

Vegetation versus Flora

What lives where and why?

Ecological hypotheses

Do the species occur here because of similar climate? latitude?

animal grazing? montane rain shadows? fire history?



Australian grass savanna



African grass savanna

Vegetation versus Flora

What lives where and why?

Ecological hypotheses

These hypotheses and questions examine environmental stresses on species to produce these characteristic vegetation types, physiognomy, or life forms

Convergent adaptation or evolution operating?



Australian grass savanna



African grass savanna

Vegetation versus Flora

What lives where and why?

Historical hypotheses

Are the species occurring in both areas related?

Has there been long distance dispersal between the two areas?

Areas related geologically - once sharing a common biota?



Australian grass savanna



African grass savanna

Vegetation versus Flora

What lives where and why?

Historical hypotheses

These hypotheses and questions are interested in the flora (actual species composition) and history of the both the **species** and the **areas** they inhabit



Australian grass savanna



African grass savanna

Vegetation versus Flora

Similarity of Australian and African grass savannas largely explained **by ecological answers**

Both have *Acacia* as the dominant small tree and grasses as the dominant herbs, but the species are unrelated



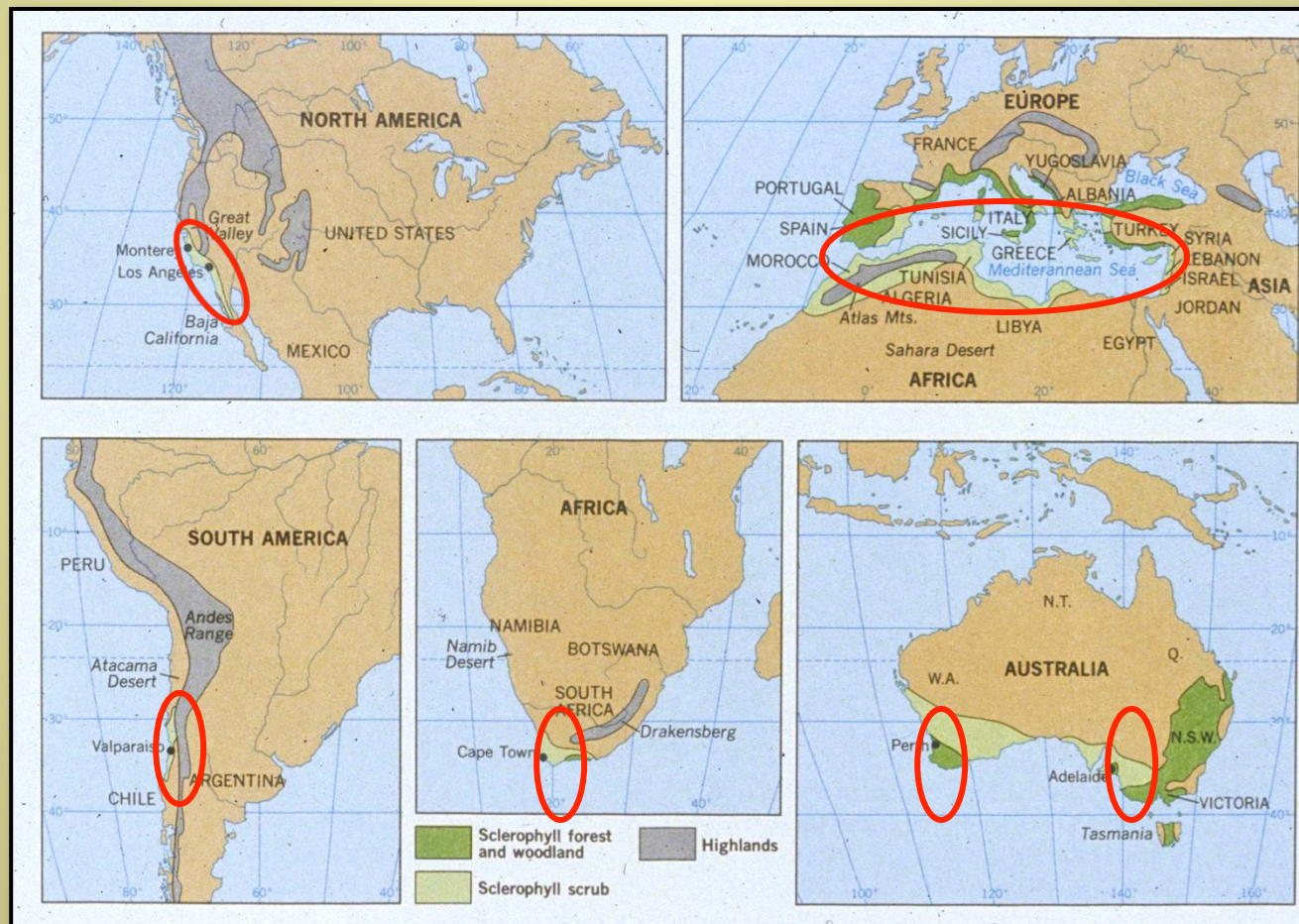
