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GSL Researcher

Fall 2024



Jerry Volesky, Range Scientist



In 1978, Elmer "Pete" and Abbie Gudmundsen gave the former Rafter C Ranch (12,800 acres) to the University of Nebraska Foundation. The University of Nebraska-Lincoln leased the Gudmundsen Sandhills Laboratory from the Foundation in 1981. This year marks the 25th anniversary of an annual Gudmundsen Sandhills Laboratory (GSL) Open House.

It is important to note, that prior to 2000, there were several other Field Days at GSL. The first was in October of 1987. This field day had the theme of "GSL – The First Six Years". Research reports for that event included topics of heifer development, cow reproduction and nutrition, herd health, fly and parasite control, range and meadow management, and forestry. Student training has always been very important at GSL. At that first field day, it was noted that eight graduate students had conducted their thesis research at GSL. In June of 1989, GSL hosted a Field Day and tour as part of a summer meeting for the Society for Range Management. Research reports for this event focused on meadow and range management and geology and ground water. Other field days were also held in 1994, 1996, and 1998. The event in 1996 completely focused on the calving seasons research and the program in 1998 was centered on meadow and rangeland management.

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, cost-effective cattle management, groundwater issues and wildlife management.

Research faculty involved in these projects are affiliated with the West Central and Panhandle Research Extension and Education Centers, and several departments, as well as the School of Natural Resources on campus in Lincoln.

With the integration of ranch economics into many facets of research, GSL has become an integral part in developing plant/animal production systems that are economically and environmentally sustainable in the Sandhills of Nebraska.

This year also marks the 25th session of the Nebraska Ranch Practicum. The Ranch Practicum, with most sessions held at GSL, is a three-season, hands-on educational program designed to give participants the skills and education needed in today's complex ranching industry. Participants develop their ability to efficiently use decision support tools to evaluate management and marketing alternatives dealing with grazing strategies and systems, methods of managing market risk, calving and weaning dates, winter livestock nutrition, cull cow management, feed rations and mineral supplements. Over its existence, the Practicum has provided training to over 700 participants.

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GSL SPOTLIGHT



Karla Wilke has been the UNL cow-calf, stocker management specialist at the Panhandle Research and Extension Center in Scottsbluff, NE since 2009. Karla did her PhD research at the Gudmundsen Sandhills Laboratory evaluating metabolizable protein needs of nursing calves and rumen degradable protein requirements of gestating cows with Don Adams and Terry Klopferstein.

Her current research includes supplementation strategies to improve pregnancy rates in 2- and 3-year-old cows grazing Sandhills range and strategic supplementation of yearling cattle during summer grazing at the High Plains Ag Lab near Sidney, NE. Additionally, her research has included evaluating sugar beets and field peas for beef cattle, and maintaining production cows in confinement due to limited pasture resources.

The best part of her job is sharing research-based information with producers.

She and her husband Todd also run cows north of Dix, Nebraska in a semi-confinement, integrated crops and livestock system.

GSL INTERNS



Marina Guynn spent her spring break at GSL then returned in May to continue her internship. Marina grew up in Kiowa, Colorado on a small cow/calf operation. At one point, they were part of American Bucking Bulls Inc., but now raise steers for beef. She and her brother showed cattle in 4H. Marina graduated from the Nebraska College of Technical Agriculture in 2024 with an AAS for Livestock Management.



Makenna Dirkschneider started her internship at GSL in May. She is a senior at UNL studying Animal Science with an option in Food Animal Production and Management, with minors in the Krutsinger Beef Industry Scholars and Agribusiness. She is a member of Sigma Alpha Alpha Delta Sorority. Makenna is from West Point, Nebraska, and grew up working on her family's feedlot operation, participating in 4-H, and FFA. During her free time, Makenna enjoys spending time with her family and fiancé, hunting, riding horses, and working with her dog. After graduation, Makenna plans to pursue a career that allows her to advocate and best represent the beef industry.

Welcome to New Communications Specialist!

Karlie Gerlach joined UNL's West Central Research, Extension and Education Center as Communications Specialist in June. She recently graduated from UNL with a bachelor's degree in Agricultural and Environmental Sciences Communication, along with minors in Agricultural Leadership and the Engler Agribusiness Entrepreneurship program.



