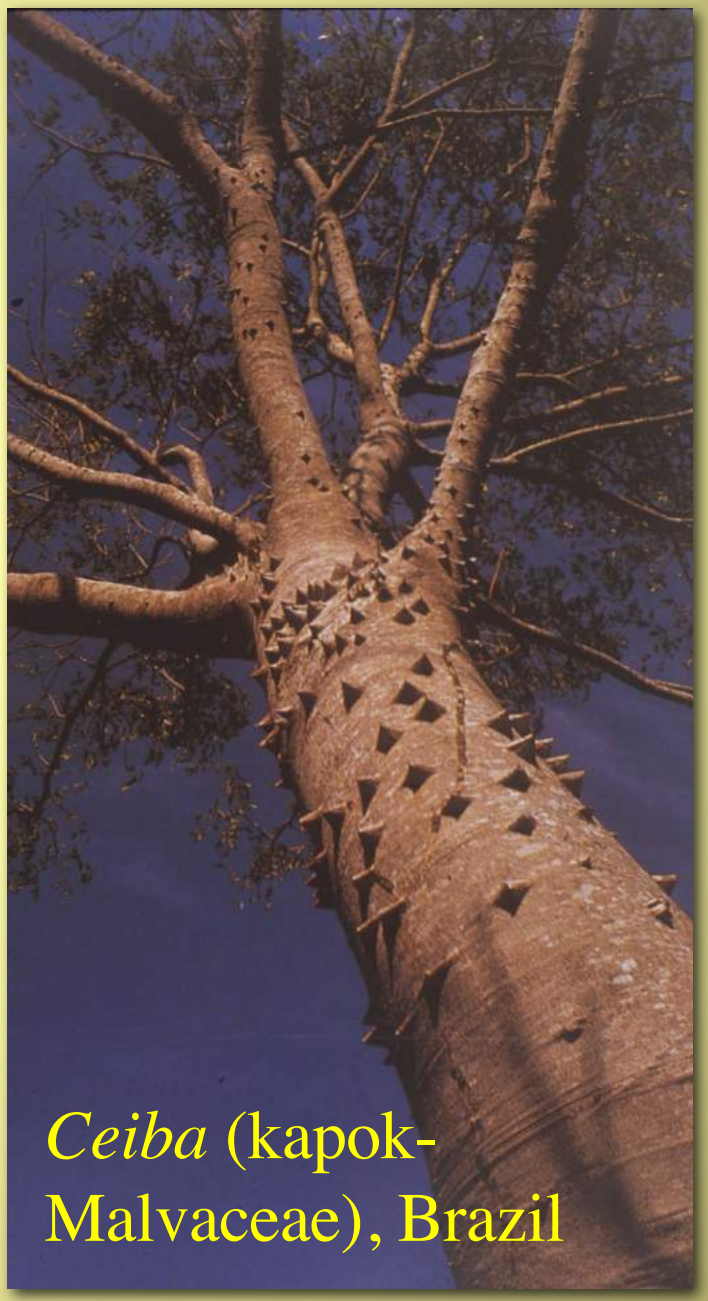
Cochlospermum (Cochlospermaceae - Panama)

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 (Flacourtiaceae Thailand)

Acacia (Fabaceae, Mexico)

Deckenia, palm cabbage, Seychelles

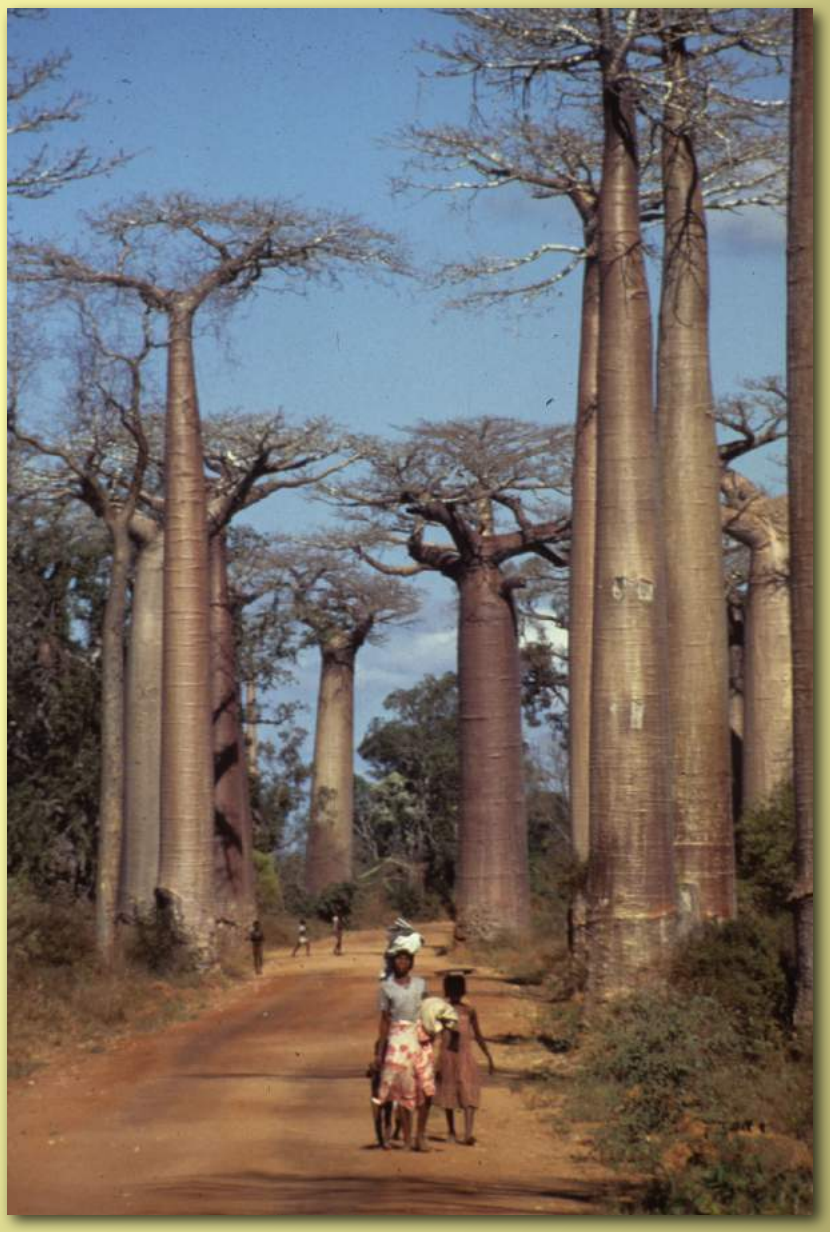
Astrocaryum (palm- Mexico)

