FOOD HABITS AND OVERLAPS BETWEEN LIVESTOCK AND MONGOLIAN SAIGA

PROJECT REPORT 2010-2011

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Abstract

The Mongolian saiga *(Saiga tatarica mongolica)* is listed as a critically endangered antelope in IUCN Red list and their conservation is urgently needed. Recent increases in livestock numbers have potentially reduced the capacity of habitats to sustain saiga because of forage or interference competition. We studied the potential for forage competition between saiga and domestic livestock in Shargyn Gobi, western Mongolia by quantifying diet overlaps using microscopic analysis of fecal samples. We collected 10 fecal samples from each of saiga, goat, sheep, horse, and camels in summer of 2011. We also established 105 plots at sightings of marked saiga antelope in June 2011 to determine vegetation community within saiga range. Each plot was subdivided into 5 adjacent 1 m^2 square quadrats and the plants in them were surveyed. Onions or *Allium* appeared greater proportions in the diet composition of saiga, goat, and sheep. Diet composition of camels consisted mainly from shrubs, whereas *Stipa* was the dominantly found in the diet of horses. Among twenty-five plant species were recorded in the vegetation plots, *Allium sp* was the most frequently occurred species. The food habits of Mongolian saiga were quite similar to those of sheep and goats but were different from those of horses and camels. Our results suggest the saiga and sheep/goats would potentially be competitive on pasture as were suggested in similar study on Mongolian gazelle and argali sheep in Mongolia.

Introduction

The critically endangered saiga antelope (*Saiga tatarica*), which occurs in arid steppe and desert ecosystems of Central Asia (Bekenov et al. 1998), is recognized as one of the most rapidly declining species in the world; its population has crashed from nearly 2 million to fewer than 60,000 since the early 1990s (Milner–Gulland et al. 2001), although populations have rebounded in areas with enhanced protection (Chimeddorj et al. 2009).

One of two subspecies (*S. t. mongolica*) occurs as a separate, threatened population of 5,000-7,000 individuals in western Mongolia (Young et al. 2010). Recently, competition with increasing numbers of domestic livestock for forage and access to water is a serious concern. However, there is no study exists on food habits and overlap between Mongolian saigas and livestock, which is relevant for conservation.

There are increasing global concerns on the effects of livestock on wild ungulates because they are sometimes competitive in food habits and/or habitat use (Liu and Jiang 2004, Madhusudan 2004, Mishra et al. 2004, Yoakum 2004). This is particularly the case in Mongolia because the land has long been sustainably used for livestock grazing and also it has been the habitat of wild ungulates such as the Mongolian gazelle *(Procapra gutterosa),* the khulan or the Mongolian wild ass *(Equus hemionus),* and the argali sheep *(Ovis ammon)* (Campos Arceiz et al. 2004; Yoshihara et al. 2006; Wingard et al. 2011).

After the political regime changed in 1990 in Mongolia, the human population and consequent livestock populations increased (Honhold 1995), resulting in overgrazing. Since livestock husbandry is the most important industry for Mongolia, sustainable use of the grassland by good management of livestock to minimize the decline of the Mongolian saiga

is needed. Therefore, with we aimed to gather data on food relations between the Mongolian saiga and sympatric livestock. Specific aims are 1) to identify the food habit and overlap between the saiga and livestock, and 2) to conduct vegetation survey in SNR to understand habitat selection and evaluate food availability.

Methods

Food habits of Mongolian saiga and livestock were studied by the fecal analysis method (Stewart, 1967). Fecal samples were collected in SNR, which is the main refuge for saiga antelope in Mongolia (Fig. 1). 10 fecal pellets from each 10 dung piles of Mongolian saiga and sheep/goats were collected. Only fresh pellets of Mongolian saigas were collected after the saiga herds left the sampling place. Since sheep and goats were herded together, the pellets were collected at pens where both livestock were kept together, and were not distinguished and analyzed as those of "sheep/goats". Smaller and angled fecal of saiga is distinguishable from goat and sheep ones. 10 dungs of horses were collected, and 10 spoonfuls of camel dung were collected. Samples were preserved in an alcohol before analyses. The fecal analysis was done with aid of digital microscope (40X-1600X binocular microscope; Image 1). The samples will be washed thoroughly in water over a sieve of 0.1 mm aperture. Plant fragments spread over a slide glass, which is gridded by lines of 1mm aperture. Grid points (100 points) covered by plant fragments will be counted for each sample (Chamrad and Box, 1964). For plant identification, leaves of representative food plants such as *Allium, Anabasis*, *Stipa,* and *Artemisa*, were collected and references will be made following Stewart (1965). The degrees of overlap in food composition of animals were calculated in R 2.13.1 (R Development Core Team, 2008) with ‘pgirmess’ library using Pianka’s overlap index (OI; Pianka, 1973).

