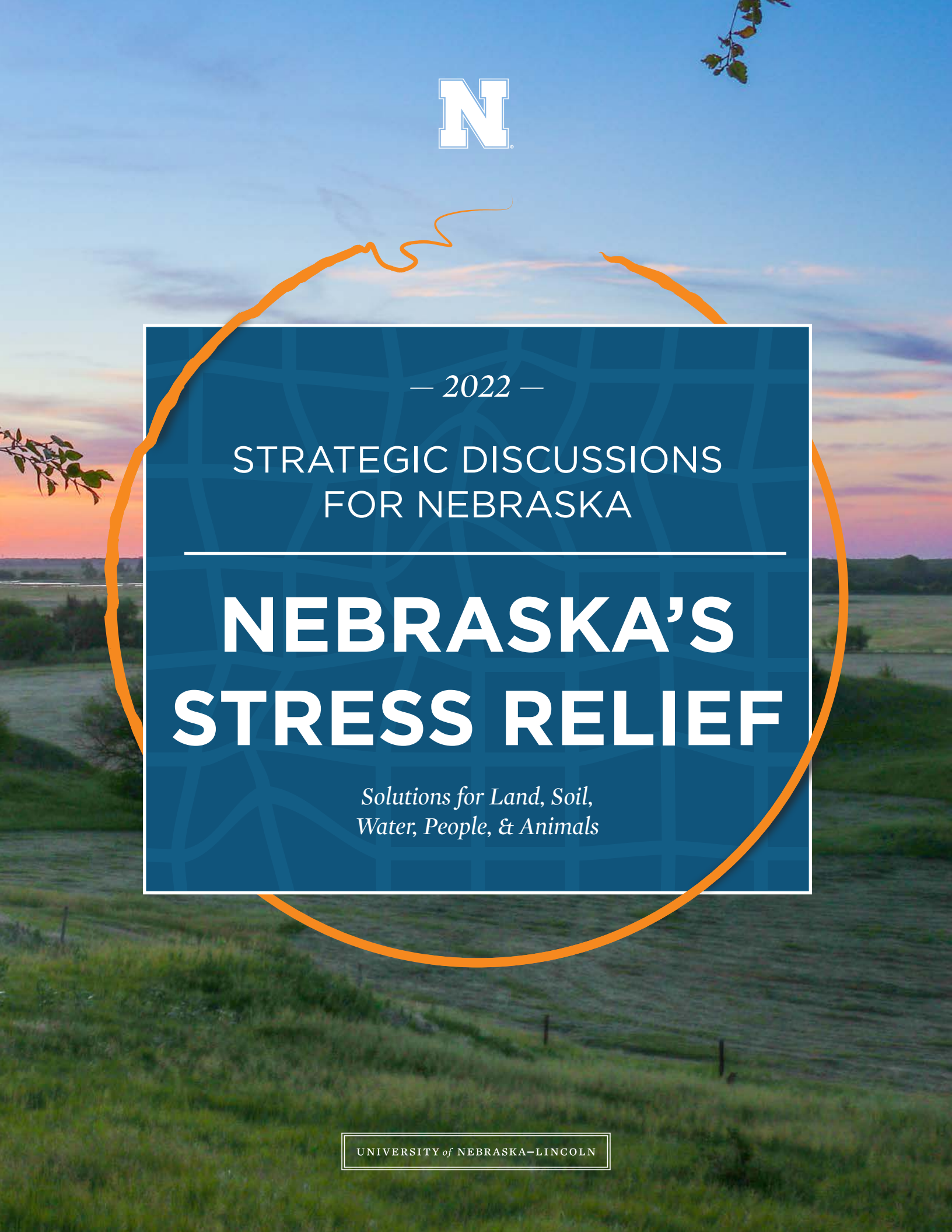


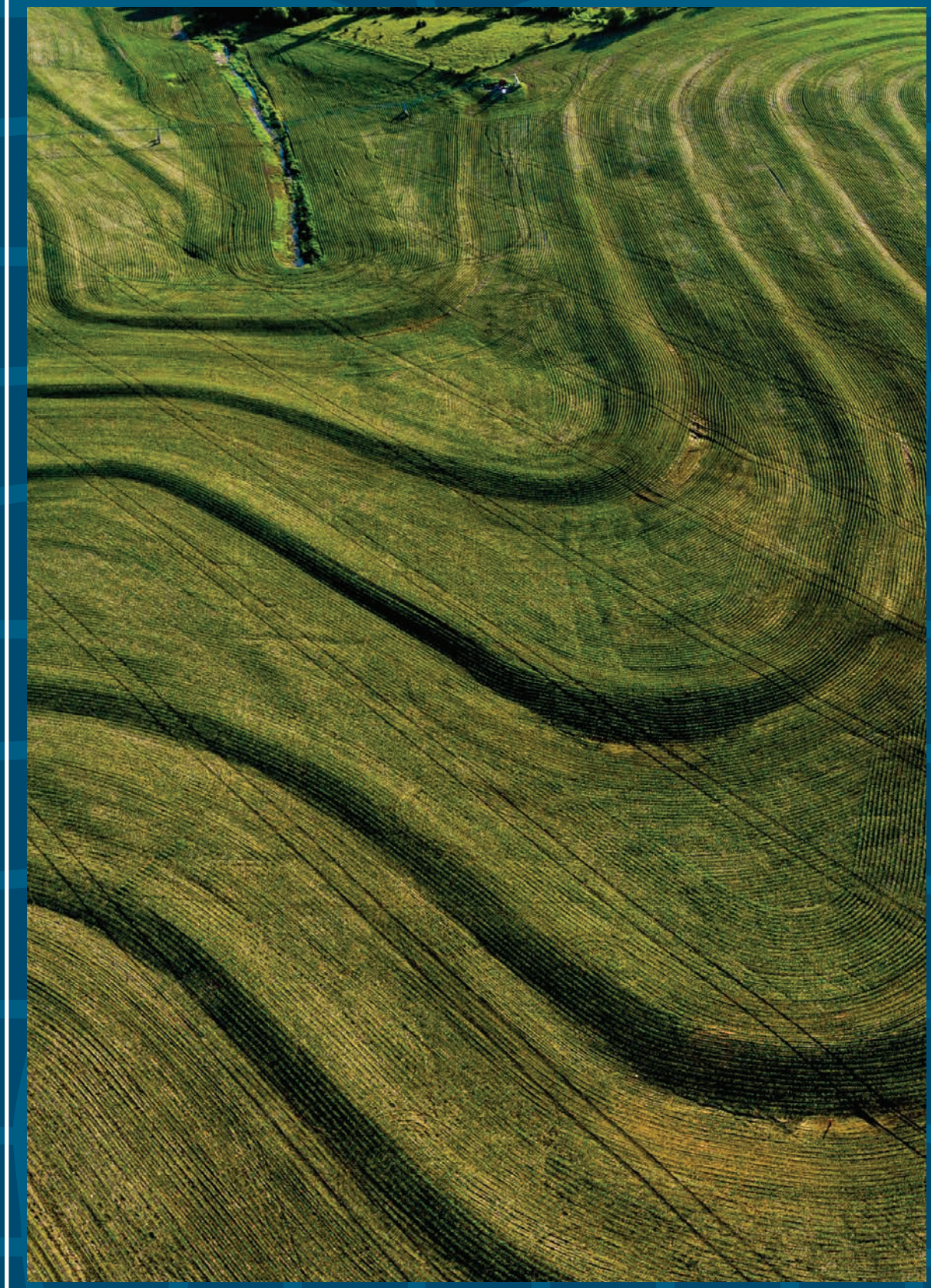
— 2022 —

STRATEGIC DISCUSSIONS FOR NEBRASKA

NEBRASKA'S STRESS RELIEF

Solutions for Land, Soil, Water, People, & Animals

UNIVERSITY of NEBRASKA–LINCOLN



“Advancing production agriculture in a way that also takes care of our water and our land cannot happen without bringing together leading experts to share their expertise about stress biology. It is an honor to channel these efforts to serve the people and industries of Nebraska.”

– Michael J. Boehm –

University of Nebraska Vice President for Agriculture and Natural Resources
University of Nebraska–Lincoln Harlan Vice Chancellor
Institute of Agriculture and Natural Resources

INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES

University of Nebraska–Lincoln Institute of Agriculture and Natural Resources (IANR) focuses on people and the food, energy, water, natural resources, and communities that sustain them.

IANR scientific innovation in the land-grant mission areas of teaching, research, and Extension places Nebraska on the leading edge of food production, environmental stewardship, human nutrition, business development and youth engagement.

IANR comprises the College of Agricultural Sciences and Natural Resources (CASNR), the Agricultural Research Division (ARD), Nebraska Extension, and the ARD and Extension components of three departments in the College of Education and Human Services.

The Nebraska Legislature created IANR in 1973 through the enactment of LB149. IANR is committed to growing the future of Nebraska's people, businesses, and communities.

