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Pollen-based reconstruction reveals the impact of the onset of agriculture on plant functional trait composition

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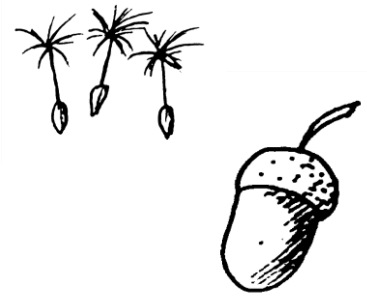
Spread of intensive agriculture in Europe

Year: 10,000 BP

ArchaeoGLOBE, 2019

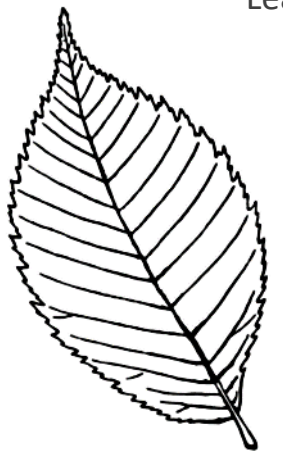
Plant traits are central ecosystem processes

Plant size



Seed size & number

Leaf size,
Area to mass (SLA),
Leaf nutrients

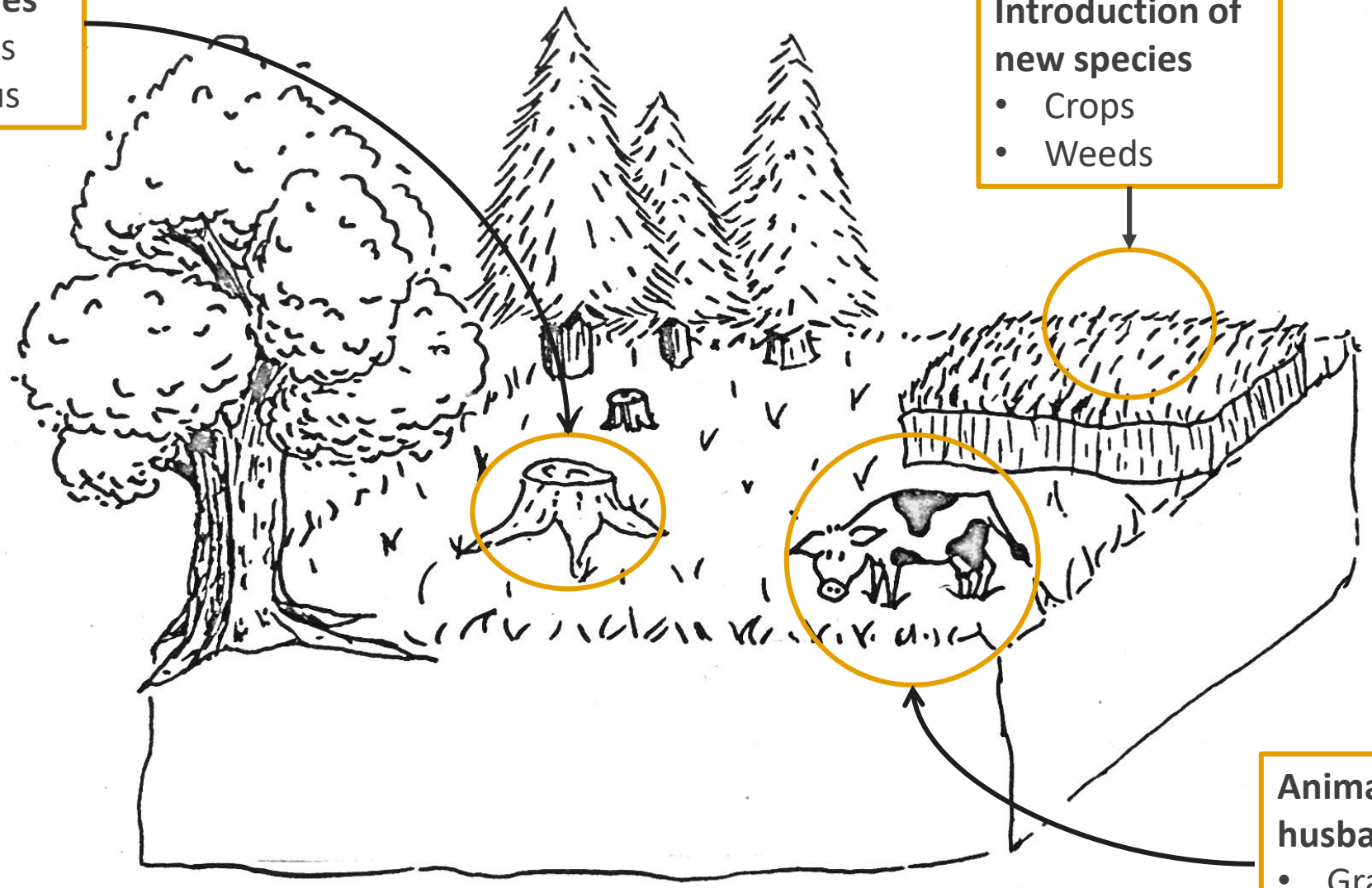


Leaf economic spectrum

What is the effect of agriculture on plant functional composition?

Removal of woody species
- Deciduous
- Coniferous

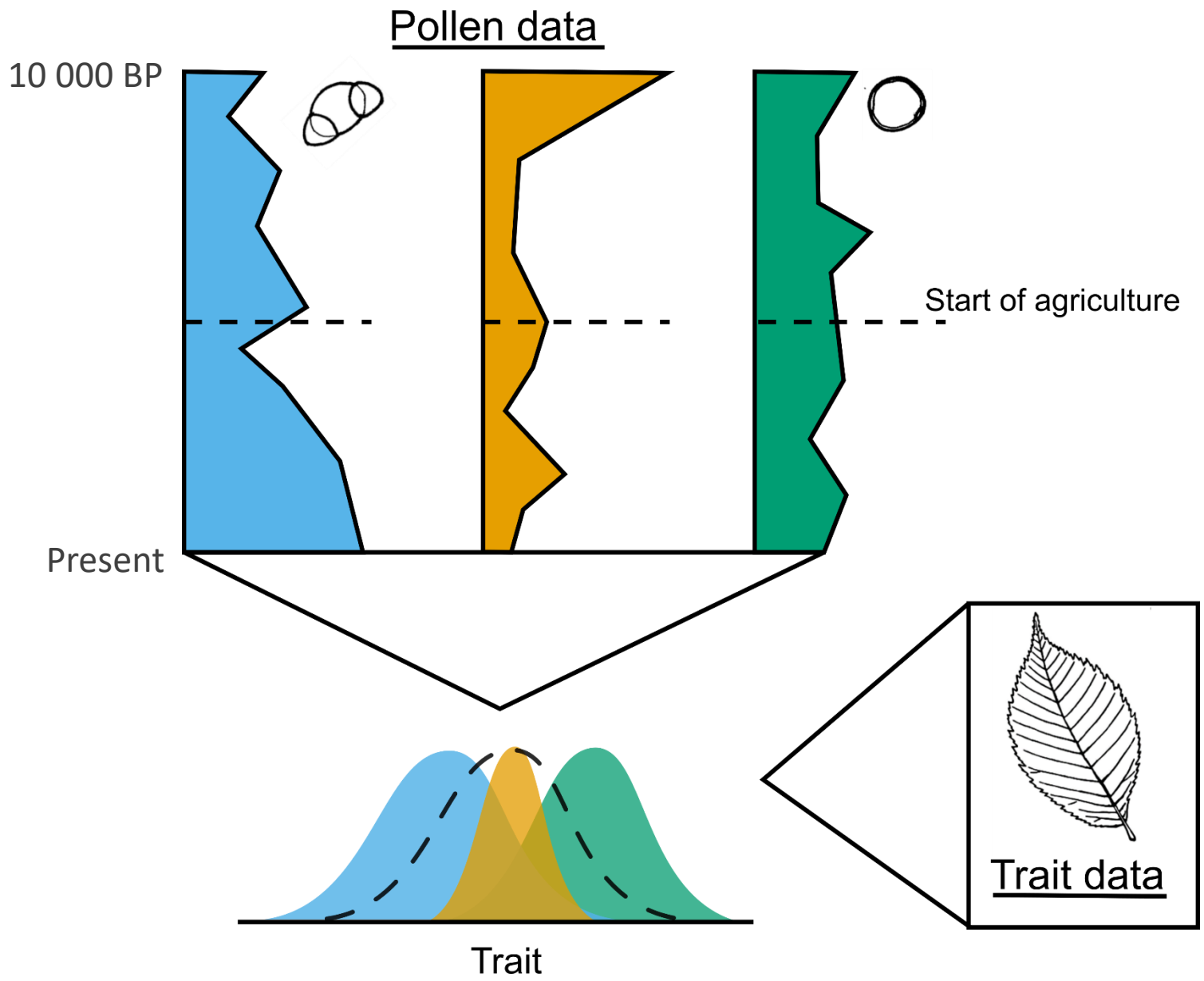
Introduction of new species
- Crops
- Weeds