During the summer of 2010, 36 newborn calves (1– to 3-day old) from 35 females were captured with long-handled loop nets and fitted with a 70–g expandable VHF radio-collars (Model M4210, Advanced Telemetry Systems Inc., Isanti, MN). Animal handling methods were approved by the University of Massachusetts Amherst Institutional Animal Care and Use Committee (No. 2010–0001). All radio-collared calves were monitored via telemetry 3–4 times weekly through end of August. A total of 105 plots were established at sightings of marked saiga antelope within and beyond SNR to determine vegetation community (Fig. 1). Each plot was subdivided into 5 adjacent 1 m^2 square quadrats and the plants in them were surveyed. We calculated for each quadrat the frequency of each species, percentage of occurrence, the mean cover scale values of each species, and the standard deviation of the cover scale of each species.

Results

Food habits of saiga and livestock

The fecal compositions of camels were different from those of Mongolian saiga, sheep, goats, and horses (Fig. 1). Camels predominantly fed on shrubs and the percentage of shrub species was 49%. Whereas *Allium* appeared greater proportions in saiga, goat, and sheep diet composition, *Stipa* was the dominant species in the fecal composition of horses. *Anabasis* was found only in the fecal composition of saiga and camels, accounted for about 10% and 12%, respectively.

Plant survey

Twenty-five plant species were recorded in the vegetation plots at the sightings of the marked saiga antelope (Table 1). The number of shrub, grass, and forb species recorded

were 5, 6, and 14, respectively. Onions or *Allium sp.* (combining two species including *A. polyrrhizum* and *A. mongolicum*) was the most frequently occurred species during the study (e.g. the frequency of occurrence was 432 in 525 plots). Among the 5 most abundant species (the percentage of occurrence > 40%), there were 3 species of forbs (*Anabasis brevifolia*, *Allium polyrrhizum* and *A. mongolicum)* and 1 species of grass (*Stipa gobica*) and 1 species of shrub (*Artemisia sp*; Table 1).

Dietary overlap

Our results on the food habits of the Mongolian saiga and livestock in Shargyn Gobi (Gobi-Altay province) have shown that the food habits of Mongolian saiga were quite similar to those of sheep (OI = 0.96), and goats (OI = 0.95) but were different from those of horses (OI = 0.88), and camels (OI = 0.73; Table 2). While the least food overlap was observed between goat and camels (OI = 0.71), the overlap index was the greatest between goat and sheep (OI = 0.98; Table 2).

Conclusions

1. Dietary analysis showed that forbs including *Allium sp and Anabasis* contribute great proportion into the food composition of the saiga, goat, and sheep, whereas grass and shrubs were commonly occurred in the diet composition of horse and camels, respectively.
2. Food habits of Mongolian saiga were quite similar to those of sheep and goats but were different from those of horses and camel, indicating a competition for food resources during food-limited period is potentially high between saiga and goat/sheep.

3. Our findings suggest that good managed herding of goat-sheep can reduce or avoid competition with Mongolian saigas, and that herding management is important for conservation of the wild ungulates as well as the Mongolian steppe.

Project inputs into CMS MTWP implementation

Information collected during the project is a vital part of implementation of the goal 4.4 MTWP (Human dimension). The diet composition of Mongolian saiga suggests that they have preference to feed on high quality plants such as *Allium and Anabaisis,* although vegetation availability and diversity is low comparing to other part of the country. Similar research on Mongolian gazelles and argali sheep in Omnogobi and Dornogobi showed they have potentially competitive interaction with livestock in terms of food (Campos Arceiz et al. 2004; Wingard et al. 2011). Thus, from the viewpoint of pasture management and conservation of the endangered saiga antelope, grazing of goat and sheep should be avoided in key areas for saiga during autumn, which is essential to lessen food competition and to guarantee adequate food resources for the saiga to survive harsh winters.

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Table 1. Frequency of occurrence and mean ± SD percent cover of plant species recorded at saiga observation sites (n: 105x5=525).

