Plant functional trait expression in the Rengen Grassland Experiment (RGE)

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Introduction

- Plant functional trait expression in the Rengen Grassland Experiment has been investigated in order to improve our understanding on the response of grassland vegetation to nutrient gradient under controlled *ceteris paribus* conditions.

Methodology

- The RGE is located in the Eifel Mountains (Germany) at an altitude of 475 m. Plots are fertilized and cut twice per year but not grazed since 1941. Fertilizer treatments are unfertilized control (A), Ca (B), CaN (C), CaNP (D), CaNPKCl (E) and CaNPK$_2$SO$_4$ (F).

Photo: M. Hejcman

- Categorical traits of communities were derived from plant species composition determined immediately before first cut throughout four consecutive years (2005 – 2008) and from trait data base (LEDA, BIOLFLOR).

Figure 2 Ellenberg Indicator Value (EIV) for nutrients in relation to samples scores of axis 1 of the RDA presented in Figure 1. ** significant at 0.01 level.
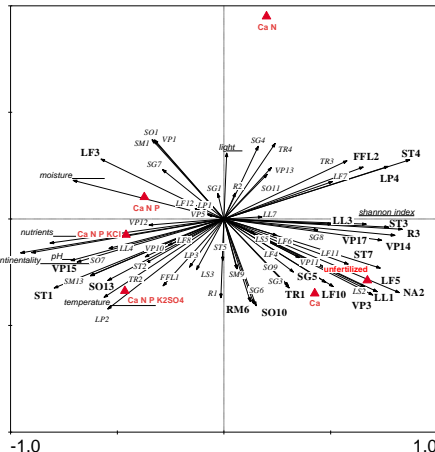

$$y = -1,11x + 5,016$$
$$R^2 = 0,88 **$$

Figure 1 Ordination diagram displaying plant functional trait attributes and EIV values in relation to fertilizer treatments as a result of the RDA in the RGE. Traits exhibiting significant differences among treatments (p<0.05) are in bold.
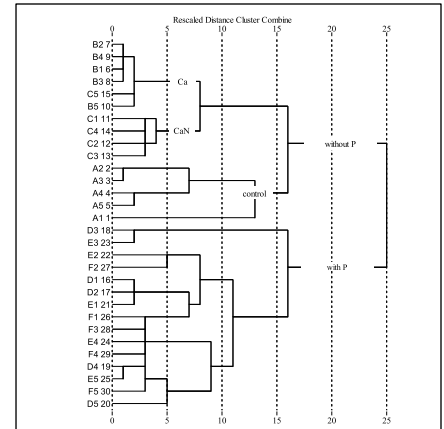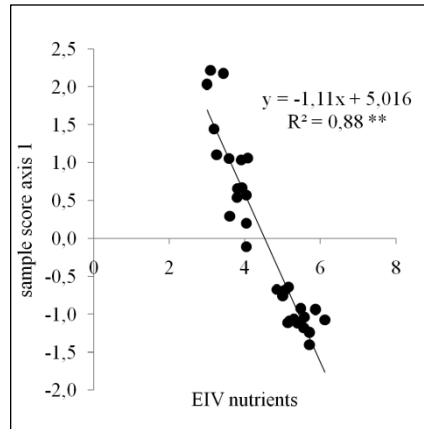

Figure 3 Dendrogram of experimental plots in the RGE clustered based on combinations of their categorical plant functional traits (four years average of data, 2005-2008). Indices are followed by plot numbers (replicates) and series number of data set.

Results

- Redundancy analysis (RDA) revealed high similarity of categorical traits in CaNP, CaNPKCl and CaNPK$_2$SO$_4$ treatments, but a distinct differentiation to CaN and Ca treatments and unfertilized control (Figure 1).
- Sample scores of axis 1 in RDA were negatively correlated with Ellenberg Nutrient Indicators (EIV) (Figure 2).
- Cluster analysis identified distinct clusters of traits in the treatments in relation to P and N application (Figure 3).

Discussion and conclusions

- Long-term fertilizer application induced significant variation in categorical traits allowing the identification of trait based strategy of adaptation of plant communities in response to environmental gradient.
- Differentiation of plant community properties and competitive ability among fertilizer treatments can well be explained by combination of categorical response traits.
- Functional traits contribute differently to segregation of functions within plant communities and they are differently important with respect to niche colonization and survival of the species.

Schellberg, J.*, Möseler, B.M., Kühbauch, W., Rademacher, I.F., 1999. Long-term effects of fertilizer on soil nutrient concentration, yield, forage quality and floristic composition of a hay meadow in the Eifel mountains, Germany. Grass and Forage Science, 54, 195-207.