

GSL Researcher

Spring 2023



Greetings from the staff, students, faculty, and crew at GSL!

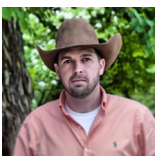
The last year has been another mentally and physically challenging test for many producers. With another year of limited rainfall and in some areas decreased forage quality, pregnancy rates across the state have been all across the board. Along with the limited moisture this last year, we had a shortage in hay produced and overall hay inventory. Coupling low hay supplies and a wet, cold winter, we have seen a lot of thinner than average cows across the state. With good contingency planning and herd management by the crew, our March-calving cows at GSL calved on average in a better body condition score than our historic average. Jacki Musgrave and John Nollette will get you up to date on the cattle operations with the Ranch Update.

Currently, the drought outlook for much of the Sandhills and western Nebraska is a little optimistic that drought conditions may be eased up. While we may like to be optimistic about spring moisture, making sure you have an updated drought/contingency plan will be important as we move closer to the growing season. As Jerry Volesky points out in the weather and forage forecast, we may want to be planning a later turnout than our “normal” turnout. This means our contingency or feeding plans may need to go out into middle part of June.

As Andy Applegarth retired this last November, John Nollette was promoted and transitioned to a lead role of operations. Over the last couple of years, John has taken on more and more responsibilities at GSL and has done a tremendous job leading the crew. As research increased at GSL the last several years, John was instrumental at meeting the challenges and helping scientists and faculty achieve their goals with beef production systems research. With that, check out more about John in our staff spotlight this edition.

We are currently advertising for the 2023 Ranch Practicum. Troy Walz has done a tremendous job of advertising and has had a lot of interest early on this year for participants. Later in the newsletter is more information. If you are interested in the Practicum, please send them Troy’s way at 308-872-6831.

Just a reminder the 24th Annual UNL GSL Open House will be held Wednesday, August 23rd. More information will be coming out this summer on the agenda; however, we do plan this to be a hybrid event with an in-person and virtual option as we have done the last three years. We had a great turnout and program this last year with approximately 205 in-person and online participants from 7 different states and 3 countries (US, New Zealand, and Canada). Moving to a hybrid format has really helped increase the reach of what is going on at UNL and GSL. We continue to receive extremely positive feedback on the direction of the Open House and overall research objectives showcased during the Open House. So, kudos to the crew and faculty that help put this on each year.



We hope you get something out of this issue and please let us know how we can better serve you.

Travis Mulliniks, Range Cattle Nutritionist

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STAFF SPOTLIGHT

JOHN NOLLETTE



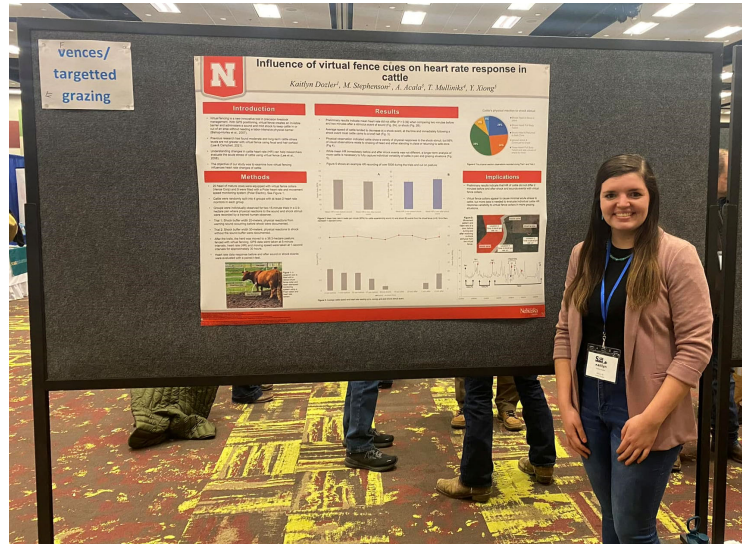
John is a native of Nenzel, NE. He attended Chadron State College and UNL. John built houses in Lincoln for six years. After that he worked in ranch and feedlot positions in central and eastern Nebraska before coming to GSL.

