

Forgotten but present:

The legacy of historical coppicing in the forest
herbaceous vegetation of central Europe

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Long-term legacy of the past management in vegetation

Why does it matter?

- Understanding the **present patterns** in species distribution, diversity, composition, physical structure...
- Key knowledge for management of ecological functions:
conservation and restoration



Coppicing

Short-rotation forest management system utilizing natural resprouting ability of tree species (mostly deciduous)



Coppicing in European forests

- coppicing was extremely important in the past
- highly effective systems run for centuries
- abandoned in 19-20th centuries in many countries (UK, Germany, Czechoslovakia)
- coppicing abandonment had also negative effects
- current efforts for coppicing restoration (IUFRO, EU, national level)



Coppicing and its effects on vegetation

- shifting mosaic of **light** and dark environments
 - maintaining spatio-temporal heterogeneity of species assemblages
 - maintaining spatio-temporal heterogeneity of soil seed bank
 - **nutrient** uptake (in woody biomass) and dynamics:
 - moderating competition asymmetry
 - shifting mosaic of nitrogen poor--nitrogen rich patches
- » creation of **specific habitats**
- » maintaining **high vegetation biodiversity**



Coppicing, 19th century

Legend

▧ No data

Unknown proportion

0% - 25%

26% - 50%

51% - 75%

76% - 100%

■ No forest

Coppice proportion

0%

1% - 10%

11% - 20%

21% - 30%

31% - 40%

41% - 50%

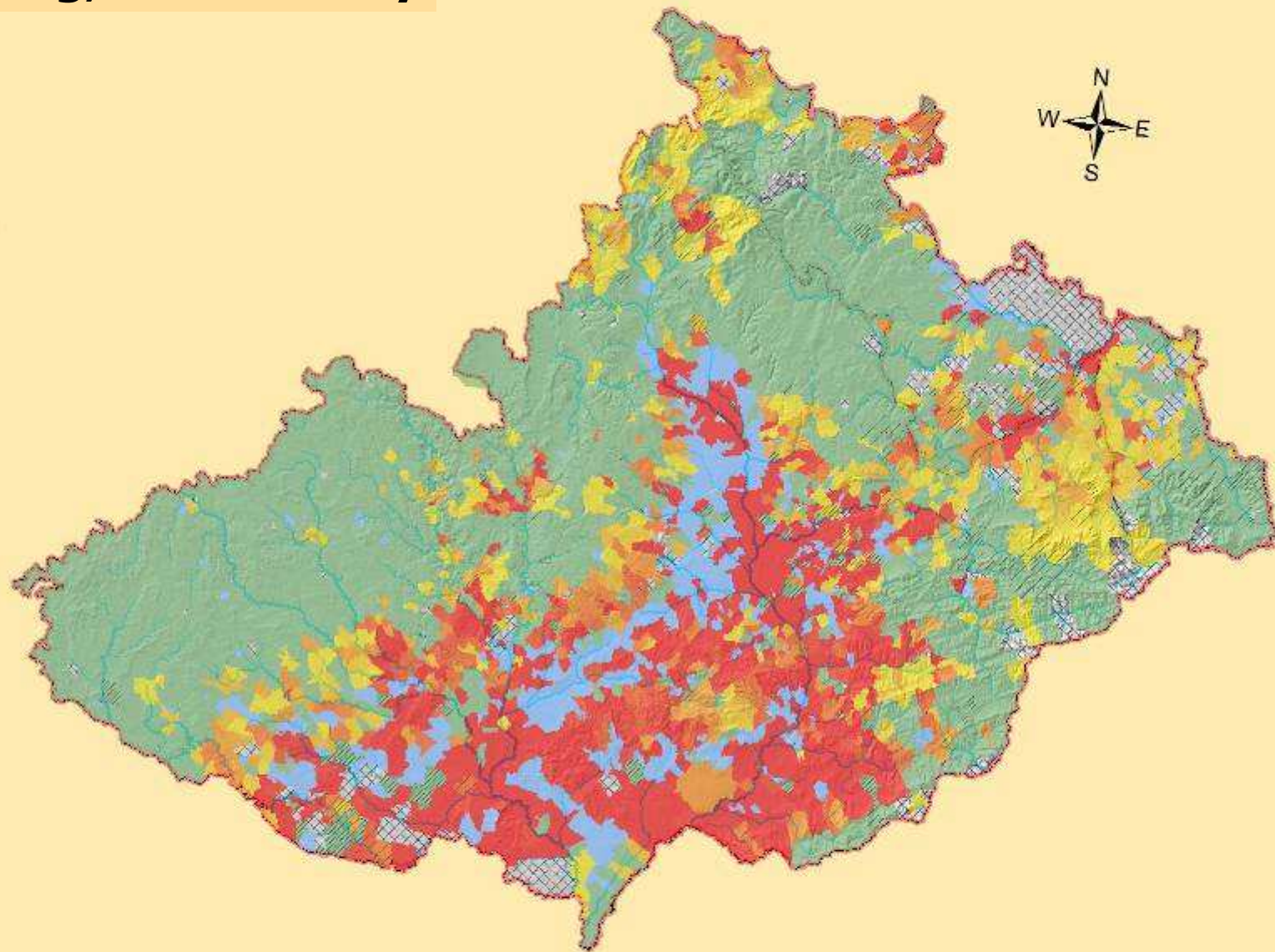
51% - 60%

61% - 70%

71% - 80%

81% - 90%

91% - 100%



Questions

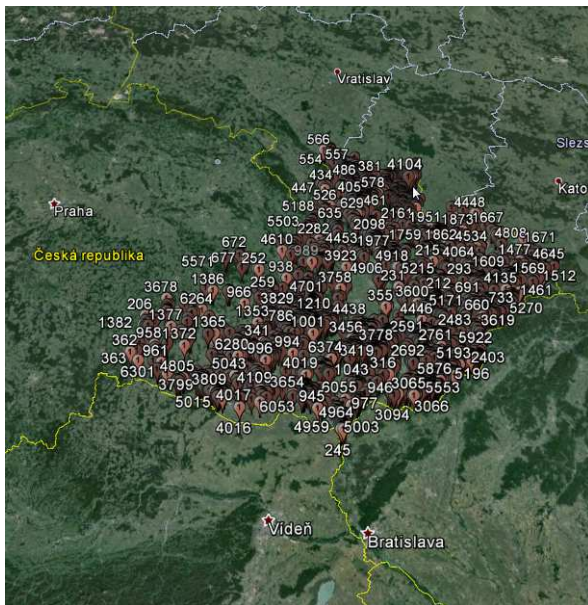
1. Linkage of coppicing to environmental factors
2. Legacy of coppicing in species richness
3. Legacy of coppicing in species composition



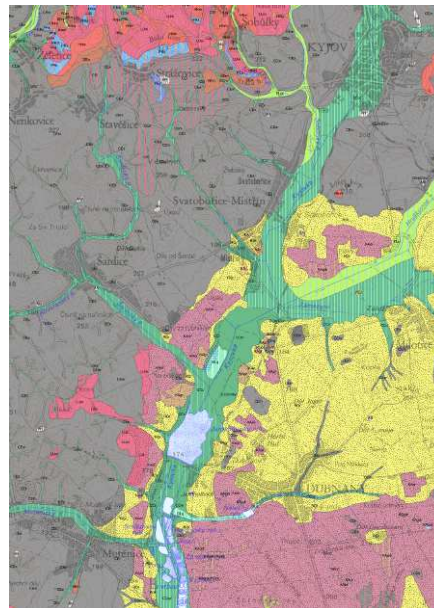
Data sources

- vegetation composition from plot data (Czech National Phytosociological Database)
- abiotic factors from GIS layers (climate, topography, soils)
- coppicing via database of historical records (database of historical forest use)

