

Land-use and cover changes in the Massif Central region of France

Extent of afforestation and its consequences on ecosystems

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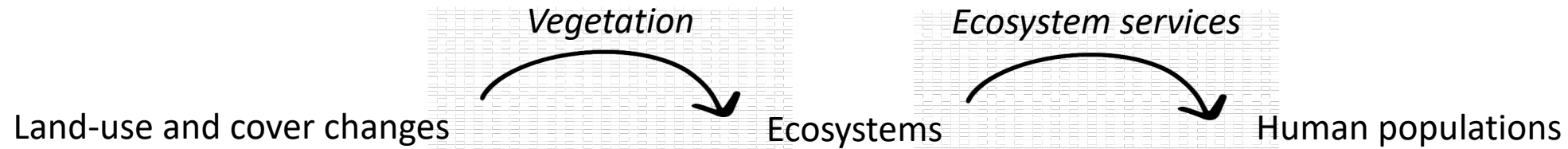
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Introduction



Natural afforestation following agricultural abandonment

Global trend

- 150 millions ha of croplands abandoned between 1700 and 1992 (Ramankutty and Foley 1999)

Regional differences

- From 12% up to 99% of lands in mountainous areas (Europe) (Lasanta et al. 2017)



Introduction

Natural afforestation following agricultural abandonment

Consequences

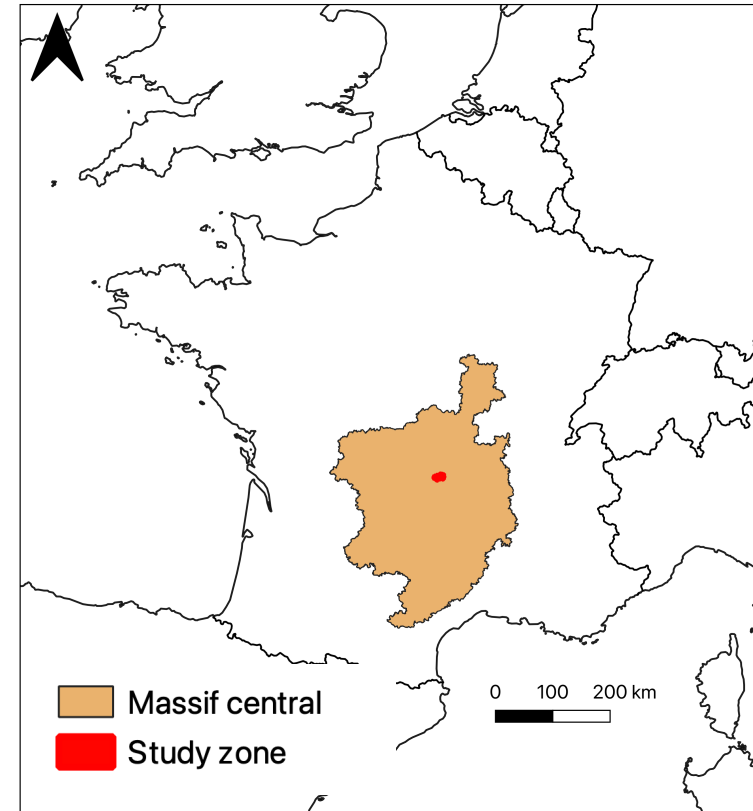
- Vegetation communities (Lepart et Escarré 1983)
- Ecosystem functioning ? (Piché et al. 2015, Buscaldo et al. 2019)
- Ecosystem services ? (Ustaoglu et al. 2018)
 - Carbon stock
 - Soil fertility
 - Erosion limitation



