MUNI
SCI

04 People and nature in prehistory

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2. Megafaunal extinctions
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4. Elm and the Landnam theory
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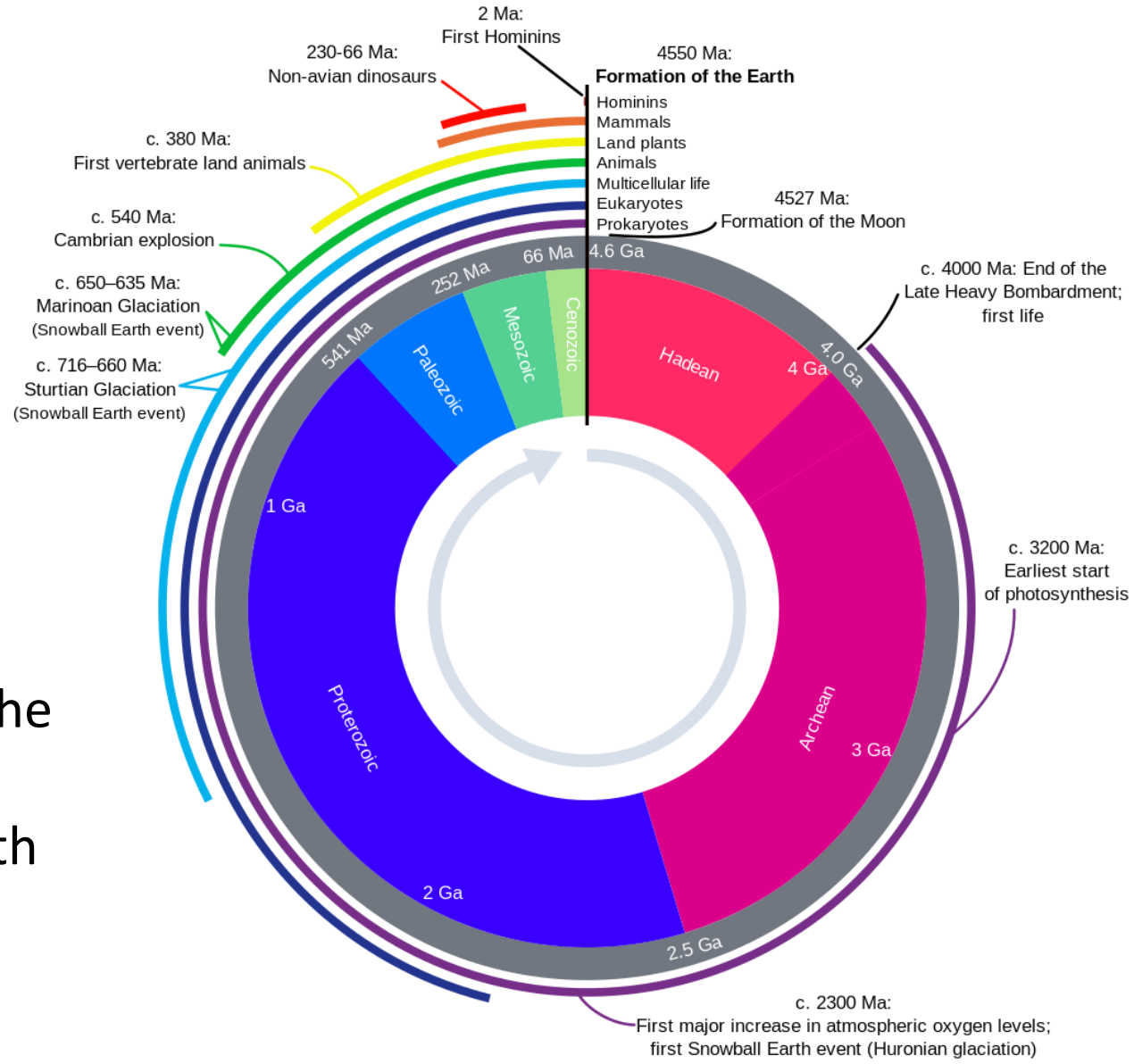
Geological time



- humans are a very recent addition to the planet
- this makes our modification of the Earth System even more astonishing

