

A simple classification of French permanent grasslands to evaluate their forage and environmental services

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Permanent grasslands in France

Grasslands not reseeded for more than 5 years : a large variability of types from SNG to more “intensive” grasslands

About 30% of agricultural land area : 10 M ha

The main forage resource for livestock :

- About 2/3 of area used for forage production
- 50 % of total forage biomass production
- 40 % of E and N used by ruminants



An important environmental resource :

- Biodiversity conservation
- Pollination
- Carbon storage
- Landscape...



...but grasslands area declined by 4 M ha since 1970



A lack of scientific and technical knowledge on forage and environmental services provided by permanent grasslands

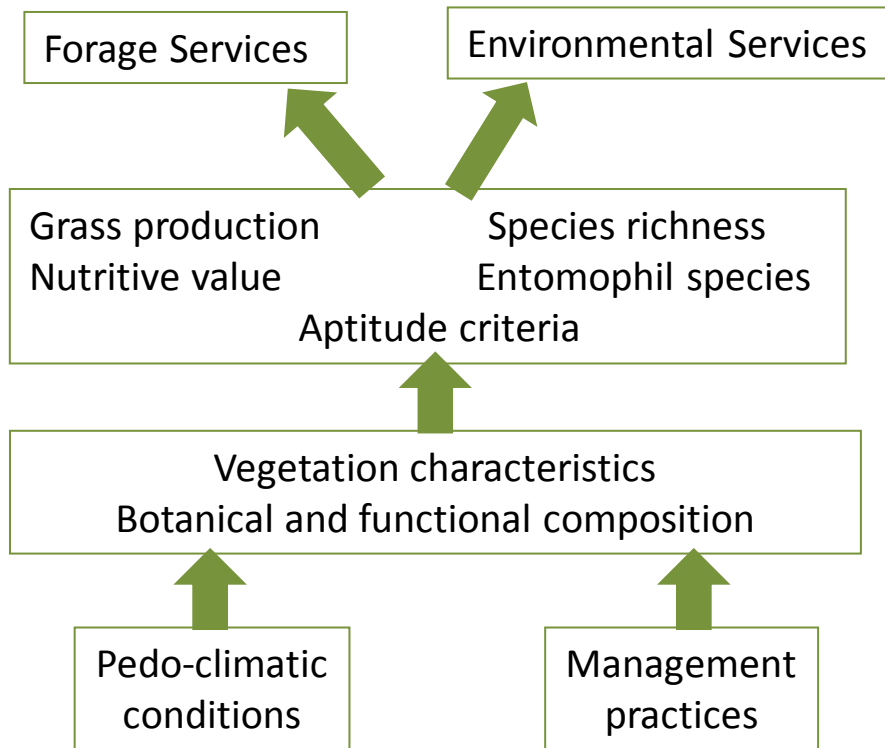
- Few and old reference data (nutritive value)
- Bad characterisation and utilisation of variability
- Low interest of farmers in permanent grasslands

↳ ***A national research and development program (2008 – 2011) to characterise French permanent grasslands for a better utilisation in livestock farming systems***

Classification of grasslands

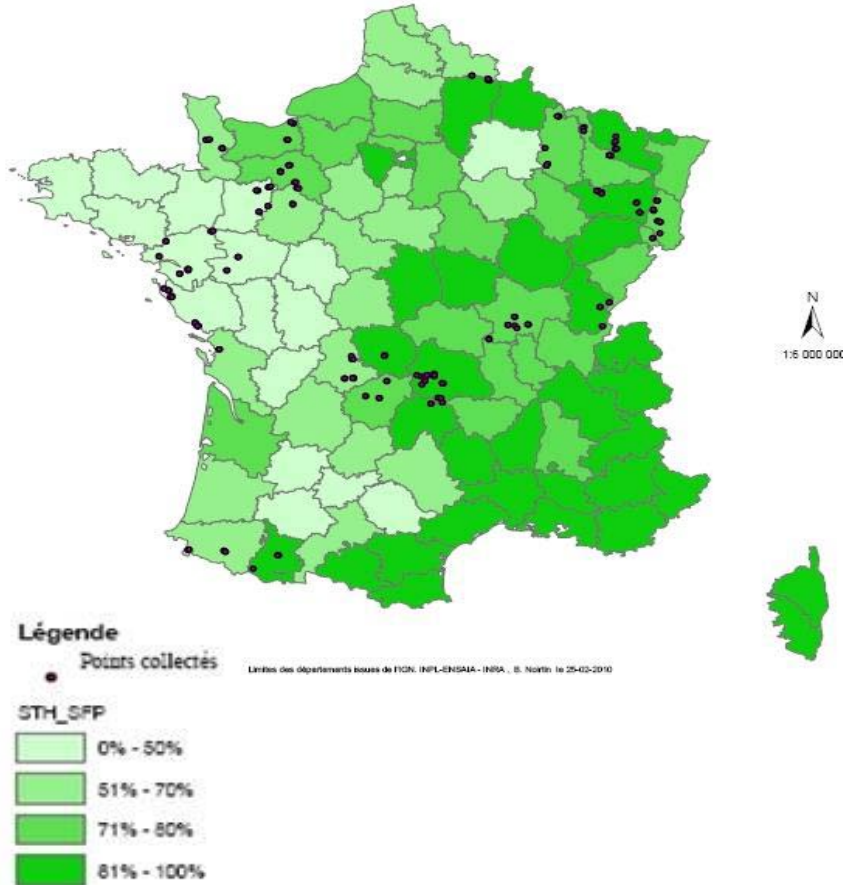
Agronomists and ecologists classify permanent grasslands for various purposes: describe, understand or predict.

In this program, the objective was to build a classification to predict forage and environmental services



Based on the survey of a network of permanent grasslands over a large gradient of pedo-climatic conditions and management practices

The network of grasslands



78 farms with more than 50% permanent grasslands (> 10 years) in the forage production area

- Recording of practices
- Analyses of the role of grasslands in the forage system

➔ A database of 1500 plots:
*Definition of **10 forage services** according the main use, the quality of the forage and the type of animals*

