Biogeography

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Lectures 31–34

Outline

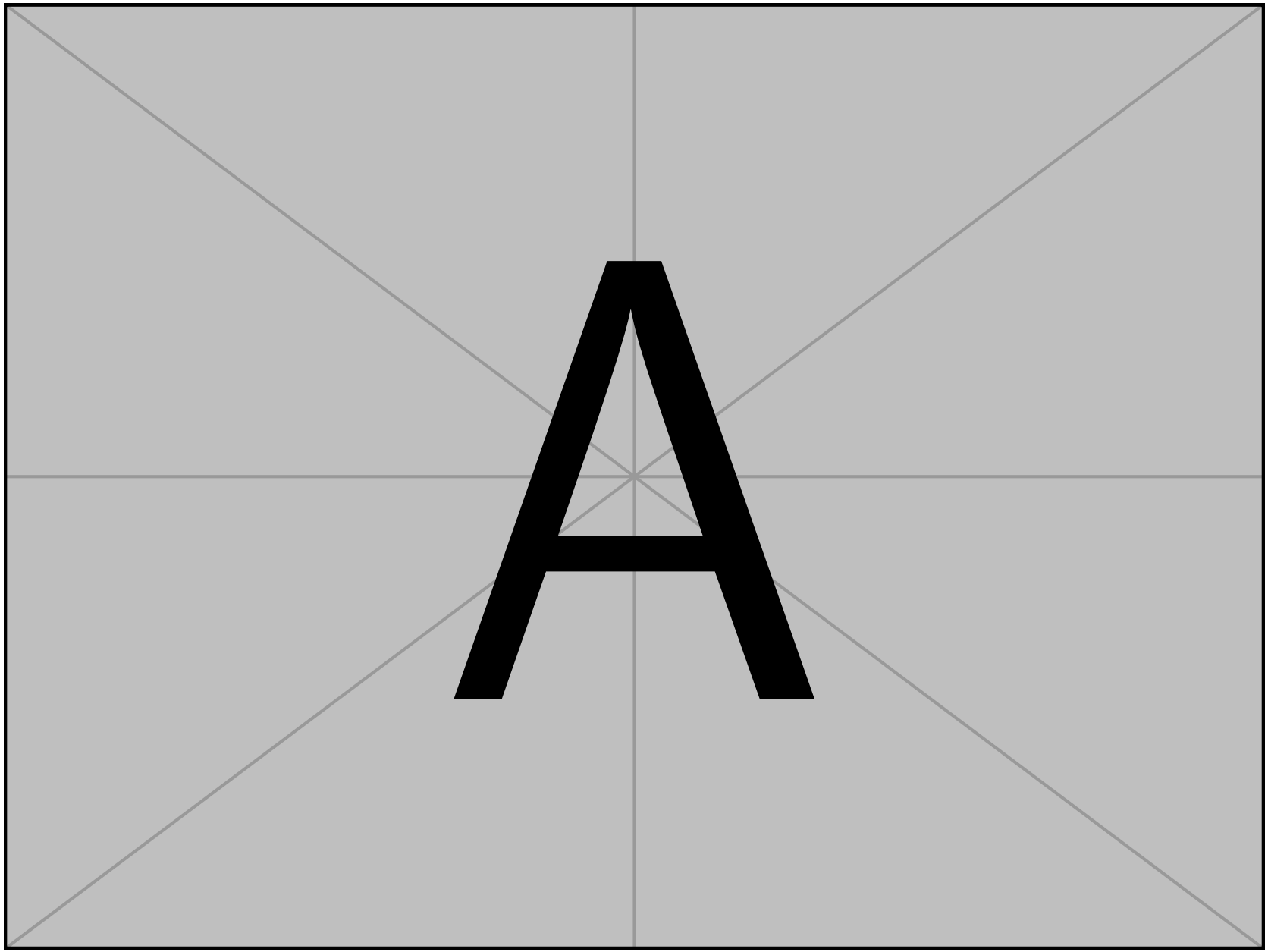
Biogeography of the World

- Biogeography of Indo-Pacific region
- The basics of island biogeography
- Biogeography of Australian region
- Rising seas
- Very basics of Ocean biogeography

