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Survey of the biodiversity-productivity relationship in Swiss summer pastures

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Agroscope





Introduction & Motivation

- Summer pastures are an important land use in Switzerland (5300 km², 35% of agricultural land, 13% of surface)
- Summer pastures provide a number of services:
 - Fodder production
 - Biodiversity
 - Soil protection
 - Carbon sequestration
 - Recreation
 - Landscape aesthetics
 - Tradition





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Questions

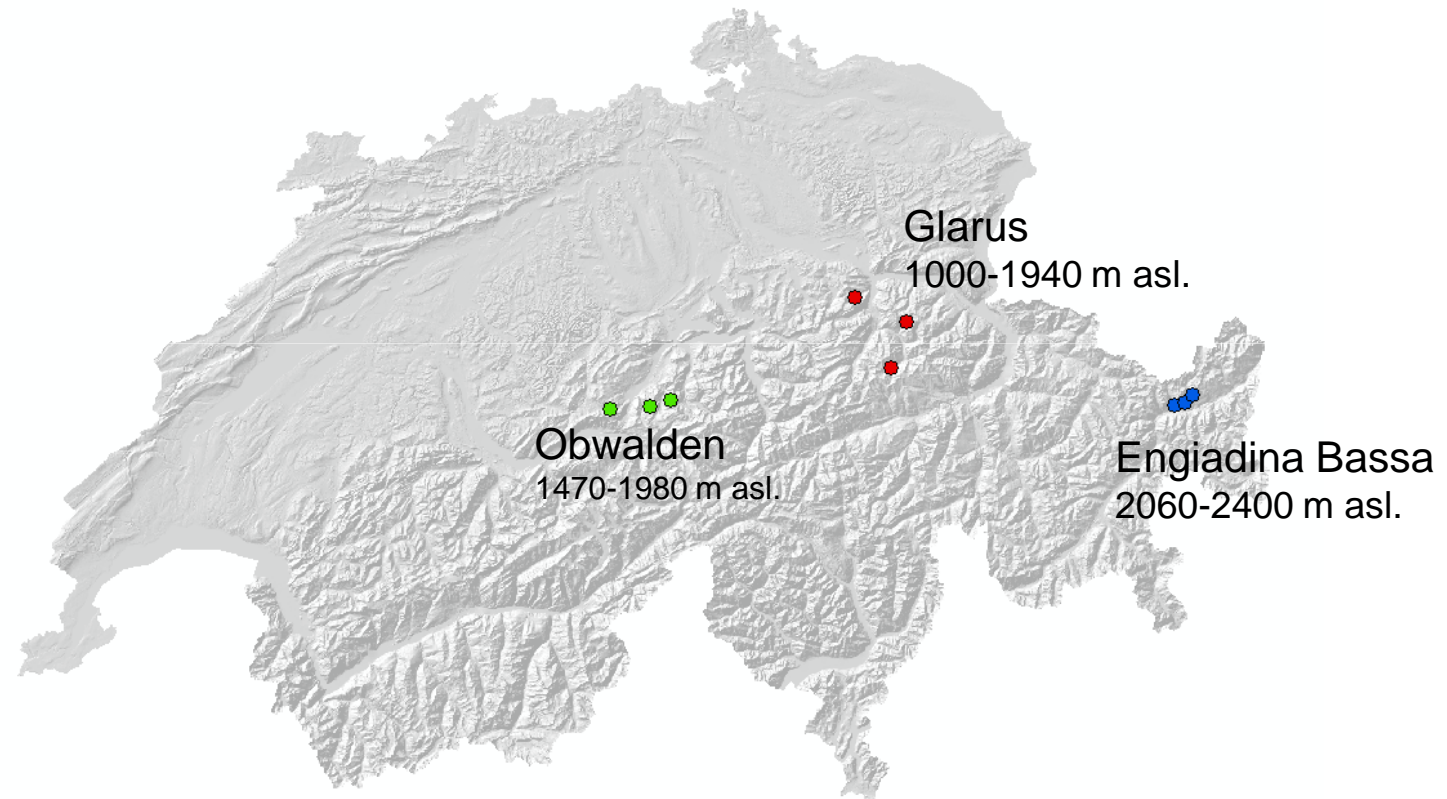
How are ecosystem services affected by changes in management and how can the services be optimised at farm and regional level?

