

Grassland Precipitation-Use Efficiency Varies Across a Resource Gradient

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Abstract:

ABSTRACT Aboveground net primary production (ANPP) is positively related to mean annual precipitation, an estimate of water availability. This relationship is fundamental to our understanding and management of grassland ecosystems. However, the slope of the relationship between ANPP and precipitation (precipitation-use efficiency, PUE) has been shown to be different for temporal compared with spatial precipitation series. When ANPP and precipitation are averaged over a number of years for different sites, PUE is similar for grasslands all over the world. Studies for two US Long Term Ecological Research Sites have shown that PUE derived from a long-term dataset (temporal model) has a significantly lower slope than the value derived for sites distributed across the US central grassland region (spatial model). PUE differences between the temporal model and the spatial model may be associated with both vegetational and biogeochemical constraints. Here we use two independent datasets, one derived from field estimates of ANPP and the other from remote sensing, to show that the PUE is low at both the dry end and the wet end of the annual precipitation gradient typical of grassland areas (200–1200 mm), and peaks around 475 mm. The intermediate peak may be related to relatively low levels of both vegetational and biogeochemical constraints at this level of resource availability.

Keywords:

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