Biogeography of the World

Biogeography of Indo-Pacific region

Western Indo-Pacific



Eastern Indo-Pacific

Oceania cultures

Indo-Pacific: temperatures

Indo-Pacific: precipitation

Indo-Pacific geology: the "giant puzzle"

Indo-Pacific: potential biomes

Indo-Pacific: biogeographical regions and Wallace line

Indo-Pacific: 8 biogeographical regions

1. North India
2. Deccan Plateau and South India
3. Sundaland: Indochina
4. Sundaland: Malay archipelago
5. Wallacea
6. New Guinea and Melanesia
7. Coral Pacific Islands
8. Volcanic Pacific Islands

Indo-Pacific regions: key features

1. **North India**: Asian lions (*Panthera leo persica*) and tigers (*Panthera tigris*)
2. **Deccan Plateau and South India**: the most "African" fauna outside of Africa, e.g., Asian elephant (*Elephas maximus*) (smaller ears and less skinny), Indian rhinoceros (*Rhinoceros unicornis*) and multiple species of antelopes like gazelles (*Gazella gazella*); also, many "true" Asian elements like king cobra (*Ophiophagus hannah*), the largest venomous snake.
3. **Indochina**: domestication center of many animals like cattle (e.g., wild gaur *Bos gaurus*) and chicken, Red Junglefowl (*Gallus gallus*). Terrestrial leeches (Haemadipsidae).
4. **Malay archipelago**: one of the most species-rich regions of the World. Unique animals: orangutans (*Pongo pygmaeus* and *Pongo abelii*), gibbons (family Hylobatidae), flying lemurs (order Dermoptera), flying lizards (*Draco volans*) and even flying frogs (*Rhacophorus*)! Hornbills (family Bucerotidae, substitute of South American toucans) and scaly anteaters (order Pholidota) are common with African biota. Lots of epiphytes (e.g., orchids) but no bromeliads. Pitcher vine *Nepenthes* (some in symbiosis with tree shrews, order Scandentia) is also specific to the region. Famous island Krakatoa exploded in 1883 is located here, between Java and Sumatra.
5. **Wallacea**: border between Sundaland and Sahul; islands which have never been connected with Asia (some of them like Sulawesi are disputable) and therefore "stepstones to Australia". Most famous is Komodo, the island of Komodo dragon (*Varanus komodoensis*), the largest terrestrial reptile (up to 3.1 m)
6. **New Guinea and Melanesia**: have multiple Australian elements like echidna (*Zaglossus*) but also placental mammals (like Muridae, mice) and endemic groups (like birds of paradise, family Paradisaeidae).
7. **Coral Pacific Islands**: very poor soils and consequently poor biota
8. **Volcanic Pacific Islands like Hawaii**: recently radiated flora and ornithofauna (like Hawaiian honeycreepers, Drepanididae) and relatively poor terrestrial fauna.

Summary for Indo-Pacific

- Geological "puzzle", region with extremely complex history
- Humid and rich
- Numerous borders (like Wallace line) and connections (like Madagascar / Indonesia disjunctions)

Biogeography of the World

The basics of island biogeography

The basics of island biogeography

- Immigration and extinction
- Distance effect
- Species-area curve and the effect of island size

Species-logarea line for reptiles and amphibians in Caribbean

Biogeography of the World

Biogeography of Australian region

Australian region

Australia: temperatures

Australia: precipitation

Australian geology

Australia: potential biomes

Australian: 7 biogeographical regions

1. Tropical North
2. Tropical East: Queensland
3. Desert Center
4. Australian core: South and Southeast
5. Australian Southwest
6. Tasmania
7. Zealandia, partly submerged microcontinent: New Zealand, Lord Howe and New Caledonia