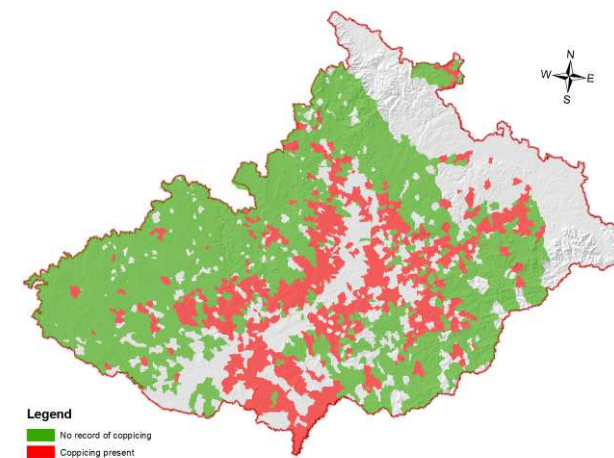
forest vegetation plots



environmental data



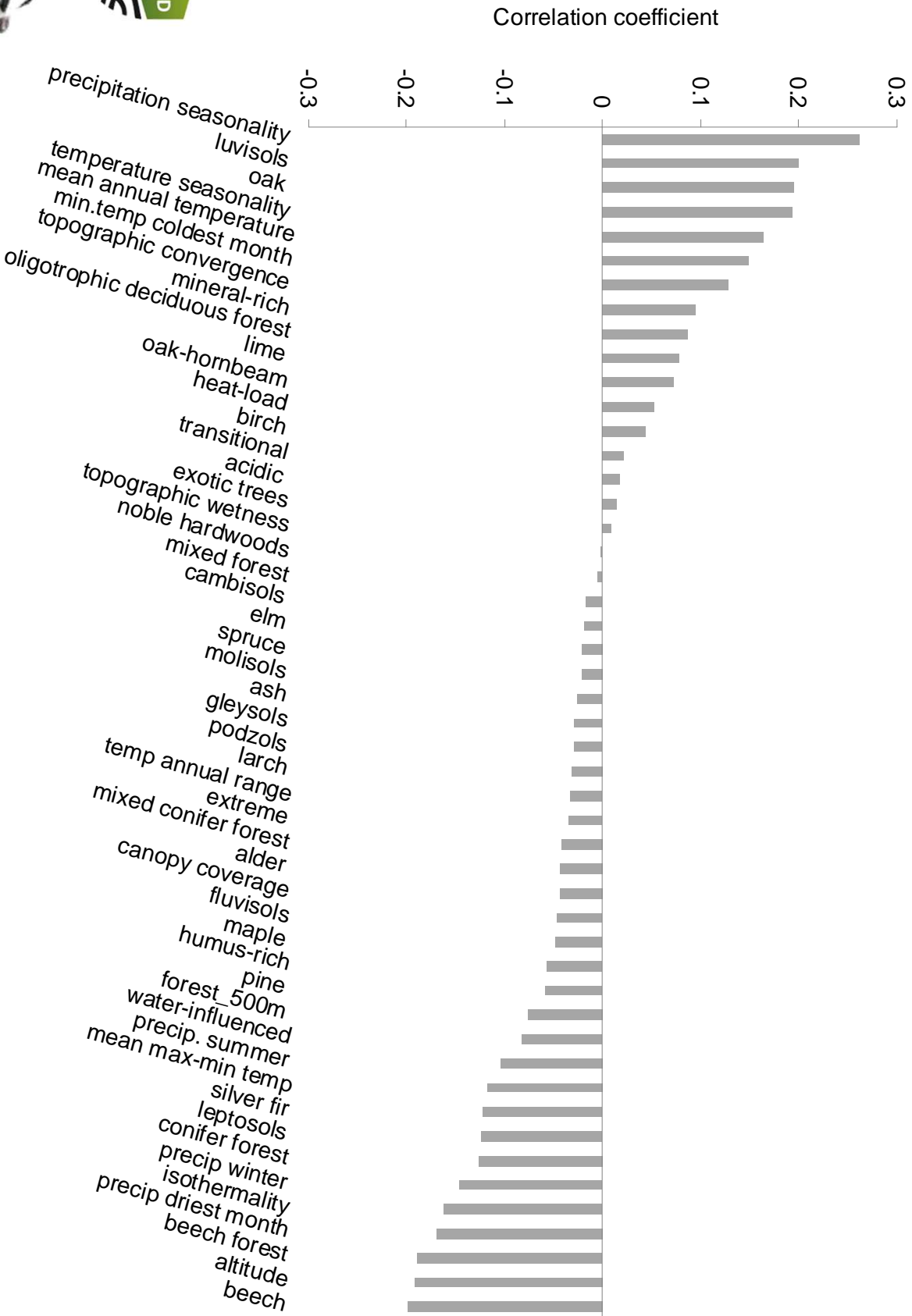
coppicing in 3,500 cadastres



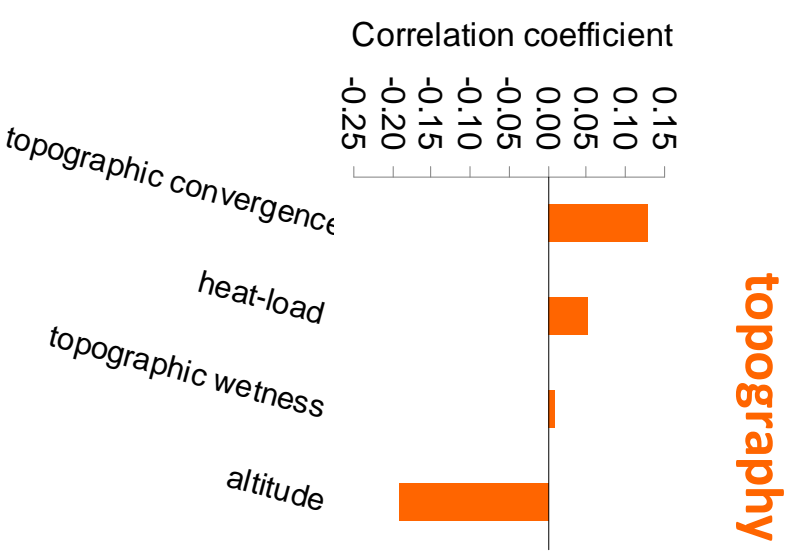