Study region

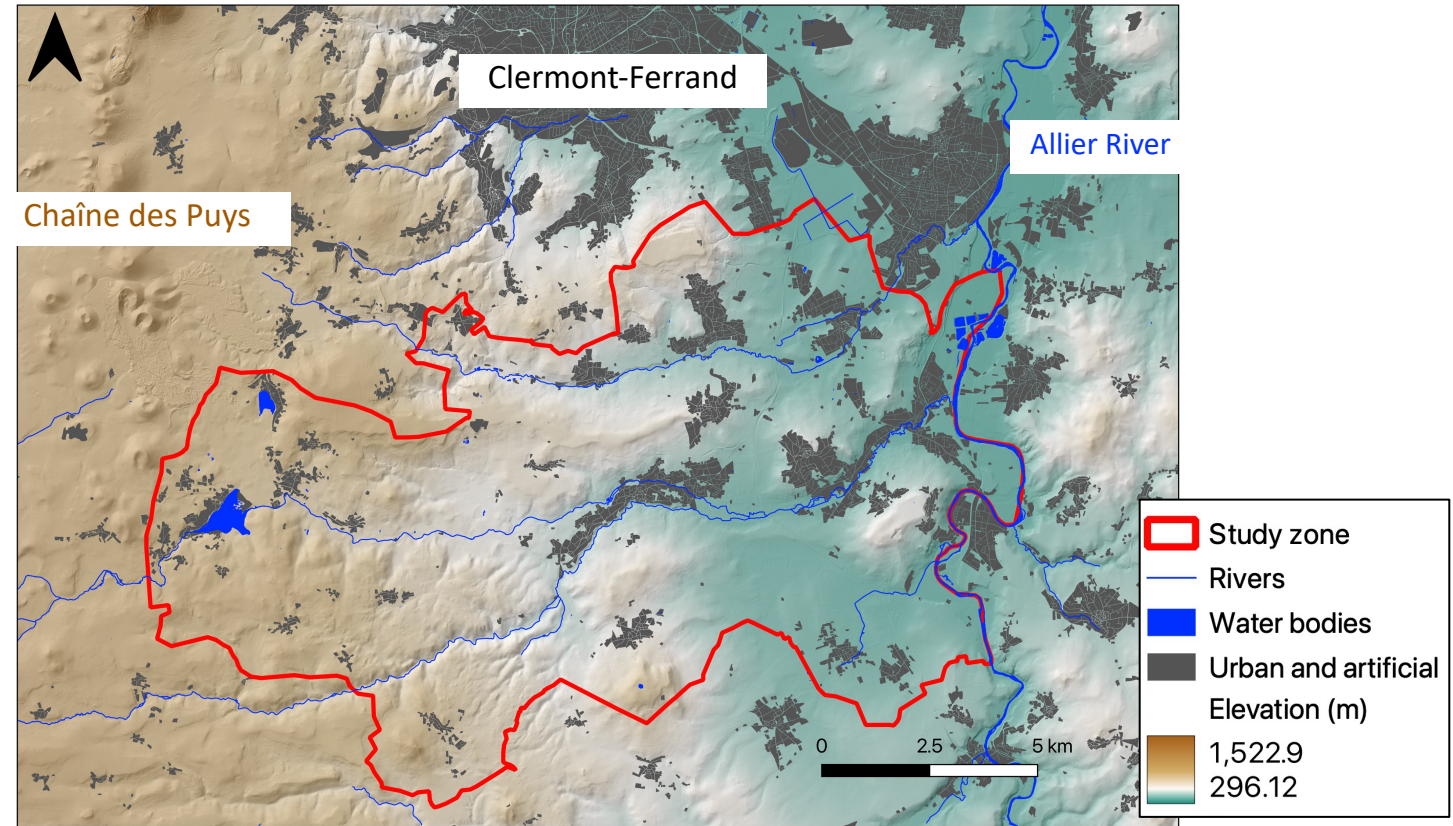
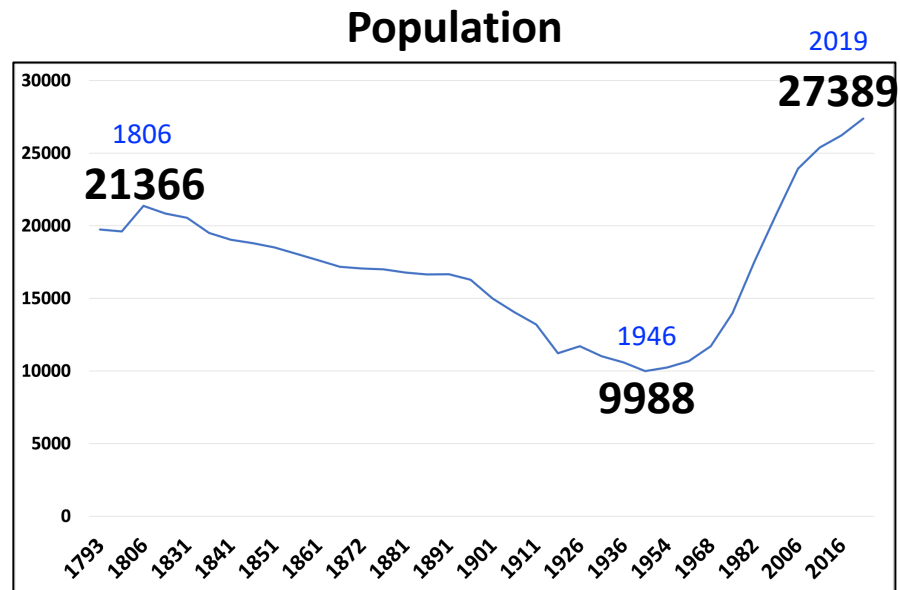
Massif central region

History of rural depopulation, changing agricultural practices and landscapes (Diry et al. 2000)



Study zone

Between mountains and plain
Demographic changes








→ **Q1.** What are the land-use and cover changes in the study zone ? What is the extent of natural afforestation ?

