



**HAL**  
open science

# Which ecosystem services are provided by agropastoral habitats in low mountain region: Evaluation of ES bundles and social expectations

Benjamin Allard, Anne Bonis

## ► To cite this version:

Benjamin Allard, Anne Bonis. Which ecosystem services are provided by agropastoral habitats in low mountain region: Evaluation of ES bundles and social expectations. *Ecology & Evolution: New perspectives and social challenges*, Nov 2022, Metz, France. hal-04894579

**HAL Id: hal-04894579**

**<https://hal.science/hal-04894579v1>**

Submitted on 17 Jan 2025

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



# Which ecosystem services are provided by agropastoral habitats in low mountain region : Evaluation of ES bundles and social expectations.

Benjamin ALLARD<sup>1</sup>, Anne BONIS<sup>1</sup>

## Introduction

The Chaîne des Puys is a good example of a rich area of a diversity of semi-natural habitats that must cope with a diversity of stakeholders, uses and demands. By providing a diversity of ecosystem services (ES), grassland habitats may contribute to the multifunctionality of this territory. This work aims to study the synergies and trade-offs that occur between ES, as well as to characterize the demands of stakeholders in the territory. It will then provide foundational knowledge that can be used in a management plan.

## Aims

This work aims to assess how the diversity of grasslands and local conditions (soil) contribute to the provision of a diverse range of ES that would meet a diversity of societal demands. We expect complementarity between different grassland habitats in the provision of ES. Such complementarity may for example operate through differences in ES capacities, or via a phenological relay effect between grassland habitats, and lead to spatial synergies or avoidance of potential trade-off on ES flows.

## Methods

The characterization of 5 ES capacity was performed. The fodder provision corresponds to the mass of dried standing consumable fodder per 1 m<sup>2</sup> over all the grazing period (using exclos, from spring at 500 GDD to fall at 2900 GDD). Carbon storage is here approached by the SOC stock characterized on a depth of 40 cm for 1 m<sup>2</sup>. The bloomed flower cover is used for pollination ES, and the S/T ratio for soil quality. Lastly, aesthetic ES is the sum of flower color preference scores (collected by survey) weighted by bloomed flower colors cover. The evaluation of the demand and flow of ES was carried out through a survey of the local population and tourists

