

Effect of stocking rate on a *Stipa breviflora* Desert Steppe community of Inner Mongolia

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Introduction Stocking rate is an important factor in grazing management. The stocking rate defines utilization and ultimately grazing pressure, which in turn affects grassland sustainability. Grassland sustainability is partly defined by its species composition and ultimately by its productivity. These attributes are unique for specific plant communities and the effect of stocking rate must be established for each in order to understand the community response to grazing and to determine its carrying capacity. While some information exists on the effects of stocking rate on livestock production in the *Stipa breviflora* Griseb. Desert Steppe (Wei *et al.*, 2000), the effects on the plant community are not understood well. This study aimed to determine the effects of stocking rate on the species composition and productivity of that community.

Materials and methods The study was conducted on the Inner Mongolian Plateau (41° 47' N, 111° 54' E, average annual precipitation, 280 mm: elevation, 1450 m asl: soil, Light Chestnut) in May, 2004. The dominant species were *S. breviflora*, *Artemisia frigida* Willd. and *Cleistogenes songorica* (Roshev.) Ohwi. The site had been moderately degraded. A 4 (stocking rates) x 3 (replicates) study commenced in 2004. Each paddock was 4.4 ha and stocked with 0 (control), 0.46 (light), 0.91 (moderate) or 1.35 (heavy) sheep units/ha per yr in a randomized complete block design. Standing crop was estimated monthly from May to October using 10 moveable cages (1.5 x 1.5 m) that were randomly located within each paddock. Total above ground annual production (ANPP), and ANPP of individual species, were estimated by the cumulative difference method of paired grazed and ungrazed plots (1 x 1 m). The cages were moved to a new location after each harvest.

Results Total ANPP was greater ($P < 0.05$) with the control and light stocking rate, than with the moderate and heavy stocking rate (Table 1). The ground cover of the plant community decreased linearly with increasing stocking rate. Similar trends were observed for individual species, with the greatest difference occurring between the control and light grazing (Table 1).

Table 1 Effect of stocking rate on the ANPP (kg/ha per yr) and ground cover (%) of the whole plant community and of selected species in the Desert Steppe of Inner Mongolia

Stocking rate	Plant community	<i>Stipa breviflora</i>	<i>Artemisia frigida</i>	<i>Cleistogenes songorica</i>	<i>Convolvulus ammannii</i>	<i>Heteropappus altaicus</i>
-----Above ground net primary production (Mean±SD)-----						
Control	108.8±5.3a	12.9±2.0a	71.9±5.3a	5.0±0.8a	6.7±1.1a	1.5±0.3a
Light	81.4±4.8b	6.2±2.0b	53.2±5.7b	3.5±0.8ab	1.3±0.9b	0.2±0.1b
Moderate	62.3±6.8c	6.3±1.5b	56.0±3.6b	3.1±1.2ab	0.1±0.0b	0.1±0.1b
Heavy	51.1±3.7c	6.9±2.0b	34.9±4.8c	1.0±0.6b	0.8±0.5b	0.1±0.1b
-----Ground cover (Mean±SD)-----						
Control	23.3±0.9a	3.8±0.8a	15.0±1.1b	2.6±4.2a	1.4±0.2a	0.6±0.1a
Light	22.2±0.9a	3.3±0.6ab	18.2±1.3a	1.8±2.4ab	0.9±0.2ab	0.6±0.1a
Moderate	16.6±0.8b	2.6±0.3ab	11.8±0.7c	2.3±2.0ab	1.1±0.2ab	0.2±0.1b
Heavy	10.6±0.4c	2.3±0.1b	7.8±0.3d	1.3±0.8b	0.8±0.1b	0.1±0.0b

Means within a subset of a column having a common letter are not different ($P > 0.05$)

Conclusion A sustainable stocking rate on the *Stipa breviflora* Desert Steppe community appears to be <0.91 (moderate) sheep/ha per yr. This stocking rate is below 1.1 sheep/ha per yr, which was recommended by Han *et al.* (2000), based on liveweight gain. These results are not unexpected because the optimal stocking rate for livestock often exceeds the optimal to maintain a desirable plant community.

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References

- Wei, Z., G. Han, J. Yang & Xiong Lu (2000). The response of *S. breviflora* community to stocking rate. *Grassland of China*, 6: 1-5.
- Han, G., B. Li, Z. Wei & H. Li (2000). Liveweight change of sheep under 5 stocking rates in *Stipa breviflora* Desert Steppe. *Grassland of China*, 6: 4-6.