

Main Points

- 1) **Recap from last time**
- 2) **Latitudinal gradients continued, briefly**
- 2) **Paleoecology**
 - **a history of mass extinctions**
 - **glacial maxima and minima, and range shifts of mammals**
 - **evolution of maximum body size in mammals and dinosaurs**
 - **example: ecological anachronisms and the ghost of predation past**

Terms: ecological anachronism, Wallacea, Cope's rule



Beavers
Ecosystem engineers extraordinaire, beavers gnaw down trees to make lodges and dams. Their dams create lakes in which they can avoid predators, providing valuable habitat for many other organisms.



Gophers
Ground squirrels are sometimes called "gophers", but this group of North American burrowers is the real deal. Thanks to their subterranean habits, they were among the local species that survived the 1980 Mt. St. Helens eruption.



Heteromyids
A group of desert-adapted rodents mainly found in North America, the kangaroo rats in particular are specialized hoopers, able to jump away from danger in less than 60 milliseconds.



Anomalurids
A group of African rodents, most of which are gliders. Scales underneath their tails provide them with extra grip while climbing. Not to be confused with flying squirrels!



Springhares
The largest hopping rodents at up to 7 kg, able to cover over 2 m in one leap. By day they rest in burrows, which they dig with their long claws.



Dipodops
These include specialized hoopers like beach mice, jumping mice, and jirds. In jirds, the bones of the foot have fused up, similar to those of bats.



Spalacids
A group of specialized burrowers, some species are so specialized for underground life that their eyes are completely covered by skin.



Calomysids
Hailing from central Asia, these rodents can live for up to 9 years, longer than any other mammal.



Dormice
Dormice living in temperate climates are known for their long periods of hibernation. Some are known to hibernate for up to 11 months!



Squirrels
More than just tree-dwellers, squirrels have also diversified into a variety of ground-dwelling forms, including chipmunks, prairie dogs, and marmots.



Sciurids
The only living representative is sometimes also called the mountain beaver, but it is not a beaver nor particularly specialized for mountain life.



Glirromorphs
They amplify their calls with noisy resonating chambers in their cheeks. The skin of glirromorphs is covered by small scales in addition to hair.



Caviids
This group includes guinea pigs, the ham-like nutria, and the largest living rodent, the capybara, which can attain a body mass of over 60 kg.



Dipodomys
Only one species remains today, but an extinct dipodomys, the 1-ton Josephochoerus, was the largest known rodent ever to live.



Platacanthomyids
These are tree-dwelling rodents from Asia, including the nearly blind Chinese pygmy dormouse, which is the only arboreal mammal known to use echolocation.



Edithomyids
Many have spiny hair, presumably for defense. Include climbing and burrowing forms as well as the semi-aquatic nutria.



Nesomyids
A diverse radiation of African rodents. They account for the recovery of native rodent diversity in Madagascar.



Diatomyids
The only living species is anatomically very similar to extinct members of this group that lived 11 million years ago.



Prokallitid mole poropithecids
Unlike the distantly related Old World poropithecids, these rodents spend much of their time in trees.



New World poropithecids
Unlike the distantly related Old World poropithecids, these rodents spend much of their time in trees.



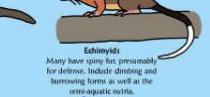
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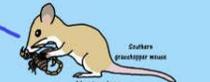
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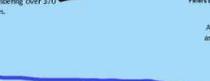
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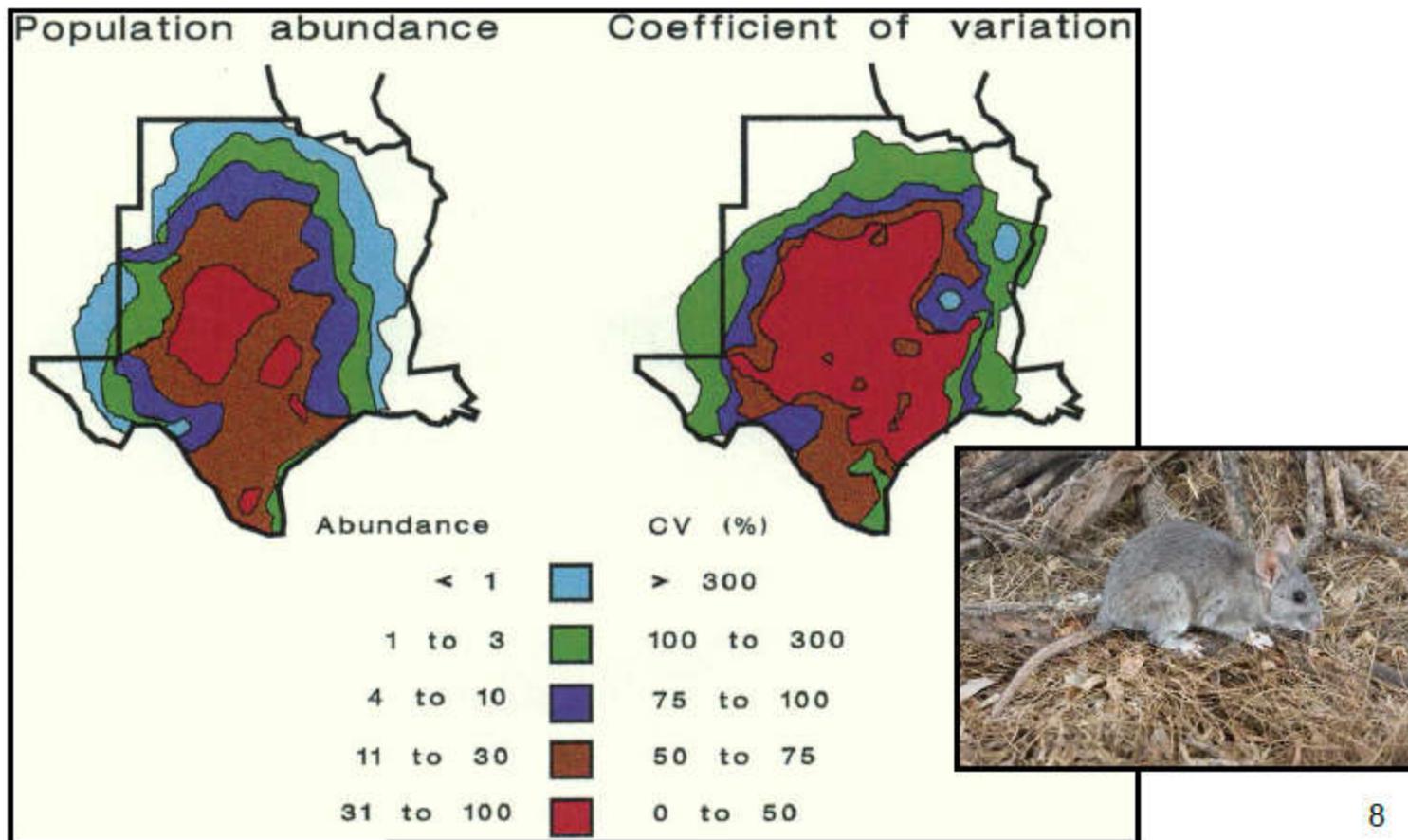
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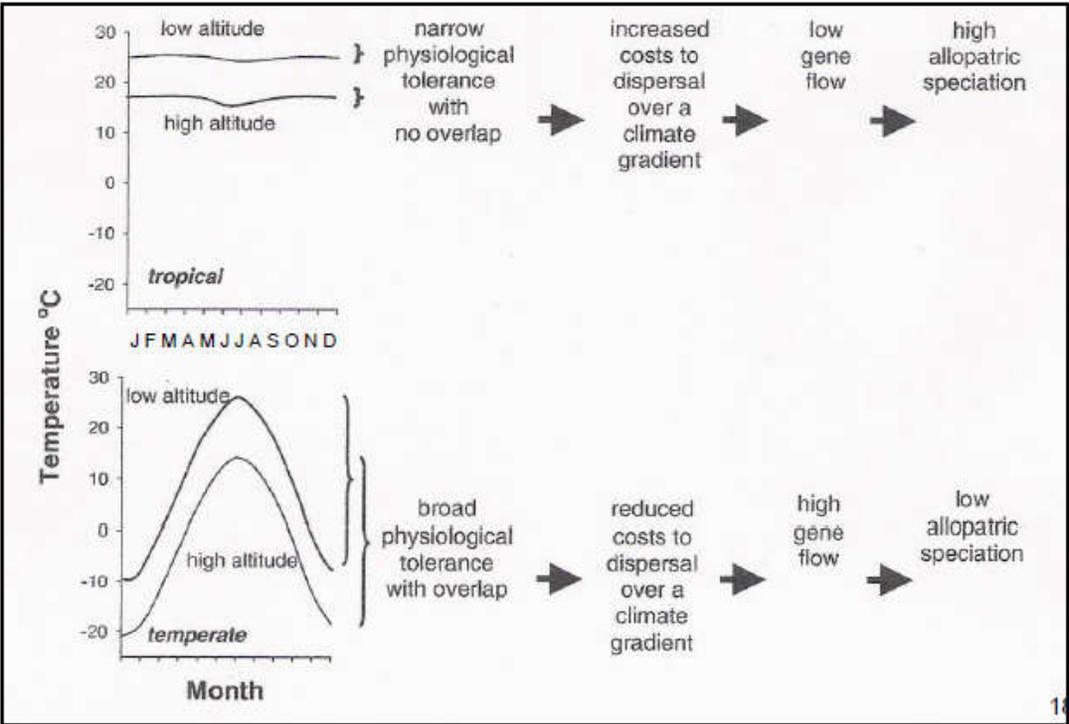
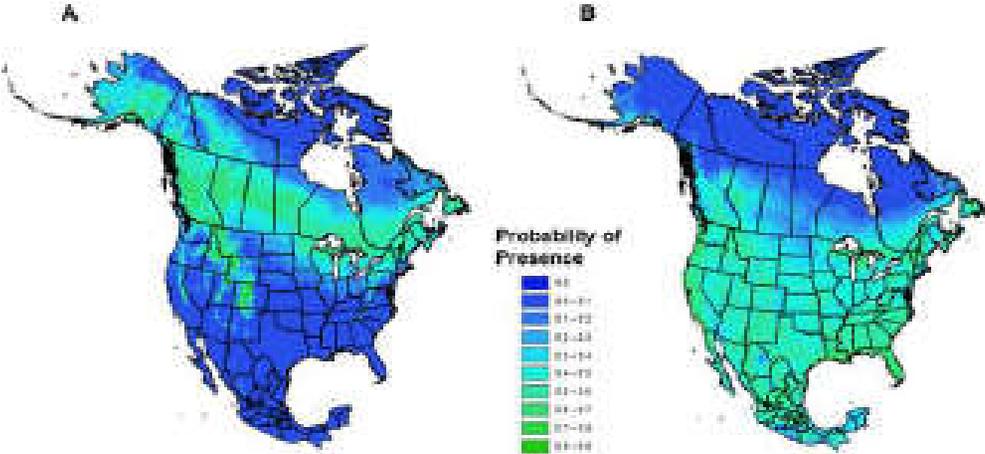
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Lecture 17 recap: we discussed the science of macroecology, and two macroecological patterns. One was the abundant center rule, which describes patterns of abundance within a geographic range. The second was the abundance-distribution relationship.