Plate tectonics

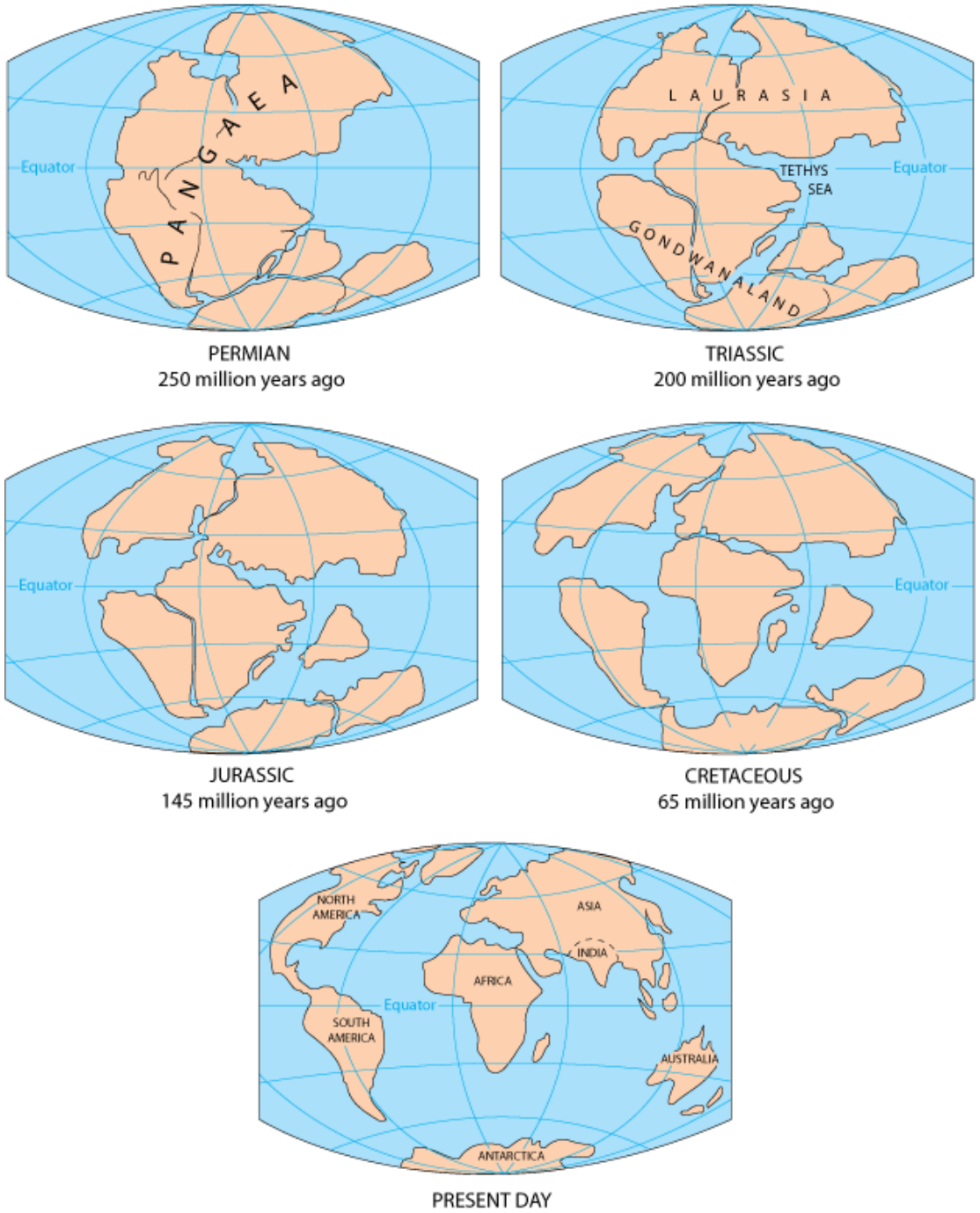
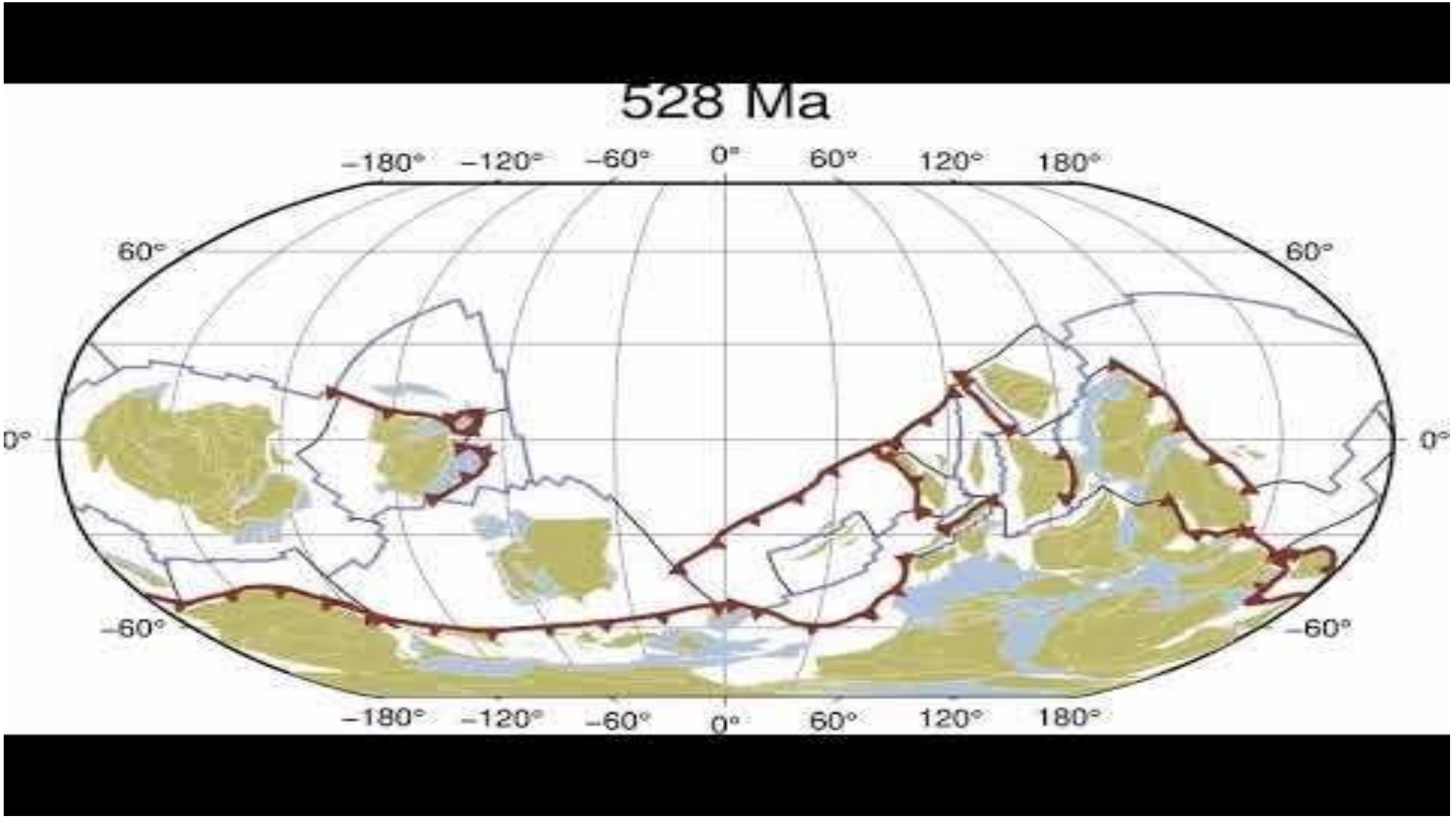
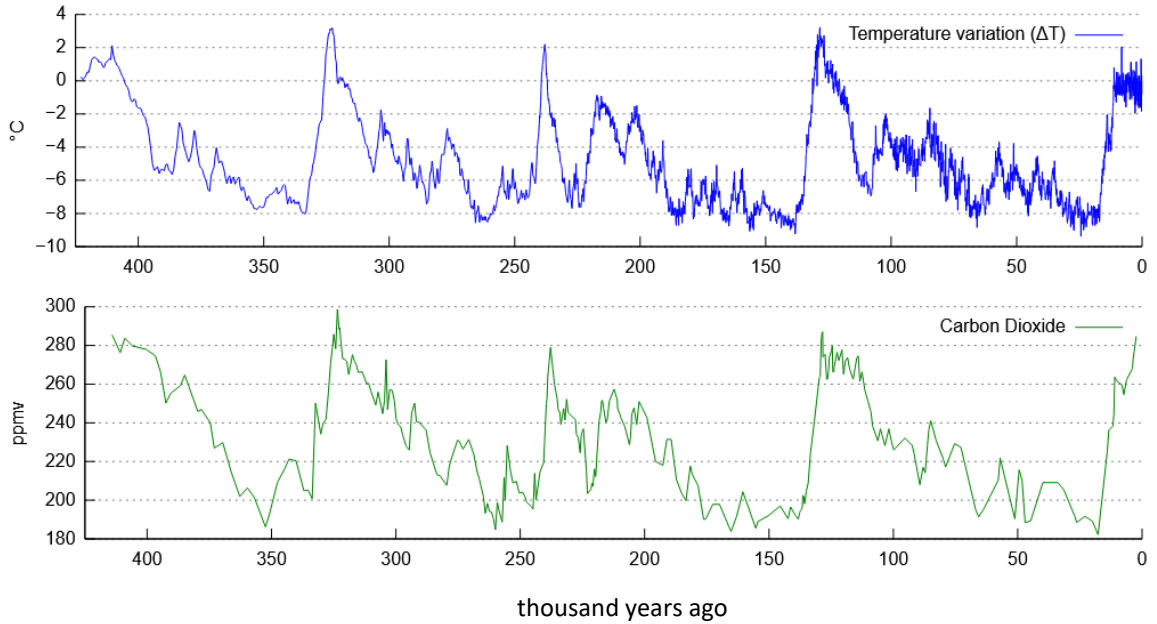
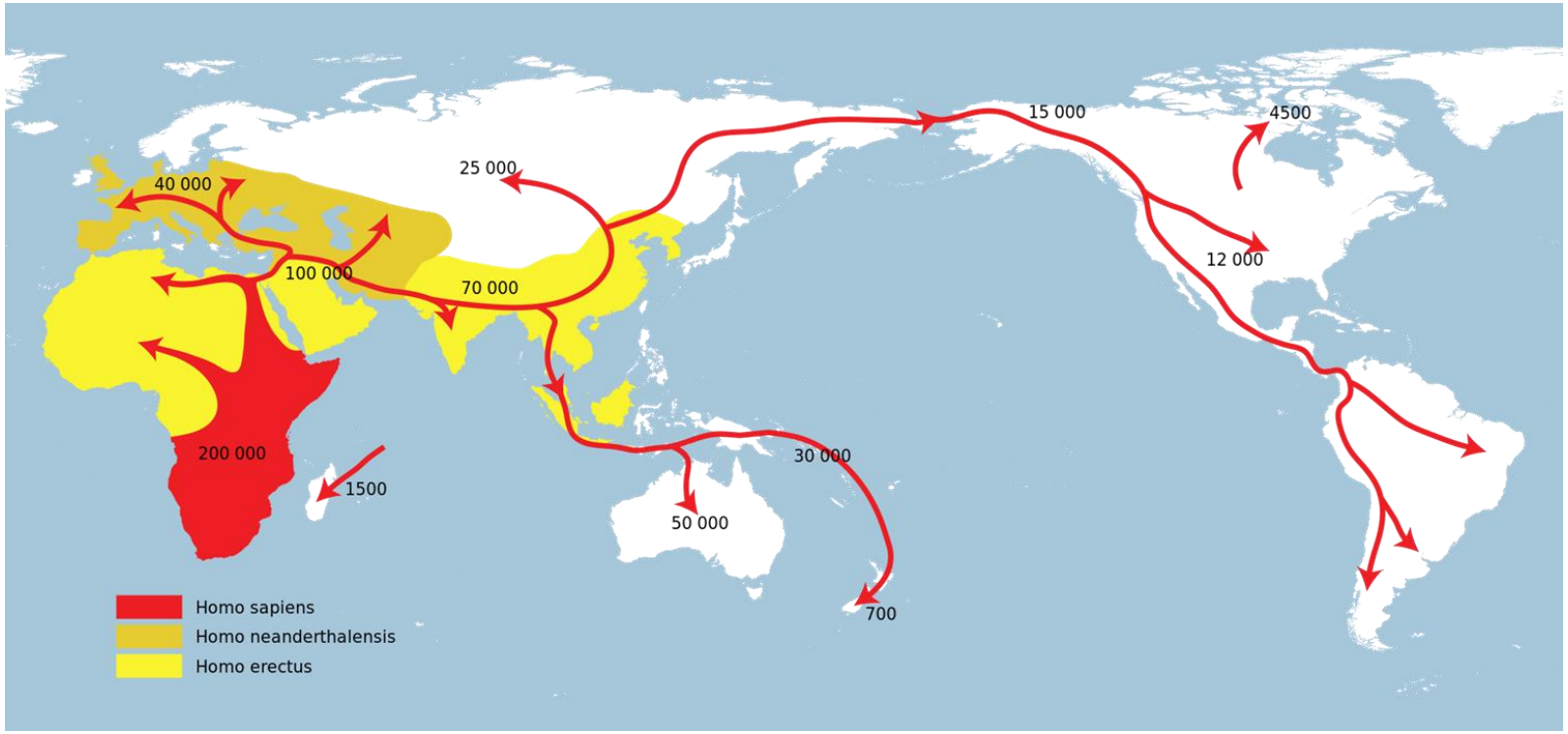