Succession after land abandonment

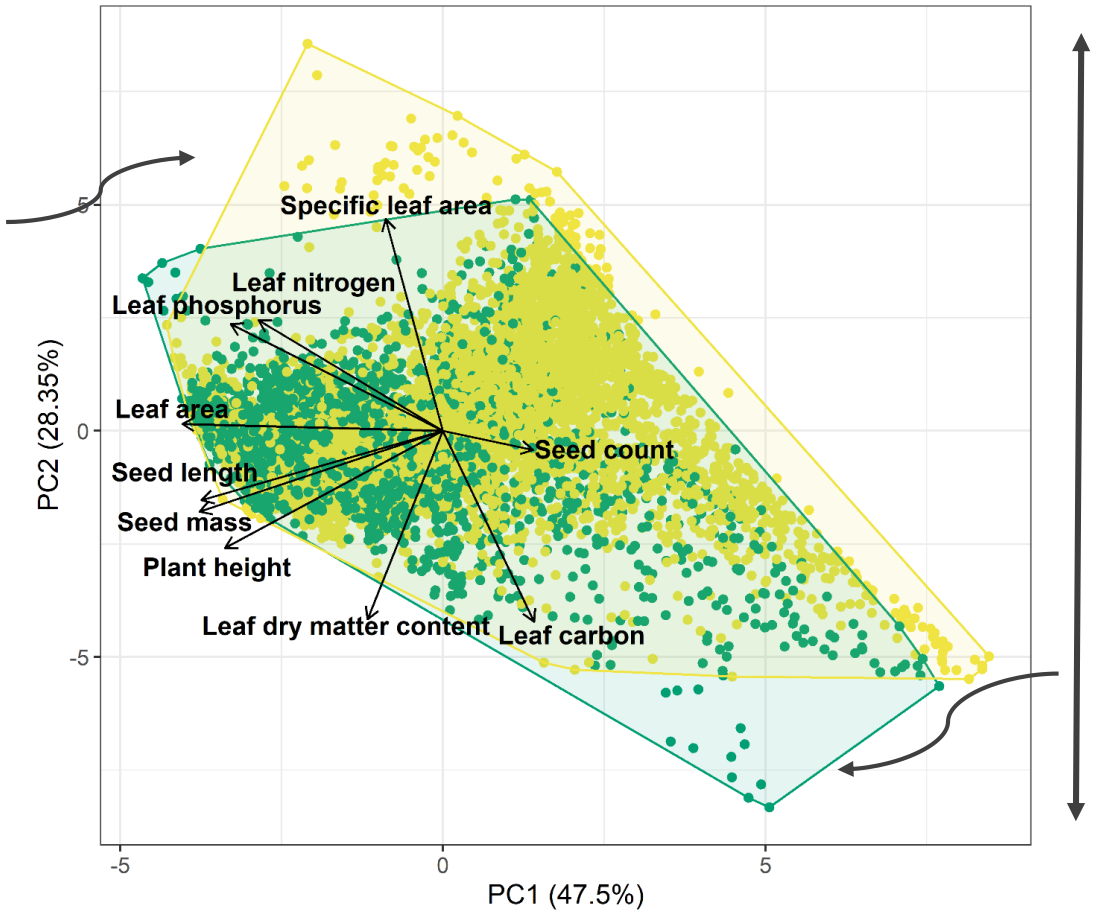
Animal husbandry
- Grazing
- Fertilization