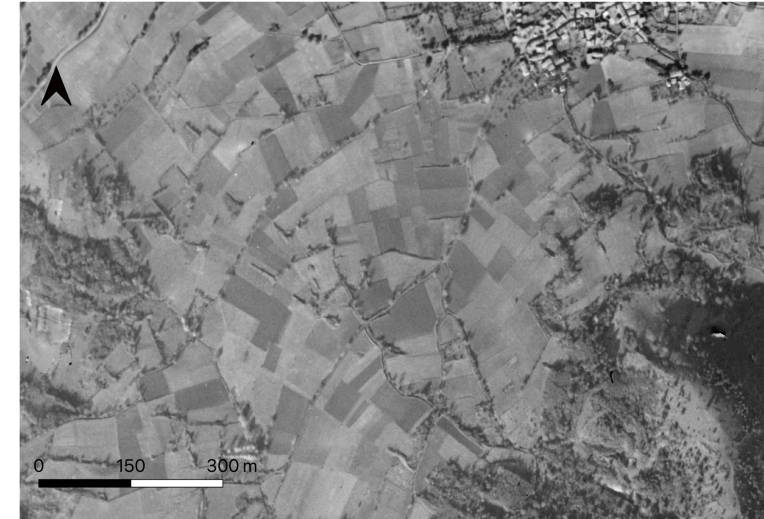
Land-use/cover changes: methods

Historical mapping 1946 - 2019

- Historical areal photographs
- Land use data

Main categories

- Forest 
- Planted forests 
- Shrubs 
- Agricultural lands 
- Urban and artificial 

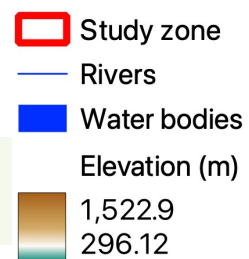
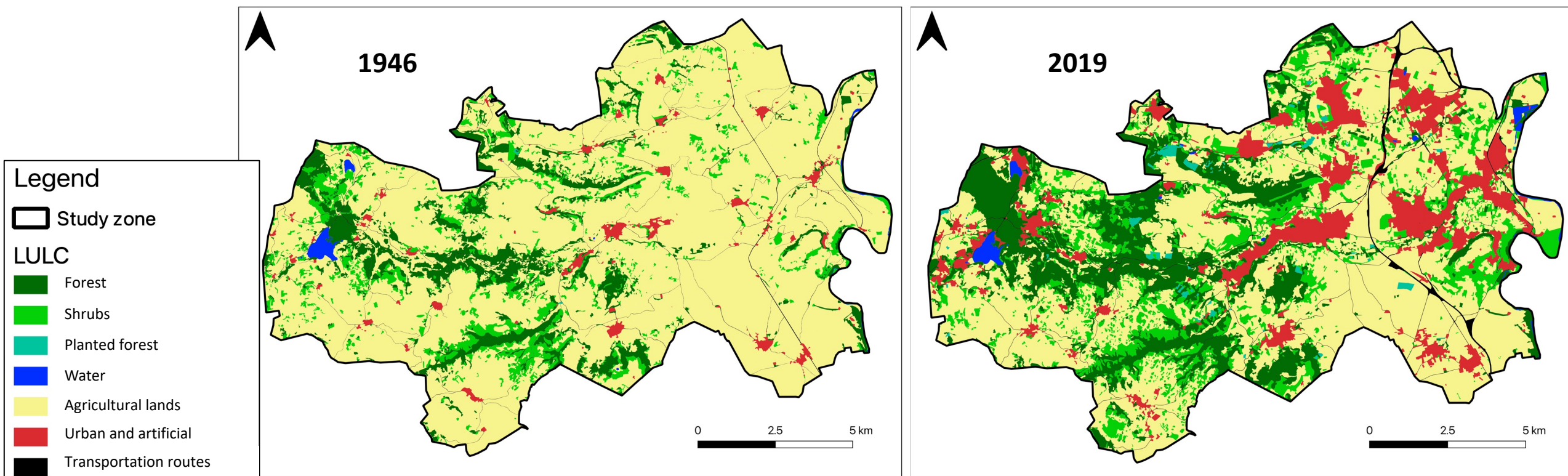


