GFE publication 2015-4

Vegetation Responses to Prescribed Burning of Grazed Shortgrass Steppe

A summary of David J. Augustine and Daniel G. Milchunas, 2009
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DISTURBANCE PROCESSES IN RANGELAND

Researchers have established that fire and grazing influence structure and function of rangeland ecosystems. Fire's effects in combination with grazing management varies throughout the Great Plains. The results of using fire in tallgrass prairie or in sagebrush differs from those in shortgrass steppe, and rangeland managers must take care in applying study results from one system to another. Additionally, the effects of unplanned wildland fire may differ from those of prescribed fire within the same system. Fire in some places under certain conditions has adversely affected forage. This resulted in questions about whether prescribed fire

1. Affects above ground net herbaceous production (ANHP).
2. Effects depend on variability in precipitation.
3. Suppresses abundance of broom snakeweed (*Gutierrezia sarothrae*) and prickly pear cactus (*Opuntia polyacantha*).
4. Affects nitrogen content in forage.

WHAT DID THE RESEARCHERS EXAMINE?

The authors specifically addressed forage production or ANHP and plant nitrogen content over five years on shortgrass steppe of Pawnee National Grassland in northeast Colorado. Vegetation consisted primarily of two perennial shortgrasses, blue grama (*Bouteloua gracilis*) and buffalograss (*Buchloe dactyloides*). Two undesirable species, prickly pear and broom snakeweed, occurred within the study area. Environmental conditions, principally precipitation, varied over the five-year study.

The researchers studied prescribed fires conducted by the USDA-Forest Service during 1997-2002 on grazed land. The researchers compared findings from sampling sites within burned areas and an unburned or control site each year. They examined the effects of prescribed fire followed by varying amounts of precipitation. This study encompassed dry, intermediate, and wet years, and also included one year of severe drought in 2002. The study even examined the effect of subjecting one area to two prescribed fires within a four-year period.

The researchers used grazing exclusion cages within the sampling sites and determined plant biomass by species within the cages in early August. They then calculated the ANHP as a sum of peak standing crop for all grasses, forbs, and subshrubs (excluding cactus and perennial shrubs). They determined nitrogen content of current-year growth for blue grama and buffalograss. Whenever possible, the researchers calculated ANHP in the second growing season after prescribed fire also.

The study included nitrogen analysis of a *bite* of blue grama and the dominant forb, scarlet globemallow (*Sphaeralcea coccinia*) in mid-month of May, June, and July. Each sample represented material in a grazing cow's bite. Within a *bite*, nitrogen levels of living tissue may indicate the degree to which prescribed fire made nitrogen available to plants through soil processes.

DOES PRESCRIBED FIRE AFFECT FORAGE?

Generally, data showed that prescribed fire performed in late winter did not adversely affect herbaceous production for the first or second growing seasons after burning. Prescribed fires also suppressed abundance of broom snakeweed and prickly pear cactus. Nitrogen levels, initially higher in burned area samples than in unburned area samples during May and June, converged by mid-July (Figure 1). In situations where cattle select grazing locations in spring, high nitrogen content early in spring may increase cattle performance.

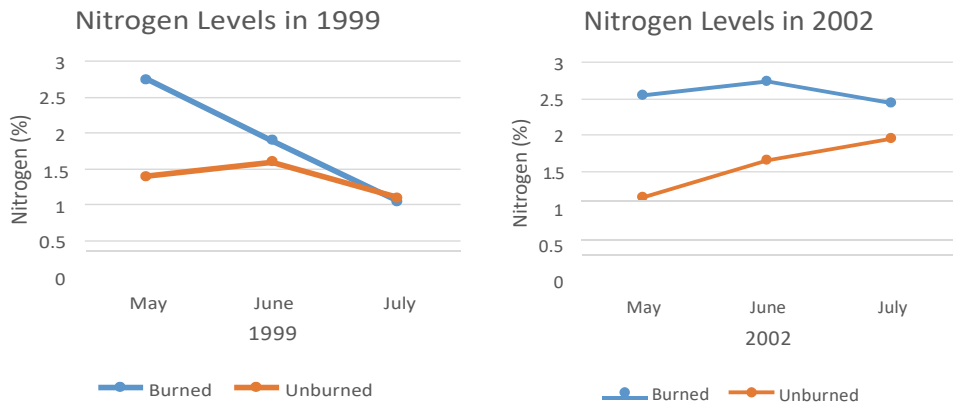
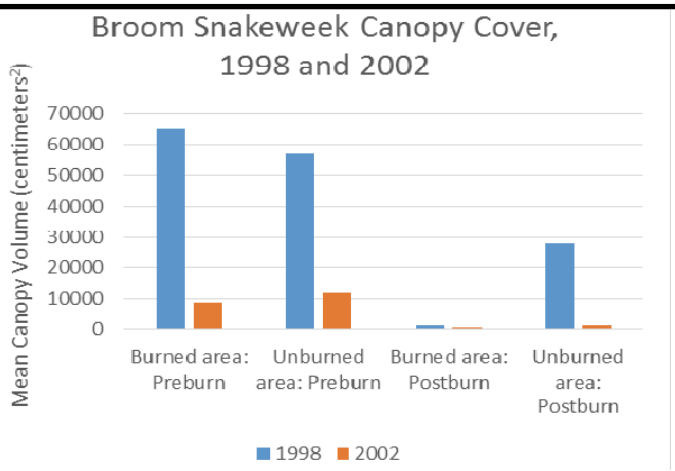