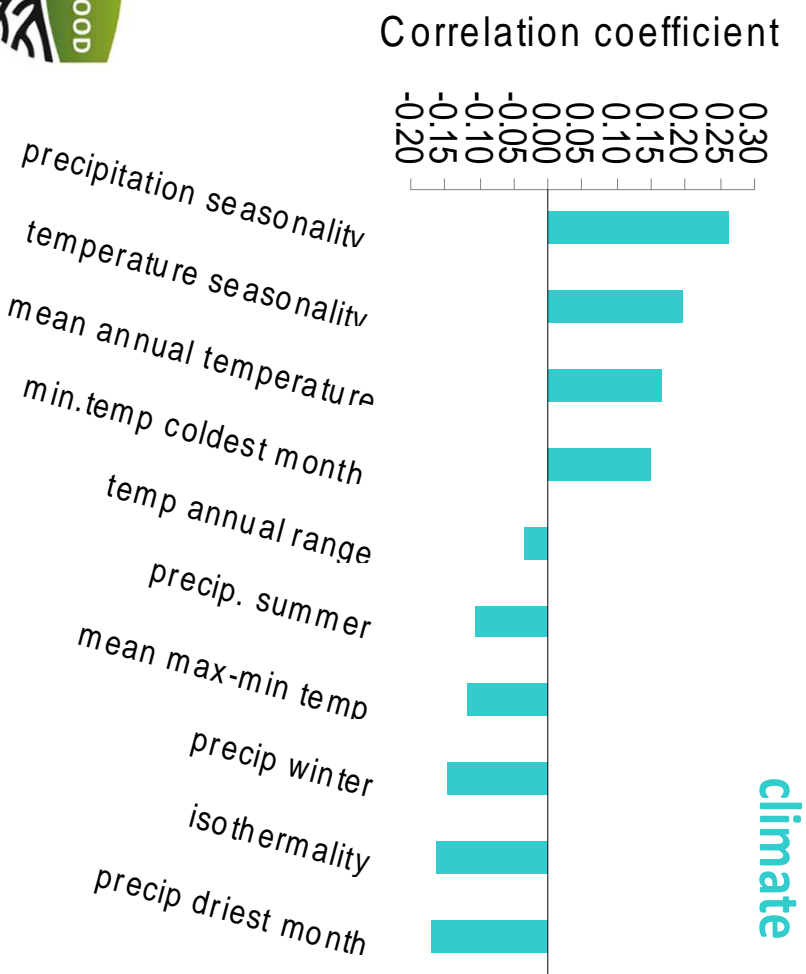
- 28,000 km², historical Moravia
- 4600 forest vegetation plots sampled in 1980-2015
- size 100-500 m²
- 50 environmental variables and covariables, plot-wise data