1. How are productivity and plant species richness of summer pastures related to each other?
2. What is the effect of management, topography and environment?



Materials and Methods

9 summer farms in 3 regions of Switzerland





Materials and Methods

Biomass production measured with exclusion cages (2 regions) and with fences (1 region).

Plant species richness was recorded on a 5x5 m² area

Some missing values
-> 54 plots in total



Plant species composition was classified into predefined phytosociological classes using Soerensen distance.

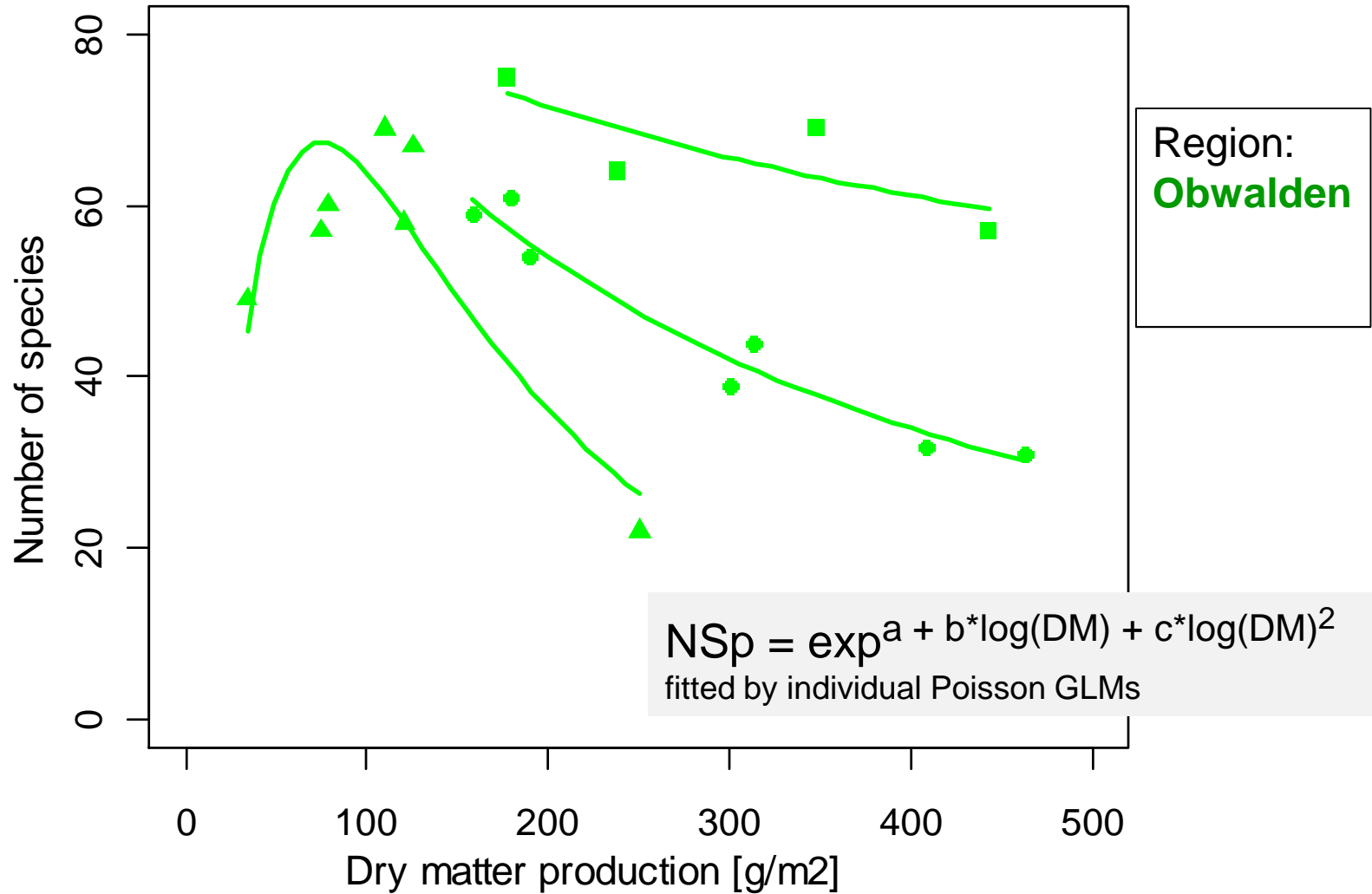


Regrouped vegetation types

Group	Characteristics	Alliances
1	Dry and semi-dry pastures	Mesobromion, Seslerion
2	Fertile mesic pastures	Trisetion, Cynosurion, Poion alpinae
3	Fertile humid pastures	Cynosurion, Rumicion, Calthion
4	Nutrient-poor mesic pastures	Nardion, Caricion curvulae
5	Nutrient-poor humid pastures	Nardion, Calluno-Vaccinion, Caricion ferrugineum
6	Wet pastures and meadows	Calthion, Molinion, Caricion fuscae