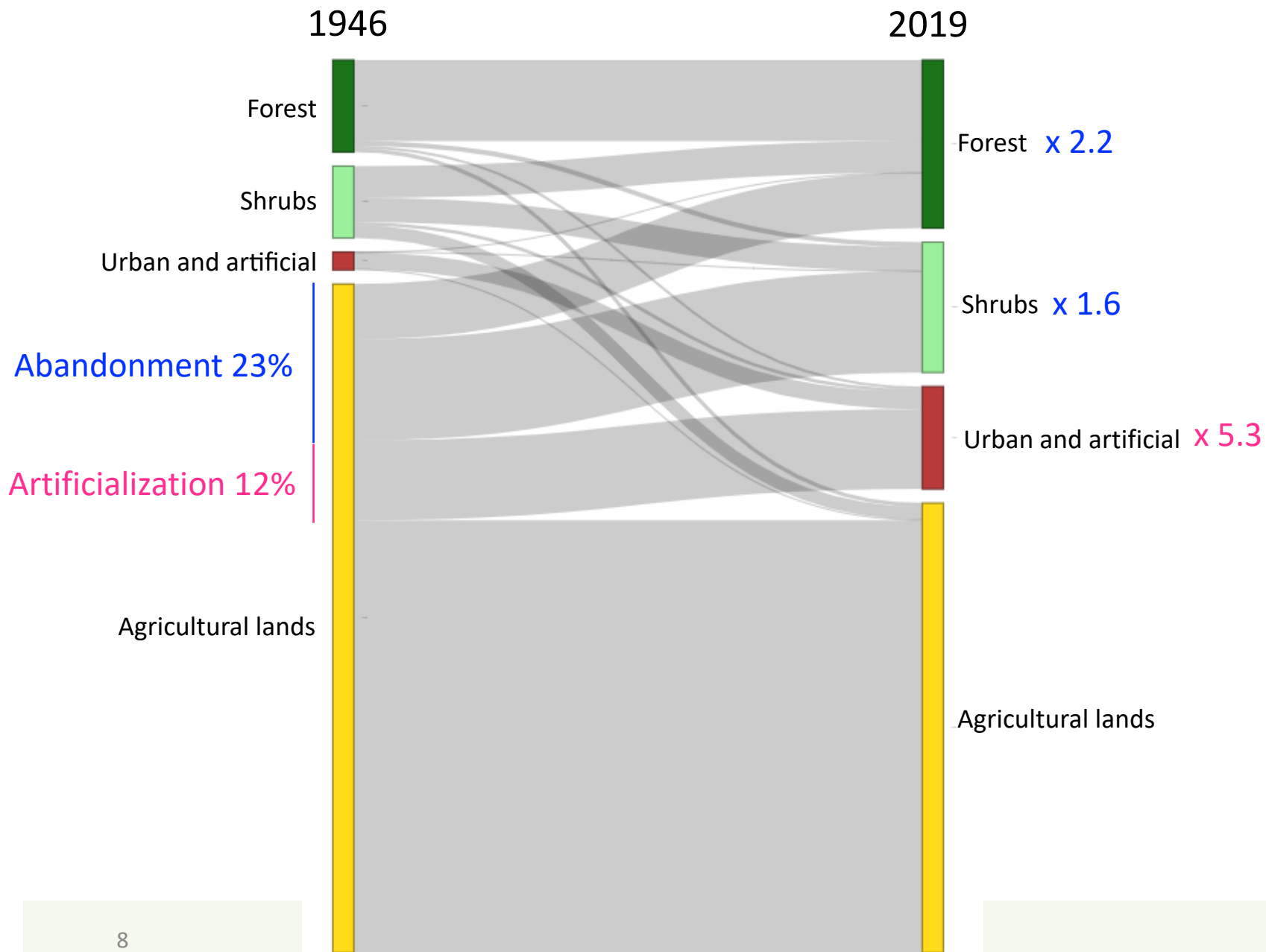
1946



2019

Land-use and cover changes: results





A1: LUCC = agricultural abandonment, natural afforestation and urbanization

→ Representative of European territories

(Ustaoglu et al. 2018, Shaw et al. 2020)

Q2: how does vegetation change?

Vegetation changes: methods



0



1



2



3



4



5

Grasslands under agriculture use

Forest since 1946



Vegetation changes: methods



0



1



2



3



4

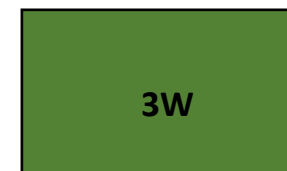
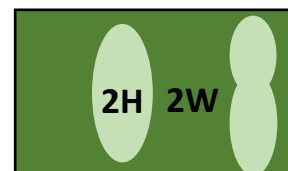
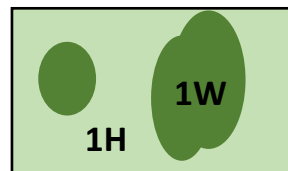
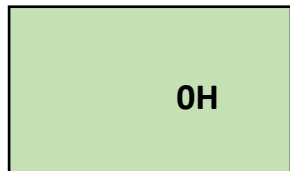