#	Species	Frequency of occurrence	% of occurrence	Mean cover % ± SD	Type[b]
1	*Stipa gobica*	382	72.76	4.13 ± 3.53	G
2	*Anabasis brevifolia*	312	59.43	3.19 ± 2.01	F
3	*Artemisia sp.*	274	52.19	2.36 ± 2.14	S
4	*Allium polyrrhizum*	221	42.10	5.26 ± 2.83	F
5	*Allium mongolicum*	211	40.19	2.20 ± 2.08	F
6	*Dontestomon sp*	88	16.76	1.22 ± 0.44	F
7	*Oxythropus aciphylla*	85	16.19	1.86 ± 1.55	S
8	*Eurotia ceratoides*	53	10.10	4.53 ± 3.91	S
9	*Agropyron cristatum*	51	9.71	2.22 ± 1.53	G
10	*Salsola paulsinii*	39	7.43	1.33 ± 0.81	F
11	*Ajania trifida*	37	7.05	1.19 ± 0.60	F
12	*Agriophyllum pungens*	24	4.57	2.63 ± 2.00	F
13	*Micropeplus sp.*	21	4.00	1.14 ± 0.36	F
14	*Asparagus gobicus*	20	3.81	4.40 ± 4.63	F
15	*Cleistogenes soongorica*	19	3.62	1.05 ± 0.23	G
16	*Kochia prostrata*	15	2.86	1.25 ± 0.45	F
17	*Ptilothrichum*	14	2.67	1.00 ± 0.00	F
18	*Ephedra monospema*	13	2.48	3.00 ± 5.24	F
19	*Caragana sp.*	6	1.14	8.33 ± 5.85	S
20	*Carex sp.*	5	0.95	1.40 ± 0.55	G
21	*Reemuria soongorica*	5	0.95	1.00 ± 0.00	S
22	*Convolvulvus gortschakovii*	3	0.57	1.33 ± 0.58	F
23	*Iris tenuifolia*	1	0.19	NA	G
24	*Limonium aureum*	1	0.19	NA	F
25	*zurman suul*	1	0.19	NA	G

[b] F = forb, G = grass, S = shrub. NA = not applicable

Table 2. Pianka's indices of among-animal food overlap in western Mongolia

	saiga	sheep	goat	horse	camel
saiga	--				
sheep	0.96	--			
goat	0.95	0.98	--		
horse	0.88	0.92	0.96	--	
camel	0.73	0.78	0.71	0.78	--

Table 3. Budget expenses of the scholarship grant

Expense type	Items	USD	MNT	# Receipt
Equipment	USB digital microscope	585.0		1
	Anemometer (wind, humid, temperature index)	155.0		2
	Shipping cost of equipment from US to Mongolia	78.9		3
	Tax for the equipment	57.9	72.400	4
	Sieve	28.0	35.000	5
	Propane gas	21.6	27.000	6
Field expenses	Vehicle rental	400.0	500.000	7
	Benzene	100.8	126.000	8
	Benzene	140.2	175.200	9
	Benzene	105.6	132.000	10
	Food	164.8	206.000	11
	Food	39.4	49.200	12
	Food	62.7	78.420	13
	Camera and GPS battery (AA)	16.0	20.000	14
	Car oil and coolant	34.0	42.500	15
	Miscellaneous	9.8	12.300	16
	Total	**1999.7**		

