David Little Livestock
Range Management Endowment
AT THE UNIVERSITY OF IDAHO

2021 Project Progress Report:

Mesic Meadow Habitat Responses to Variation in Grazing Management Practices: Balancing the Habitat Requirements of Greater Sage-Grouse with Livestock Production

PERSONNEL:
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PRELIMINARY RESULTS for 2021:

BACKGROUND:

In the arid Western United States, mesic meadow systems serve as vital sources of water and forage for ranching operations and wildlife species. Because mesic areas comprise a small portion of the landscape (Donnelly et al. 2016), management influencing these systems has become a focal point among diverse stakeholders, including the livestock industry, land management agencies, and conservationists. Greater sage-grouse (*Centrocercus urophasianus*), an Idaho Species of Greatest Conservation Need (Idaho Department of Fish and Game 2017), rely upon dietary forbs that occur in mesic meadows during late brood-rearing stages (Schreiber et al. 2015). Based on the utility and value of specific forbs to sage-grouse, such as when and which portions of the plant are available, palatable, and nutritive, dietary forbs can be further classified into categories of moderate or high importance (Luna et al. 2018). Because late brood-rearing occurs during summer months (Boyd et al. 2014), sage-grouse often co-occur in mesic meadows with grazing livestock. Given the broad importance of mesic systems, identifying management techniques that provide grazing opportunity while supporting the habitat needs of wildlife is crucial. To accommodate both sage-grouse and livestock needs, our project addressed the viability and effects of multiple grazing strategies on mesic meadows in south-central Idaho.

Vegetation communities have been documented to respond to grazing when implemented as a management tool (Boyd et al. 2014; Rosenthal et al. 2012). Additionally, livestock grazing has been shown to be both compatible and mutually beneficial for coexisting livestock and wildlife, even when similar resources are required (Young et al. 2018). Understanding how livestock grazing influences wildlife habitat within mesic meadows is critical to understanding how livestock may influence sage-grouse habitat, and calls for research to evaluate the intricacies of this relationship have been put forward (Pennington et al. 2016). To evaluate grazing effects on sage-grouse habitat, we evaluated the influences of grazing timing and intensity on habitat characteristics such as foliar and canopy cover, abundance of preferred forbs, and vegetation structure. To determine the viability of grazing strategies for producers, we tracked the gains in weight of livestock, determined herbaceous biomass production, and analyzed forage samples for nutrient quality. This work will address the needs of the livestock industry, inform citizens about the practical and sustainable use of grazing as a management tool, and advance the scientific community's understanding of ecological processes and responses to livestock grazing in mesic meadow habitats.

HYPOTHESIS or OBJECTIVES:

Our hypotheses and objectives were designed to evaluate vegetation responses of experimental pastures within mesic meadows to multiple short-duration grazing and continuous grazing strategies. For this study, short-duration gazing took place for only a portion of the growing season (<1 month). Continuous grazing took place for the majority of the growing season (>2.5 months). Two independent manuscripts addressing our hypotheses and objectives are in preparation. Hypotheses evaluated within manuscripts are provided below:

Managing forbs preferred by greater sage-grouse and soil moisture conditions in mesic meadows with short-duration cattle grazing

H_1: We hypothesized that the responses of foliar cover and herbaceous biomass of preferred forbs would vary with grazing management because differences in season and intensity of grazing would disproportionately reduce competitive forage grasses, creating opportunities for preferred forbs to establish or increase in size.

H_2: We hypothesized that seasonal depletion rates of soil moisture would vary as a function of grazing management because the season and intensity of grazing would create dissimilarity in litter accumulation and herbaceous cover among pastures, resulting in differential moisture loss over the summer among treatments.

Changes in forage quality and cattle performance in a short-duration grazing experiment in south-central Idaho

H_1: We hypothesized that forage quantity would decrease as a function of increasing grazing pressure. Further, we hypothesized that forage quality would be a function of grazing season and intensity because differences in these short-duration grazing parameters would facilitate variation in the phenological stages and regrowth progression of forages (Clark et al. 2000).

