



Center for Grassland Studies

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Photo: Nic McMillan
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May 2024

UNL Range Club Takes First Place for Second Year in a Row

By: Caitlin Copenhaver; Student, School of Natural Resources and Center for Grassland Studies, Lincoln, NE

Every year at the Society for Range Management (SRM) meeting, one of the main events is the Rangeland Cup - a research poster presentation where students are provided with a range science-related prompt and tasked with finding potential solutions to it. This year's prompt was certainly tricky, but fascinating as well! It required students to research novel technologies (specifically those developed or applied to range science within the past decade) and incorporate them into a research poster with a plan to mitigate the issues presented by climate change on rangelands. Following the development of the research poster, students have to begin practicing their presentational skills! At the SRM meeting, students must then present their posters to a series of judges and visitors over a 3-hour period.

Our UNL team, composed of undergraduate students Caitlin Copenhaver, Jacob VanDress, and Josie Ivy, was ready to roll and explore this topic. In our presentation entitled "Heterogeneity is Heterogenius. Using Spectroscopy to Measure Heterogeneity and Biodiversity in a Changing Climate", we discussed our proposal to use heterogeneity, defined as the variability in various factors of the ecosystem, as a metric of judging rangeland health in order to decide the best management practices in the face of climate change. Climate change on the range poses a serious concern for preserving heterogeneity. The myriad negative effects of climate change such as the loss of biodiversity, spread of invasive species, and woody encroachment have the potential to decrease heterogeneity and ecosystem resilience. A decrease in heterogeneity will also lead to a decrease in range capacity for carbon sequestration, thereby compounding this already serious problem and our ability to effectively fight it. By combining multiple technologies such as spectroscopy or aerial systems with a traditional boots-on-the-ground approach, we can increase understanding on how best to manage our rangelands to promote heterogeneity, combat climate change, and increase producers' economic gains.

The results of this year's Rangeland Cup presentation were very close! Brigham Young University (BYU) took third place, while fellow Nebraskan school Chadron State University placed second. But UNL's Rangeland Cup team was able to pull ahead with a first place win for the second year in a row! Our team was thrilled at this turn of events, and we are grateful to everyone who provided us with feedback throughout this process, especially to our UNL Range Club advisors Cheryl Dunn and Nic McMillan! Please support the UNL Range Club at <https://nufoundation.org/fund/01163590/>

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Director's Column

David Wedin, Director, Center for Grassland Studies; Professor, School of Natural Resources, Lincoln, NE



Nebraska is an outstanding place to study grasslands. The University of Nebraska is a leader in both rangeland management and prairie conservation. These disciplines focus on the present and the future. However, you can get a deep perspective on our grasslands and the paleontologists that have studied them for over 150 years at Morrill Hall (University of Nebraska State Museum), which reopened in spring 2024 after remodeling. Nebraska fossils tell the 34-million-year story of how the world's great grasslands, like the Great Plains, developed. In fact, we have the best fossils in North America for this story. In the museum's new Cherish Nebraska exhibit, murals and fossils capture the dramatic battle between trees and grasses during the Miocene and Pliocene (23 to 2.6 million years ago). As the climate cooled and dried, Nebraska's landscape changed from forest to open woodland to grassland. Diverse mammalian herbivores evolved while our grasslands expanded. Imagine walking through a Nebraska grassland 4 million years ago and encountering over 20 types of herbivores including horses, pronghorns, camels, elephants, rhinos, sloths, tapirs, deer, and peccaries, not to mention their predators. Grassland herbivores had adaptations including, hooved feet, high crowned (hypsodont) teeth, long fast legs, and ruminant or specialized hind-gut digestion. Many of these mammal families, like horses, camels, and rhinos, evolved in North American grasslands for over 30 million years before spreading to the Old World and South America while going extinct here.

