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## The Role of Environmental Factors and Grazing on Rangeland Productivity Along an Altitudinal Gradient in the Chinese and Mongolian Altay

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### Abstract

The alteration of traditional grazing management including changes in herd size and composition and diminished spatial distribution of livestock is likely to affect rangeland productivity in the Chinese-Mongolian Altay Mountains. Traditionally, herds seasonally shift between desert steppe, flood plain, mountain steppe and alpine belt. The study aimed to assess the interaction of soil, vegetation, and climate parameters and grazing management on quantity and quality of pasture biomass. Environmental variables (altitude, topographic position), vegetation cover, and above ground biomass were assessed at 359 sampling locations in China and 510 in Mongolia. Biomass samples were analysed for neutral detergent fiber, crude protein, calcium and phosphorous. At 166 locations soil samples were taken and analysed for carbon, nitrogen, organic matter, pH and phosphorous. Moreover, one cow and one goat carried GPS collars to record the temporal and spatial extent of pasture use on either side of the border. The difference in altitude between the lowest and highest pasture was 1195 m (China) and 1430 m (Mongolia). Biomass availability at the onset of a grazing period (kg DM ha<sup>-1</sup>) ranged from 847/554 in the desert steppe to 1685/535 in the alpine belt (China/Mongolia). In both countries, altitude was the main influencing variable, corresponding most likely with rainfall. With rising altitude, carbon, nitrogen and organic matter concentration in soil increased ( $r_s > 0.61$ ,  $p < 0.001$ ), while pH decreased ( $r_s = -0.60$ ,  $p < 0.001$ ). In China, biomass quality (neutral detergent fiber/crude protein) showed a moderate correlation with carbon and nitrogen concentration ( $r_s > -0.56$ ,  $p < 0.001$  /  $r_s > 0.39$ ,  $p < 0.001$ ). In Mongolia, animal density seemed to be a main determinant of biomass availability (vegetation allowance,  $r_s = -0.84$ ,  $p < 0.001$ ), and soil carbon and nitrogen concentration were negatively correlated with the herds' duration of stay on the pasture ( $r_s = -0.61$ ,  $p = 0.020$ ). In conclusion, the type of pasture utilisation was not the main determinant on pasture productivity in China, probably due to strict political regulations on grazing management. While in Mongolia the pasture productivity could be enhanced by alteration in pasture utilisation due to reduced stocking densities or shorter grazing of herds.

**Keywords:** Central Asia, GPS tracking, vegetation and soil parameter