Australian grass savanna



African grass savanna

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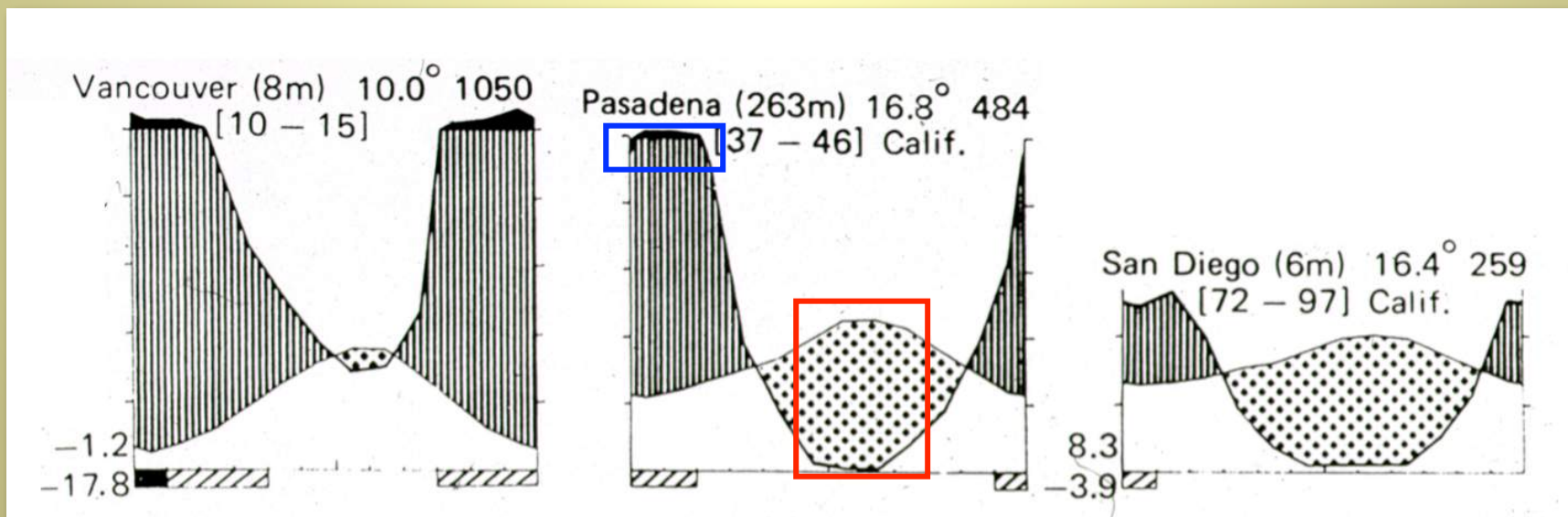
Do species occurring in Mediterranean biomes (5 of them) look similar because of **ecological similarity** or because they are **floristically similar**?



Vegetation versus Flora

Do species occurring in Mediterranean biomes (5 of them) look similar because of ecological similarity or because they are floristically similar?

Because of the severe alternation of **winter rain** and **summer aridity**?
Because of cold ocean currents flowing from high latitudes on west sides of continents?



Vegetation versus Flora

Do many species have “holly” leaves because they are closely related? or, because tough leathery leaves, with spine tips are an adaptation to the Mediterranean climate? **Convergent evolution!**



Ilex (Aquifoliaceae)
holly



Quercus ilex
(Fagaceae)



Banksia ilicifolia
(Proteaceae)

Vegetation versus Flora



Does mountain sweet cicely have this amphitropical distribution because **ecological conditions** are similar in all three areas? or **long distance dispersal**? or previous **continental connections**?

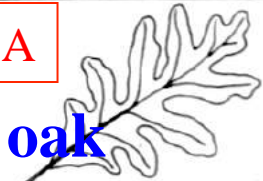


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Are these amphi-Atlantic species pairs simply **ecological replacements**? or are they **closely related species** separated by a now expanding North Atlantic ocean?

