

Effects of grazing exclusion on species composition in high-altitude grasslands of the Central Alps

R. Mayer^a, R. Kaufmann^b, K. Vorhauser^c, B. Erschbamer^{a,*}

^a*Institute of Botany, University of Innsbruck, A-6020 Innsbruck, Sternwartestrasse 15, Austria*

^b*Institute of Ecology, University of Innsbruck, A-6020 Innsbruck, Technikerstrasse 25, Austria*

^c*Gregor-Gasser-Strasse 1, I-39010 Nals, Italy*

Received 27 February 2008; accepted 13 October 2008

Abstract

Our study examines the effects of grazing exclusion on low-productive subalpine and alpine grasslands of the Central Alps (UNESCO Biosphere Park Gurgler Kamm, Obergurgl, Austria). A long-term exclusion experiment was established in 2000 in the subalpine, the lower, and the upper alpine zone. With exception of the subalpine zone, domestic herbivores have been grazing during the whole growing season. In grazed and enclosure plots species frequencies were recorded for 7 years. We analysed enclosure effects on species number, community composition, life forms, and functional groups.

Species richness did not decrease significantly within the enclosures, but changes in species composition occurred in each zone, although some were transitory in nature. The dynamic trends of the plots were significantly explained by the ‘treatment × year’ effect along the whole altitudinal gradient, but the effects decreased considerably with altitude. In the subalpine and upper alpine enclosures, stress-tolerators, species of low or no nutritive value, and mosses showed a decreasing trend, whereas tall grasses (subalpine enclosures), competitors, and species with high or medium nutritive values (lower alpine enclosures) tended to increase.

Overall, our 7-year study revealed that several functional groups reacted to grazing, according to our main expectations. We suggest that these effects will intensify in the long term.

© 2008 Gesellschaft für Ökologie. Published by Elsevier GmbH. All rights reserved.

Zusammenfassung

Die Auswirkungen eines Beweidungsausschlusses wurden seit dem Jahr 2000 auf nährstoffarmen subalpinen und alpinen Weiden in den Zentralalpen (UNESCO Biosphärenpark Gurgler Kamm, Obergurgl, Österreich) untersucht. Mit Ausnahme der subalpinen Stufe hielten sich die Weidetiere während der gesamten Vegetationsperiode auf den Flächen auf. In beweideten und nicht beweideten Dauerflächen wurden die Frequenzen der Pflanzenarten über sieben Jahre hinweg erhoben. Wir analysierten die Effekte des Beweidungsausschlusses auf Artenzahl, Artenzusammensetzung der Gesellschaft, Lebensformen und funktionelle Gruppen.

Es konnte zwar keine signifikante Abnahme der Artenvielfalt in den Ausschlussflächen festgestellt werden, doch änderte sich die Zusammensetzung der Bestände mit der Zeit sehr deutlich, wenn auch manche dieser Veränderungen

*Corresponding author. Tel.: +43 512 5075954; fax: +43 512 5072715.

E-mail address: Brigitta.Erschbamer@uibk.ac.at (B. Erschbamer).

Übergangscharakter hatten. Signifikant unterschiedliche Entwicklungen zwischen den beweideten und nicht beweideten Dauerflächen konnten auf jeder Höhenstufe nachgewiesen werden, sie fielen jedoch mit zunehmender Höhe deutlich geringer aus. Unter Beweidungsausschluss nahmen in der subalpinen und oberen alpinen Stufe Stresstolerante, Arten mit geringem oder ohne Nährstoffwert und Moose tendenziell ab, während hochwüchsige Gräser (subalpine Stufe), konkurrenzkräftige Arten und Arten mit hohem oder mittlerem Nährstoffwert (untere alpine Stufe) tendenziell zunahmen.

Insgesamt zeigte unsere 7-jährige Studie, dass mehrere funktionelle Gruppen auf den Beweidungsausschluss reagierten. Damit wurden unsere zentralen Erwartungen bestätigt. Langfristig wird diese Entwicklung sicherlich noch deutlicher zum Ausdruck kommen.