Museums house huge collections of fossils, rocks, animals, and plants that, when studied by new scientists with new techniques, provide fresh insights into grassland ecology, the evolution of grazers, and long-term climate change. A fascinating technique is the use of carbon's stable isotopes to distinguish organic matter produced by C₄ (warm season) plants versus C₃ (cool season) plants. Examples of C₄ plants include warm season grasses such as big bluestem, switchgrass, and buffalo grass, while C₃ plants include trees, shrubs, most of our flowers, bluegrass and brome grass. Analyses of stable isotopes in soil organic matter from the wall of a 125-year-old sod house showed that 75% to 80% of the soil organic matter in the original prairie sod came from C₄ grasses, indicating our native prairies were dominated by grasses such as big bluestem. (That piece of sod, under plexiglass, is my small contribution to the 4th floor exhibits). Now, apply that same technique to the fossil teeth of mammals at Morrill Hall. Grasslands had expanded by 24 million years ago, but those grasslands were only ruled by C₄ grasses starting around 6 million years ago. The teeth tell the story. C₄ grasses were adapted not only to increasingly arid climate, but also to the lower concentrations of atmospheric carbon dioxide observed over the last 6 million years.

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Celebrate Rangelands and Pastoralists

By: Walter Schacht, Professor Emeritus, University of Nebraska-Lincoln, Lincoln, NE

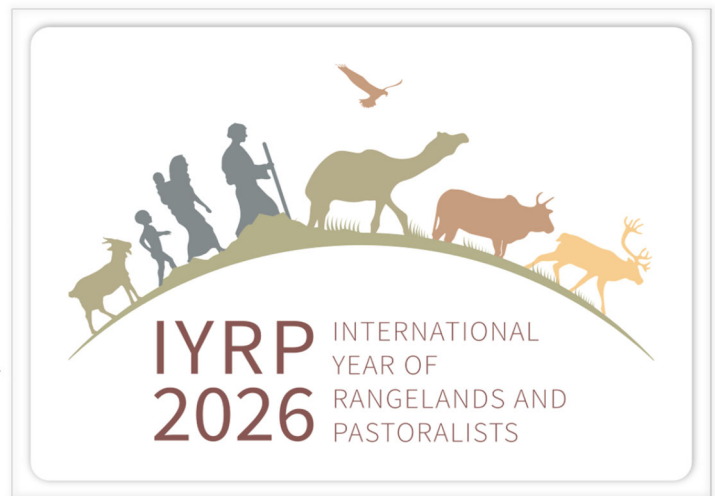
In its 76th session, the United Nations General Assembly adopted the resolution made by the Government of Mongolia to celebrate an International Year of Rangelands and Pastoralists (IYRP). The General Assembly designated 2026 as the IYRP and invited the Food and Agriculture Organization of the United Nations to facilitate its implementation. The IYRP reflects the importance of rangelands in creating a sustainable planet and supporting economic growth and resilient livelihoods for pastoralist (a person who raises livestock) communities around the world. Rangelands are commonly described as uncultivated lands that include grasslands, savannahs, steppes, shrub lands, deserts, and tundra. They make up about 770 million acres, or 30% of the land cover of the US, and about 53% of land cover in the Great Plains and western USA. Every citizen of the world is impacted by rangelands, which constitute approximately half of the earth's land surface area. Rangelands are used primarily for extensive livestock production, and their health, productivity, and environmental sustainability are directly critical to the livelihoods and cultures of more than 500 million pastoralists in the world.

The IYRP seeks to increase worldwide understanding of the value of rangelands and pastoralism at regional and global scales and work towards the stewardship, policies, and processes that protect and improve ecosystem services and economic benefits provided by rangelands. Greater understanding will inform efforts to better manage rangelands and to change national and global policies that improve food security, habitat, and biodiversity. Better management and national and global policy changes have potential to mitigate climate change, increase the value of ecosystem services, and limit out-migration of human populations. This in turn has the potential in many parts of the world to improve political stability, lessen conflict, and reduce gender inequity.

The IYRP 2026 coalition consists of an International Support Group with members from around the world, collaborating in Regional IYRP Support Groups and thematic Working Groups. Information on IYRP programs and activities is shared primarily through the IYRP website and listserv. Each country will decide how to observe IYRP, but a global framework of 12 monthly themes is being advocated to highlight urgent and topical issues, and demonstrate that pastoralists (ranchers, in the case of the USA) and rangelands across the globe share similar issues and concerns despite their diversity and complexity. Themes include the importance of rangelands and pastoralists, access to rangelands by pastoralists, services and resources for pastoralists, climate change, and biodiversity and ecosystem services. Possible activities under consideration include national and state/provincial events to showcase sustainable rangeland systems, an international congress on the state of science and knowledge on rangelands, and social media campaigns and video productions.