white oak

A



Quercus alba

B



Q. robur

beech

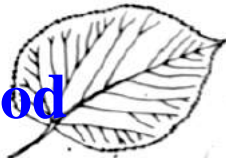


Fagus grandifolia



F. sylvatica

basswood



Tilia americana



T. cordata

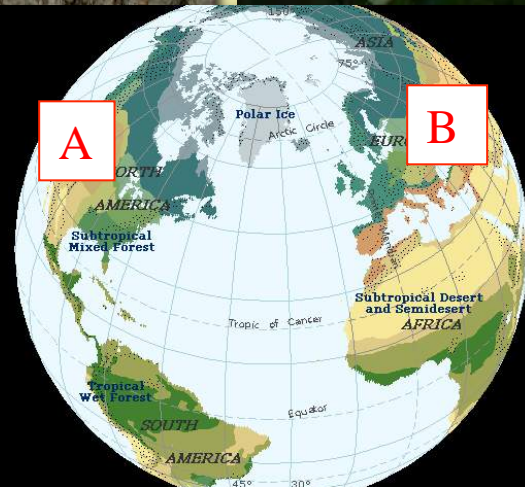
ash



Fraxinus nigra



F. excelsior

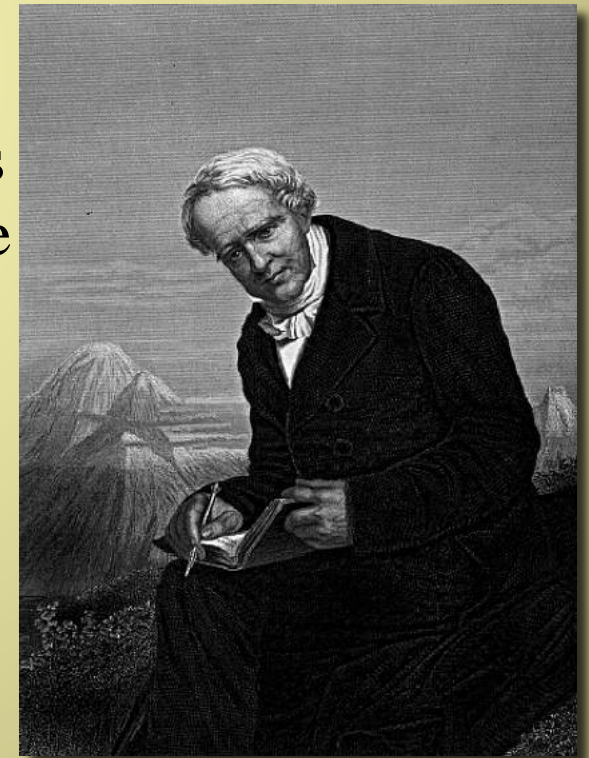


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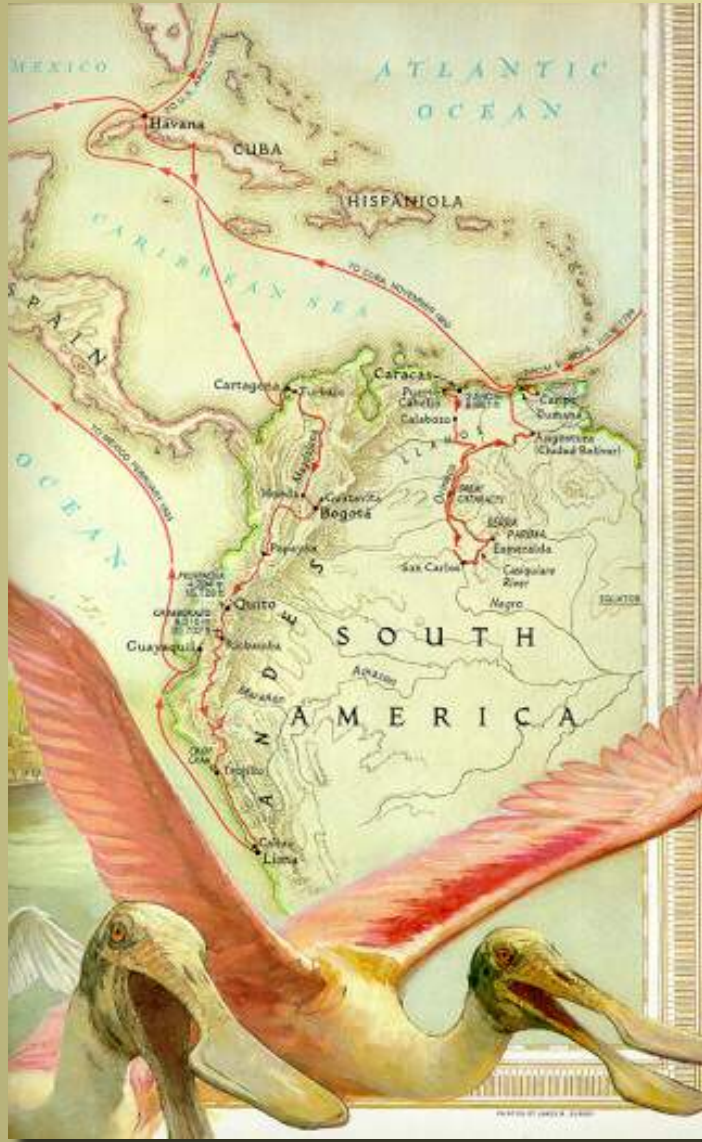
Alexander von Humboldt (1769-1859)

- First naturalist to make explicit distinction between vegetation and flora and connection between climate and plant distributions
- Funeral in 1859 was one of the greatest the city of Berlin ever saw



What did he do that was so special?

Vegetation versus Flora



- 1799 left for Latin America with Aine Bonpland for 6 years
- landed in Venezuela and visited Cuba, Colombia, Ecuador, Peru, and Mexico
- studied flora, fauna, geology, meteorology, ocean currents



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Epidendrum ibaguense H.B.K.

