Self Rehabilitation of Degraded Mongolian Rangeland by Grazing Exclosure

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Introduction Due to its continental and dry climate , Mongolia is one of the world's large rangeland areas . Nomadic pastoralism on these rangelands is the backbone of Mongolia's agricultural sector and builds the basis of income for many herder families . However , large areas of Mongolian rangeland pastures are heavily degraded , mainly due to overgrazing . We examined whether a resting time without grazing results in self rehabilitation of degraded rangeland .

Materials and methods At five sites selected according to their level of degradation grazing exclosures with fences were installed . After four years vegetation inside (rested) and outside the fences (grazed) were compared . Standing biomass and biomass proportions of grasses , forbs and sedges were measured by cutting ten replicates of 1 m^2 areas . Canopy cover , basal cover , litter cover and proportion of bare soil were measured using the line point intercept method . Data were analysed with analyses of variance .

Results and discussion Degradation was characterised by a strong decrease in canopy , basal and litter cover resulting in a strong increase in open soil . The proportion of grass species dramatically decreased with increasing degradation as observed by Sasaki *et al* . (2007) . In parallel the species number and the standing biomass decreased . All these strong effects (all $P<0.0001$) indicate how much the different services rangelands provide are impaired by degradation .

Resting time of four years strongly increased canopy ($P<0.0001$) and litter ($P<0.01$) cover and thus reduced open soil ($P<0.0001$) . These changes may have protected soils from erosion and formation of hard soil crusts . This may , in turn , have ameliorated the conditions for the recovery of the existing vegetation . In fact , key grass species as *Agropyron cristatum* and *Stipa sibirica* strongly profited from the resting (grass proportion , $P<0.0001$) .

An important finding of the study was that the success of fencing strongly varied among the three levels of degradation for important characters as canopy cover , litter cover , bare ground , standing biomass and grass proportion (degradation level x resting ; $P<0.001$) . The lacking effect of resting on species number (P : ns) and the still nearly inexistent grass proportion in the totally degraded site suggest that the capacity of a plant community for resilience may be high as long as adapted plant species are still present above a minimum threshold . Reintroduction of species that were lost during the process of degradation seems much more difficult (Ulambayar *et al* . 2008) and time consuming .

Conclusion Self rehabilitation of degraded rangeland by grazing exclosure was successful as long as the adapted plant species were still present in the plant community i .e . as long as degradation was not too severe .

Table 1 *Effect of degradation level and four years of resting (grazing exclosure) on species number (SpNr) , cover of canopy , plant bases , litter and bare soil , standing dry mass (DM) and dry mass proportion of plant types . (SEM : standard error of mean ; n=20 for slight and heavy degradation and 10 for total degradation) .*

Degrad . Level	Resting	SpNr (m^{-2})	Cover(%)				DM ($g\ m^{-2}$)	DM proportion(%)		
			Canopy	Basal	Litter	Bare		Grass	Forb	Sedge
Slight	Yes	13	64	17	28	8 .3	68	37	58	4 .9
	No	13	61	22	14	25	60	26	68	5 .1
Heavy	Yes	11	93	5 .7	5 .5	1 .7	99	48	33	19
	No	11	80	2 .8	6 .7	14	54	24	45	32
Total	Yes	5 .1	74	0 .0	4 .7	21	53	1 .6	86	12
	No	2 .7	47	0 .0	0 .3	53	24	0 .3	84	16
SEM		0 .8	2 .5	2 .0	2 .3	2 .5	10 .2	3 .8	4 .2	4 .0

References

Sasaki , T . , et al . , 2007 . Threshold changes in vegetation along a grazing gradient in Mongolian rangelands . *Journal of Ecology* 96 , 145-154 .
Ulambayar , B . , et al . , 2008 . Restoration of degraded Mongolian rangeland by overseeding techniques ? This Volume .