5

x5 plots = 30



Vegetation survey : plant species and their respective cover

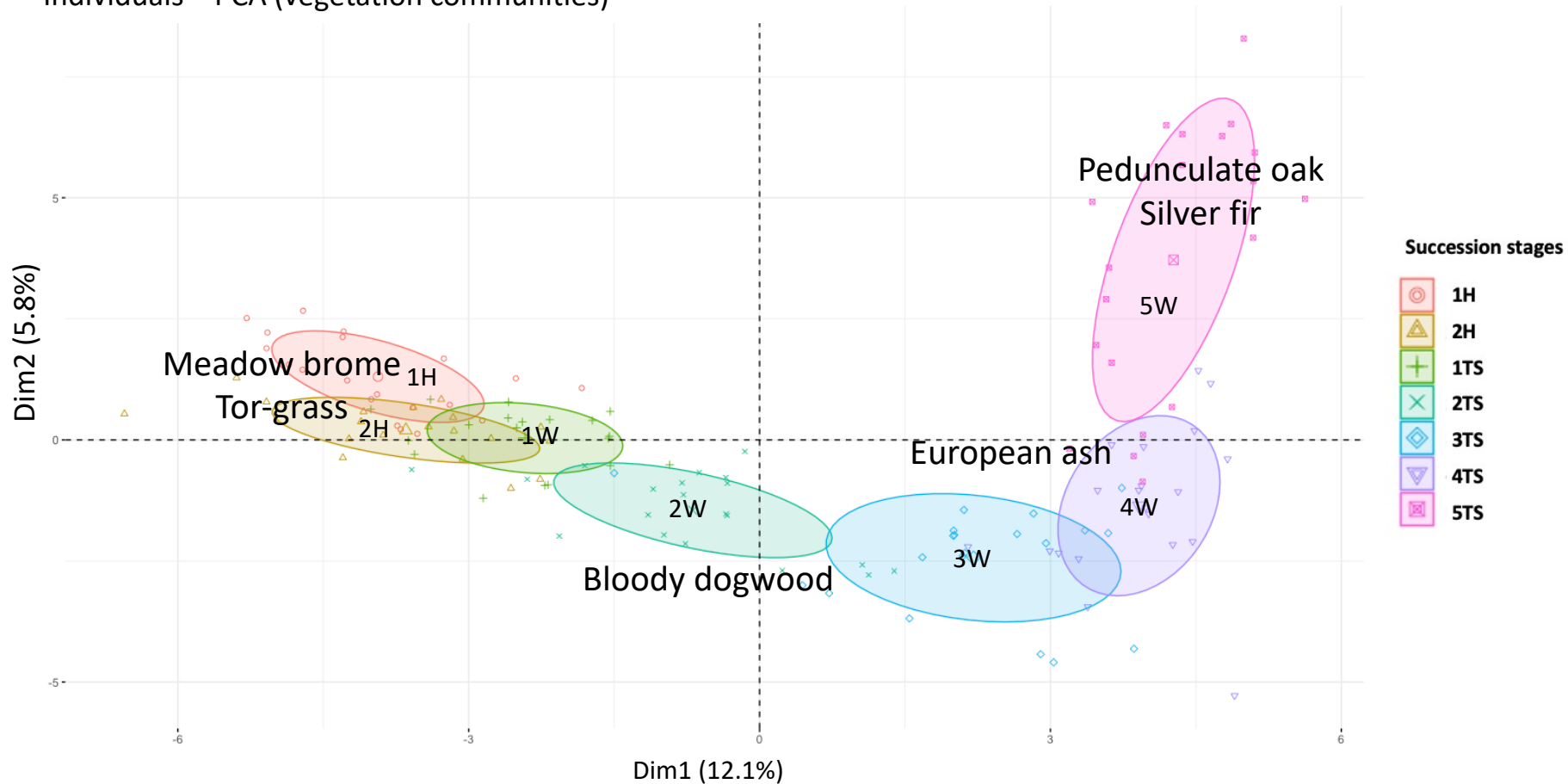


= 158 sub-plots

H = herbaceous, W = woody

Vegetation changes: results

Individuals – PCA (vegetation communities)



A2: gradual change of species composition

Q3: how do ecosystem services change?

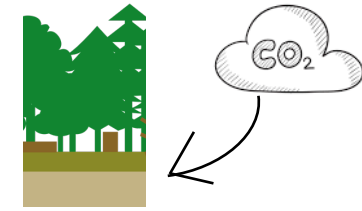
Ecosystem services: methods, results and discussion

Ecosystem services ?