RANGE & PASTURE UPDATE

By **Jerry Volesky**,
Range Scientist



At the Gudmundsen Sandhills Lab (GSL), the 2024 growing season started with April and May precipitation slightly below the long-term average, but above average in June and July. The 5.11 inches that fell in June was well distributed across the entire month and benefited both cool- and warm-season grasses. Through July, the cumulative precipitation since last October is above the long-term average (Figure 1).

From our annual mid-June sampling of upland range production at GSL, we found total current year forage production at that time to be 1322 lb/acre (Table 2). This is above the long-term average for that date. Most of the difference came from greater production of warm-season grasses and forbs. Early August warm-season grass growth in this area of the Sandhills looks excellent, boosted by the abundant June and July rainfall.

Table 1. GSL Precipitation, inches

Month	Ave	22-23	23-24	23-24 Cumulative
Oct to Mar	3.66	5.84	5.11	5.11
April	2.05	0.76	1.83	6.94
May	3.32	5.00	2.58	9.52
June	3.43	4.50	5.37	14.89
July	3.07	4.68	3.19	18.08
August	2.19	2.04		
September	1.74	1.25		
Total	19.46	24.07		

Table 2. Mid-June forage production of upland range at GSL by plant group, lb/acre

	Cool-season grasses & sedges	Warm-season grasses	Forbs	Total
2024	552	555	215	1322
Average(2007-2024)	536	398	98	1032

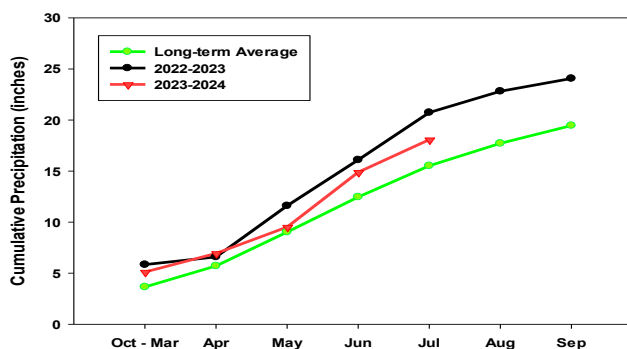
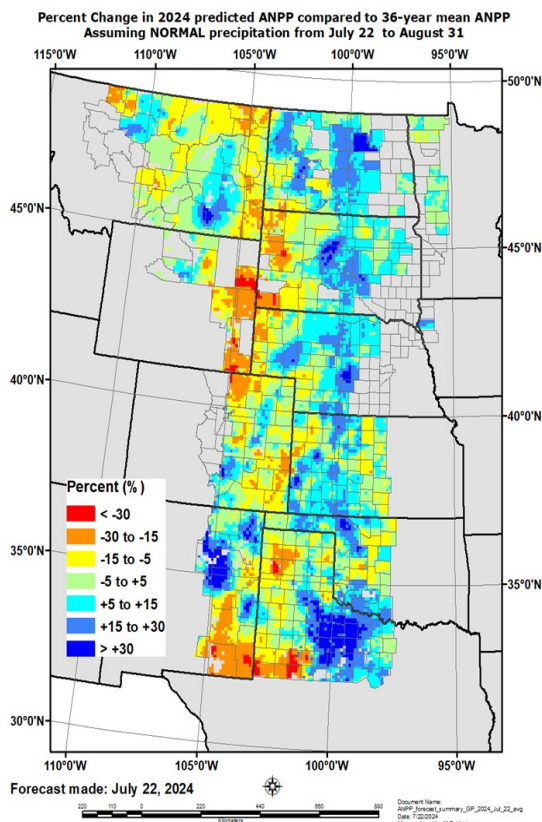


Figure 1. Cumulative precipitation at the Gudmundsen Sandhills Laboratory from October 2023 through July 2024

Grassland Production Forecast (Grass-Cast), a model for Central and Northern Great Plains, predicts 2024 range and pasture production will be above normal in most parts of the Nebraska Sandhills (Figure 2). Production in much of the western Nebraska Panhandle is projected to be below average because of drought conditions the past spring and summer. Additional information on Grass-Cast can be found at <https://grasscast.unl.edu/>

HIGHLIGHTED RESEARCH

Impact of overwinter gain on growth and reproductive performance in March-born heifers



Josie Crouch,

Livestock Systems Extension Educator, Nance County

Replacement heifers are the next generation in the cow herd, where future herd productivity can be affected by selection and management decisions. Producers have been encouraged to develop heifers at growth rates that promote attainment of puberty prior to breeding, since age at puberty is an important trait. However, challenges may arise to meet nutrient demands and gains when cattle are consuming low-quality forages.