Hundreds of organizations are supporting the IYRP in the USA, including professional societies, universities, state and federal agencies, and conservation groups. The Nebraska Section of the Society for Range Management is collaborating with other organizations in Nebraska, including the Natural Resources Conservation Service, the Nebraska Grazing Lands Coalition, and the Center for Grassland Studies, with the goal of educating and engaging Nebraskans concerning the value of rangelands as an economic and natural resource base of Nebraska and the world, ultimately creating an informed population that is involved in policy decision-making. The group will work together in developing media, seminars and meetings, and educational programs focusing on the significance of rangelands and in influencing policy related to rangelands. To learn more and to contribute to IYRP, go to <https://iyrp.info> and contact Bob Broweleit (bentbarc@gmail.com) or Walt Schacht (weschacht@unl.edu).

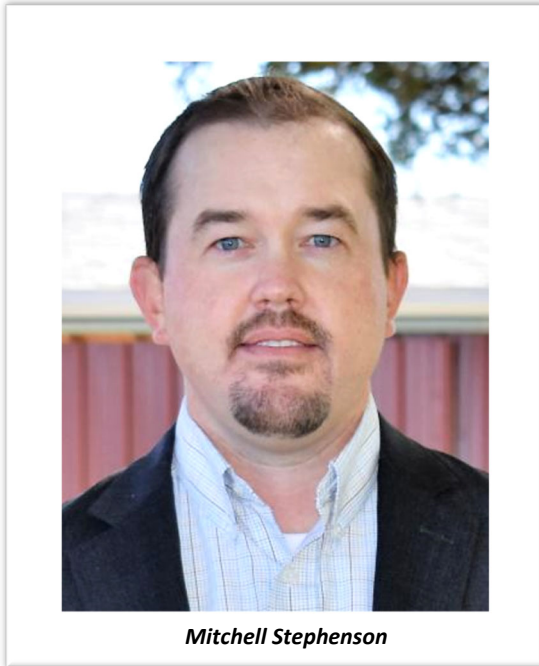
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Precision Livestock Management on Extensive Rangelands

By: Mitch Stephenson, Associate Professor, Agronomy & Horticulture UNL

Precision livestock and rangeland management on extensive rangelands has made large strides in using the best available technology to generate opportunities for improved livestock performance and rangeland management. Precision livestock management has been defined as a “...management system based on continuous automatic real-time monitoring and control of production/reproduction, animal health and welfare, and the environmental impact of livestock production” (di Virgilio et al. 2018). Technology that captures continuous real-time monitoring data with the use of on-



animal sensors record information on movement and, when combined with algorithms that identify behavior, can be linked to grazing time and other health and welfare concerns with grazing livestock. Additionally, tools like virtual fence can allow livestock managers opportunities to manipulate user-defined boundaries to manage where cattle are grazing.

While the concept of virtual fence has been around for decades, and utilized more to keep dogs within back yards, more recent advances in technology have led to several companies developing this product at commercial scales for livestock. Current research at the UNL Gudmundsen Sandhills Lab (GSL) is exploring the current viability of commercially available virtual fence systems to manage cattle grazing. The goal of this research is to identify potential challenges and opportunities with the deployment of this relatively new technology. Over the last few years, we have observed nearly 100 cows on the ranch that have been fitted with virtual fence collars and managed with virtual fence. We have tracked the efficacy of the collars in keeping cattle out of specific areas (i.e., riparian zones or heavily grazed preferred locations) or within defined regions of a pasture in a rotation grazing scenario. Additionally, we have used heart rate monitors to explore the acute stress response of

cattle when exposed to audio and electric cues from virtual fence to examine the welfare of animals fitted with this technology.

Working with virtual fences at GSL has given us a better idea of some of the challenges associated with virtual fence technology. The first challenge that we have encountered is keeping the collars on animals and working. While we have generally been successful in keeping collars on animals, there have been a portion of animals in the herds (typically between 5 to 15% of the collars on animals) that have had collars either fall off or become damaged. In general, these animals have generally stayed close to the larger herd, but still go outside of the set virtual boundaries. Because we have not had 100% success in keeping cattle within the virtual boundaries, it is important to consider areas of concern, such as along roads, and maintaining a boundary physical fence to keeping cattle within larger areas when using virtual fence.

