Conference Volume	6th Symposium for Research in Protected Areas 2 to 3 November 2017, Salzburg	pages 513 - 515

The effects of mountain farming on biodiversity-monitoring and evaluation of vegetation changes on managed and abandoned mountain pastures in the Gesäuse National Park (Styria, Austria) in an eleven years timescale

Claudia Plank, Andreas Bohner, Thomas Wrbka

Abstract

Mountain pastures, a characteristic element of the Austrian cultural landscape, cover large parts in protected areas. In our study, we analysed the impact of management and abandonment of mountain pastures on phytodiversity in Gesaeuse National Park (Styria, Austria). Furthermore the effects of short-term shifts in management or climate change were investigated. Permanent plots were used to detect changes in plant species composition and plant species richness of managed and abandoned mountain pastures. Monitoring was realised in an eleven years timescale (2005-2016). A phytosociological characterization was performed. Additional analyses with indicator values were implemented. The relevance for nature protection was assessed with biodiversity indices (number of vascular plant species, Shannon diversity index and Evenness).

The plant species composition showed a few differences at each plot. No significant changes of phytodiversity have been observed during the monitoring period. Trends are visible. The highest phytodiversity was observed in plots of managed mountain pastures. Plant species richness and Shannon diversity index in plots of abandoned mountain pastures were significantly lower. In some abandoned mountain pastures heavy browsing by wild animals was observed. There, a high number of vascular plant species was found. No effects of climate change were observed. From nature conservation point of view, an extensive, site-adapted management should be continued in the Gesaeuse National Park.

Keywords

Nature conservation, mountain farming, preservation of cultural landscape, short-term monitoring, plant species composition, plant species richness, climate change

Introduction

Mountain pastures are a characteristic element of the Austrian cultural landscape. They often cover large parts in protected areas such as National Parks. Due to their diverse small-scale habitats with a locally adapted flora and fauna they are often hot spots for biodiversity. NIEDRIST et al. (2009) found that extensively managed mountain pastures belong to the species-richest ecosystems in Central Europe.

Since the beginning of World War II, many mountain pastures were abandoned due to intensification of grassland sites in the valley (NIEDRIST et al. 2009; BÄTZING 2003; EGGER & AIGNER 1999). Also mountain pastures in protected areas were concerned by that progress, leading to changes in biodiversity.

Nowadays, as a consequence of climate change, it is assumed that mountain farming can regain its original importance. The grazing period is restricted by the length of the growing season which may extend due to increase in temperature. In the long run, the rise in temperature may also cause changes in the plant species composition, possibly leading to an increase of the forage yield of mountain pastures which may further result in a higher stocking rate (BOHNER 2010).

In this study, permanent plots were used to detect changes in plant species composition and plant species richness of managed and abandoned mountain pastures at Gesaeuse National Park. In order to examine short-term shifts in management or climate change this study was conducted in 2016, after eleven years timeframe. Furthermore, the importance of sustainable mountain farming for phytodiversity was assessed. The following specific research questions were examined:

- Did the plant species composition and phytodiversity change within eleven years? If yes, which factors are responsible? Did the site-adapted management change or are influences of climate change visible?
- What is the impact of management and abandonment on phytodiversity (average number of plant species per plot, Shannon diversity index) of mountain pastures?

Study area

The study was conducted on six managed and abandoned mountain pastures in the Gesaeuse National Park in Austria (coordinates 47°35“, 14°38“), which is part of the LTSER platform Eisenwurzen (Long Term Socio-Ecological Research). Predominant rocks are northern limestone and dolomite rock. Characteristic soil types are calcareous brown loam and rendzina. The study region is influenced by a mild and damp central European/oceanic climate. The vegetation surveys were carried out between 1023 and 1691 meters a.s.l.. The grazing period lasts from June to September.

Methods

Altogether, 36 vegetation surveys on permanent plots were carried out to detect changes in plant species composition and plant species richness in an eleven years timescale. 36 additional vegetation surveys were realised. They were conducted between June and September 2016, according to Braun-Blanquet with a modified scale for species cover consisting of three subdivisions per Braun-Blanquet cover class. Only homogeneous vegetation plots were investigated. The size of each plot was 20 m². A cluster analysis, followed by non-metric multidimensional scaling and phytosociological characterisation of the vegetation surveys were performed. In addition, the Ellenberg indicator values were compared and analysed. ANOVA and GLM as well as post-hoc tests were used for tests of the statistical significance. The importance for nature protection was assessed through biodiversity indices (number of vascular plant species, Shannon diversity index and Evenness). Supposing that an extensive management of mountain pastures generates a higher phytodiversity than abandonment, categorical comparisons were implemented.

