GSL Researcher

Travis Mulliniks,
Range Cattle Nutritionist

Greetings from the faculty, cowboys, staff, and students at and associated with the Gudmundsen Sandhills Laboratory. In this edition, you will find updates on what is going on at GSL and achievements from faculty and staff associated with GSL.

We are excited for the Open House this year. Our goal is to always put on a high-quality program that fits the needs of our clientele and stakeholders in the state. I believe this year we have a program that fits a lot of needs for producers across the state. The morning session will cover cattle market updates, long-range weather forecasts with Don Day, flexible grazing strategies with David Augustine from the ARS-USDA Rangeland Resources and Systems Research Unit, and a post-fire producer panel. In the afternoon, Shelby Rosasco, University of Wyoming Beef Specialist, will discuss young cow management strategies to improve reproductive performance and longevity of the cowherd. Alfredo DiCostanzo, UNL beef educator, will cover how retaining ownership might look for a cow-calf producer. In addition, the afternoon session will wrap up with updates on research happening here at GSL. If you are unable to attend the Open House or watch the live webinar, the recorded presentations will be available at gsl.unl.edu after the Open House.

In the last year, we have had a lot of research projects ending, which most of these can be found in the upcoming 2024 Nebraska Beef Report. Yijie Xiong published a paper validating depth cameras to estimate body weight of mature range cows. Josie Crouch, a MS student for Kacie McCarthy and myself, retrospectively analyzed 15 years of GSL heifer data on the impact of percentage of mature body weight at breeding on long-term performance. Mitch Stephenson finalized a study on the impact of grazing subirrigated meadow on subsequent year hay production and forage quality. My lab will have five different reports covering a couple late gestation supplementation strategies studies on cow-calf performance through finishing phase, a couple young cow postpartum supplementation studies focused on increasing reproductive performance, and a study on the impact of increasing milk production in both March - and May-calving herds on cow-calf performance. Some data analyzed in the milk production study can be seen in the Highlighted Research in this newsletter.

On a different note, this will be my last GSL Researcher introduction. The last six years of serving Nebraska has been very rewarding. Nebraska has some of the best clientele in the nation to work with and do production systems research to fit their needs. When I arrived at UNL, GSL had challenges with limited number of faculty involved, low reproductive performance especially with young cows, a broad calving distribution with a high number of later calving cows, and under-utilized pastures. A focus of ours since my arrival has been how we can fix these issues. From the cow herd perspective, we have been able to increase reproductive performance and tighten the calving window by going to a low-cost strategic supplementation and targeted grazing of subirrigated meadows early in the growing season. I am also proud of what we have accomplished in the last six years with growing the number of faculty members doing production systems research driven by the needs of our diverse and numerous stakeholders across Nebraska. With all of that, it was a bittersweet decision, but in May, I accepted an endowed professorship and Associate Department Head position at Oregon State University. It has been my pleasure and honor to have worked with some of the best producers in the state, faculty members on and off campus, and especially the staff located at GSL, which are some of the best research staff in the system.

I hope you enjoy the August 2023 GSL Researcher. If we can do anything better to serve you, please let us know.

UN GUDMUNDSEN SANDHILLS LABORATORY

GSL SPOTLIGHT

Jessica Koenen grew up in Ohio showing horses. She is currently taking classes through the University of Nebraska-Lincoln to finish a Bachelor of Applied Science with a minor in Animal Science. She has worked at GSL for six months. She enjoys being outside all day and working with cattle. Jessica spends her free time hiking and riding her horse.

GSL INTERNS

Parker Garcia started interning at GSL in May. He is from Paton, Iowa. He will graduate in May 2024 from Iowa Central Community College with an Animal Science degree and welding certificate. He is thankful for the opportunity to work at GSL and the connections he has made.

MarLee Neu started her internship at GSL in May. She is from Minatare, Nebraska and grew up showing cattle through 4-H and FFA. She went to Northeastern Junior College in Sterling, Colorado where she was on a competitive livestock judging team. She graduated with her Associates of Animal Science and Ag Business degree. She will be starting her senior year this fall at West Texas A&M University and graduating with a Bachelors of Animal Science degree. MarLee is grateful for this opportunity to learn more about the cattle industry and be a part of the ranching and research process at GSL this summer.