Some research has suggested that developing heifers at slower or restricted rates of gain during the post-weaning period has a potential economic benefit, reducing feed costs, without negatively impacting overall heifer performance. This 3-year study utilized Red Angus x Simmental crossbred heifers at the University of Nebraska Gudmundsen Sandhills Laboratory to determine the impact of rate of overwinter gain on growth rates, reproductive performance, and economics in March-born yearling heifers. Heifers were stratified by 3-d body weight (BW) averages and randomly assigned to achieve a 1) low overwinter average daily gain (ADG) at 0.75 lb/d (**LO**) or 2) high overwinter ADG at 1.50 lb/d (**HI**). The supplementation period averaged 111-d and was offered from January to May via a C-Lock super SmartFeed supplement feeder. To achieve targeted gains, heifers were fed dried distillers grain and allotted supplement intakes at 2.2lb for LO gain heifers and 4.4 lb for HI gain heifers.

As expected, HI gain heifers, had a greater ADG from January to breeding; however, ADG was similar from breeding to pre-calving. At breeding, HI gain (813 lb) heifers were heavier than LO gain (788 lb) heifers, which reflects the differences observed in ADG. Heifer BW after breeding was not different, this response suggests compensatory gain occurred for LO heifers, reducing any BW differences. There were no differences in heifer BCS between treatments. The percentage of heifers cycling prior to breeding was low, but similar between LO (32%) and HI (39%) treatments. Heifer pregnancy rates were similar, averaging 86% between treatments. Although the percentage of heifers that gave birth within the first 21-d was not different, a treatment $\times$ year interaction for calving date occurred, where HI gain heifers calved 7-d earlier than LO gain heifers in year 1. In years 2 and 3, calving date was similar between treatments. Economic analysis revealed that LO gain heifers had a net return \$31.26 greater per heifer than HI gain heifers. This suggests there is an opportunity to lower input costs by reducing the amount of total supplement when developing replacement heifers during the postweaning period, without detrimental impacts to performance.



RANCH UPDATE



By **John Nollette** and
Jacki Musgrave

A mild spring provided favorable conditions for our March-calving cows. In 2024, 89.9% of our mature March cows calved within the first 21 days, up from 72.2% in 2023. However, fewer three-year-old March cows calved in this period in 2024 (77.5%) compared to 2023 (89.1%). On the other hand, a higher percentage of March heifers calved within the first 21 days in 2024 (87.2%) compared to 2023 (81%).

For May-calving cows, more mature cows calved in the first 21 days in 2024 (89.1%) compared to 2023 (82.8%), while fewer May three-year-olds did so (90.9% in 2024 vs. 96.2% in 2023). The percentage of May heifers calving within the first 21 days remained similar in both years, with 90.3% in 2024 and 91.4% in 2023.

We had a relatively wet late spring and early summer with timely rains, which led to a significant amount of forage in the hills and meadows. Despite the plentiful grass, its quality is lower than usual. Upland range diets from esophageally fistulated cows showed 7.8% crude protein in June and 8.2% in July, compared to our long-term averages of 12.3% and 9.9% for these months. Meadow diets had 11.1% CP in June and 8.8% in July, which is also below our long-term averages of 14.0% and 13.0% for June and July, respectively. It is not uncommon to see lower forage quality in wet years due in part to a dilution effect. High moisture levels can cause rapid growth in plants, which leads to a higher proportion of stems to leaves. Stems are typically lower quality than leaves, which leads to overall reduced forage quality.

In recent years, our May yearlings have grazed sub-irrigated meadow through the summer. This year they went to upland range in early May, weighing 591 lbs. On June 28 they weighed 722 lbs, gaining 2.3 lb/d for this period. They were assigned to a light and heavy group based on their June 28 weight. Half of each group were shipped to the feedlot at that time and the other half remained on upland range at GSL until August 8, when they were weighed and shipped to the feedlot. Cattle weighed 819 on August 8, gaining 2.37 lb/d since June 28. Differences in feedlot performance based on animal weight and feedlot entry time will be evaluated on this group of cattle.