John has been a part of the daily workings of the ranch since 2000. He has enjoyed meeting and working with the many students that have done work at GSL. John and his wife, Stacy, have been known for their welcoming hospitality to students who have spent time at GSL over the years.

John recently transitioned to the lead role of operations at GSL. He says he enjoys the challenges of the position. "The challenge is what keeps me going." Asking the right questions to take the researchers proposals to the great outdoors, is one of his strengths. He also believes in building a strong team by surrounding yourself with good people. "You are only as good as the people around you."

John enjoys playing golf, hunting, ice fishing and spending time with family and friends. John and Stacy raised their kids Chelsea, Ashlee and Brock here. Their family has expanded to include a son-in-law, Michael, and two granddaughters, Regan and Taylee.

Graduate Student Update



Kaitlyn Dozler, grad student working with Mitch Stephenson and Andy Little, won third place in the MS poster competition at the 2023 Society for Range Management Annual Meeting, Boise, ID. The poster focused on the virtual fence technology work being done here at GSL.



RANGE & PASTURE UPDATE



By **Jerry Volesky**,
Range and Forage
Specialist

Total annual precipitation during 2022 at the Gudmundsen Sandhills Lab (GSL) was 16.74 inches which was 2.81 inches below the long-term average (Table 1). While total precipitation during the primary part of the growing season (April through August) was near normal, the month of June was very dry. Summer temperatures were also above the long-term average.

Month	Precipitation (inches)	Departure from Ave	Average temperature	Departure from Ave
January	0.11	-0.22	27	+1
February	0.20	-0.26	27	-1
March	0.29	-0.55	36	-1
April	2.40	+0.36	44	-1
May	3.56	+0.25	56	0
June	0.97	-2.53	70	+3
July	3.39	+0.33	75	+4
August	2.90	+0.73	75	+4
September	0.46	-1.32	67	+5
October	0.33	-0.92	52	+3
November	0.03	-0.52	33	-4
December	2.10	+1.84	22	-6
Total	16.65	-2.89		

In 2022, overall upland range forage production at GSL was 64% of the long-term average (Table 2). This production deficit primarily came from warm-season grasses which were affected by the very dry June. Cool-season grass and sedge production was below the average.

	Cool-season grasses & sedges	Warm-season grasses	Forbs	Shrubs	Total
	----- lb/acre -----				
2022	534	451	103	53	1141
2004 – 2022 average	627	870	232	45	1778

2023 Spring and Early Summer Outlook

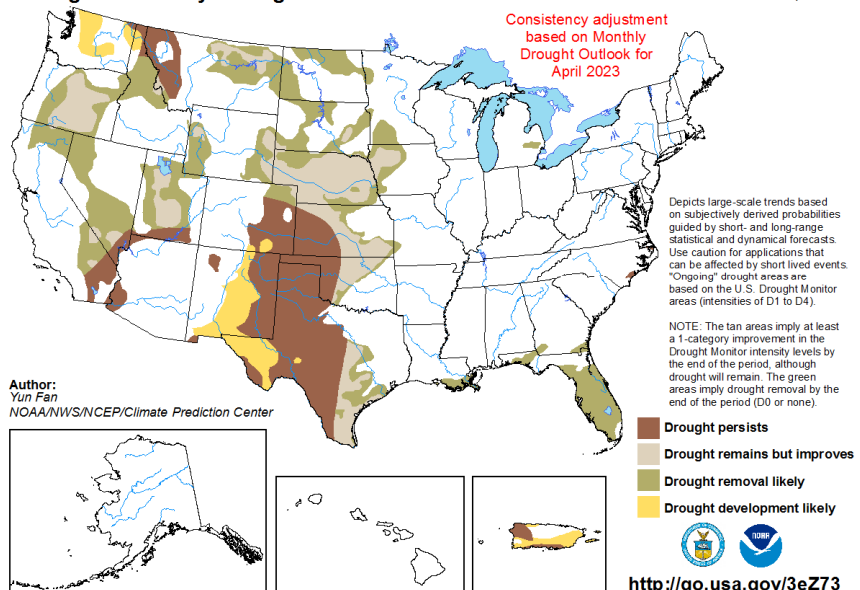
While all of Nebraska was affected by drought in 2022, the 2022 – 2023 winter has brought above average precipitation across most of the state. The U.S. Seasonal Drought Outlook through May 31 is optimistic and suggests an easing of drought conditions for most of the state except southwest Nebraska and the southern Panhandle (Figure 1). This is mostly associated with the ending of the La Nina and ENSO-neutral conditions are expected through early summer.

