Cattle Respond to Higher-quality Forage Under Patch-burn Grazing on Kentucky Bluegrass-invaded Rangeland

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Heterogeneity in forage quality and quantity can enhance rangeland quality for livestock and wildlife. We seek to increase heterogeneity by applying a rotational patch-burn grazing treatment to pastures with season-long grazing. High forage quality in recently burned patches attracts livestock during the season. We present data following two years of treatment comparing forage quality across three different grazing management types.

Introduction

Disturbance-driven heterogeneity is important to maintain rangelands that evolved with disturbances such as fire and grazing (Bowman et al., 2009; Kay, 1998). Heterogeneity can stabilize forage availability during the growing season, and the forage bank created by heterogeneous disturbance can benefit cattle by giving them patches of available forage even during drought, thus maintaining cattle weights during stressful times (McGranahan et al., 2016; Allred et al. 2014).

Historically, rangeland management in the Great Plains has minimized disturbance or made it spatially even. By combining season-long grazing with a yearly rotation of spatially discrete fires, patch-burn grazing creates contrast in forage quality and forage quantity between recently burned and unburned patches within a pasture (Fuhlendorf et al., 2017).

Grazers often are more attracted to recently burned patches than to unburned patches (Archibald et al., 2005; Fuhlendorf and Engle, 2004). This "magnet effect" comes from greater protein content and lower fiber in recently burned patches, creating higher forage quality despite lower plant biomass, compared with unburned patches (Fuhlendorf et al., 2017; Sensenig et al., 2010).

Preference for the burned patch allows other patches to accumulate biomass and increase vegetation height and density, creating contrasting patches throughout the pasture (Powell et al., 2018). The contrasting vegetation structure created by patch burning enhances habitat diversity for grassland-dependent wildlife (Hovick et al., 2012).

Objectives

Our objectives are to determine the effectiveness of patch-burn grazing in northern mixed-grass prairie, and to monitor forage quality, forage biomass and grazer occupancy during a four-year patch-burn rotation, which began in the spring of 2017. We expect to see high forage quality, measured here by crude protein percentage, with the highest at low plant biomass (on the most recent burns).

We also expect to see consistently higher forage quality and higher grazing density on the most recently burned patches.