H_2: We hypothesized that daily weight gain of yearling heifers would not vary significantly among treatments due to the limited amount of time available to individuals to select the most palatable vegetation.

PROCEDURES:

This study took place at Rinker Rock Creek Ranch (RRCR), the Wood River Ranch (WRR), and the Crichton Creek LTD partnership (CCLP) in Blaine and Camas Counties, Idaho. The RRCR is a biological field station operated by the University of Idaho. The WRR and CCLP are privately owned operations where the dominant land use is cattle grazing. Short-duration grazing took place May-August, and continuous grazing took place July-September in 2019 and 2020. The CCLP was not sampled in 2020.

We established 15 pastures (approximately 1.7 hectares each) for short-duration grazing at RRCR. We used yearling heifers from the University of Idaho's Nancy M. Cummings Research, Extension, and Education Center to stock pastures in 2019. Yearling heifers supplied by Prescott Cattle were used to stock pastures in 2020. Heifers grazed six pastures in June (early season; 16 days) and six pastures in August (late-season; 16 days) at moderate (30-40%) and high (70-80%) relative utilization levels (n = 3 pastures per treatment). Three pastures provided un-grazed controls. Grazing trials began at roughly (< 4 days) the same time during both years of the experiment with a slight variation to standardize grazing timing with plant phenology between years. Three previously established wet meadow pastures, one at each study site, were included in our sampling to evaluate the effects of continuous grazing. These pastures encompassed both mesic meadows and adjacent uplands. Continuous grazing pastures were stocked with cow-calf pairs in the first week of July. Cow-calf pairs grazed continuously to achieve an overall (60%) utilization.

Measurements on plant community and heifer performance occurred during pre-grazing and post-grazing sampling periods (< 7 days). Plant community measurements were also evaluated in September to assess vegetation regrowth in short-duration grazing pastures. Sampling on continuous grazing pastures took place before grazing (< 7 days) and during the regrowth period. Measurements of plant community composition, foliar cover, the average height of vegetation by species, biomass, and soil moisture occurred along vegetation transects. Transect (n = 4 per pasture; n = 5 at WRR) locations were randomly placed within stratified plant community cover types in each pasture. We used Vegetation biomass collected before grazing to determine heifer stocking requirements to achieve desired utilization. A modified utilization gauge was employed during and after grazing to ensure target utilization rates were achieved (Aldon and Francis 1984, Sprinkle and Arispe 2017).

ACCOMPLISHMENTS or RESULTS:

In experimental short-duration grazing pastures, grazing took place during June 4-20 and July 30-August 15 in 2019. In 2020, short-duration pasture grazing occurred from June 2-18 and July 28-August 13. Continuous grazing pastures were stocked during the first week of July and lasted into September during 2019 and 2020. Results from

analyses of short-duration grazing treatments are described below. Evaluation of continuous grazing treatments is ongoing.

Despite initial measurements of high-importance forbs (HIF) cover being proportionally low in abundance and biomass compared with other plants, our results suggested that short-duration livestock grazing during the early summer can sustain or enhance forbs preferred by sage-grouse in mesic meadows dominated by competitive forage grasses (Figure 1). Late summer grazing did not improve HIF cover or biomass percentages in the short term, but importantly did not reduce HIF metrics relative to pastures with no cattle grazing, suggesting that short-duration grazing later in the summer may not be detrimental to HIF communities (Figure 1). Although not as consistent as early-season grazing, high-intensity grazing may also facilitate positive responses in HIF communities (Figure 2). Changes in soil moisture and weed cover were not attributed to short-duration grazing, suggesting that short-duration grazing is compatible with the overall functioning of mesic meadows (Table 2). With consideration of initial pasture conditions and environmental variables, short-duration grazing can be a valuable tool to help enhance dietary resources of sage-grouse without compromising pasture condition over short time intervals.