Tropical Deciduous Forests

Vegetation

- "Bottle" trees - water storage

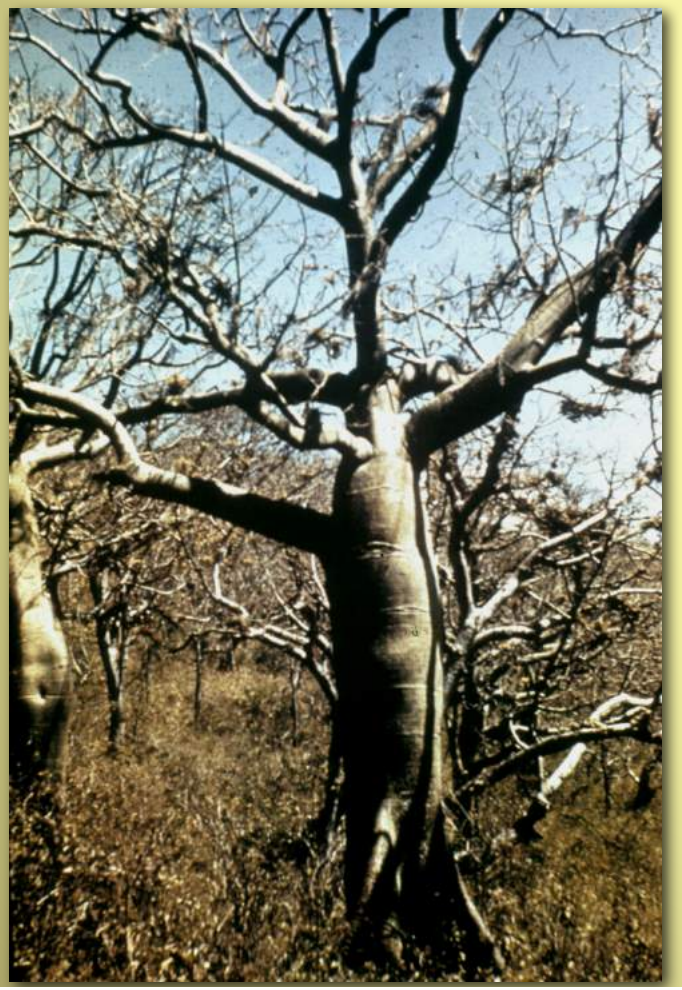
Adansonia (Malvaceae)
Madagascar & Africa & Australia



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

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 same location)

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 same location)

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

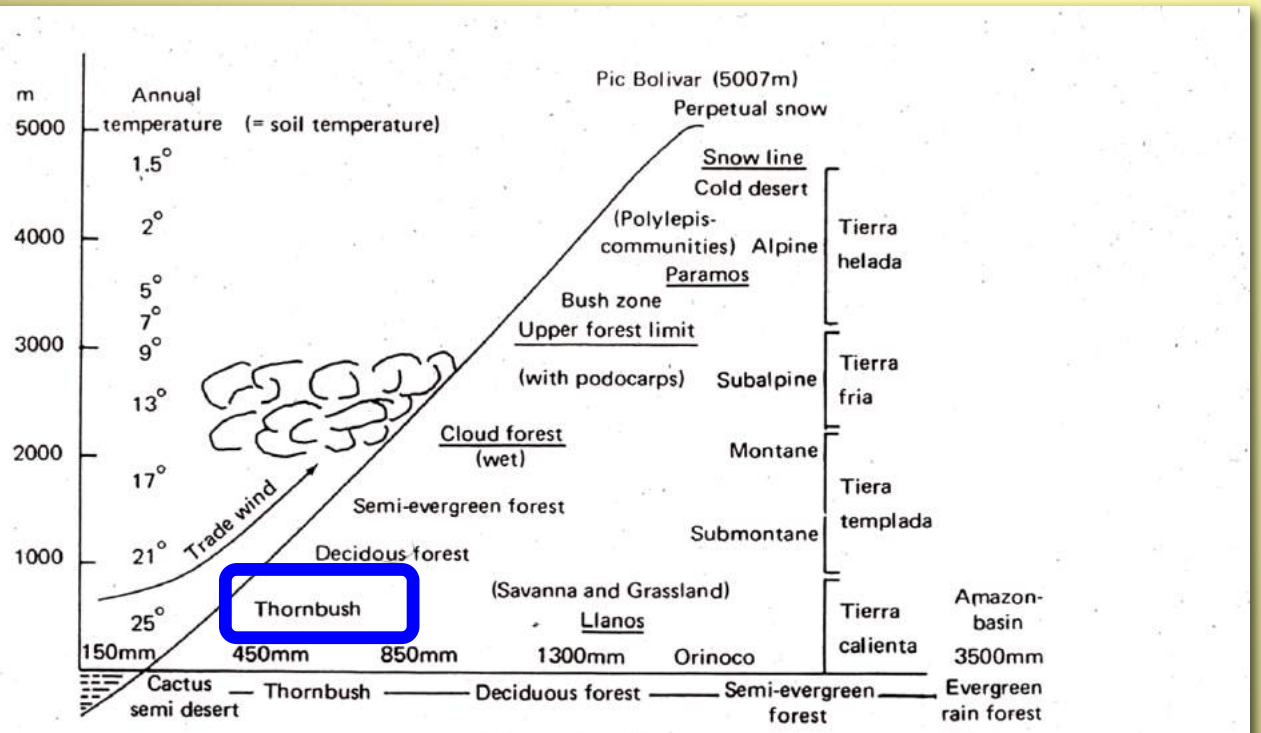


Fig. 31. Schematic representation of the additudinal belts in Venezuela. Man annual temperature is in degrees Centigrade. The abscissa shows change in vegetation from north to south with increasing rainfall (in millimeters)