ABOUT STRATEGIC DISCUSSIONS FOR NEBRASKA

Strategic Discussions for Nebraska (SDN) is an annual publication covering research and Extension projects within IANR.

SDN shares the IANR story by translating research-based science to be understood by the general audience. SDN has been produced annually since 2008, each focusing on a different overall topic.

As their senior capstone experience, students in the Agricultural and Environmental Sciences Communication (AESC) in the Department of Agricultural Leadership, Education and Communication (ALEC) create all content for SDN.

Each year, University Communication provides graphic design support and IANR Media offers website design expertise. IANR provides funding, business, and liaison services for the production of this publication.

A sincere appreciation is expressed for the original vision and financial support of the Robert and Ardis James Family Foundation, which founded SDN in 2007.

STRATEGIC DISCUSSIONS FOR NEBRASKA 2022

We are pleased to present the 2022 edition of Strategic Discussions for Nebraska (SDN) – *Nebraska's Stress Relief: Solutions for Land, Soil, Water, People, and Animals.*

This is an exciting year on East Campus as the Institute of Agriculture and Natural Resources (IANR) is celebrating its 50-year anniversary and the College of Agricultural Sciences and Natural Resources (CASNR) is celebrating 150 years. SDN is delighted to share stories of new developments happening during this celebration of innovation.

SDN is an annual publication produced in IANR to highlight faculty research and Nebraska Extension projects that people in the state might find useful.

This 2022 edition focuses on the overarching topic of Stress Biology, with each story offering ways to alleviate stress on land, soil, water, people, and animals.

Our hope for SDN is to connect Nebraskans with information about university efforts that might benefit them.

Specifically, this edition includes stories on programming – from Nebraska Extension being available for crisis planning and aftermath response, to the National Drought Mitigation Center helping farmers and ranchers determine ways to deal with drought, to the Nebraska On-Farm Research Network offering expertise for improving soil – SDN explains these initiatives and offers websites to learn more and get involved.

SDN 2022 also introduces new, interdisciplinary hubs such as the Water and Integrated Cropping Systems (WICS) Hub, the Nebraska Integrated Beef Systems (NIBS) Hub, and the Center for Resilience in Agricultural Working Landscapes (CRAWL) that work with Nebraskans to keep our water, beef, and land healthy. There are several programs for Nebraskans highlighted – there is likely something for everyone!

Students in the Agricultural and Environmental Sciences Communication (AESC) program write the stories and prepare promotional content for the SDN publication as part of their senior capstone experience. These writers are highlighted on the next pages with photos and hometowns.

This year, we are also excited to share that an AESC May 2022 graduate, Grace McDonald, designed the entire SDN 2022 publication. This is the first time a student has taken on this task, and we are so proud of the work she has done. A sincere, special thank you to Grace for her dedicated efforts!

Thank you for your continued support of the university and Strategic Discussions for Nebraska! We look forward to connecting with you. Follow us on Facebook and Twitter @sdn_unl or visit our website sdn.unl.edu to see all editions and more information.

Dr. Laura E. Young

SDN Director and Editor

Email: laura.young@unl.edu | Phone: 402.472.2807

2022

STRATEGIC DISCUSSIONS FOR NEBRASKA STUDENT WRITERS

Students in the Agricultural and Environmental Sciences Communication program in the Department of Agricultural Leadership, Education and Communication at the University of Nebraska–Lincoln write the stories for the Strategic Discussions for Nebraska publication.

The senior capstone course provides a learning experience similar to those students may encounter in the workplace, emphasizing accurate, clear and objective communication of science-based information.

During the course, students learn about interdisiplinary research and projects conducted at the university and the diverse funding sources required to support the work.

Throughout one semester, students interview faculty and Extention educators from many disciplines and write stories, take photos, create videos, and design social media content based on those interviews. The stories in this publication were reviewed by the sources and approved for publication.

Cade Adamson

Cade is from Cody, Nebraska and graduated from the University of Nebraska–Lincoln in December 2021 with an Agricultural and Environmental Sciences Communication major and Agricultural Economics minor.

Bella Chaffin

Bella is from Waverly, Nebraska and graduated from the University of Nebraska–Lincoln in May 2022 with an Agricultural and Environmental Sciences Communication major and Leadership & Communication minor.

Dani Laible

Dani is from Atkinson, Nebraska and graduated from the University of Nebraska–Lincoln in May 2022 with an Agricultural and Environmental Sciences Communication major with an emphasis in strategic communication.

Malina Lindstrom

Malina is from Elm Creek, Nebraska and graduated from the University of Nebraska–Lincoln in May 2022 with majors in Agricultural and Environmental Sciences Communication and Animal Science and a Nebraska Beef Industry Scholars minor.