Continued on page 4

U.S. Seasonal Drought Outlook

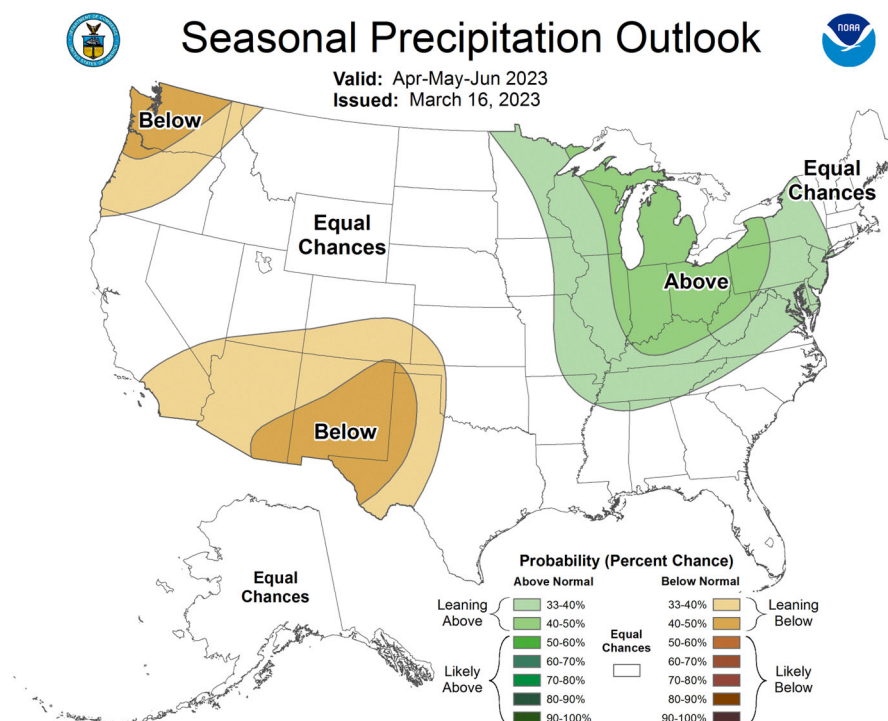
Drought Tendency During the Valid Period

Valid for April 1 - June 30, 2023
Released March 31, 2023



RANGE & PASTURE UPDATE, CONTINUED

The NOAA long-term precipitation outlook for April, May, and June 2023 shows equal chances of above or below precipitation during that period. (Figure 2).



2023 Grazing Plans

Whether or not dry conditions continue, grazing management during 2023 should focus on maintaining or assisting the recovery of the pasture grasses. Some key points include:

- ◆ Evaluate 2022 grazing records with emphasis on:
 - ◇ Time of grazing
 - ◇ Stocking rate
 - ◇ Amount of residual herbage
- ◆ Outline a (flexible) plan for the entire 2023 season.
- ◆ 2022 Drought + heavy grazing = reduced pasture production in 2023 (even with average rainfall).
- ◆ Plan for some reduction in stocking rate.
- ◆ Delay turn-out to primary summer pastures. This can be difficult with low hay reserves, but this allows grasses to accumulate some growth and begin recovery.
- ◆ Early flash grazing of pastures dominated by warm-season grasses will allow you to capitalize on growth of cool-season grasses and weeds. This should only be done for short periods and the recommendation to delay turn-out to the primary summer pastures does remain.
- ◆ If you use pasture rotations, pastures that were grazed first and into July in 2022; delay grazing of those pastures until later in the summer.
- ◆ Annual weeds will likely be more abundant in pastures. This is short-term and there is no need to worry about them. Many have good forage value and provide other benefits.