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

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

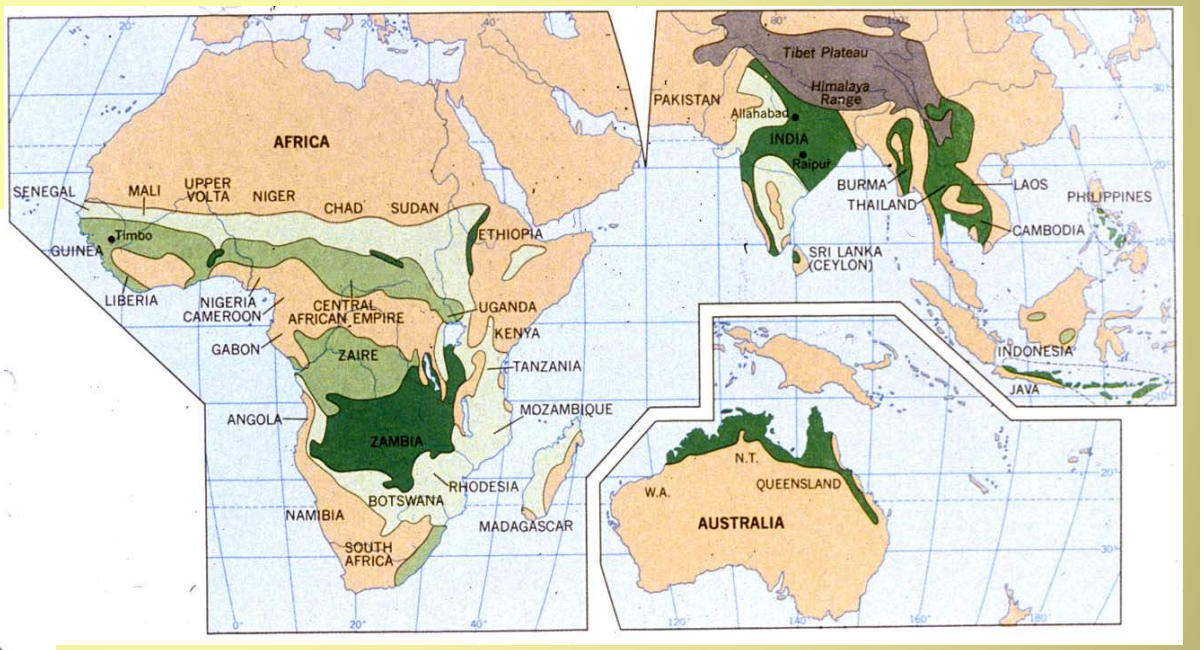

Oleaceae, south Texas


Opuntia (Cactaceae)
south Texas


Koeberlinia (Koberliniaceae) Mexico

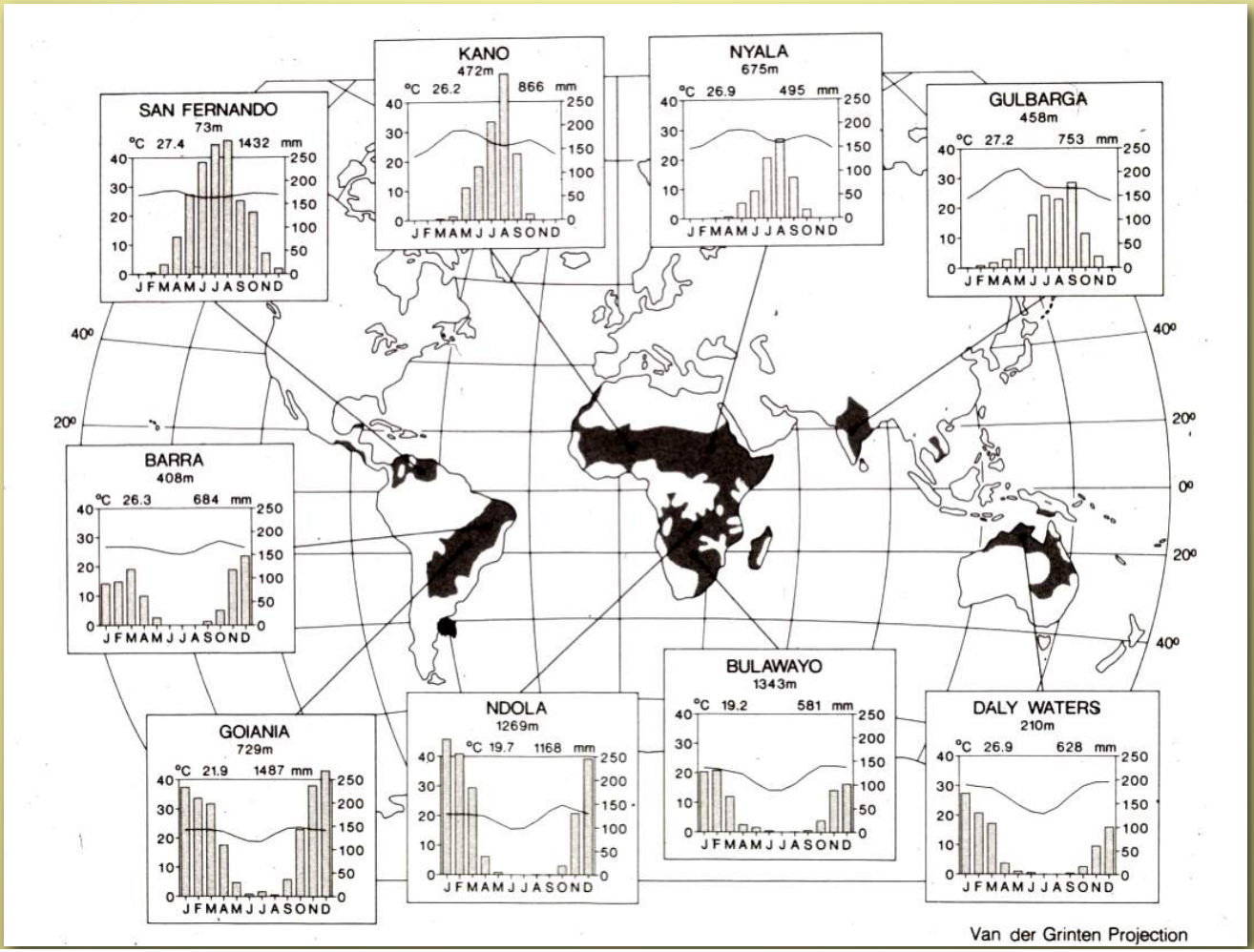
Tropical Savanna Woodland

- 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



Tropical Savanna Woodland