➔ **190 selected for a survey during 2 years**

The survey and the measurements



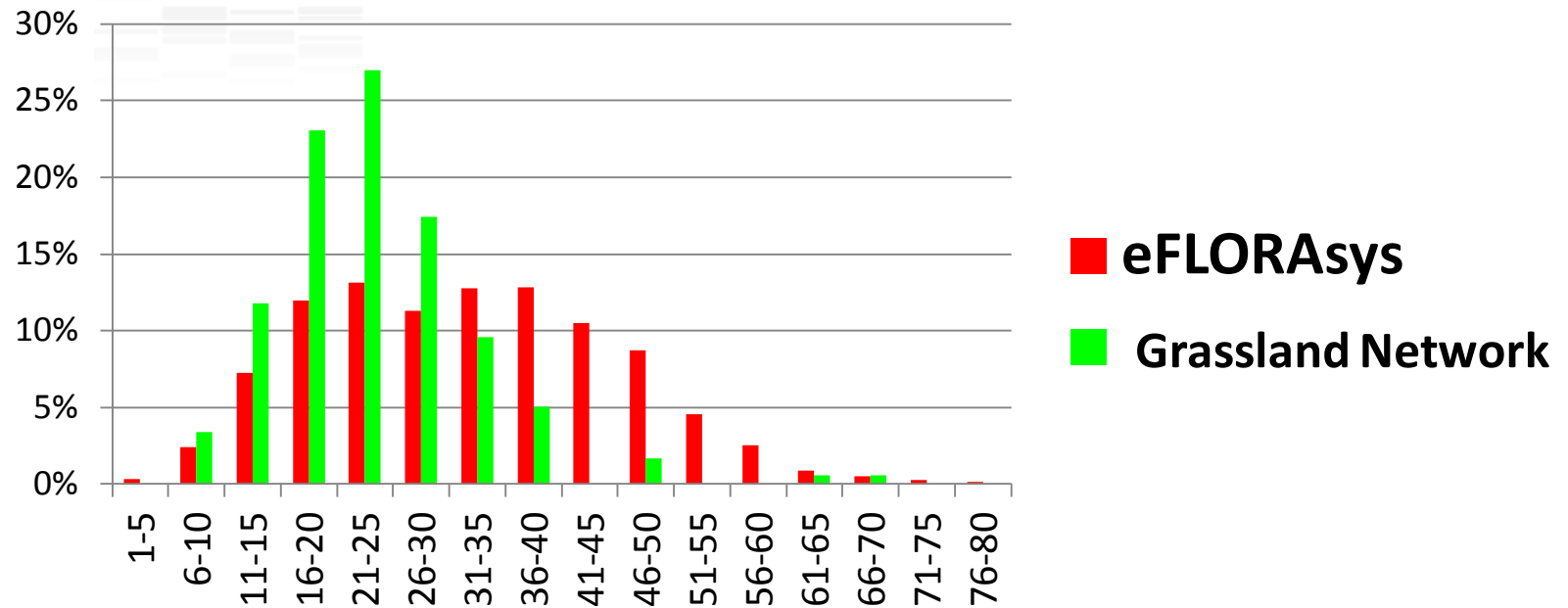
- ✓ Botanical composition
 - Botanical inventory in spring 2009
- ✓ A detailed recording of management practices (cutting, grazing, fertilisation...)
- ✓ Grass samples in exclosures:
 - 4 samples/year: beginning and late spring, summer and autumn regrowths
 - Biomass production, Functional composition, Nutritive value



1520 samples →



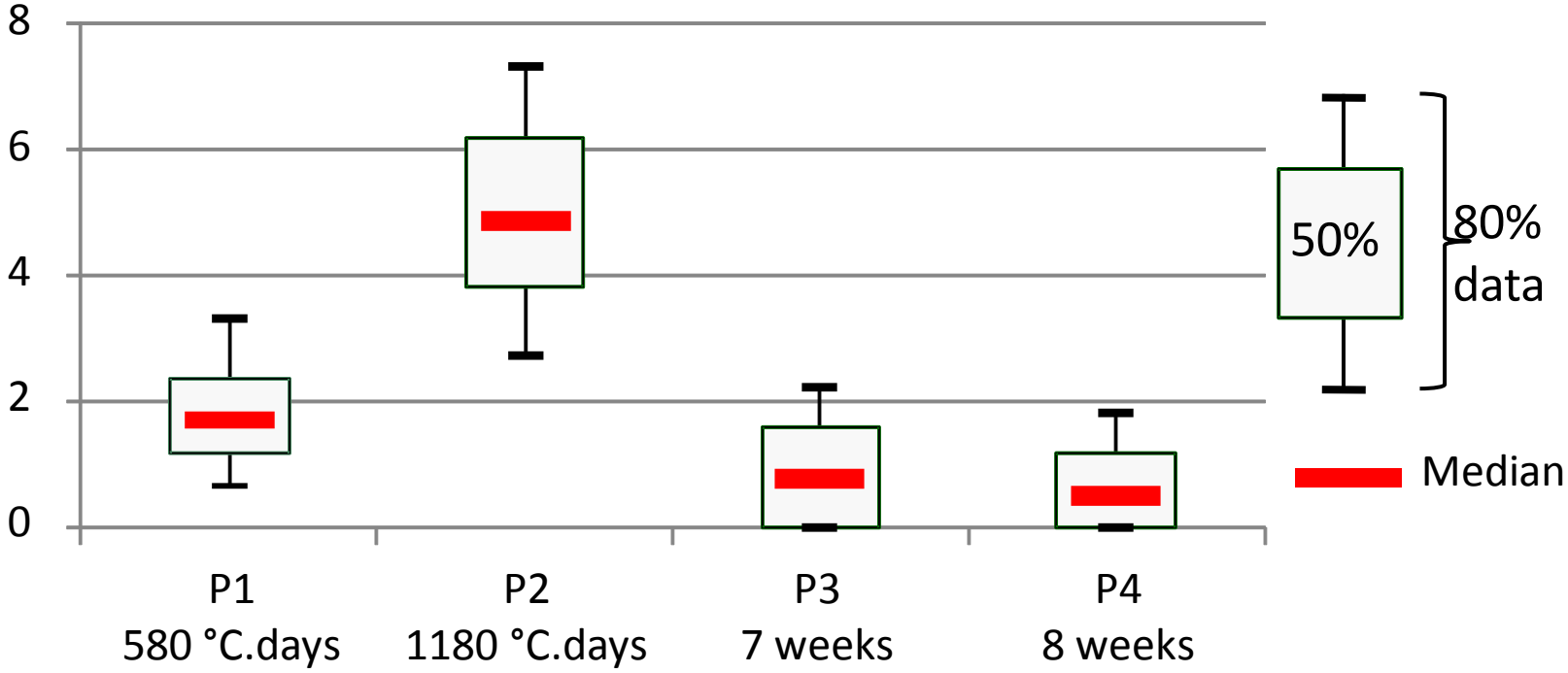
A relatively low biodiversity



- ✓ A mean species richness of 24 in the network, in contrast to 32 species for the 4326 grasslands in the database eFLORAsys
- ✓ No protected species
- ✓ But this does not mean that grasslands of the network have a low environmental value

The biomass production across the season

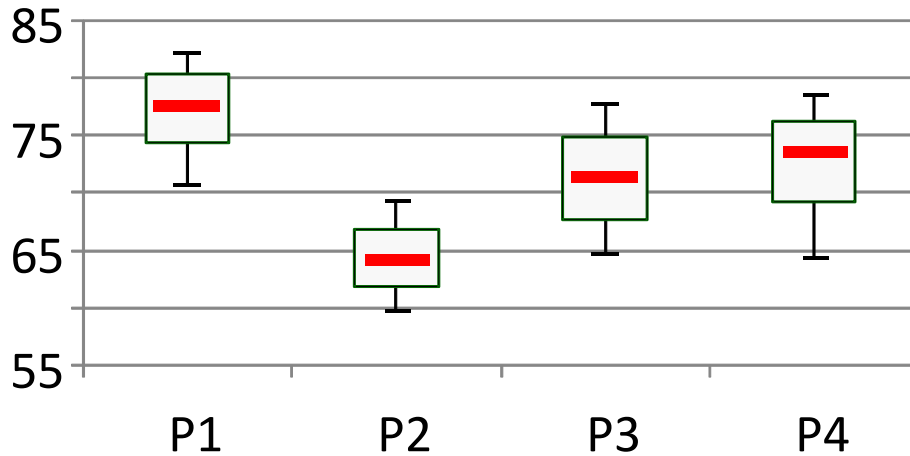
Biomass (T of DM /ha)