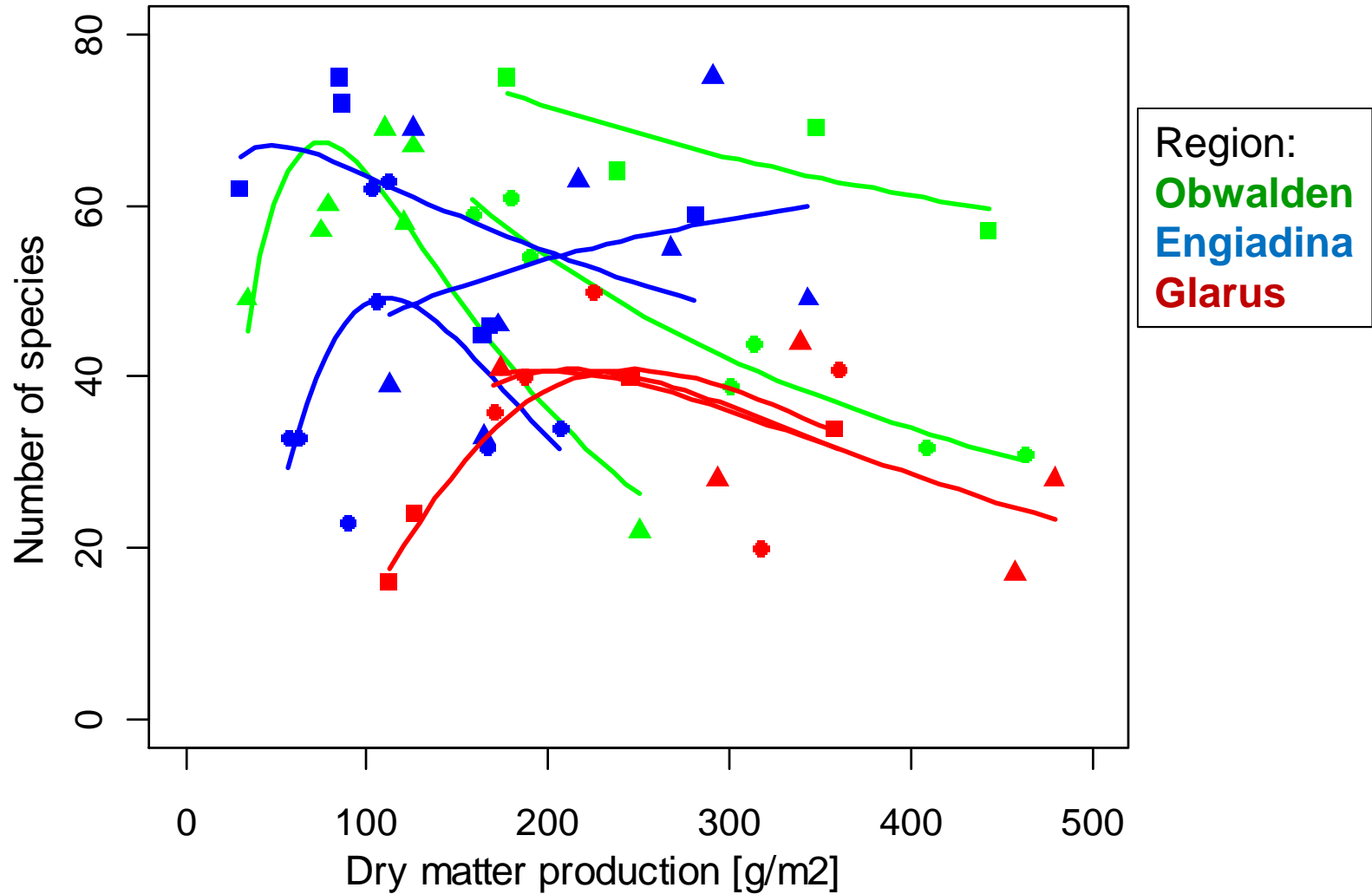


Results: productivity vs. no. of