2022 Project Progress Report (Project 848915)

Maternal Influences Upon Calf Adaptability to Rangeland

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BACKGROUND

Our recent research (Sprinkle et al., 2021a), suggests that "efficient" 2-yr-old lactating cows use rugged rangelands more sustainably than "inefficient" 2-yr-old lactating cows. Cows that were previously ranked as more efficient (using data from GrowSafe™ feeding units) climbed higher at Rinker Rock Creek Ranch (**RRCR**) during the hot days of August.

Are differences in grazing behavior that have been observed for efficient vs inefficient cattle grazing rugged rangelands due to 'nature' or 'nurture'? How important is the role of social learning? Launchbaugh and Howery (2005) reiterated the premise that the "*most important models for social learning for a young animal were its mother and young companions"*. Furthermore, they stated that "*Mother markedly influences the establishment and persistence of her offspring's diet and habitat-selection patterns."*

If the differences in grazing rugged rangelands can be attributed mainly to genetic influences, then selection of replacement heifers could be aided by using genetic markers as those become available (Bailey et al., 2015; Stegmiller et al., 2021).

Numerous studies suggest that the influence of 'mother' declines as offspring mature (Launchbaugh and Howery, 2005). Anecdotal and scientific studies also affirm that younger animals grazing rangelands spend less time following mother as she is engaged in morning and evening grazing bouts and more time in the presence of a "guard" cow. As a calf starts eating more forage and relying less on mother's milk, the opportunity for social learning may increase. Calves aged 2 to 3 months can be expected to consume approximately 20 to 40% of the dietary calories from forage but up to 40 to 70% at 3 to 5 months (depending upon year and cow milk production; Ansotegui et al., 1991).

This research fits within the *sustainable range livestock production* mission of the David Little Livestock Range Management Endowment. Not only is it important to have resilient rangelands, it is also important to have cows that fit those rangelands, especially as climate change contributes to hotter, longer summers. As we search for the optimal cow to fit Idaho rangelands, it is important to determine how cattle distribute over rugged rangelands and how that is influenced by both nature and nurture.

HYPOTHESES/OBJECTIVES

We hypothesized that calves from efficiently ranked cows would follow mother as the calf aged and temperatures increased, and that grazing behavior would differ, with calves from efficient cows accessing more difficult slopes and spending less time resting during the heat of the day than calves from inefficient cows. Additionally, we hypothesized that cows differing in feed efficiency would exhibit differences in grazing behavior and grazing distribution, with efficient cows traveling further and grazing

more of the available pasture. We also hypothesized that efficient and inefficient cattle would differ in the amount of time spent grazing, resting, and walking.

PROCEDURES

Experimental Pastures and Animals. This research occurred at RRCR, 11 miles southwest of Hailey, Idaho. There were 35 three to 8-yr-old cows and their calves (17 efficient; 18 inefficient) which carried grazing collars (Sprinkle, 2021b) containing both accelerometers and GPS loggers. Cattle grazed upland range pastures with the rest of the 165-cow herd from approximately mid-May until mid-October with calves being weaned in mid-September. Grazing locations and other GPS data were determined on 5- to 7-minute intervals and daily accelerometer activity was evaluated at 5 second intervals. Collars were installed at turnout on May 19th, then each cow and calf had their behavior (grazing, resting, walking + suckling for calves) observed in a smaller pasture over 4 days in order to obtain a "data signature" for the recorded accelerometer data. Collars were removed after 27 days and then reinstalled July, following the same procedures. Little or no work has been done with suckling calves to determine grazing behavior. We anticipated that grazing behavior data for calves less than 4 months of age would be difficult to determine and that we might only obtain reliable GPS data for the first sample period. However, we anticipated that we would be able to obtain reliable accelerometer data on calves as they grazed more later in lactation. Weather data from the nearest remote weather station will be compared against daily cattle behavior to quantify the effects of climate upon animal behavior. It should be mentioned that an accompanying study split the 35 cows in each group and their calves into two groups and cows either received or did not receive an injectable trace mineral (ITM). However, sample size was adequate to determine treatment differences within each factorial treatment.

Production Data. All cattle were weighed and scored for body condition (cows only) each time collars were mounted or removed. Adjusted calf weaning weights and cow pregnancy status were determined at weaning.

Forage Utilization and Production. Forage production was collected prior to the first cattle entry at 1 location within the experimental pastures with 20 randomized 0.16 m^2 quadrat frames at each location. These samples will be further evaluated for forage quality (digestibility and crude protein). Forage utilization was estimated using the height:weight utilization gauge method.