In mesic meadow communities dominated by non-native forage grasses, nutritional quality of forages can be enhanced through variations in the season and intensity of short-duration grazing. Our data suggested that early summer (early June) grazing at high intensities can delay the phenological progression of forages, subsequently enhancing future forage quality into the fall (late September) and the following year. When grazing occurred late in the summer (early August), forage quality was unlikely to respond because grasses such as meadow foxtail had already matured and entered into a state of dormancy. Increasing grazing intensity can result in lower forage biomass; however, this is highly contingent upon environmental factors such as spring and annual precipitation. Differences in the average daily gains of livestock between treatments were small yet may be of economic importance in livestock production (Figure 3). However, because the nutritional quality of forages decrease with increasing plant maturity, grazing early in the summer may provide livestock with access to higher quality forage than grazing later in the summer. Further, increases in grazing intensity will result in slightly lower individual gains, but does provide greater total livestock production per hectare.

PUBLICATIONS or OUTPUTS:

See table to find a list of outputs from this project (Table 1).

LITERATURE CITED:

Aldon, E. F., and R. E. Francis. 1984. A modified utilization gauge for western range grasses. USDA-USFS, Rocky Mountain Forest and Range Experiment Station, Research Note RM-438, Ft. Collins, CO. <https://www.fs.fed.us/rm/pubs_rm/rm_rn438.pdf>. Accessed 28 Oct 2020.

Boyd, C. S., J. L. Beck, and J. A. Tanaka. 2014. Livestock Grazing and Sage-Grouse Habitat: Impacts and Opportunities. Tanaka Journal of Rangeland Applications 1:58-77.

Clark, P. E., Krueger, W. C., Bryant, L. D., Thomas, D. R. 2000. Livestock grazing effects on forage quality of elk winter range. Journal of Range Management 53, 97-105.

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Sprinkle, J. (Author), and S. A. (Director) Arispe. 2017. Developing Your Own Utilization Curve. [4:56 min video; Cattle Producer's Handbook]. Ontario, Oregon. Oregon State University Extension Service. <https://media.oregonstate.edu/media/t/0_25gnl4to>. Accessed 28 Oct 2020.

Young, T. P., L. M. Porensky, C. Riginos, K. E. Veblen, W. O. Odadi, D. M. Kimuyu, G. K. Charles, and H. S. Young. 2018. Relationships Between Cattle and Biodiversity in Multiuse Landscape Revealed by Kenya Long-Term Exclosure Experiment. Rangeland Ecology & Management 281–291.

Table 1. List of publications and outputs from research.

Publications and Outputs:
Randall, K. J., Johnson, T. N., and Ellison, M. J. 2021. Mesic meadow responses to variation in grazing management: balancing sage-grouse resources with livestock production. M.S. thesis defense, University of Idaho, Moscow. Moscow, Idaho.
Randall, K. J., Ellison, M. J., Johnson, T. N., and J. V. Yelich. 2021. Mesic meadow habitat responses to variation in grazing management. Annual Rinker Rock Creek Ranch Research Webinar – Ongoing Research. Moscow, Idaho.
Randall, K. J., Ellison, M. J., and T. N. Johnson. 2021. Wet meadow habitat responses to variation in grazing management practices: balancing habitat requirements of greater sage-grouse with livestock production. Society for Range Management International Meeting, Virtual Meeting.
Johnson, T.N., K. Randall, and M. Ellison. 2020. Mesic meadow response to grazing utilization in south-central Idaho. Annual Meeting of the Society for Range Management, Idaho Chapter, Virtual Meeting.
"Grazing wet meadows at Rinker Rock Creek Ranch" by Heather Smith Thomas, *Ag Proud Idaho* Aug 2020 Vol. 2 (8): 23-24.
Randall, K.J., Ellison, M.J., and T.N. Johnson. 2020. Mesic meadow habitat responses to variation in grazing management: balancing sage-grouse habitat with livestock production. Idaho Chapter of the Wildlife Society Annual Meeting. Moscow, Idaho.
Randall, K.J., Ellison, M.J., and T.N. Johnson. 2020. Mesic meadow habitat responses to variation in grazing management: balancing sage-grouse habitat with livestock production. Society for Range Management National Meeting. Denver, Colorado.
Randall, K.J., Ellison, M.J., and T.N. Johnson. 2020. Mesic meadow habitat responses to variation in grazing management: balancing sage-grouse habitat with livestock production. Annual Rinker Rock Creek Ranch Research Webinar, Virtual Meeting.
Randall, K.J., Ellison, M.J., and T.N. Johnson. 2019. Mesic meadow habitat responses to variation in grazing management: balancing sage-grouse habitat with livestock production. Idaho Chapter of the Wildlife Society Annual Meeting. Boise, Idaho.
Randall, K.J., Ellison, M.J., and T.N. Johnson. 2019. Mesic meadow habitat responses to variation in grazing management: balancing sage-grouse habitat with livestock production. Annual Rinker Rock Creek Ranch Research Webinar, Virtual Meeting.