Figure 1: Nitrogen levels usually converged for burned and unburned areas by mid-July, as in 1999. Convergence did not occur in July 2002 after repeat burning. Additionally, drought complicated interpretation of results from repeated prescribed fire.

Even though burning caused adverse impacts on shortgrass range in other studies, adverse impacts did not occur in this study. The principle difference being that in this study cattle grazed 40% of production, which left low fuel loads, resulting in low fire intensity. Other studies done on ungrazed land may have had high fuel loads. This finding supports a hypothesis that seasonality of fire and fire intensity affect plant production. Seasonality and fire intensity also affect suppression of broom snakeweed and prickly pear cactus. Late-winter burns reduced the canopy of broom snakeweed, but did not produce as high mortalities as summer burns (Figure 2). This study indicated that fire caused small but significant reduction in prickly pear cactus abundance, making forage available for one or two years after the burn.

The researchers found that, when comparing ANHP from the first to the second year after prescribed fire, precipitation levels among years related to differences in ANHP. The study produced consistent results across a wide range of growing-season precipitation with one exception. The 2002 burn preceded severe drought. While burning had no effect on production during the drought, it did reduce mean herbaceous production by 19% the next year (2003). The combination of drought and burning may increase loss of soil moisture, resulting in grass-crown mortality. Unfortunately, the site used in 2002 had also burned in 1998, so the researchers could not distinguish between the effects of repeat burning and drought.

These findings indicate that prescribed fire conducted on shortgrass steppe for objectives unrelated to livestock production can also have neutral or positive consequences for livestock.



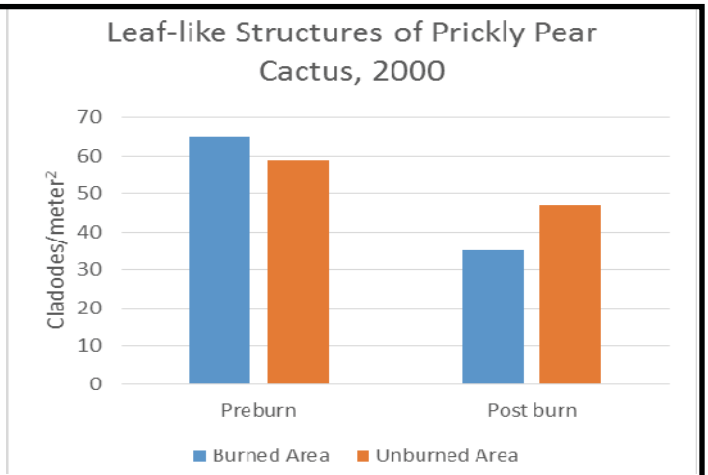


Figure 2: Late-winter prescribed fire suppressed broom snakeweed canopy the first year after fire. Drought complicated interpretation of results from repeat burning, but canopy cover appeared lower prior to burning in 2002 than in 1998. Similarly, late-winter fires had some effect on prickly pear cactus abundance, as typified in 2000 in this study.

Augustine, D.J. and D.G. Milchunas. 2009. Vegetation Responses to Prescribed Burning of Grazed Shortgrass Steppe. Rangeland Ecology & Management 62:89-97.

For more information:

http://GPFireScience.org