°C.days : sum of temperature from 1st February
P1: beginning of spring, P2: end of spring (accumulation)
P3: summer regrowth, P4: autumn regrowth

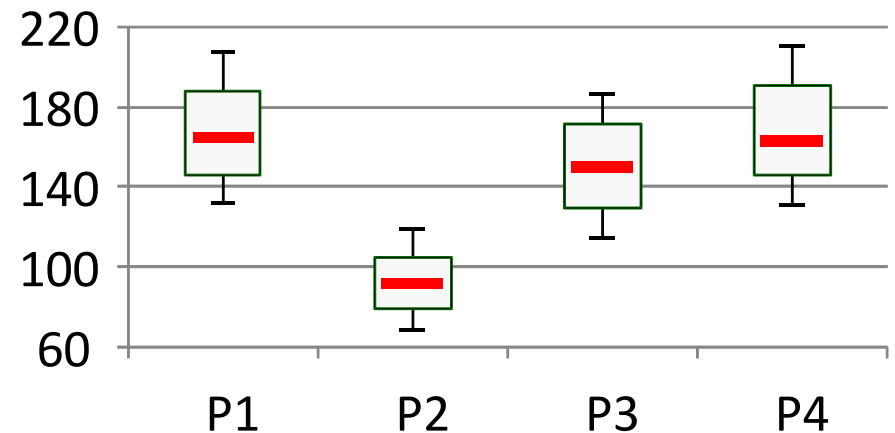
The nutritive value across the season

Predicted OM digestibility (%)



P1: beginning of spring,
P2: end of spring (accumulation)
P3: summer regrowth,
P4: autumn regrowth

Crude protein content (g/kg DM)

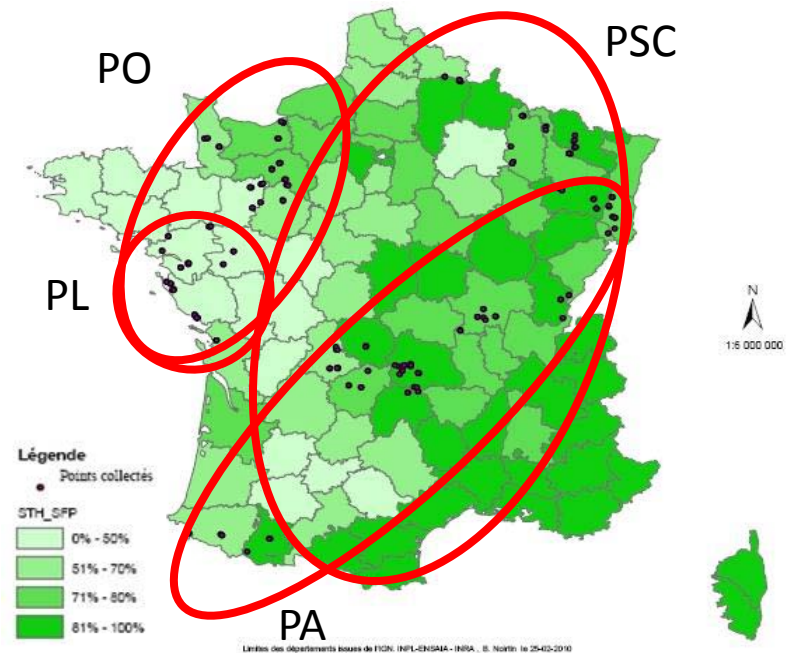


The grassland classification

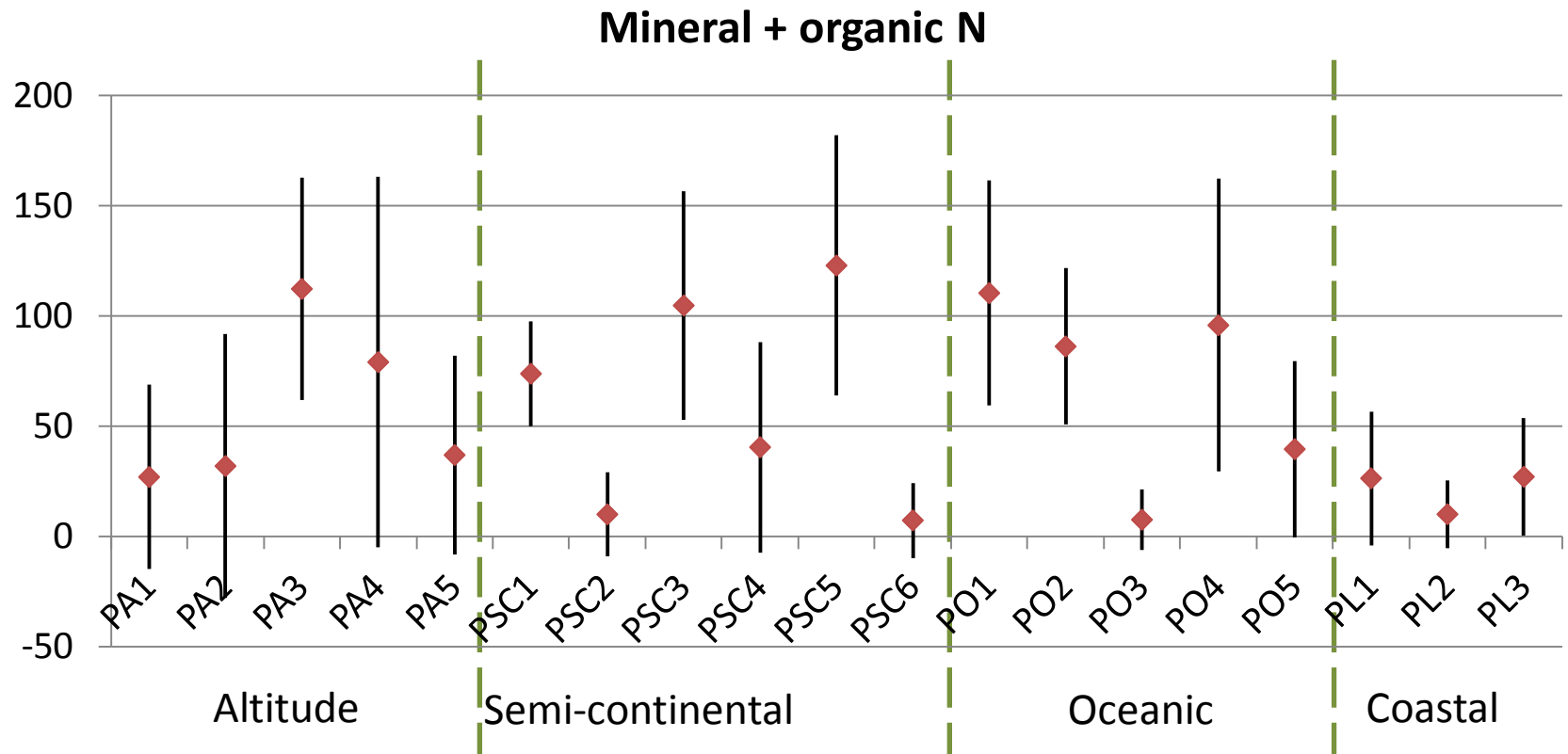
- ✓ **19 types based on botanical composition:** presence and dominance of species, functional types (types of grasses, legumes, forbs)
- ✓ **An identification key organised in 5 levels**
 - Geography and altitude
 - Soil and water regime
 - Proportion of forbs and legumes
 - Main use of the grassland
 - Level of fertilisation