Plate tectonics



until ca. BC 6500

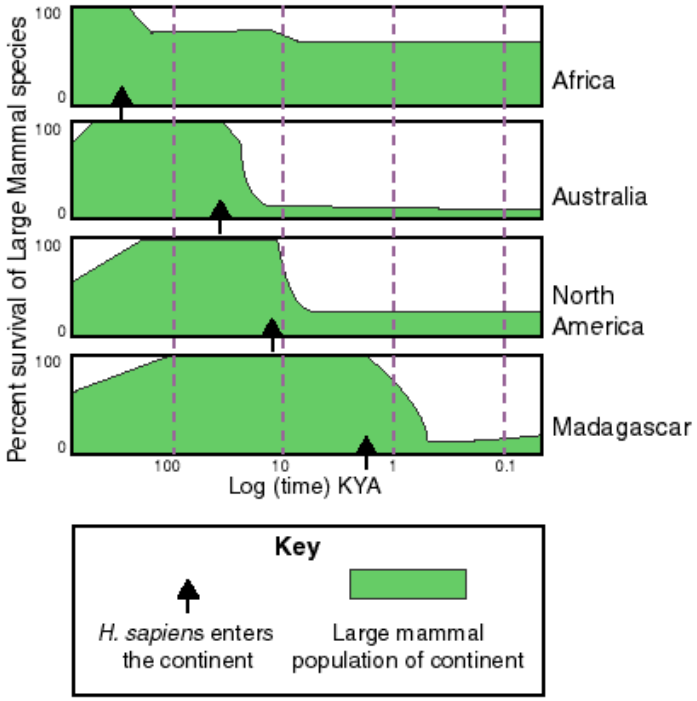


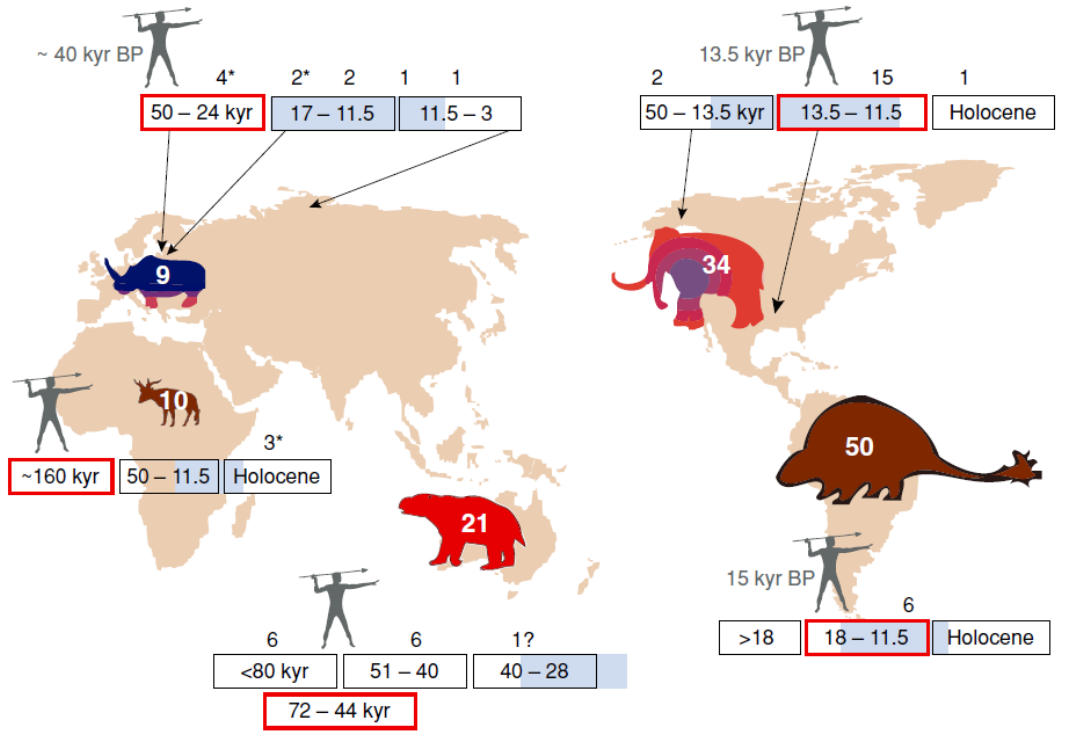


geological cycles have significant consequences for human history

Influence of people on nature in prehistory: yes, we can?

Megafaunal extinctions





- anthropogenic and climatic reasons are difficult to separate
- overall: later human arrival means more dramatic effect on megafauna
- disappearance of megafauna changes entire ecosystems

Causes of extinction
- Humans
- Climate
- Insufficient data

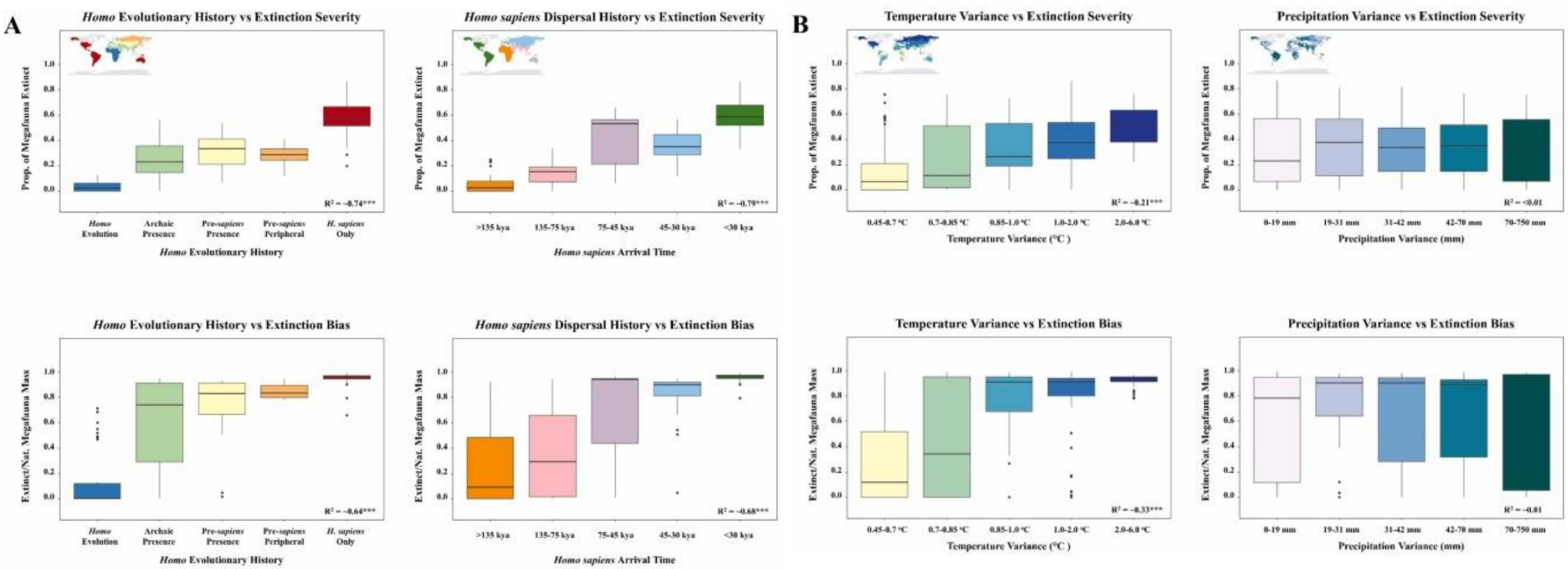
Relative size of extinct-taxon icon corresponds to relative magnitude of extinction. Number of extinct genera is listed on each icon.