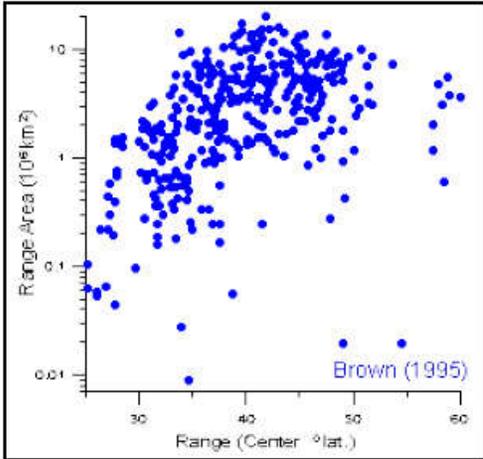
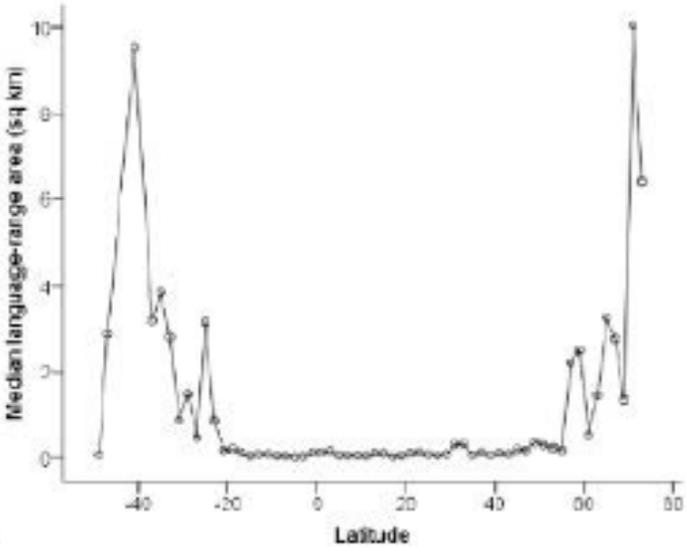
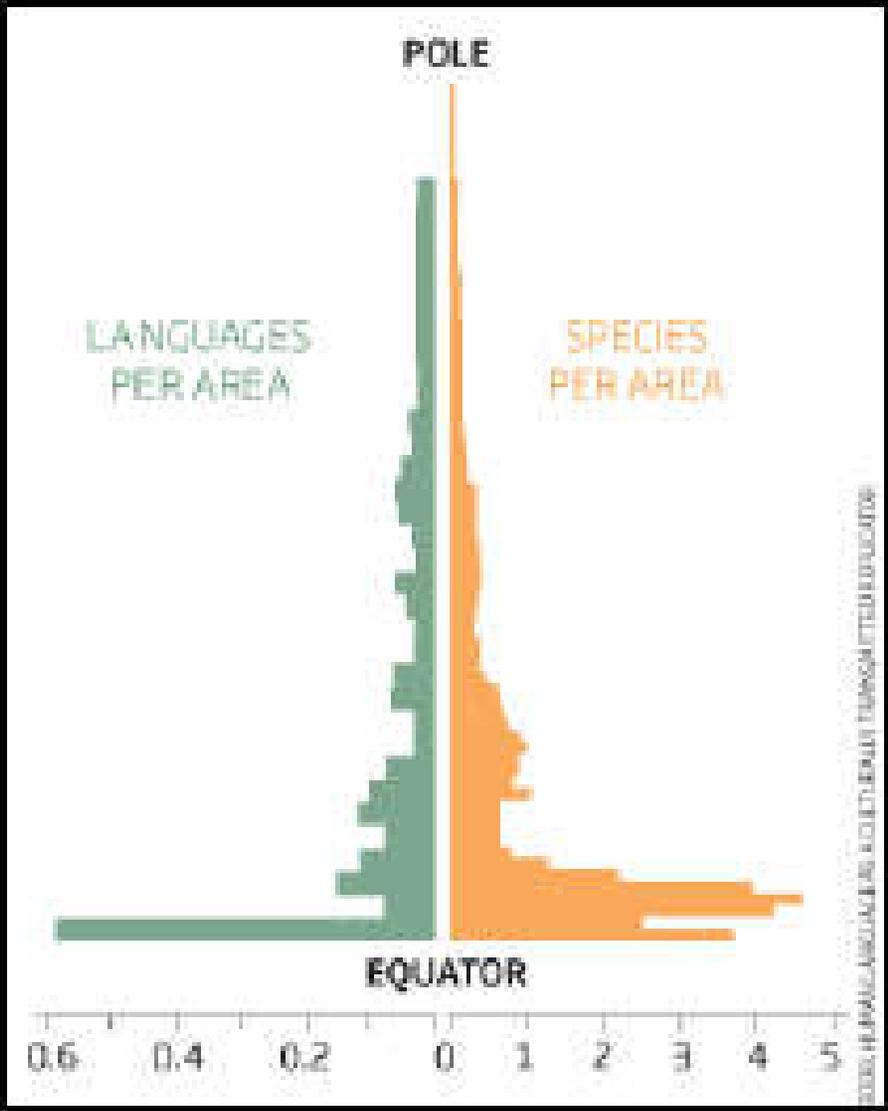
Macroecology—Abundant Center Rule



Lecture 17 recap: we also discussed two other hypotheses, Connell's hypothesis and Janzen's hypothesis.



Lecture 17 recap: there are strong parallels between latitudinal patterns in species richness/species ranges, and language numbers/area over which languages are spoken.