Statistics: Cow and calf grazing behavior data will be analyzed within each sample period by mixed model procedures for repeated measures with RFI group, ITM treatment, date, ITM treatment x date, and RFI group x date as fixed effects and cow (or calf) within RFI group x ITM treatment as a random effect. Production data will be analyzed by a mixed model procedures for repeated measures with RFI group, ITM treatment, cow age, sampling date, year, and RFI group x ITM treatment as fixed main effects and cow or calf within RFI group x ITM treatment as a random effect. The DNA data will have a Genome-Wide Association Studies performed using the SNP & Variation Suite version 8.7.2 software (Golden Helilx, Inc., www.goldenhelix.com).

We received $7,000 from the David Little Livestock Range Management Endowment and spent all the money to support travel for 6 people who assisted with data collection in 2022. Total travel funds expended in 2022 to support this research was $8,475, the balance being covered by other funding.

ACCOMPLISHMENTS/PRELIMINARY RESULTS for 2022

Grazing behavior data were collected on 35 cows + calves at RRCR during mid and late lactation. The company that has been helping us develop the data loggers we are using continues to help us to improve data acquisition. We retrieved an average of 11 to 12 days data for the loggers, but there were units that logged data for 30 days. The company will be assessing all our data collected in July 2022 and will seek to improve the firmware (software) to extend data collection over more days.

We were able to successfully process 2021 calf grazing behavior data (1st year of project) for calves aged 3 to 4 months (to date, have processed 17 calves for this age group).

DNA has been collected for all cows and calves on this project.

Figure 1 compares an inefficient cow and her calf on July 16, 2021. Both cow and calf were lying down in the same bedding ground from midnight until early morning. When the cow went to water on the SE corner of the pasture, the calf stayed behind. At around 10:41 AM, the cow started grazing towards water on the NE corner of the pasture and the calf was following by 11:20 AM. Both cow and calf were resting at the NE part of the pasture by 13:06. The cow got up to graze in the lower part of the pasture at

16:23. At 18:13, the cow commenced grazing towards the uplands and the calf did not follow, preferring to graze at lower elevations.