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



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

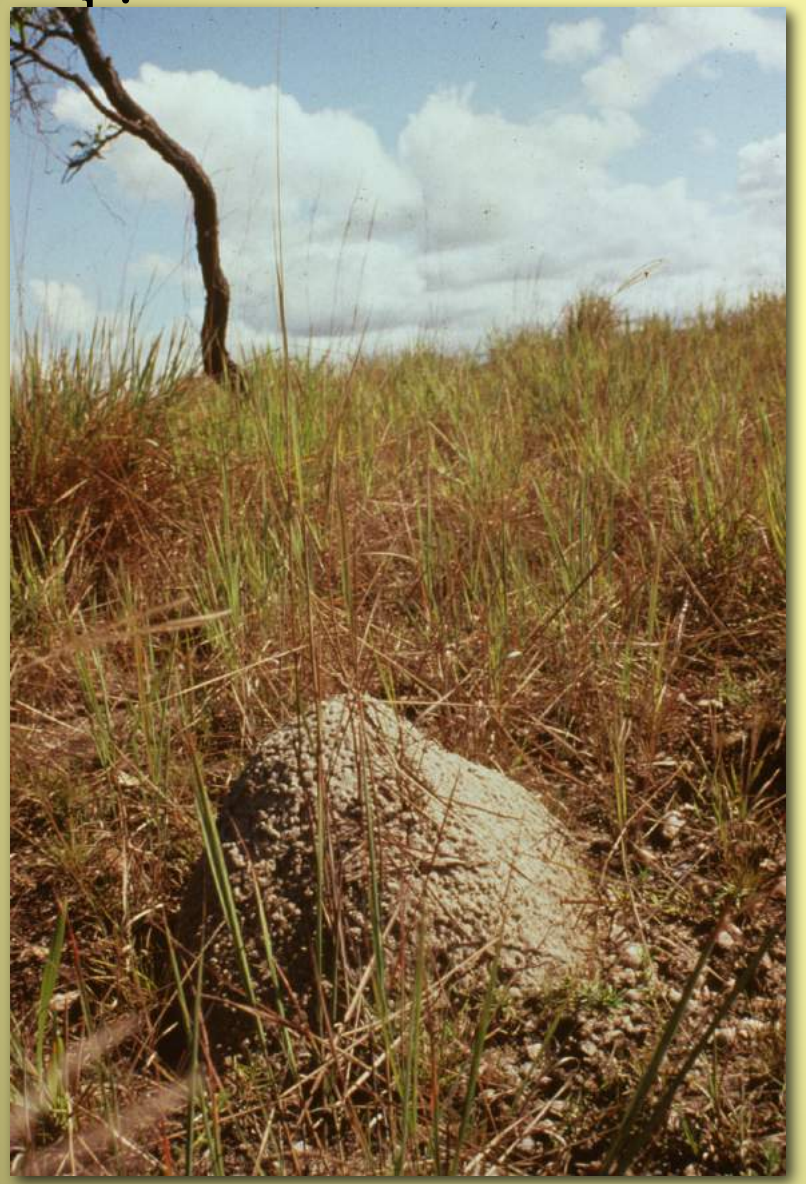
Tropical Savanna Woodland

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

Venezuelan llanos

Tropical Savanna Woodland

- Termites and fire go together in savanna

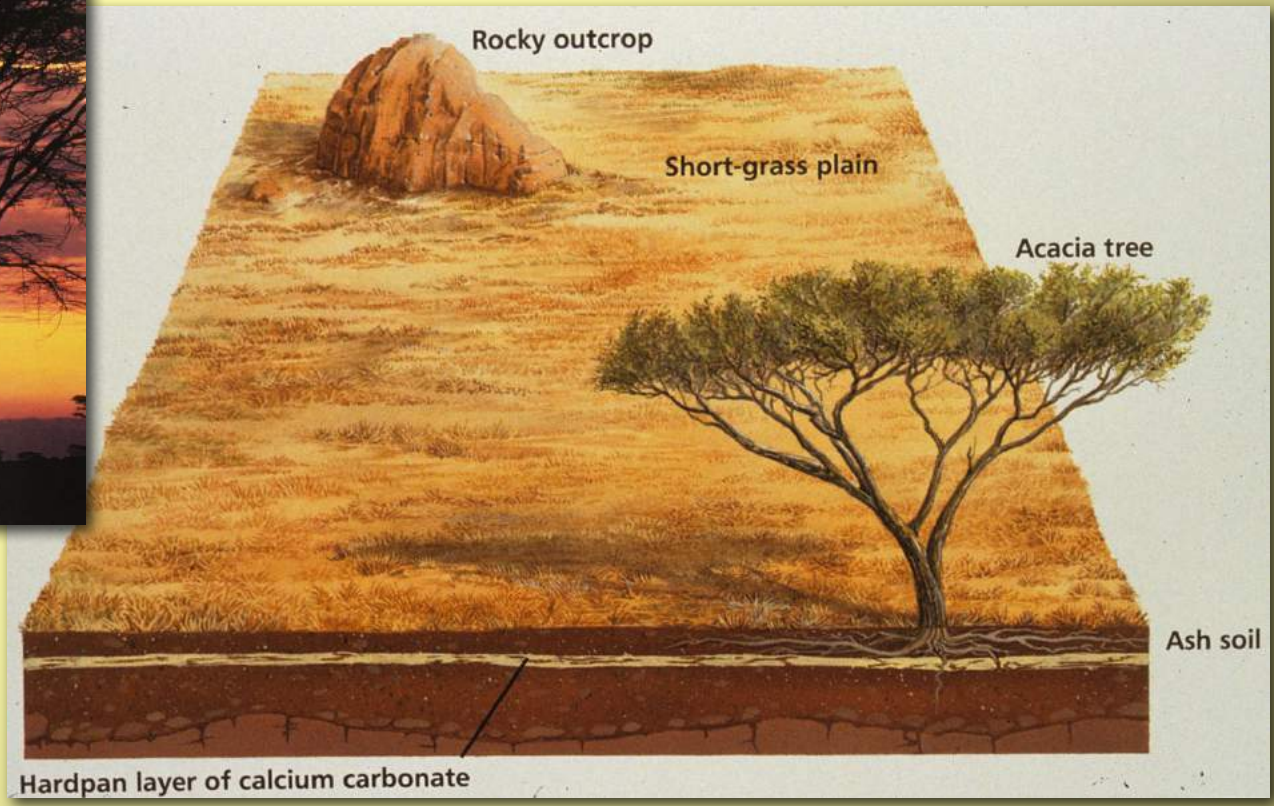