Continental Drift Events



PRESENT DAY



Circa 40 Million years ago



Circa 80 Million years ago



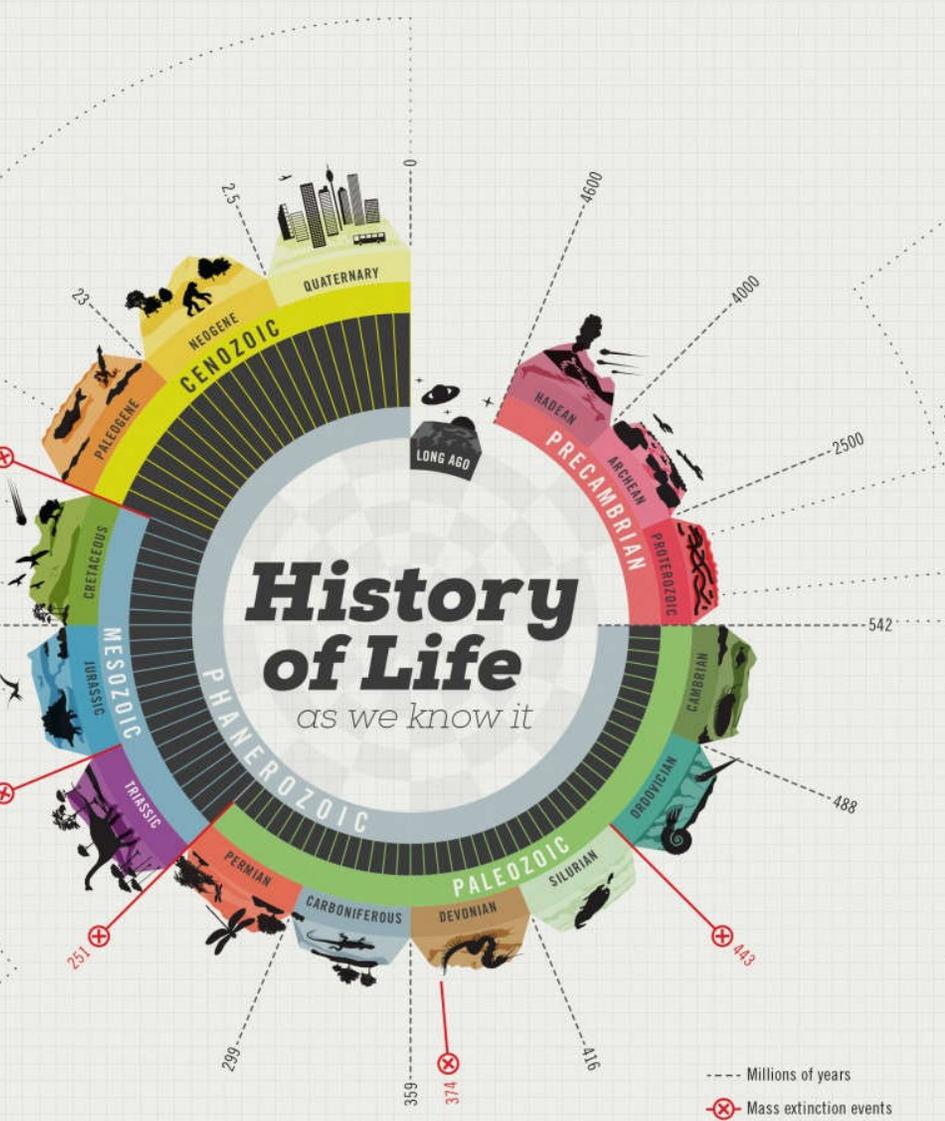
Circa 120 Million years ago



Circa 160 Million years ago



PANGEA
Circa 200 Million years ago



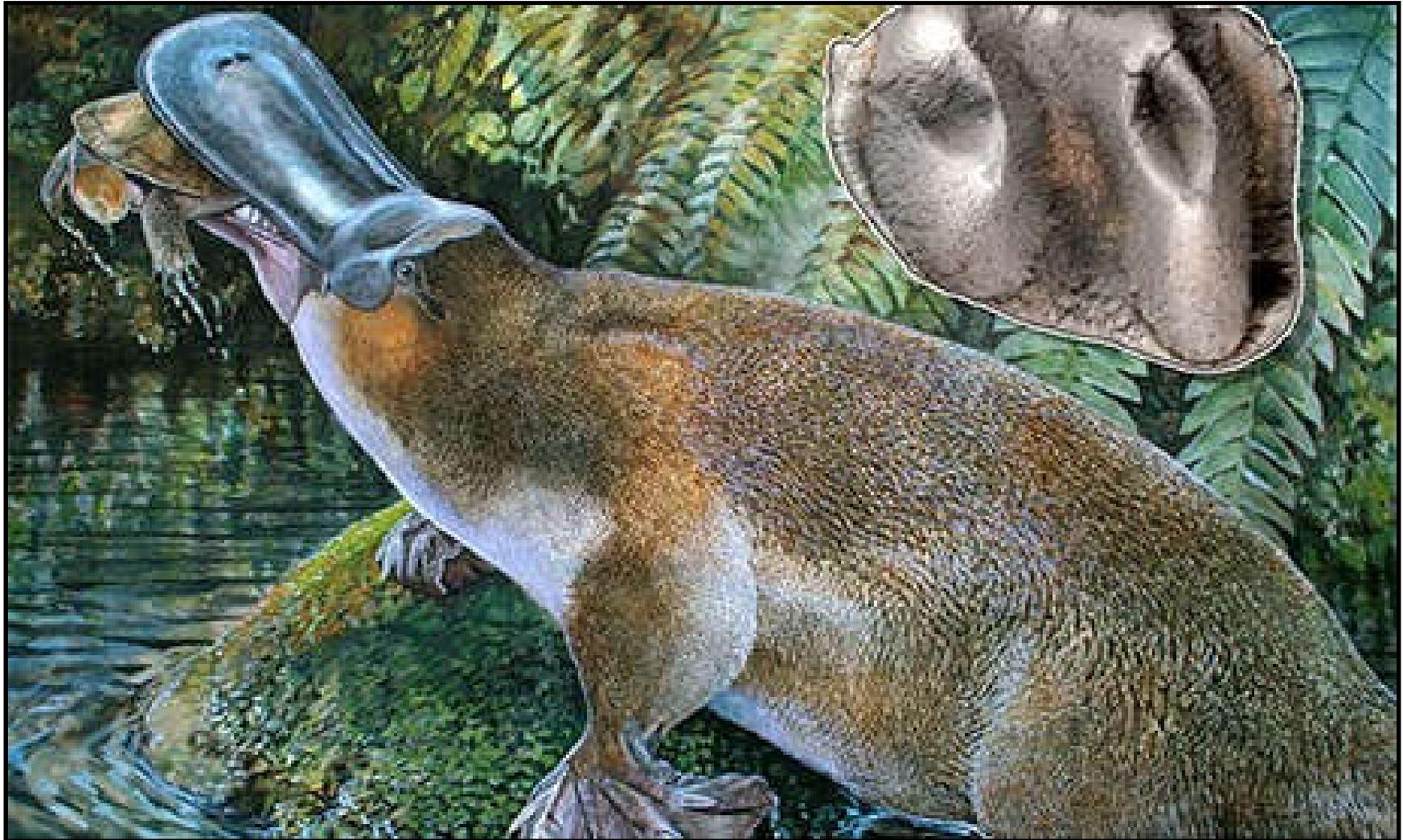
Milestones

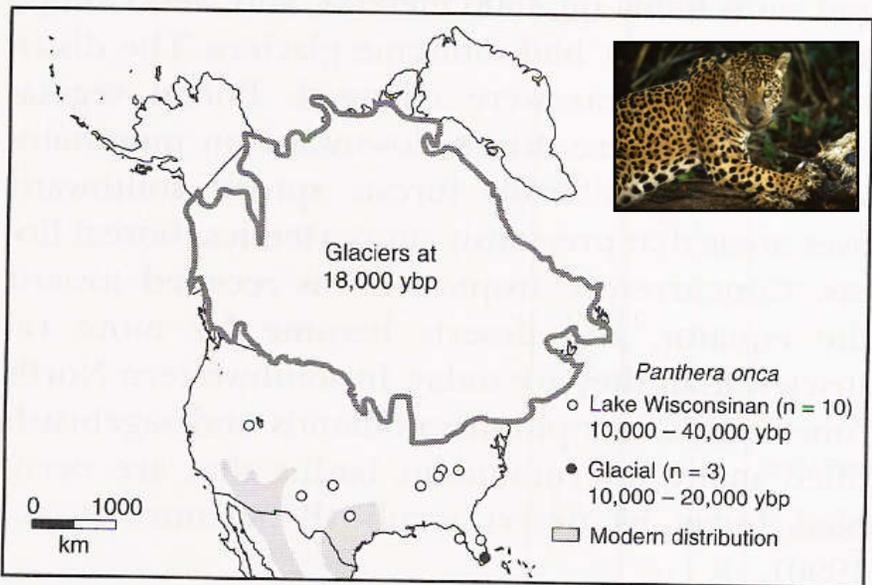
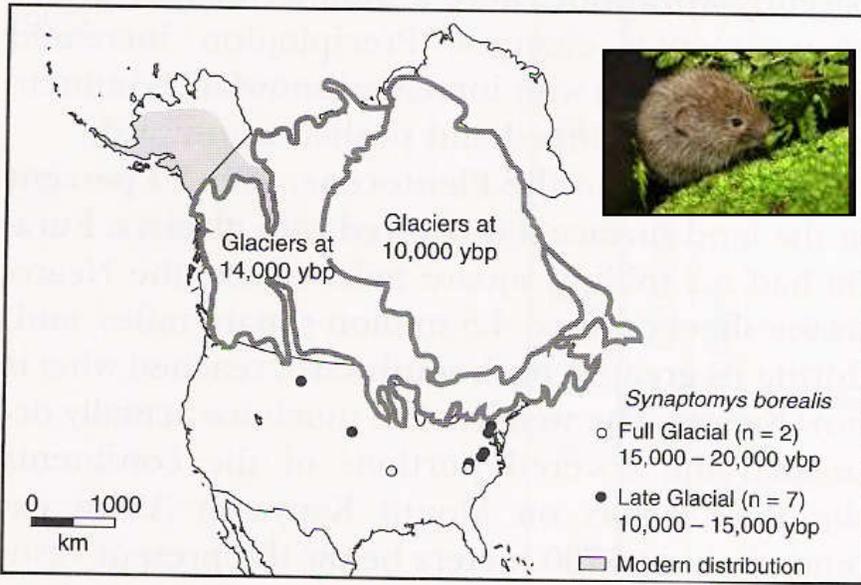
- CENOZOIC**
 - Human civilization
 - Hominids
 - Whales
- MESOZOIC**
 - First birds
 - Stegosaurus
 - Dinosaurians
- PHANEROZOIC**
 - Primitive dragonflies
 - Amphibians
 - Arthropods
 - Fishes
 - Nautiloids
 - Trilobites
- PALEOZOIC**
 - Multicelled organisms
 - Stromatolites
 - High volcanism, asteroid impacts
- PRECAMBRIAN**
 - Earth's formation

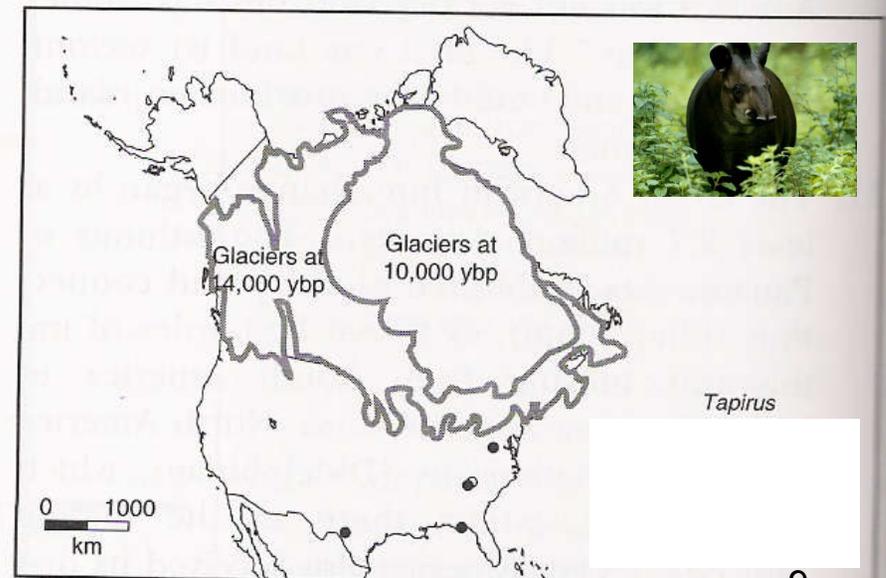
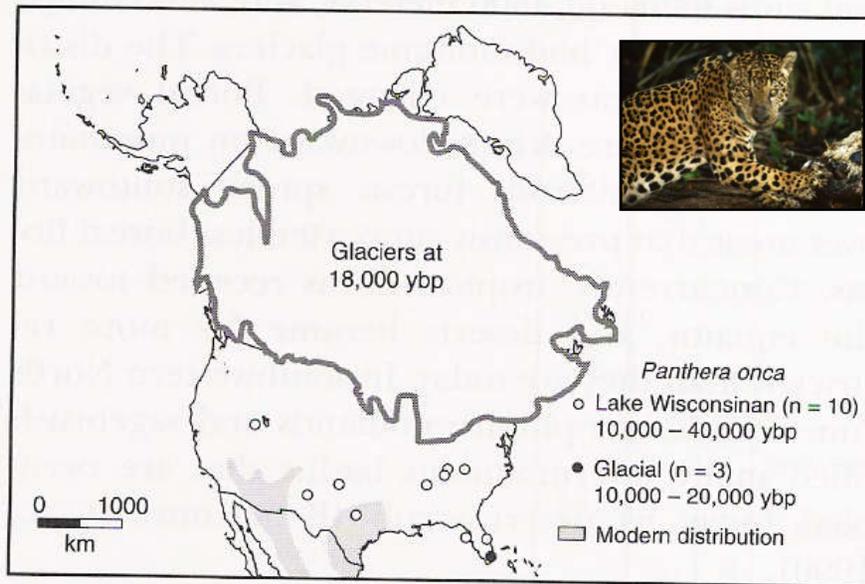
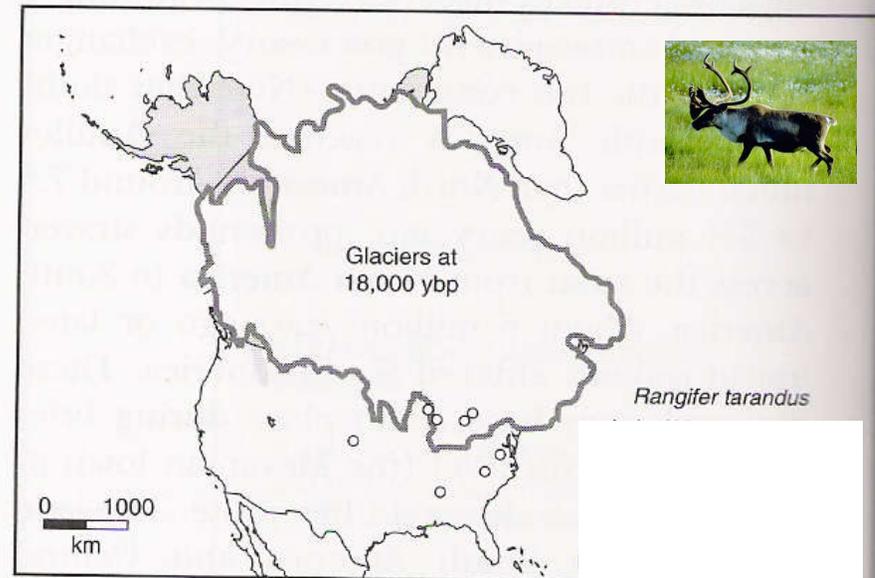
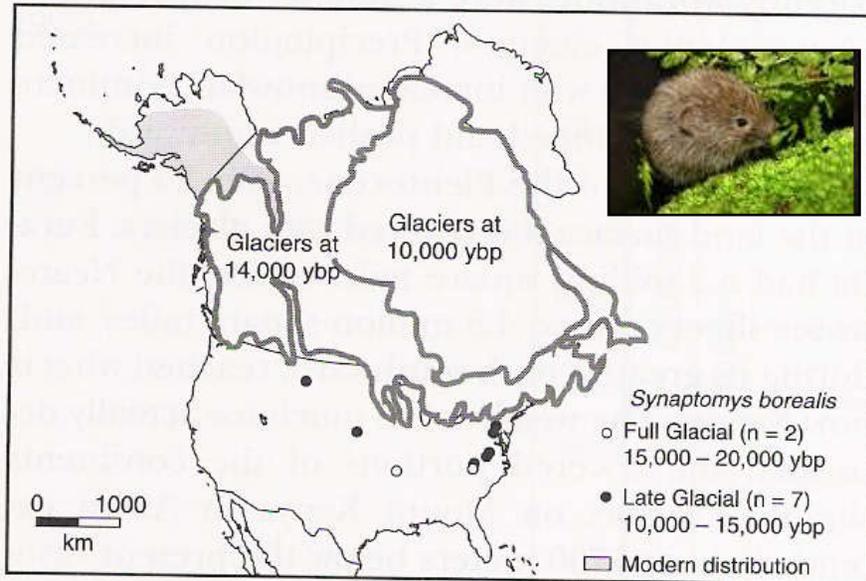
Phanerozoic Timeline