Grace McDonald

Grace is from Phillips, Nebraska and graduated from the University of Nebraska–Lincoln in May 2022 with majors in Agricultural and Environmental Sciences Communication & Graphic Design and an Agribusiness minor.

Rebel Sjeklocha

Rebel is from Hays Center, Nebraska and graduated from the University of Nebraska–Lincoln in December 2021 with an Agricultural and Environmental Sciences Communication major and minors in Engler Agribusiness Entrepreneurship and Law & Business.

Whitney Steckel

Whitney is from Taylor, Nebraska and graduated from the University of Nebraska–Lincoln in December 2021 with an Agricultural and Environmental Sciences Communication major and Nebraska Beef Industry Scholars minor.

Sophia Svanda

Sophia is from Nehawka, Nebraska and graduated from the University of Nebraska–Lincoln in May 2022 with an Agricultural and Environmental Sciences Communication major and Leadership & Communication minor.

CELEBRATION OF INNOVATION
CASNR 150 IANR 50

Rachel Williss

Rachel is from Papillion, Nebraska and graduated from the University of Nebraska–Lincoln in May 2022 with majors in Agricultural and Environmental Sciences Communication and Integrated Science.

Mickayla Yard

Mickayla is from Alvo, Nebraska and graduated from the University of Nebraska–Lincoln in May 2022 with an Agricultural and Environmental Sciences Communication major and Animal Science minor.

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MANAGING STRESS IN TURBULENT ENVIRONMENTS

IANR's Commitment to Stress Biology

By Rebel Sjeklocha

Managing stress in both plants and animals is a necessity to produce the food, feed, fiber, and fuel needed to sustain a growing population. The Institute of Agriculture and Natural Resources (IANR) is committed to finding solutions for Nebraska's agricultural producers and ranchers as demonstrated through its continual work in the area of stress biology.

Stress biology is "the impact of the environment, which could be physical, chemical, or biological interactions, on a living organism, and the response of that organism to the stimulus," as defined by Michael J. Boehm, University of Nebraska Vice President for Agriculture and Natural Resources and Harlan Vice Chancellor of IANR at the University of Nebraska–Lincoln.

Simply put, stress biology is the study of how people, livestock, and crops interact with, and rebound from, the stressors of their environment.

The seemingly insurmountable challenges of the future – climate change, extreme drought, flooding, heat stress, and an increasing list of internal and external threats to both the livestock and crop sectors – are the driving forces behind IANR's research and innovation in this space.

For those in production agriculture, Boehm said, stressors of both crops and livestock can impact production decisions, total output, and ultimately, the bottom lines of corporations, cooperatives, and the family farms and ranches that keep rural Nebraska strong.

IANR faculty and staff have committed to reducing these impacts on Nebraska farmers and ranchers. This edition of SDN highlights some of that work.

Michael J. Boehm
University of Nebraska
Vice President for Agriculture and
Natural Resources
Harlan Vice Chancellor of IANR

A RESOUNDING IMPACT

IANR's current research in the stress biology arena will have long-term ripple effects on production decisions made by Nebraska farmers and ranchers, Boehm said. With increasing challenges and more dramatic stressors on both livestock and crops, understanding how organisms react, respond, and rebound from stressors is vitally important.

IANR has committed to research and innovation in the area of stress biology by identifying it as a community focus area and appointing two IANR faculty members as community leaders to direct the charge, Clint Krehbiel and Loren Giesler.

Clint Krehbiel, professor and head of the Department of Animal Science, said managing stress in livestock, particularly beef cattle, is a nonnegotiable focus area for the future.

"Heat stress creates a metabolic response that is hard for cattle to compensate for," Krehbiel said. "Mitigating the impacts of both heat stress and bovine respiratory disease will be critical as we look to the future."

Loren Geisler, professor and head of the Department of Plant Pathology, sheds light on how a greater understanding of crop stressors will push the state's ag economy forward.

"Stress biology research conducted at the university is going to impact our farmers by providing them with a more sustainable and profitable production system," Geisler said.

STRATEGIC DISCUSSIONS FOR NEBRASKA: 2022 HIGHLIGHTS

The 2022 edition of SDN highlights the collaborative focus of IANR and the interdisciplinary hubs, teams, and initiatives working on projects ranging from drought and climate, and livestock systems to crisis management, to name a few.

