

Extinction: a natural versus human-caused process

How do current extinction rates and patterns compare to historical extinctions?

The Meaning of Extinct

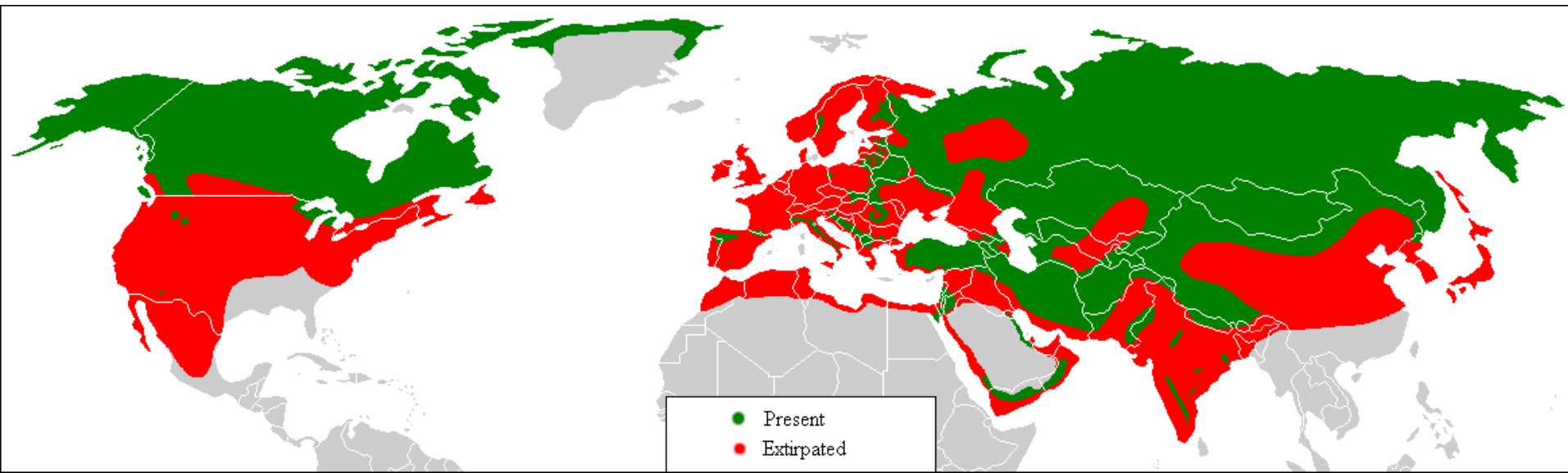
- A species is **extinct** when no member of the species remains alive anywhere in the world.



- A species is **extinct in the wild** if it is only alive in captivity



- A species is **locally extinct** or **extirpated** when it is no longer found in an area it used to inhabit but is still found elsewhere