19 grassland types :

- PA: Altitude (>600m) grasslands (5 types)
- PSC: Semi-continental grasslands (6 types)
- PO: Oceanic grasslands (5 types)
- PL: Coastal grasslands (3 types)

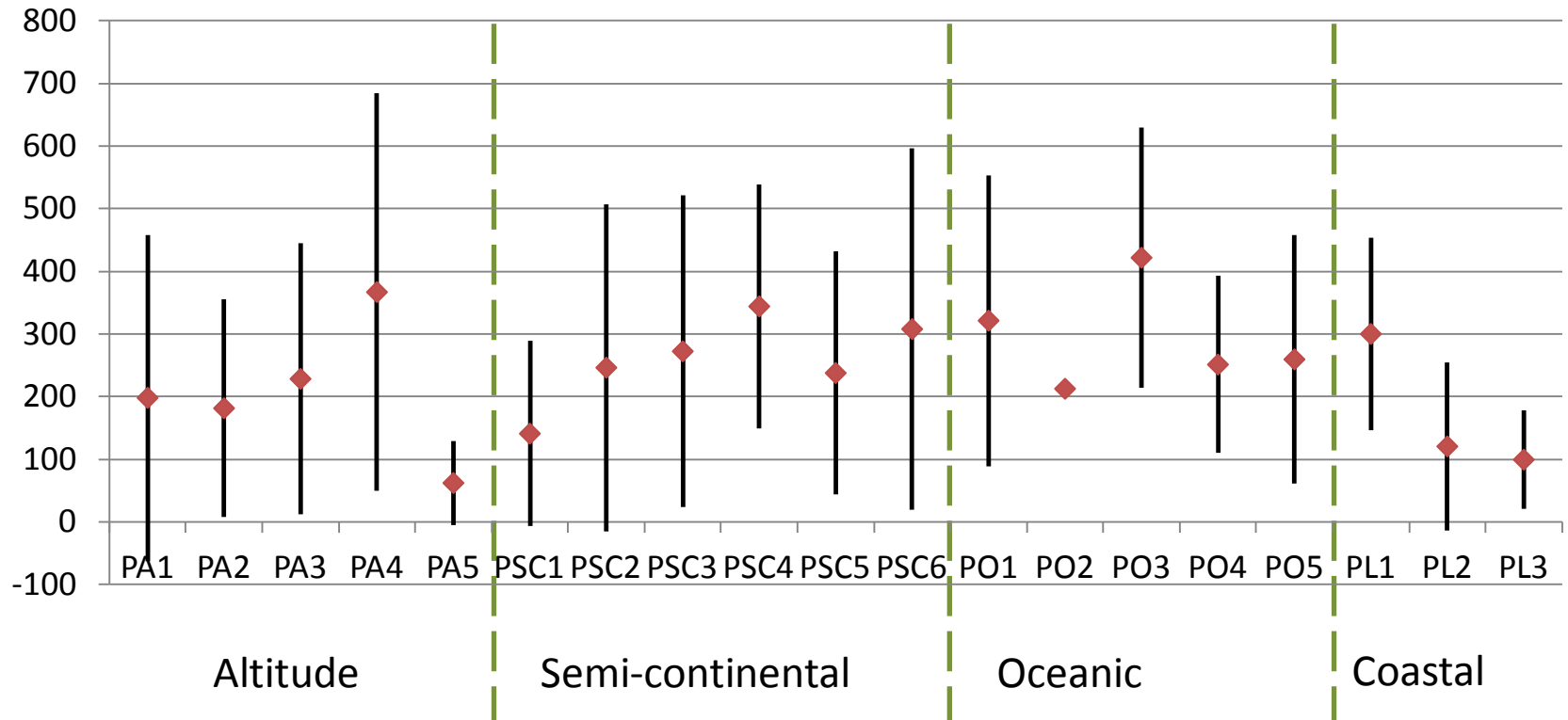


The management practices: fertilisation



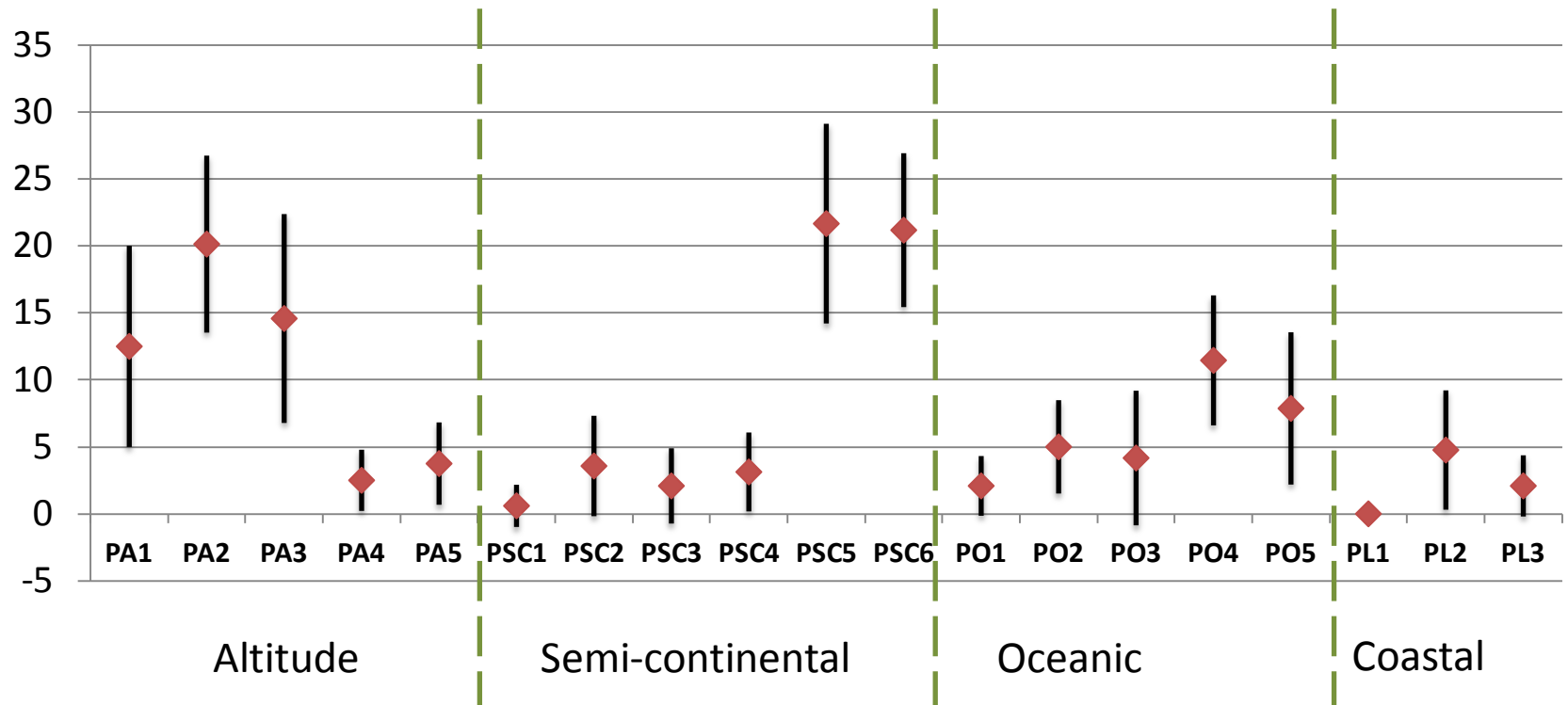
The management practices: Intensity of grazing