Exchange rate: 1USD = 1250 MNT

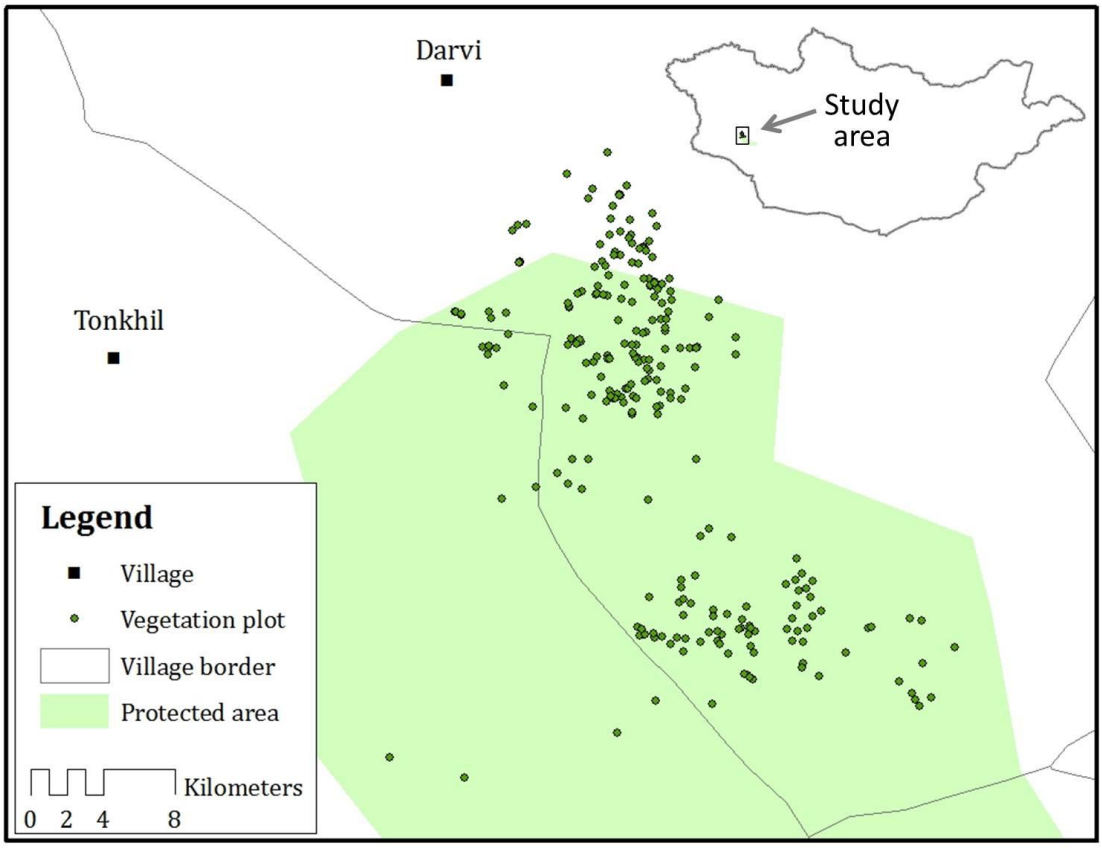

Figure 1. A map of study area and vegetation sampling points in western Mongolia

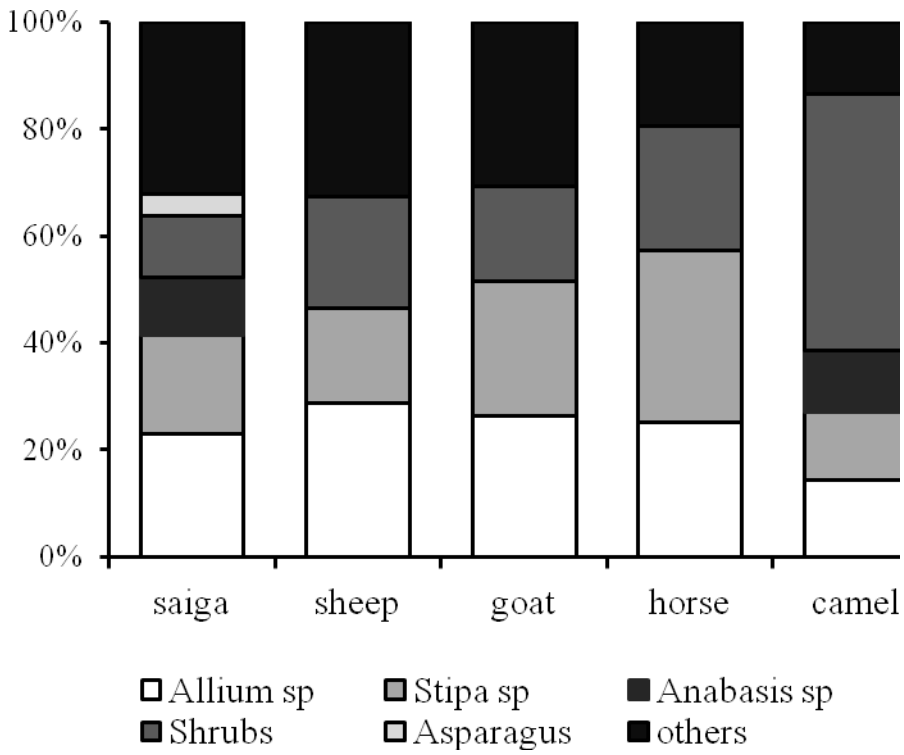

Figure 2. Fecal compositions of saiga and livestock in Shargyn Gobi, western Mongolia.