Queensland, Australia

Venezuelan llanos

Tropical Savanna Woodland

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



Serengeti hardpan with *Acacia* (Fabaceae)

Tropical Savanna Woodland

Vegetation:

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

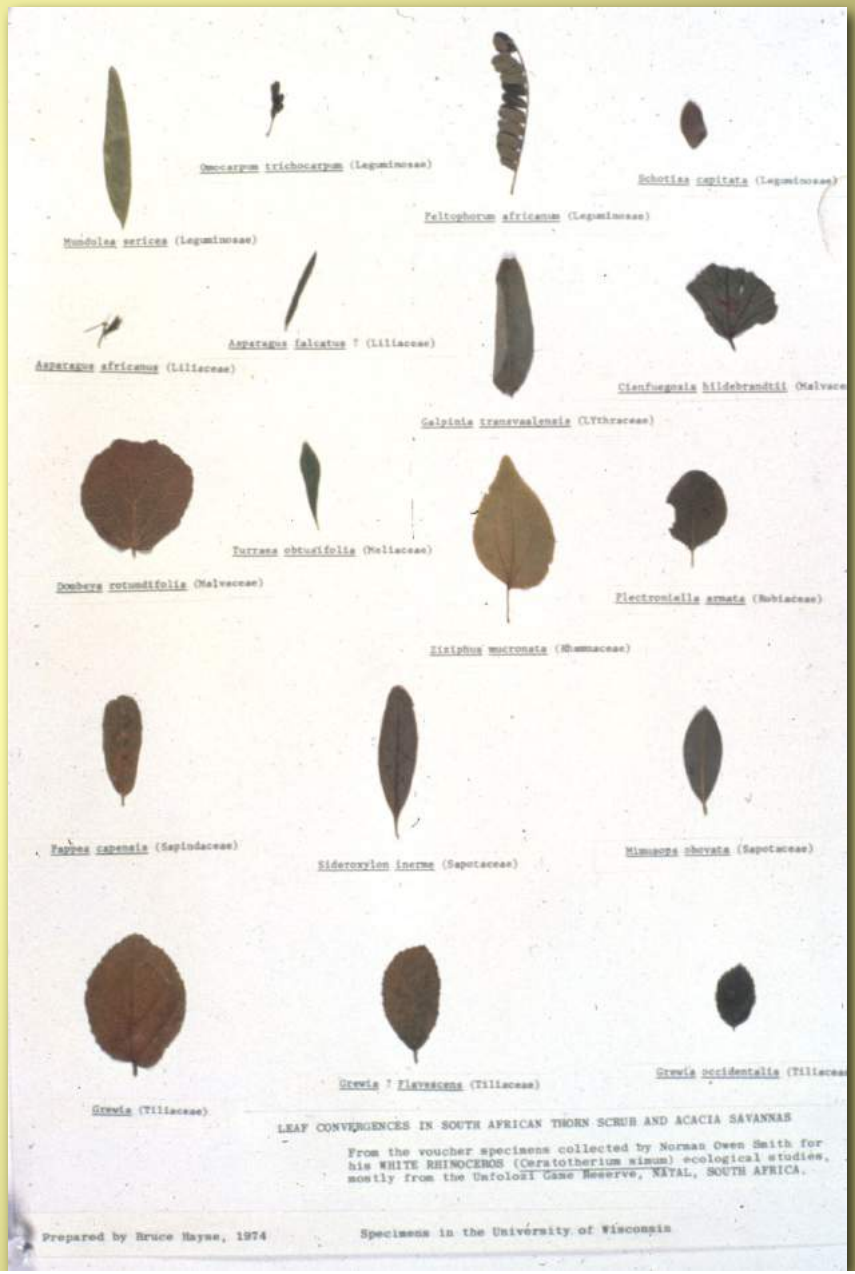
Byrsonima (Malpighiaceae), llanos

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)