Number of days grazed (in days.LU/ha)



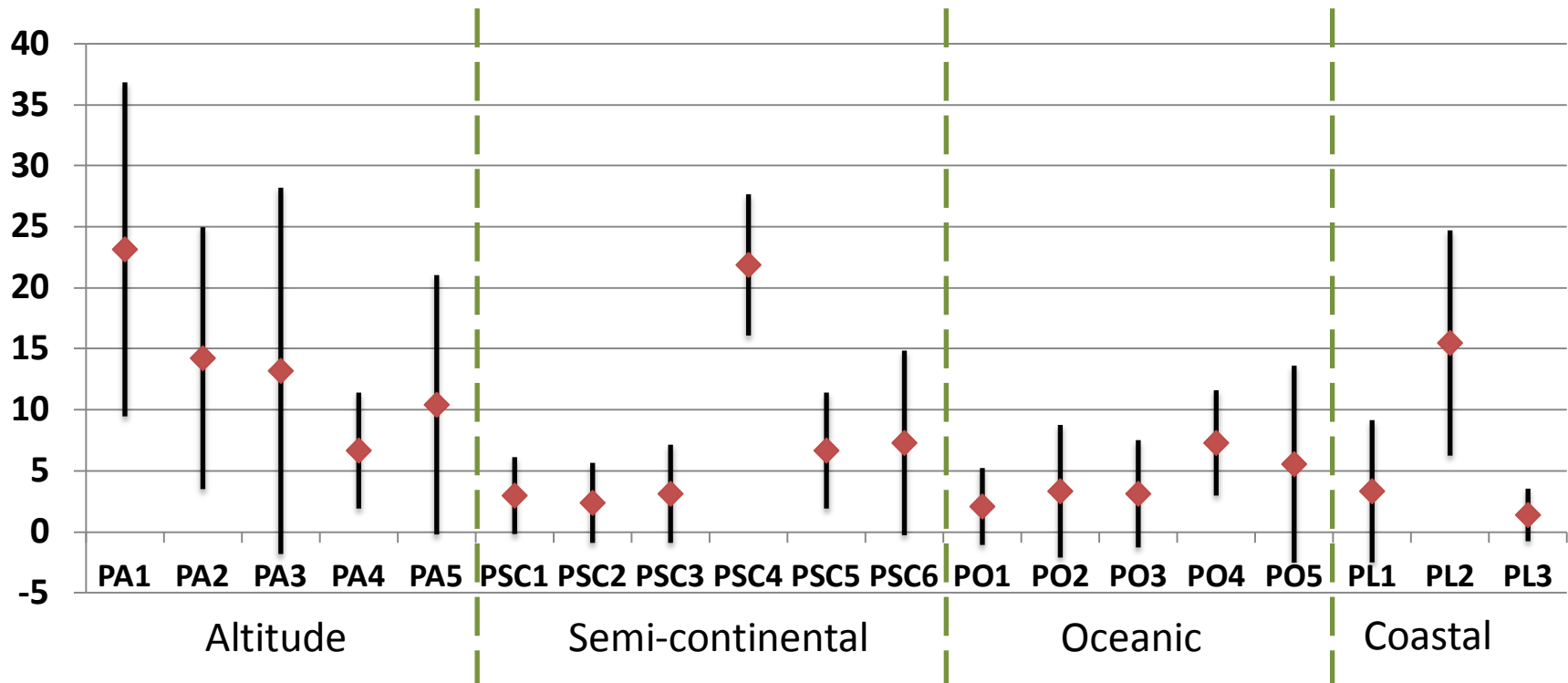
The vegetation of the types

Proportion of legumes in end of spring



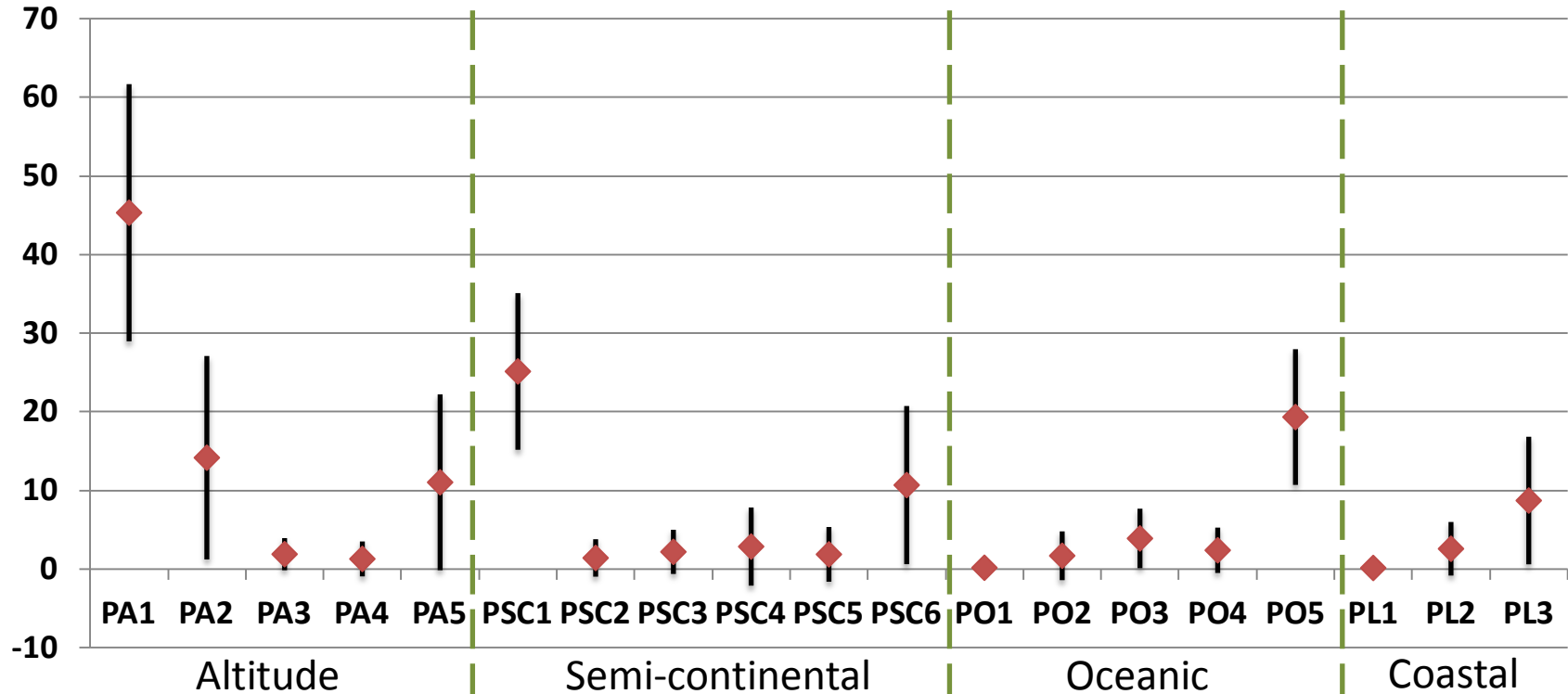