78 sites
10 000 years
10 traits



Shift in functional space after the arrival of agriculture

More communities at the resource-acquisitive side of the leaf economic spectrum



Leaf economic spectrum

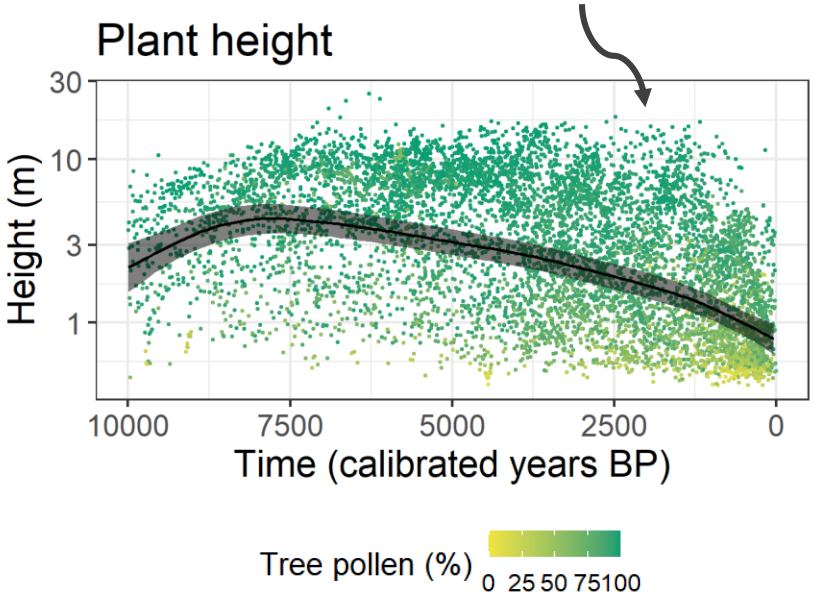
Less communities at the resource-conservative side of the leaf economic spectrum

