Small-scale species richness and its spatial variation in an alpine meadow on the Qinghai-Tibet Plateau

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Introduction We investigated how the high small-scale species richness of an alpine meadow on the Qinghai-Tibet Plateau, China, is maintained. This area is characterized by strong wind and severe cold during long winters. In winter, most livestock is grazed on dead leaves in small pastures near farmers' residences, whereas in the short summer, livestock is grazed in mountainous areas far from farmers' residences.

Study area and methods The number of plant species and the aboveground biomass were surveyed for three adjacent pastures differing in grazing management: a late-winter-grazing pasture grazed moderately from 1 February to 30 April (LWG), an early-winter-grazing pasture grazed lightly from 20 September to late October (EWG), and a whole-year-grazing pasture grazed intensively throughout the entire year (WYG). In each pasture, we harvested the aboveground biomass from 80 or 100 quadrats of 0.01 m^2 along a transect and classified the contents by species.

Results and discussion We observed 16-20 species per 0.01 m^2, which is high richness per 0.01 m^2 worldwide (Table 1). The species richness in the two winter-grazing pastures was higher than that in the whole-year-grazing pasture. The spatial variation in species richness and species composition in the two winter-grazing pastures in which species richness was high was greater than that in the whole-year-grazing pasture in which species richness was lower. Most of the leaves that are preserved on the winter-grazing pastures during summer are blown away by strong wind during winter, and the remaining leaves are completely exhausted in winter by livestock grazing. A pasture with a high richess is accompanied with a high spatial variation in species richness and species composition. There is a high possibility that the characteristics of spatial variation is also caused by the traditional grazing practice in this area.

Table 1 *Mean species richness observed in* 80 0.01-cm^2 *in* 2002 *and* 100 0.01-cm^2 *in* 2003, *variance in richness among quadrats, coefficient of variation (CV) of richness, and the total aboveground richness biomass per* 0.01-m^2 *quadrat.*

Item	EWG	LWG		WYG	
	2002	2002	2003	2002	2003
Mean species richness (0.01-m^{-2}) ±se	19.36±0.30	19.09±0.33	19.69±0.38	16.11±0.24	15.51±0.30
Evenness for species biomass*	0.770	0.688	0.775	0.727	0.780
Variance for richness (0.01-m^{-2})	7.22	8.79	14.64	4.51	9.08
Observed CV of richness	0.139	0.155	0.194	0.132	0.194
Theoretical CV of richness**	0.137	0.144	0.146	0.145	0.156
Observed CV/Theoretical CV	1.01	1.08	1.33	0.91	1.24
Biomass (g/0.01m^2) ±se	3.32±0.115	3.10±0.097	3.02±0.081	3.26±0.109	3.14±0.099

Calculated by the formula of $\{\Sigma p_i(1-p_i)/(\Sigma p_i)^2\}^{1/2}$, where p_i denotes the occurrence rate per quadrat for species i, and Σ means sum for all species appeared. The theoretical CV-value was calculated under an assumption that each species distribute at random quadrat.

Reference

Chen, J., Yamamura, Y., Hori, Y., Shiyomi, M., Yasuda, T., Zhou, H.K., Li, Y.N., Tang, Y.H., (2007). Small-scale species richness and its spatial variation in an alpine meadow on the Qinghai-Tibet Plateau. *Ecological Research*.