However, when collars stay on, are working properly, and the cattle are trained to recognize and respond positively to the warning audio and deterring electric cues, virtual fence has been highly effective in managing where most cattle in herd graze and provide potential opportunities for targeted cattle grazing and increasing harvest efficiency. Cattle quickly learn and adapt to the audio and electric cues and associate these cues with the boundaries. We observed cattle positively learning cues associated with boundary lines within 10 to 15 minutes.

Does virtual fence cause short- and long-term stress for cattle? While we are still exploring this question, preliminary research with heart rate monitors has suggested that heart rate is elevated at the time of the electric cue, but that this increase in heart rate only lasts about 30 to 90 seconds before cattle heart rate returns to levels before their interaction with the electric cue boundary. [Continued to Page 5 see Precision Management](#)

Continued: Precision Management

This suggests that any stress associated with the electric cue is likely short-term and cattle appear to be able to function similarly to if there had been just a physical fence constraint. Research in other locations has explored longer-term stress responses of cattle using hair and fecal cortisol levels and most have not seen appreciable long-term stress indications between virtual and physical electric fence. Overall, our research combined with others suggests that cattle can adapt to virtual fence without increases in stress associated with the collar mechanisms to keep cattle within boundaries. Is this for everyone? This technology will not fit every situation and doing research on costs and benefits to an operation is important. Virtual fencing systems can give ranchers the ability to create diverse grazing strategies with very little input of putting in physical putting fence to create pastures. Additionally, virtual boundaries



can be infinitely flexible in where they are put using computer mapping programs. For example, virtual fence systems give frequent updates on where cattle are grazing which can be used to monitor areas of overuse. Virtual boundaries can then be placed to exclude those areas as the growing season progresses and provide in-season recovery while still grazing on pasture areas that have had little or no grazing. Targeted cattle grazing at strategic locations for specific purposes (e.g., invasive species management) can also be accomplished by managing virtual boundaries to increase stock densities at these locations. More research is needed to develop a stronger understanding of the economic feasibility of this technology, but as the technology improves, there will be more opportunities to develop virtual fencing as a viable tool to manage cattle grazing across large landscapes.

Photo Caption: Cattle with virtual fence collars and heart rate monitors at the Gudmundsen Sandhills lab and an example of the online user interface with the white boundary showing the area where cattle will receive an audio cue warning and the red boundary showing areas where cattle will receive an electric cue if they continue within the area. Current cattle GPS locations are represented by the black cattle icons. Photo by Kaitlyn Dozler, UNL graduate student.

Continued: Director's Column:

David Wedin, Director, Center for Grassland Studies; Professor, School of Natural Resources, Lincoln, NE

Our herbivore diversity persisted through the climate roller coaster of the Pleistocene (Ice Age) from 2.6 MYA to 12,000 years ago. Stand in Morrill Hall's Elephant Hall and imagine mammoths grazing and mastodons browsing in Nebraska's Ice Age grasslands and woodlands. These huge herbivores were joined by multiple species of horses, camels, pronghorns, musk ox, and ancestral bison, the latter immigrating from the Old World just 130,000 years ago. During Northern Hemisphere "cold snaps" as glaciers expanded, fossil plants and soils indicate Nebraska had woodlands with spruce and other trees along with grasses. However, before you think Nebraska was a vast boreal forest during glacial times, Paul Hanson (UNL School of Natural Resources) reminds us that the highest rates of dust deposition ever observed on Earth formed Nebraska's deep wind-blown loess soils east and south of the Sandhills. These soils were created when vast ice sheets lay a few hundred miles north of Nebraska and the Sandhills dunes were moving. Our Ice Age herbivores survived in a cold, windy, arid, and generally open landscape. But the climate started warming 15,000 years ago, and a new mammal crossed the land bridge connecting Siberia to Alaska. Within a few thousand years, early North American hunters together with climate change drove most of our herbivore species to extinction. By 10,000 years ago, the only large herbivores left in Nebraska's grasslands were bison, pronghorns, deer, and elk. Of these, only pronghorn has been here, evolving, during the entire 34-million-year story of Nebraska's grasslands. I encourage you to see that story at Morrill Hall.

