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Available wood in small forest patches and its links with plant diversity and ecosystem services

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IUFRO-Landscape ecology

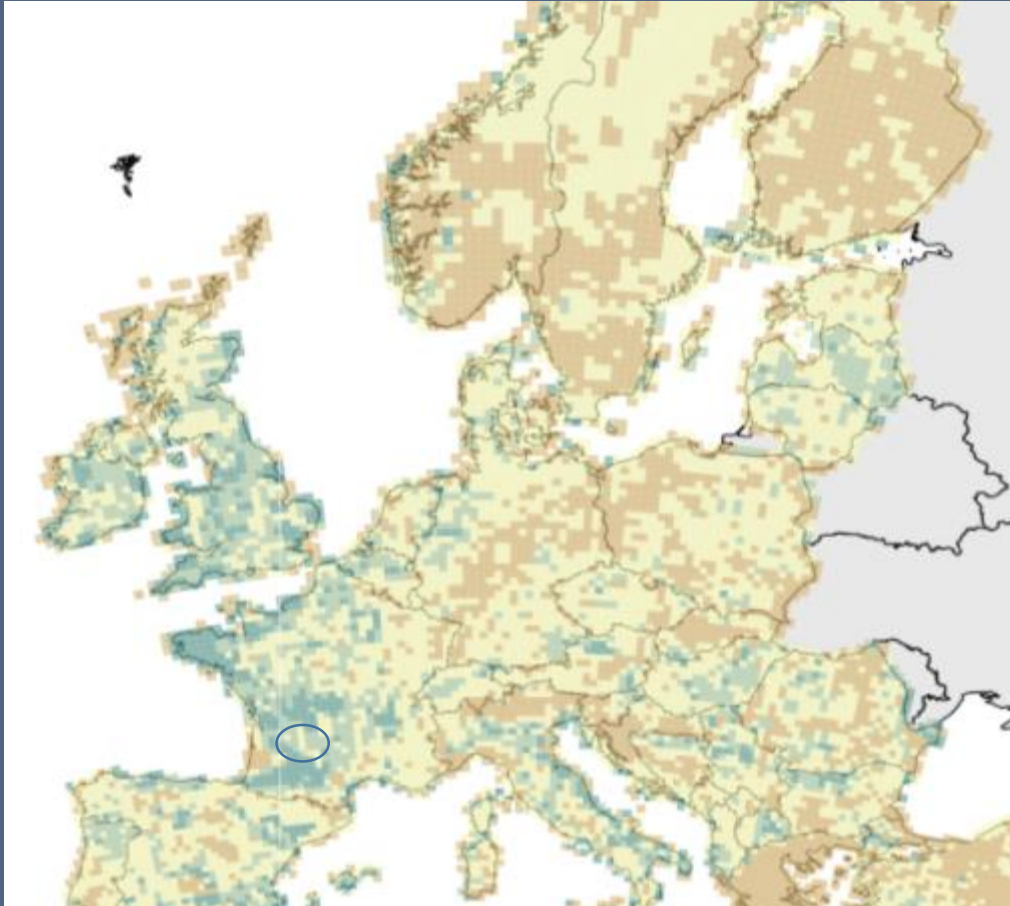
Halle – 25-28/09/2017



DYNAFOR

UMR 1201 | INRA - INP TOULOUSE

Small forest patches: a lack of knowledge despite their importance in European rural landscapes



