

# Biogeography

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Lectures 28–30

# Outline

## Biogeography of the World

- Biogeography of South America, or Neotropics

- Biogeography of Africa

- Biogeography of Holarctic Eurasia

# Biogeography of the World

## Biogeography of South America, or Neotropics

# South America: 13 biogeographical regions

1. Tropical Central America
2. West Indies
3. Venezuela and Guiana Shield
4. Amazonian Basin
5. Brazilian Northeast and Plateau
6. Brazilian Atlantic Forest
7. Gran Chaco
8. North and Central Andes (Columbia, Ecuador and Peru)
9. Pampas
10. Atacama desert
11. *Galapagos Islands*
12. Patagonia and Juan Fernandez
13. *South American Antarctic Islands*



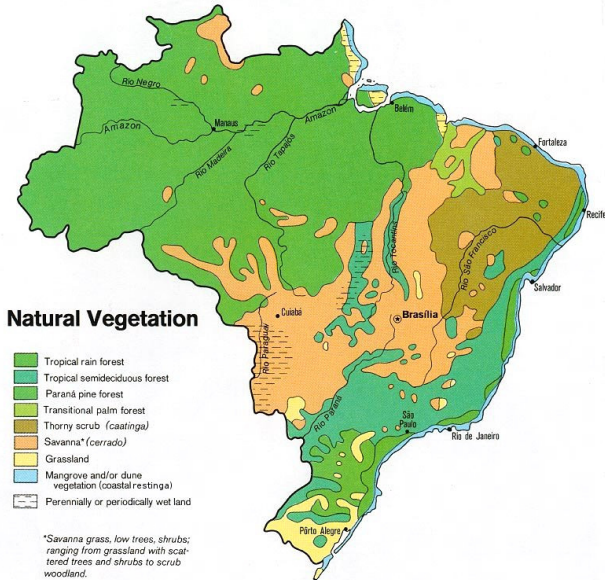
## Regions 3 and 4: Venezuela, Guiana Shield and Amazonia

- ▶ Llanos are northern grasslands in South America; they cover the big part of Venezuela
- ▶ Guiana Shield is the famous “lost world” with a high level of endemism in both plant and animal groups plus the highest waterfall on Earth, Angel Falls.
- ▶ **Amazonia** is a geologically new region, speciation processes are just starting there. Nevertheless, the diversity is overwhelming.
- ▶ The most famous plant and animal representatives are:
  - ▶ Victoria regia giant waterlily, chocolate tree (Theobroma cacao) and Brazil nut (Bertholletia excelsa), papaya (Carica papaya) and guarana (Paulinia cupana)
  - ▶ Morpho butterfly, Theraphosa blondi giant birdeater spider, and leafcutter ants (Atta colombica)
  - ▶ Four-eyed (Anableps) and piranha (Hydrolycus) fish
  - ▶ Trumpeter (Psophia), hoatzin (Opisthocomus) and toucans (Ramphastos) birds
  - ▶ Anteaters like tamandua, tree anteater (Tamandua tetradactyla), American tapir (Tapirus terrestris), giant capybara (Hydrochoerus), specific Platyrrhini monkeys, Desmodus vampire bats and Bradypus sloths.

## Regions 5 and 6: Brazilian Northeast, Brazilian Plateau and Brazilian Atlantic Forest

- ▶ Drier, sometimes semi-desert regions. Brazilian Northeast is extremely species-poor comparing with Amazonia (somehow, analogous to Dekkan Plateau in India).
- ▶ Unusual dry spiny forest, *caatinga* with domination of cactuses and legumes. One of native plants, cashew (*Anacardium occidentale*) is widely cultivated.
- ▶ Located inside plateau (*cerrado*) is one of the most splendid natural attractions on Earth—Iguazu waterfall.
- ▶ The home of many agricultural plants like peanuts (*Arachis hypogaea*) and bromeliad pineapples (*Ananas comosus*).
- ▶ Atlantic forest (*mata Atlantica*) consists of Amazon-like but more seasonal forest plus some unusual ecosystems like *restinga* (coastal semi-forest).

