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Dynamics of ecosystem services over the last 200 years

First results from the Bassiès valley (Ariège, France)



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Context and aim of the study

Mountains provide various Ecosystem Services (ES) ^{1,2} and are heavily affected by climatic and land-cover changes ³
 Most studies on ES temporal changes are based on photographic and cartographic analyses and cover only few decades ^{4,5}
 Studies on longer time scale are necessary to assess ES sustainability, synergies, interactions and time lags ⁴

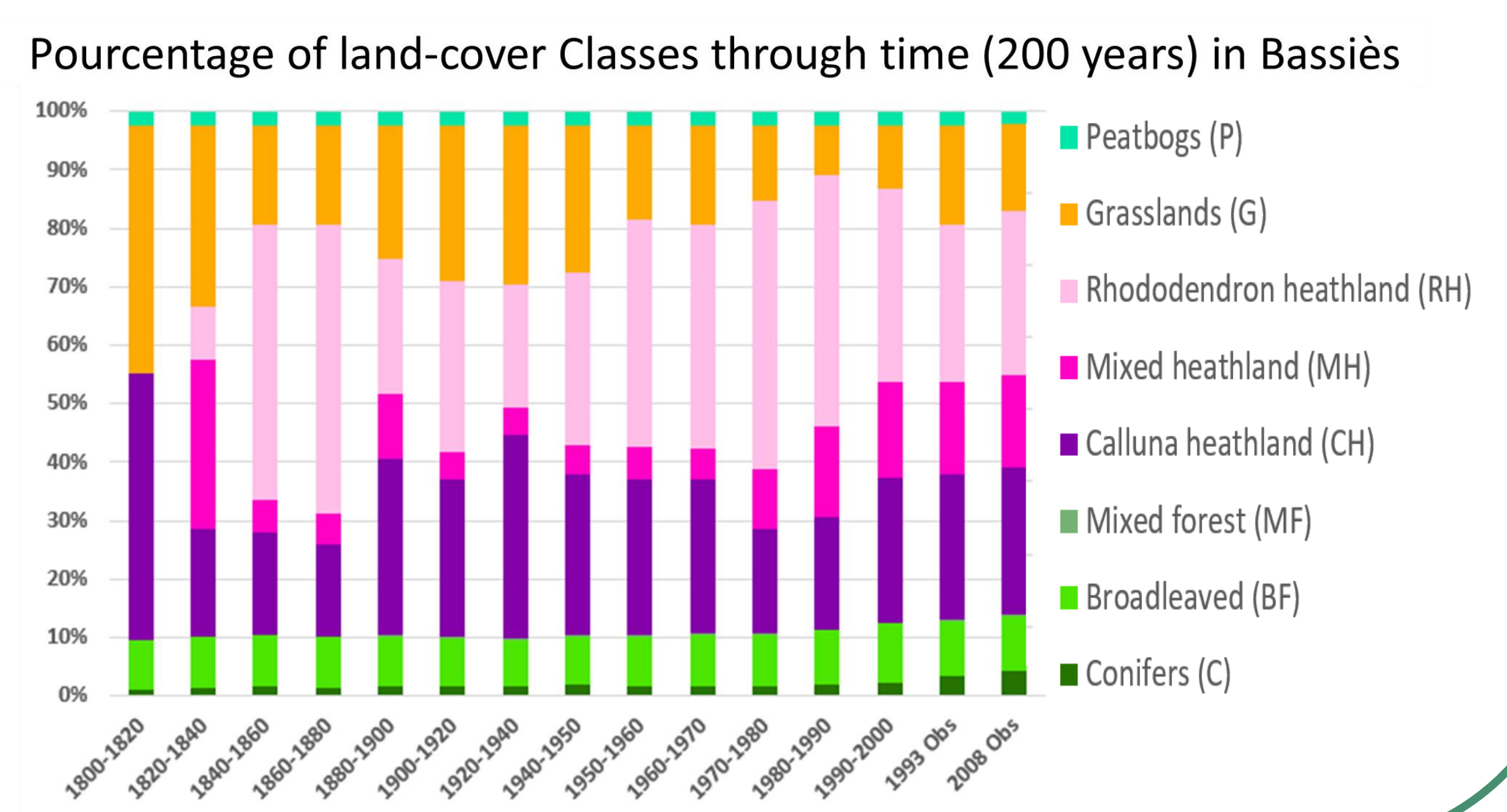
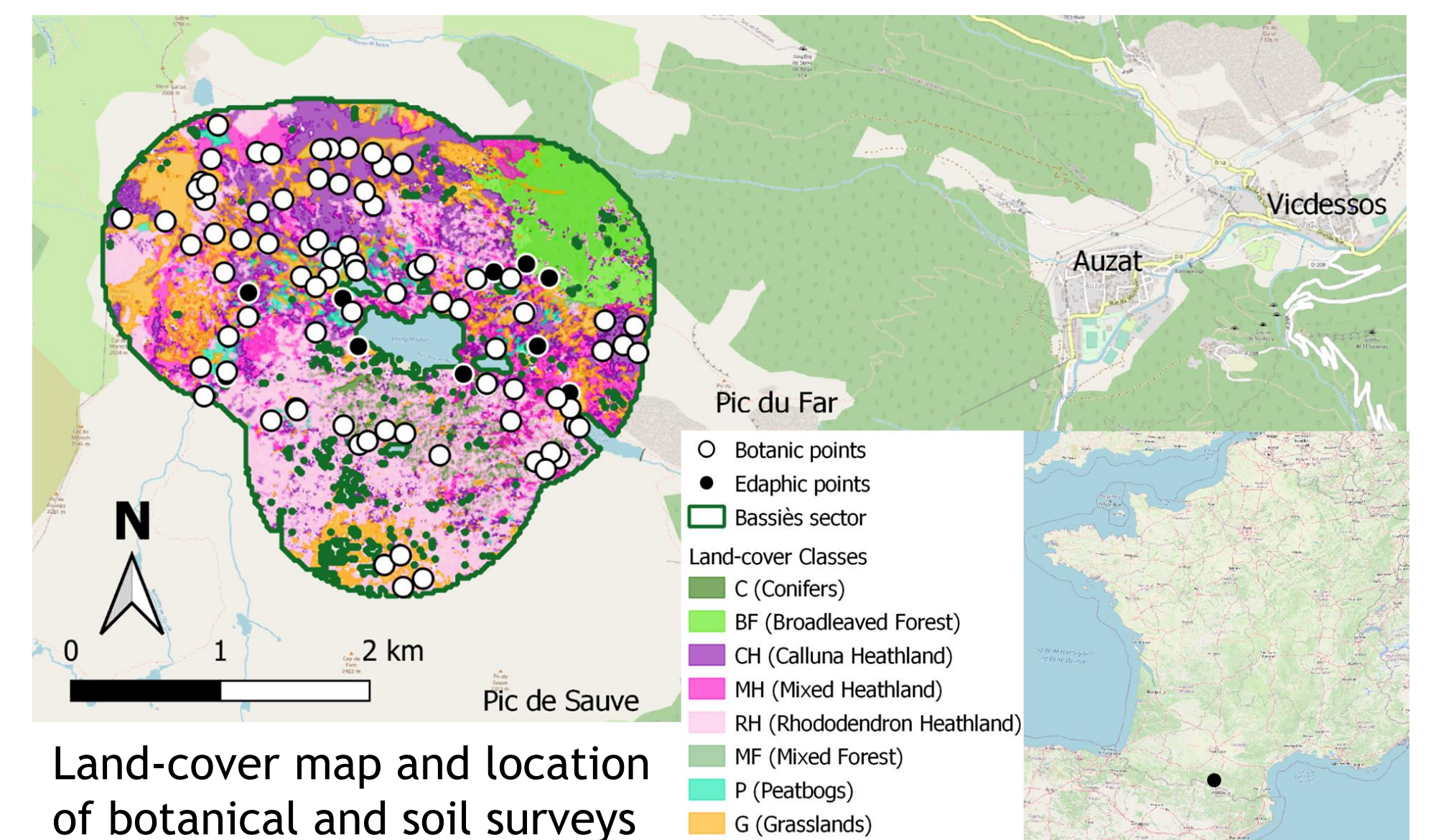
We aimed to reconstruct the trajectory of ES over the last 200 years in the Bassiès valley, by combining data on ES provided by current land-cover types and pollen-based land cover maps available for the last 200 years