GRADUATE STUDENT UPDATE

Josie Crouch: M.S Student from Rolla, MO, is working with Kacie McCarthy and Travis Mulliniks. She received her B.S in Animal Science from the University of Missouri-Columbia in May 2022. She completed the first year of her master's program in Lincoln and will finish her second year at GSL. Her research investigates different heifer development strategies in regard to the use of pre-breeding/breeding supplementation, different overwinter rates of gain, and the impacts that has on economics and heifer performance.

Biquan Zhao: Ph.D. student from China is working with Mitch Stephenson. He is working on the long-term plant production data at GSL, studying changes and trends in long-term biomass production for different plant functional groups and their responses to variability in precipitation and temperature. He received a master's degree in agricultural information engineering in China, and his study interest is leveraging remote sensing and integrating multiple sources of information into agriculture systems to dedicate a smart farming. Results will improve understanding of the rangeland ecological function in productivity at GSL and highlight the importance of long-term rangeland monitoring.

RANGE & PASTURE UPDATE

By **Jerry Volesky**,
Range Scientist

At GSL the 2023 growing season started with a very dry April, but precipitation in May, June and July was 144% of average for that 3-month period. This good rainfall has certainly benefitted range recovery that was impacted by the 2022 drought.
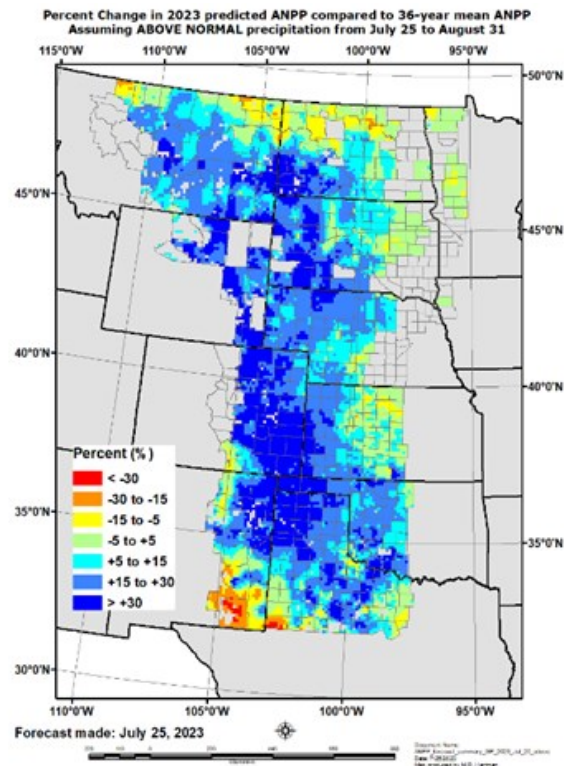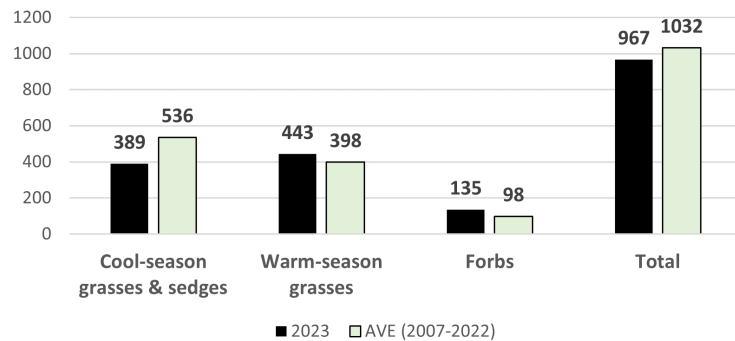
From our annual mid-June sampling of upland range production at GSL, we found current year forage production at that time to be 967 lb/acre (Figure 1). This is just slightly below the long-term average for that date. Most of the difference came from lower production of cool-season grasses and sedges which were more affected by the dry April. It is not uncommon to see lower pasture production the year following a drought even if there is good precipitation. This is because of the drought's impact on perennial grass vigor. Weedy annual forbs also tend to be more abundant after drought. We did observe more forbs in mid-June compared to the long-term average and I would expect a further increase in forbs throughout August as species like sunflowers and lambsquarters continue to grow.