# Brazilian vegetation types





## Regions 7 and 9: Gran Chaco and Pampas

- ▶ The west of region—Bolivian yungas, Andes foothills rich of plantations, homeland of quinine tree, Cinchona
- ▶ To the east, in Grand Chaco, there are contrasted dry and wet periods: wetlands in rain season and semi-deserts otherwise, dominated with “palo borracho”, “drunken tree” Ceiba speciosa
- ▶ Rich fauna (e.g., most species of armadillos including the giant tatu carreta Priodontes maximus) and maned wolf Chrysocyon brachyurus; and the second center of Cactaceae distribution
- ▶ Famous Gondwana lungfishes have one representative in South America, Lepidosiren. Two other genera live in Africa and Eastern Australia. Another Gondwana group, ratite birds, have representative in Pampas: American nandu (Rhea americana)
- ▶ Pampas, like llanos is another grassland region of South America

## Region 8: North and Central Andes

- ▶ Unusual, rich alpine regions with the domination of specific plant groups like *Aragoa*, *Puya raimondii*, balsa (*Ochroma lagopus*), the tree with a lightest wood
- ▶ **Páramo**—specific alpine wetlands dominated with *Espeletia*, the amazing life form from aster family
- ▶ **Puna**—alpine grasslands, supported with large camelid herbivores like guanaco (*Lama guanicoe*) and alpaca (*Vicugna pacos*)
- ▶ One of highest diversity hotspots of birds (1,500 species versus 700 for **all** North America)
- ▶ The homeland of great South American civilizations

## Region 10: Atacama desert

- ▶ The driest place on Earth: zero precipitation level
- ▶ Systematically broken by El Niño when cold Humboldt current is deviating from the coast
- ▶ Frequent earthquakes
- ▶ Dense fogs (fog density in “lomas” is sometimes up to 200–300 mm)
- ▶ Extremely rich marine/coastal (e.g., Humboldt’s penguin *Spheniscus humboldtii*), and very poor terrestrial life

## Region 12: Patagonia

- ▶ The southern temperate region with flora similar to Australia and New Zealand (!)
- ▶ Conifer forests (*Araucaria araucana*, *Libocedrus*, *Saxegothaea*) domination
- ▶ In more humid regions, the main dominant is birch-like *Nothofagus* (same genus as in New Zealand)
- ▶ Many giant Patagonian animals (like giant xenarthran *Megatherium* and *Glyptodon*) are now extinct

# Summary for South America

- ▶ Low and narrow, wettest continent
- ▶ Part of Gondwana: many groups which are also distributed in Australia, New Zealand and Africa
- ▶ Isolated for most of Cenozoic: unique groups of plants and animals (e.g., Xenarthra)