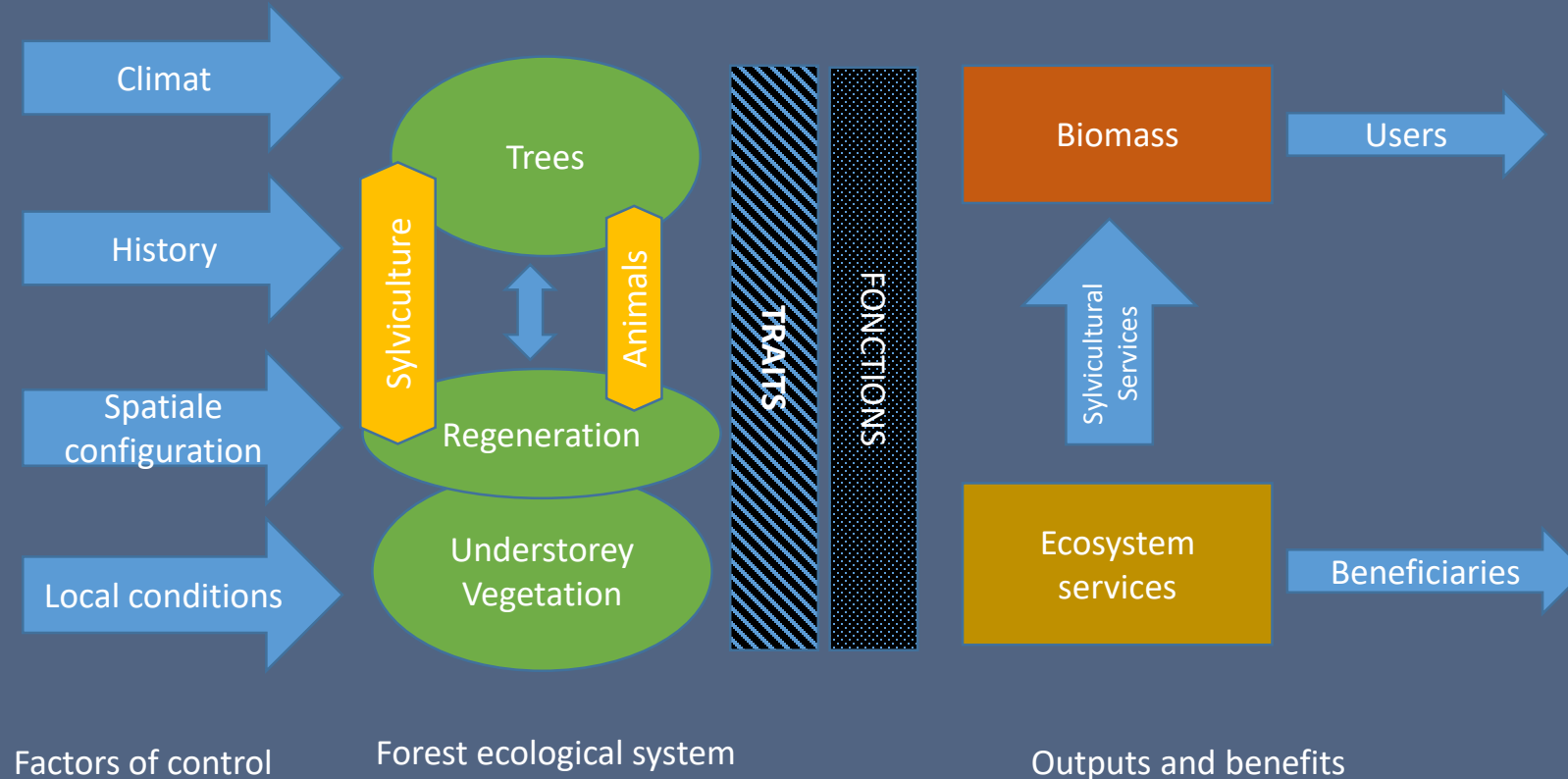
Proportion of « islets » (Guidos) in 25km squares
(High - Low)

A potential source of wood



A critical role for many ecosystem services

Decocq, G., Andrieu, E., Brunet, J., Chabrierie, O., De Frenne, P., De Smedt, P., Deconchat, M., Diekmann, M., Ehrmann, S., Giffard, B., Mifsud, E.G., Hansen, K., Hermy, M., Kolb, A., Lenoir, J., Liira, J., Moldan, F., Prokofieva, I., Rosenqvist, L., Varela, E., Valdés, A., Verheyen, K., Wulf, M., **2016. Ecosystem Services from Small Forest Patches in Agricultural Landscapes. Current Forestry Reports 2, 30-44.**



What are the links between wood and ecosystem services related to plant diversity/abundance?

Hypotheses

1. Small forests are poor forests: low amount of wood and low diversity
2. Forests with higher wood amounts have lower plant cover and diversity
3. The variability of wood and/or plant abundance are linked to landscape characteristics

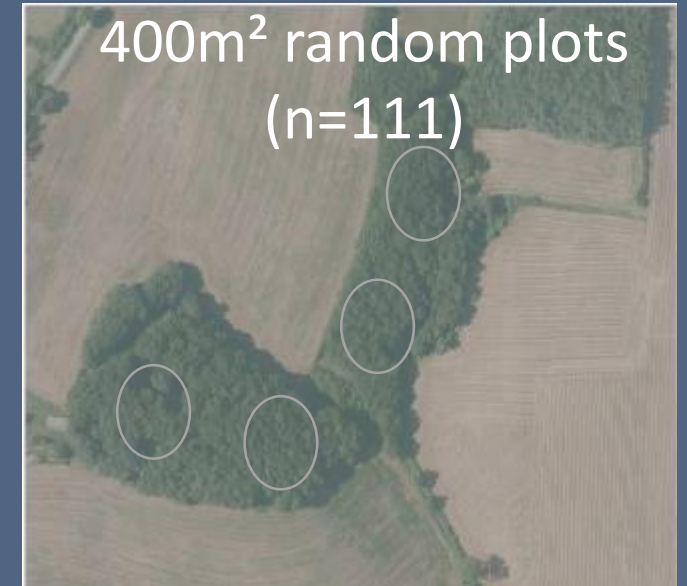
Aim

Identify factors to improve wood products and ecosystem services from small forests

