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Abstract

Most wildfires occur during summer in the northern hemisphere, the area burned annually is increasing, and fire effects during this season are least understood. Understanding plant response to grazing following summer fire is required to reduce ecological and financial risks associated with wildfire. Forty 0.75-ha plots were assigned to summer fire then 0, 17, 34 or 50% biomass removal by grazing the following growing season, or no fire and no grazing. Root, litter, and aboveground biomass were measured before fire, immediately after grazing, and 1 yr after grazing with the experiment repeated during 2 yr to evaluate weather effects. Fire years were followed by the second driest and fifth wettest springs in 70 yr. Biomass was more responsive to weather than fire and grazing, with a 452% increase from a dry to wet year and 31% reduction from a wet to average spring. Fire reduced litter 53% and had no first-year effect on productivity for any biomass component. Grazing after fire reduced postgrazing grass biomass along the prescribed utilization gradient. Fire and grazing had no effect on total aboveground productivity the year after grazing compared to nonburned, nongrazed sites (1 327 vs. 1 249 $\pm$ 65 kg $\cdot$ ha^{-1}). Fire and grazing increased grass productivity 16%, particularly for *Pascopyrum smithii*. The combined disturbances reduced forbs (51%), annual grasses (49%), and litter (46%). Results indicate grazing with up to 50% biomass removal the first growing season after summer fire was not detrimental to productivity of semiarid rangeland plant communities. Livestock exclusion the year after summer fire did not increase productivity or shift species composition compared to grazed sites. Reduction of previous years' standing dead material was the only indication that fire may temporarily reduce forage availability. The consistent responses among dry, wet, and near-average years suggest plant response is species-specific rather than climatically controlled.

Key Words: drought, grassland, herbivory, prescribed burn, productivity, wildfire

INTRODUCTION

Grazing management decisions following wildfire are currently difficult to justify. Federal agencies in the United States commonly require complete removal of livestock for 2 yr following fire to facilitate recovery of plant and soil resources, but rest periods vary from 1 to 3 yr (Bureau of Land Management 2007). These policies can increase costs of wildfire considerably beyond the immediate costs of fire suppression, damaged infrastructure, and immediate loss of forage resources. Agencies lose revenue otherwise gained from grazing leases and have increased costs associated with monitoring. However, these costs are typically minor relative to total agency budgets and provide little incentive to hasten approval for grazing. Livestock producers are faced with the brunt of wildfire impacts, with costs of relocating livestock, purchasing harvested feeds, leasing pasture, reducing herd size, and obtaining the capital to effect any of those changes. The areal extent of individual wildfires has increased in recent years (Westerling et al. 2006; Rideout-Hanzak et al. 2011), further reducing availability of replacement pasture and amplifying losses to local economies. Degradation of plant and soil resources are primary concerns for all affected parties, but trade-offs between ecological and economic needs cannot be accurately assessed with currently available information. Limited data exist quantifying plant response to fire during the wildfire season, and data are particularly limited regarding grazing effects after fire.

Despite the identified benefits of prescribed fire, wildfires are often perceived to be detrimental to vegetation because they tend to occur during more severe fuel and weather conditions. Worldwide, most fires occur during the dry season (Govender et al. 2006). In the western United States, more than 70% of the wildfires and nearly 90% of the resulting burned area are from fires ignited during the summer months of July and August (Higgins 1984; Westerling et al. 2003). At a global scale, areal extent of summer wildfires has also increased in midlatitudes of the northern hemisphere during recent decades (Riaño et al. 2007). Studies following wildfires are often pseudoreplicated and lack knowledge of prefire conditions, including species composition and productivity. Prescribed fires are seldom conducted during summer because of increased safety and containment concerns. Therefore, data from controlled experiments on fire effects are most lacking for this period.

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