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Testing congruence among multiple grazing indicators: a multi-site study across the Tibetan plateau

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Aim
Animal husbandry is one of the most widespread land use types, and grazing is a key topic in grassland management. A wide range of indicators are employed in grazing assessments and they often yield widely differing estimates on the associated level of degradation threat. Covering Tibet as a large grassland region with long history of pastoralism, we selected representative indicators to test: (1) how grazing responses change along large-scale climatic gradients, and (2) whether their responses to both grazing intensities and local abiotic conditions are congruent.

Location
Tibetan Plateau

Methods
Biotic indicators including species and growth form compositions of vascular plants, richness and abundance of small mammals and ants, together with soil nutrients and field spectra were compared in pairs of high and low grazing intensity at 18 sites across large climatic gradients. Altitude, temperature, and precipitation were considered as potentially influential abiotic factors. Responses of indicators to grazing intensity and environmental gradients were explored by multivariate and univariate analyses.

Results
All indicators responded strongly to environmental changes, but the response patterns and the most influential abiotic factors varied among indicators. Grazing responses showed low overall congruence. Only vegetation cover, soil nutrient concentrations, and spectral indices were sensitive to grazing across large spatial scales. Grazing effects were significant only when local abiotic factors were taken into account.

Main conclusions
The results imply that grazing assessments require both appropriate indicators and local calibration. Overall, the threat of grassland degradation across the Tibetan Plateau is not as severe as is commonly assumed.