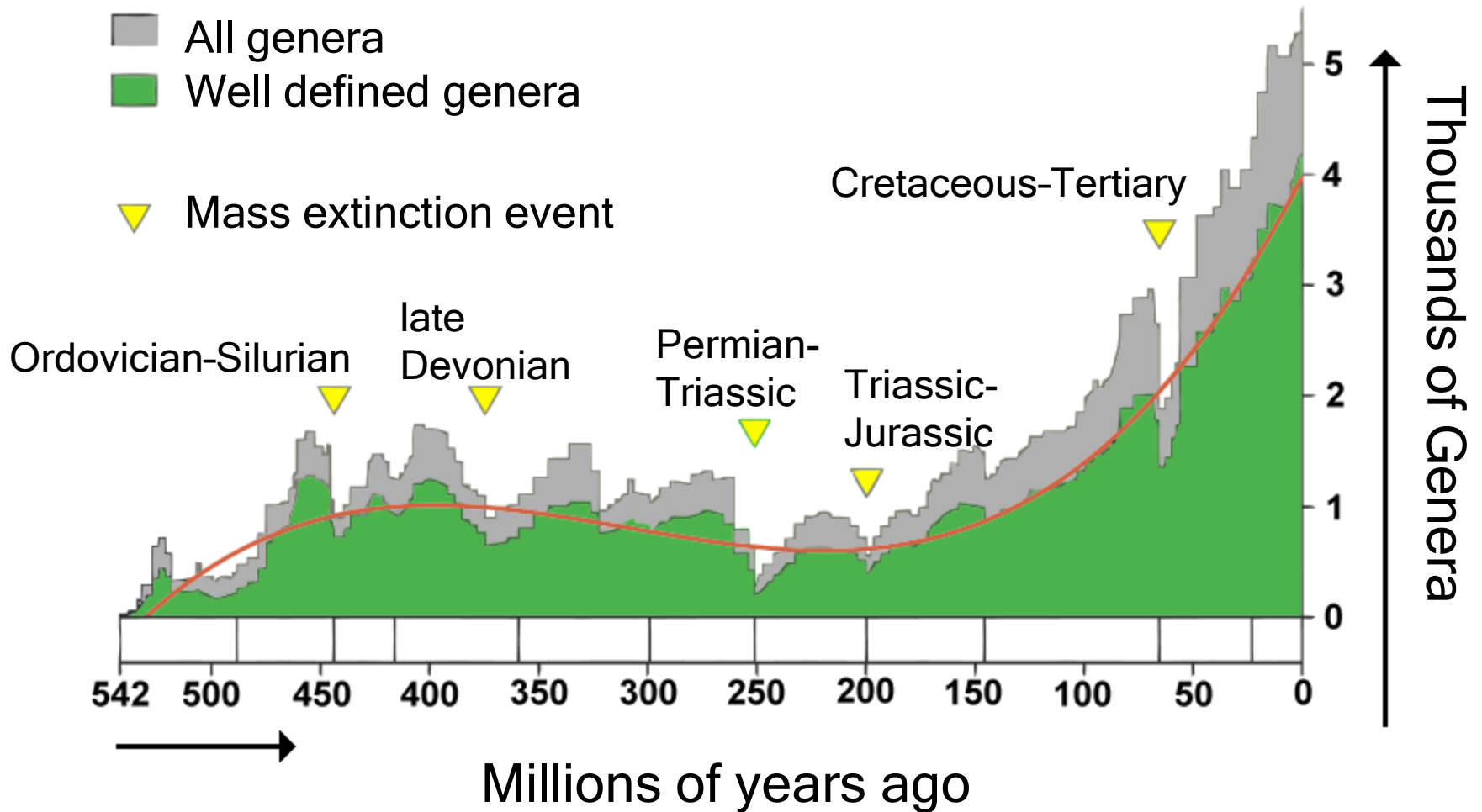
- A species is **ecologically extinct** if it persists in such reduced numbers that its effects on other species is negligible.



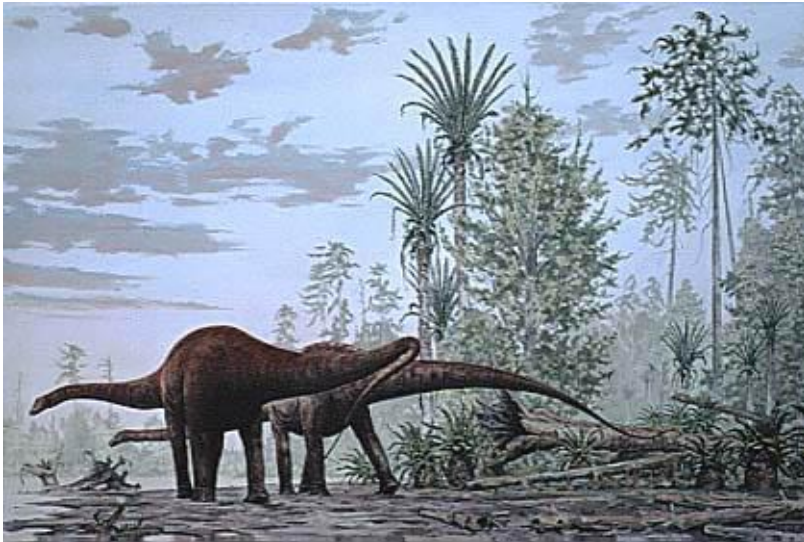
WHAT ARE BACKGROUND EXTINCTION RATES?