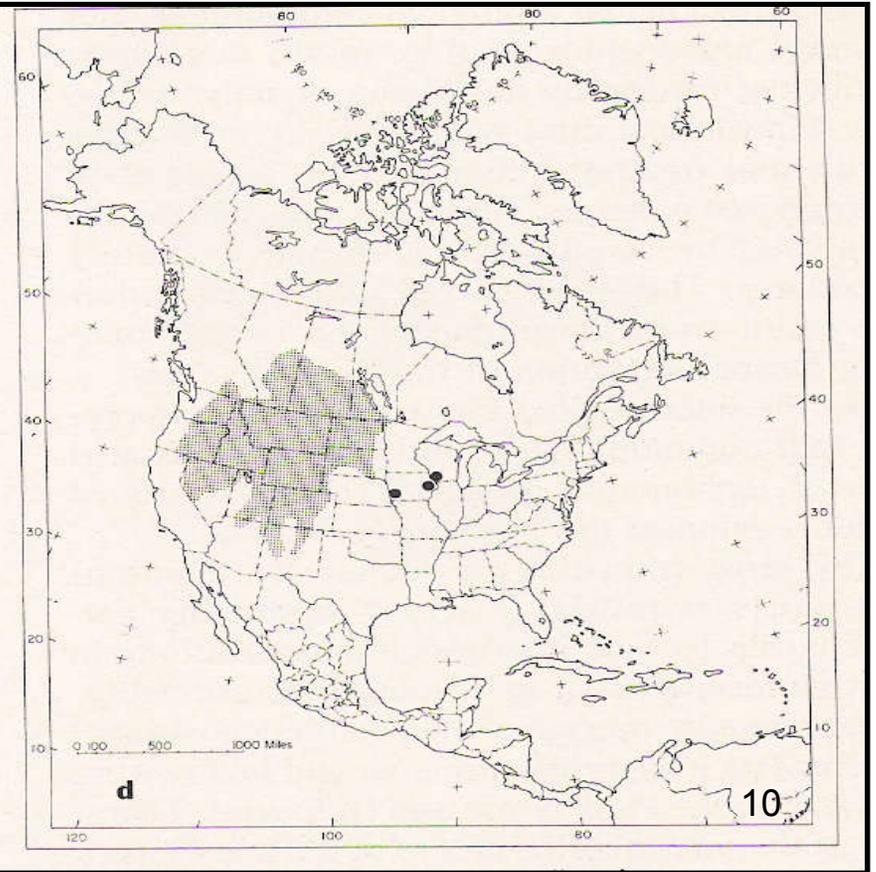
A recently discovered giant platypus from the Cenozoic







Idiosyncratic responses of mammals to climate change

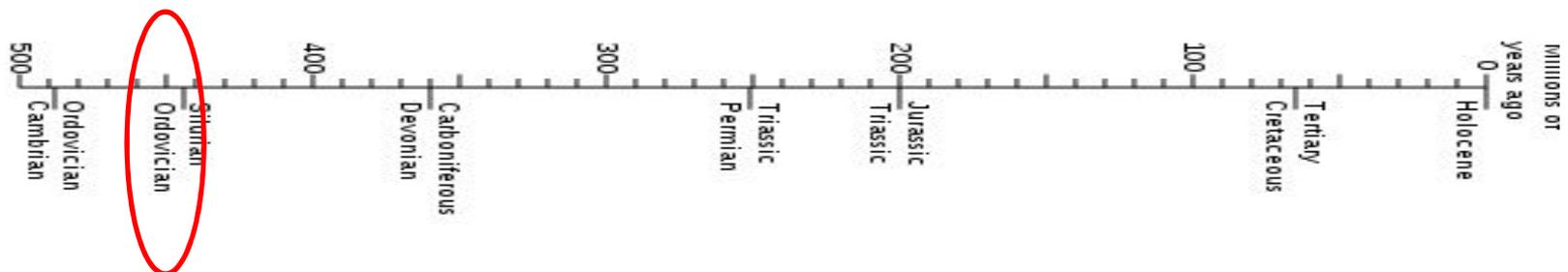
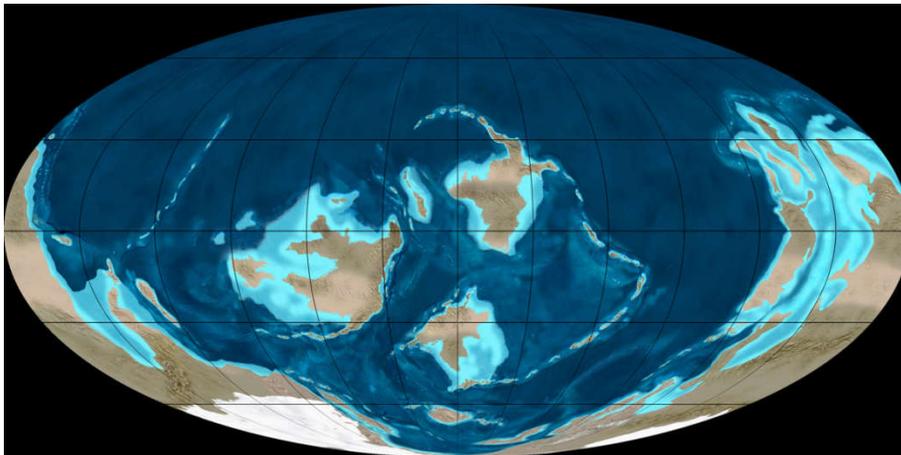


Over 400 Million Years of Extinction and Speciation

Ordovician Event, ~450 MYA

86% of species
lost within 2 MY

Glacial and interglacial
episodes. Uplift of Appalachia
leading to increase in ATM CO₂

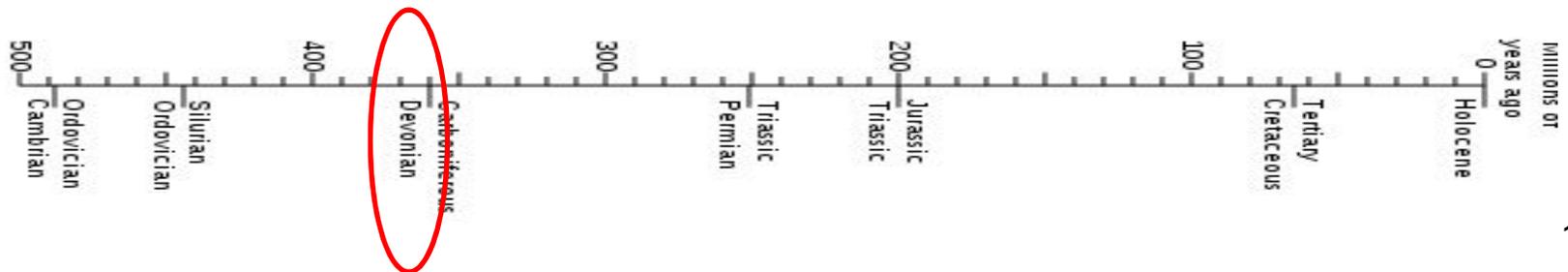
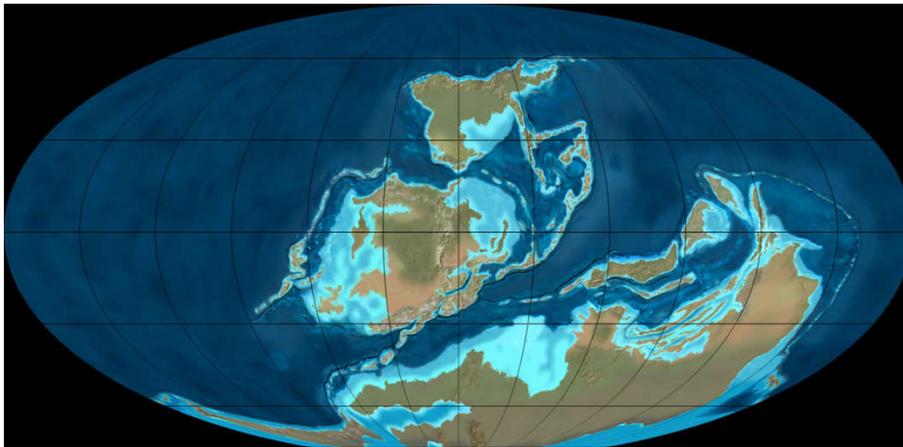