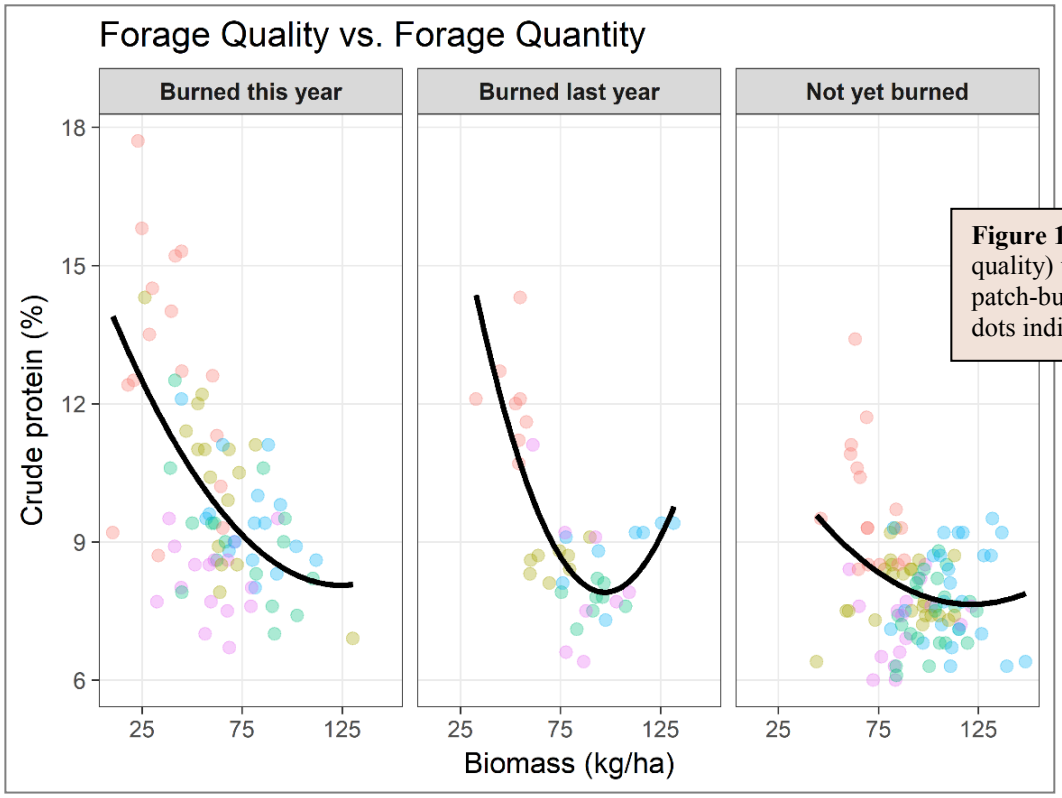

Figure 1. Crude protein percentage (forage quality) versus biomass (forage quantity) on patch-burn grazed pastures in 2018. Colored dots indicate different sampling months.

In addition, we anticipate that patch burning will produce better forage and higher cattle weight gains when compared with conventional or rotational grazing systems.

Procedures

We sampled 16 pasture replicates at the CGREC: four continuously grazed, four rotationally grazed and eight patch-burn grazed (PBG). Four PBG pastures received an entire 40-acre patch burn in the spring, while the other four received a 20-acre patch burn in spring and a 20-acre patch burn in late summer. Cow-calf pairs grazed each pasture at a 30 percent forage utilization rate from May to October.

We clipped above-ground biomass once per month from 25- by 25 -centimeter (cm) quadrats at predetermined points along transects in each patch per pasture. At each sampling point, we counted fecal pats within 5 meters (m) of the point to determine grazer usage.

All forage samples were dried for 48 hours in a 60 C drying oven, weighed and ground in a Wiley mill through a 1-millileter (mm) screen. We used near infrared spectroscopy (NIR) to determine crude protein and fiber content based on a custom calibration for mixed rangeland. Here we use crude protein as our measure of forage quality.

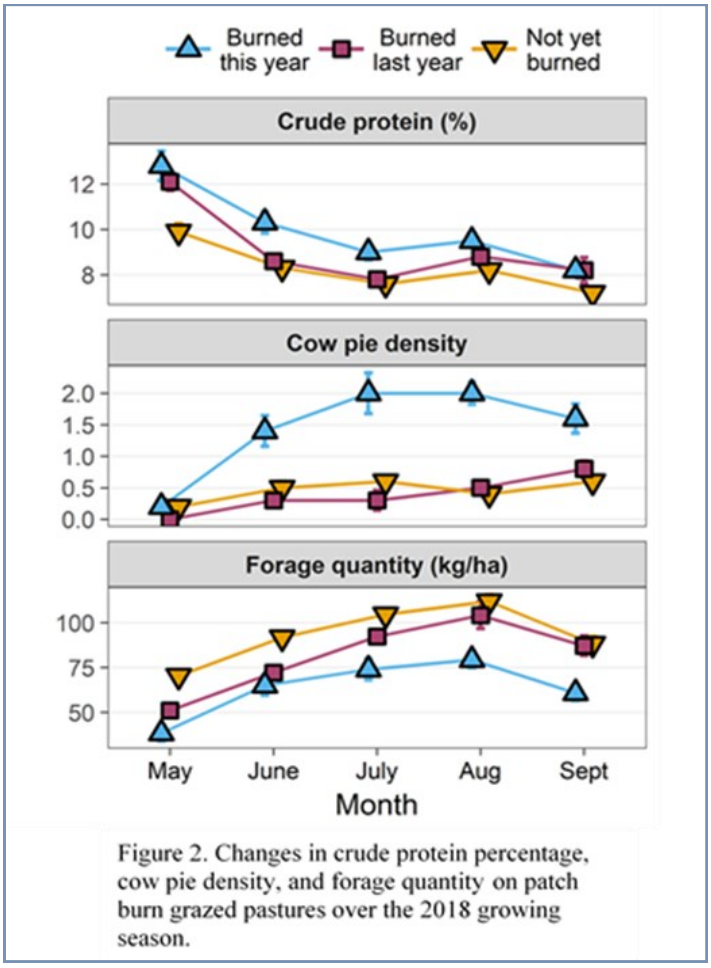

Figure 2. Changes in crude protein percentage, cow pie density, and forage quantity on patch burn grazed pastures over the 2018 growing season.