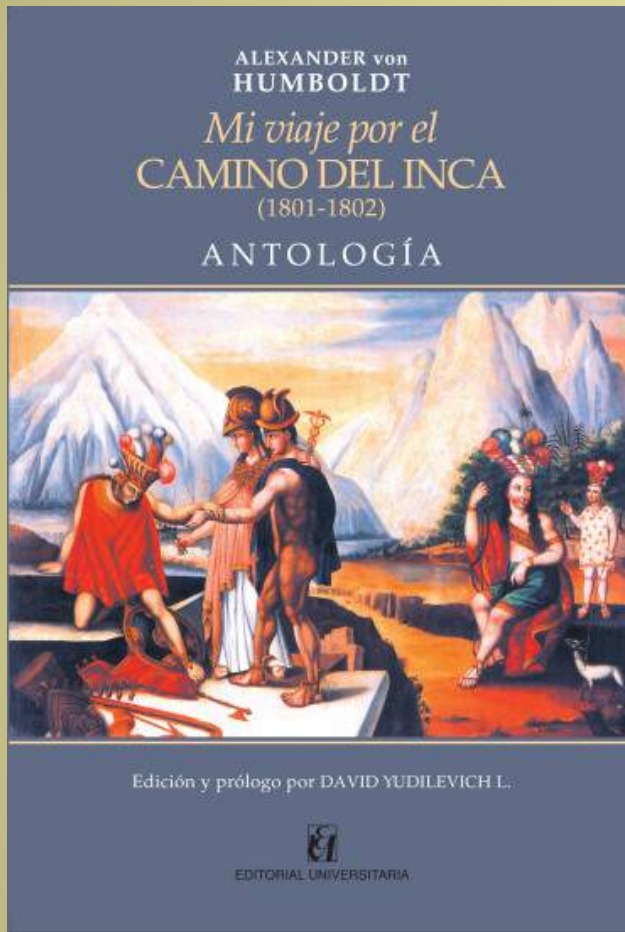
- made first plant collections for the area
- many new species with H.B.K.
authority designation
- traversed the Upper Orinoco in southern Venezuela, documenting its unusual flow



Cinchona - quinine



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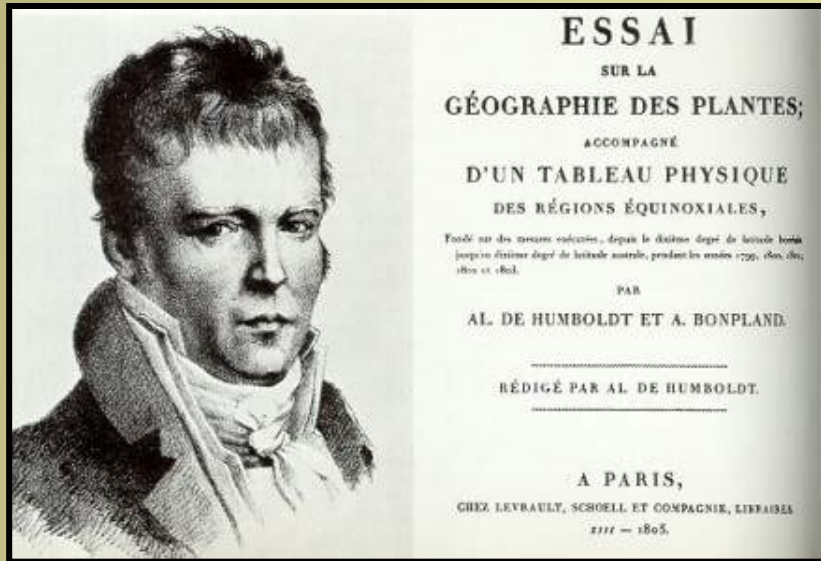


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- wrote extensively on indigenous inhabitants for the first time

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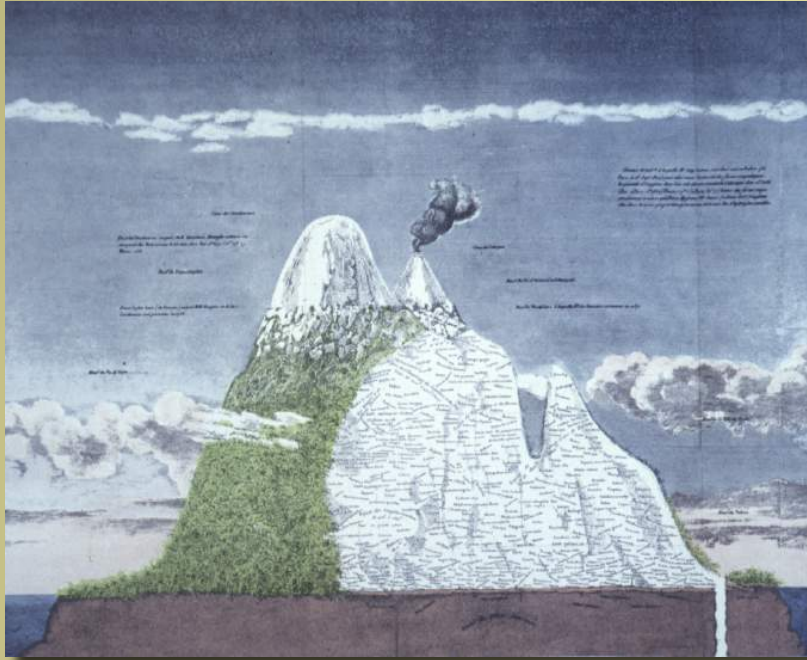
most notable writings include “*Essays on the Geography of Plants*” (1805)