Part of a larger project studying a range of ecosystem services in crops and forests in rural landscapes and how to map them thanks to remote sensing data.

Methods

Current and ancient forest cover



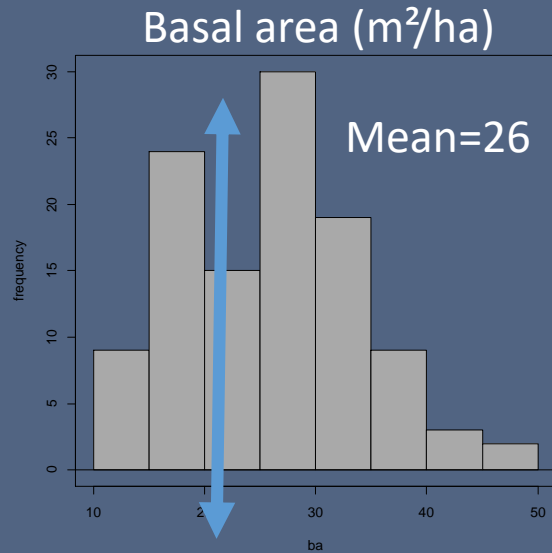
Wood/trees



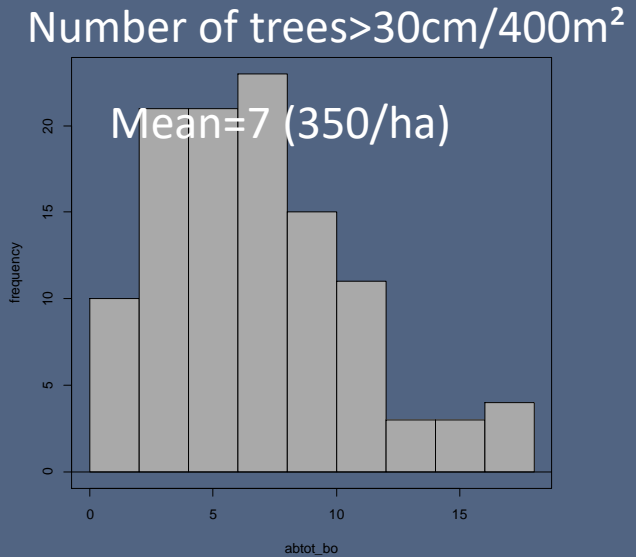
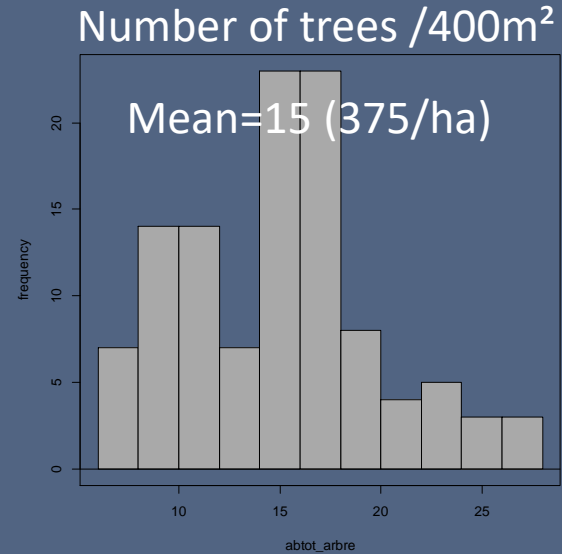
Understorey plant species cover