Over 400 Million Years of Extinction and Speciation

Devonian Event, ~360 MYA

75% of species
lost within 2 MY

Global cooling tied to
diversification of land plants



Over 400 Million Years of Extinction and Speciation

Permian Event, ~250 MYA

96% of species
within 2 MY-
160,000 yr

Volcanic activity in Siberia led
to global warming and
increased ATM CO₂

Triassic Event, ~200 MYA

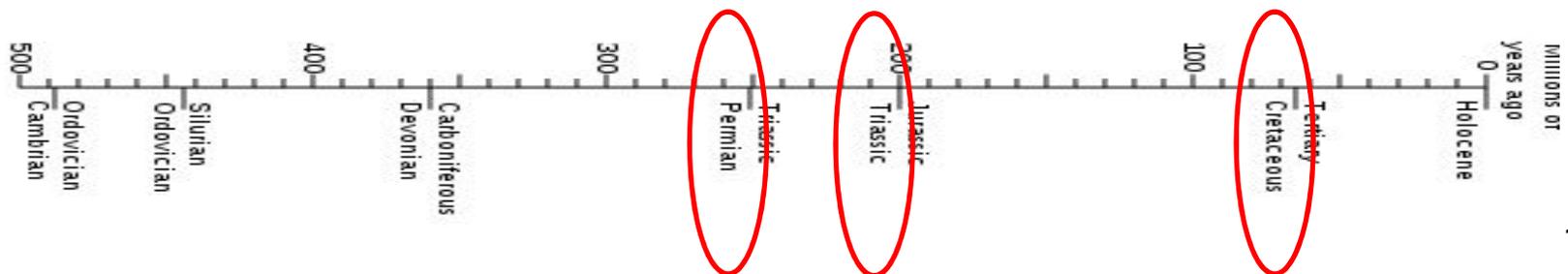
80% of species
within 8 MY-
600,000 yr

Increased ATM CO₂ and calcifi-
cation of oceans

Cretaceous Event, ~65 MYA

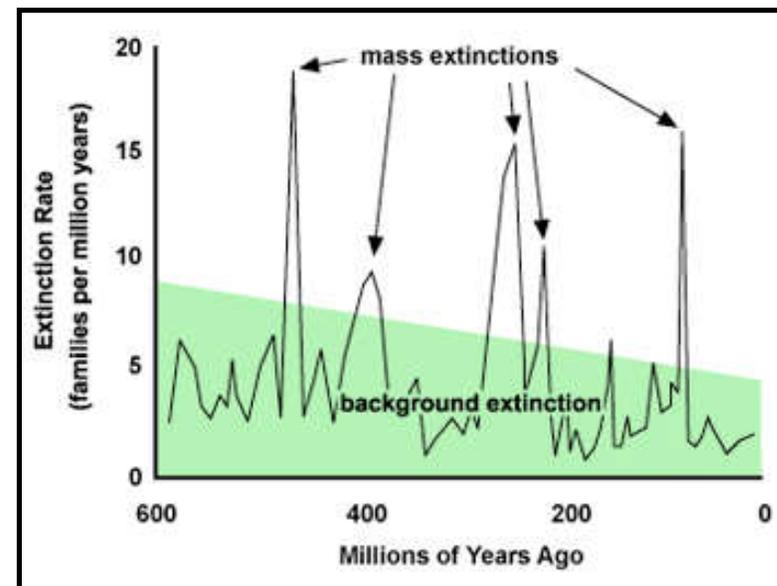
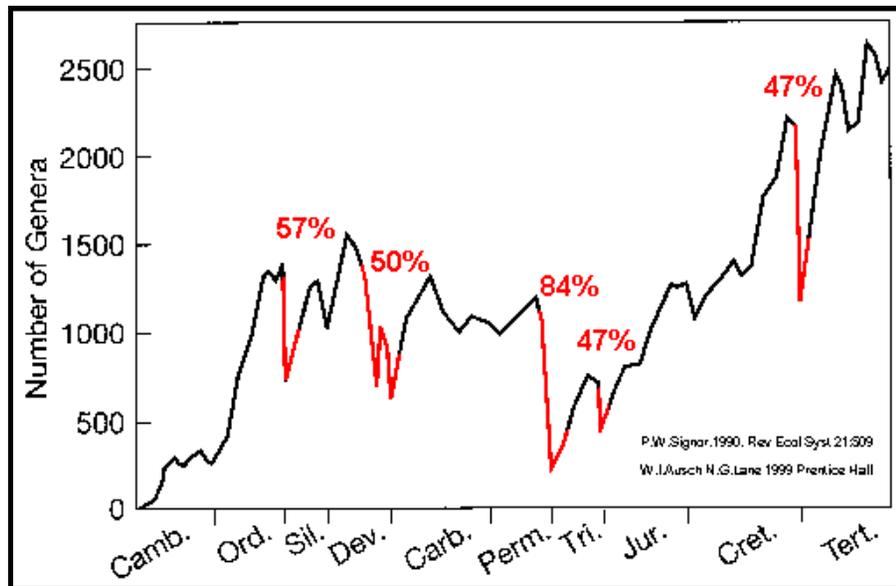
76% of species
within 2-3 MY

Meteor collision in Yucatan,
tectonic uplifting and erosion



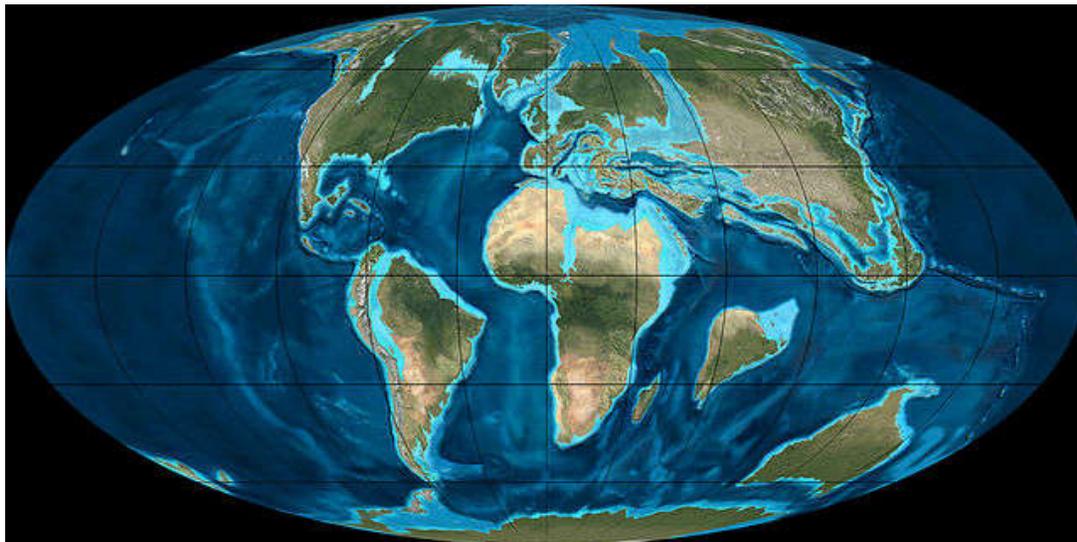
Over 400 Million Years of Extinction and Speciation

Mass Extinction = a spike in extinction rates, such that a loss of over 75% of species occurs within a geologically short period of time



Cretaceous-Tertiary Transition

- **AKA K/T boundary**
- **So-called “boundary” because of a thin film of sediment (presumably from asteroid) in geological record dated to ~65 MYA**