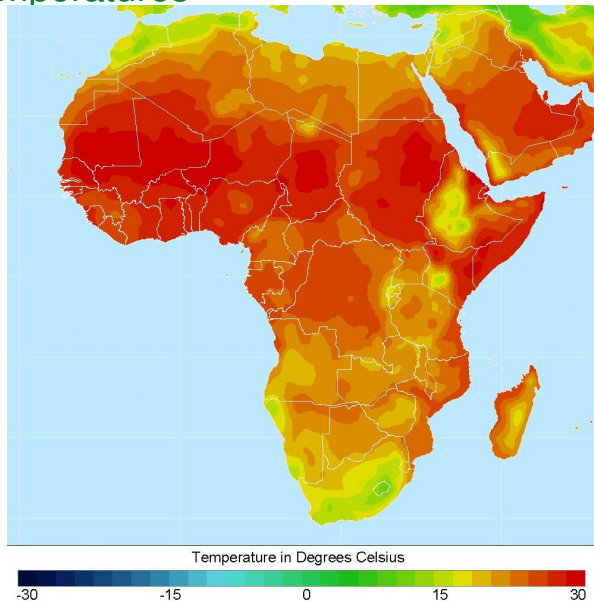
# Biogeography of the World

## Biogeography of Africa



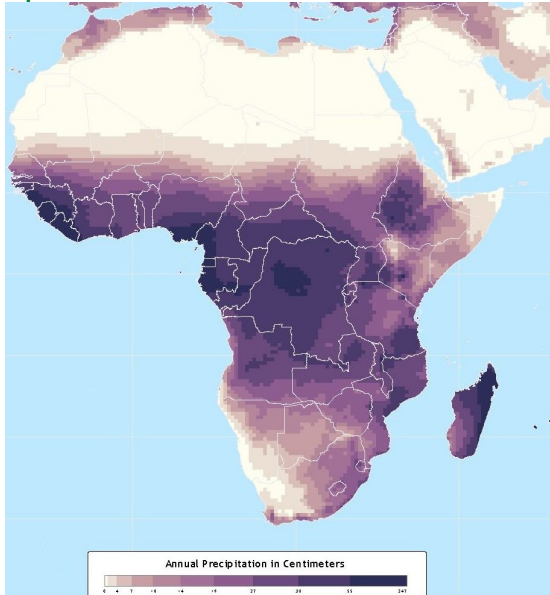
(we exclude Mediterranean Africa)

# Africa: temperatures

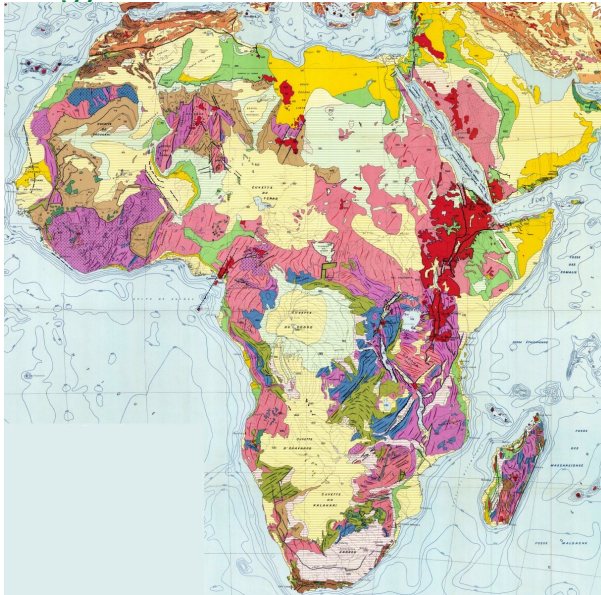




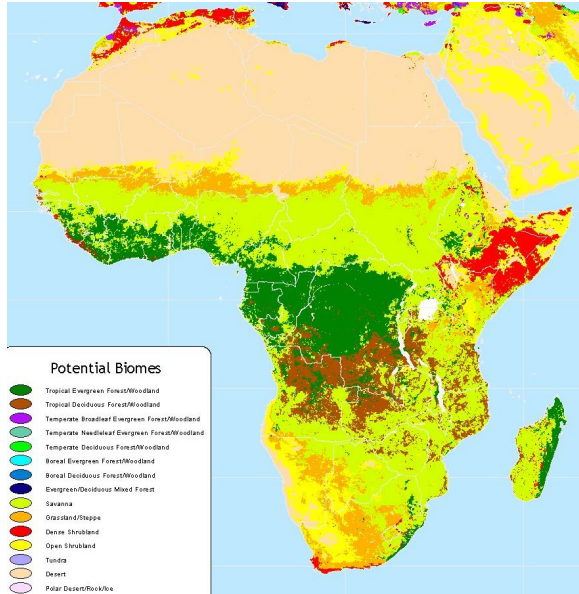
# Africa: precipitation



# Africa: geology



# Africa: potential biomes



# Africa: biogeographical regions



# Africa: 8 biogeographical regions

1. Sahara
2. Northern savanna belt
3. Ethiopian highlands
4. Kongo forests
5. Eastern savannas
6. Kalahari and other southern deserts
7. Cape
8. Madagascar