Table 2. Least-squares means estimates ± standard error for change in volumetric water content (%) between early-season (early June) and late-season (early August) pre-grazing sample periods and the regrowth sampling period (late September) in mesic meadow pastures during 2019 and 2020 at the Rinker Rock Creek Ranch in Blaine County, Idaho[1].

	Year (Y)		Season (S)	
	2019	2020	Early	Late
Change in Volumetric Water Content (%)	-11.53 ± 1.24[a]	-5.51 ± 1.24[b]	-14.93 ± 1.31[a]	-2.12 ± 1.31[b]

[1] Pastures were grazed for 16 days in 2019 and 2020.

[a, b]Means within year or season categories with different letters are different ($P \leq 0.05$).

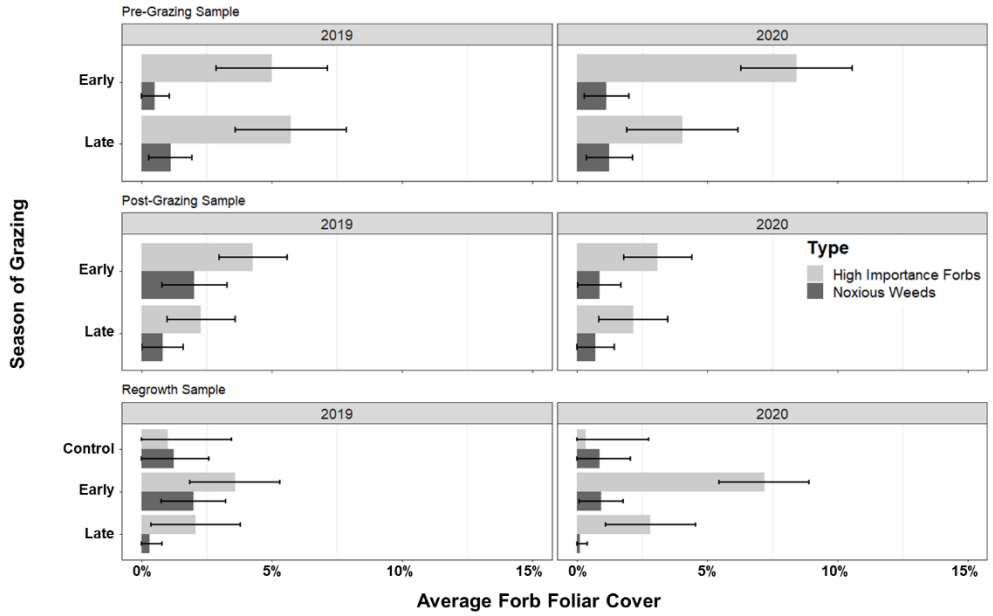
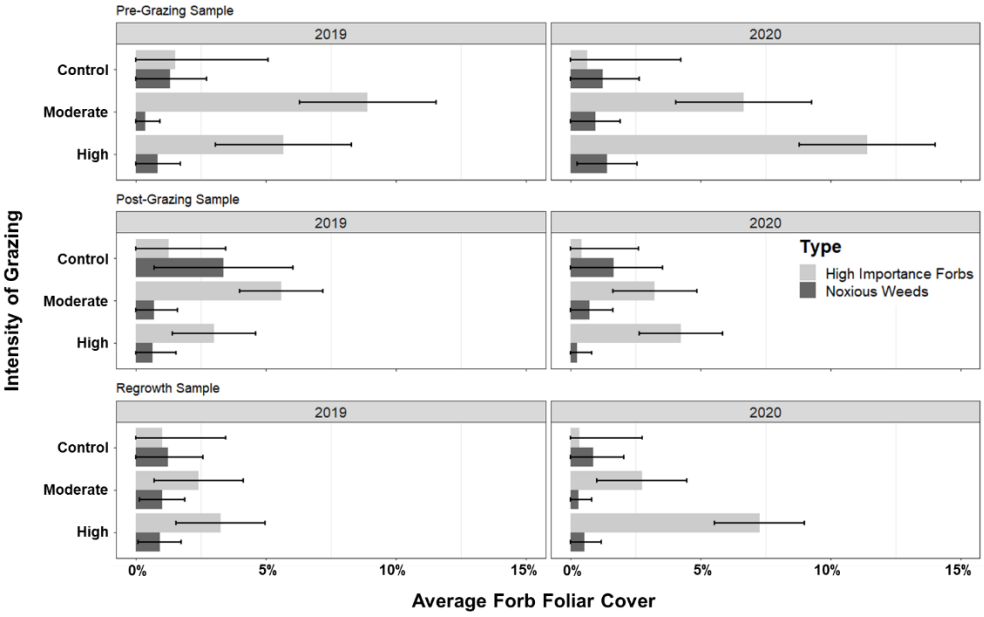