Correlations in time
- Humans arrive
- Climatic change

Numbers indicate how many genera have robust dating control evidence except as indicated:
- * Provisional evidence
- ? Needs more work

Koch & Barnosky 2006.

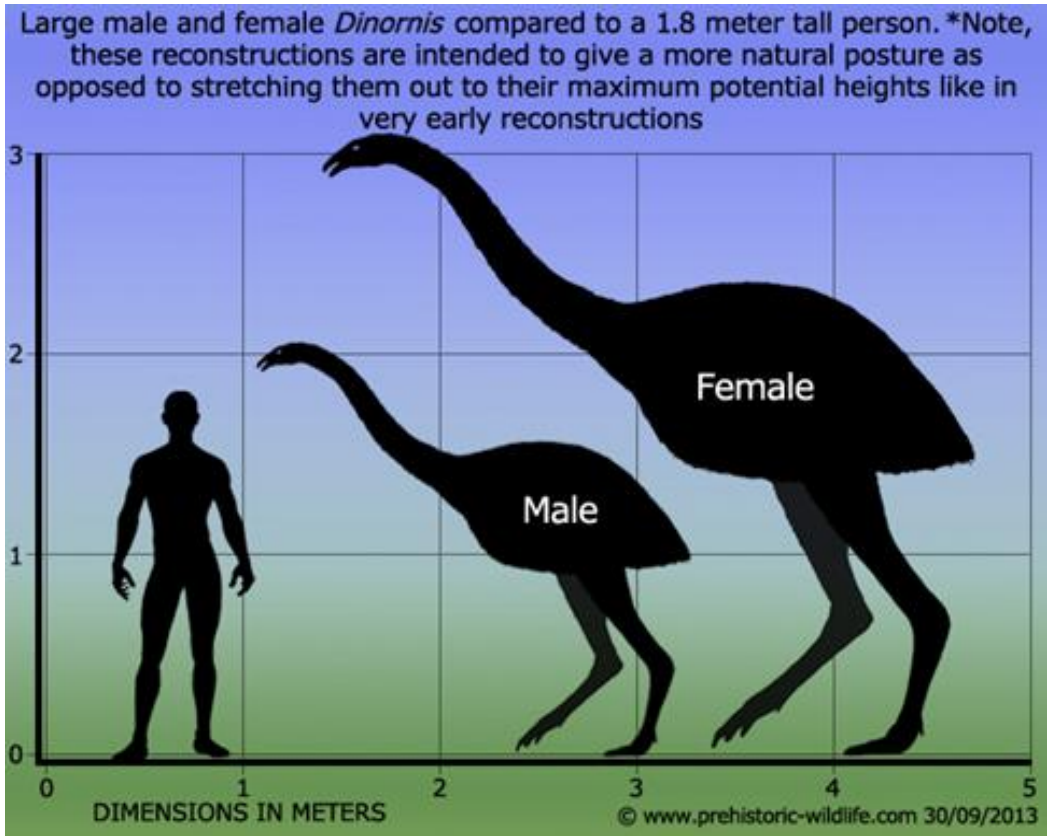
Megafaunal extinctions



Box plots of the raw (anthropic) and grouped (climatic) data. A) Shows the relationship between anthropic explanatory variables and extinction severity (top) and bias (bottom). B) Shows the relationship between climatic explanatory variables and extinction severity (top) and bias (bottom). Factors are divided according to 20% percentiles. For both A and B, the maps in the top-left of the topmost charts represent the distribution of categories globally. R^2 values from linear models are visible in the bottom right corner of each plot, with asterisks representing significance level (* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$).

Lemoine et al. 2023

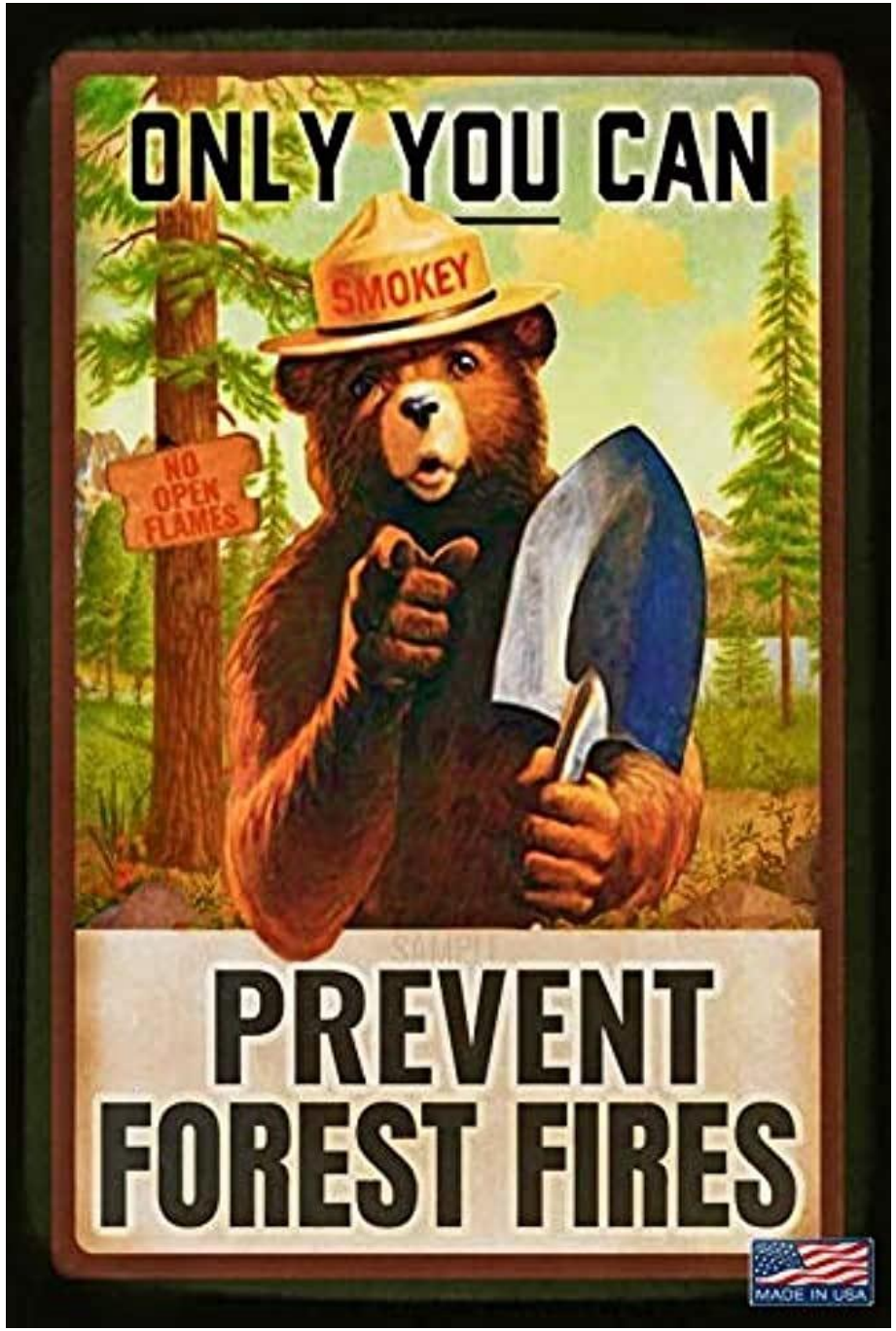
Megafaunal extinctions



- Maori colonization: ca. 1320
- Giant moa extinct by 1500

Use of fire in prehistory

Today:
fire is considered ‘unnatural’



Use of fire in prehistory

Scherjon et al.