Oak dominated forests:
85% of big trees

Available wood



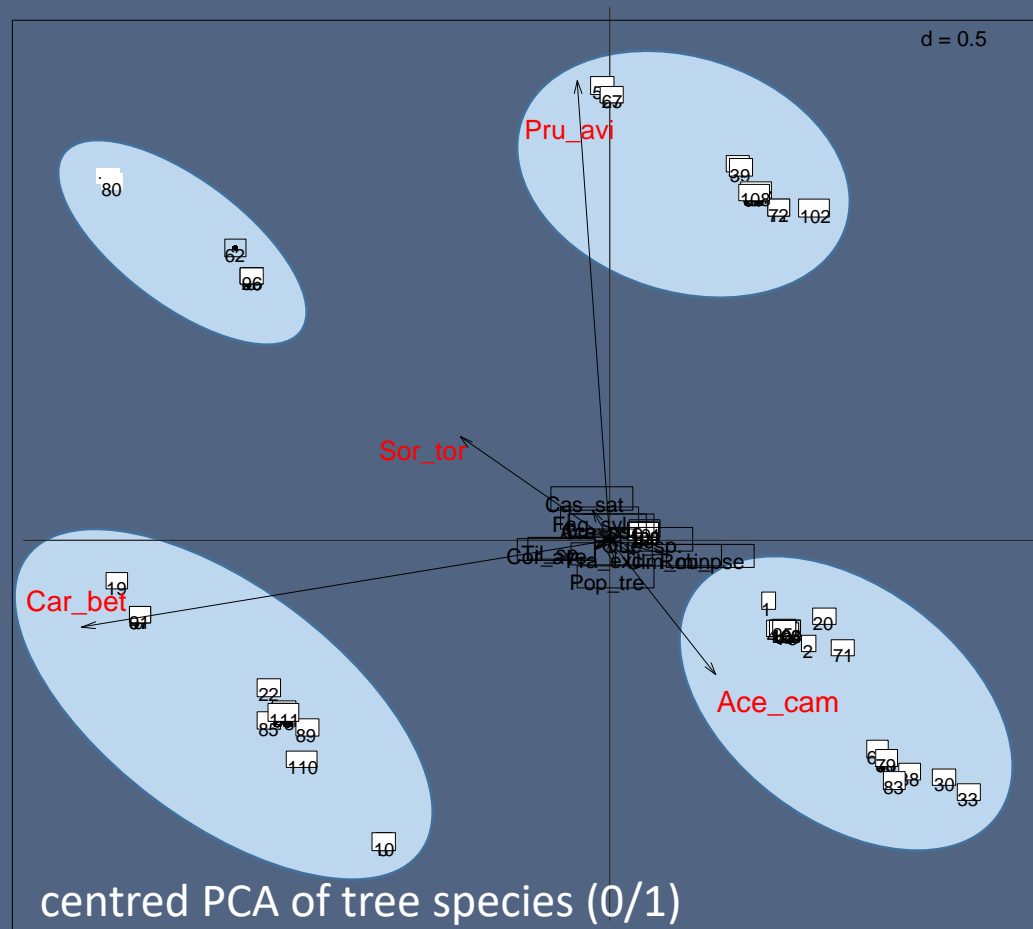
Mean national value



Biomass (estimation) ==> $\approx 200-300 \text{ m}^3/\text{ha}$ ==> $\approx 1000-1500 \text{ m}^3/\text{forest patch}$
But much higher values are possible!

Tree species distribution

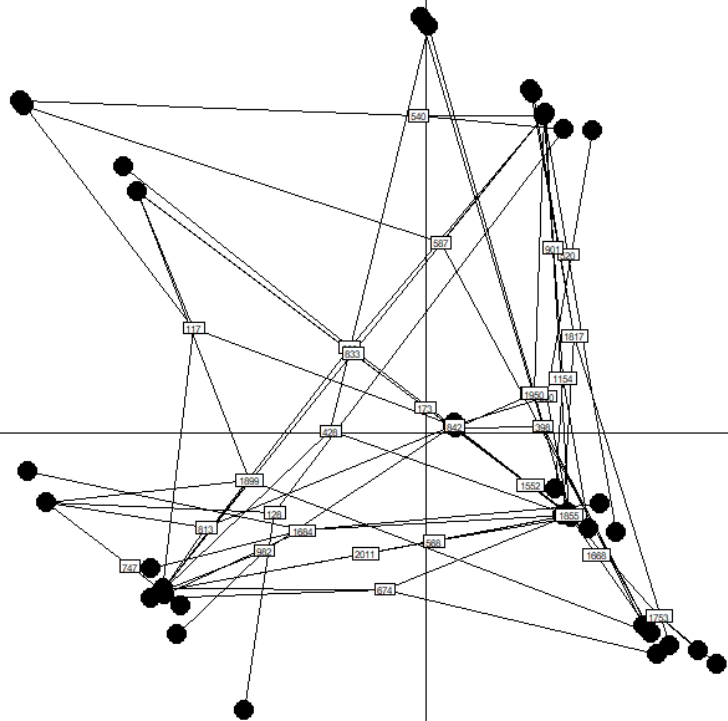
- 14 tree species in total, 2.3 species/plot (min=1; max=7)
- Hornbeam, Cherry tree, (*Acer campestre* and *Sorbus torminalis*) define groups of plots