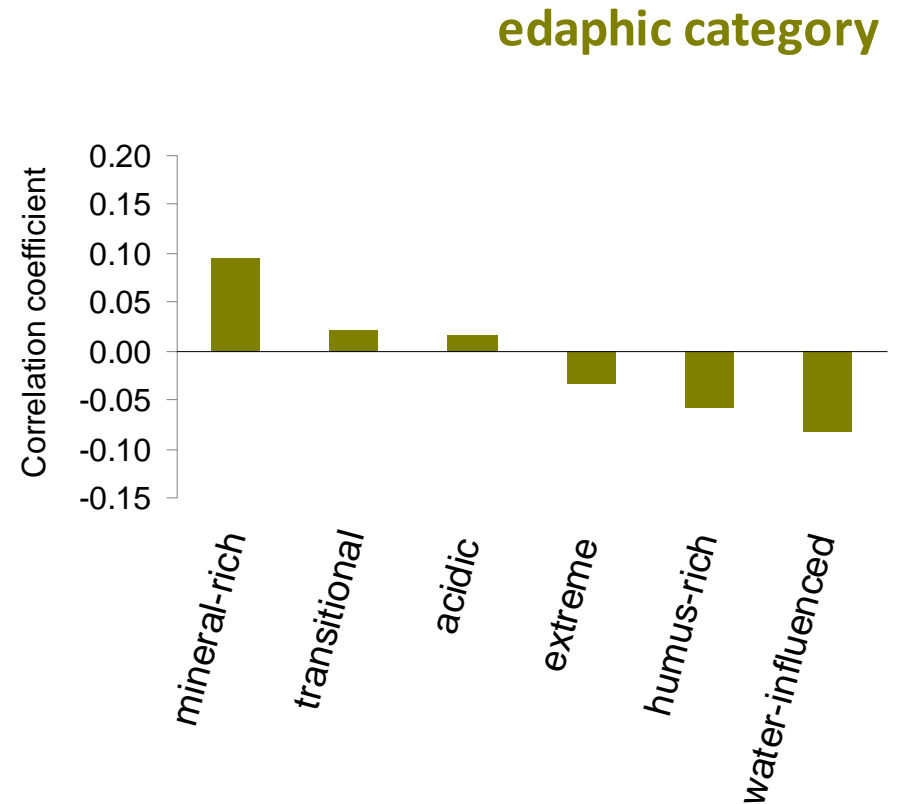
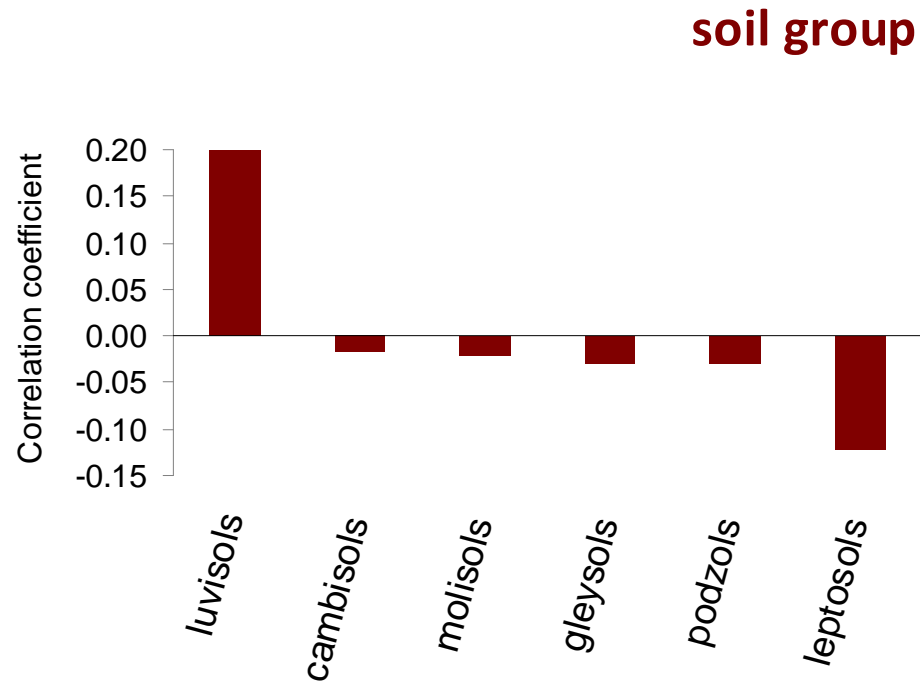
Correlation of environmental factors with coppicing (plot level)



Correlation of environmental factors with coppicing (plot level)