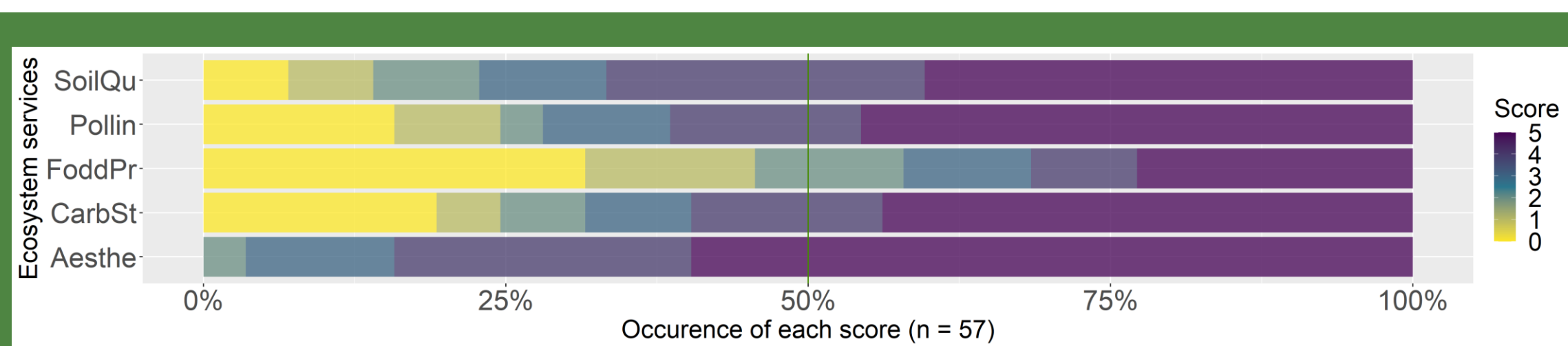
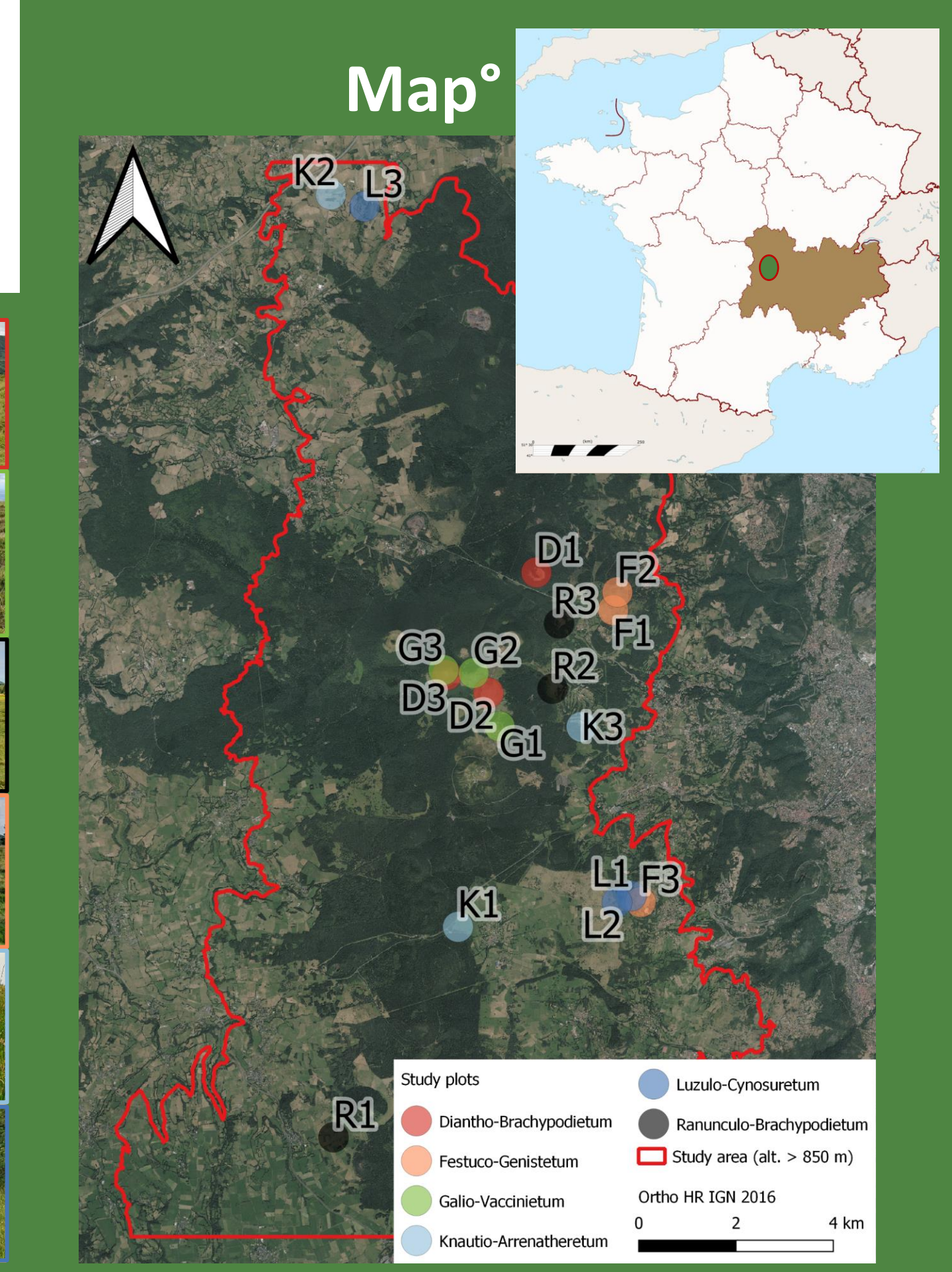