Continental Drift Events



PRESENT DAY



Circa 40 Million years ago



Circa 80 Million years ago



Circa 120 Million years ago

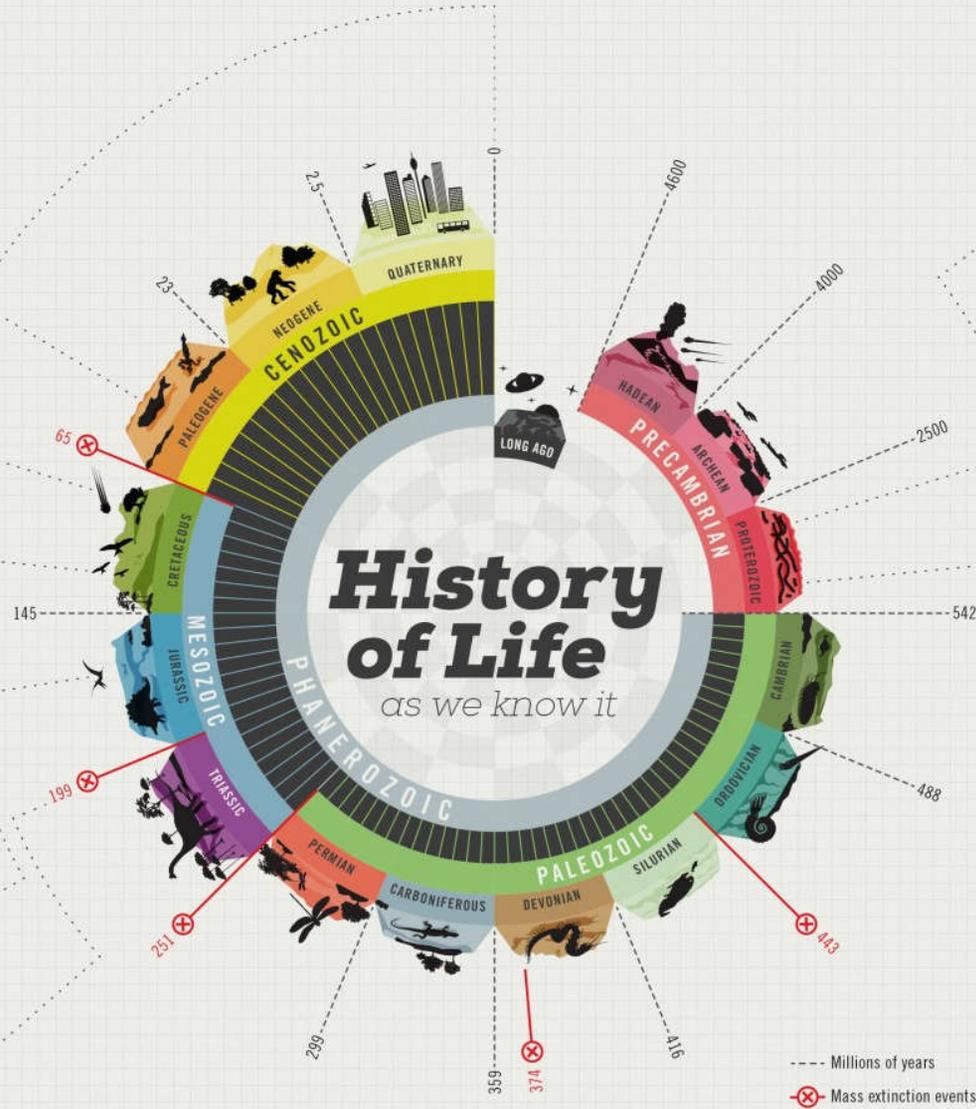


Circa 160 Million years ago

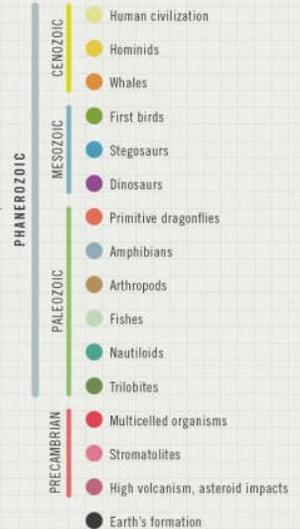


PANGEA

Circa 200 Million years ago



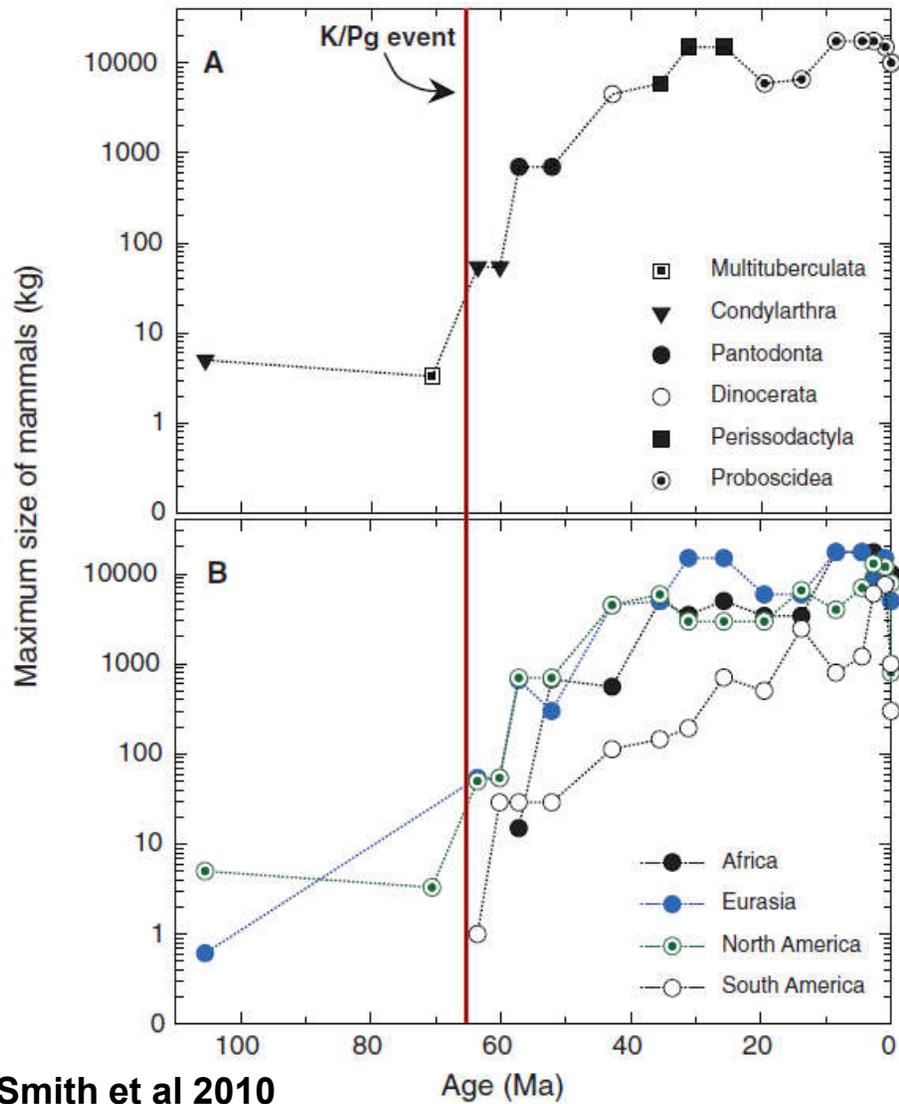
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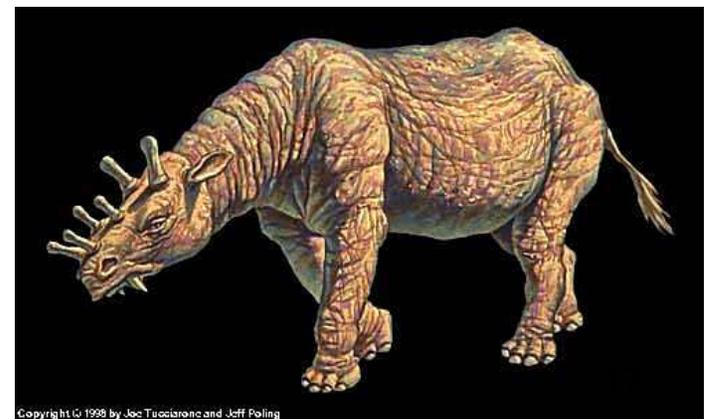
Cretaceous-Tertiary Transition



Indricotherium

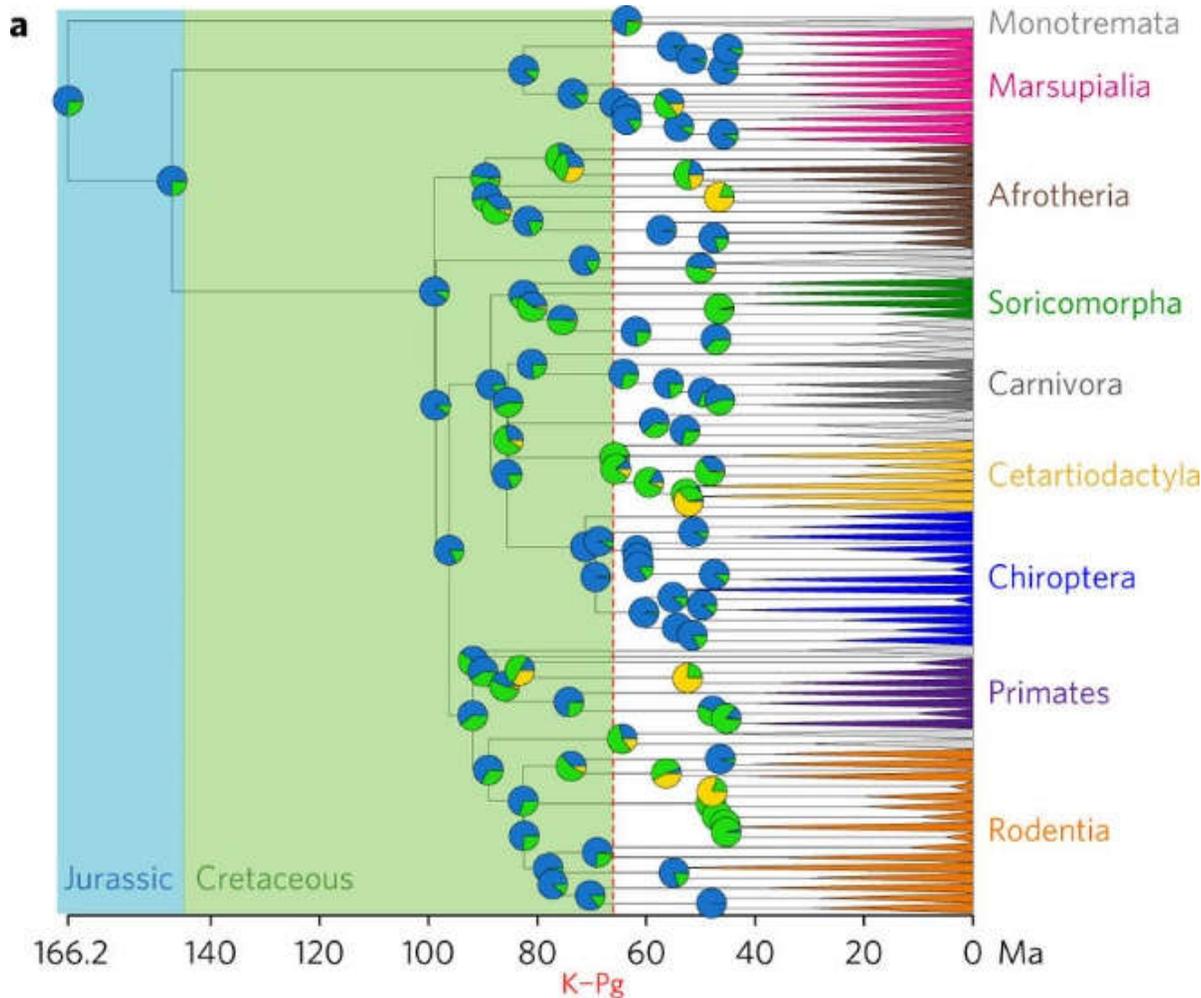


Pantodonta



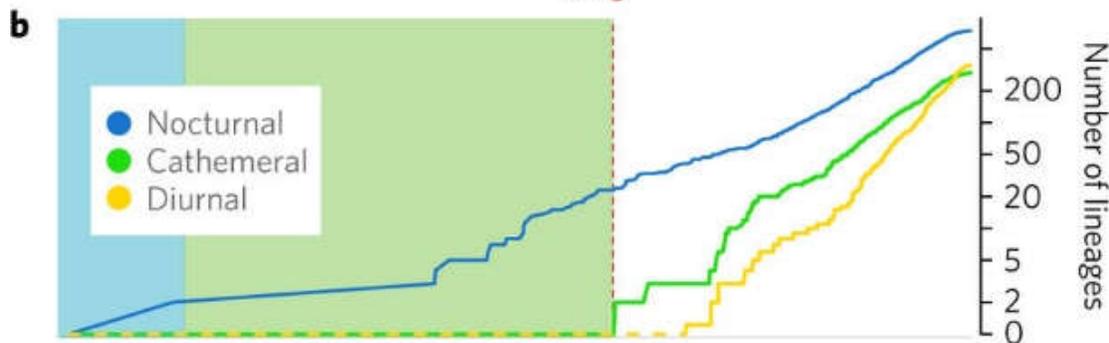
Smith et al 2010

Cretaceous-Tertiary Transition



Lineages of diurnal mammals originated following the extinction of dinosaurs

Primates were among the first diurnal mammals



Maor et al. 2017.

One undergraduate's creative cure for insomnia

 **Colin J Carlson**
@ColinJCarlson

in the face of insomnia i will attempt to assign letter grades to the weird foxes. please stand by and watch this space for weird fox letter grades,, thank you

1:13 AM - Nov 12, 2017 · Berkeley, CA

356 10,412 21,919

 **Colin J Carlson** @ColinJCarlson 12 Nov

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 **Colin J Carlson**
@ColinJCarlson

a disclaimer before i begin: i am not a fox expert nor do i know things about foxes. please correct me if i am wrong. however the letter grades will not be wrong. this is the definitive ranking

1:14 AM - Nov 12, 2017 · Berkeley, CA

18 246 2,924



 **Colin J Carlson**
@ColinJCarlson

Replying to @ColinJCarlson

red fox (*vulpes vulpes*)

- the classic fox, the bar for foxness, a necessary prerequisite
- a good fox but NOT weird. weird-deficient. just a standard fox
- grade: B

1:18 AM - Nov 12, 2017 · Berkeley, CA

28 738 5,144

One undergraduate's creative cure for insomnia



Colin J Carlson
@ColinJCarlson

Replying to @ColinJCarlson

kit fox (*vulpes macrotis*)

- i'll say it: they're trying too hard to be cute
- neither fox enough nor weird enough
- i'm making the unpopular call and taking a stand
- grade: C

1:35 AM - Nov 12, 2017 · Berkeley, CA

39 526 4,403



Colin J Carlson
@ColinJCarlson

Replying to @ColinJCarlson

bat-eared fox (*otocyon megalotis*)

- a return to weird fox form
- arguably the perfect deviant fox bauplane, doing it's own thing
- this fox answers to no one
- ears full of secrets?
- grade: A++. i will not be negotiated down from this.