Heterogeneity of tree composition in small forests

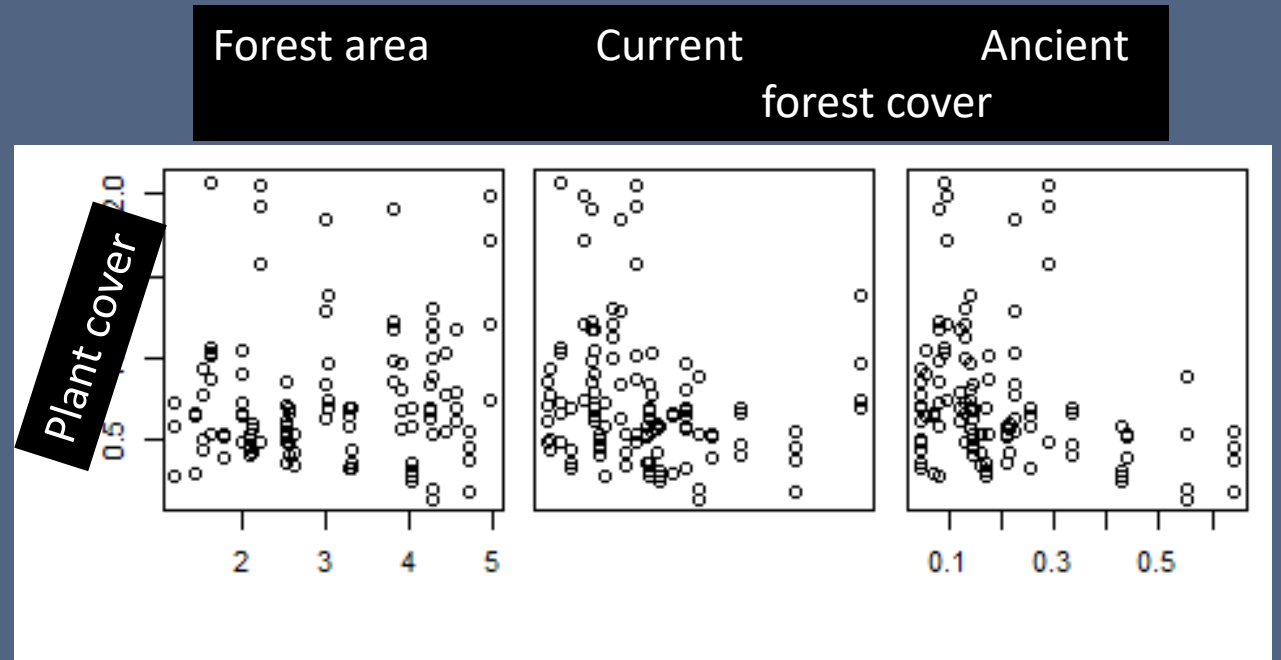
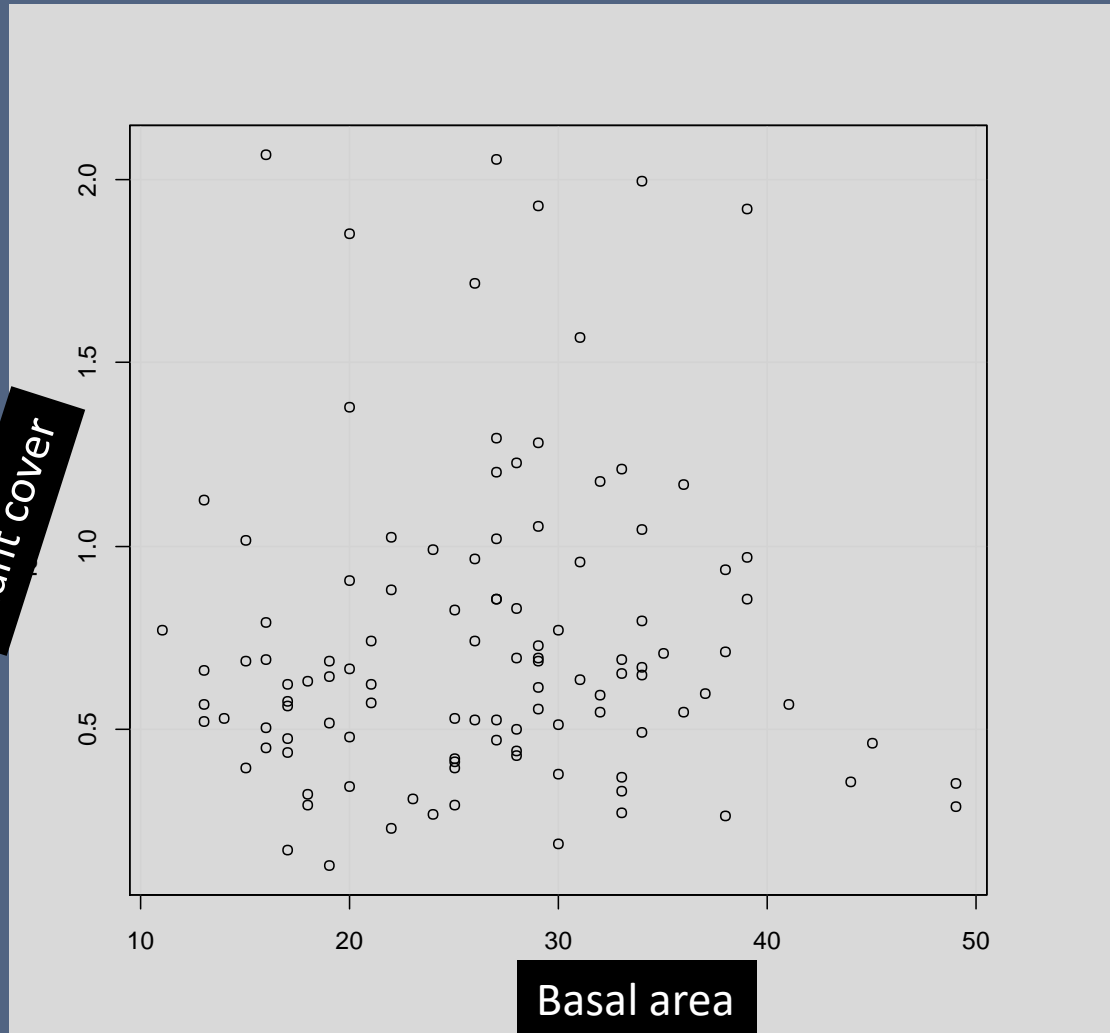
Small forests (<5ha) contain plots with very different tree compositions (but dominated by oaks)