- Paleontologists estimate that most species “last” 1-10 million years
- If we assume there are 10 million species, 1-10 species go extinct each year (**0.00001% to 0.0001% per year**)
- This rate could be considered a normal background rate against which to gauge mass extinctions

THE FIVE MAJOR MASS EXTINCTIONS



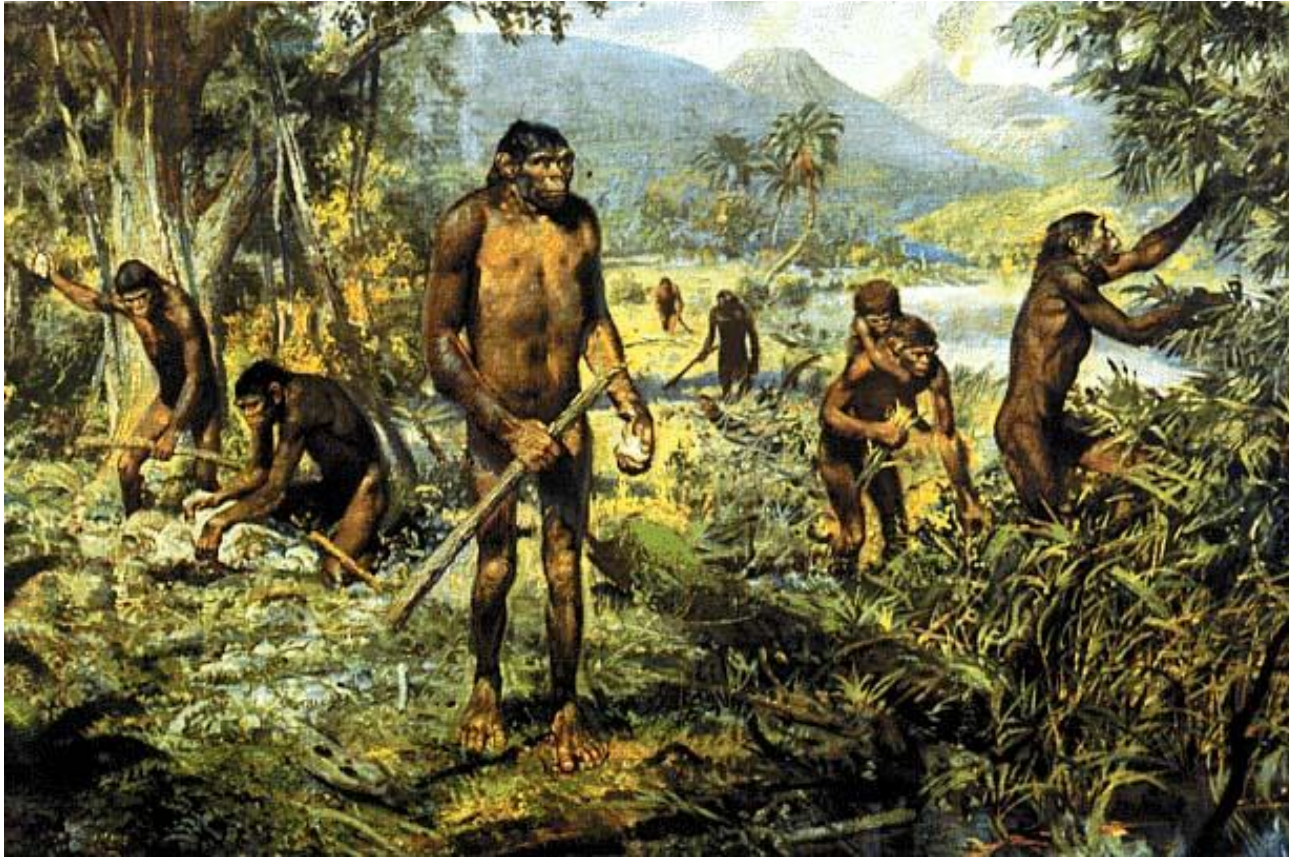
CRETACEOUS EXTINCTIONS



- 50% of all genera lost, on land and sea
- Demise of dinosaurs as dominant group
- Impact of extraterrestrial object is the generally accepted cause

THE PRESENT

- Global biodiversity reached an all time high in the present geological period (about 30,000 years ago)
- Biodiversity has declined ever since due to human-induced habitat loss, invasive species, and overexploitation; and is now threatened by pollution, disease, and climate change



Our ancestors were hunters & gatherers and not a threat to other species. The playing field was level.

