

Inter-annual variation in primary production of a semi-arid grassland related to previous-year production

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Mean annual precipitation accounts for a large proportion of the variation in mean above-ground net primary production (ANPP) of grasslands worldwide. However, the inter-annual variation in production in any grassland site is only loosely correlated with precipitation. The longest record of variation in production and precipitation for a site corresponds to a shortgrass steppe in Colorado, USA. A previous study of this record showed that current-year precipitation accounted for 39% of the inter-annual variation in ANPP. In this note, we show that ca. one third of the unexplained variation is related to previous-year ANPP: ANPP per mm of precipitation was higher in years preceded by wet, more productive years than in years preceded by average years; similarly, ANPP per mm of precipitation was lower in years preceded by dry, less productive years than in years preceded by average years. Since previous-year ANPP was, in turn, associated with precipitation of a year before, current-year ANPP was also explained by precipitation of two previous years. Our finding not only increases our predictive ability, but it also changes our understanding of how ANPP responds to fluctuations in precipitation. If ANPP is thought to vary according to current-year precipitation only, it will simply track annual precipitation in time. According to this new result, however, ANPP fluctuations are buffered if wet, more productive years alternate with dry, less productive years, and they are amplified if wet or dry sequences of several years take place.