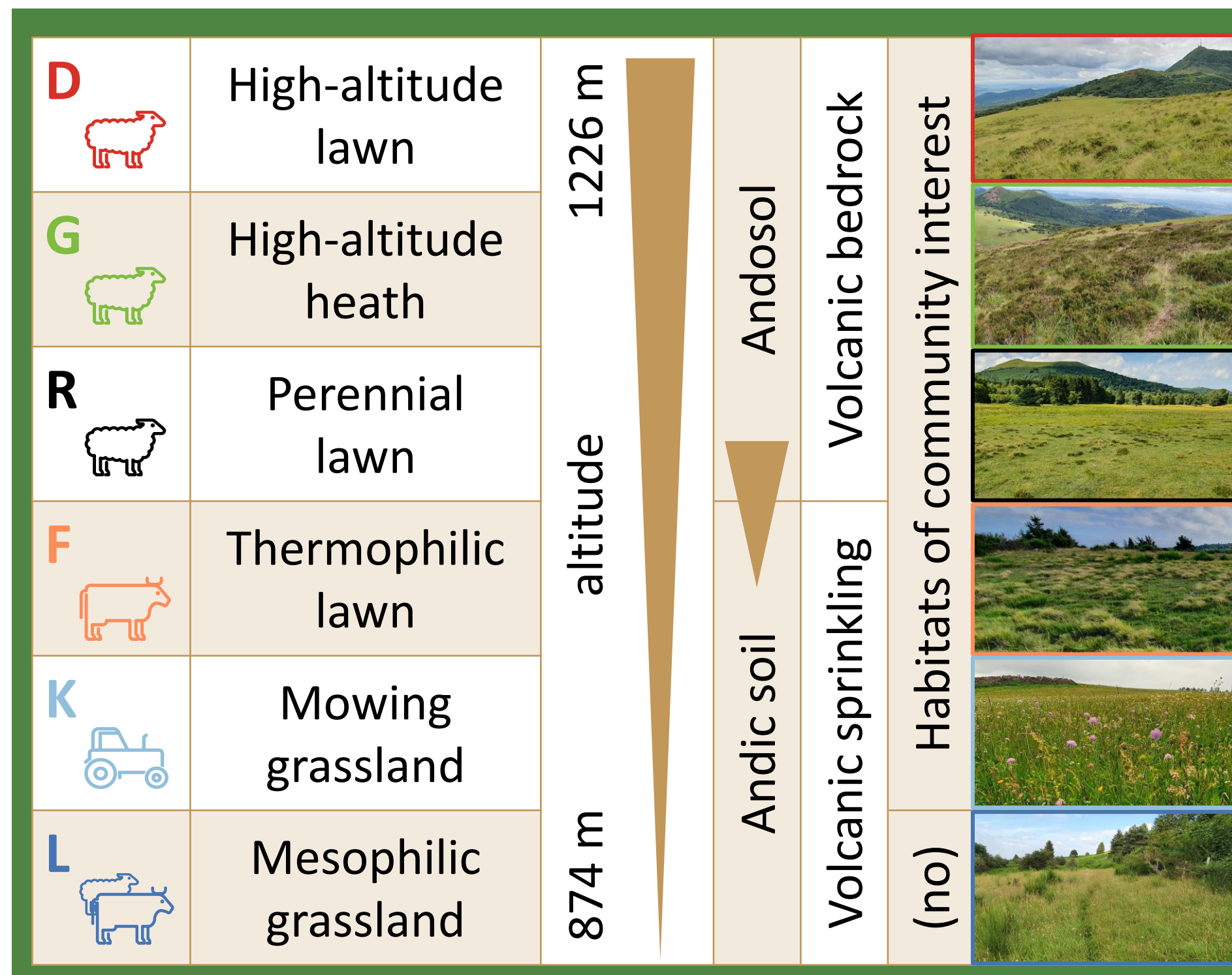
## Preliminary results