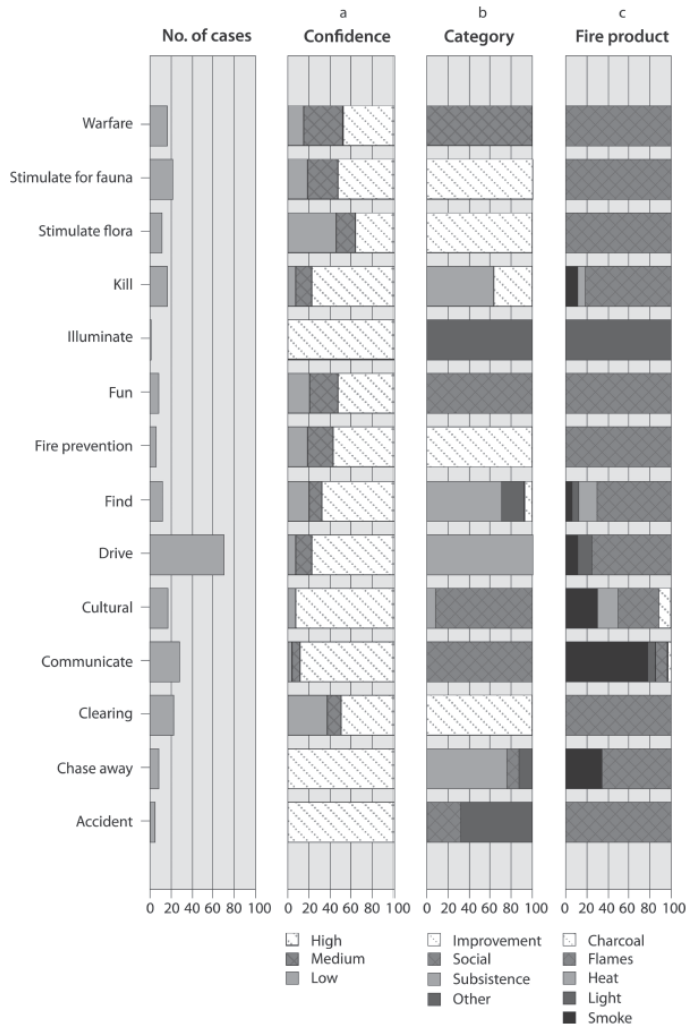


Figure 3. Objectives in absolute numbers of cases versus confidence (*a*), category (*b*), and fire product (*c*) in percentages.

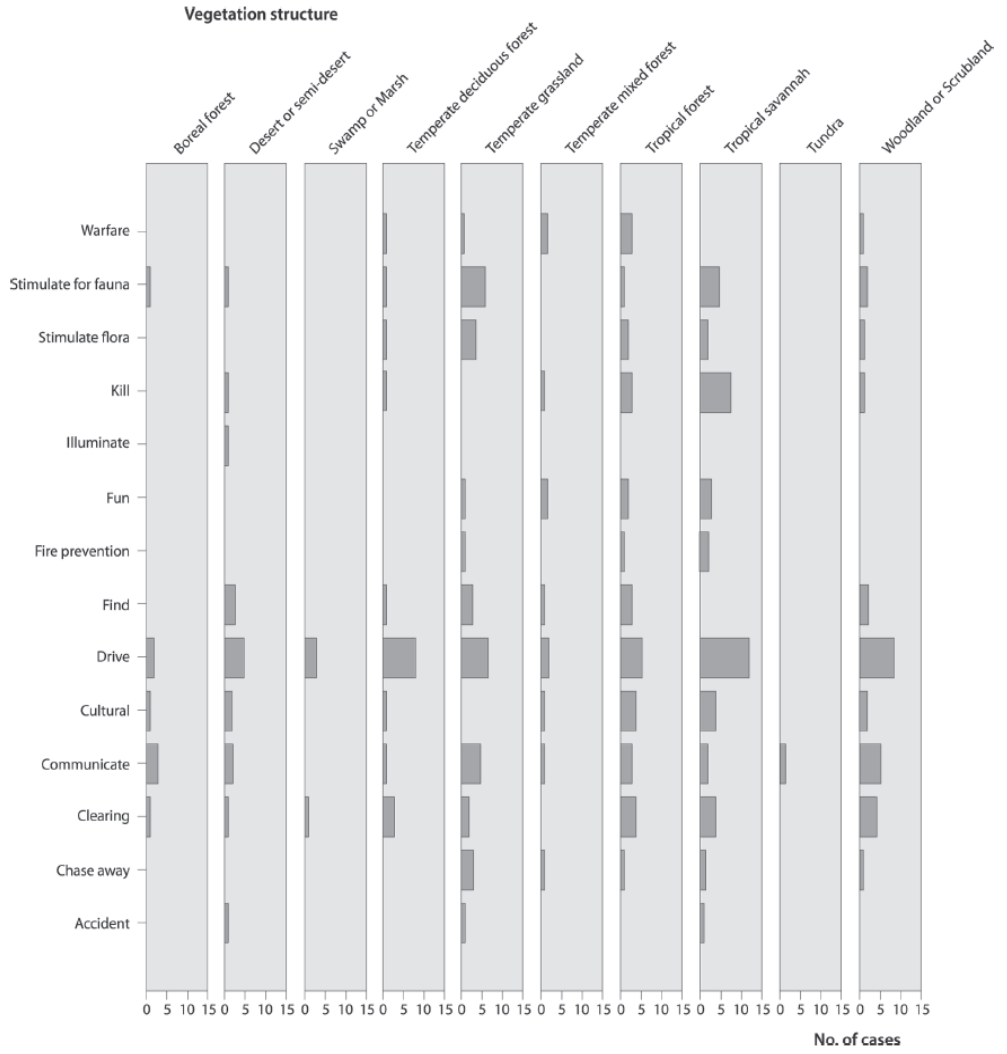
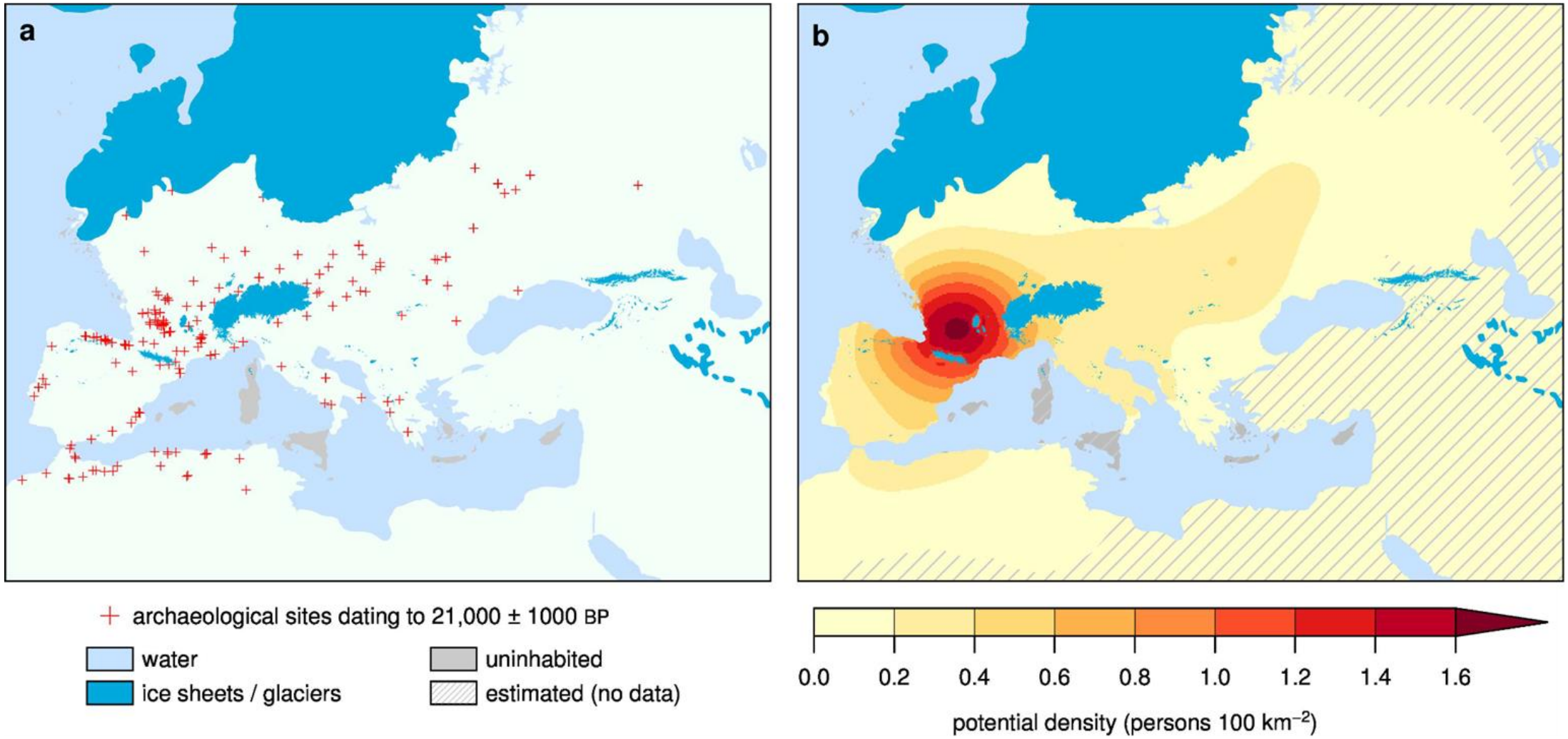