- Carbon stock
- Soil fertility

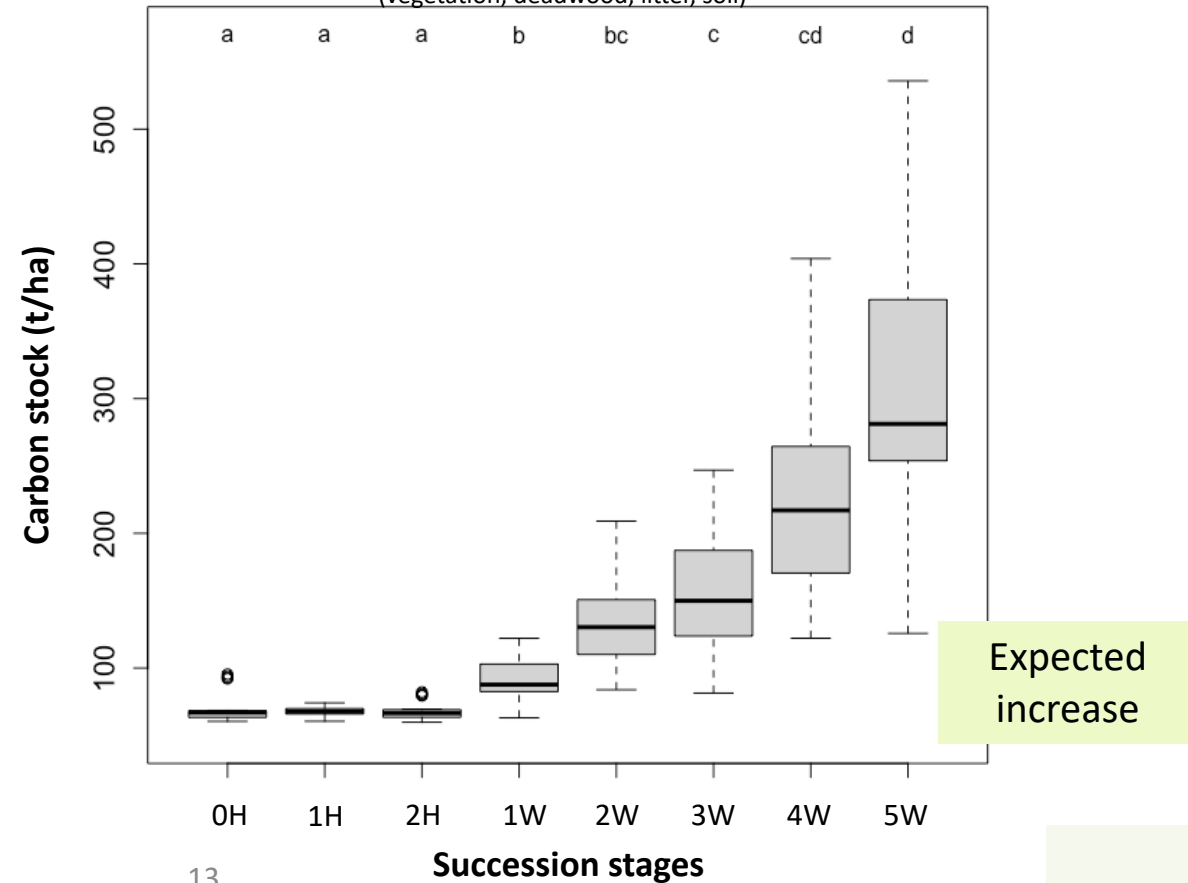
Carbon stock

- vegetation + deadwood and litter + soil (Bartholomé et al. 2018)
- Total stock of carbon (t/ha)

