

Does the short-term grazing affect functional group and plant species diversity of alpine meadow in the Tibetan Plateau?

Fuhong Miao, Zhenggang Guo and Yuying Shen

State Key Laboratory of Grassland Agro-ecosystems, College of Pastoral Agriculture Science and Technology, Lanzhou University, Lanzhou 730020, Gansu Province, People's Republic of China, www.lzu.edu.cn.

Contact email: miaofh10@lzu.edu.cn

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Introduction

Grazing affects the physiological and ecological characteristics of the plant community, through livestock intake and trampling (Georgiadis *et al.* 1989). Previous studies in the Qinghai-Tibetan Plateau have shown that the composition and structure of alpine meadow plant communities respond to grazing (Niu *et al.* 2010). However, the changes to functional groups and species diversity caused by grazing are not well documented, especially with regards to short term effects (McLaren 2008). In this study, different grazing rates were used to determine the relationship between functional groups, community diversity and yak stocking rates. The objective of this study was to reveal plant functional group responses to grazing and to predict the evolutionary trend of alpine meadow plant functional groups and community diversity under different grazing conditions, thereby providing a theoretical basis for the management of degraded grassland and the conservation of grassland diversity.

Methods

The experiment was conducted from 2010 onwards in Tianzhu county (37°10'~37°11'N and 102°44'~102°49'E, 2900-3100 m a.s.l.), Gansu, located on the east edge of the Tibetan Plateau. Grazing occurred from the last week of June until the last week of September in all years. Four grazing rates: (1) high yak density (HG, 1.25 yak/ha); (2) moderate yak density (MG, 1.00 yak/ha); (3) low yak density (LG, 0.75 yak/ha) and (4) no grazing (CK) were set up with three replications. Grassland parameters were assessed in 36 quadrats (0.25×0.25 m² each) selected

randomly in each treatment plot. These quadrats were monitored in the middle of July, August and September in 2012. Vegetation was categorised into four functional groups: sedges (S), grasses (G), polygonaceae (P) and forbs (F). The community diversity was measured by standard methods, *viz.* the Richness index, the Shannon-Wiener index and the Pielou index (Greig 1983).

Results

Functional group biomass

In July, sedge and grass biomass did not change significantly, whereas the polygonaceae biomass decreased with increasing grazing rates, and forb biomass was the least under MG (Fig. 1a). In August, the grass and polygonaceae biomasses were the greatest and the forb biomass was the least under MG (Fig. 1b). In September, sedge, grass and polygonaceae biomasses were not significantly different between LG and MG, but a significant difference in forbs was found between grazing rates (Fig. 1c).

Diversity

In July, the Richness index and Shannon-Wiener index were the greatest under MG, whereas Pielou index did not change significantly. In August, the Richness index, Shannon-Wiener index and Pielou index all decreased as the grazing rate increased, and there was no significant difference between these indices between LG and MG. In September, the Shannon-Wiener index and Pielou index were the greatest in the MG (Table 1).

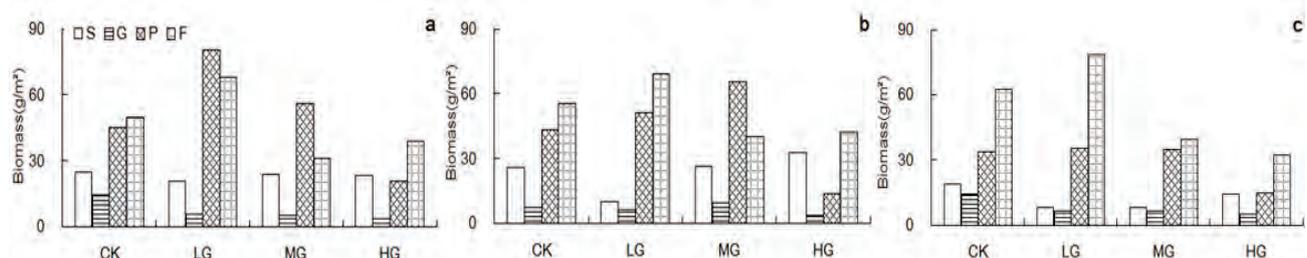


Figure 1. Effect of grazing on functional group biomass of alpine meadow at Tianzhu, China, in July (a), August (b), September (c) of 2012, sedges (S), grasses (G), polygonaceae (P) and forbs (F).

Table 1. Effect of grazing on Species index, Shannon-Wiener index and Pielou index of alpine meadow communities at Tianzhu, China, in 2012.

Month	Richness index				Shannon-Wiener index				Pielou index			
	CK	LG	MG	HG	CK	LG	MG	HG	CK	LG	MG	HG
July	14.93	14.33	15.78	14.89	2.40	2.41	2.49	2.43	0.89	0.91	0.89	0.90
August	12.24	10.78	10.33	10.11	2.10	1.89	1.80	1.77	0.84	0.80	0.77	0.77
September	12.11	12.22	11.67	11.78	2.17	2.19	2.20	2.18	0.88	0.88	0.90	0.89

Conclusion

This study suggests that the functional groups and plant species diversity of the alpine meadow was affected by short term-grazing. However, the study suggests that grazing at 1.00 yak/ha is an appropriate grazing rate in the north-eastern edge region of Qinghai-Tibetan Plateau.

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