Figure 5. Objective versus vegetation structure (number of examples).

modern analogues show varied fire use among hunter-gatherers

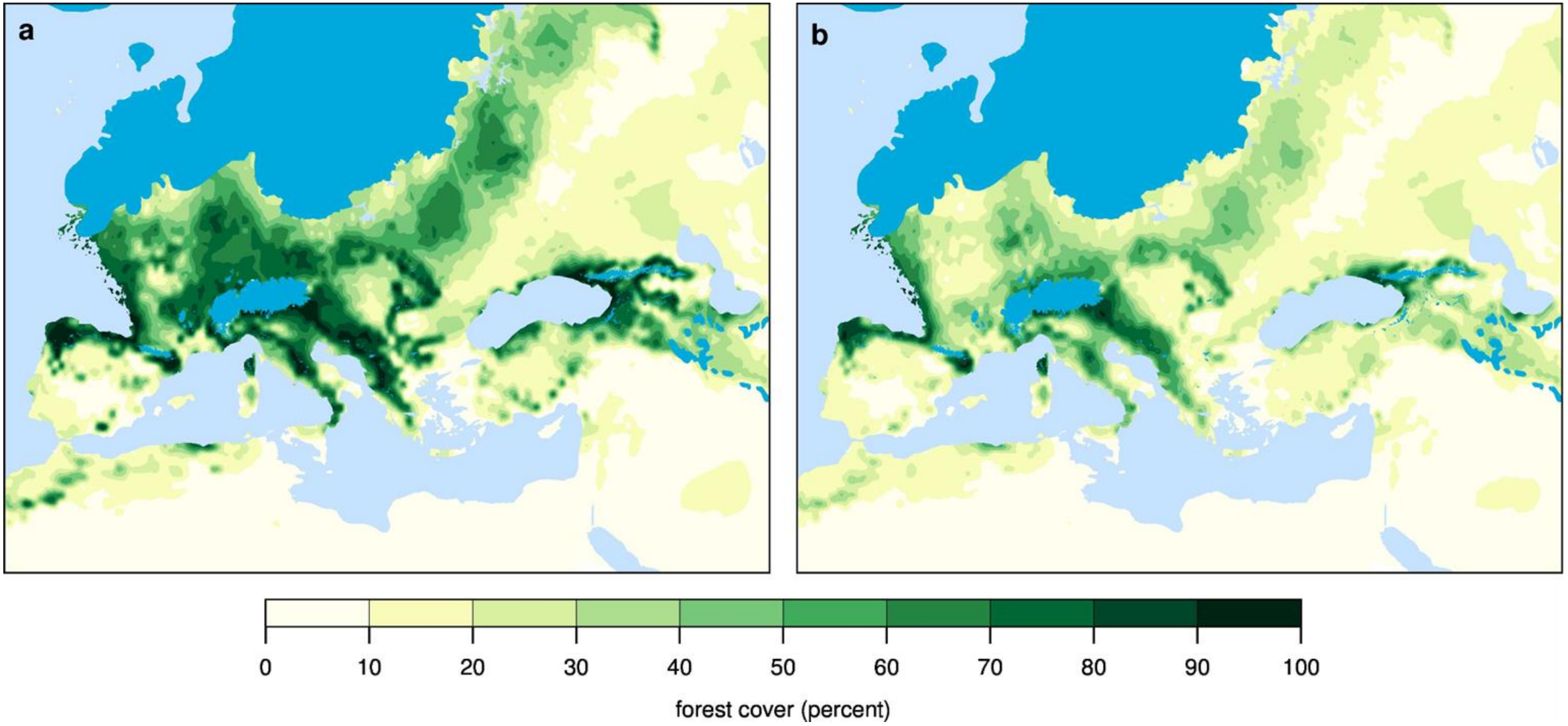
Use of fire in prehistory

Kaplan et al. 2016.



Archaeological evidence for human population during the Late Glacial Maximum (21,000 year ago)

Use of fire in prehistory



Simulated tree cover without or with human burning

Elm and the Landnam theory

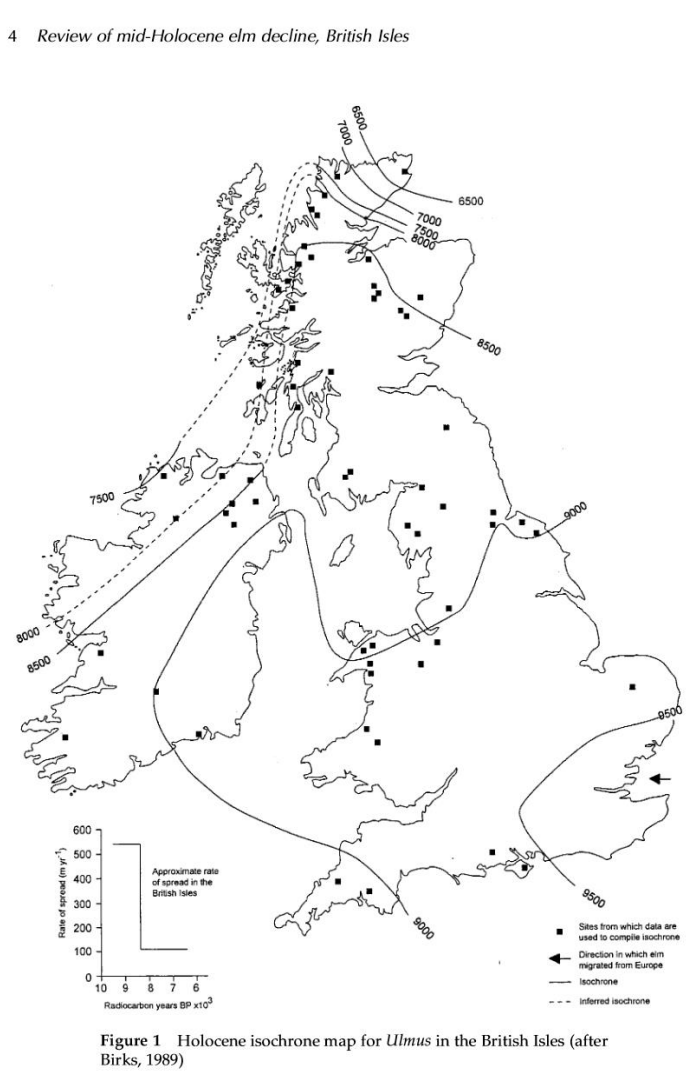
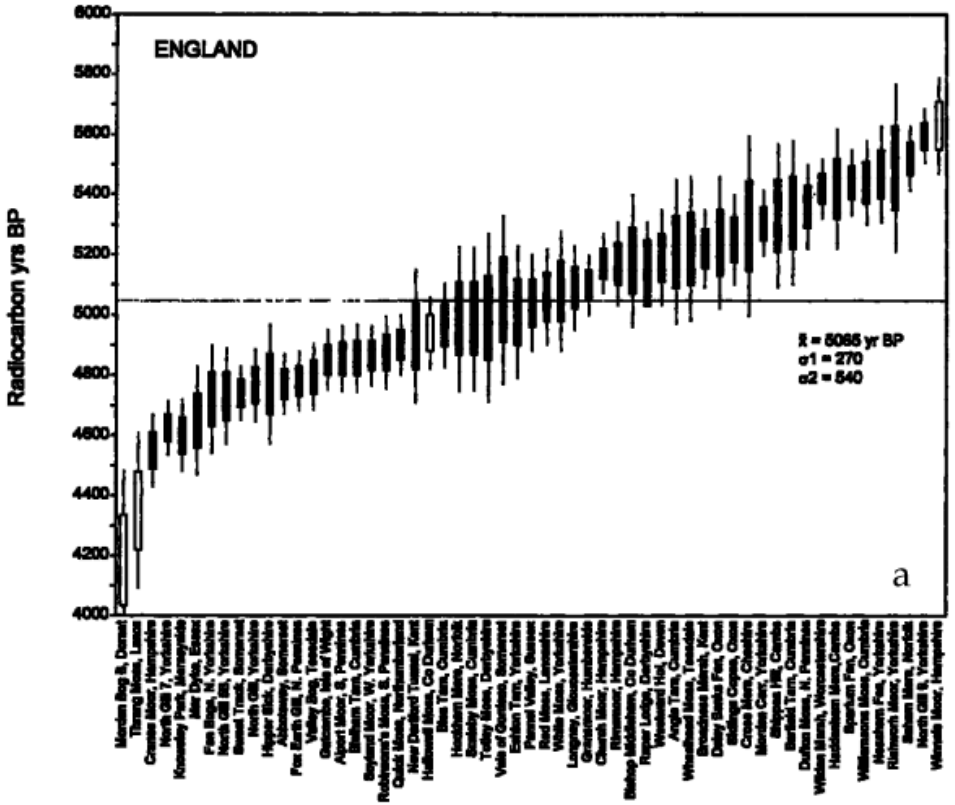