EMERGENCE OF TOOL MAKING AND CULTURAL EVOLUTION

- Tool making allowed a quantum leap in predation capacity and efficiency
- **Cultural evolution** allowed the rapid spread of new technologies
- 100,000-40,000 ya humans became a super-predator, capable of overexploiting almost any prey.
- Species couldn't respond via biological evolution when extinct

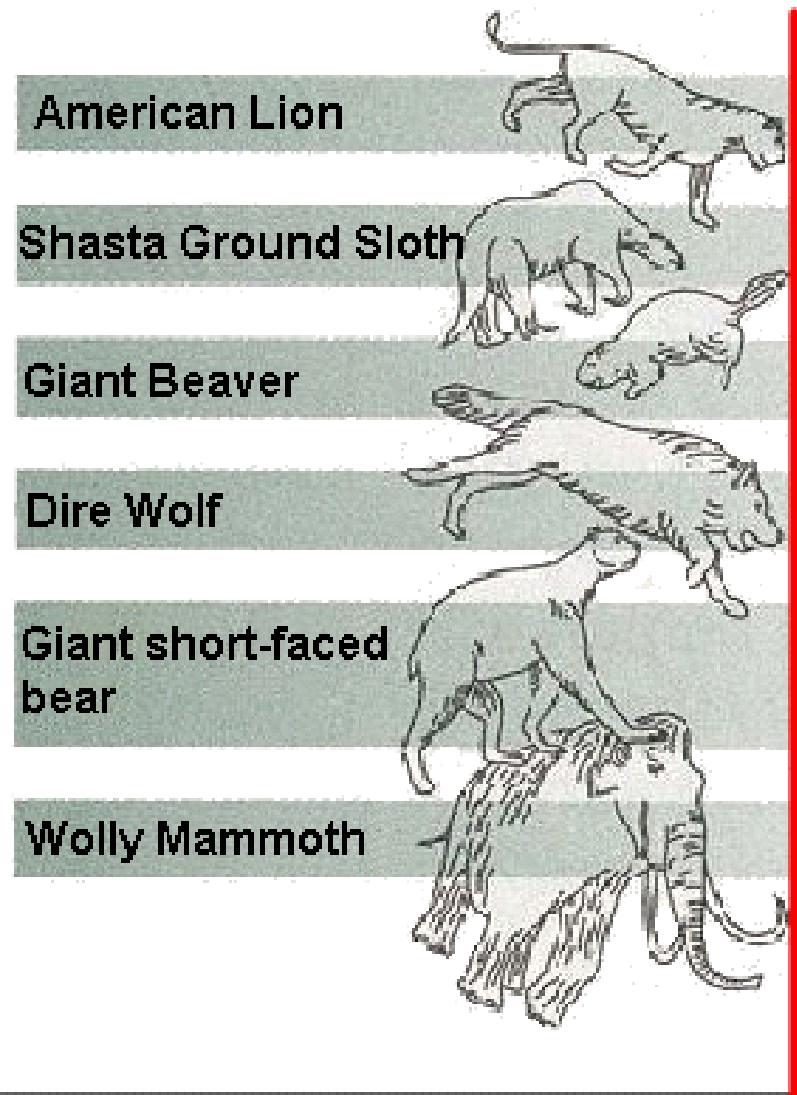
THE FIRST AMERICANS CROSSED

USAirmail 50

OVER FROM ASIA



AMERICA



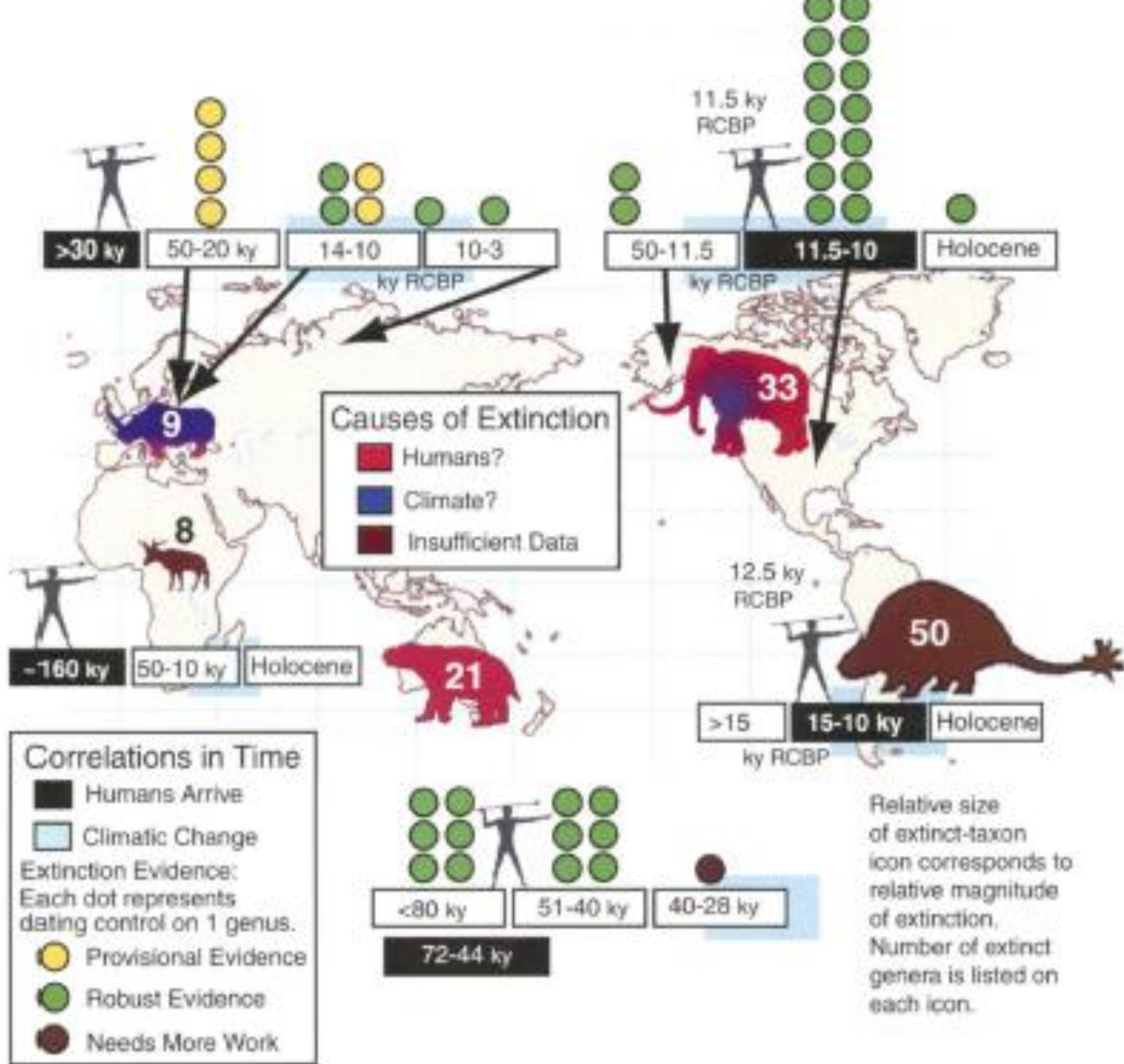
North American Megafaunal Extinction

70% of the North American large (> 100 lb) mammal genera went extinct at the end of the of the last ice age.

2,500,000

12,000 years ago

Present



DOCUMENTING EXTINCTIONS

- Historical (background) extinction rates have been estimated from the fossil record, which does not provide the resolution to recent (last few hundred) extinction rates for most taxa
- Recent extinction rates for 99% of the world's species are guesses at best
- Recent extinctions and extinction rates are best known for land vertebrates, particularly mammals and birds