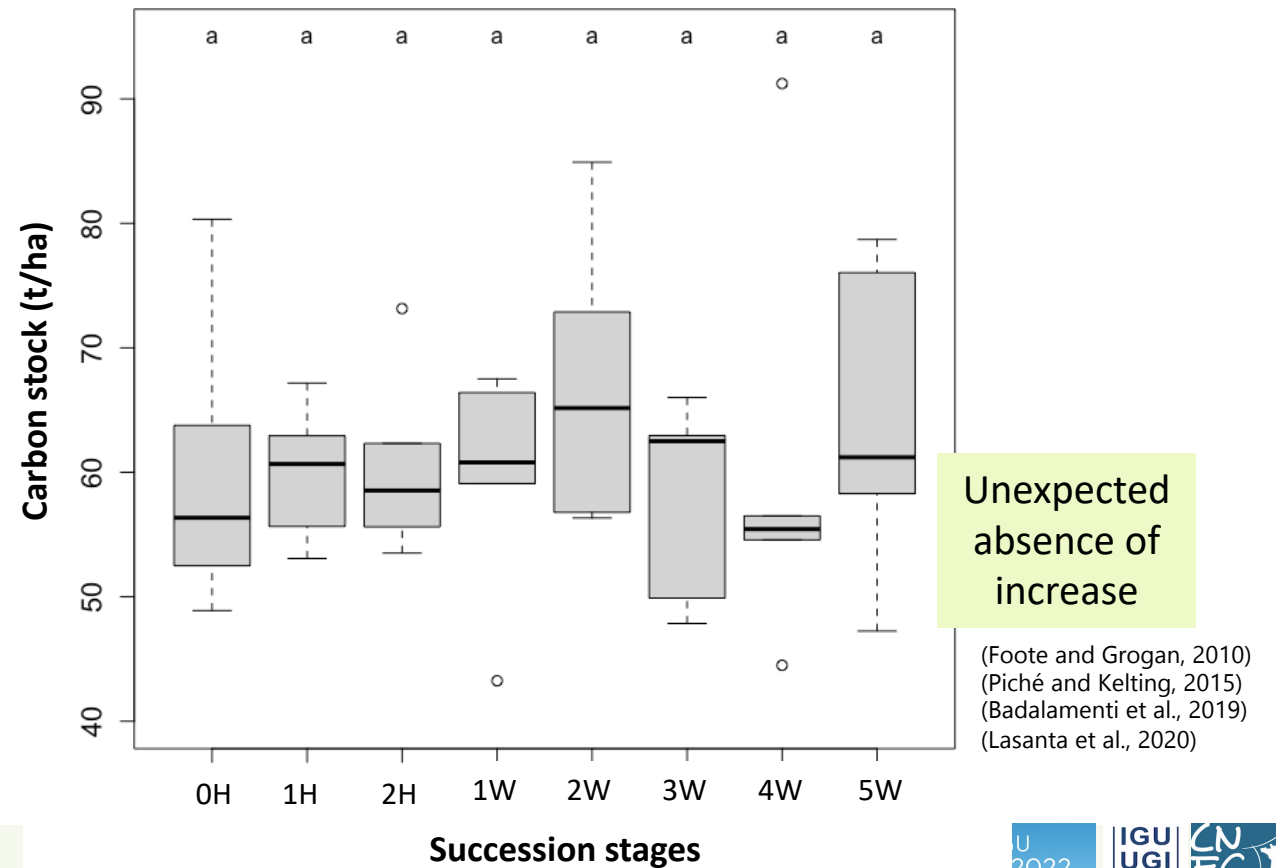


Total

(vegetation, deadwood, litter, soil)