**Overview of the 5 ES in spring:** The aesthetic dimension stands out strongly in front of the other SE by the presence of flowers and can meet local demand. Soil quality, thought of as an important agronomic attribute, is better in mowed grassland (K). The relative differences in the ES capacities of grasslands habitats support the view that it's possible to meet different demands at the same time.

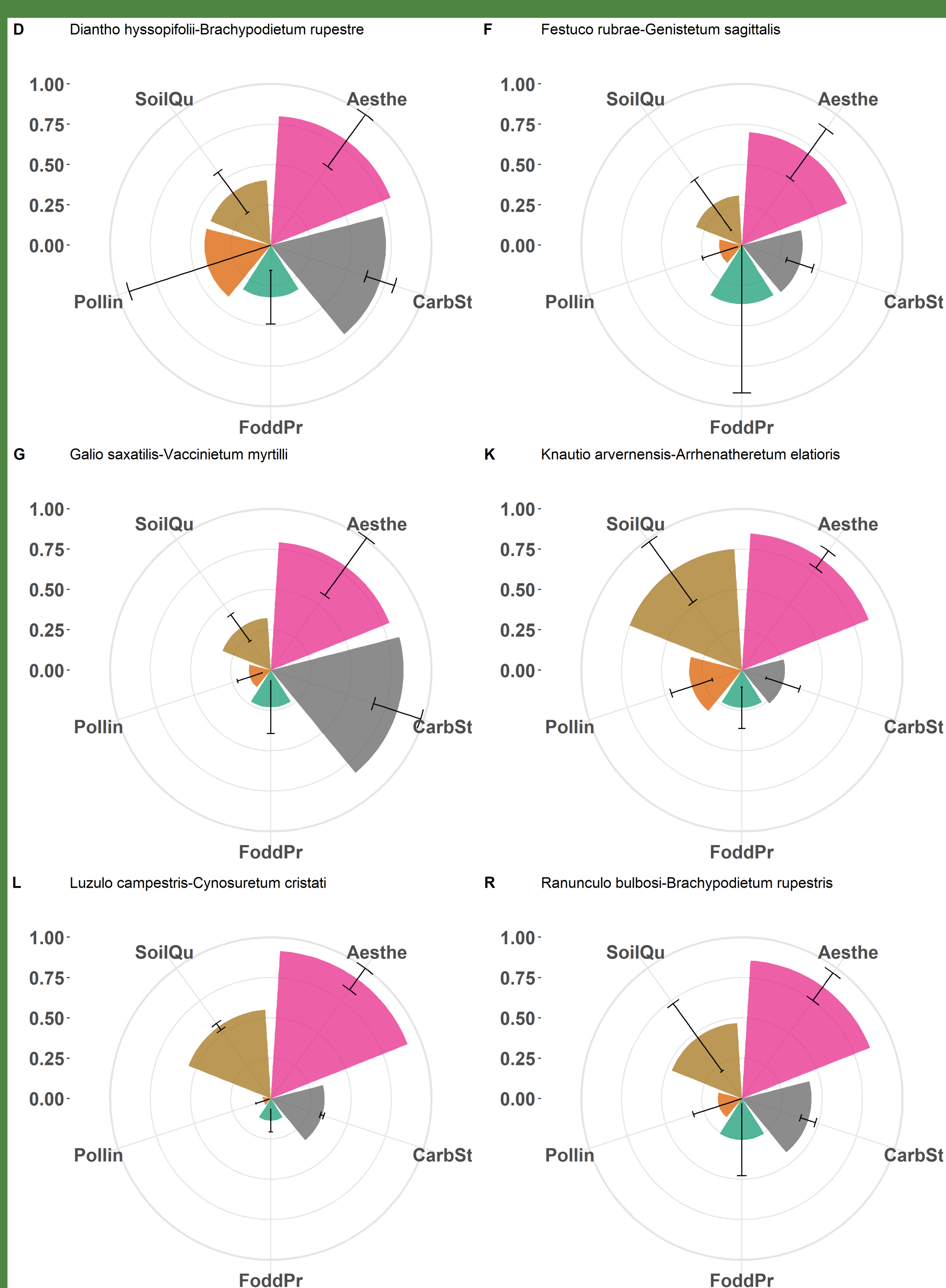
**Focus on the Fodder provision ES :** The supply of fodder is indicated as essential by the local farmers who depend on it. The study of the capacity of ecosystem services over time makes it possible to observe potential synergies or trade-offs in ES flow. For the fodder provision, the evolution of this service may affect the management carried out by the farmer, and consequently the expression of other services of potential interest.

## Study site

The study was conducted on 6 contrasted grassland habitats with 3 replicas, i.e. 18 plots on the Chaîne des Puys (180 km<sup>2</sup>).