species



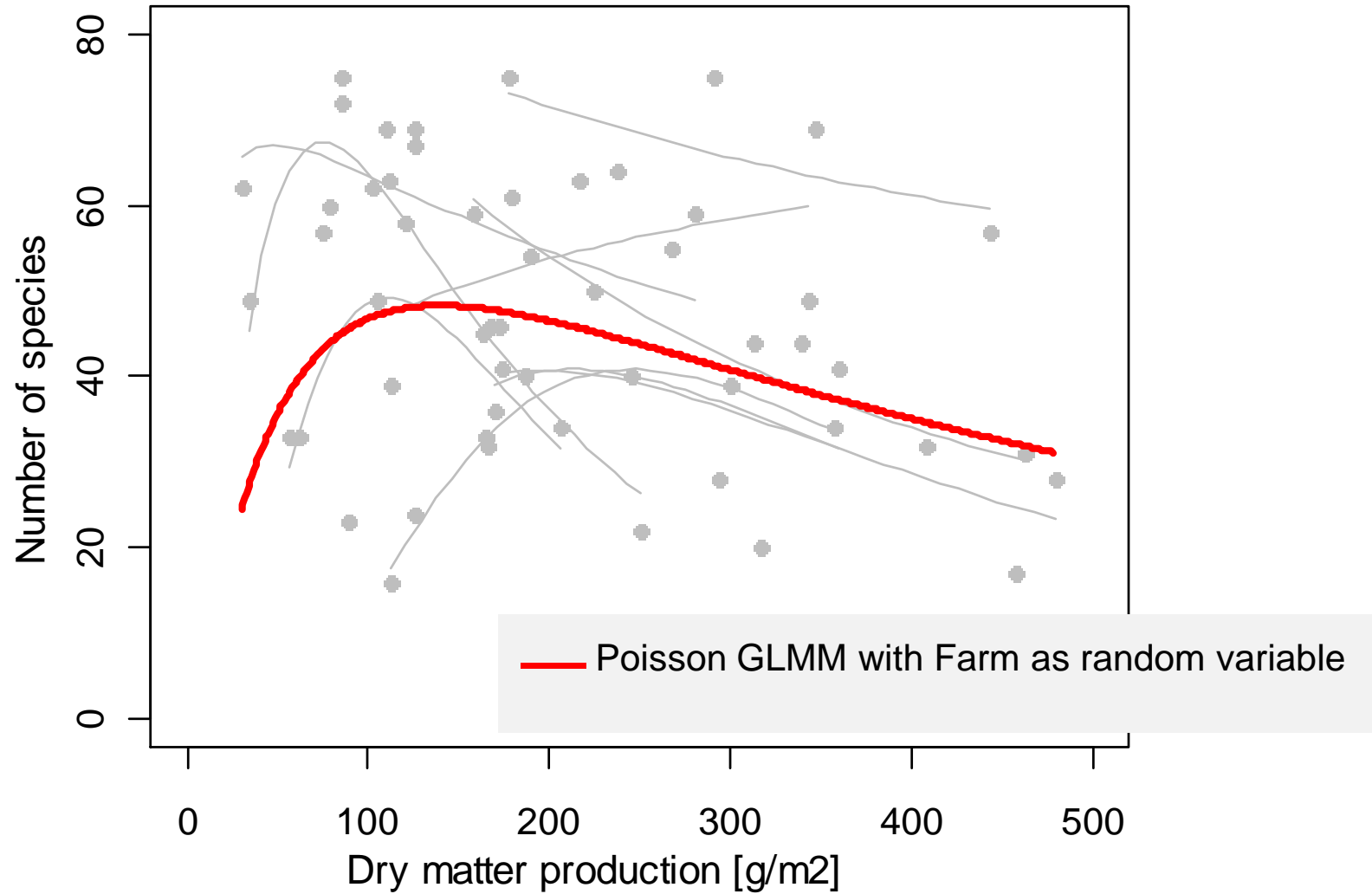


