



Forage competition between livestock and Mongolian Pika (*Ochotona pallasii*) in Southern Mongolian mountain steppes

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Received 8 December 2005; accepted 30 May 2006

KEYWORDS

Grazing;
Resource competi-
tion;
Exclosure experi-
ment;
Phytomass produc-
tion;
Stipa krylovii;
*Agropyron crista-
tum*;
Allium polyrrhizum;
Ochotona pallasii;
Drought

Summary

Nomadic pastoralism is the most suitable form of land use in the semi-arid grasslands of the world and from a pastoralist point of view wild herbivores are considered forage competitors to livestock. Although small mammals are abundant in steppe ecosystems forage competition between small mammals and livestock has rarely been quantified. This study presents the results of an exclosure experiment investigating forage competition between the Mongolian Pika (*Ochotona pallasii*) and livestock in the *Stipa*–*Allium*-steppes of the Gobi Gurvan Saykhan, southern Mongolia. Available forage in the area consists primarily of *Stipa krylovii*, *Agropyron cristatum*, and *Allium polyrrhizum* (representing 80% of available phytomass), all of which are regarded as desirable forage plants. In the drought year of 2001 however, species heights indicated that *Allium* is avoided by pika and livestock alike while *Stipa* and *Agropyron* are intensely browsed.

Pika and livestock populate the same habitat and browse the same limited forage species, leading to the conclusion that both herbivore groups compete for forage. Due to their smaller body size, pika are able to bite down the vegetation to a lower level and thereby consume more of the available forage, giving them a competitive advantage over the livestock.

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Zusammenfassung

In den semi-ariden Steppengebieten der Erde ist nomadische Weidenutzung die angepaßte traditionelle Landnutzungsform. Aus Sicht der Viehhirten sind wilde Herbivore Futterkonkurrenten für das Weidevieh. Obwohl Kleinsäuger in Steppen-Ökosysteme häufig große Dichten erreichen, wurde die Futterkonkurrenz zwischen Kleinsäufern und Weidetieren bislang nur selten quantifiziert. Die vorliegende Studie

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untersucht die Futterkonkurrenz zwischen dem Mongolischen Pfeifhasen (*Ochotona pallasii*) und dem Weidevieh in den *Stipa-Allium*-Steppen des Gobi Gurvan Saykhan (südliche Mongolei). Die Hauptweidearten sind *Stipa krylovii*, *Agropyron cristatum* und *Allium polyrrhizum*, die zusammen etwa 80% der verfügbaren Phytomasse ausmachen. All diese Arten gelten als wünschenswerte Futterpflanzen. Messungen der Pflanzenhöhen zeigen, dass in dem Dürrejahr 2001 *Allium* sowohl von Pfeifhasen wie Weidevieh gemieden wird, wohingegen *Stipa* und *Agropyron* intensiv beweidet werden.

Pfeifhasen und Weidevieh nutzen die *Stipa-Allium*-Steppen ganzjährig und beweideten dieselben durch die Dürre begrenzten Futterressourcen. Daher stehen im Untersuchungsjahr beide Herbivorengruppen in Futterkonkurrenz zueinander. Aufgrund ihrer geringeren Körpergröße können Pfeifhasen die Vegetation auf ein niedrigeres Niveau abweiden als das Weidevieh. Sie erreichen so einen größeren Prozentsatz der verfügbaren Phytomasse, und besitzen daher einen Konkurrenzvorteil gegenüber dem Weidevieh.

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Introduction

Grasslands cover approximately 40% of the earth's terrestrial surface, and semi-arid grasslands account for some 28% of these grasslands (White, Murray, & Rohweder, 2000). Semi-arid grasslands have been shaped over millennia by grazing of large herbivores and soil-digging small mammals such as pocket gophers, prairie dogs, or pika (Bond & Keeley, 2005; Kinlaw, 1999; Whitford & Kay, 1999).

Since most grassland regions are unsuitable for non-irrigated agriculture due to low and erratic rainfall, the dominant land-use is (semi-)nomadic pastoralism (Scholz, 1995). Thus, competition for forage between wild herbivores and livestock is of general importance in most semi-arid areas and numerous studies have investigated and often demonstrated forage competition between large wild herbivores and livestock (e.g. Bagchi, Mishra, & Bhatnagar, 2004; Mishra, Van Wieren, Ketner, Heitkonig, & Prins, 2004; Voeten & Prins, 1999). As wild ungulates have been drastically reduced in numbers, currently the focus of eradication programs is on small mammals (see the overview for North America by Fagerstone & Ramey, 1996 or Samjaa, Zöphel, & Peterson, 2000; Zhang, Zhang, & Liu, 2003 for examples from Asia). However, studies on competition between small mammals and livestock are scarce and often solely focus on dietary overlap (Krueger, 1986; Mellado, Olvera, Quero, & Mendoza, 2005). One reason may be that, although forage competition is widely assumed whenever animals graze the same area, it is far less simple to provide scientifically sound evidence for it: Even in times of general forage shortage herbivores can partition resources with respect to habitat use and/or forage selection and therefore may not compete

directly (see also Madhusudan, 2004). In order to establish forage competition three criteria have to be fulfilled: (1) overlap of habitat use, (2) overlap of forage selection, and (3) forage scarcity (resource limitation; Begon, Harper, & Townsend, 1996; van der Wal, Kunst, & Drent, 1998).

In Mongolia the impact of small mammals and forage competition are of special relevance because almost 75% of its area is used for semi-nomadic pastoralism, which contributes heavily to the gross domestic product (~17% in 2004, National Statistical Office of Mongolia, 2005). Following privatisation of state herds during the political transformation in the 1990s, livestock numbers increased to an temporary all-time high of 33.5 million heads (National Statistical Office of Mongolia, 2005), while the breakdown of industry, administration, and state farms forced many people to return to livestock rearing (so-called "new nomads", Müller, 1995).

Some small mammals are known to benefit from high grazing impact and concerns have been raised that they may additionally impair pasture: In the steppes of central Mongolia and China the Brandt's vole (*Microtus brandti*) seems to benefit from overgrazing. Apart from forage competition, its negative reputation relates especially to its potential for massive population outbreaks and its habit of 'devastating the landscape' by constantly digging new burrows (Samjaa et al., 2000; Zhang, Zhang et al., 2003; Zhang, Pech et al., 2003). This initiates a vegetation succession cycle which only gradually regenerates to 'natural' steppe vegetation (Samjaa et al., 2000). For these reasons, the Brandt's vole is classified as a pest and major eradication programs are targeting the species (Davis, Leirs, Pech, Zhang, & Stenseth, 2004).

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