The Grassland Production Forecast (Grass-Cast), a model for the Central and Northern Great Plains does predict that 2023 range and pasture production will be above normal in most parts of Nebraska (Figure 2). However, I feel the magnitude of the increase may be somewhat high considering the impact of the 2022 drought on the grasses. Most of the northern states of South Dakota, North Dakota, and eastern Montana, will have above average range production. Additional information on Grass-Cast can be found at https://grasscast.unl.edu/

Table 1. GSL Precipitation (inches)

Month	Ave	21-22	22-23	22-23 Cumulative
Oct–Mar	3.66	1.85	5.84	5.84
April	2.05	2.40	0.76	6.60
May	3.32	3.56	5.00	11.60
June	3.43	0.97	4.50	16.10
July	3.07	3.39	4.68	20.78
Aug	2.19	2.90		
Sept	1.74	0.46		
Total	19.46	15.53		

Figure 1. Mid-June forage production (lb/acre) of upland range at GSL by plant functional group.

■ 2023   □ AVE (2007-2022)

Percent Change in 2023 predicted ANPP compared to 36-year mean ANPP Assuming ABOVE NORMAL precipitation from July 25 to August 31

Forecast made: July 25, 2023

3

TECHNICAL NOTE: EVALUATING THE EFFECTS OF ACUTE HEAT STRESS IN FEEDLOT CATTLE

Rachel Gibbs, Postdoctoral Research Fellow

Heat stress occurs when the animal's heat load (internal heat production and external inputs) outweighs its ability to dissipate it. Clinical signs of heat stress include increased respiratory rates, elevated rectal temperatures, and reduced feed intake. These heat stress events result from sudden changes in environmental temperatures and may only last for a few days. A recent example occurred in Gudmundsen Sandhill Laboratory (GSL) steers being finished at the West Central Research & Extension Center (WCREC) Feedlot, North Platte. These cattle experienced a 5-day heat event in late July where ambient temperatures over 100°F, created heat indices topping 105°F. Graduate students from UNL observed clinical signs of severe heat stress during peak heat each day, which included open-mouth panting, rectal temperatures greater than 106°F, and 2-fold increases in respiratory rates.

Figure 1. Evaluating direct effects of acute heat stress in a controlled environment on UNL campus in Lincoln.

Heat stress is estimated to cost the cattle industry upward of $350 million/year. With nearly 2.5 million finishing cattle in Nebraska feedlots alone, understanding how acute heat events influence animal behavior, health, and productivity is critical for developing strategies to protect livestock from heat stress. Four UNL animal scientists have collaborated to investigate the effects of acute heat stress on behavioral changes (Ty Schmidt, Ruth Woiwode), animal physiological responses and recovery (Dustin Yates), and animal genetic/genomic influence (Jessica Petersen). Funded by the UNL Agricultural Research Division Hatch Multistate Enhanced Research Award, this 5-yr project combines three main objectives: 1) characterizing stereotypical behaviors of heat-stressed feedlot cattle utilizing artificial technology, 2) evaluating the epigenetic changes following acute heat stress exposure, and 3) identifying physiological responses to acute heat stress and how long they persist following exposure. This ongoing project involves a two-phase design. First, GSL steers are initially challenged with acute heat stress in controlled environmental chambers (Fig. 1) on the UNL campus in Lincoln. Afterwards, cattle are finished and evaluated at WCREC, North Platte. During both phases, biological samples including blood plasma and muscle and adipose tissue are collected to evaluate physiological and genomic changes while behavioral changes are tracked with the NU Livestock Monitoring Software (Fig. 2). This approach will provide detailed information on the physiological effects of acute heat stress as well as real-time evaluation of cattle behavior within a feedlot system following acute heat stress.

Figure 2. Real-time monitoring of cattle behavior and response to acute heat stress at the West Central Research & Extension Center with the NU Livestock Monitoring System Software.

RANCH UPDATE

By **John Nollette** and **Jacki Musgrave**

After a long cold winter, we were fortunate to get through March calving without any major storms. Fewer March heifers calved in the first 21 days compared to 2022 (82.5 vs 92%, 2023 vs 2022). We had fewer March cows calving in the first 21 days in 2023 (76.1%) compared to 2022 (80%). However, we had 93% of May heifers calving in the first 21 days, up from 76% in 2022. Slightly more May cows calved in the first 21 days in 2023 (87.5%) compared to 2022 (84%). Calf birth weights were similar to the previous two years across all herds.

Due to another dry spring, we did see some impacts on forage quality. Forage quality on upland range and sub-irrigated meadow were both below average in June and July. Crude protein of range diets collected from esophageally fistulated cows in June were 10.7% compared to our long-term average of 12.5%. July range diets remained below our long-term average (10.0%) at 8.7% CP. Meadow CP values were much lower than average in June (9.2 vs 14.1%) and July (7.9 vs 13.2%).