Figure 3. The digital microscope we used for fecal analysis

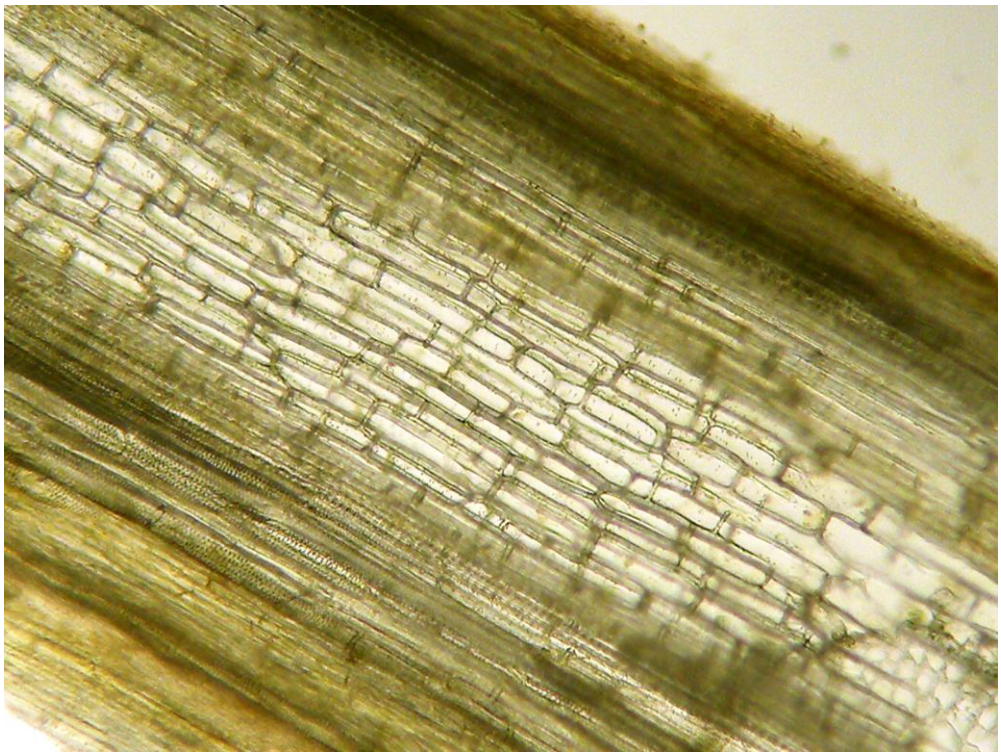

Figure 4. Cell structure of *Allium sp.*

Figure 4. A herd goats in Shargyn Gobi, Western Mongolia

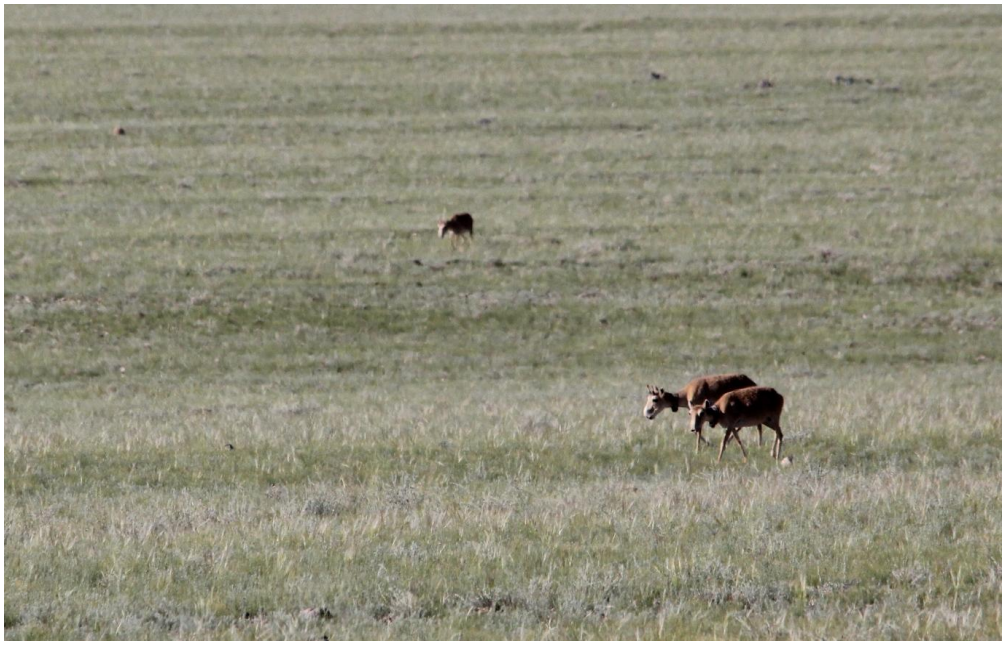

Figure 5. Radio-collared saiga antelope in Shargyn Gobi