© 2008 Gesellschaft für Ökologie. Published by Elsevier GmbH. All rights reserved.

Keywords: C-S-R strategies; Exclosures; Functional groups; Life forms; Nutritive value; Redundancy analysis (RDA); Traditional grazing system

Introduction

Grazing has an outstanding impact on vegetation structure, species composition, and richness of grassland communities (Altesor, Oesterheld, Leoni, Lezama, & Rodriguez 2005). Studies were conducted to examine the effects of different grazing intensities and management systems on forage quality, animal performance, diet selection, nutritive value of herbage, and on biodiversity (Pavlu, Hejman, Pavlu, & Gaisler 2007; Isselstein, Griffith, Pradel, & Venerus 2007). Exclosure studies were performed in mountain regions around the world such as the Fennoscandian mountains (Virtanen, Salminen, & Strömmer 2008), the Rocky Mountains (Binkey, Singer, Kaye, & Rochelle 2003), and the Andes (Buttolph & Coppock 2004).

In the Alps, several studies have been conducted in the subalpine zone (Dietl 1982a; Dullinger, Dirnböck, Greimler, & Grabherr 2003; Jewell, et al. 2007). The most prominent long-term exclusion experiments have taken place in the Swiss National Park with permanent plots installed already between 1917 and 1945 (Scheurer 2000). In alpine grasslands above timberline, the role of grazing in maintaining or enhancing species diversity is still poorly understood (Erschbamer, Virtanen, & Nagy 2003) and relatively few studies have been published (Schneiter 1997; Erschbamer, Moser, & Vorhauser 2004).

The subalpine and alpine zone of the Central Alps has probably changed by grazing for more than 5000 years (Vorren, Mørkved, & Bortenschlager 1993). Grazing indicators such as *Mutellina adonidifolia* and *Lotus* were detected in pollen records from the Neolithic period onwards (4500–6000 years BP; Bortenschlager 1999). As a result of this long-lasting impact, equilibrium between grazing regime and natural vegetation dynamics has probably been established. This is likely to change significantly by the exclusion of large herbivores due to changes in the competitive balance between plant species (Mulder 1999). According to the ‘competitive exclusion hypothesis’ (Grime 1979), highly dominant competitors

such as certain graminoids may increase due to grazing cessation, out-competing weaker strategy groups, and thus provoking a decrease of species richness. Additionally, the intermediate disturbance hypothesis predicts an increase of species richness in low-productive environments under medium to low grazing regime (Milchunas & Lauenroth 1993; Proulx & Mazumder 1998).

In order to examine the effects of grazing and to test these general hypotheses, a long-term grazing exclusion experiment was initiated in the Austrian Central Alps (Tyrol) in the year 2000 along an altitudinal gradient from the subalpine to the upper alpine zone. The aim of this study is to detect grazing effects on community composition in terms of species, life forms and functional groups. The first analyses were done after 7 years to evaluate short-term effects.

The following specific predictions were tested: (1) grazing maintains and increases plant diversity in the subalpine and alpine zone; hence, species number will decrease in the exclosures. (2) We expected a general divergent development of community composition in the exclosures compared to the grazed plots. (3) Weak competitors (ruderals, stress-tolerators) will decrease or even disappear in the exclosures. (4) Species of high or medium nutritive value will increase in the exclosures, while (5) mosses and lichens will decrease due to litter accumulation and shading by competitive phanerogams.

Material and methods

Study sites and sub-sites

Our monitoring programme was started in summer 2000 in the UNESCO Biosphere Park Gurgler Kamm (Oetz valley, Tyrol, Austria, 1950–2650 m a.s.l., Appendix A: Fig.) at Obergurgl (46°52'N, 11°02'E). Average monthly temperatures during the growing season ranged between 10.4 °C (July) and 7.1 °C (September), and average monthly precipitation rates varied between 91.4 mm (July) and 60.9 mm (September) (means of

Download English Version:

<https://daneshyari.com/en/article/4384550>

Download Persian Version:

<https://daneshyari.com/article/4384550>

[Daneshyari.com](https://daneshyari.com)