Post-Grazing Vegetation Structure and Ground Surface Temperature Responses to Grazing Intensity in a Rangeland Soil Health Experiment in a Wyoming Mixed-Grass Prairie

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Introduction
Producers are increasingly making grazing-management decisions based upon projected impacts to soil health, but disagreement persists regarding the direction and magnitude of potential soil health changes. Previous research has indicated potential negative effects of grazing management intensification on soil health in low-productivity environments. Other studies suggest that more intensive, short-duration grazing benefits soil health, while others yet have shown no change in these properties. These inconsistencies demand more empirical assessments of the top-down effects of grazing management on soil health.

To better understand the effects of grazing on the soil health of Wyoming’s rangelands, we established an experiment in a mixed-grass prairie at the James C. Hageman Sustainable Agriculture Research and Extension Center (SAREC [Fig. 1]). Baseline soil analyses (e.g., organic matter, nitrogen content, and microbiological parameters) and forage data (e.g., biomass and composition) were taken prior to grazing and will be presented after our research concludes in summer 2019. Other soil and vegetation observations that were more likely to be effected in the short term (e.g., ground surface temperature and grazing height) were taken post-grazing in 2017, year one of the three-year grazing experiment, and these results are reported in this paper (Figs. 2–3).

Objectives
Our specific objectives are to (1) determine how grazing intensity, or complete exclusion, alters soil health properties; (2) quantify both the direction (positive, negative, or neutral) and magnitude (great or small relative to change) of any soil health alterations relative to grazing management; and (3) relate the soil health feedbacks associated with grazing management to vegetation responses.

Materials and Methods
This study was established in June 2017 at SAREC (Fig. 1). Twelve, one-acre paddocks were utilized, and each grazing treatment was replicated four times in a randomized complete block design. Three grazing treatments were utilized one time annually: (1) no grazing (NG); (2) moderate rotational grazing (MRG) consisting of four, 1,200-pound heifers (or 4,800 lb/acre) spending from four to nine days in the paddocks; and (3) ultra-high-density (UHD) grazing consisting of 33 cow/calf pairs and two bulls (60,500 lb/ac) spending seven to 25 hours in the paddocks.

Due to the natural variation in forage production across the 12 paddocks, pre-grazed forage height and biomass were used to determine grazing time in each paddock, with grazing time calculated for 50% utilization. Vegetation height was recorded post-grazing. To quantify the short-term treatment effect on litter accumulation and soil microclimate, soil surface temperatures were taken post-grazing at eight intervals along a 240-foot transect in each paddock. Surface temperatures were recorded using a Performance Tool W89722 Infrared Thermometer at waist height (~3 ft) above ground and relativized to a reference temperature taken at each point using a white sheet of

Figure 1. Ultra-high density herd (60,500 lb/ac).
paper following Twomey et al., 1986. Surface temperature readings began at 11:30 a.m. with an air temperature of 86°F. Statistical analyses were performed on vegetation and temperature data to address any differences in surface temps between grazing treatments and to identify if uniform forage utilization was accurately achieved.

Results and Discussion
Post-grazing ground surface temperatures did not differ statistically relative to treatment (Fig. 2), potentially indicating that adequate forage cover was left in each paddock. Post-grazing forage height did differ statistically relative to treatment (Fig. 3). As expected, the NG paddocks had the greatest post-grazing height; meanwhile, the UHD and MRG paddocks were found to be statistically similar to one another, but statistically different from the NG paddocks (Fig. 3).

The importance of this early result is that we can confirm that our predicted grazing times in paddocks for the two grazing treatments achieved similar utilization rates with different stock densities and time in paddocks. Baseline soil sampling occurred prior to grazing treatments and will be repeated at the conclusion of the study (summer 2019). This should allow us to identify any changes to soil health in response to grazing treatments.

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Literature Cited

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Figure 2. Change in surface soil temperature (°F) relative to treatments post-grazing (p=0.272). UHD=ultra-high-density grazing (60,500 lb/ac), MRG=moderate rotational grazing (4,800 lb/ac), and NG=no grazing.

Figure 3. Post-grazing height (p=0.0127).