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Effects of 10 years of fire and climate variability on perennial grass cover in shortgrass steppe

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Key words: fire, drought, shortgrass steppe, *Buchloë dactyloides*, *Bouteloua gracilis*

Introduction The objective of this study is to examine the effects of 10 years of fire and climate variability on perennial grass cover in shortgrass steppe. The research is part of a long-term, 18-year study examining effects of fire in the growing vs. dormant season at return intervals of 3, 6 and 9 years. In general, the response of grasslands to fire seems to depend primarily on pre- and post-fire levels of precipitation (Ford, 1999). The southwestern United States has experienced drought 9 of the past 10 years, with an extreme drought occurring in 2002.

Materials and methods The study site was located in semi-arid shortgrass steppe in the southern Great Plains of northeastern New Mexico, USA (36° 31' 20" N, 103° 3' 30" W). The site has mostly native vegetation with *Buchloë dactyloides* and *Bouteloua gracilis* being the dominant plant cover. The majority of precipitation occurs from May through September, with peak rainfall in July. Thirty-year mean annual precipitation (MAP) for the site was 356 mm. Total precipitation was slightly below average in 1996, the year prior to fire treatments, as well as for 1997, the first year fire was applied. Total precipitation in 1998 was 50 percent below MAP and drought conditions also existed in 2003, and was again below average in 2006 (Figure 1). The experimental design was completely randomized, with 7 treatments replicated 5 times on 2-ha plots/treatment. The treatments discussed here are (1) **D**, dormant-season fire applied April 1997 and (2) **U**, unburned. Live perennial grass cover was measured annually from 1996-2006.

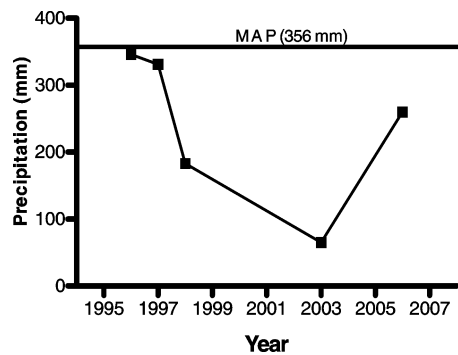


Figure 1 Total annual precipitation.

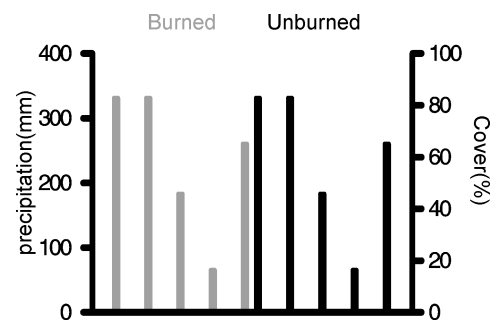


Figure 2 Perennial grass cover.

Results D and U perennial grass cover (percent) and total annual precipitation (mm) were plotted over 5 sample periods (pre-treatment 1997, and post-treatment 1997, 1998, 2003, 2006). There appeared to be a direct positive relationship between perennial grass cover and precipitation, and precipitation appeared to override fire effects (Figure 2).

Conclusions Though the MAP for the site was 356 mm, most actual total annual precipitation for the site over the 10-year period was generally lower than MAP, and in some cases as much as 50 percent lower. For management purposes, the frequency and severity of drought are more important than long-term average climate conditions. Too often, land managers plan for average climate conditions, rather than the climatic extremes that can be expected (Potter and Ford, 2004). Since this and other studies have indicated weather patterns can supersede fire effects in shortgrass steppe (Ford and Johnson, 2006), the use of fire as a management tool in a drought year should be carefully considered and aligned with management goals (Ford *et al.*, 2004).

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