The vegetation of the types

Proportion of forbs in end of spring



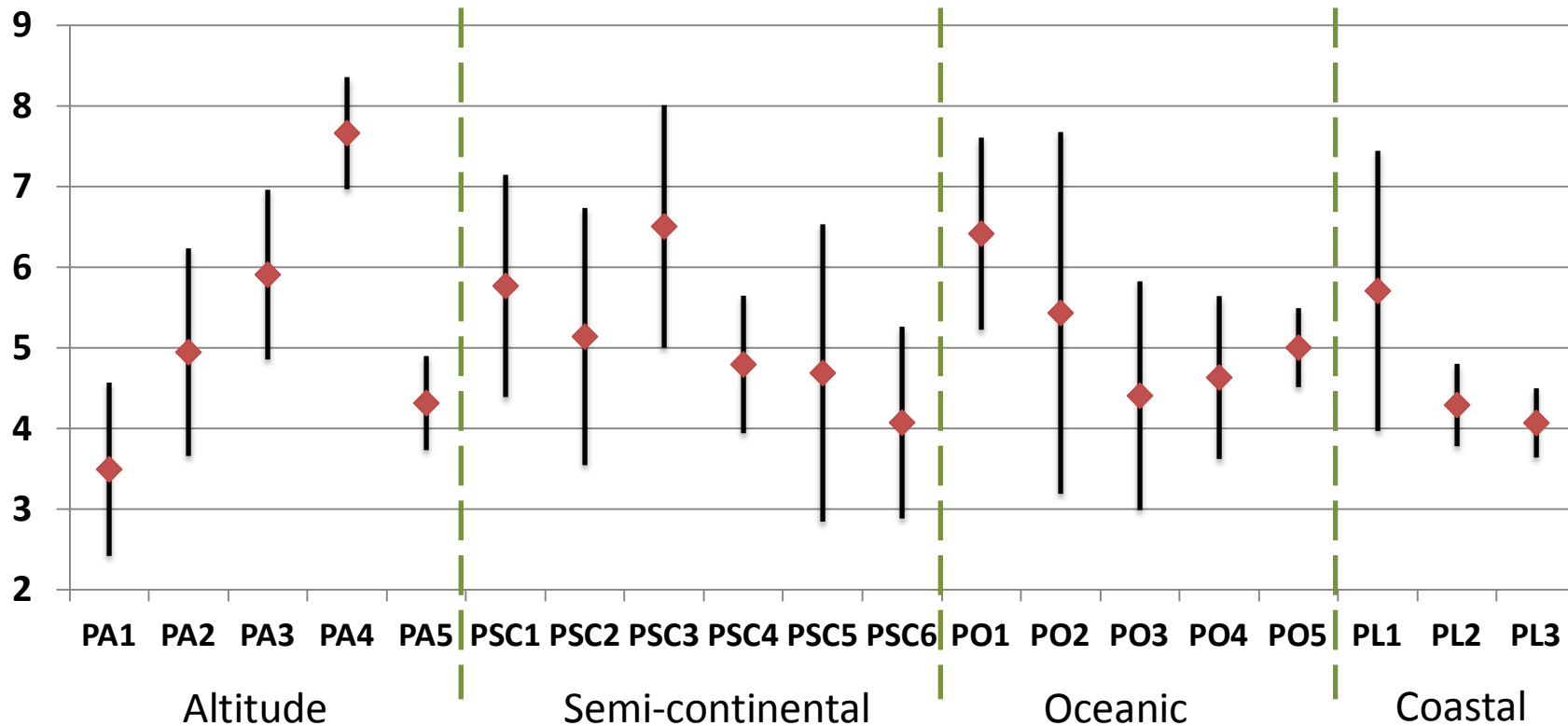
The vegetation of the types

Proportion of conservative grasses (functional type C)