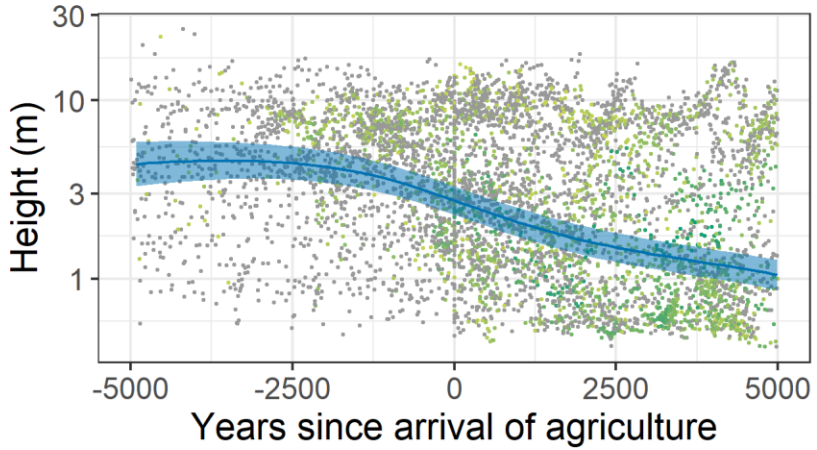
Before agriculture After agriculture

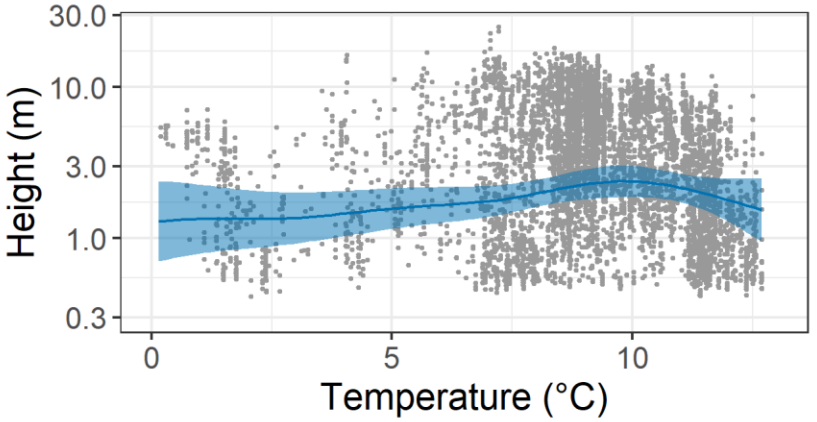
Plant size spectrum

Overall decrease in plant height

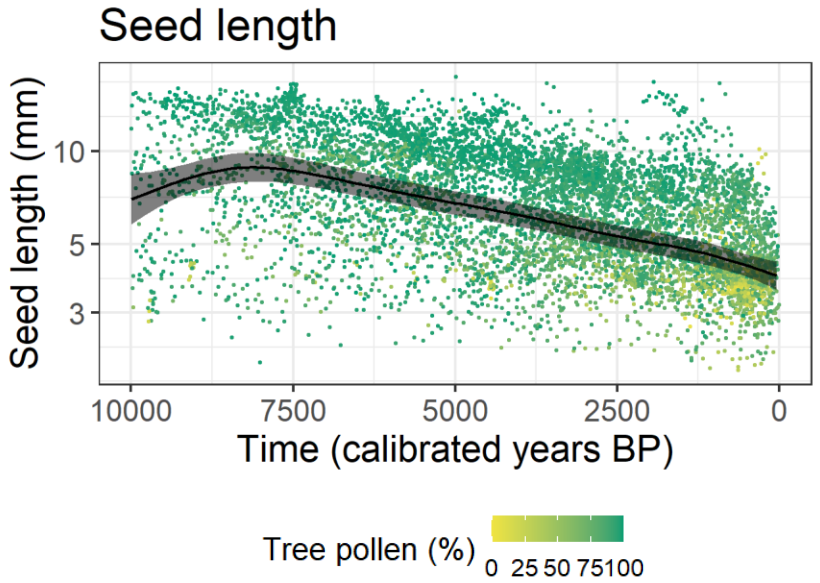
~4 times decrease in plant height

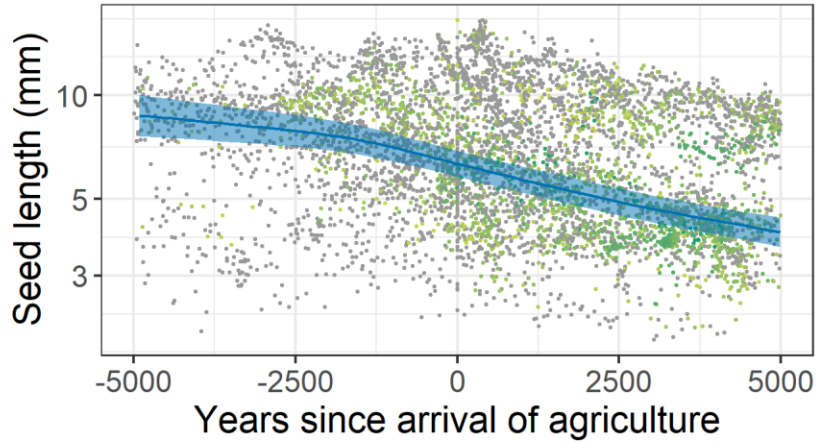


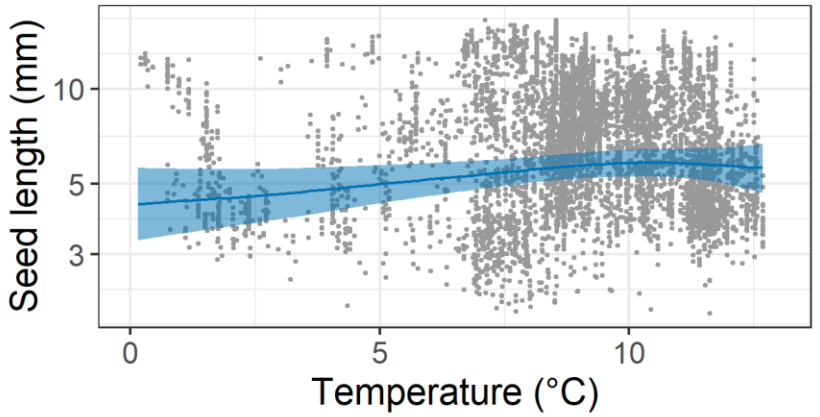




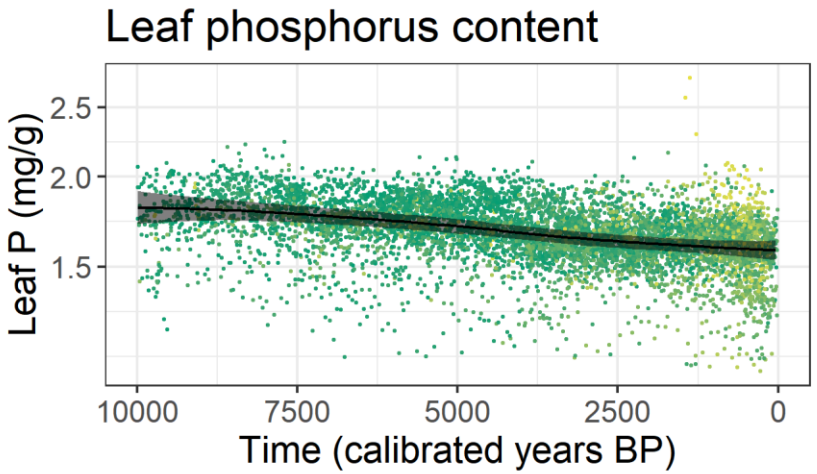
A decrease in seed size

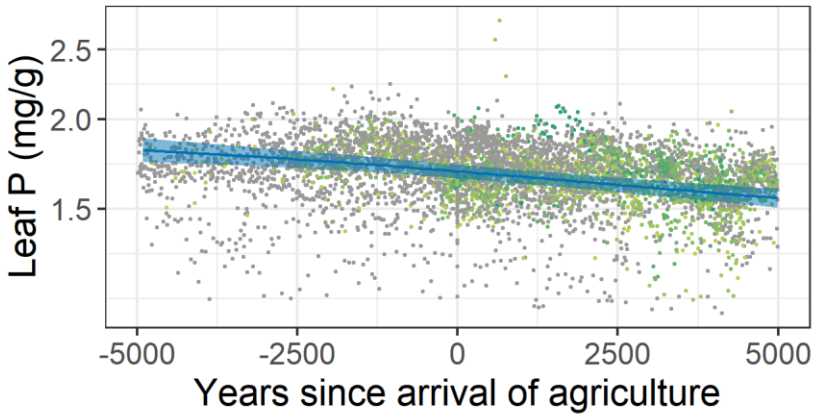


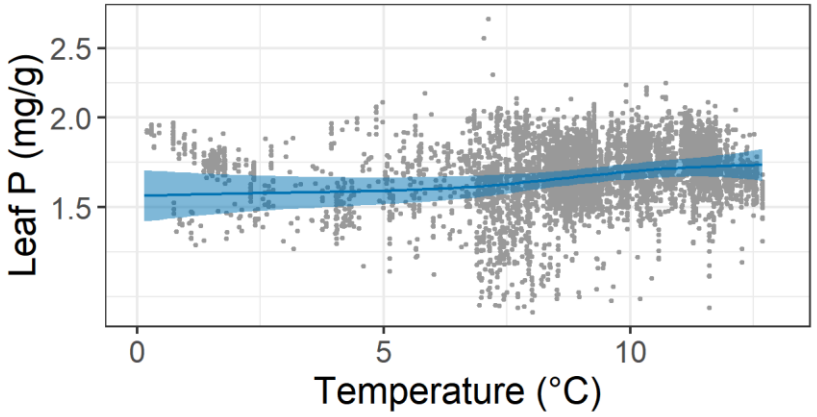




A decrease in leaf phosphorus content







Conclusion

These results indicate that agriculture changes plant functional composition in three ways:

- A shift in functional space toward the **resource-acquisitive** end of the leaf economic spectrum
- An overall **decrease in plant** and associated decreases in **seed size**
- More conservative communities might have appeared due to nutrient depletion through grazing and burning

Next steps:

- Validation with modern data
- Examining the effect of agricultural type, soil differences
- Involving proxies of ecosystem functions

Thanks to the contributors to the following databases:

NEOTOMA PALEOECOLOGY DATABASE

TRY

GBIF

Thank you!

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