# African regions: the most significant bio-markers

1. **Sahara:** date palm (*Phoenix dactylifera*), dum palm (*Hyphaene*)
2. **Northern savanna (Sudan and Guinea) belt:** African *Acacia* trees, oryx antelopes (*Oryx*) and cheetah (*Acinonyx jubatus*)
3. **Ethiopian highlands:** gelada baboon (*Theropithecus gelada*) and walia ibex (*Capra walie*)
4. **Kongo forests:** three species of anthropoid apes, *Gorilla gorilla* (*Gorilla beringei* occurs in the next region) and *Pan troglodytes* and *Pan paniscus* and hornbill birds (Bucerotidae).
5. **Eastern great savannas:** the Great African Grassland fauna ("Safari" fauna) including African elephants (*Loxodonta africana*), lions (*Panthera leo*), giraffes (*Giraffa camelopardalis*) and rhinos (*Ceratotherium* and *Diceros*). This fauna has a lot of connections with Old World faunas (except Australia).
6. **Kalahari and other southern deserts:** *Welwitschia mirabilis*, unique gymnosperm, also aloe (like *Aloe arborescens*) and cactus-like spurge (*Euphorbia*)
7. **Cape:** amazing diversity of plant species, especially from Protea family (Proteaceae).
8. **Madagascar:** indri (*Indri indri*), tenrecs (Tenrecidae), giraffe weevil (*Trachelophorus giraffa*), panther chameleon (*Furcifer pardalis*), pygmy chameleon (*Rhampholeon*), Lac Alaotra bamboo lemur (*Hapalemur alaotrensis*), crowned lemur (*Eulemur coronatus*), fossa (*Cryptoprocta ferox*), Verreaux's sifaka (*Propithecus verreauxi*), Ward's Flycatcher (*Pseudobias wardi*), Crested Drongo (*Dicrurus forficatus*).

# Summary for Africa

- ▶ High, uniform and dry continent
- ▶ Homeland for the **majority** of recent plant and animal groups (“tropical pump”), e.g., Afrotheria (elephants Proboscidea, elephant shrews Macroscelidea, hyraxes Hyracoidea, tenrecs Tenrecidae with golden moles Chrysochloridae, sea cows Sirenia and armadillos Tubulidentata). All World grassland fauna originated in Africa. The third example of cosmopolitan mammal with African savanna origin are humans (genus Homo).