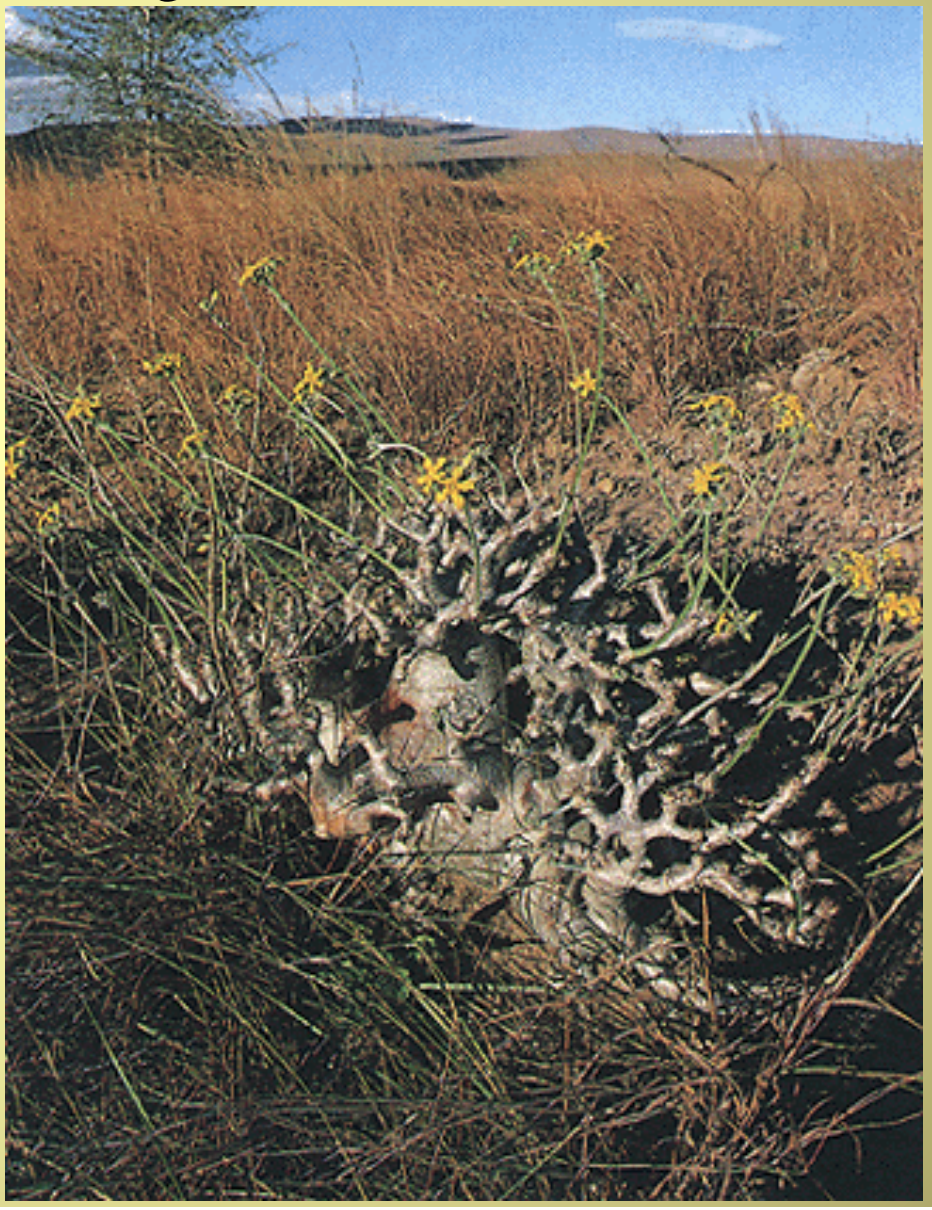
Tropical Savanna Woodland

- 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

Marcelo F. Simon[a,b,1], Rosaura Grether[c], Luciano P. de Queiroz[d], Cynthia Skema[a,2], R. Toby Pennington[a], and Colin E. Hughes[a]

PNAS 2009

- 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)