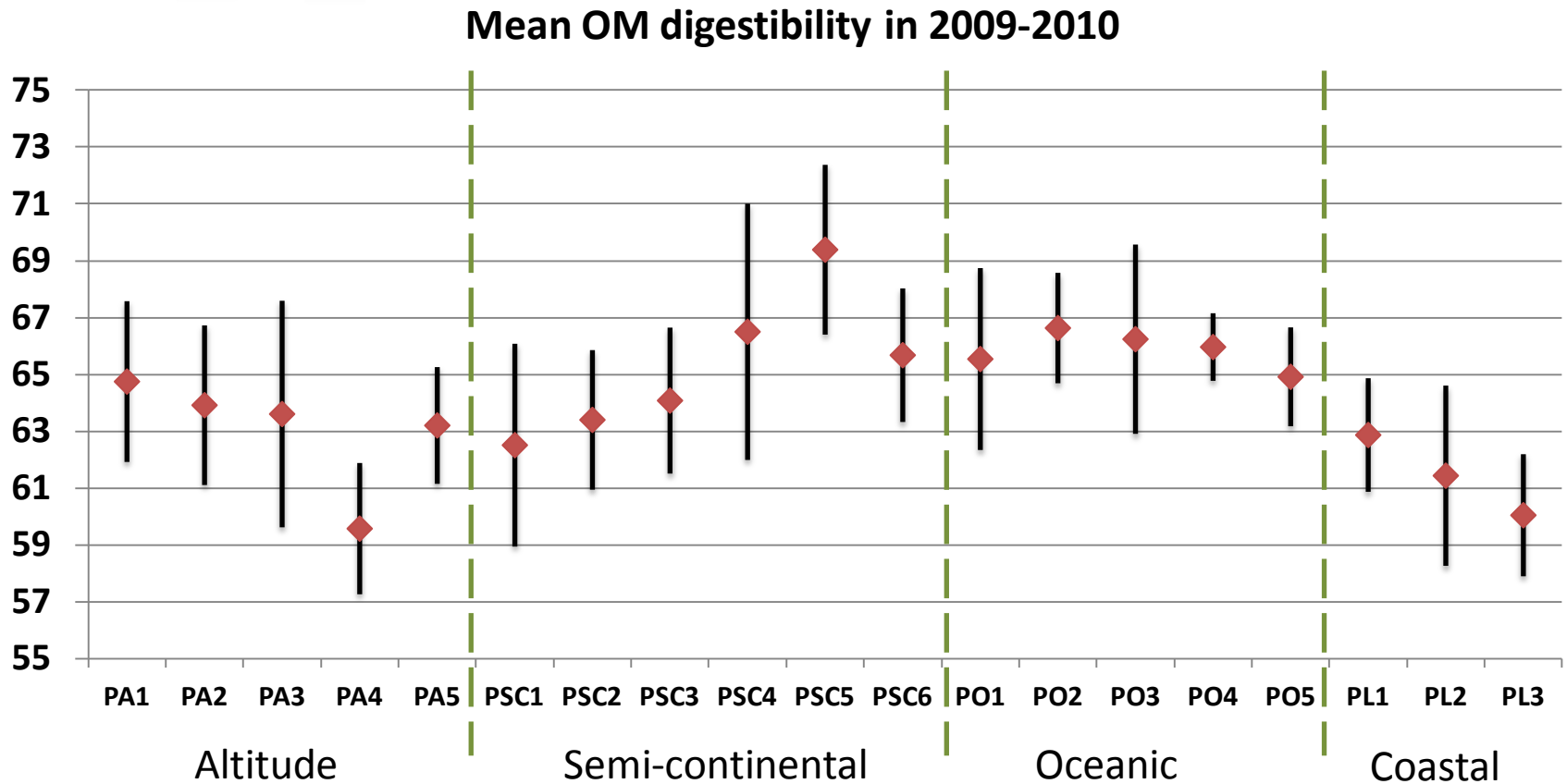


The production of the types

Mean biomass production of 2009-2010 in T DM/ha/year

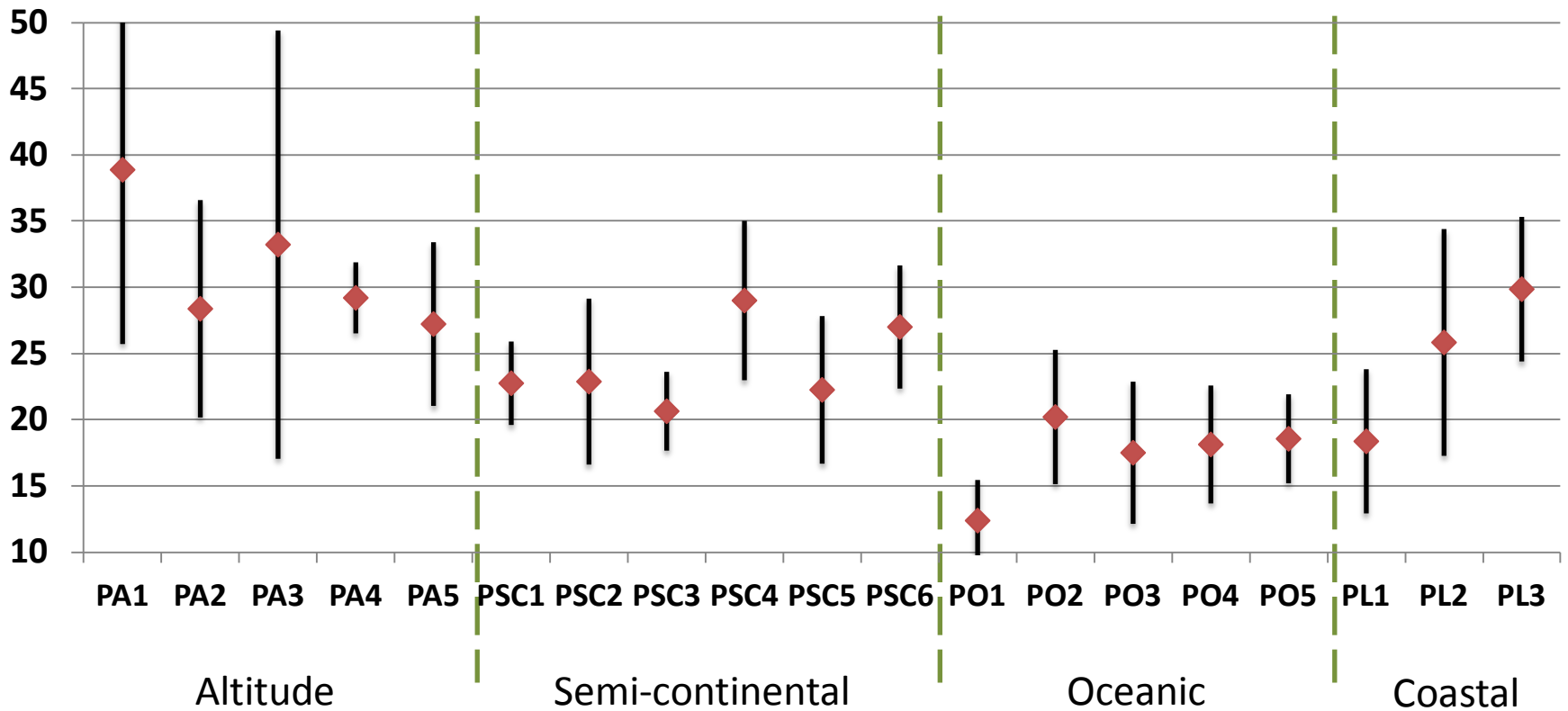


The nutritive value of the types

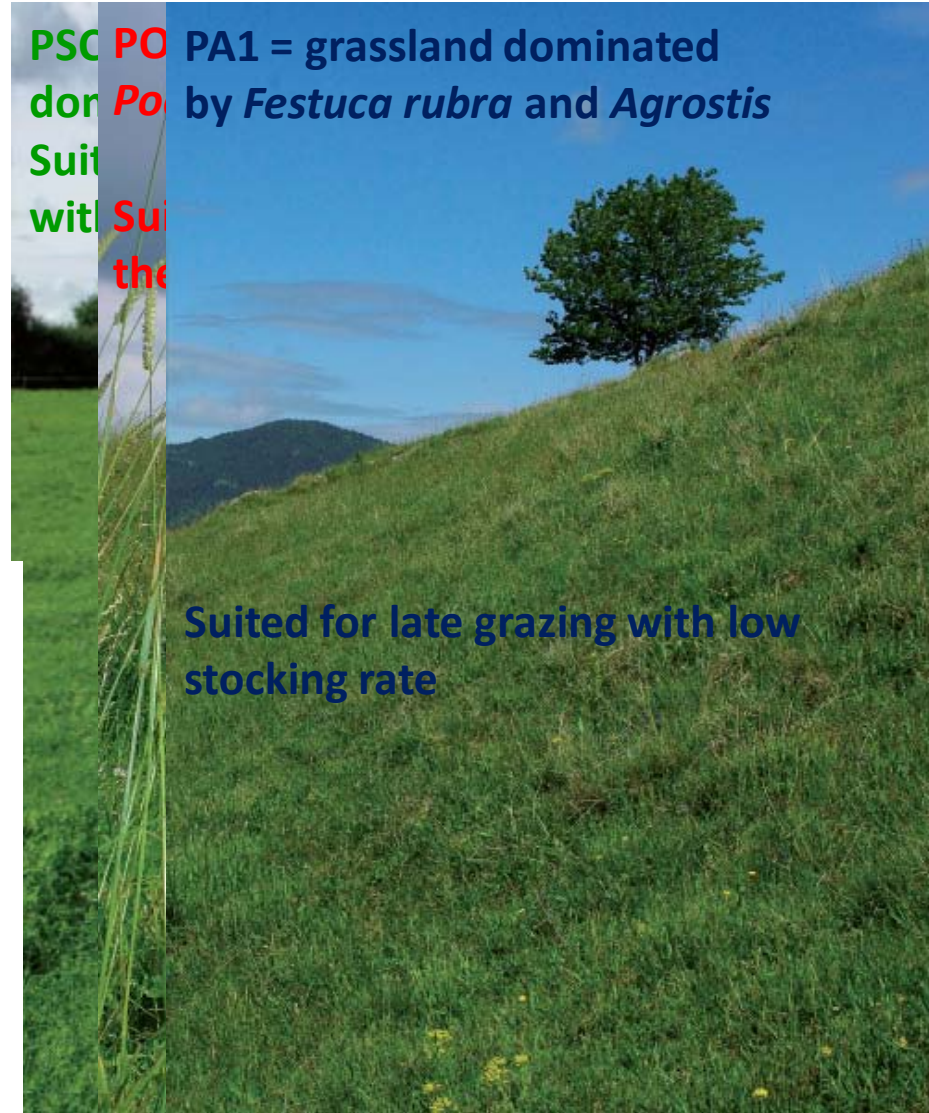
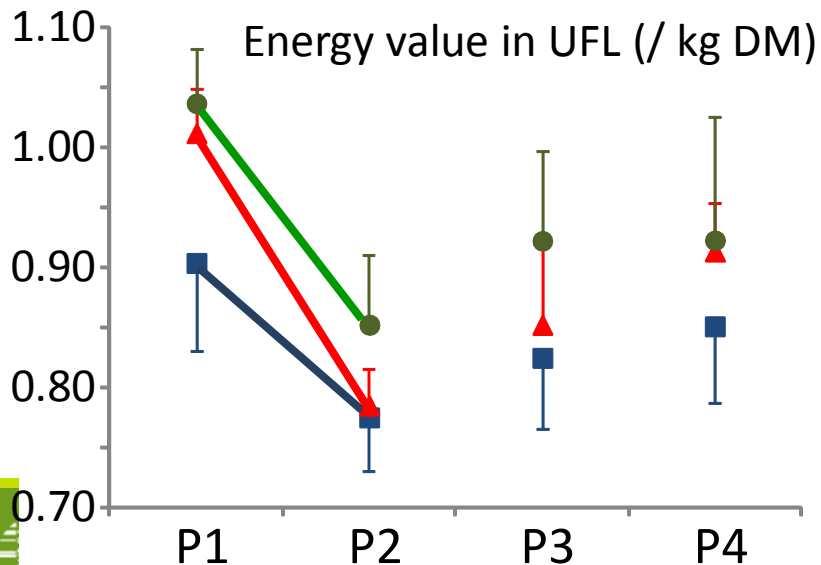
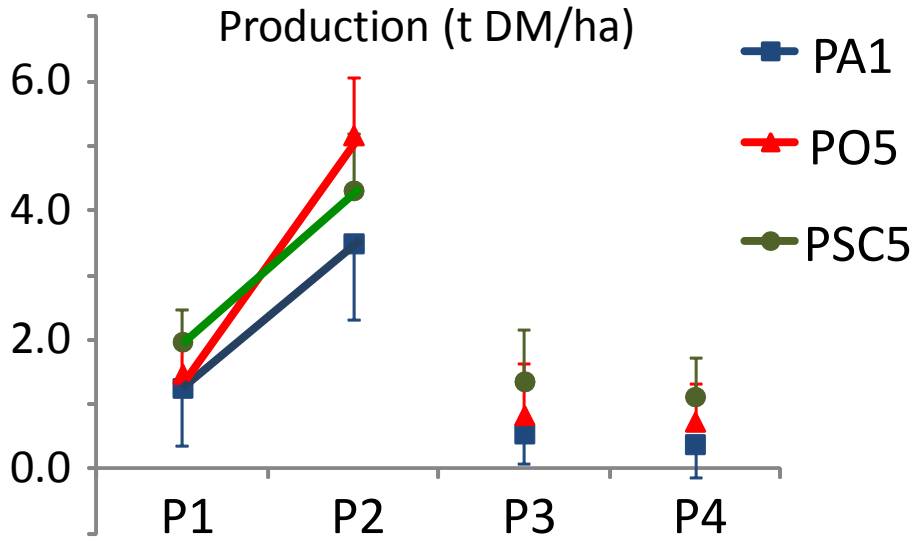


The biodiversity of the types

Species richness



Different types of grasslands for different forage services





Conclusion

A tool that:

- ✓ Characterize and quantify the diversity of permanent grasslands and of their forage and (some) environmental services
- ✓ Describes the intra-annual dynamic of permanent grasslands and gives reference data for the management

Future prospects:

- ✓ Need to complete the evaluation of environmental services (carbon storage...) and of forage services (links with milk and meat quality, animal health...)
- ✓ Extension at an European level ?

Thanks for your attention

To know more about this work:

- ✓ A book published by Institut de l'Élevage (in French)



Scientific papers :

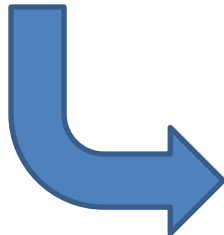
- ✓ MICHAUD A., PLANTUREUX S., AMIAUD B., CARRÈRE P., CRUZ P., DURU M., DURY B., FARRUGGIA A., FIORELLI J.L., KERNEIS E., BAUMONT R., 2012. Identification of the environmental factors which drive the botanical and functional composition of permanent grasslands. *The Journal of Agricultural Science*, 150, 219-236.