Plots linked to their forests



	Basal area	Tree number	Big tree number	Tree richness	Oak abundance.
Forest area	-0,09	-0,07	-0,12	0,14	-0,22
Current forest cover	-0,21	-0,18	-0,15	0,05	-0,22
Ancient forest cover	-0,17	-0,18	-0,28	-0,07	-0,16

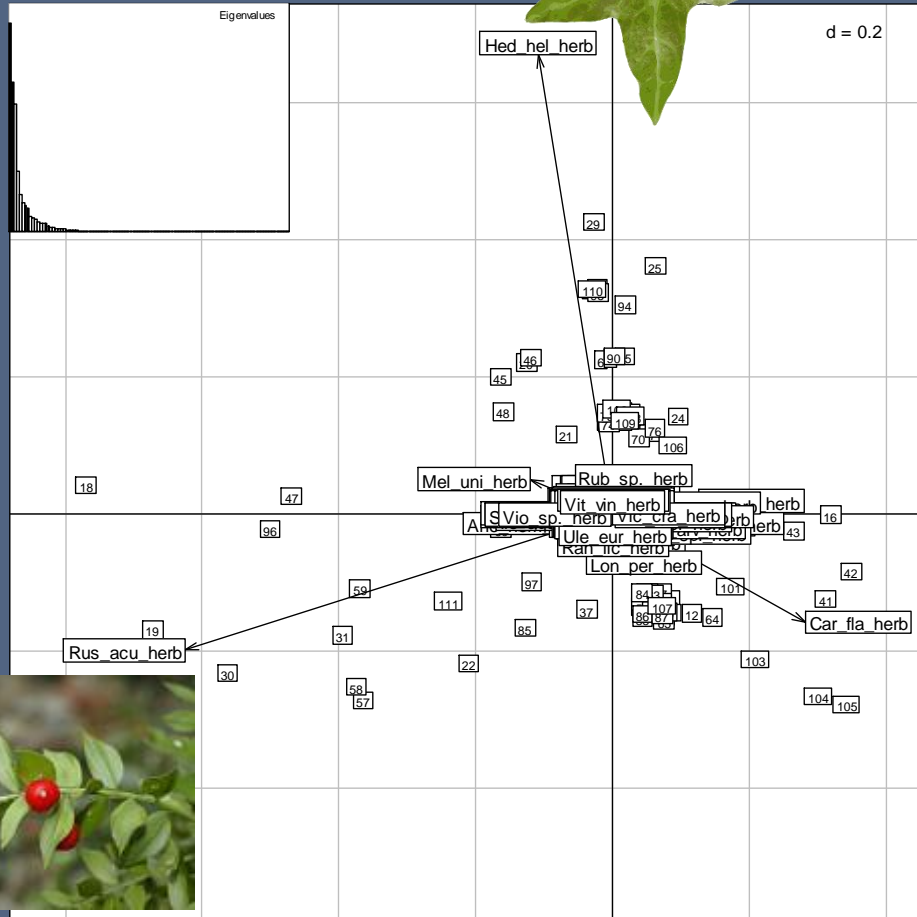
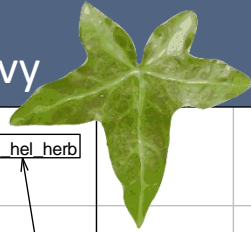
Large and unexplained variability of vegetation cover (herbaceous layer)