Materials and Methods

1° Selection of ES proxies relevant in mountains, based on literature

Type of SE	Potential Indice	Measured variable
Production	Pastoral value	Total cover of plants with pastoral value (%)
	Plant picking	Abundance of picked plants (%)
Cultural	Patrimonial value	Abundance of patrimonial plants (%)
	Flowers Aesthetics	Total cover of forbs flowers (%)
	Butterflies Aesthetics	Abundance of butterflies (occurrence)
Regulation (pollination)	Pollination	Abundance of entomogamous plants (%)
Regulation (Carbon Cycle)	Organic C fixation	Labile organic matter stabilizing factor
	Organic C stock	SOC* (kgC/m ²)
	Inorganic C fixation	Capture CO ² (g/m ² /year)
Regulation (Water cycle)	Water retention	Useful Water Supply (mm)
	Water infiltration	Water flux (L/m ² /year)
Regulation (Environnement quality)	Organic matter recycling	Biodegradation rate (g/day)
	Nutrient supply	Cation Exchange Capacity (cmol/kg)
	Biological activity	microbial biomass (µg/g)

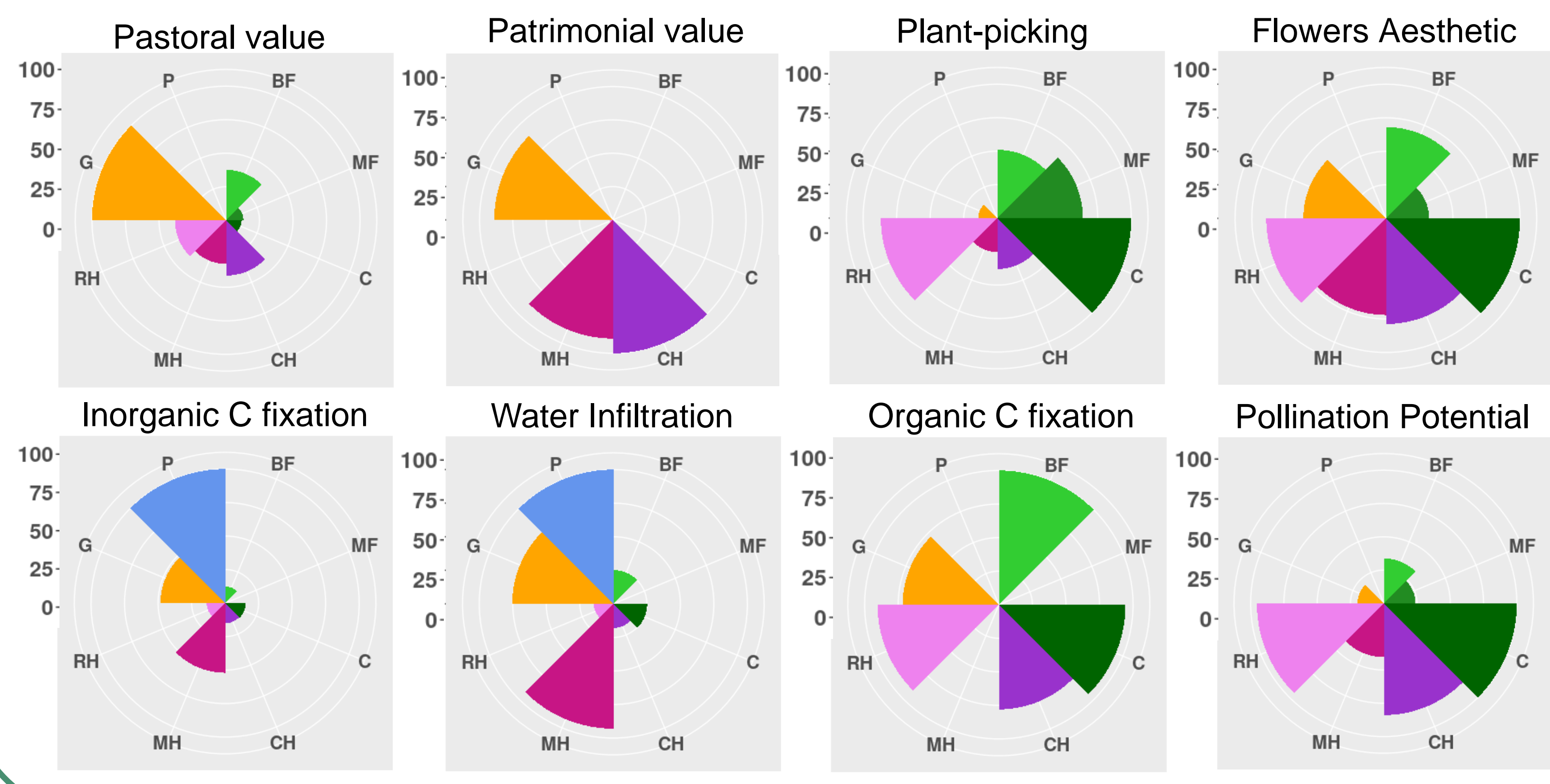
2° On-site data collection on plants, butterflies and soil