Uden Receives Junior Faculty Award for Excellence in Research

By Ronica Stromberg

Daniel Uden, spatial scientist in the Center for Resilience in Agricultural Landscapes and a faculty collaborator in the Center for Grassland Studies, received a Junior Faculty for Excellence in Research award from the Agricultural Research Division of the University of Nebraska–Lincoln on February 13. Uden serves on the Center for Grassland Studies curriculum committee and helped develop the Grasslands Systems major and minor. He has taught “Research Experiences in Grasslands” and three other classes since being hired in August 2020 as a professor in the School of Natural Resources and Department of Agronomy and Horticulture. In his dual appointments, Uden has also developed curriculum for the College of Agricultural Sciences and Natural Resources and advised eight graduate students, seeing two to graduation.



Left to Right: Larkin Powell, Dan Uden, and Marth Mamo

He has collaborated with the Center for Resilience in Agricultural Working Landscapes, CALMIT, Andy Little and his AWESM lab, the Nebraska-Montana EPSCoR, Powell Center, Nebraska Game and Parks, Pheasants Forever, the Daugherty Water for Food Global Institute and the adaptive management project at Barta Brothers Ranch. Despite being hired during a full-throttle pandemic, Uden managed to rack up 17 publications and help secure \$4 million in funds for teams. He created and delivered about 15 tools to help agencies, farmers and ranchers in making decisions. “I think all the nominators have been impressed with Dan really hitting the ground running,” said Craig Allen, director of the Center for Resilience in Agricultural Working Landscapes and one of seven professors who nominated Uden. “Dan has been able to get traction under his research and teaching programs and do so during a period that corresponded with Covid quite a bit. So, obviously, his skills are in demand.” Uden uses tools such as GPS, remote sensing and geographic information systems to track changes on land and equip land managers. He earned his graduate degrees from Nebraska and served briefly as a postdoc before taking his current position as a resilience spatial scientist. He said his prior work on campus helped him some during Covid. “I’ve been able to build momentum quickly because of some of the work I had started as a postdoc here and following through on those efforts,” he said. He also said he has benefited from the success of others and sees himself as making the most of their contributions in his fields of interest.

Larkin Powell, the director of the School of Natural Resources, led the professors to nominate Uden and, in his nomination letter, encouraged the award committee to try to count the number of groups Uden had been involved with. “We believe you will find substantial evidence that Dan’s peers are highly aware of his skills and abilities,” Powell wrote. “Dan is a ‘sought after’ scientist, and his impact is limited only by the number of hours in the day.” Powell said Uden’s work at Barta Brothers Ranch has shown his impact goes beyond the university, to local agricultural producers. “Dan can get up and talk to the local landowners about the project in a way that brings them into the conversation,” Powell said. “That is a unique trait for such a successful scientist.” Uden said he was honored and humbled by the award and wanted to thank his nominators and celebrate with his students and collaborators. “Maybe I can find a way to celebrate that recognizes everyone’s contributions to the award,” he said. “I don’t see it as just mine.”

He and Katarzyna Glowacka from the Biochemistry department received the junior faculty award, which included a certificate, recognition ceremony and \$3,000 grant to each winner to use for professional development or research-related activities. Uden said he plans to use his \$3,000 to support the research of graduate students he advises.

2024 Summer Grazing School & Range Short Course

Nebraska Grazing School

NEBRASKA
Grazing Lands Coalition

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Join the Nebraska Grazing Lands Coalition and Nebraska Extension Range Short Course Summer Grazing School at Spring Lake Ranch - Gordon, NE. This school will feature instructors Bart Carmichael and Pat Guptill of Principled Land Managers LLC. The Nebraska Grazing Lands Coalition provides this unique opportunity to receive hands-on education and training provided by industry experts. Registration includes interactive instruction, class materials, textbooks, meals, and breaks. This is a highly interactive and intensive three-day school includes some of the following activities:

- Plant identification
- Grazier's Math and Clipping Demonstration
- Grazing for healthier soil
- Clip like a cow
- Soil Health and infiltration
- Forage Planning
- Paradigm Shift
- Animal Nutrition
- Winter Grazing

The Nebraska Grazing Lands Coalition
and Nebraska Extension Range Short Course
Summer Grazing School-June 25-27, 2024
Spring Lake Ranch-Gordon



Featuring instructors Bart Carmichael and Pat Guptill
of Principled Land Managers LLC
Register at www.nebraskagrazinglands.org