Australian: 7 regions

Thin line is a border of Zealandia

Australian regions: key features

1. **Tropical North**: climate similar to Gran Chaco in South America, developed rain and extremely dry seasons. Billabongs (shallow drying lakes) are common. The east of region is Australian grasslands, home of many bird species like emu (*Dromaius novaehollandiae*), malleefowl (*Leipoa ocellata*), numerous cockatoo parrots (Cacatuoidea) and Rainbow bee-eaters (*Merops ornatus*). Extinct "marsuplial hippo", *Diprotodon*, also lived here.
2. **Queensland**: One of three richest regions. Wet forests. Cuscuses (*Phalanger*) there replace monkeys, *Agathis* conifer substitute for angiosperm tree dominants. Forest "ostrich" cassowary (*Casuarius*)
3. **Desert Center**: similar to Sahara. Species-poor. Bowerbirds (Ptilonorhynchidae) are probably most famous animals here.
4. **Australian core**: "all what you know about Australia", platypus (*Ornithorhynchus anatinus*), koala (*Phascolarctos cinereus*), kangaroo (*Macropus giganteus*) and other marsupials, Proteaceae and Myrtaceae plants like *Banksia* and *Eucalyptus*, each with many species. Home of living fossil Wollemi pine, *Wollemia nobilis*. Among birds, many "non-singing" passerines like lyrebird (*Menura novaehollandiae*).
5. **Australian Southwest**: Very small but rich region with high endemism. Many interesting marsupials like numbats (*Myrmecobius fasciatus*, replacement of anteater), the only Australian pitcher plant (*Cephalotus follicularis*), grass trees (*Xanthorrhoea*), moloch lizard (*Moloch horridus*) and many others.
6. **Tasmania**: the temperate variant of Australian biota, the only glaciated (50%) region. Most famous representatives are two marsupial carnivores, Tasmanian devil (*Sarcophilus harrisii*) and (now extinct) Tasmanian wolf (or tiger) (*Thylacinus cynocephalus*). Lots of unusual plants like Huon pine, *Lagarostrobos* or *Tasmannia*.
7. **Zealandia**: shatters of microcontinent, probably close to the extinct biota of Antarctic. **No mammals**. Extinct moa (*Dinornis*) and extant kiwi bird (*Apteryx*). Tuatara (*Sphenodon*). The most primitive flowering plant (*Amborella*).

Summary for Australia

- The most biogeographically isolated region
- High and dry: similar to Africa
- New Zealand (Aotearoa) has multiple "Holantarctic" connections

Biogeography of the World

Rising seas

Rising seas: Antarctica

Rising seas: Asia

Rising seas: Australia

Rising seas: Europe

Rising seas: North America

Rising seas: South America

Rising seas: Africa

Biogeography of the World

Very basics of Ocean biogeography

Biogeography of Ocean

- Diversity in 3D space
- Rich cool and poor tropical waters
- Rich coastal and poor open ocean waters
- Whereas surface biogeography of ocean is determined by continents and currents, biogeography of abyssal is unique.

Ocean depths

Ocean temperatures

Ocean productivity

Abyssal provinces from Watling et al., 2013

Short anonymous absolutely voluntary survey

1. What do you **like** most in biogeography course (except the trip ;-)?
2. What do you **dislike** most in biogeography course?
3. Please grade (1—bad, 5—excellent):
   - 3.1 Lectures
   - 3.2 The trip
   - 3.3 Presentations
   - 3.4 Exams
4. Please recommend something for the next Biogeography class.

For Further Reading


Sundaland.
http://en.wikipedia.org/wiki/Sundaland


Oceania.
http://en.wikipedia.org/wiki/Oceania


Australia.
http://en.wikipedia.org/wiki/Australia


New Zealand.
http://en.wikipedia.org/wiki/New_Zaaland


A. Shipunov. *Biogeography*. 2014—onwards.
http://ashipunov.info/shipunov/school/biol_330


A. Shipunov. *Introduction to Biogegraphy and Tropical Biology*. 2017—onwards.
http://ashipunov.info/shipunov/school/biol_330/intr_biogeogr_trop_biol/intr_biogeogr_trop_biol.pdf