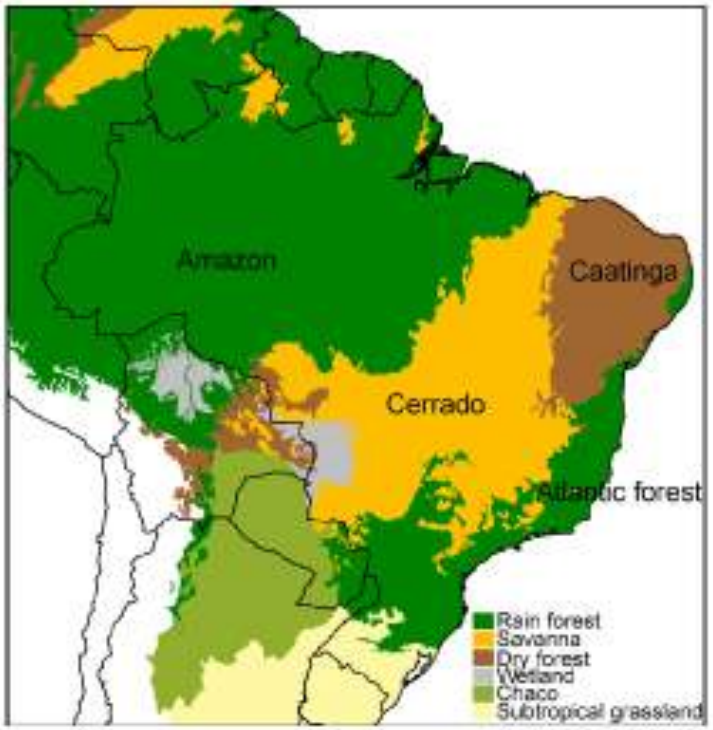
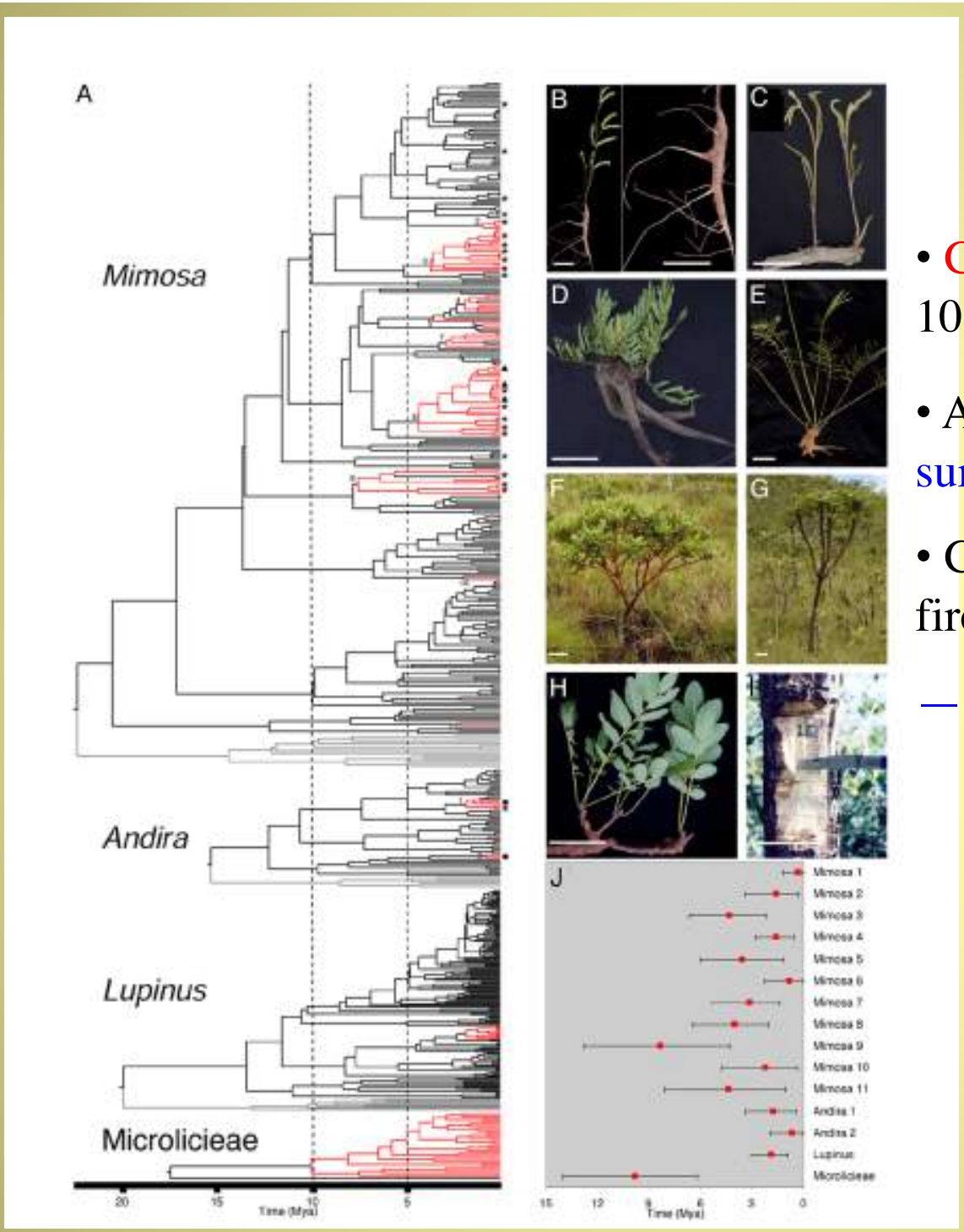


Fig. 1. Map of major vegetation types in South America showing the location of the Cerrado surrounded by a diverse array of other biomes.