1. Observations on the effect of altitudinal differences on vegetation

Cerro Avila, north of Caracas, first mountain “zoned”



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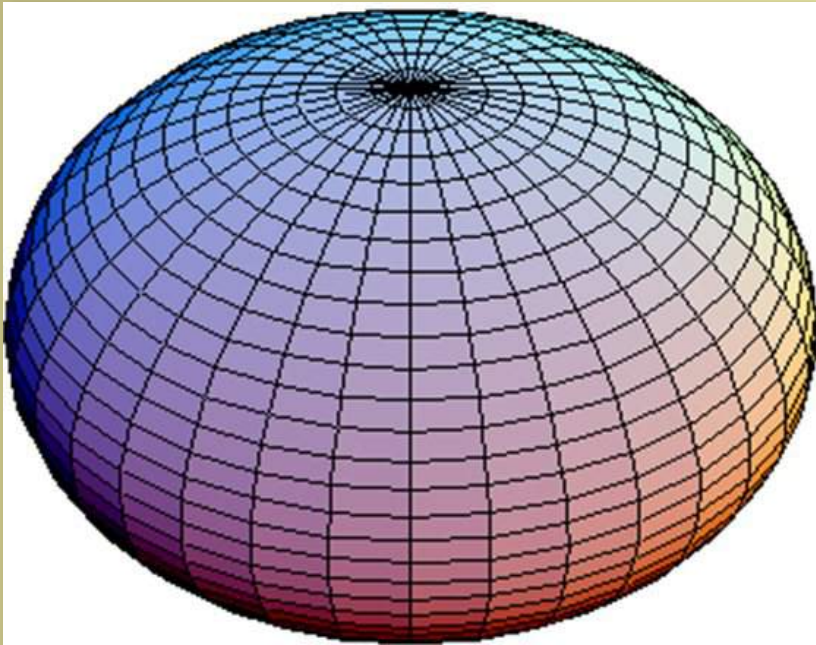
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Chimborazo, Ecuador (1.5° S;
20,703ft - 6,310m)



Vegetation versus Flora



Earth is an oblate sphere – radius at equator 22km larger than at poles

Chimborazo is 2km further from center of earth than Mt. Everest

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Chimborazo, Ecuador (1.5° S;
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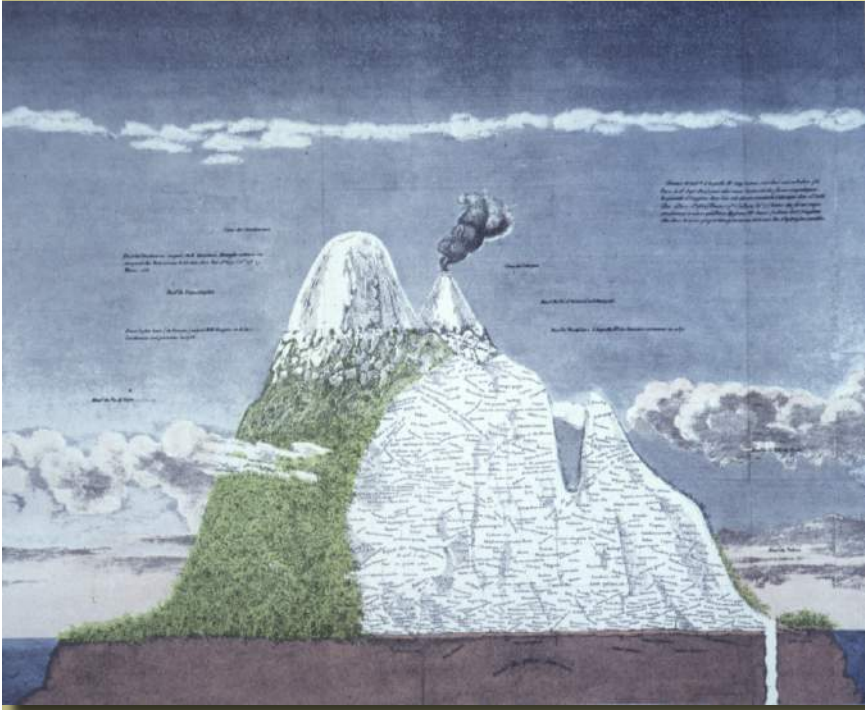