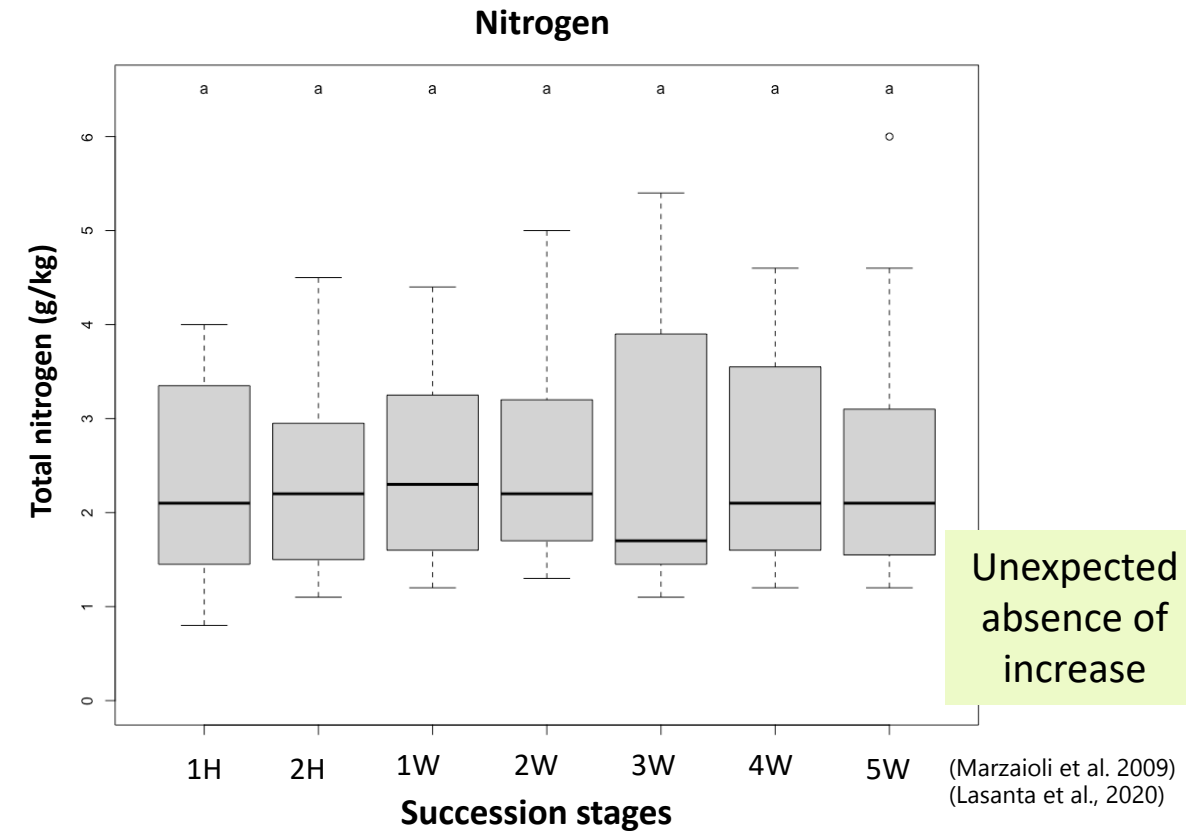
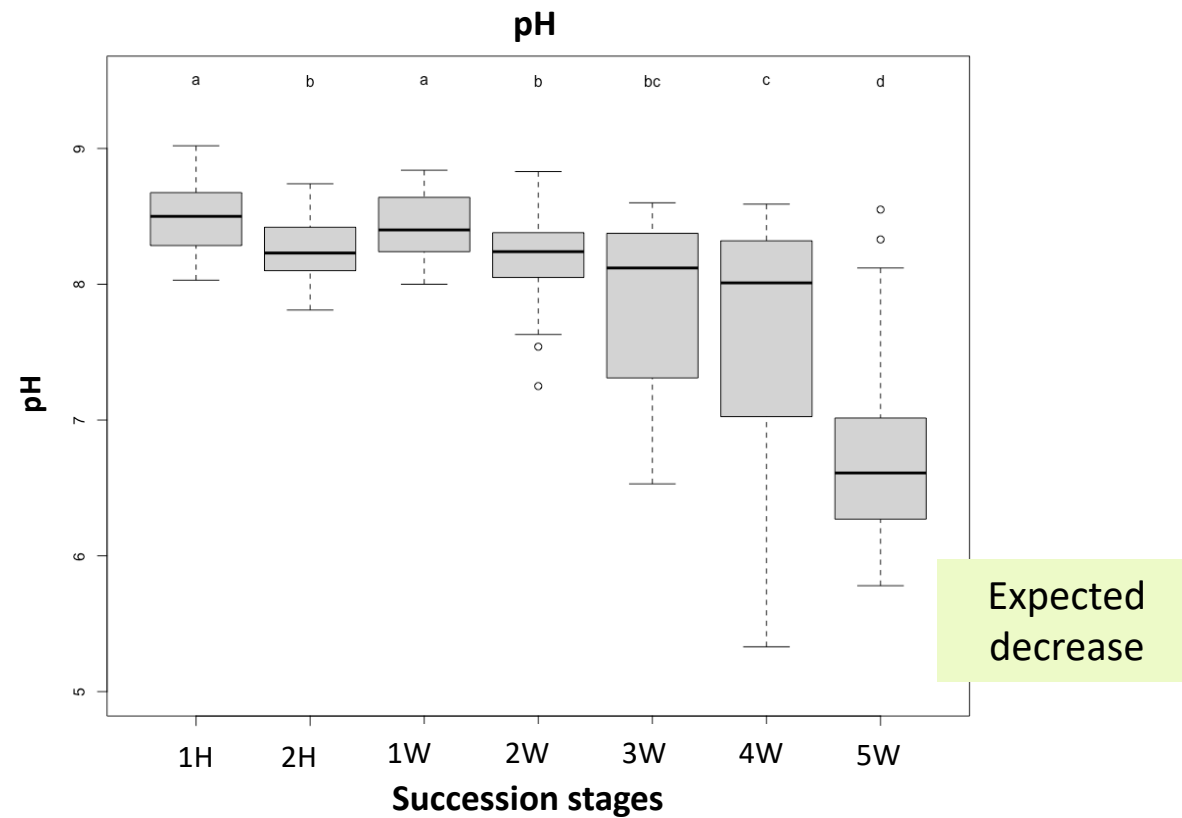
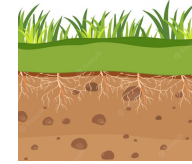
Soil organic carbon



Soil fertility

Multifactorial:

- pH
- Soil nutrient content (nitrogen)



Conclusion

A1: Land-use and cover changes

- Study zone concerned by natural afforestation
- European trends

A2: Vegetation:

- Gradual change of species

A3: Ecosystem services changes through stages :

- Carbon stock: increase but not in soil
- Fertility: pH decrease, N stable

Perspective: which drivers of ecosystem services changes?

→ Effects of vegetation changes : trough species ? Functional groups ?

→ Other explanatory factors: aspect?

PhD perspective: perception of natural afforestation and its effects on cultural ecosystem services?



Thank you for you attention

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