For example, the National Drought Mitigation Center's (NDMC) mission is to not only mitigate the impacts of drought, but also to reduce the economic impact drought has on Nebraskans and the world. Simply put, the impact of drought spans beyond plant and animal needs. People, energy, and resources are all touched by periods of low moisture, and NDMC creates drought plans for those dealing with such stress.

Second, faculty and staff involved in the Soil Health Initiative research soil health and the impacts on crop production, water management, and human and wildlife health.

Healthy soils provide the foundation for reliable and sustainable food sources, even in the face of extreme weather events like flooding and drought. The important work done through Nebraska Extension and faculty research in soil health helps to mitigate risk to keep ecosystems productive.

Third, with cutting-edge technology and research, the Nebraska Integrated Beef Systems (NIBS) Hub helps beef producers adapt to industry stressors. Through a multifaceted, collaborative effort, the NIBS Hub addresses narrow profit margins to help producers pass their livelihoods on to the next generation.

Finally, Nebraska One Health connects the relationships between animal, plant, and human

"Stress biology research conducted at the university is going to impact our farmers by providing them with a more sustainable and profitable production system."

Loren Geisler

The story of stress biology within IANR is told by this year's AESC senior class, as pictured here, AESC Senior Rachel Williss. Much of the work for this publication was completed within the walls of the Agricultural Communications building, as featured in the background of this photo.

health through Citizen Science Projects and the Community Scientists of Nebraska Network. This multidisciplinary approach acknowledges that there is no “one piece,” and that all living things are part of an interconnected system.

Together, these stories highlight a glimpse of work being conducted within IANR.

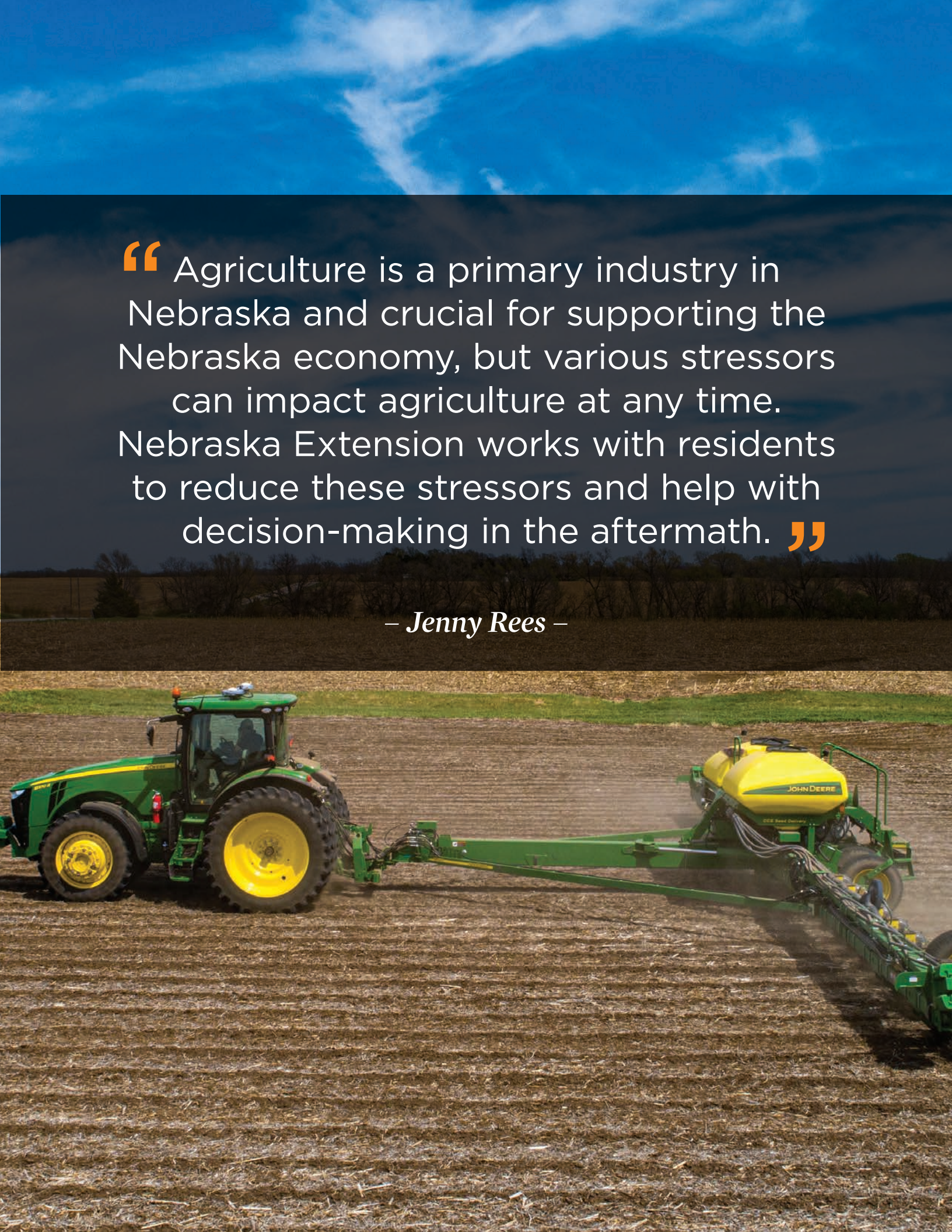
“Advancing production agriculture in a way that also takes care of our water and our land cannot happen without bringing together leading experts to share their expertise about stress biology,” Boehm said. “It is an honor to channel these efforts to serve the people and industries of Nebraska.”