Results and Discussion

No significant changes of phytodiversity could be observed during the monitoring period. Small trends are visible. There were only slight changes in plant species composition and plant species richness during the eleven years timeframe. Also the Ellenberg indicator values did not change significantly. This is probably linked to the management. There were only minor changes in the number of grazing cattle, stocking rate and area of forage of the observed mountain pastures. We observed no effects of climate change, probably due to the short monitoring period.

In the present study, a positive effect of extensive grazing on phytodiversity was found. The vegetation plots of managed mountain pastures showed a significantly higher phytodiversity than the plots of abandoned mountain pastures (Fig. 1). The average number of vascular plant species was 54 in plots of managed pastures and 40 in plots of abandoned mountain pastures.

In Europe, a plant community is considered as species-rich if it comprises more than 50 different vascular plant species, mosses and lichens in an area of 100 m² (Hobohm 2005). In accordance to Niedrist et al. (2009), Maag et al. (2001) and Tasser et al. (2001), our study shows that the phytodiversity of extensively managed mountain pastures is remarkably high. Thus, mountain pastures can be very valuable for nature protection. The results are also in line with the Intermediate Disturbance Hypothesis (Connell 1978), claiming that a low intensity of disturbance, such as temporary grazing, leads to an increase of phytodiversity (Bohner et al. 2009; Niedrist et al. 2009).

In some plots of the abandoned mountain pastures, heavy browsing by wild animals, especially chamois and red deer, was observed. Nevertheless, a high phytodiversity was found with an average number of vascular plant species of about 45 per 20 m². According to studies of Tschöpe et al. 2004, Schütz et al. 1998 and Schreiber & Schiefer 1985 wild animals can modify the process of ecological succession by delaying the secondary succession and maintaining species richness over several decades. In combination with natural disturbance processes such as windthrow, avalanches and debris flows it may be possible that wild animals create a similar level of biodiversity like it can be found in extensively managed mountain pastures. However, the spatial scale would be different as on the one hand there would be less phytodiversity on average area but on the other hand the number of species-rich disturbance patches could be more frequent. Further investigations on that topic might be interesting for protected areas like National Parks, as they have designated zones where natural processes occur without human disturbance.

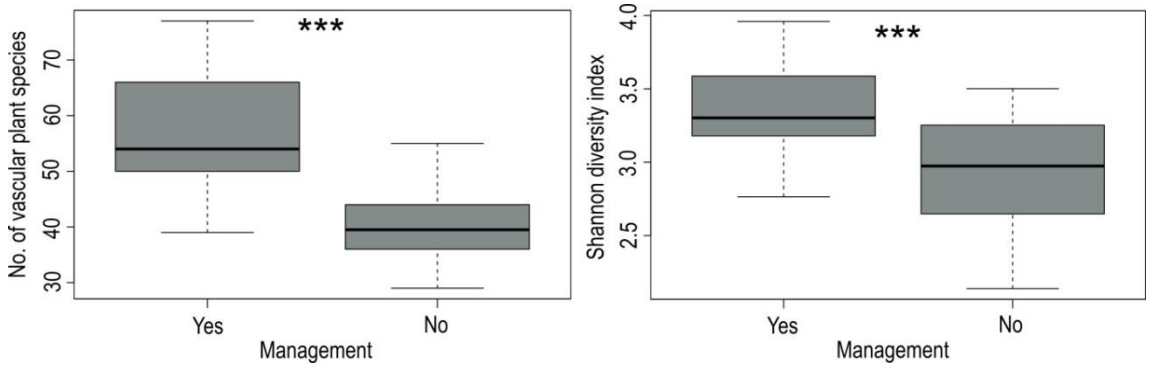

Figure 1: Phytodiversity of vegetation plots on observed managed and abandoned mountain pastures in the Gesaeuse National Park (n = 54, significance level after post-hoc test: p ≤ 0,001 = ***).

Conclusion

The results of this study demonstrate that sustainable agriculture in the form of extensive, site-adapted grazing of mountain pastures can contribute to species-rich mountainous ecosystems. However, it was also observed that wild animals can contribute to preserve a high phytodiversity, at least within an eleven years timescale. The analysis of vegetation changes provides a valuable data base for the development and implementation of further monitoring and management measures. Until now, no effects of climate change were observed.