Results

Forage quality decreases as biomass increases, regardless of time since fire, and this relationship is more pronounced on the most recent burns (Figure 1). The percent of crude protein is consistently highest in the recently burned patches, and we observed a general trend of declining forage quality during the season (Figure 2).

By looking at cow pie density, we can see that cattle show a pronounced attraction to the burned patches that increases during the season. This gives evidence for the "magnet effect": Cows will continue to be attracted to the recently burned patches vs. the unburned patches, even as forage quality decreases. The burned patches provide substantial forage for most of the season, and all patches exhibit general declines in late summer, which is an

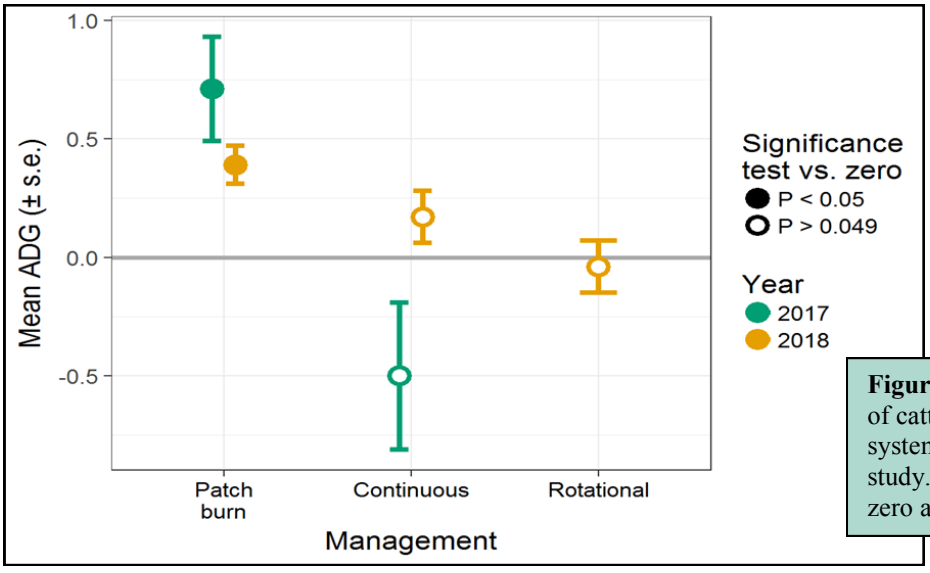

Figure 3. Mean average daily gains of cattle on all three management systems during both years of the study. Significant differences from zero are shown.

expected characteristic of cool-season stands (Figure 2).

Cattle on the patch-burn grazing pastures had consistent gains in both years (Figure 3). The continuously grazed pastures showed annual variability in the average daily gains, but that variability was not significantly different from zero.

With the one year of data we have from the rotationally grazed pastures, we see a nonsignificant trend toward weight loss. The most notable aspect of this is the stability of cattle weights on the patch-burn pastures.

Discussion

In preliminary analysis of livestock usage data, livestock show a preference for recently burned patches vs. unburned patches, despite those patches having lower available forage. This is likely due to the increased forage quality in the burned patches.

We expect to continue seeing this preference because this attraction has been documented in similar studies (Powell et al., 2018; Sensenig et al., 2010). While producers might be concerned that this attraction will diminish as time since fire increases, our data indicate that is not the case. Cattle remain attracted to recently burned patches and continue to avoid unburned patches.

As our study progresses and we rotate burns through the remaining patches, we expect to see continued grazer attraction to the most recently burned patch in each pasture, and greater landscape-level contrast in forage quality and quantity, driven by this gradient in time-since-fire. We also expect this gradient will create a patchy mosaic of available forage and habitat that will change as the burn patches shift. Although patches are intensively grazed for a season, the subsequent seasons of rest ensure the long-term sustainability of the forage base.

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