DOCUMENTING EXTINCTIONS

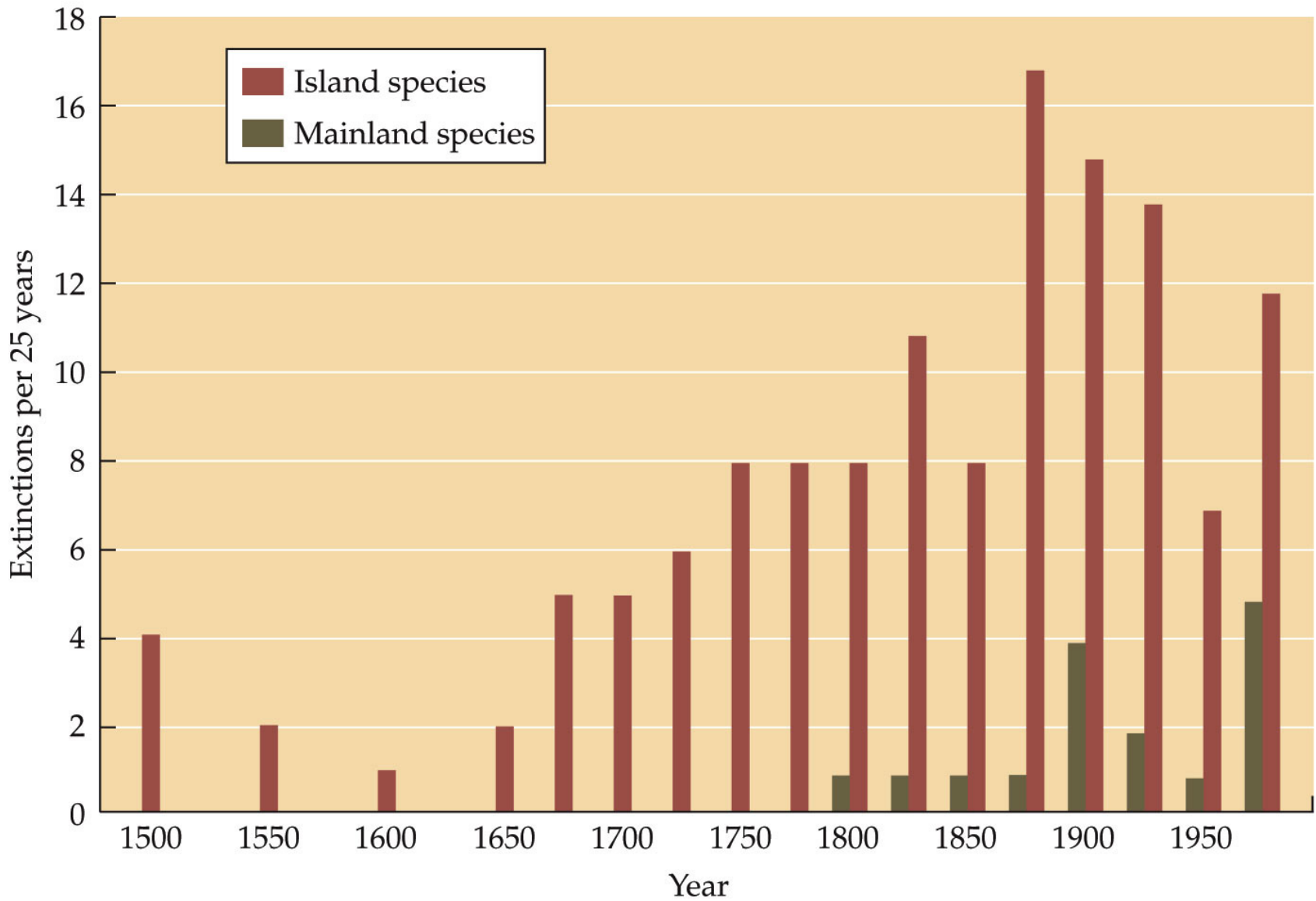
- Determining if a species has gone extinct can be difficult even for contemporary mammals and birds



CURRENT RATE OF AVIAN AND MAMMALIAN EXTINCTIONS

- Global pool of about 15,300 well known species
- Extinction rate is now documented to be about 2 species per year or **0.01% per year**
- Recall: background rate = **0.00001% to 0.0001% per year**
- Current rate is **100X to 1000X** background rate
- Assuming that less well known taxa have similar rates, we are experiencing the sixth mass extinction of life on earth