Figure 1. Least-squares means ± standard error of foliar cover (%) for preferred forbs of high importance to greater sage-grouse (*Centrocercus urophasianus*) and noxious weeds [cumulatively, field bindweed (*Convolvulus arvensis*), diffuse knapweed (*Centaurea diffusa*), and thistle (*Cirsium* spp.)] by grazing season during the pre-grazing (< 7 days), post-grazing (< 7 days), and regrowth (late September) sampling periods in early-season (early June) and late-season (early August) short-duration grazing treatments during 2019 and 2020 at the Rinker Rock Creek Ranch in Blaine County, Idaho.



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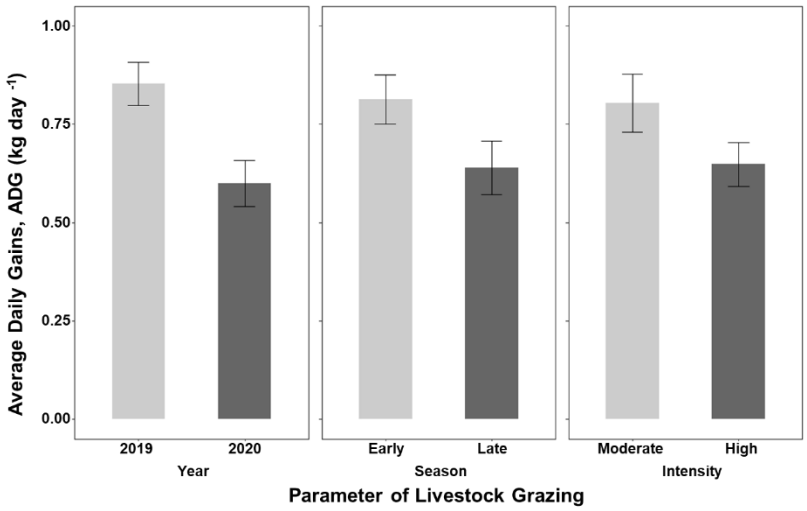

Figure 3. Least-squares means ± standard error of average daily gains (kg day^{-1}) per individual yearling heifer (Angus × Hereford crossbred) by year, season (Early: early June; Late: early August), and intensity (Moderate: 30-40% relative use; High: 70-80% relative use) of short-duration grazing treatments at the Rinker Rock Creek Ranch in south-central Idaho.