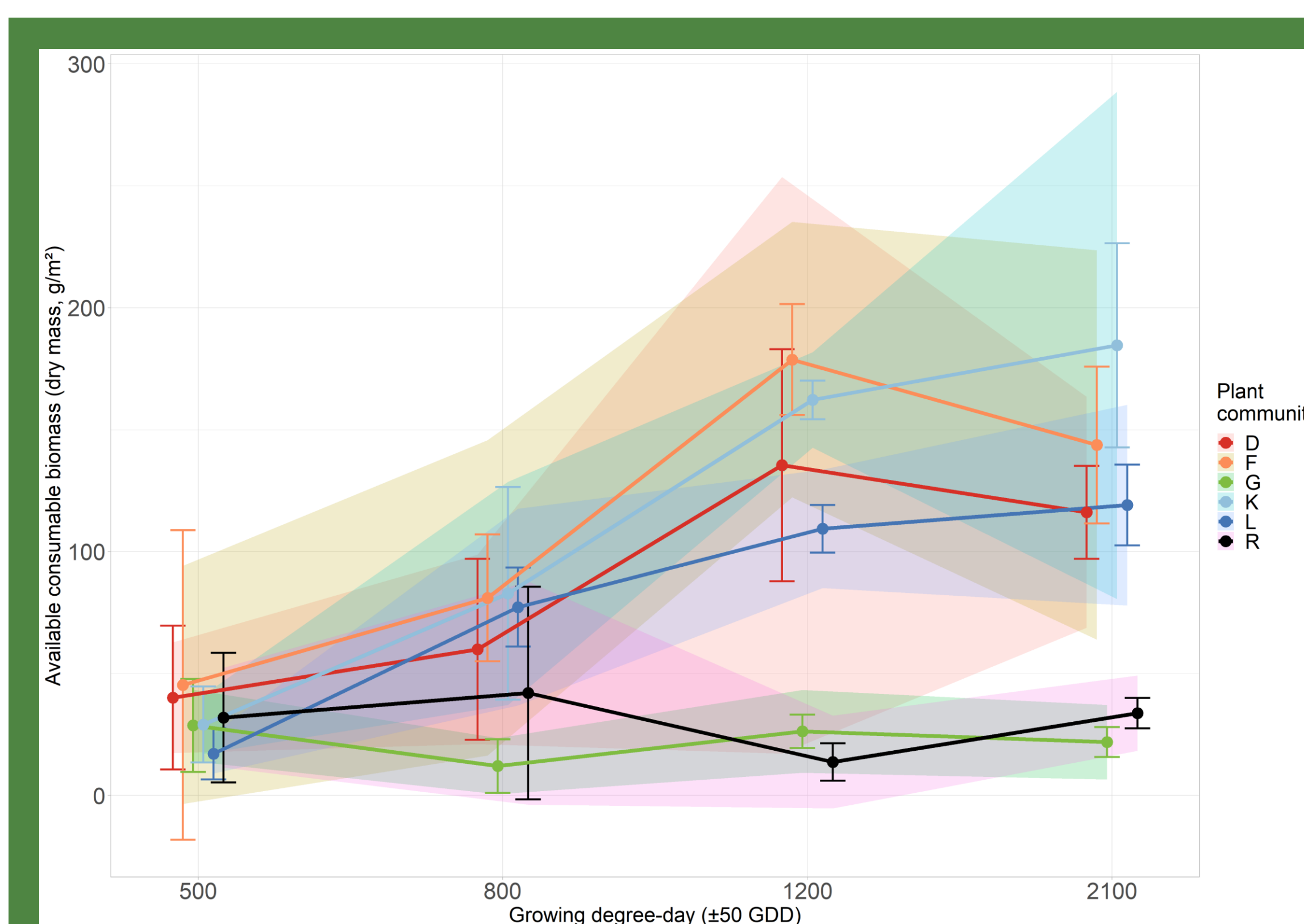


1° "Grassland user" preference score for each ES collected by survey (n = 57)



2° : Relative evaluation of 5 ES capacity for 6 grassland habitats in spring (500 GDD, May-June 2022).

The value 1 is assigned for each ES to the plot with the highest ES capacity, each level of ES capacity per grassland habitat is an average of ES capacity of the 3 plot repetitions. Error bars correspond to standard deviations