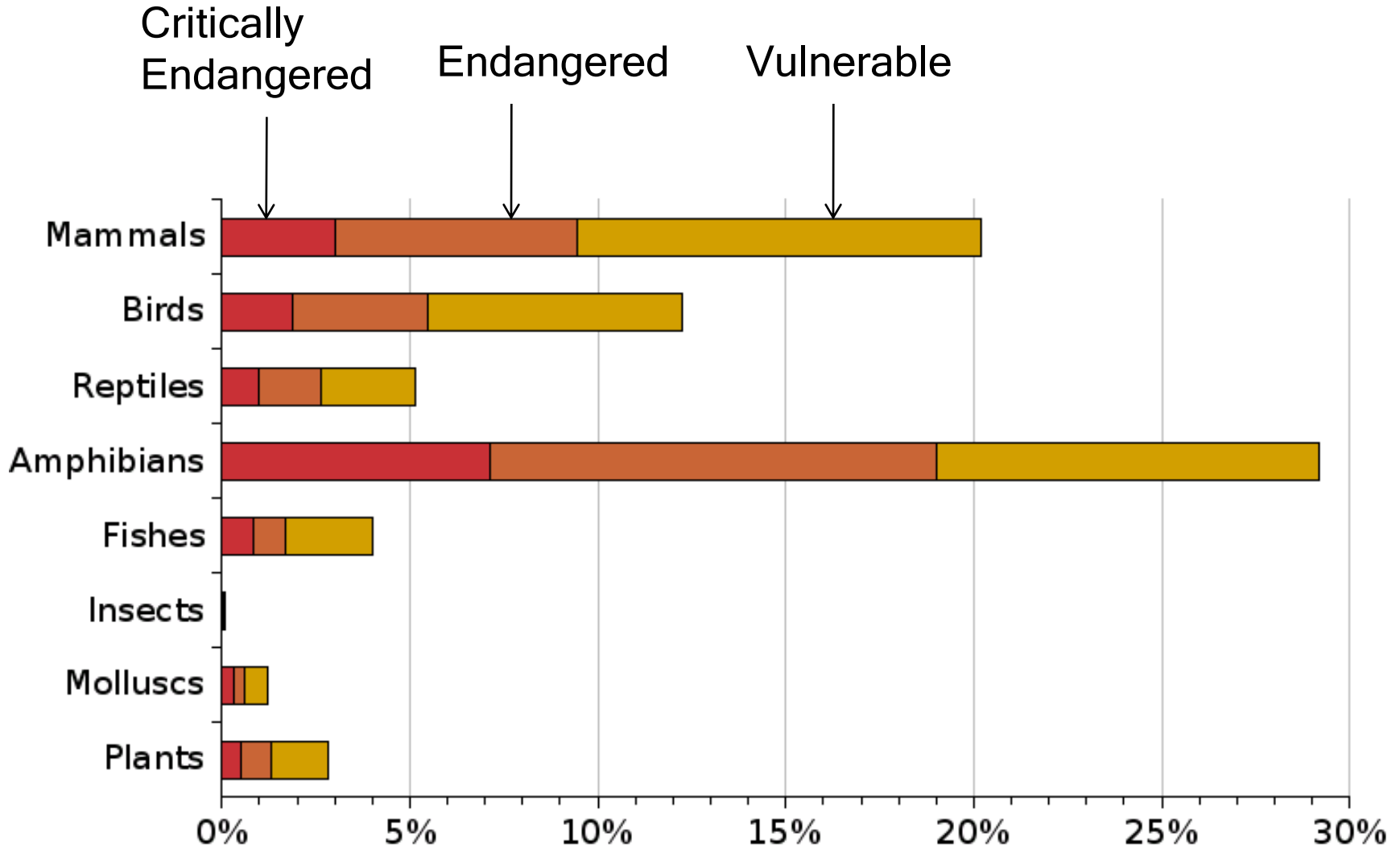
AVIAN EXTINCTIONS



WHAT ARE THE BIG TRENDS IN THE CURRENT MASS EXTINCTION ?

- The extinction rate has been accelerating exponentially
- Shifting from species-poor islands to species-rich continents
- Species are threatened in increasingly complex ways
- More types of species are being affected and most of the earth's biotas are now suffering losses

The IUCN's Red List of Threatened Species by Taxonomic Group (45,000 Species Assessed)



- **The Bottom Line**: Many more species will go extinct
- **Our Job**: Slow the rate of extinction