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Source: Rangeland Ecology & Management, 67(6):621-628.
Published By: Society for Range Management
DOI: http://dx.doi.org/10.2111/REM-D-13-00133.1
URL: http://www.bioone.org/doi/full/10.2111/REM-D-13-00133.1

Rangeland Ecol Manage 67:621–628 | November 2014 | DOI: 10.2111/REM-D-13-00133.1

Chihuahuan Desert Grassland Responds Similarly to Fall, Spring, and Summer Fires During Prolonged Drought

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Abstract

Land managers frequently use prescribed burning to help maintain grassland communities. Semiarid grassland dynamics following fire are linked to precipitation, with increasing soil moisture accelerating the rate of recovery. Prescribed fires are typically scheduled to follow natural fire regimes, but burning outside the natural fire season could be equally effective and more convenient for managers, depending on their management objectives. We conducted a field experiment in desert grassland to determine if fire seasonality influenced plant community recovery. Experimental burn treatments occurred in fall, spring, and summer in replicate 0.24-ha plots to determine if fire seasonality affected the rate of recovery of an ungrazed Chihuahuan Desert grassland in central New Mexico. Plant communities were surveyed seasonally for 5 yr after the burns. Grassland community structure responded to fire but not fire seasonality. Grass cover in all burned treatments remained lower than unburned controls for 3 yr after the burns. Community change through time was largely influenced by low rainfall, as grass cover in burned and unburned communities converged during a year with severe drought. In conclusion, fire seasonality did not influence rate of community recovery, but extended drought was possibly more influential than fire on grassland dynamics.

Key Words: black grama, *Bouteloua eriopoda*, fire seasonality, semiarid grassland

INTRODUCTION

Grasses are a critical component of rangeland function. Both natural phenomena and poor management practices can compromise grassland integrity, and maintaining semiarid grassland vegetation remains a challenge for rangeland managers. Fire frequently shapes and maintains grass-dominated communities (Pausas and Ribeiro 2013) and is often used as a management tool due to its affordability, effectiveness, and speed of treatment (Teague et al. 2001, 2008). Prescribed fires are effective in mesic grasslands where fire stimulates productivity (Knapp and Seastedt 1986), yet in semiarid grasslands lower water availability leads to decreased, patchy fuel loads and longer fire-return intervals. As aridity increases, the magnitude of ecosystem benefits of fire decrease, and often semiarid plant communities are neutrally or negatively impacted by fire (Scheintaub et al. 2009). Several years might be necessary for semiarid vegetation recovery (Gosz and Gosz 1996; Parmenter 2008), and many impacts of fire on semiarid grasslands can be unpredictable (Scheintaub et al. 2009; Pastro et al. 2011). A better understanding of community response to prescribed fire is needed to help managers create optimal fire management practices within semiarid rangelands.

Research was funded in part by an NSF grant to the University of New Mexico for Long-Term Ecological Research and by a grant from the USDA Forest Service National Fire Plan.

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Manuscript received 2 September 2013; manuscript accepted 2 May 2014.

Water availability greatly influences desert grassland recovery (Drewa and Havstad 2001; Scheintaub et al. 2009; Pastro et al. 2011), and higher soil moisture after fire leads to faster grass recovery (Drewa et al. 2006). Total precipitation is low and variable within and between years in semiarid systems (Dettinger et al. 2011), therefore recovery from fire is frequently inconsistent between years or sites. Because response to fire is linked to variable precipitation patterns and fire can negatively impact semiarid systems (Gosz and Gosz 1996; Scheintaub et al. 2009), studying the intricacies of semiarid community response to fire is critical for effective fire management.

The timing of fire with regard to the growing season can impact community response. Within semiarid grasslands of the southwestern United States, perennial grasses predominantly grow during the monsoon season (Muldavin et al. 2008) and natural wildfires generally occur in early summer before the monsoon, when lightning ignites dry grasses (Parmenter 2008). In more mesic (mean annual precipitation [MAP] 665 mm) southern prairie grasslands of northern Texas, species respond differently to the timing of fire, with summer fires stimulating long-term growth of several codominant grass species and winter fires favoring others (Ansley et al. 2006; Ansley and Castellano 2007). Meanwhile, studies have found negative effects of fires during the growing season on *Bouteloua eriopoda* (Torr.) Torr., a dominant grass of more xeric (MAP 250 mm) Chihuahuan Desert grasslands (Cable 1965; Drewa and Havstad 2001; Parmenter 2008; Killgore et al. 2009). However, it is unclear how prescribed fires during different times of the year affect *B. eriopoda*, particularly because a related species, *Bouteloua gracilis* (Willd. ex Kunth) Lag. ex Griffiths, is affected by timing of prescribed fire. Cover of *B. gracilis*, a dominant grass of the shortgrass steppe, showed little