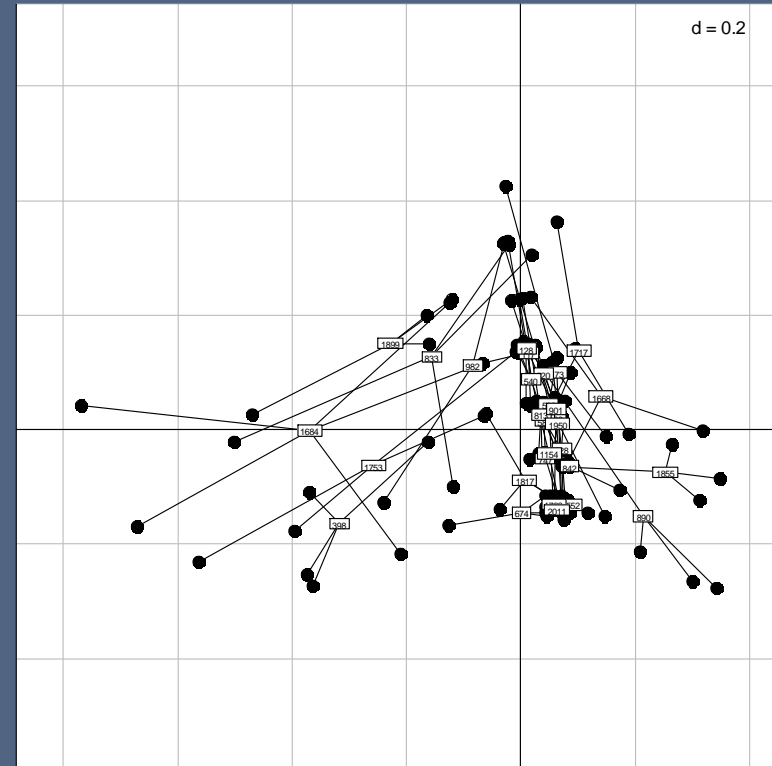
Correlation with first axis of tree composition=-0.1

Plant species composition: dominated by 2 species, very high variability in forests