- 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

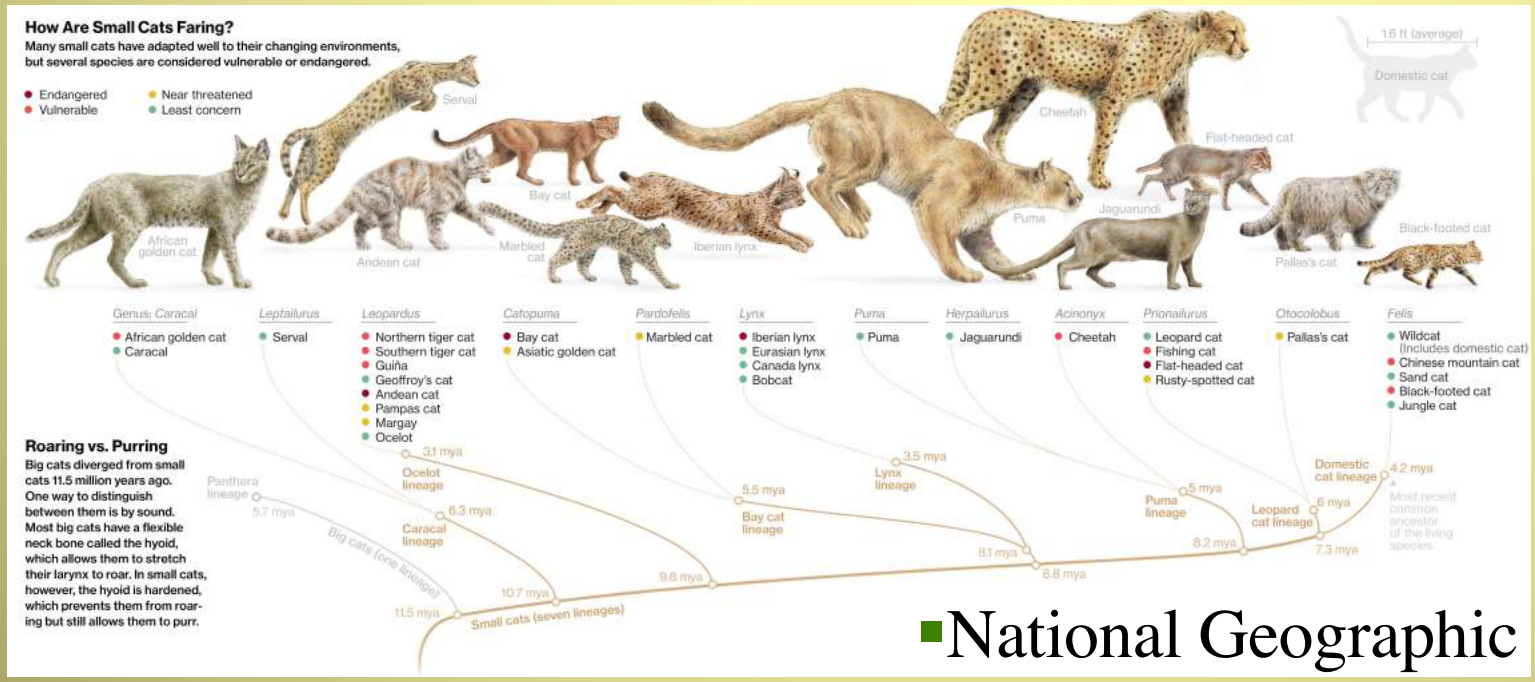
- nocturnal & small rodents elsewhere

- lizards account for up to 40% species in Neotropical dry forest fauna - *Anolis*

- Myrmicinae ant radiations (*Atta*)

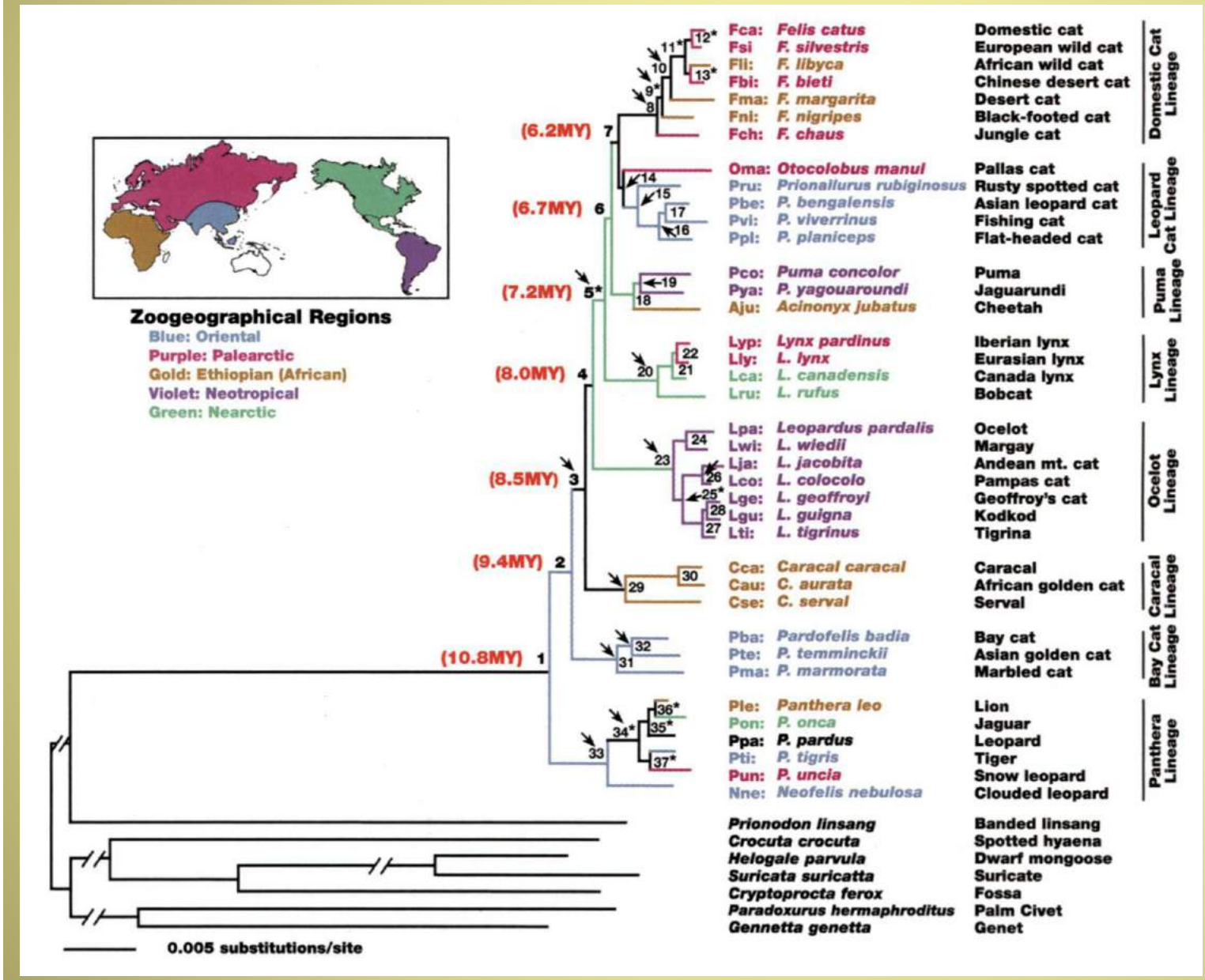
Tropical "Dry Forest" Flora & Fauna Relationships

- 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?