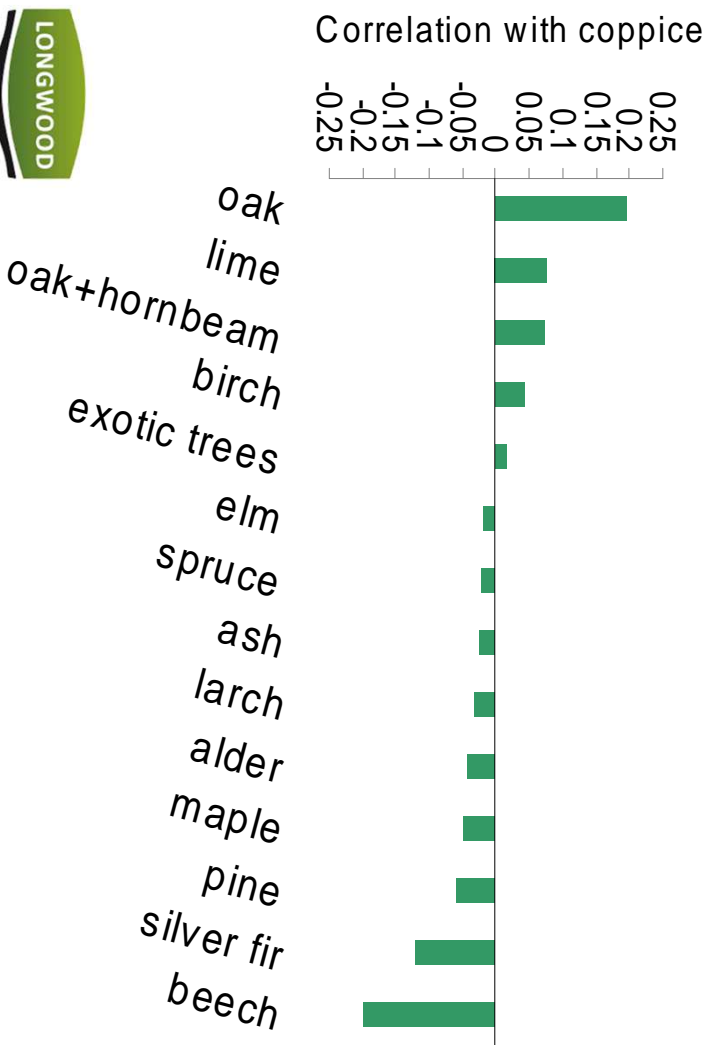


Correlation of environmental factors with coppicing (plot level)

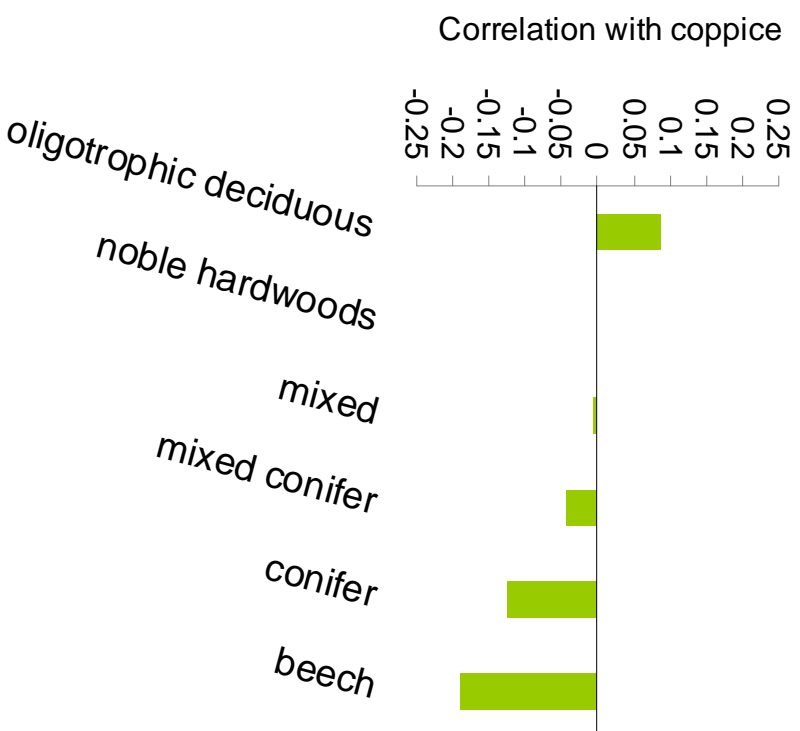


Correlation of environmental factors with coppicing (plot level)

tree dominants



forest type



Correlation of environmental factors with coppicing (plot level)