RANCH UPDATE



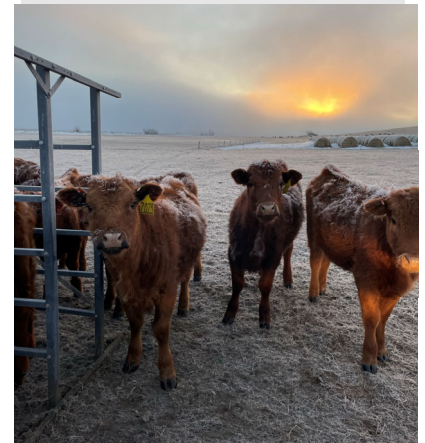
By **John Nollette** and **Jacki Musgrave**

As with many areas of the state, the winter has been a challenging one at GSL. Multiple winter storms with sub-zero temps and several inches of snow have necessitated feeding more hay than usual. We are thankful for the moisture, as we started the winter in a moderate drought condition. We are hoping for milder temperatures to continue through the remainder of calving season.



Our 2022 hay crop was 97% of our 17-year average. We feel our decision to fertilize 300 of the 475 acres baled helped us maintain hay production levels through drought conditions. We plan to fertilize the same number of acres again in 2023. Overall, our hay averaged 7.8% CP and 55.3 % TDN, which is similar to our long-term average.

Pregnancy rates in our March and May calving heifers were similar at 82.9% and 84.3% for March and May in a 30-day breeding season, respectively. Pregnancy rates for March-born heifers were similar to pregnancy rates in 2021 (83.1%); however, May heifers were higher than 2021 (66.2%). Two-year-old pregnancy rates were higher for both March (90.2 vs 71.8%, 2022 vs 2021, respectively) and May (93.3 vs 85.3%, 2022 vs 2021, respectively) herds. Pregnancy rates for mature March-calving cows were similar to 2021 (93%); however, mature May cows were lower (88.7 vs 94.7%, 2022 vs 2021, respectively).



Weaning weights for calves from mature March calving cows were also similar in 2021 and 2022, however cow body condition scores (BCS) were 0.4 lower in 2022. March two-year-old's calves were 33 pounds heavier; however, March three-year-old's calves were 72 pounds lighter in 2022 than 2021. Mature May cow weaning weights were 31 pounds lower in 2022 than 2021. May two-year-old's calves were 12 pounds heavier; however, May three-year-old's calves were 8 pounds lighter in 2022 than 2021.

Our March and May mature cows as well as our May yearlings and March replacement heifers have been fed through our Smart Feeder units this winter. Mature March cow BCS at pre-calving was the same in 2022 and 2023 (5.1). Supplemented cows maintained body condition while non-supplemented cows lost 0.4 BCS from weaning to pre-calving, which is not a big loss with how harsh our winter truly was.



Andy Applegarth retired December 1, 2022, after 44 years with the University. We wish Andy the best in his retirement. Jessica Koenen joined the ranch crew in early March. We are excited to have Jessica join the crew.

TECHNICAL NOTE:
GENOMICS — ENHANCING RESEARCH TO ENABLE MORE PROFITABLE DECISIONS



By **Matt Spangler**, Extension Beef Genetics Specialist

Genomic tools are not new to the U.S. Beef Industry. For over 15 years there have been products in the market place. However, the technology has advanced substantially to the point of becoming relatively commonplace in the majority of seedstock enterprises. The benefit is clear, the accuracy of EPD increases for genotyped animals enabling faster genetic change and the ability to make more accurate selection decisions. Although the use of genomic data is common in seedstock enterprises and by the animal genetics research community, the use of genomic data need not end there.