Gains of grazing yearlings are a good indicator of forage quality. Average daily gains on sub-irrigated meadow were lower in 2023 than the previous two years. Gains from early May to early August were 1.81 lb/d in 2023 compared to 2.95 and 2.45lb/d in 2022 and 2021, respectively. The decreased gains are likely due to the lower-than-average meadow quality.

With a wet July, we are behind schedule haying. Our contractors were able to get the higher ground put up in mid-July. As with a lot of producers in our area, we fed more hay last winter (1,043 tons) compared to our 5-year average (954 tons). As much as we appreciate the precipitation, we are hoping to be able get most of the low ground put up so we can replenish our hay reserves.

In the last 3 years, we have AI'd cows to high-milk EPD Red Angus sires to determine the impact of intentionally increasing the milking potential of the herd on cow performance. The first crop of May-calving heifers out of high-milk EPD AI sires entered the cow herd this year. Last month, we milked a subset of heifers from both the high-milk EPD sires and our moderate-milk EPD bulls. Twenty-four-hour milk production at 60 d post-partum was 9.6 pounds for high-milk heifers compared to 8.9 pounds for natural service sired heifers. Although milk production was greater in the AI-born heifers, the difference was not as much as we expected.

This marks the last edition of The Researcher with Travis's involvement as he is leaving to take a position in Oregon. The ranch and crew have evolved quite a bit since Travis came to UNL in 2017 -- from the way we collect cattle weights, to the use of technology (aka Smart Feeders) used to deliver supplement to cattle. Through his research, we have all grown in our knowledge of new and changing techniques in data collection. Travis has left a lasting impression on GSL and we all wish him the best of luck in his new position.
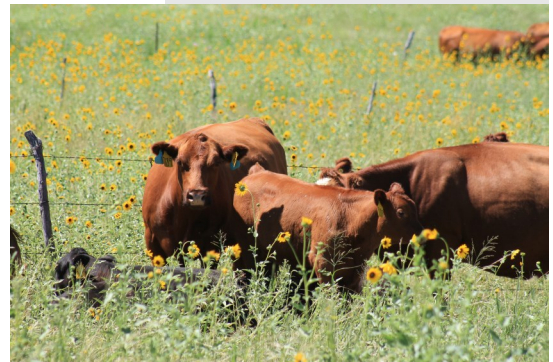
Impact of calving season on milk production characteristics
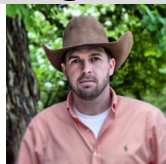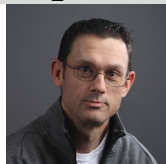
Matt Spangler, Extension Beef Genetics Specialist
Travis Mulliniks, Range Cattle Nutritionist

As part of a USDA-CARE grant looking at the impacts of increasing milk production in cow-calf production systems, data were analyzed to characterize milk production parameters and the heritability of milk production in the March and May-calving herds at GSL. This part of the study was done with the help of Melanie Hess and Matt Spangler. In a 3-yr study, data were collected on 178 crossbred cow-calf pairs from March- and May-calving herds. On approximately 30, 60, 90, 120, and 210 d postpartum, individual cow 24-h milk yield was estimated through weigh-suckle-weigh techniques. A lactation curve (Wood's Curve), which graphically represents the daily milk yield, was fitted to each cow's milk yield data across the 5 milkings. Milk yield across the entire lactation curve tended to be greater 2 out of 3 years in the May -calving herd than the March-calving herd (Table 1). Peak lactation occurred later in March-calving cows all 3 years compared to the May-calving herd. Peak lactation is generally thought to occur around 58 days post-calving. In this dataset, time to peak lactation occurred 47 days or less in the March-calving cows. Interestingly, peak lactation occurred 12 to 31 days after calving in the May-calving herd. May-calving cows did average 8-10 lb more milk at peak milk production.