- ✓ MICHAUD A., ANDUEZA D., PICARD F., PLANTUREUX S., BAUMONT R., 2012. Seasonal dynamics of biomass production and herbage quality of three grasslands with contrasting functional compositions. *Grass and Forage Science*, 67, 64-76.
- ✓ ROSSIGNOL N., ANDUEZA D., CARRÈRE P., CRUZ P., DURU M., FIORELLI J.-L., MICHAUD A., PLANTUREUX S., POTTIER E., BAUMONT R., 2013 Assessing population maturity of three perennial grass species: Influence of phenology and tiller demography along latitudinal and altitudinal gradients *Grass and Forage Science*, DOI:10.1111/gfs.12067.
- ✓ A. MICHAUD, S. PLANTUREUX, E. POTTIER AND R. BAUMONT, 2014. Links between functional composition, biomass production and forage quality in permanent grasslands over a broad gradient of conditions *The Journal of Agricultural Science*, doi:10.1017/S0021859614000653

The elaboration of the classification

From the botanical composition in
the exclosures (2009 et 2010)



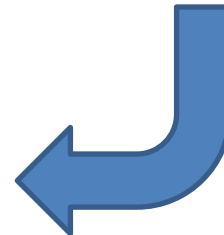
15 types of grasslands that
explain the forage services



From the botanical inventory
(exhaustive botanical composition in
2009)



12 types of grasslands that explain
environmental services
(biodiversity, pollination)



Final synthesis
19 grassland types