Climate:

warmer, drier (winter)
more seasonal

Topography:

lower altitudes (180-600 m)
convex shapes

Soil:

+luvisols
-leptosols
+mineral rich
-water influenced

Trees:

+oak, lime, hornbeam
-beech, silver fir
-conifers

Other factors

-forest patch size
+canopy coverage



Species richness

Two GLS models

1. environmental factors
2. environmental factors + coppicing

Model 2 significantly better (at $p=0.0012$)

Factors:

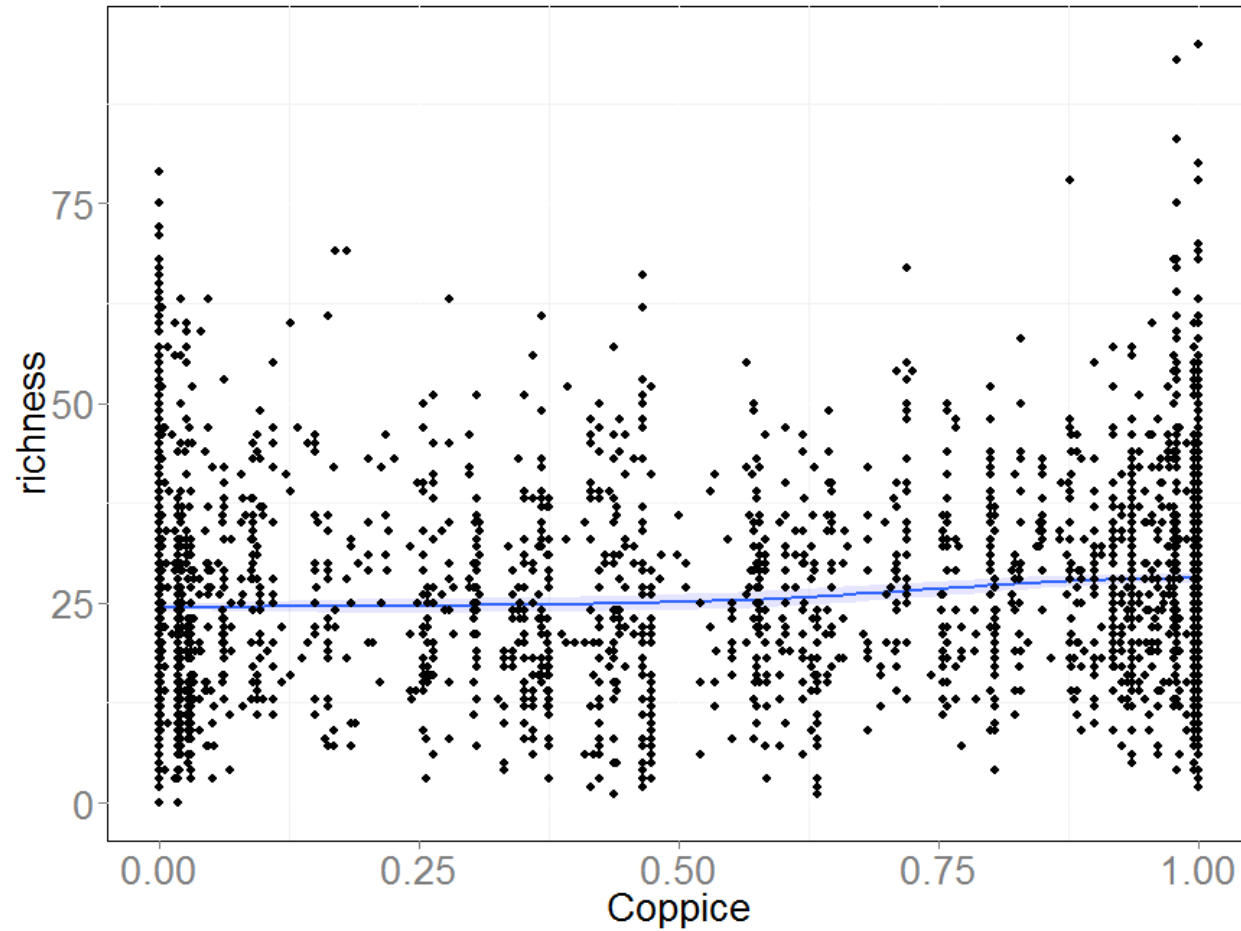
18 selected factors

6 covariates (plot area, year of sampling, location, authorship)

