

## Effect of stocking density of yak (*Bos grunniens*) on floral diversity and biomass of rangeland in northern Qinghai-Tibetan Plateau

R. Song<sup>1</sup>, G. Li<sup>2</sup>, N. Hasegawa<sup>3</sup>, Y. Wang<sup>4</sup> and S. Feng<sup>5</sup>

<sup>1</sup>Yushu Prefectural Animal Husbandry and Veterinary Center, Mingzhulu, Jiegu, Yushu State, Qinghai Province, 815000, China; E-mail: songrende@yahoo.com.cn, <sup>2</sup>Yushu Prefectural Grassland Station, Jiegu, Yushu State, Qinghai Province, 815000, China; <sup>3</sup>Faculty of Agriculture, University of Miyazaki, Miyazaki, 889-2192, Japan; <sup>4</sup>Mengyuan Prefectural Grassland Station, Haomanzhen, Mengyuan Prefecture, Haibei State, Qinghai Province, 810300, China; <sup>5</sup>Mengyuan Prefectural Animal Husbandry and Veterinary Station, Haomanzhen, Mengyuan Prefecture, Haibei State, Qinghai Province, 810300, China

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**Introduction** Degradation of alpine rangelands in Qinghai-Tibetan Plateau was reported by Song *et al.* (2006) and Li *et al.* (2006). It is considered that it has been caused by an increase in the numbers of domestic animals following the rise of human populations in addition to global warming. The purpose of this trial was to investigate the effect of stocking density of yaks in set-stock-grazing system on vegetation of rangeland in Qinghai-Tibetan Plateau for preventing the rangelands from deterioration and desertification.

**Materials and methods** Experiment was conducted in *Elymus nutans*-dominant alpine meadow which was utilized as cold-season-grazing paddock from 1996 to 2004 in Mengyuan Prefecture, Heibei State, Qinghai Province, China. From May in 2005, 3 one-year-old yaks were set-stocked in each of paddocks with different stocking rates of heavy (H), moderate (M), light (L) and control (C) treatments as given in Table 1. Vegetation was evaluated by 5 50 cm x 50 cm quadrats for each treatment and aboveground biomass were measured by cutting plants in quadrats which were classified into plant species and dried with electric oven in Augusts, 2005 and 2006.

**Results and discussion** Vegetation coverage was the highest in C among treatments followed by that in L in 2005 and 2006. Aboveground biomass was negatively correlated with stocking rate in 2005 ( $r=-0.903$ ,  $p<0.1$ ) and in 2006 ( $r=-0.987$ ,  $p<0.01$ ), and decreased significantly in M and L between 2 years ( $p<0.05$ ). Richness index was the smallest in H among treatments but other items did not differ. It was considered that increase of intake which was caused by growth of yaks decreased dramatically aboveground biomass between 2 years especially in M and H by overgrazing.

**Table 1** Characteristics of plant communities in pasture under different stocking rates.

Item	Treatment			
	Heavy	Moderate	Light	Control
Stocking rate, head/ha	6.25	4.11	3.23	0
Vegetation coverage, %	2005	82.5±5.7 <sup>c</sup>	85.4±3.6 <sup>c</sup>	90.0±3.1 <sup>b</sup>
	2006	70.0±5.0 <sup>d</sup>	81.0±4.2 <sup>c</sup>	94.6±2.9 <sup>b</sup>
Height of community, cm	2005	17.8±4.4 <sup>ab</sup>	16.3±3.7 <sup>b</sup>	19.8±4.1 <sup>ab</sup>
	2006	5.2±1.3 <sup>d</sup>	8.9±2.3 <sup>c</sup>	14.5±4.9 <sup>b</sup>
Aboveground biomass, gDM/m <sup>2</sup>	2005	444.6±134.6	473.9±94.7	583.5±167.4
	2006	240.4±91.2 <sup>c</sup>	280.0±52.8 <sup>c</sup>	442.8±84.4 <sup>b</sup>
Richness index, No. of species/m <sup>2</sup>		20.6±9.1 <sup>b</sup>	26.0±4.9 <sup>ab</sup>	28.2±2.6 <sup>a</sup>
Shannon-Wiener diversity index		2.238±0.821	2.454±0.352	2.493±0.213
Simpson diversity index		0.825±0.169	0.869±0.053	0.886±0.035
Pielou evenness index		0.750±0.146	0.754±0.069	0.747±0.053

<sup>a,b,c</sup> Mean±SD with different letters within a row differ significantly at  $p<0.05$ .

**Conclusion** From these results, proper stocking rate of mature yak older than 2 years old in set-stock-grazing system was estimated to be less than 1.8 head/ha for securing the enough intake during cold season.

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