For more information on IANR, visit ianr.unl.edu

KEY TAKEAWAYS

1. Stress biology, the focus of this SDN edition, is the study of how people, livestock, and crops interact with, and rebound from, the stressors of their environment.
2. The seemingly insurmountable challenges of the future – climate change, extreme drought, flooding, heat stress, and an increasing list of internal and external threats to both the livestock and crop sectors – are the driving forces behind IANR’s research and innovation in this space.
3. IANR’s work in stress biology will have a resounding impact for Nebraska’s producers, increasing the profitability of farms and ranches and improving the vitality of rural communities.
4. This year’s edition of SDN features a broad array of research projects that impact all facets of Nebraska agriculture, from drought, to soil, to beef.

For more information on IANR, visit ianr.unl.edu.



“Agriculture is a primary industry in Nebraska and crucial for supporting the Nebraska economy, but various stressors can impact agriculture at any time. Nebraska Extension works with residents to reduce these stressors and help with decision-making in the aftermath.”

– Jenny Rees –

Stressors Impact Nebraska ***Land and Soil***

The Center for Resilience in Agricultural Working Landscapes (CRAWL)

Resilience Keeps Landscapes Functional Despite Stressors

By Rachel Williss

The resilience of a landscape to stressors, such as weather or ecological changes, is essential to preserving its ability to function, whether it be for agricultural, recreational, or other uses.

In a world that is expected to continue to increase agricultural yields to meet the needs of global food security, it is especially important to understand how to keep landscapes from reaching the threshold of becoming unusable.

Scientists in the Center for Resilience in Agricultural Working Landscapes (CRAWL) at

the University of Nebraska–Lincoln study these interconnected systems in interdisciplinary teams, using cutting-edge technology.

Craig Allen, professor in the School of Natural Resources and director of CRAWL, and Dan Uden, assistant professor in the School of Natural Resources and the Department of Agronomy and Horticulture at the university, are two resilience scientists working to build CRAWL to preserve the productivity of landscapes in Nebraska and beyond.

"A resilience scientist sees the world in terms of systems and the disturbances that those systems experience," Uden said. "And resilience scientists work to understand and anticipate those disturbances and their impacts."

Research conducted in CRAWL focuses on how agricultural landscapes respond to stressors such as weather (drought, hail, damaging winds, etc.) and ecological changes (such as invasive species), as well as social pressures and economic drivers.

"Nature does not exist in isolation anymore," Allen said. "There is an important human linkage that must be considered this type of research."

RESILIENCE – NOT JUST A BUZZWORD

The term "resilience" is one that many people have likely heard, but within resilience research, Uden said there is a more specific definition.

"Resilience refers to a system and the level of disturbance that system can experience before it starts functioning in a fundamentally different way," Uden said.