Figure 1 Holocene isochrone map for *Ulmus* in the British Isles (after Birks, 1989)

Parker et al. 2002.



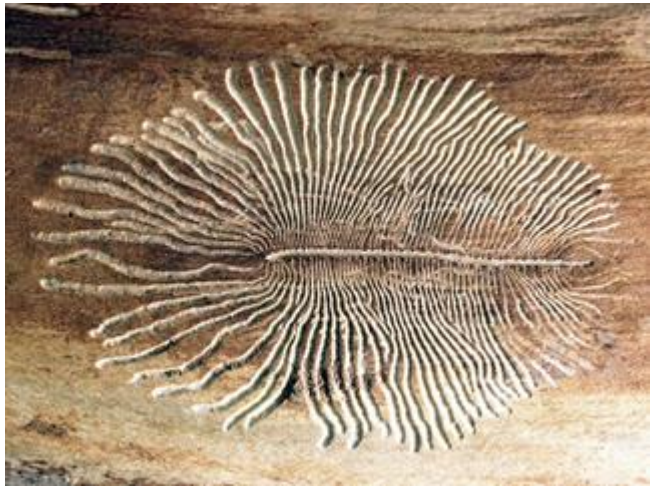
- decline in elm pollen is attributed to arrival of humans and their animals
- could there really be this many people and animals?

Dutch elm disease

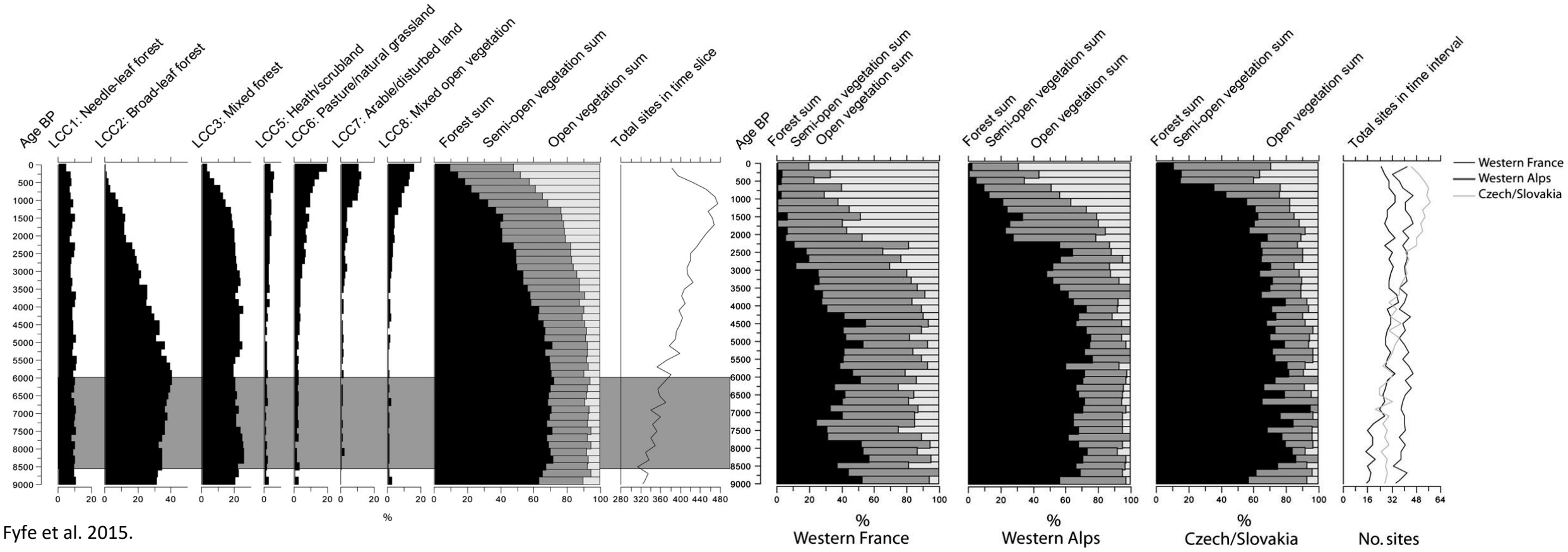
Ophiostoma ulmi

As ever, anthropogenic and human causes are hard to separate

Scolytus scolytus



Local and regional vegetation change



Fyfe et al. 2015.

Prehistoric global change

- wildlands covered only 27.5% of the Earth as early as 10,000 BC
- human population increase and anthrome transformation get decoupled in mid-20th century

Ellis et al. 2021.