New Book Highlights Nebraska Sandhills

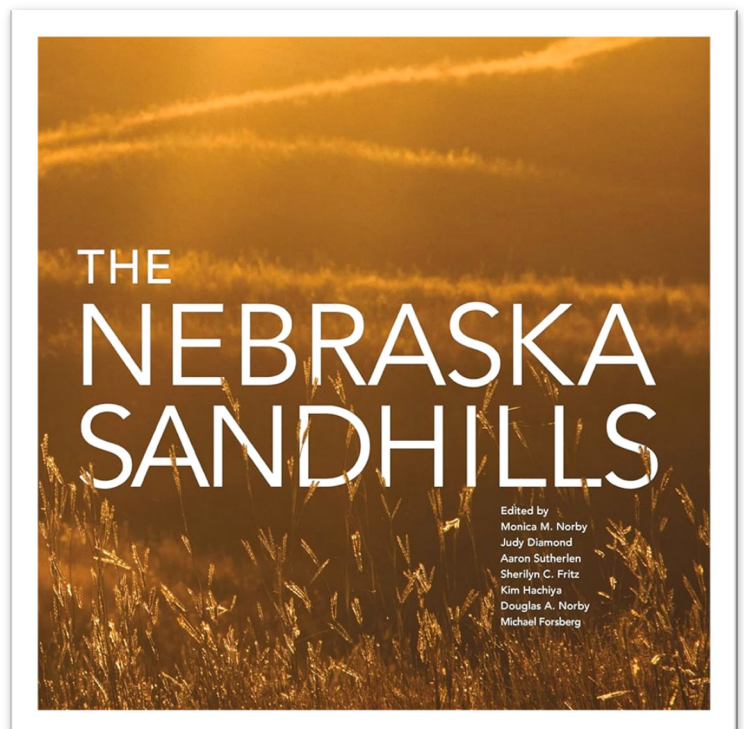
University of Nebraska Press, Lincoln, NE

"Like a rumpled wool blanket, the Nebraska Sandhills spreads out over twenty thousand square miles of north central Nebraska and is the largest stabilized dune field in the Western Hemisphere. It is also the largest intact mixed-grass prairie left on the continent."

This description by photographer Michael Forsberg alludes to the exceptional physical geography of the Nebraska Sandhills, a place of rolling grasslands, rivers, and wetlands created by the Ogallala Aquifer that underlies the region. Home to abundant wildlife, from pronghorn antelope to sandhill cranes, the Sandhills are an ecological treasure. Dotted with ranches and small towns, the Sandhills are rich with deep cultural history, including those of Indigenous peoples, settlers, Black homesteaders, immigrants, ecotourists, and some adventurous golfers.

The Nebraska Sandhills features nearly forty essays about the history, people, geography, geology, ecology, and conservation of the Nebraska Sandhills. Illustrated with hundreds of remarkable color photographs of the area, this is the most up-to-date and illuminating portrayal of this remarkable yet largely unknown region of the United States.

Publication of the book was supported by the Center for Grassland Studies. Order your copy of *The Nebraska Sandhills* at University of Nebraska press "Bison books."





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2024 Nebraska Grazing Conference

Jerry Volesky, Associate Director, Center for Grassland Studies; Professor, Agronomy & Horticulture, Lincoln, NE

Final planning is in progress for the 2024 Nebraska Grazing Conference set to be Tuesday and Wednesday, August 6 and 7, 2024, at the Younes Center in Kearney, Nebraska. The Conference will begin on Tuesday morning with a special focus on grassland soils. This field activity and tour will be at the Platte River Prairies site managed by The Nature Conservancy. A rainfall simulator demonstration will occur and soil pits will be available for participants to see and learn about grassland soil types and soil health.

The Tuesday afternoon session at the Conference Center in Kearney will open with recognition of the past year's Leopold Conservation Award winner. The main theme for the afternoon will be grassland soil health with speakers covering topics such as 'what is soil health', soil carbon, and management to improve soils.

The Wednesday morning session is devoted to grazing and wildlife conservation with several speakers presenting on different wildlife species and grazing management practices. The Conference also has an exhibitor trade show both days.

To register, go to: <https://grassland.unl.edu/nebraska-grazing-conference> We look forward to seeing you in Kearney!