This year, we decided to preg check our March heifers earlier than usual. After a 30-day breeding season, they averaged 83% pregnant, slightly higher than the 80% in 2023. The open March heifers were added to the May heifers for a second breeding opportunity. We will assess the pregnancy status of the May heifers in early October.

This summer, we were fortunate to have two interns, Marina Guynn and Makenna Dirkschneider. We thank them for their contributions and wish them the best of luck as they embark on their next chapter.



HISTORICAL RESEARCH

40+ Years of GSL and Its Impact on Beef Cattle and Range Systems (Updated from 2019 Nebraska Beef Cattle Report, p. 24)

Original Authors: Jack C Whittier, Kelly W. Bruns, Rick N. Funston, Jerry D. Volesky, Terry K. Klopfenstein, and Don C. Adams

The University of Nebraska (UNL) Gudmundsen Sandhills Laboratory (GSL) is a 12,800-acre research ranch in the Nebraska Sandhills. In 1978, Elmer “Pete” and Abbie Gudmundsen gifted the former Rafter C Ranch to the University of Nebraska Foundation. Thus, 2024 is the 46th year of UNL oversight of GSL. To the credit of UNL Administration, development for range livestock research at GSL was delegated to a team of research and extension specialists chaired by Don Clanton. Other members of that original team were Jim Nichols, Range Science; Gene Deutscher, Reproductive Physiologist; Dick Clark, Agricultural Economist; and Ivan Rush, Beef Extension Specialist. This team configured the ranch to investigate production and management questions pertinent to the region.

The objective of this paper is to briefly describe impact on beef and range management systems resulting from vision-ary development of a working research ranch in the Nebraska Sandhills by the University of Nebraska.

One of the most significant accomplishments at GSL has been the development and implementation over the years of a systems approach to research. An example is that early work was primarily conducted on components of production. As time progressed, it became clear that a systems approach from pre-breeding to harvest better identifies and describes the overall impact on a ranch. A systems approach often changes the interpretation of results obtained from research dealing solely with segments of production systems.

Examples of the importance of considering the system, rather than individual components separately, are the fetal programming work, calving date and weaning date systems, heifer development and grazing vs feeding harvested hay systems. The Nebraska Ranch Practicum is the education component to the systems work at GSL.

Some of the conclusions at the time of the research have changed as economics and deeper understanding of biological principles have evolved with time and further systems-based investigations. For example, market value of Sandhills pasture has increased at a greater rate than cost of feeding hay in the Sandhills. Therefore, this has changed the relationship between grazing and hay feeding in some situations. Major evolution of impacts on beef and range systems from GSL are:

1. Development and implementation of a systems approach to research while training students in systems thinking.
2. Protein, rather than high levels of starch, is most always the preferred winter supplement for Sandhills forages.
3. Production systems using self-harvesting by grazing are typically most economical in Sandhills cow-calf systems.
4. June vs. March calving for the Nebraska Sandhills beef systems best matches rangeland quality and quantity.
5. Validation of the NRC models for Nutrient Requirements of Beef Cattle in Sandhills systems.
6. Use of distiller’s grains as supplements are used effectively to extend range capacity and provide a beneficial nutrient profile for gestating cows and yearlings when grazing cool- season meadow and upland range.
7. Time and type of supplementation affect prenatal fetal programming to impact changes in BCS, weight, carcass traits and cow productivity through epigenetic mechanisms.
8. Nebraska Ranch Practicum at GSL provides valuable, science-based, systems approach education to clientele in multiple states.
9. Heifer development systems are a key component of sustainable beef systems in the Nebraska Sandhills.
10. Proper sub-irrigated meadow management offers a key component to profitable forage management systems.

Gudmundsen Sandhills Laboratory has been, and will continue to be, a prized resource for training students, informing producers and exploring beef and range production systems. An example of this are the 129 articles that report research at GSL in Nebraska Beef Reports through 2024. We conclude that GSL provides an important resource for solving ranching problems in beef systems.