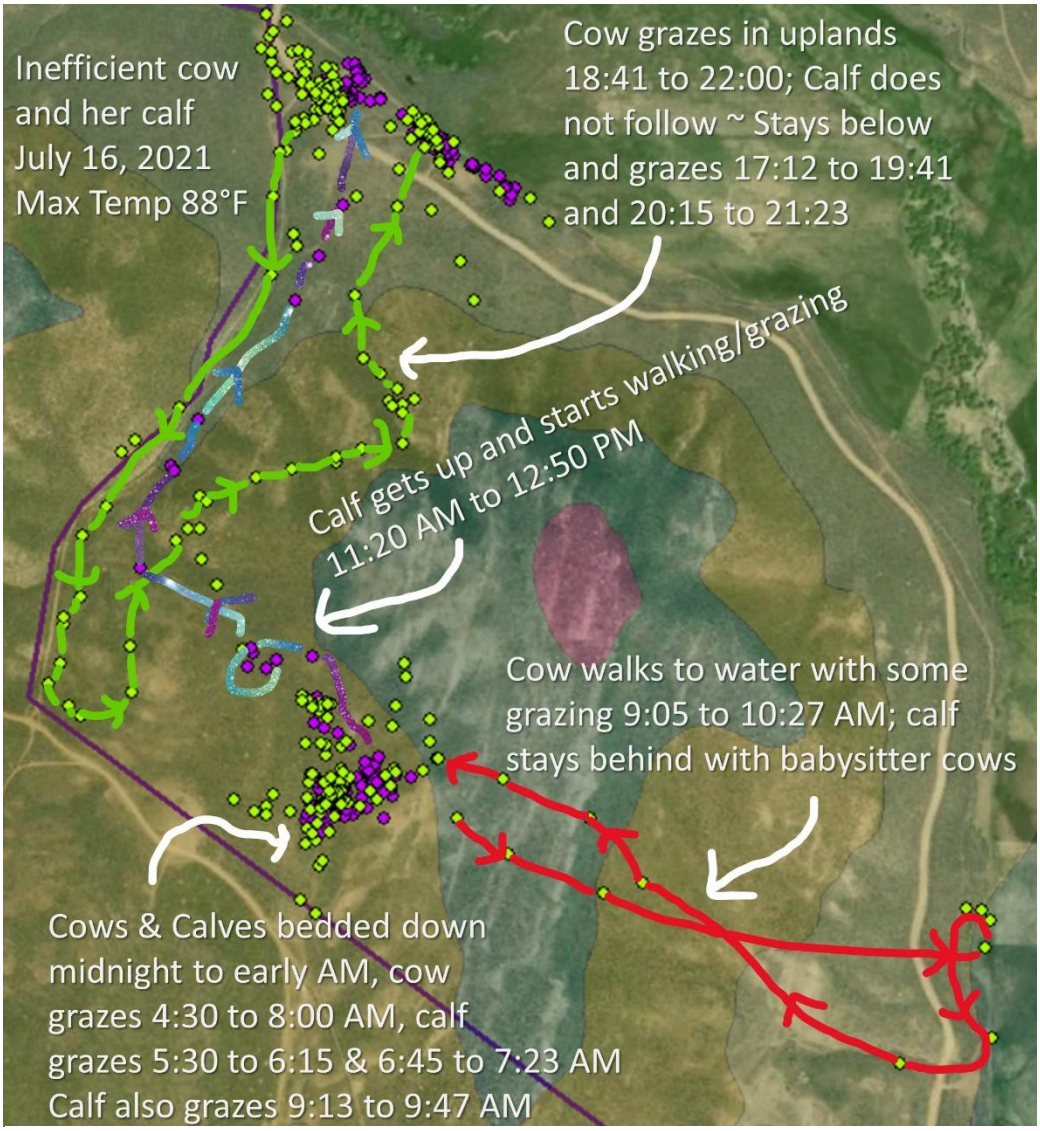

Figure 1. A cow (green dots) and her calf (purple dots) on July 16, 2021. The cow grazed 10.6 h, rested 11.9 h, and walked 1.5 h. The calf grazed 6.9 h, rested 16.0 h, walked 0.7 h, and nursed for 0.5 h. Nursing was about 50% of the average on this day. On this day the cow spent 8.2% of her time on slopes greater than 15% while the calf only spent 0.7% of its time on steeper slopes.

PUBLICATIONS/OUTPUTS

This project will be the subject of a future *Life on the Range* video production. We were interviewed and filmed by Steve Stuebner in May of 2021 at RRCR. He is planning on completing the story this coming spring after we complete our preliminary data analysis. Some of this initial story is featured on the Life on the Range Facebook page https://www.facebook.com/lifeontherange/posts/visited-the-rinker-rock-creek-ranch-today-for-a-research-story-about-genetic-and/3991896690879691/ .

The methodology for using accelerometers for predicting grazing behavior has been published (Sprinkle et al., 2021b). Jim Sprinkle has been asked to review several accelerometer journal articles. Additionally, he delivered guest lectures in both the UI College of Agriculture and Life Sciences and the College of Natural Resources in 2022 on using accelerometers in precision agriculture systems. Additionally, he has provided training to students at Brigham Young University on using this technology.

A highlight this year was an invited presentation on *Finding the Ideal Cow to Fit Idaho Rangelands* by Jim Sprinkle to the Idaho Legislature House Agricultural Affairs Committee. The same topic was presented by Scott Jensen at the National Association of County Agricultural Agents at their annual meeting at West Palm Beach, Florida in July 2022. He also presented a synopsis of the project at the Owyhee County Winter Beef School.

This research has also been featured in the Idaho Post Register (June 24, 2022 by John O'Connell) and in the Rangeland Center Website (July 2022 issue).

Dr. Brenda Murdoch's research lab at the University of Idaho has been cooperating with us in the analysis of DNA to look for genetic markers for cattle related to terrain use and grazing behavior. Her graduate student, Morgan Stegemiller, presented gene marker research derived from our prior grazing behavior research (2016-2017) at RRCR at the Western Section, American Society of Animal Science Meeting in Fort Collins on October 19, 2021. Scientists from other universities were interested in this research and sought Morgan out for more information. Morgan found 5 gene marker regions in our experimental cattle that related to terrain use and grazing behavior, explaining from 43 to 52% of the animal variance for grazing time, walking time, maximum slope, and time spent on slopes > 15 degrees (Stegemiller et al., 2021). We are excited about these results and look forward to additional information to be contributed by our current research.

We anticipate completing data analysis by the fall of 2023 with manuscript submissions by the spring of 2024. We anticipate the presentation of this research to Extension audiences such as the Idaho Range Livestock Symposium. We also anticipate the production of an Extension bulletin and/or video about fitting cows to a range environment.

We appreciate the funding from the David Little Livestock Range Management Endowment that has helped make this research possible.

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