The use of genomic technology can largely fall into three broad buckets: 1) parentage testing/validation, 2) diagnostic tests for simply inherited traits (i.e., genetic defects, coat color, horned/pooled status), and 3) prediction of genetic value for complex traits (i.e., growth, fertility, carcass merit, etc.). The ability to routinely genotype large research herds, like the one at GSL, enables research that leverages all three of these buckets. All animals in the GSL herd are genotyped with ~100,000 DNA markers (single nucleotide polymorphisms; SNP) and have been since 2019. These markers allow for the formation of pedigree by correctly assigning animals to their respective parents. Having known pedigree allows these animals to be recorded with the American Simmental Association and for the calculation of EPD for the animals in this herd. Simply having paternity assigned in a research setting can lead to experimental design and/or downstream data analysis that can tease apart differences in outcomes due to genetics and those due to experimental treatments. This can not only increase the power of experiments but can also lead to more accurate and robust recommendations to producers. Overtime, as the amount of data grows, the degree to which genetics and environment/management interact can be quantified ultimately leading to more prescriptive recommendations to beef cattle producers. Another benefit of having such dense genomic information available is the identification of novel genetic abnormalities (defects). Mutations occur relatively frequently although most are neutral meaning that they have no (known) effect. Some mutations are even beneficial, giving rise to new sources of genetic variation. However, some are not desirable. In research herds, where trained personnel carefully record abnormalities, these observations can be paired with genomic data to determine the location in the genome responsible and to enable the global beef industry to make selection and mating decisions with this knowledge in hand.

In heavily phenotyped research herds, such as GSL, there are often novel traits recorded—grazing behavior of animals, milk yield/composition/persistency, and traits related to metabolic efficiency. There is little doubt that there is some degree of genetic control of all of these characteristics, but quantifying the relative role that genetics, nutrition, management, and the production environment all play is a critical step towards being able to provide advice to producers who wish to change their own herds. Having genomic information allows us to do that.

Genetic/genomic data are not, and should not, be restricted to use cases involving only geneticists. These are tools that can benefit all disciplines as we move forward in elucidating the complex interactions between genotype, environment, management, and societal needs/concerns. Turning these data into information to answer research questions is only the first step. Ultimately the goal is to turn the information into actionable items for on-ranch decisions.



HIGHLIGHTED RESEARCH: AN AQUIFER TOUR ALONG THE UPPER MIDDLE LOUP RIVER



By **Troy Gilmore**, Groundwater Hydrologist

Traveling west toward Thedford, Nebraska, on Route 2, a visitor to the Sandhills may notice smooth-flowing water and patches of bare white sand where the Middle Loup River cuts into dunes to the south. Within eight miles of passing Thedford, the traveler crosses the river three times before the channel disappears across the dunes to the north and threads toward Seneca. If the traveler had the far-fetched idea (and, importantly, permission) to start walking upstream from Seneca, following every meander of the Middle Loup River, the South Branch of the Middle Loup River, and the South Fork of the South Branch of the Middle Loup River, they would arrive at the Gudmundsen Sandhills Laboratory (GSL) after a 60-mile journey. As the crow flies, that trip would be about 30 miles.

The traveler would see and hear many things along this walk, perhaps noticing wildlife, cattle, sandburs, the sound of wind, and the quietness of the grassy dunes. What they may not notice, however, is the lifeblood of this region—the mostly invisible groundwater that sustains life here. Well known by locals, this groundwater is the source of steady Sandhills streams and the cool water that flows from windmill to stock tank. In fact, by the time the traveler reached GSL, they would be standing over nearly 1,000 feet of saturated sand, silt, and gravel that make up the thickest part of the High Plains Aquifer. Stopping by the GSL dormitory for a drink, the traveler would hold up a glass full of groundwater pumped from about 600 feet below. They might be surprised to learn groundwater at that depth has been slowly creeping through the aquifer for thousands of years before being pulled through the well screen and jettisoned to daylight. *continued on next page*



Sampling and measuring groundwater seepage into the South Branch of the Middle Loup River on Gudmundsen Sandhills Laboratory in May 2019. Image courtesy of Mikaela Cherry.