Lactation persistence, defined as the rate of decline in production after peak milk production, was also calculated, with high lactation persistency meaning a slow rate of decline and low lactation persistency meaning a rapid rate of decline. In the current data, May-calving cows had lower lactation persistence, which is probably due to the timing of lactation days and sharp decline in forage quality in July and August. These results illustrate the ability of the grazing environment to manipulate milk yield, time to peak, and persistency of the lactation curve. Look for more on the heratibility results in the Spring 2024 GSL Researcher

Table 1: Mean and Standard Deviation of Wood's Curve Phenotypes by Season of Calving and Year

Month	Year	Milk Yield (lb)	Time To Peak (Days)	Peak (lb)	Persistence
March	2020	2,194 ± 357	23.2 ± 32.4	16.7 ± 4.0	6.2 ± 1.7
	2021	2,486 ± 421	47.5 ± 34.6	15.5 ± 3.2	7.1 ± 1.3
	2022	2,301 ± 351	47.4 ± 27.0	14.9 ± 4.8	6.9 ± 1.3
May	2020	2,431 ± 581	12.2 ± 18.8	24.5 ± 10.3	5.3 ± 1.1
	2021	2,735 ± 581	19.4 ± 24.4	25.4 ± 11.2	5.8 ± 1.6
	2022	2,124 ± 525	31.6 ± 23.9	22.5 ± 10.1	7.0 ± 2.4

Gudmundsen Sandhills Laboratory: Serving the Beef Industry for 44 years

N EXTENSION

24th Annual Open House

Wednesday, August 23, 2023
8:00 AM to 3:30 PM (MDT)
Gudmundsen Sandhills Laboratory
Wagonhammer Education Center
Whitman, Nebraska

This year's Open House is a hybrid format with our traditional in-person event along with being live streamed online. Activities and commercial exhibits are planned so our guests can come and go as they please throughout the day.

AGENDA	
8:00 AM	Registration
All day	Visit with exhibitors.
8:15	Welcome - Kelly Bruns, WCREEC Director
8:30	Cattle Market Update - Katelyn McCullock, Director of Livestock Marketing Information Center
9:15	Long Range Weather Forecast - Don Day, DayWeather Inc.
10:00	Break
10:15	Flexible Grazing Strategies - David Augustine, ARS-USDA Rangeland Resources and Systems Research Unit
11:00	Post-fire producer panel - Moderated by Mitchell Stephenson, UNL Range Extension Specialist
11:45	**Lunch - Please thank these sponsors** **ReproScan, Ward Labs, Lashley Land and Recreational Brokers, Merck, Agri Affiliates, Farm Credit Services, Emerson Equipment, Arrow Seed**
1:15	Young Cow Management to Optimize Reproductive Performance - Dr. Shelby Rosasco, University of Wyoming Extension Beef Specialist
2:00	Retaining ownership as a Cow-Calf Producer - Alfredo DiCostanzo, UNL Beef Extension Educator
2:30	Research Updates •*Heifer Development - Josie Crouch, UNL Graduate Student* •*Virtual Fence, Rangeland Plant Production, and Grazing Management - Kaitlyn Dozler, UNL Graduate Student, and Mitch Stephenson, UNL Range Extension Specialist* •*Fly Control on Pastured Cattle in 2023 - Dave Boxler, UNL Beef Extension Educator*
3:30	Adjourn, thank you for attending!

PUBLICATIONS

Xiong, Y.*, I.C.F.S. Condotta, **J. Musgrave**, T. M. Brown-Brandl, and **J. T. Mulliniks**. 2023. Estimating body weight and body condition score of mature beef cows using depth images. *Translational Animal Science: in press*. Doi: 10.1093/tas/txad085.

GSL IN THE NEWS

Forty-seven high school students from Cherry, Grant, Hooker, and Thomas counties attended the Gudmundsen Sandhills Laboratory (GSL) Youth Science Day on October 5, 2022. Read more about it at https://beef.unl.edu/beefwatch/2022/2022-gsl-youth-science-field-day. This year's Youth Science Day is scheduled for September 27, 2023.

The Gudmundsen Sandhills Laboratory (GSL) is a research ranch located in the heart of the Nebraska Sandhills. It is comprised of 11,600 acres of upland native range and 1,200 acres of subirrigated meadow. It was gifted to the University of Nebraska Foundation in 1978.

Since GSL's inception, research and educational programs have become more ecologically diverse and team oriented. Joint projects with animal, range, soil, veterinary, economics, entomology, geology, hydrology, forestry and wildlife have increased our understanding of the Sandhill's ecosystem. This has resulted in advances in range livestock nutrition, beef cattle reproduction, grazing systems, rangeland ecology, low cost cattle management, groundwater issues, and wildlife management.

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The GSL Researcher is designed and co-edited by TL Meyer, Beef Extension Educator, Thedford, and Jacki Musgrave, Research Technologist III, GSL, Whitman. The GSL Researcher is published in the spring and fall of each year.