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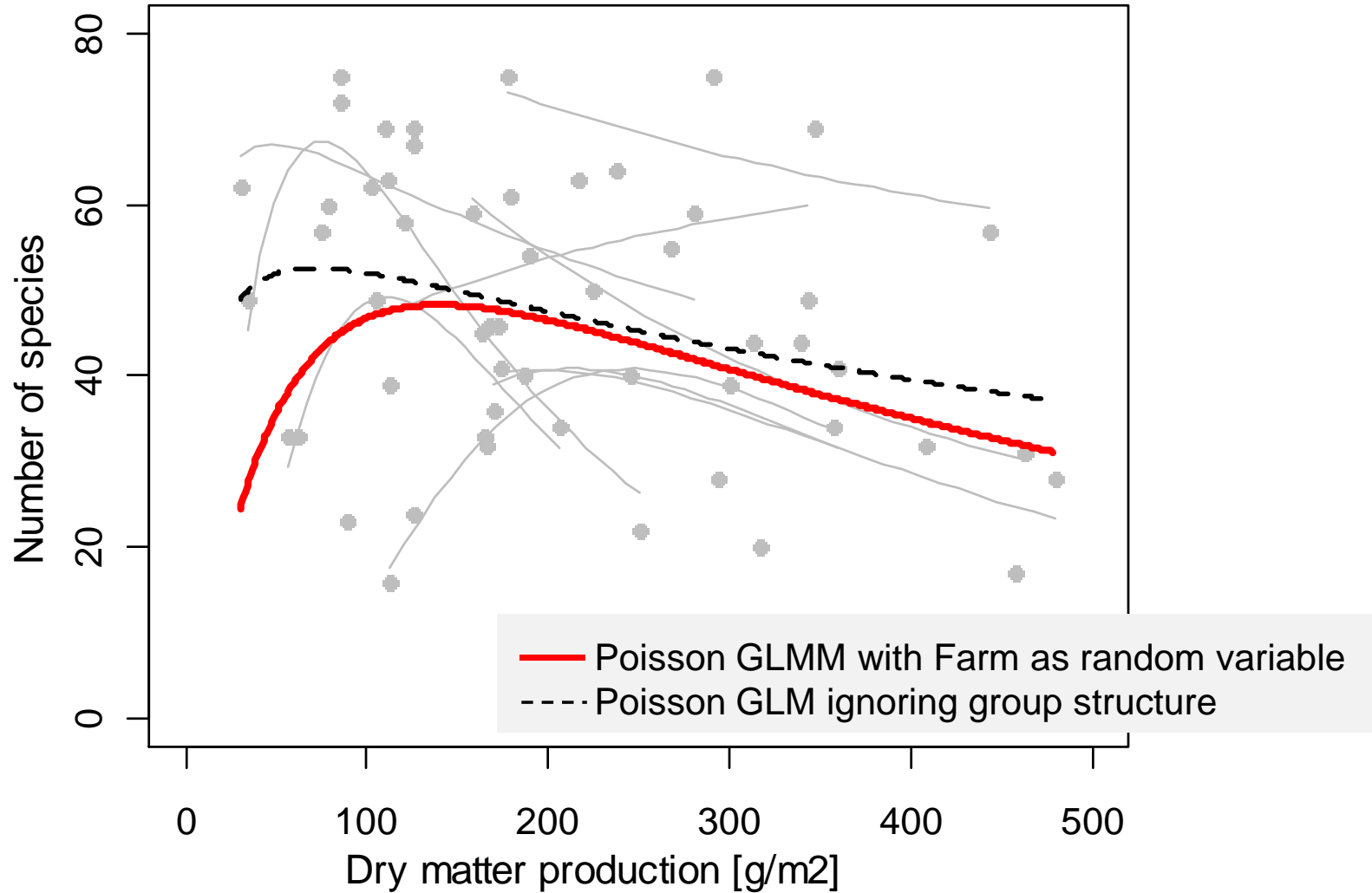