Sitting in the shade of the dormitory porch, the traveler might look across the valley and notice the rich green color of the groundwater-fed hay meadow contrasted with the greenish-brown dunes that rely more on the intermittent rain and snow for moisture. Mentally retracing their footsteps to Seneca, the traveler would first see the small channel of the South Branch of the Middle Loup River, fed by groundwater skimming closer to the top of the aquifer as it makes its way to the stream in just years or decades. Groundwater seeping into the stream originated as rain or snow that fell within the lifetime of local wildlife, cattle, and people. Further downstream, near North Hecla Road, the aquifer begins to thin slightly, and the stream channel is cut more deeply into the landscape. Groundwater, moving generally from west to east in this region, takes a much longer and slower route to this part of the South Branch. Many human generations have passed while this groundwater crept through the aquifer for, on average, about 1,700 years before arriving and seeping slowly up through the streambed and into the sandy stream. A few seeps and springs along the channel might deliver “younger” groundwater to this section of stream. Finally, having traveled in their mind all the way back to Seneca, the traveler could envision the wide, flat water surface that roughly matches the invisible water table elevation beneath the nearby dunes. Here, even older groundwater is pouring through the coarse sand and gravel riverbed, feeding the Middle Loup River. This groundwater seeping into the river at Seneca approaches the “age” of groundwater the traveler holds in their glass at the ranch, with an average travel time through the aquifer of about 5,000 years.

Surprisingly, the traveler’s long walk from Seneca to GSL was a little like taking a groundwater tour. Starting at Seneca, where old groundwater emerges from the aquifer depths, to GSL, where younger groundwater feeds ditches and streams, the traveler covered not only 60 miles but also a great expanse of time. They also walked past, waded through, and drank groundwater that represents thousands of years of history. If you are interested in a more detailed aquifer tour, please visit our Research Story Map at <https://go.unl.edu/gwss>.

Acknowledgements

Thank you to GSL Ranch personnel John Nollette, Jacki Musgrave, Andy Applegarth, Roger Carpenter, and Stacy Nollette for supporting our research. A special thank you to landowners who allowed us to access stream sites outside of GSL.

Special thanks to all who participated in field work and analysis of datasets, including collaborators at the University of Utah and North Carolina State University. Collaborators include Kip Solomon, Dave Genereux, Aaron Mittelset, Vitaly Zlotnik, Caner Zeyrek, Craig Jensen, Marcus MacNamara, Mikaela Cherry, Wil Mace, Galen Richards, Jens Ammon, and Mason Johnson. We appreciate USGS personnel who measured stream-flow during the project.



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The South Branch of the Middle Loup River looking west as it flows through GSL. Photo taken July 1, 2022.



2023-24 Nebraska Ranch Practicum

The Nebraska Ranch Practicum is a three-season, hands-on educational program designed to give participants the skills and education needed in today's complex ranching industry. Registration fee is \$675 (\$350 to add your spouse) and covers materials, noon meals and breaks. The practicum can count for college or continuing education credit. **Submit an application and registration fee by May 3.** Enrollment is limited to 35 participants.

- Tuesday, June 6, 2023, WCREC, North Platte, NE
- Wednesday, June 7, 2023, GSL, Whitman, NE
- Thursday, July 6, 2023, GSL
- Wednesday, September 6, 2023, GSL
- Thursday, September 7, 2023, GSL
- Thursday, November 2, 2023, GSL
- Tuesday, January 9, 2024, GSL
- Wednesday, January 10, 2024, North Platte, NE

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GUDMUNDSEN SANDHILLS LABORATORY

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.

GSL IN THE NEWS

“The Gudmundsen Laboratory is managed in a way to be similar to other ranches in the area,” Stephenson said. “As a research facility goes, it is a premier research facility in the Western United States.”

2022 Strategic Discussions for Nebraska (<https://sdn.unl.edu/article/maximizing-plains>)

Will the "ranch of the future" include virtual fencing, automated feeders and 3D imaging? A look at what researchers at UNL's Gudmundsen Lab in the Sandhills are working on. A story from the Nebraska Public Media series on innovation and creativity in Nebraska, "What If..."

Nebraska Public Media, December 2022, watch the video at <https://go.unl.edu/ranchtech>

“Mulliniks said at UNL and the Gudmundsen Sandhills Laboratory, they are working with companies on newer technologies focused on the cow-calf industry and seeing how they would or would not fit into production.”

Western Livestock Journal, January 2023 (<https://go.unl.edu/wjviewpoint23>)

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