



Identifying the relative contributions of climate and grazing to both direction and magnitude of alpine grassland productivity dynamic from 1993 to 2011 on the Northern Tibetan Plateau

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Alpine grasslands on the Tibetan Plateau are claimed to be sensitive and vulnerable to climate change and human disturbance. The mechanisms, directions and magnitudes of climatic and anthropogenic influences on net primary productivity (NPP) of various alpine pastures remain under debate. Here, we simulated the potential (with only climate variables considered) and actual (based on remote sensing dataset) productivity (NPP_P and NPP_A) from 1993 to 2011, and termed the difference between NPP_P and NPP_A as NPP_{pc} to explore how much forage can be potentially consumed by livestock. The productivity that has been consumed by livestock (or for meat output) was defined as NPP_{ac} and transformed from meat production and daily forage consumption. We hypothesized that the NPP_{gap} between NPP_{pc} and NPP_{ac} indicates the direction of vegetation dynamics, restoration or degradation. Our results show that growing season precipitation rather than temperature significantly relates with NPP_{gap} , although warming was significant for the entire study region while precipitation only significantly increased in the northeastern places. On the Northern Tibetan Plateau, 69.05% of available alpine pastures have been restored with positive NPP_{gap} , and for 58.74% of alpine pastures the stocking rate is suggested to increase in the future because of the positive mean NPP_{gap} and its increasing trend. This study provides a potential framework for regionally regulating grazing management, with aims to restore the degraded pastures and sustainable management of the healthy pastures on the Tibetan Plateau.