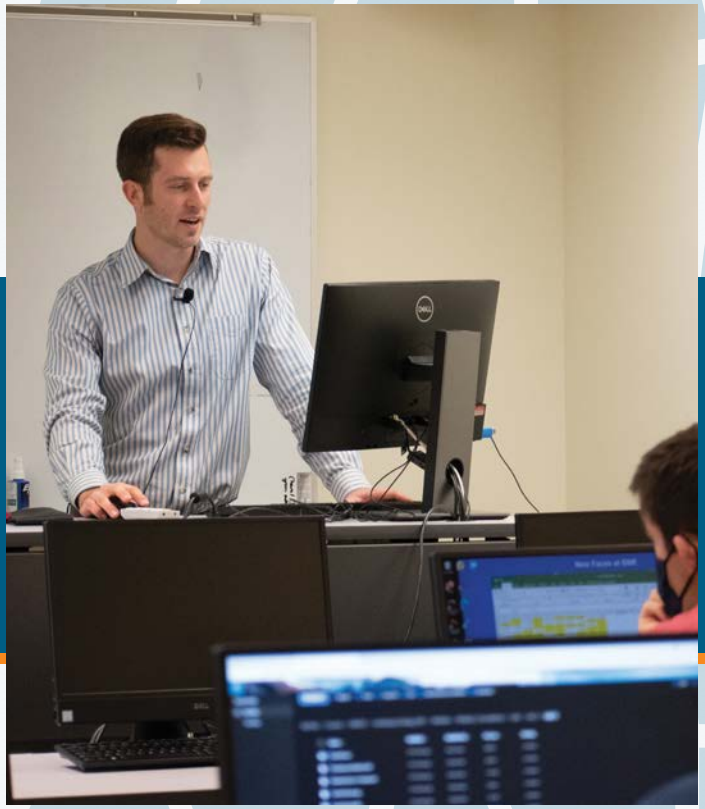
Research on resilience can be done for many different types of systems. The human body, for example, is one system that experiences and reacts to stressors. CRAWL, however, focuses specifically on landscape resilience.

"Food, fiber, fuel, and feed – those are things that we get from landscapes and from ecosystems," Uden said.

Landscapes provide essentials not only for the lives of humans and other animals, but also for recreational spaces and even opportunities to combat the severity of climate change.

"Resilience scientists work to understand and anticipate disturbances and their impacts."

Dan Uden



Dan Uden, Assistant Professor and Resilience Scientist, teaching landscape ecology in Hardin Hall.

Therefore, it is essential to understand these complex systems and how they respond to stress so that potential interventions can be developed to keep landscapes functional.

RESILIENCE IN NEBRASKA

Nebraska is a beneficial location for CRAWL because it provides connections with experts on the many facets of agricultural landscapes, as well as access to a state that has a wealth of different types of important landscape systems.

"Many states focus on either row crop agriculture or grazing and beef production," Allen said. "Nebraska does both and sometimes in an integrated way, making it an ideal location to study these landscapes."

Some people may view Nebraska as homogenous landscape, potentially making it lackluster to study, but Allen said that is not the case. There are many differences in elevation, amount of precipitation, types of soil, and water access across the state, for example, providing multiple areas of study.

"This variety in the landscape really gives us a great variety of situations to explore," Allen said.

Understanding the resilience of Nebraska's landscapes can inform land management practices that can ultimately increase the resilience of those landscapes to stressors. This ensures the land will support future generations.

"We need landscapes to be multifunctional, not just to be functional," Uden said. "It is in our best interest to think about the resilience of landscapes, because landscapes experience all sorts of stressors."

INTERDISCIPLINARITY IS KEY

Studying the resilience of a landscape requires taking into consideration all elements present in that landscape, as well as the different way in which it can be viewed.

"Complex systems are constantly changing and are comprised of human elements, social elements, ecological elements, economic elements, and infrastructure elements," Allen said.

This complexity makes it vital for resilience scientists to form highly interdisciplinary teams. CRAWL has a wide range of expertise, and its faculty are regularly looking for new ways to build connections with experts in other disciplines.

For example, Gwendwr Meredith, who specializes in socio-ecological research, and Liz VanWormer, the coordinator of Nebraska One Health, as well as many graduate researchers also work within or with CRAWL.

Creative approaches to finding new collaborators have value for this research. One way is to talk with students to learn about their interests as well as what other advisors and professors they are working with. This can lead to collaboration with faculty that have expertise in other fields, Uden said.

Ultimately, CRAWL has been successful by bringing together multiple perspectives and expertise, including from both faculty and students.

To learn more about resilience and the research being done by CRAWL, visit https://centerforresilience.unl.edu/ and sign up for the newsletter https://centerforresilience.unl.edu/newsletters.

KEY TAKEAWAYS

1. The Center for Resilience in Agricultural Working Landscapes (CRAWL) was established to study the resilience of Nebraska landscapes important for food security, producing fiber and fuel, and for recreational uses.
2. In a world that is expected to continue to increase agricultural yields to meet the needs of global food security, it is especially important to understand how to keep landscapes from reaching the threshold of becoming unusable.
3. Research conducted in CRAWL focuses on how agricultural landscapes respond to stressors such as weather (drought, hail, damaging winds, etc.) and ecological changes (such as invasive species), as well as social pressures and economic drivers.
4. Interdisciplinary teams are a pillar of resilience research because they take into consideration all the elements present in that landscape.