# Biogeography of the World

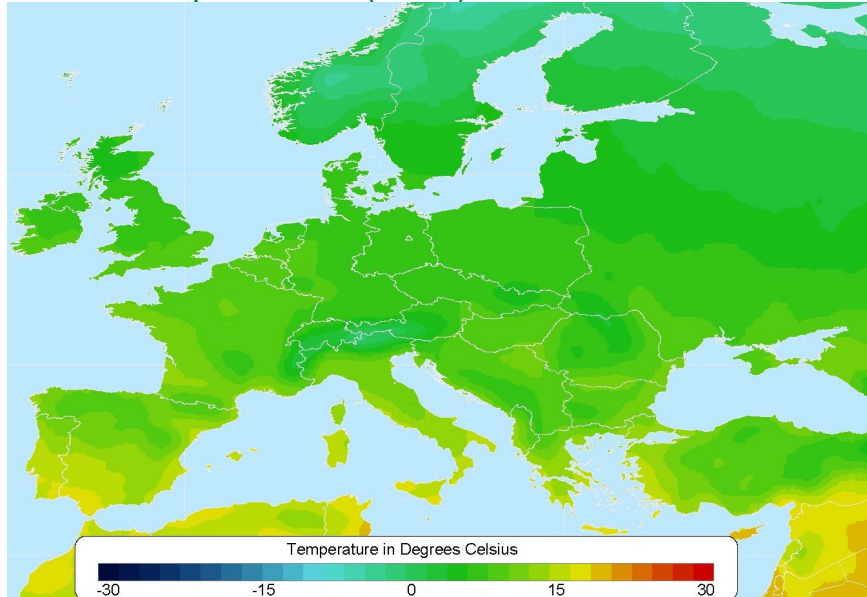
## Biogeography of Holarctic Eurasia



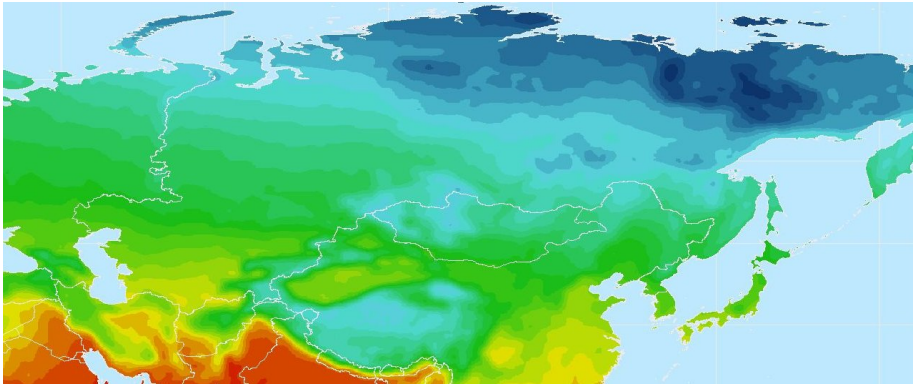


Note latitudinal mountain ranges

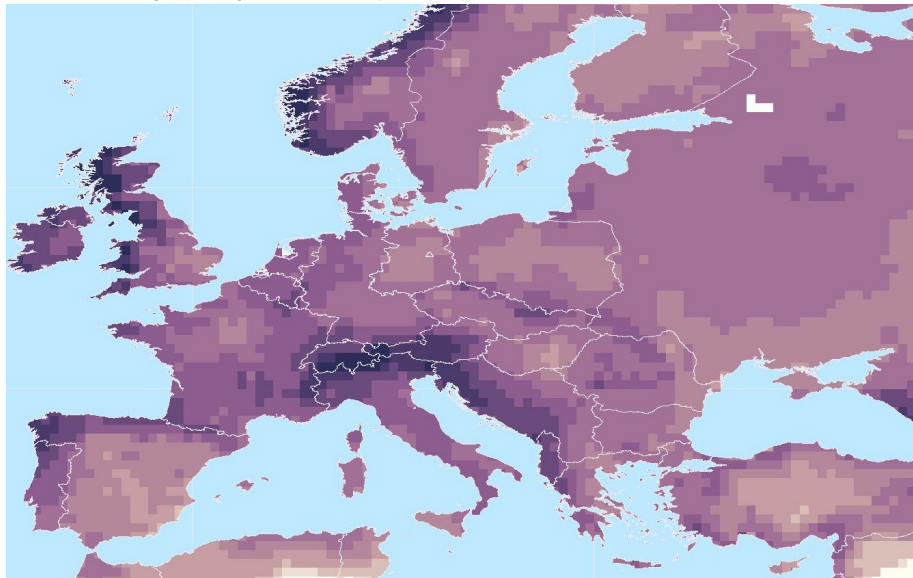
# Eurasia: temperatures (west)



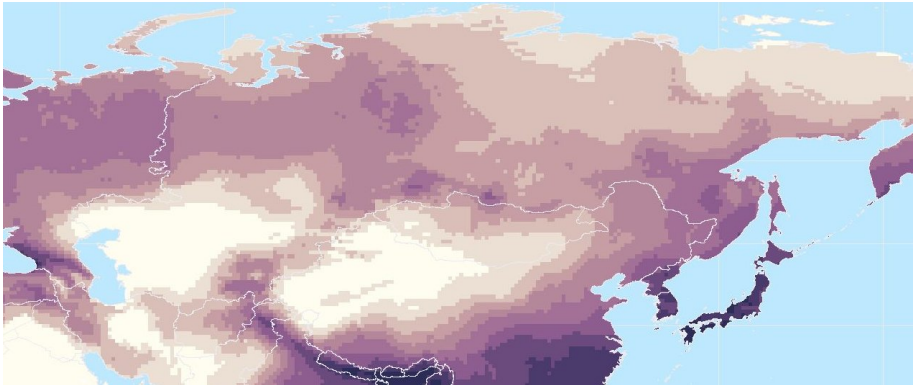
# Eurasia: temperatures (east)



