The Role of Grasslands in a Green Future

Threats and Perspectives in Less Favoured Areas

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Vegetation monitoring of extensively cultivated floodplain grasslands in the lower Havel valley, north-east Germany

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Abstract

This paper deals with the effect of extensive management on grassland vegetation in a riverine floodplain area that was predominantly managed intensively before 1990. The analysis is based on vegetation surveys of 61 permanent plots in the floodplain of the Lower Havel River (German Federal State of Brandenburg). We used cluster analysis, regression analysis, correspondence analysis and ANOVA for the statistical evaluation of the data. The vegetation relevés were classified into 5 vegetation groups, which differed greatly in their site-specific characteristics. The average ecological Ellenberg values for nitrogen were negatively correlated to measured values of species diversity. After extensive grassland management extending over 20 years, the highest fodder values were mainly found in plant stands located on moderately moist to weakly wet sites. The historical land use before 1990 significantly affected the actual botanical diversity of the meadows. The findings underline the importance of unploughed and longstanding extensively managed permanent meadows as species pools for the promotion of biodiversity in grasslands that have, historically, been intensively managed.

Keywords: land use intensity, species diversity, extensification, vegetation development

Introduction

Species-rich floodplain grasslands in North Germany have been severely threatened by habitat loss and intensification over the past 50 years (Krause et al., 2011). During this period, broad grasslands of the Lower Havel valley in north-east Germany have been drained and converted into intensive agricultural land with the consequence of species impoverishment (Haase, 1994/95). After 1990, the study area at the Lower Havel was included in programmes of nature conservation because of its great importance as a bird habitat. We installed permanent plots in that area and examined the state of the grassland vegetation based on vegetation surveys after 20 years of extensive use. The analysis allowed us to determine whether different levels of land-use intensity before 1990 influenced the species diversity of the actual grassland vegetation.

Materials and methods

The study area is located north-west of Berlin along the Lower Havel River in the German Federal State of Brandenburg and encompasses approximately 6100 ha, including the polder region Große Grabenniederung and parts of the neighbouring recent Havel River floodplains. This grassland area has been used for agriculture since 1992 on a low-input basis. As part of a monitoring programme, 61 permanent plots (size: 25 m²) were installed in that area between 1993 and 1999. The historical land use before 1990 was determined through stakeholder interviews in 2000. We prepared vegetation relevés for half of the permanent plots in 2010.
Species abundance was determined using the expanded Braun-Blanquet scale (Mühlenberg, 1989). Based on the vegetation data, the mean indicative Ellenberg values for moisture and nitrogen, and the mean abundance-weighted values for fodder quality according to Briemle et al. (2002) were calculated. The diversity measures were the species number and ‘the number of species indicating extensive use’ (method description in Kaiser et al., 2010). For the statistical analysis, we used (i) cluster analysis, (ii) detrended correspondence analysis (DCA), (iii) regression analysis and (iv) ANOVA. The analyses were carried out with PC-ORD (McCune and Mefford, 1999) (i), CANOCO (Ter Braak and Šmilauer, 2002) (ii) and SPSS 12 (iii / iv).

**Results and discussion**

The cluster analysis resulted in 5 vegetation groups that represent a wide habitat range. To clarify the ecological differences, the relevés of the groups are presented in ordination diagrams with passive explanatory variables (Figure 1). The mean nitrogen values and species diversity measures are oriented in the opposite direction.

**A: Mesic moist to dry sites**

- Mesic moist river-meadows
- Species-rich mesic moist meadows (Sanguisorba officinalis-type)
- Agrostis capillaris/Festuca ovina-community

**B: Wet sites**

- Agrostis stolonifera/Alopecurus geniculatis-seasonally flooded grassland
- Reeds and wet meadows
- Passive explanatory variable

Figure 1. Ordination diagrams (DCA) of the vegetation relevés. The classification of the vegetation groups resulted from a cluster analysis.

\[ y = 1.856x^2 - 0.172x + 0.403 \]
\[ R^2 = 0.447 \]
\[ (P < 0.001) \]

Figure 2. Mean fodder value in relation to the mean moisture value.
Grassland stands of moderately moist to weakly wet sites had the best fodder qualities (Figure 2) because the seeded forage grasses of the former intensive-use period were most abundant at this moisture level. The historical land use before 1990 significantly influenced the number of extensive-grassland species (Figure 3), even though all plots have been managed on a low-input basis for approximately 20 years. The long-standing extensively used meadows, which had not been ploughed historically, showed the highest species diversity by far.

Figure 3. Mean number of extensive species subject to historical land use. The differences are significant (Tukey, $P<0.05$) except between categories 3 and 4.

**Conclusions**

The results underline the importance of unploughed and long-standing extensively managed permanent meadows for nature conservation. These meadows are species pools for the improvement of biodiversity in neighbouring grasslands that, historically, have been intensively cultivated.

**References**