

Landscape vs. Management: Impacts on biodiversity in agro-ecosystems of the Swiss Alps

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Abstract

Agro-environmental schemes, which aim at counteracting the loss of biodiversity in agricultural landscapes, focus on management restrictions with little respect to site conditions or landscape scale. The aim of this investigation was to evaluate the effectiveness of the ecological compensation program in the Swiss Alps and to identify and quantify impacts on grassland biodiversity at different spatial scales.

In the Northern Alps of Switzerland intensively managed meadows, meadows of the ecological compensation program, and pastures were chosen in 9 municipalities (n= 243). Plant and grasshopper species were surveyed. Plot site conditions were measured in field and extracted from the GIS. To describe the landscape, topography and land cover characteristics, i.e. land cover diversity, share of wooded and built-up area, were evaluated with a digital elevation model and a 100 m point raster layer of the Swiss land cover over 1 km². The accessibility of plots was calculated using a cost-distance surface. We tested which variables significantly contributed to explain the variability of species composition by variance partitioning. A Spearman rank correlation analysis was used to investigate the relation of site conditions and landscape characteristics to species richness.

In 8 of the 9 municipalities intensively managed meadows had the lowest species numbers. In 5 municipalities the species richness of pastures was the highest. For plant species composition, the model explained 13.5 % of variability, for grasshoppers 23.7 %. Management type, plot site conditions and landscape contributed similar proportions for the plant species model, while in the grasshopper species model plot site conditions (9.8%) and landscape characteristics (5.7 %) showed a much greater impact than management type (1.9 %). The elevation and the accessibility index were positively correlated to species richness of both plants and grasshoppers ($p < 0.001$), showing higher species richness at higher elevations and in remoter areas. Additionally, plant species richness was positively correlated to slope and grasshopper species richness to solar radiation ($p < 0.001$).

We conclude, that the ecological compensation programme is effectively protecting species richness of grasslands in the Northern Swiss Alps. Pastures also have a high potential for conservational issues. A grasshopper conservation strategy based on site conditions and landscape might lead to more success, especially in mountainous areas, where climatic conditions are a limiting factor for grasshopper species. The extensive management of the species rich remote plots must be maintained, therefore the accessibility of these plots should neither be improved, which might lead to an intensification, nor neglected in order to avoid abandonment.