1:37 AM - Nov 12, 2017 · Berkeley, CA

41 2,094 9,059



Colin J Carlson
@ColinJCarlson

Replying to @ColinJCarlson

crab eating fox (*cerdocyon thous*)

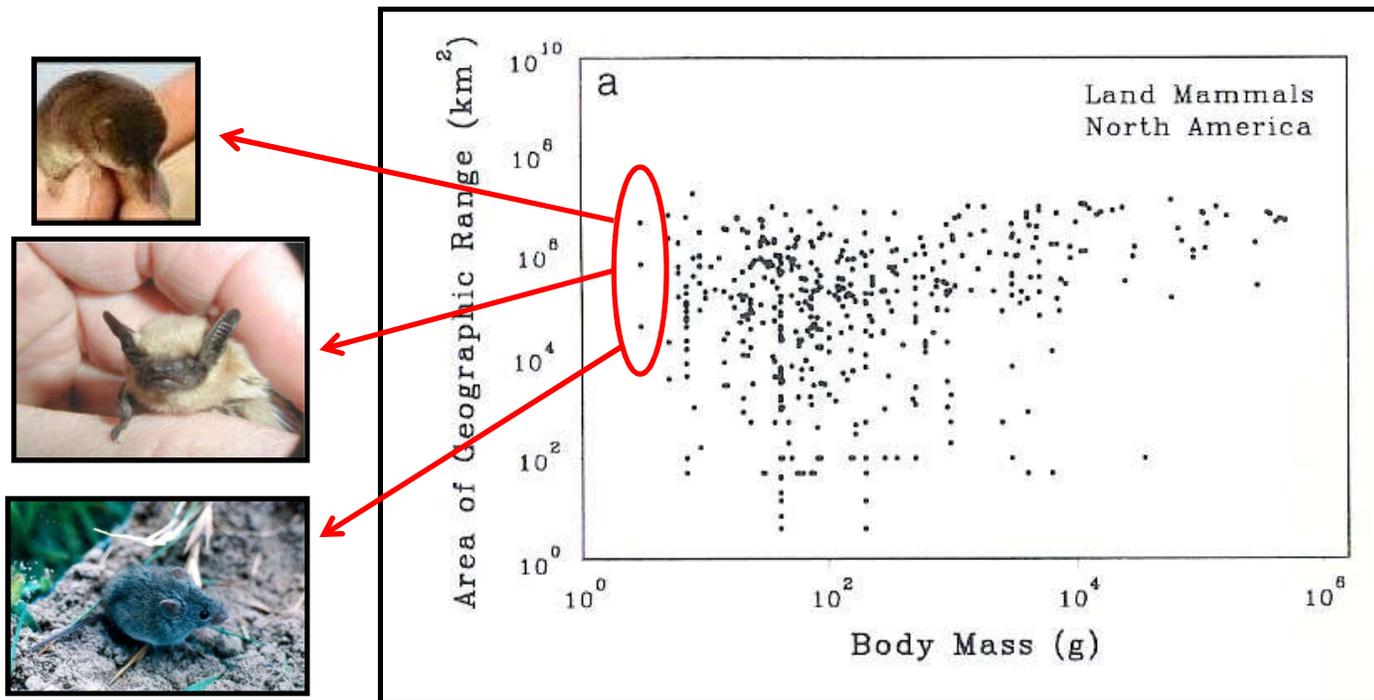
- almost but not entirely unlike a fox
- crab eating, as a fox-deviant motif: rebellious
- sort of like a dog conceptually but not in practice
- could improve with a couple rounds of constructive criticism
- grade: B+

1:50 AM - Nov 12, 2017 · Berkeley, CA

16 610 4,421

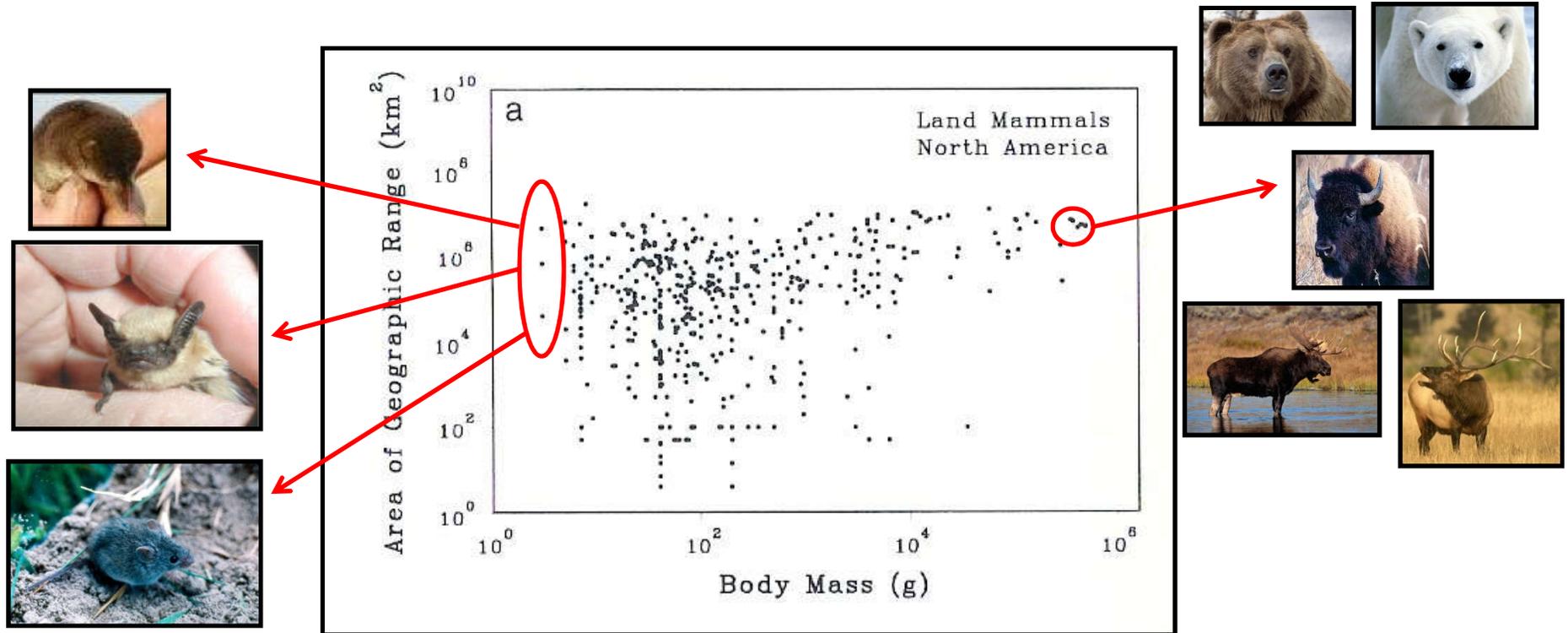
Deterministic responses of mammals to area

- Small mammals (<100 g) can have large or small geographic ranges



Deterministic responses of mammals to area

- Larger species of mammals tend to have larger geographic ranges, maybe because of a combination of energetic requirements of large mammals and minimum viable population sizes

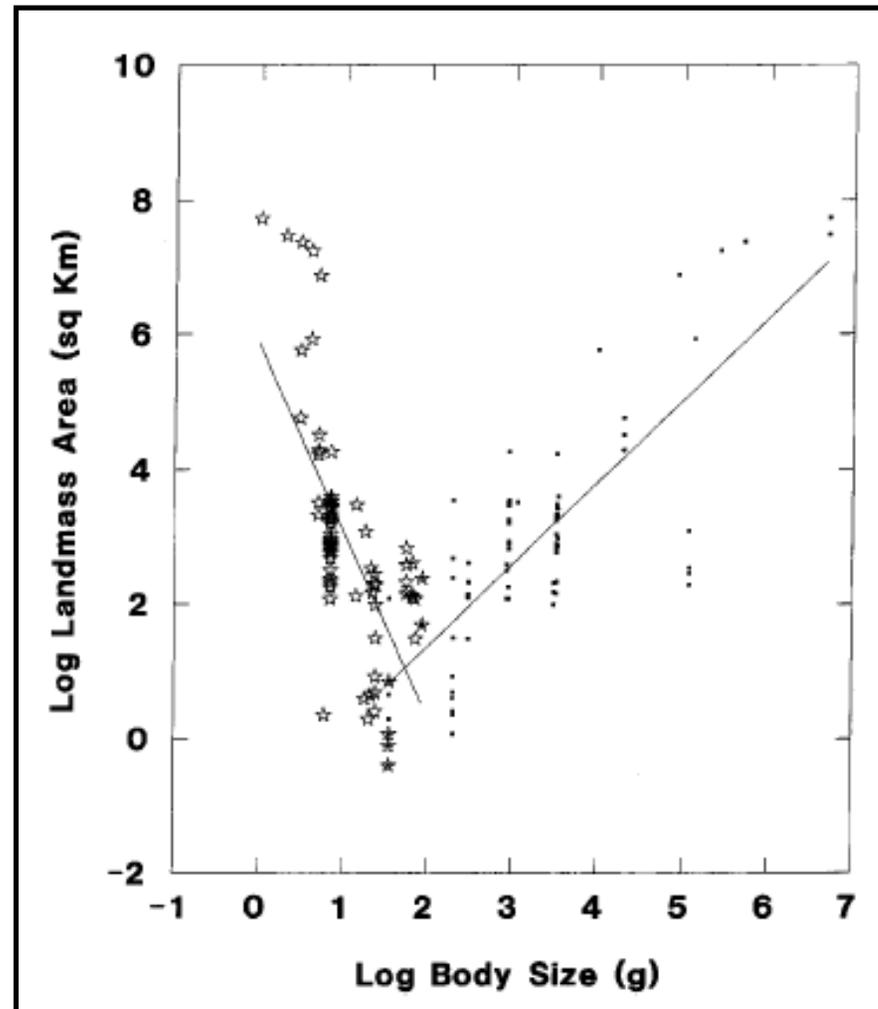


Deterministic responses of mammals to area

- larger landmasses house larger species of mammals
- suggests food might drive relationships between body size and area
- if so, energetic and trophic relations should underlie patterns currently and in the fossil record