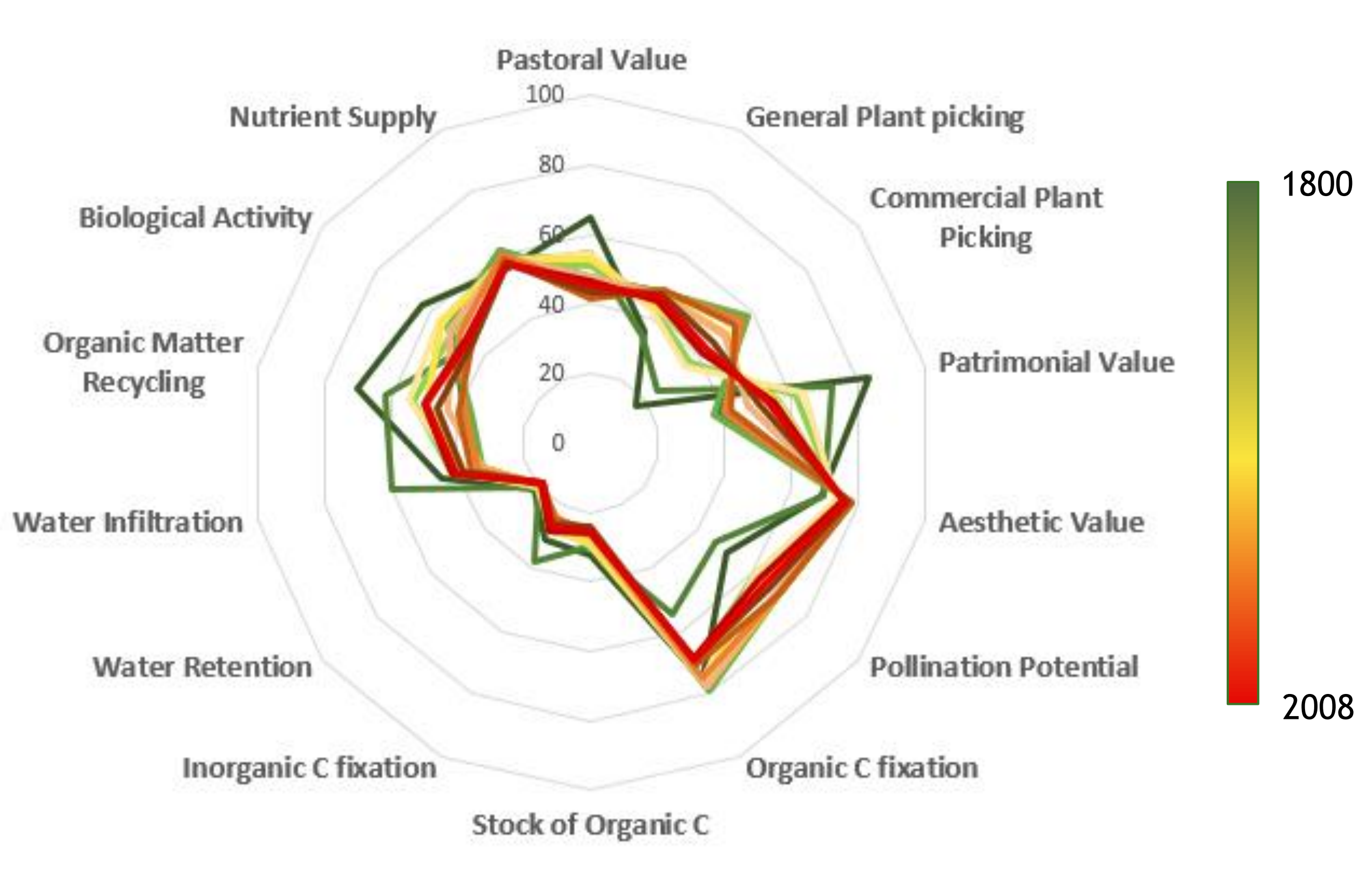
3° Use of historical land-cover maps to calculate the level of ES produced at the scale of the study site for each period between 1800 and 2008

Results

Land-cover types produce different ES bundles (see examples below)



The production level of each ES changed through time



Conclusions and perspectives

Land-cover types provide distinct combinations of ES and land abandonment therefore triggers a temporal change in ES bundles

- Grasslands mainly provide : production, patrimonial and regulation services ^{1,7,8}
- Heathlands and forests, abundant in flowers, mainly provide : plant picking, aesthetic and pollination services ^{7,9}

Complementary surveys will be conducted to increase the precision of some soil-related regulating ES. The relationship between land-cover diversity and ES diversity will be explored

¹EFEE, les écosystèmes rocheux et de haute montagne français, 2018. ; ²Martin-Lopez et al., 2019. ; ³Lavorel et al., 2017. ; ⁴Jeffers et al., 2015. ; ⁵Locatelli et al., 2017. ; ⁶Plancher et al. in prep ; ⁷Crouzat et al., 2015. ; ⁸Gis Sol, L'état des sols en France. 2011. ; ⁹Zoderer et al., 2019. ; ¹⁰Pornaro et al., 2017. ; ¹¹Briner et al., 2013.