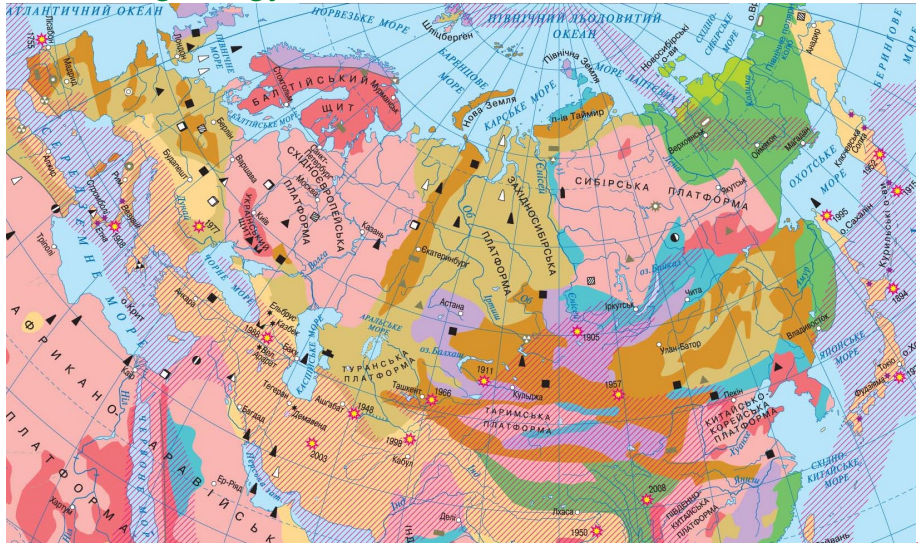
# Eurasia: precipitation (west)



# Eurasia: precipitation (east)



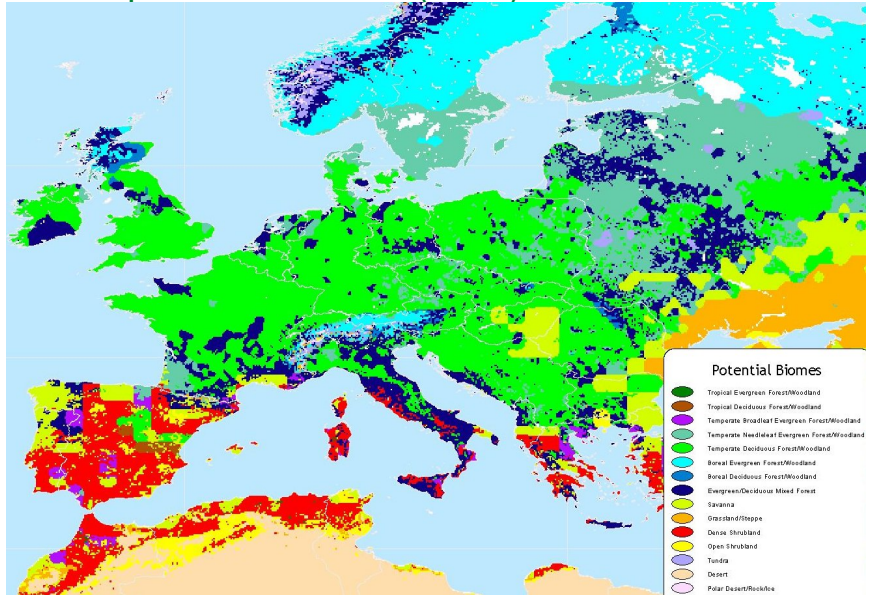
# Eurasia: geology



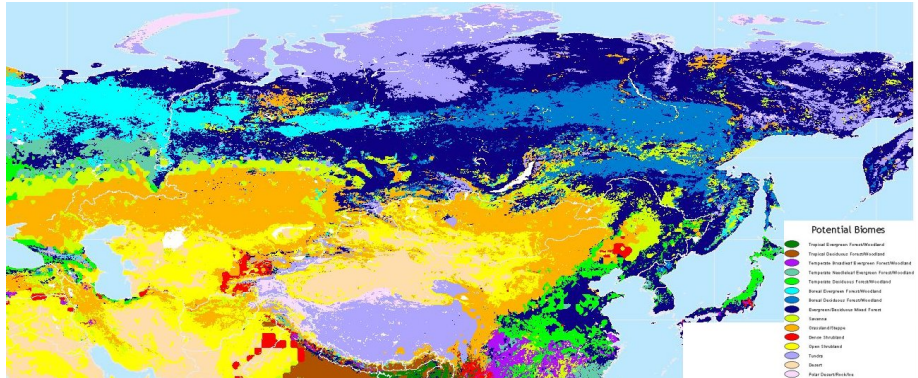
Several continental platforms and mountains on the places of collision