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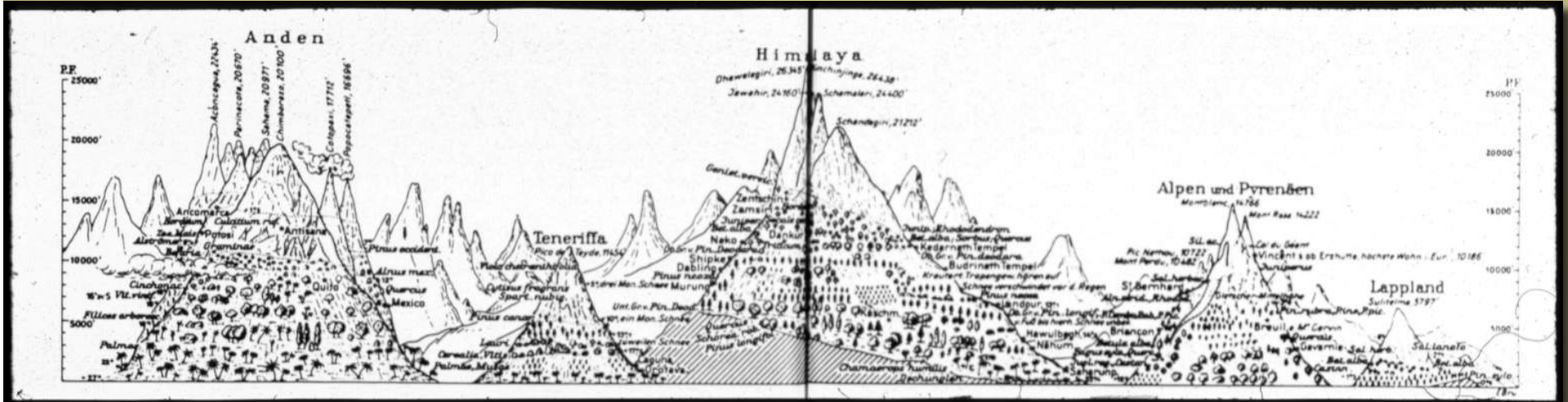
Chimborazo, Ecuador (1.5° S;
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e.g., at 1,950m left savannas and entered **sclerophyllous shrub vegetation belt** (ericads - Ericaceae or blueberry family)



Vegetation versus Flora



2. Compilation of species for both South America and Eurasia (floristics)

Demonstrated **sclerophyllous shrub belt** is found in Andes, Himalayas, and Alps, and often dominated by Ericaceae, but different genera and species!



Vegetation versus Flora

“The substitution, or the repetition, of similar, almost identical morphological types in different regions separated from each other by oceans or wide areas of land, is a marvelous law of nature”



*“Even if nature does not produce the same species in similar climates, nevertheless the **vegetation exhibits the most striking visual similarities in habit even in the most distant regions**. This phenomenon is one of the most remarkable in the history of organic creations”*

— **same vegetation *not* same flora**

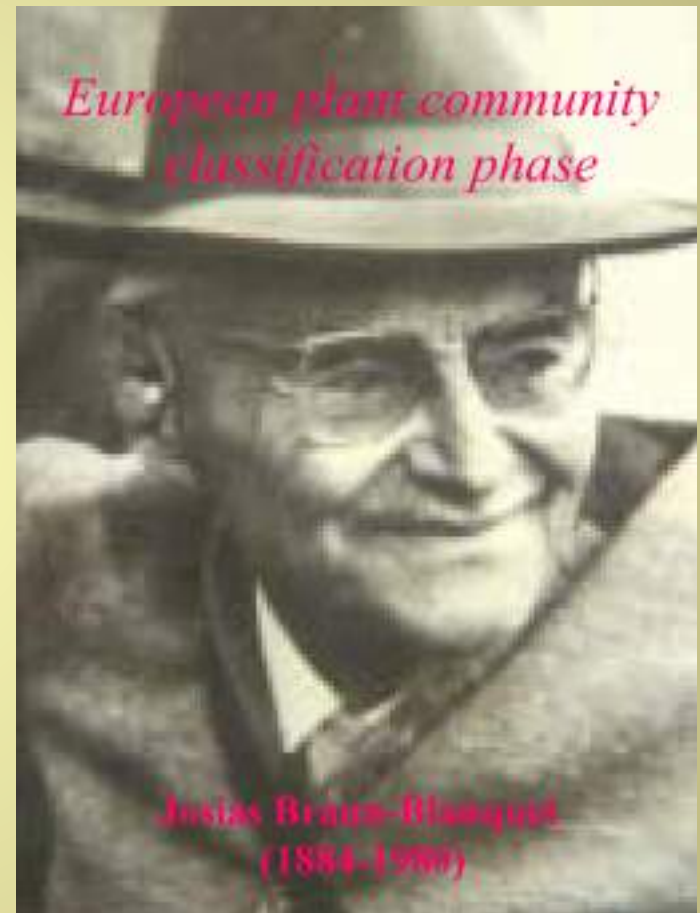
— **implies convergent evolution!**

von Humboldt

Vegetation versus Flora

*“Each plant community consists of a definite group of life forms. **Each habitat favors certain groups of life forms and almost excludes others.** The more extreme the habitat conditions the sharper the selection and the more pronounced are the ecological characteristics of the life forms.”*