Overall relationship





Overall relationship





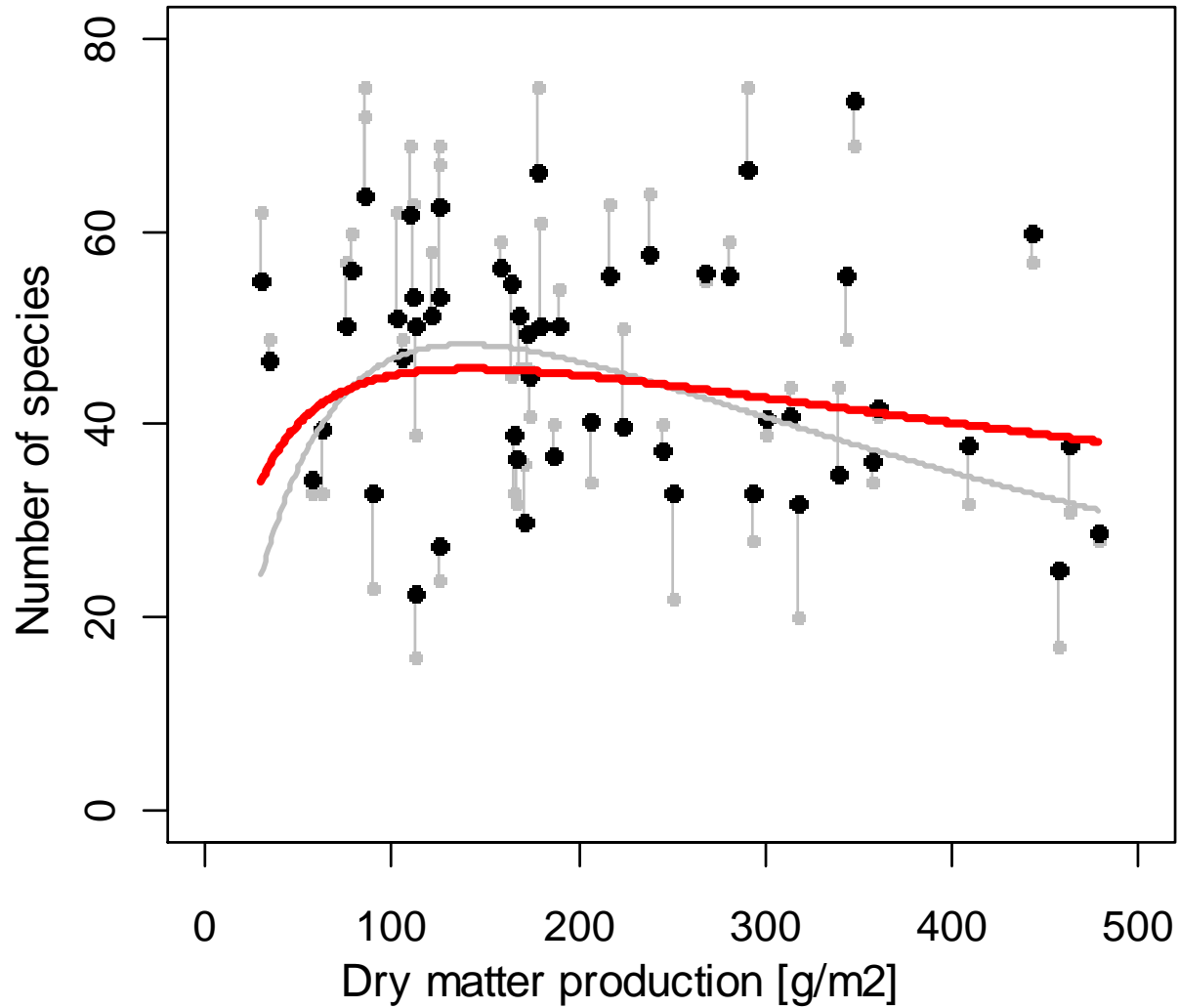
Effect of environment on no. species

Poisson GLMM with number of species as dependent and „Farm“ as random variable

	Sign	χ^2	Df _{effect}	Pr ($>\chi^2$)
log(DM)	-	2.85	1	0.09 (*)
log(DM)²	-	4.39	1	0.03 *
Slope	+	9.7	1	0.002 **
Altitude	-	1.47	1	0.22 ns
Distance	+	0.18	1	0.67 ns