Acknowledgements

We thank D. Kreiner and T. Hoebinger of the Gesaeuse National Park for providing us information and data about the study area. Special thanks also to O. Hofer from the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management who provided us management data of the observed mountain pastures.

References

BÄTZING, W. 2003. Die Alpen – Entstehung und Gefährdung einer europäischen Kulturlandschaft. 2. aktualisierte und völlig neu konzipierte Fassung. Verlag C.H. Beck.

BOHNER, A. 2010. Vegetationstypen und Pflanzenartenvielfalt auf österreichischen Almen. Lehr- und Forschungszentrum für Landwirtschaft Raumberg-Gumpenstein (Hrsg.): 16. Alpenländisches Expertenforum 2010, 11-18. ISBN: 978-3-902559-43-2.

BOHNER, A., HABELER, H., STARLINGER, F. & SUANJAK, M. 2009. Artenreiche montane Rasen-gesellschaften auf Lawinenbahnen des Nationalparks Gesäuse (Österreich). In: Tuexenia 29: 97-120. Göttingen.

CONNELL, J. H. 1978. Diversity in Tropical Rain Forests and Coral Reefs. Science 199, 1302-1310.

EGGER, G. & AIGNER, S. 1999. Naturschutz und Almwirtschaft in Kärnten. In: Kärntner Natur-schutzberichte, Band 4, 52-74.

HOBOHM, C. 2005. Was sind Biodiversity Hotspots – global, regional, lokal? Tuexenia 25, 379-386.

MAAG, S., NÖSBERGER, J. & LÜSCHER, A. 2001. Mögliche Folgen einer Bewirtschaftungsaufgabe von Wiesen und Weiden im Berggebiet. Ergebnisse des Komponentenprojektes D, Polyprojekt PRIMALP. Graslandwissenschaften ETH Zentrum, 8092 Zürich.

NIEDRIST, G., TASSER, E., LÜTH, C., DALLA VIA, J. & TAPPEINER, U. 2009. Botanisch-ökologische Untersuchungen des Wirtschaftsgrünlandes in Südtirol unter besonderer Berücksichtigung der Bergmähder. In: Grendleriana. Vol. 9 / 2009. 11-32.

SCHREIBER, K.F., SCHIEFER, J. 1985. Sukzession auf Grünlandbrachen. Vorträge eines Symposiums der Arbeitsgruppe ‚Sukzessionsforschung auf Dauerflächen' in der Internationalen Vereinigung für Vegetationskunde (IVV). Stuttgart – Hohenheim 1994.

SCHÜTZ, M., WILDI, O., KRÜSI, B.O., ACHERMANN, G. & GRAEMINGER, H. 1998. Sukzession über 585 Jahre. Modell für die subalpinen Weiden im Schweizer Nationalpark. In: Informationsblatt des Forschungsbereiches Landschaftsökologie 40, Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft. Birmensdorf, Schweiz.

TASSER, E., TAPPEINER, U., CERNUSCA, A. 2001. Südtirols Almen im Wandel. Ökologische Folgen von Landnutzungsänderungen. Europäische Akademie Bozen.

TSCHÖPE, O., BEIER, W., BURKART, B., HINRICHSEN, A., KATSCHER, K., OEHLSCHLAEGER, S., PROCHNOW, A., SCHLAUDERER, R., SEGERT, A., SINIZA, S. & DORSTEN, P. 2004. Beweidung mit Wildtieren. In: ANDERS K., MRZLJAK J., WALLSCHLÄGER D., WIEGLEB G. (Hrsg): Handbuch Offenlandmanagement. Springer, Berlin, Heidelberg.

Contact

Claudia Plank
claudia.pl@gmx.net
Falkenburg 19
8952 Irdning-Donnersbachtal
Austria

Andreas Bohner
andreas.bohner@raumberg-gumpenstein.at
HBLFA Raumberg-Gumpenstein
Department for Environmental Ecology
Raumberg 38
8952 Irdning-Donnersbachtal
Austria

Thomas Wrbka
thomas.wrbka@univie.ac.at
University Vienna
Division for Conservation Biology, Vegetation and
Landscape Ecology
Rennweg 14
1030 Vienna
Austria