Josias Braun-Blanquet, 1932



Vegetation versus Flora

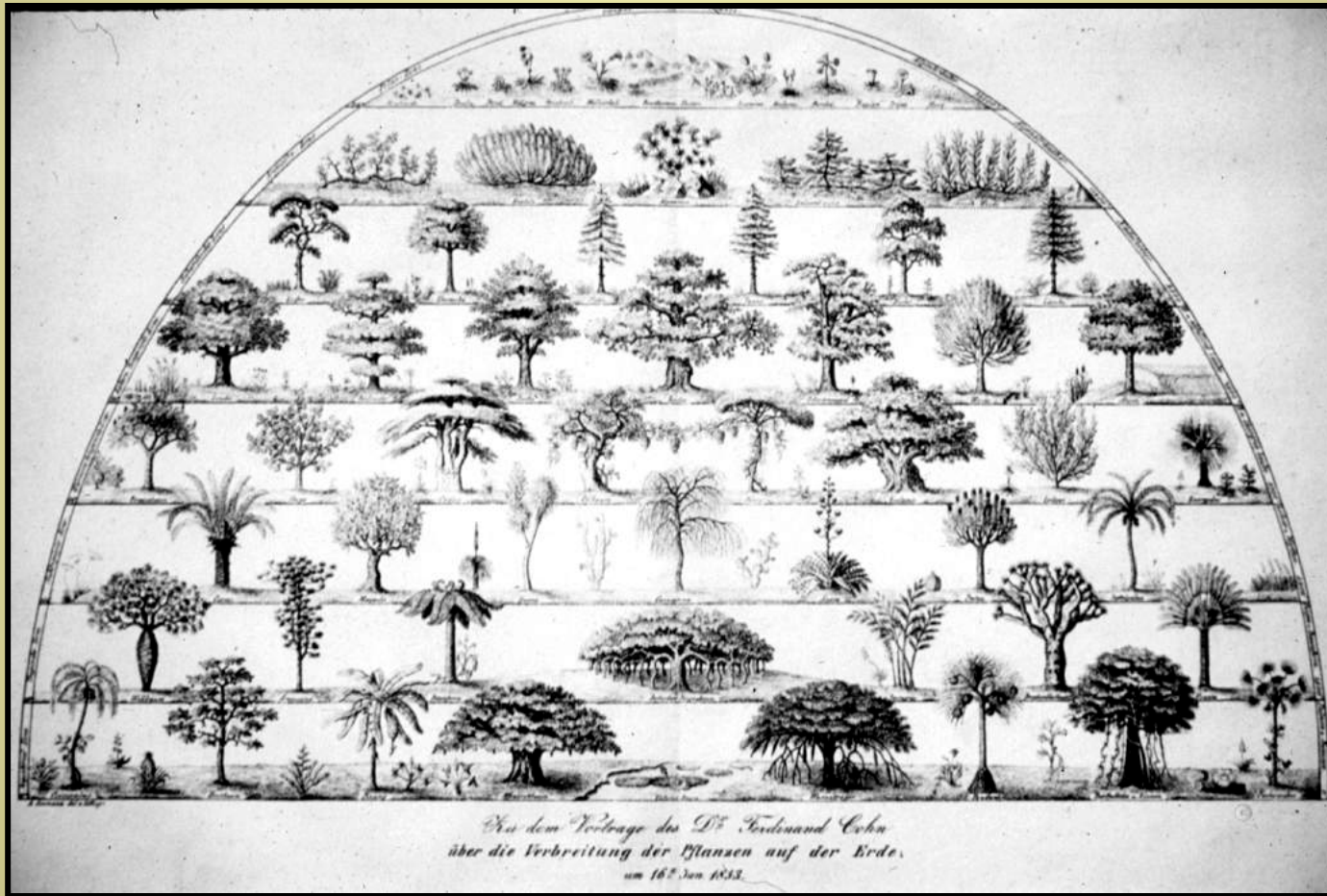


*“Quite apart from the influence of climates in the distribution of individual plant species, **climate strikes at the structure of vegetation everywhere in the same way, whatever its floristic composition. That is to say, similar climates in widely separated parts of the world induce the emergence of similar kinds of plant formations in the physiognomic sense.**”*

Pierre Dansereau, 1951

Vegetation versus Flora

3. Reduced variety of plant **life forms** to 15 basic types - first of its kind



Humboldt's life forms by latitude – based on drawing of Ferdinand Cohn

Vegetation versus Flora



- The simplest and most well known classification of plant forms that disregards their systematics is that of the Danish botanist Raunkiaer (1934)