● largest mammal on landmass

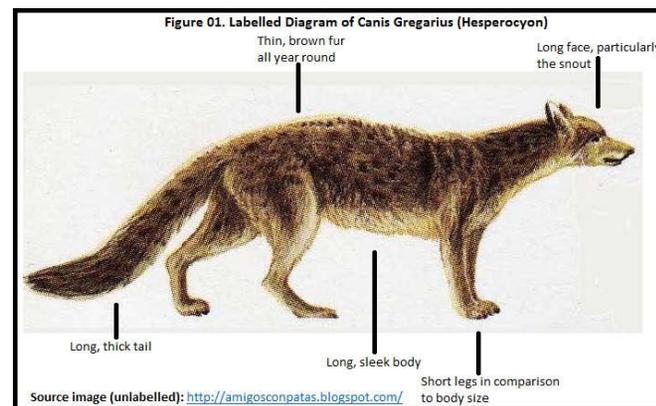
★ smallest mammal on landmass



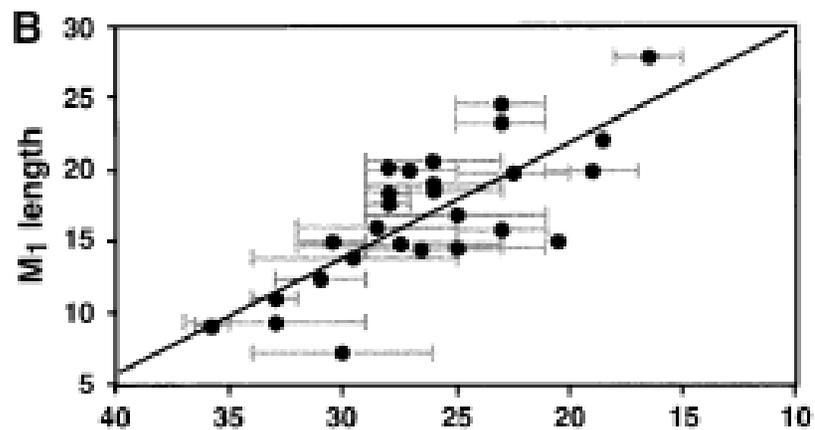
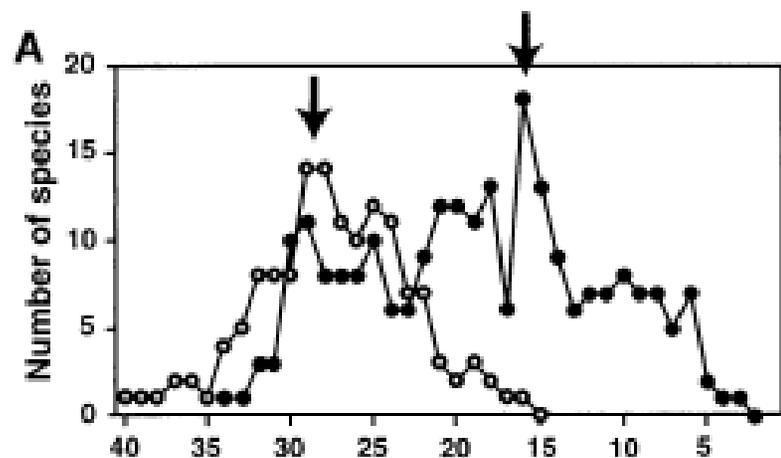
Cope's rule

- Cope's rule = selection for large body size over evolutionary time

Hesperocyoninae = ~30 sp in Nearctic



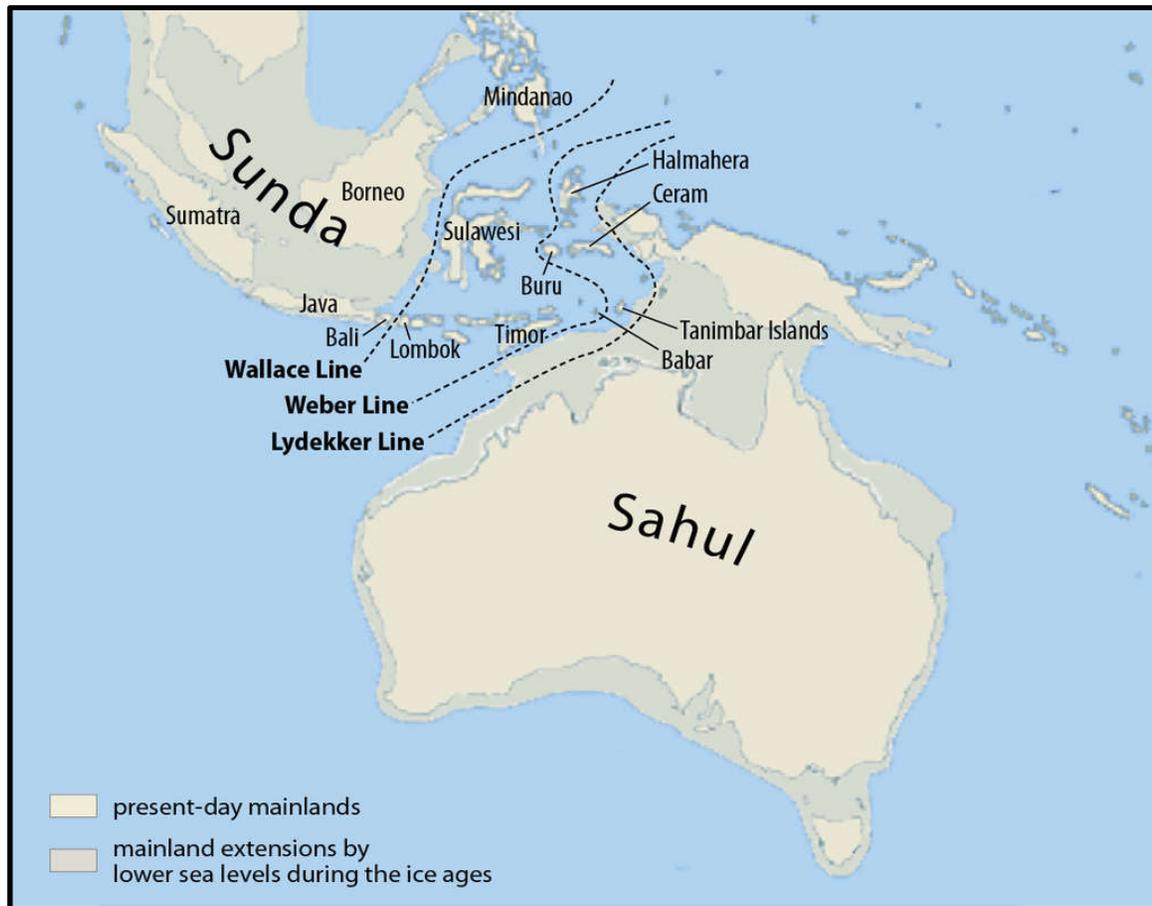
Cope's rule



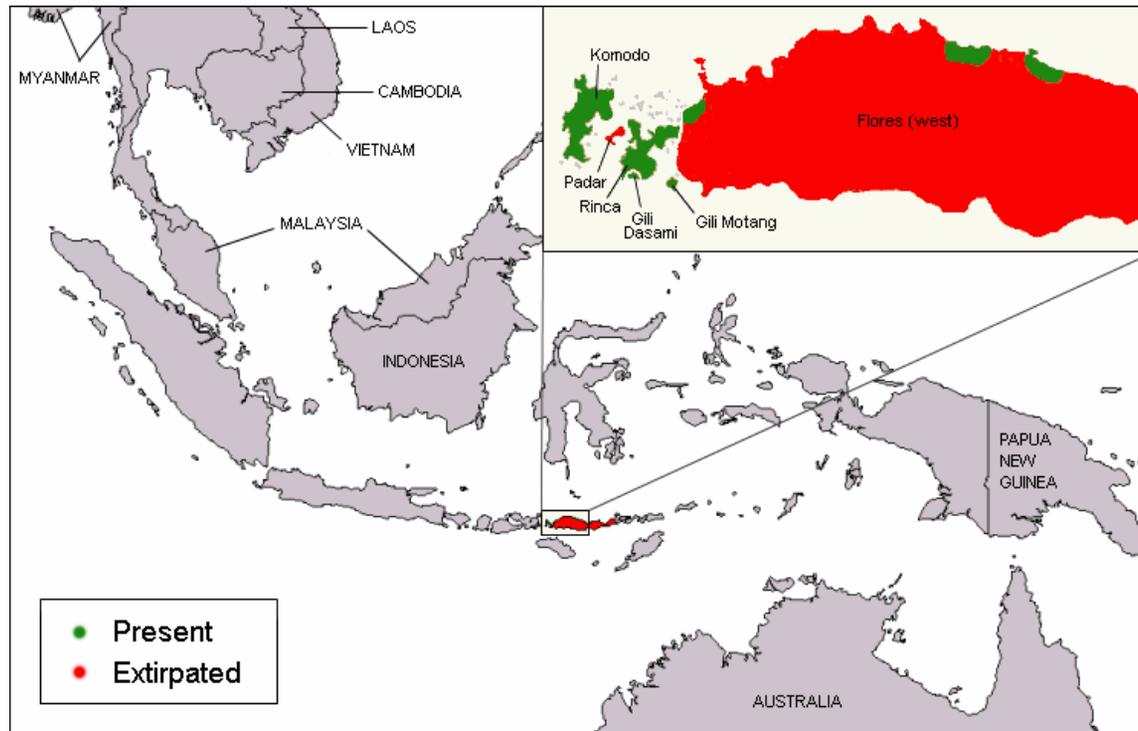
Millions of years ago

Island gigantism, dwarfism, and a ghost of predation past

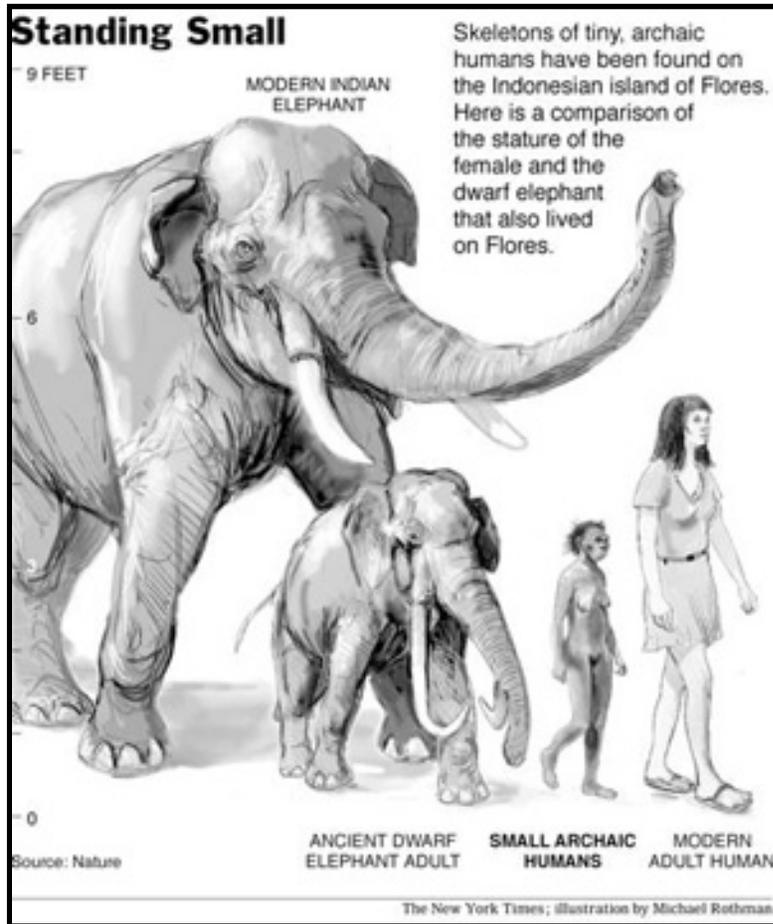
- **Wallacea** = series of islands between Oriental and Australasian zoogeographic regions where carnivorous mammals are mostly absent



Island gigantism, dwarfism, and a ghost of predation past



Island gigantism, dwarfism, and a ghost of predation past



Ecological Anachronisms

- ecological anachronism = species or attributes of species that evolved as part of an interaction with one or more other species that now are extinct.