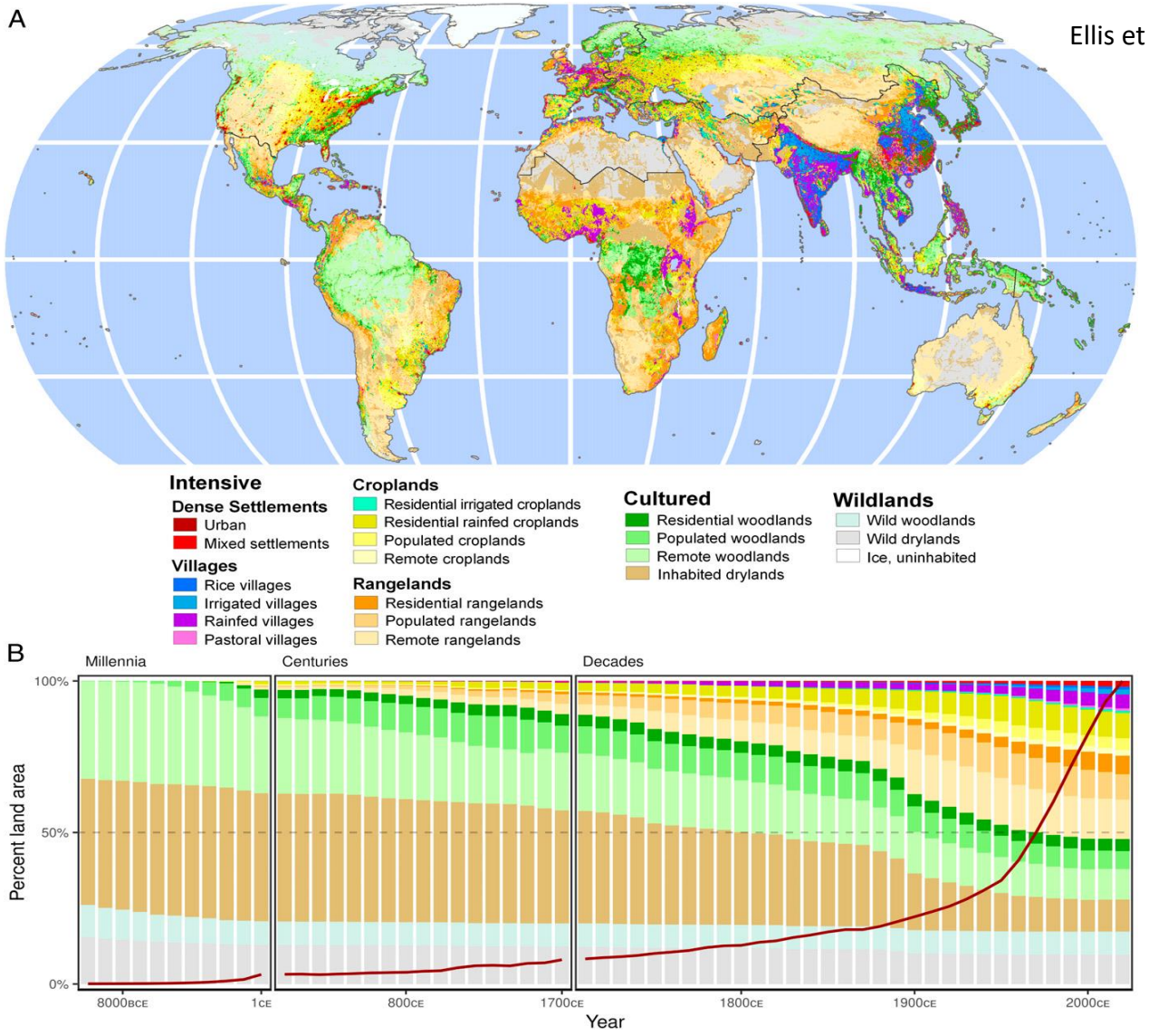


Fig. 1. Global changes in anthromes and populations 10,000 BCE to 2017 CE. (*A*) Anthrome map at 2017 CE (Eckert IV projection). (*B*) Global changes in anthrome areas, with population changes indicated by red line. Anthromes are classified using population densities and dominant intensive land use. Wildlands are defined by zero population and no intensive land use (urban + crops + grazing), Cultured anthromes have low populations and <20% intensive use, and Intensive anthromes are ≥20% intensive. Cultured and Intensive anthromes are further stratified by population densities, in persons km^{-2}, as Remote (>0 to <1), Populated (1 to <10), Residential (10 to <100), Inhabited (>0 to <100), Villages and Mixed settlements (100 to <2,500), and Urban (≥2,500). Intensive anthromes are further stratified based on their dominant intensive land use area ≥20% in order of most intensive use (urban > rice > irrigated > cropped > pastured). Woodlands combine all forest and woodland biomes (73); drylands comprise the remaining biomes, from savanna to tundra, excluding permanent ice. Global uncertainties in *SI Appendix*, Fig. S1.

Prehistoric global change

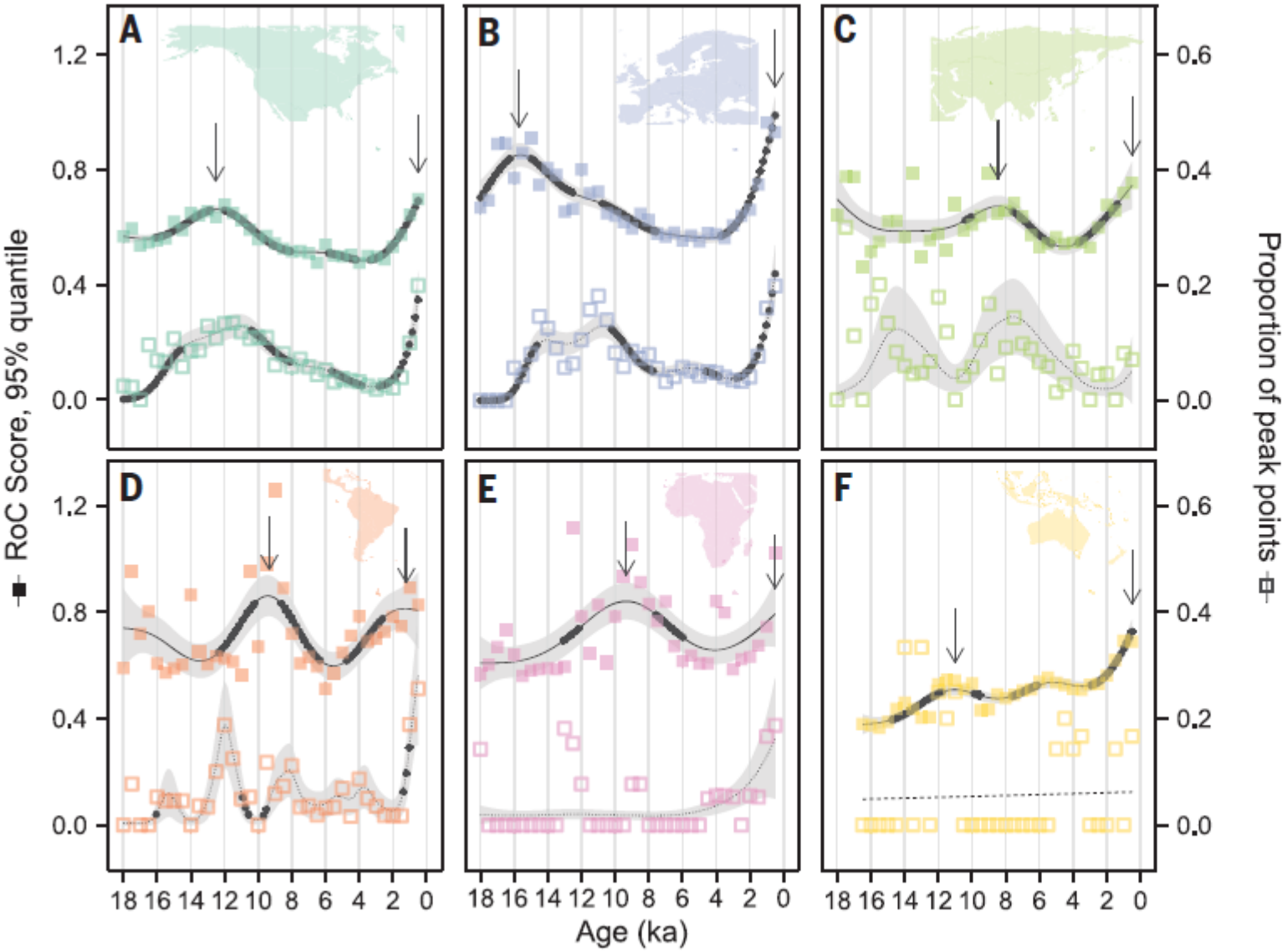


Fig. 2. RoC analyses by continent. (**A** to **F**) The filled squares represent the upper 95% quantile RoC score (left *y* axis) per 500-year time bin, with the solid curve representing the corresponding generalized additive model (GAM) (*22*). High values indicate high rates of vegetation change. Empty squares represent the proportion of peak points within each time bin (right *y* axis), with the corresponding GAM curve indicated by a dotted line. High values indicate a high synchrony in RoC among sequences (*22*). When the relationship is not significant, the GAM line is shown as dashed, and the error envelope is absent. Black asterisks on the GAM curves identify periods of significant acceleration in vegetation RoCs (i.e., where the derivative significantly differs from zero). Arrows indicate maximum RoC values for the Late Holocene and the Pleistocene-Holocene transition (table S1).

Mottl et al. 2021.

RoC = Rates of change – compositional dissimilarity between consecutive time intervals

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Thank you for your attention