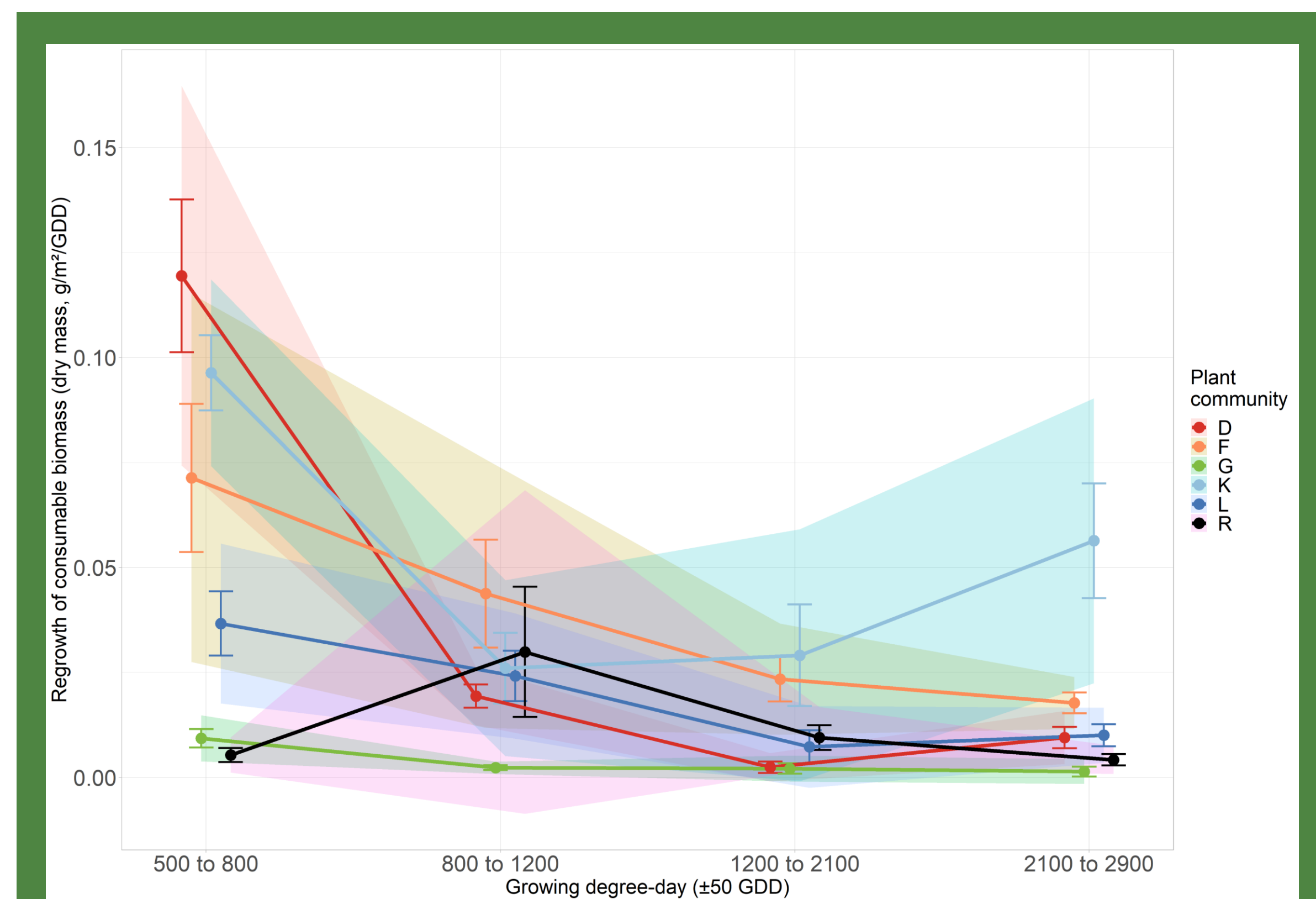


3° Standing consumable biomass at different GDD for the 6 habitats

Grasslands K and L continue to accumulate biomass over time, while lawn D and F have a peak at 1200 GDD and G and R are fairly constant (3). Surprisingly, D and F grassland habitats appear as productive as the K mowed grassland despite their constraints (altitude, water shortage), while the G heath-type habitat are as productive as the R habitat. The rotation of livestock between these different associations may maximize the ES fodder provision flow.

A phenological lag between habitats seems to occur, which may allow a relay in the supply of fodder:

D, F and L growth well after cutting in the spring (500-800 GDD), lawn R regrowth have a peak in early summer (800 to 1200 GDD) and the regrowth in the fall for K grassland provides new grazing time after mowing. The G heath may provide a constant but low resource that may be suitable for proper livestock density.



4° Regrowth of vegetation after cutting for the 6 habitats

## Perspective

Eventually, these results will make it possible (i) to fully study the relationships between ES, through the identification of bundles and trade-offs of ES between and within each grassland habitats, and (ii) to assess the flow and the demand of users and local actors towards grasslands and (iii) to distinguish the respective importance of local abiotic conditions, the characteristics of plant communities and the type or intensity of agropastoral management at the service level observed.

**Definition :**  
 ES capacity = Ecosystem potential to provide the service.  
 ES flow = Actual use of the ES.  
 ES demand = Set of preferences, expectation of a beneficiary.

ES trade-off = the increase or use of one ES is detrimental to another.  
 ES synergy is the opposite.  
 Phenological relay effect = Continuity of an ES capacity, dependent on a phenological step, allowed by a phenological shift on plant communities.

GDD = Growing degree-day. An estimate of the heat accumulation required for biological development. Here calculated from 1<sup>st</sup> Feb. bounded between 0°C and 18°C.