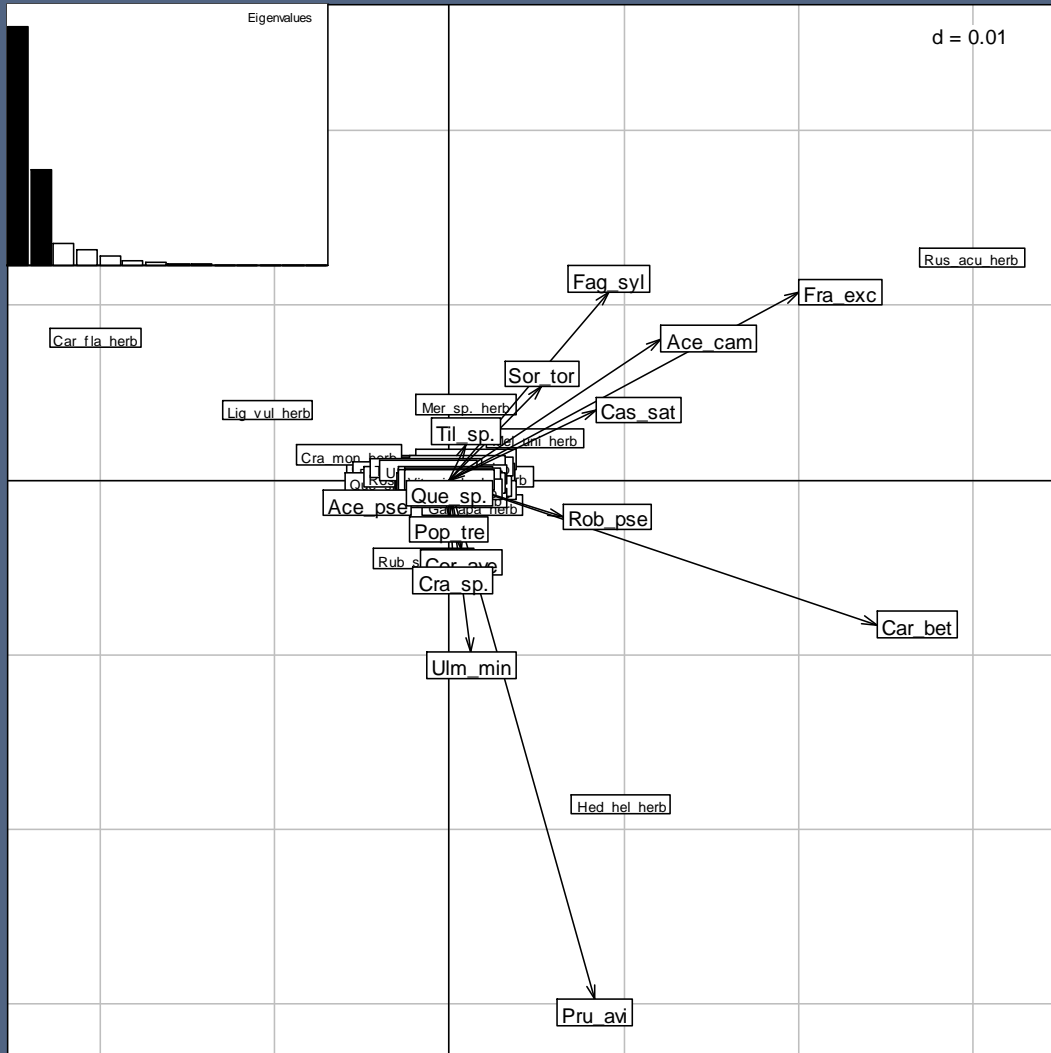
Common Ivy



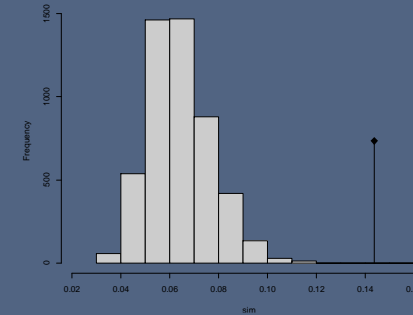
Butcher's-broom



Tree/plant composition



Plant composition is significantly linked to tree composition



No links with forest area, current and ancient forest cover

Co-inertia analysis of tree and plant composition

Discussion: Unexpected results!

- High volumes of wood available, with broad variability
 - Over mature coppice with standards
 - High densities but on small areas
 - Tree&wood quality / exploitability /demand on wood market?
- Oak dominated, but differences in tree compositions
 - Several oak species, several tree species: adaptation to climate change?
 - Diversity -> higher resistance to herbivores (Guyot et al., 2016)
- Large variability of tree composition into small forests (<5ha)
 - Fine grain factors of species distribution
 - Could it be the consequence of past management where different types of woods where needed?

- Plant cover not related to basal area!
 - Availability of light, nutrient and water seem to be not limited by higher wood volumes
 - In our case, plant related ecosystem services seem to be compatible with high level of wood production
 - Ecosystem services to be analysed through plant life traits
- Plant composition dominated by 2 species
 - Ruscus and Hedera can become very dominant
 - Ruscus: reduces accessibility to forest; Hedera: source of food for pollinators in automne
- Significant link between tree and plant composition
- No links with forest covers
 - Strong effects of local conditions and management?

Conclusion

- Very small forests (<5ha) can provide large amounts of wood without impairing plant diversity and related ecosystem services.
- Very small forests have a high level of tree and plant diversity at a fine spatial grain
- Better understanding of factors controlling these diversities are needed for a better management of these forests.