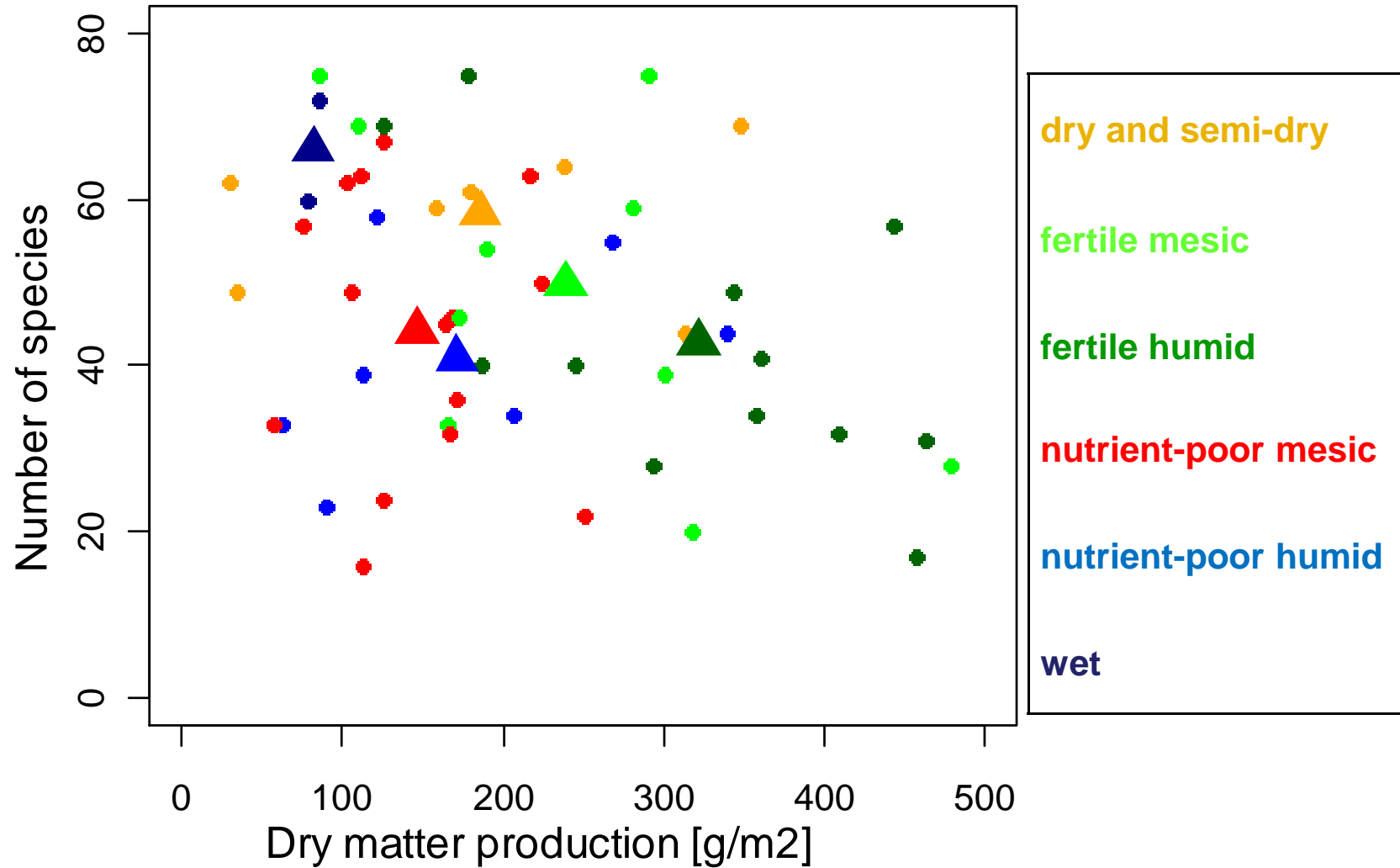


Including environment





Distribution of vegetation groups





Summary

- Evidence for a hump-shaped relationship between productivity and plant species richness in summer pastures.
- Over-all variation is large but the relationship is closer for individual farms.
- The number of species is also explained by topographic variables and vegetation types. These are likely correlated to management.



Practical relevance

- On summer farms, the species-richest vegetation may not necessarily be the least productive.
- *Mesobromion*, *Poion alpinae* and species-rich *Nardion* provide fodder and species richness.
- Medium-productivity summer pastures should receive more attention by farmers and authorities.





Thank you!