# Eurasia: potential biomes (west)



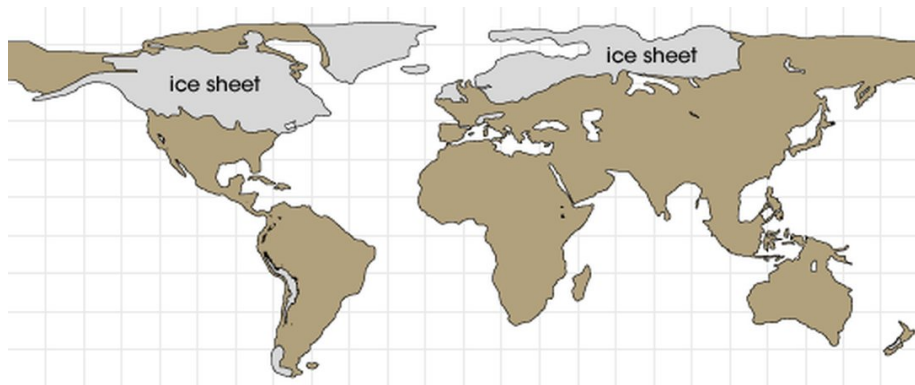
# Eurasia: potential biomes (east)



Huge “belts”



# Glaciation in North America vs. Eurasia



Note the Beringian land bridge between Eurasia and North America, and compare the relative size of glaciated regions

# Eurasia: biogeographical regions



# Holarctic Eurasia: 10 biogeographical regions

1. European mixed forests
2. Alps, Pyrenees, Balkans and Caucasus
3. Mediterranean region
4. Steppes: from Hungary to China
5. Taiga: from Scandinavia to Kamchatka
6. Tundra
7. East Asian mixed forests: Manchuria, Korea and Japan
8. Arabian deserts
9. Central Asian cold deserts and Tibet
10. China plain

# Eurasian regions: similar to North America, but not the same

1. European mixed forests: like East Coast but less diverse
2. Alps, Pyrenees, Balkans and Caucasus: like Appalachians but more diverse and more alpine (and similar also with Rockies)
3. Mediterranean region: similar to California, and also to Cape region of Africa, has rich and distinct “ethereal oil” flora
4. Steppes: very similar to North American grasslands (same genera are dominating) but more uniform, more “grassy”, less Aster family and shrubs
5. Taiga: from Scandinavia to Kamchatka: very similar to Canadian taiga but less diverse, from other point, this is a place of active hybridisation and speciation
6. Tundra: simply the same with Canadian tundra
7. East Asian mixed forests: even more similar to the East Coast, the second part of East America / East Asia disjunction
8. Arabian deserts: similar to Chihuahua desert but no cactuses
9. Central Asian cold deserts and Tibet: the most similar region is Great Basin, but dominated plant groups are different, instead of Aster family the amaranth family (Amaranthaceae) makes most of species  
Landscapes could be strikingly similar: compare Coyote Buttes, UT and Zhangye National Geopark, Sunan!
10. China plain: somewhat similar to southern states (Louisiana, Alabama) but covered with loess soils (like Iowa).

# Summary for Holarctic Eurasia

- ▶ Eurasia is extremely heterogeneous continent split in two main biogeographical parts (Holarctic and Indo-Pacific) bordering in Himalayas and North Indochina.
- ▶ Biogeographically, Holarctic Eurasia is almost non-distinct from North America. Same groups, same ecosystems.
- ▶ More continental and rich of latitudinal barriers, less glaciated

## For Further Reading



### South America.

[http://en.wikipedia.org/wiki/South\\_America](http://en.wikipedia.org/wiki/South_America)



### Africa.

<http://en.wikipedia.org/wiki/Africa>



### Eurasia.

<http://en.wikipedia.org/wiki/Eurasia>



### A. Shipunov.

*Biogeography* [Electronic resource].

2014—onwards.

Mode of access:

[http://ashipunov.info/shipunov/school/biol\\_330](http://ashipunov.info/shipunov/school/biol_330)



### A. Shipunov.

*Introduction to Biogeography and Tropical Biology* [Electronic resource].

2017—onwards.

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