GSL OPEN HOUSE 25TH ANNIVERSARY

AUGUST 21, 2024

8:00 a.m. Registration

8:15 a.m. Welcome

Kelly Bruns, WCREEC Director

8:30 a.m. Cattle Market Update

Elliott Dennis, UNL Agricultural Economist

9:00 a.m. Long Range Weather Forecast

Eric Hunt, Nebraska State Climate Office

9:30 a.m. Interactive Sessions

- Rumen Undegradable Protein, Karla Wilke
- Esophageal samples of GSL diets, Jerry Volesky and Jacki Musgrave
- Husker Mobile Beef Lab, Brent Plugge and Randy Saner
- Precision Livestock Management, Yijie Xiong and Mitch Stephenson
- Fly Control on Pastured Cattle, David Boxler
- Water Research in the Sandhills, Troy Gilmore
- Yearling Systems and Minerals, Jesse Fulton and Jim MacDonald

11:00 a.m. History of GSL

*Moderated by Jerry Volesky, UNL Range and Forage Specialist
Richard Clark, Ivan Rush, and Walt Schacht*

11:30 a.m. GSL Alumni Recognition

11:40 a.m. Lunch

1:00 p.m. Changes in the industry with Greg Lardy

Joe and Norma Peltier Vice President for Agriculture, North Dakota State University

1:30 p.m. Current Research Updates

- Range Management, Mitch Stephenson, UNL Range and Forage Specialist
- BVD, Brian Vander Ley, UNL Great Plains Veterinary Education Center
- Shaky Calf Mutation: How GSL calves helped to improve animal health and studies of meat quality, Jessica Petersen, UNL Animal Science

2:15 p.m. Value of the Nebraska Ranch Practicum Panel

Moderated by Brent Plugge, Nebraska Extension Livestock Systems Educator

3:00 p.m. Bull Pen Q&A: The Future of the Industry

Moderated by Rick Funston, UNL Beef Reproductive Physiologist

3:30 p.m. Adjourn

All times in MDT

GSL IN THE NEWS

Josie Crouch received 3rd place in the 2024 Graduate Student Paper Competition at the Western Section of the American Society of Animal Science meeting for her paper titled *Impact of rate of overwinter gain in March-born yearling range heifers on growth rates and reproductive performance*.

The 2024 Applied Animal Science Paper Award was won by "Converting Spring-born Heifers into a Summer-Calving Herd Increases Subsequent Cow Longevity and Productivity." The paper was authored by Travis Mulliniks, Oregon State University, Tim Goodnight, Jacki Musgrave, and Kacie McCarthy, University of Nebraska-Lincoln.

Jacki Musgrave received the inaugural UNL Staff Senate Research Impact Award. The UNL Staff Senate Research Impact Award recognizes an individual staff member for their commitment to establishing a culture committed to increasing the impact of research and creative activity.

PUBLICATIONS

Stephenson, M.B., T.M. Grijalva*, J.D. Volesky, and T. Mulliniks. (2023). Grazing subirrigated meadow regrowth influences subsequent-year plant production and nutritive value. *Agronomy Journal*. 115, 3035-3044. <http://dx.doi.org/10.1002/agj2.21455>

Kaitlyn Dozler, Yijie Xiong, Travis Mulliniks, Andrew Little, Mitchell Stephenson. (2024). Influence of virtual fence on heart rate response in beef cattle. *Rangelands*. (in press) <https://doi.org/10.1016/j.rala.2024.04.003>

Humphrey, C. E., Solomon, D. K., Gilmore, T. E., MacNamara, M. R., Genereux, D. P., Mittelstet, A. R., et al. (2024). Spatial variation in transit time distributions of groundwater discharge to a stream overlying the northern High Plains Aquifer, Nebraska, USA. *Water Resources Research*, 60, e2022WR034410. <https://doi.org/10.1029/2022WR034410>

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 live-stock nutrition, beef cattle reproduction, grazing systems, rangeland ecology, low cost cattle management, groundwater issues, and wildlife management.

GSL RESEARCHER CONTRIBUTORS

Jerry Volesky: 308-696-6710 or jvolesky1@unl.edu

Jacki Musgrave: 308-544-6515 or jacki.musgrave@unl.edu

John Nollette: 308-544-6515 or john.nollette@unl.edu

Josie Crouch: 308-536-2691 or jcrouch5@unl.edu

Karlie Gerlach: kgerlach2@unl.edu

TL Meyer: 308-645-2267 or tl.meyer@unl.edu

Contact GSL at 308-544-6430 or visit gsl.unl.edu

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.



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