

## Effects of climate change, fertilization and grazing on grassland productivity in the Tibetan plateau

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Uncertainty about the effects of warming and grazing on soil nitrogen (N) availability, species composition and aboveground net primary production (ANPP) limits our ability to predict how global carbon sequestration will vary under future warming with grazing in alpine regions. Through a controlled asymmetrical warming (1.2/1.7 °C during daytime/nighttime) with grazing experiment from 2006 to 2015 and nitrogen fertilization from 2010 to 2015 in an alpine meadow, we found that warming alone and moderate grazing did not significantly affect soil net N mineralization. Although plant species richness significantly decreased by 10% due to warming after 2008, we caution this may be due to the “transient occurrence or disappearance” of some rare plant species in all treatments. Warming significantly increased graminoid coverage, except in 2009, and legume coverage after 2008, but reduced non-legume forbs coverage in the community. Grazing significantly decreased coverage of graminoids and legumes before 2009 but increased forb coverage in 2010. Warming significantly increased ANPP regardless of grazing, whereas grazing reduced the response of ANPP to warming, but its effect decreased with increase of warming years. N addition significantly affected ANPP in both warming and grazing treatments after 2012. Grazing stimulated organic N uptake by plants, which counteracted the effect of warming. Our findings suggest that change of plant composition determines ANPP under simulated warming and that heavy grazing rather than warming causes degradation of the alpine meadows.