Coppicing only the 15th best explaining, significant at $p < 0.05$



Species richness

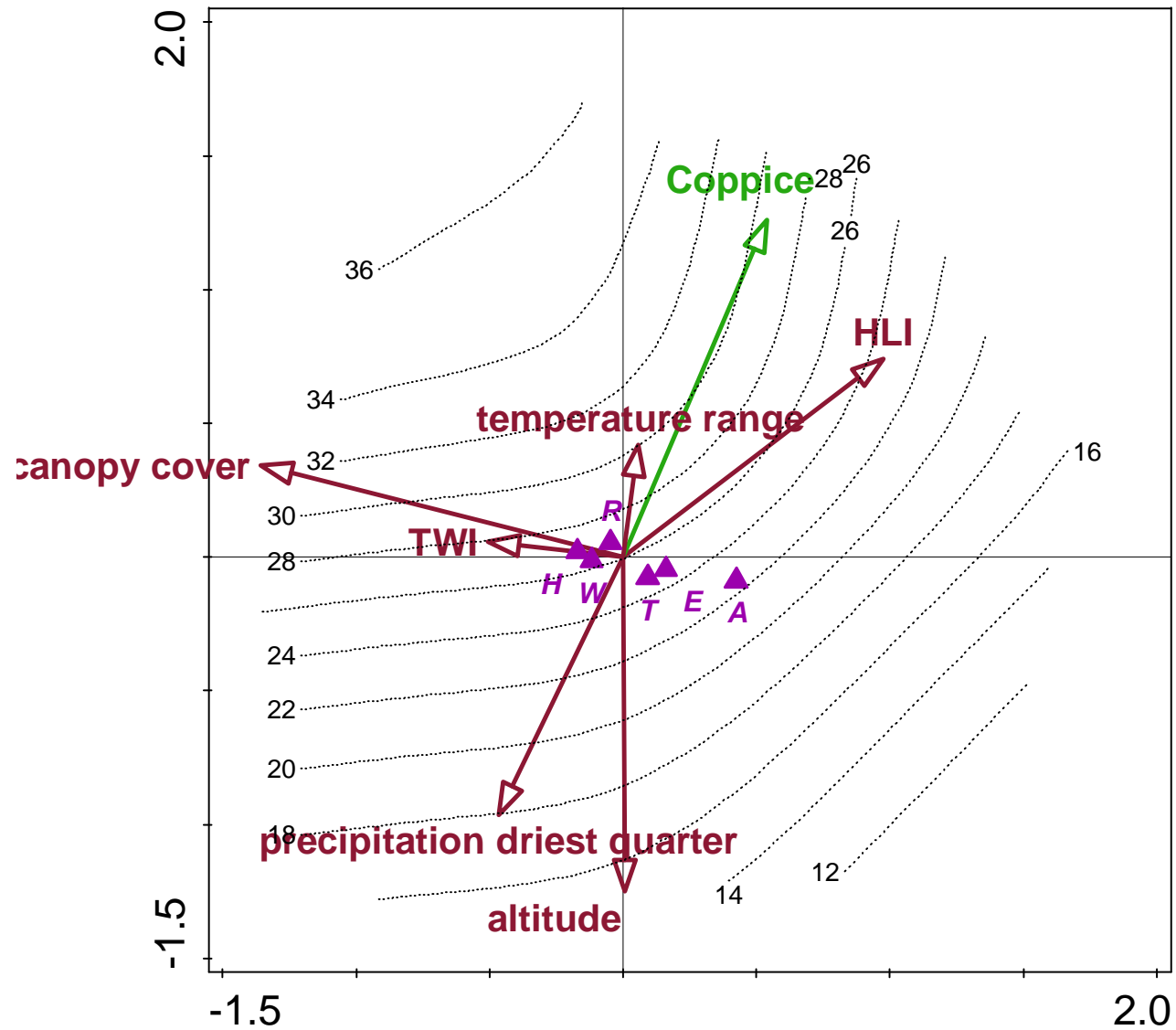


Coppice (polynomial): $p = 0.0031$

covariate: relative distance between pairs of plots

Compositional patterns

PCoA



Conclusions

Coppicing in the 19th century left legacy in current vegetation

- higher species richness
- strong association with
 - vegetation types (through trees in canopy)
 - soil types (may or may not be causality)
- many environmental factors associated with coppicing
- coppicing is not a factor *per se*: need for interpretation



Thank you

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