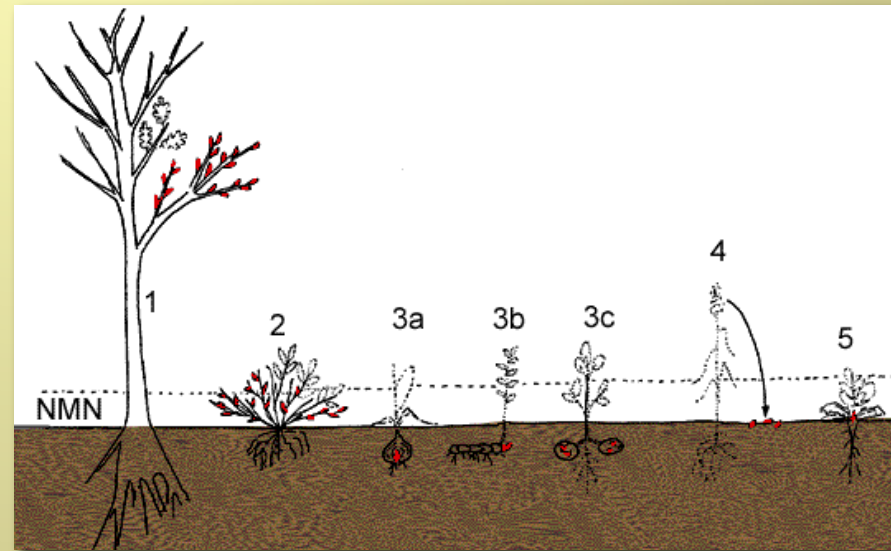
Raunkiaer, C. (1934) *The life forms of plants.*
Oxford University Press

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- He classified plants according to their ‘life forms’ defined by the way in which these buds were held and protected



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Phanerophytes - trees and shrubs

Epiphytes - plants growing on plants

Chamaephytes - buds near ground level

Hemicryptophytes - buds in leaf litter

Cryptophytes - buds covered

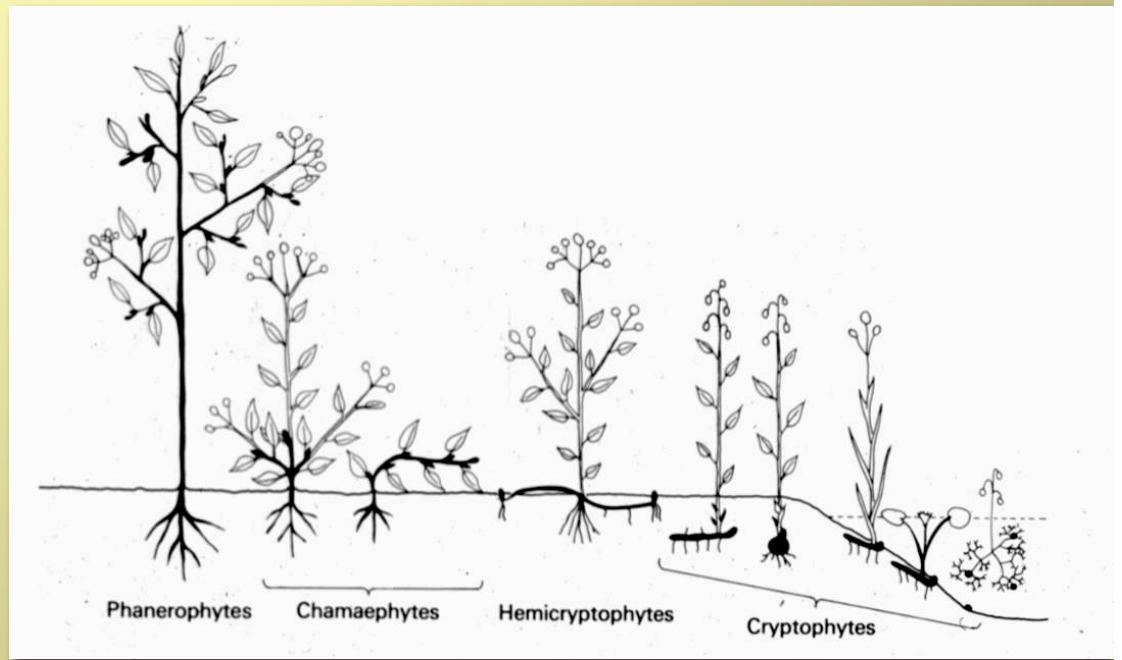
Geophytes - buds underground

Helophytes - marsh plants

Hydrophytes - aquatics

Therophytes - annuals

Raunkiaer life forms
(based on position of
perennating bud)



Vegetation versus Flora

Distribution of Plant Life Forms in Various Biomes

	Phanero. (trees/ shrubs)	Chamae. (near ground)	Hemicrypto (leaf litter)	Crypto. (under ground)	Thero. (annuals)
Rainforest	96%	2%	0%	2%	0%
Desert	11%	7%	27%	14%	41%
Temperate Deciduous Forest	15%	2%	49%	22%	12%
Tundra	0%	23%	61%	15%	1%

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