To learn more about resilience and the research being done by CRAWL, visit https://centerforresilience.unl.edu/.

Digging Into Nebraska's Soil Health

The Soil Health Initiative's Impact on Nebraska

By Mickayla Yard

Soil is a cornerstone of crop production, water management, and erosion control, as well as human, land, and wildlife health.

Soil is also the medium that supports life and provides fuel, fiber, and food for all living organisms. Therefore, when stressors impact soil, they also impact other ecological systems.

The Soil Health Initiative is a collaborative project between university researchers and Extension specialists, Nebraska farmers and ranchers, and the Natural Resource Conservation Service (NRCS) that encourages the adoption of soil health and rangeland management systems through the Nebraska On-Farm Research Network.

Soil health is defined as the ability of soil to sustain stressors from plants, animals, and humans. Healthy soil provides clean air and water, sustained crops, and productive land.

Andrea Basche, assistant professor in the

Graduate Students Fernanda Souza Krupek and Elizabeth Oys, and Faculty member Andrea Basche work with the Soil Health Initiative.

Department of Agronomy and Horticulture and Laura Thompson, associate Nebraska Extension educator with the Nebraska On-Farm Research Network at the University of Nebraska–Lincoln, examine ways to preserve and improve soil health.

"We work with farmers and experiment with different cover crop treatments on their farms," Basche said. "It is a great opportunity for us to explore research questions, co-develop with farmers, and compare results in smaller field experiments with working farms."

Healthy soils allow for reliable and sustainable food sources, even in times where extreme weather events such as flooding and drought cause food instability.

"We examine how different production practices can impact the soil's ability to produce quality food, feed, fiber, fuel and the cropping systems resilience to different environmental impacts," Thompson said.

Funded by the USDA-NRCS, the Soil Health Initiative determines best practices for land-owners, producers, and communities, such as integrating livestock, rotating crops, using cover crops, and minimizing soil disturbances.

WORKING TOGETHER WITH FARMERS

As part of the Soil Health Initiative, the Nebraska On-Farm Research Network provides Nebraska farmers and ranchers with the opportunity to their operations by participating in their studies.

"The mission of the On-Farm Research Network is to enable farmers to gain answers to critical production, profitability, and sustainability questions using their own fields and equipment," Thompson said. "Farmers are curious to learn, and we enjoy working with curious people."

Through the On-Farm Research Network, farmers work with researchers to determine a topic. While many farmers tend to choose aspects of cover crop management, livestock integration and crop rotation are also options.

As one example, a farmer might look at how a cover crop impacts soil organic matter, water holding capacity, and crop yields compared to no cover crop.

As farmers and ranchers consider the future, they must consider the value of their land and the quality of their soil in the long

> *"The mission of the On-Farm Research Network is to enable farmers to gain answers to critical production, profitability, and sustainability questions using their own fields and equipment."*
>
> **Laura Thompson**

term. This includes not only productivity, but also keeping the soil and the surrounding environment healthy.

The Soil Health Initiative and the Nebraska On-Farm Research Network collect data from research farms around the state, measuring the impact of different practices on soil health and cash crops.

EXTREME WEATHER

Healthy soils help reduce production deficits caused by extreme weather events such as flooding or drought. Again, cover crops are an option to improve soil health between cash crops or periods of heavy grazing that may deplete nutrients within the soil.

"Maintaining healthy soils can allow us to reduce the risk of negative impacts from flooding, drought, and extreme weather conditions," Thompson said.

Using cover crops has been shown to reduce environmental stressors on cash crops. One benefit is weed control, Basche said, and when there are fewer weeds, there is less competition for resources, ultimately benefiting the cash crop.

SOIL CONSERVATION IS AN AGRICULTURAL STAPLE

One way to keep soil healthy is through soil conservation. Soil conservation focuses on keeping soils healthy through a combination of techniques.

Elizabeth Oys and Fernanda Souza Krupek, graduate students in Department of Agronomy and Horticulture at the university, work with the Soil Health Initiative, particularly studying soil conservation.

Specifically, Krupek's research found that more nitrogen could be available to cash crops following cover crops, representing potential fertilizer savings for farmers.

Oys' research found that that cover crops suppressed pigweed seeds (a problematic weed in Nebraska that has developed resistance to several different herbicides) in the soil. This research is promising to demonstrate the role that cover crops can play in an integrated weed management strategy with concurrent soil benefits.

"The phrase 'soil health' is not new," Oys said, "But it has become a prevalent topic in recent years as a unique and powerful solution to many of the 21st century stressors, such as the degradation of natural resources."

Soil provides nutrients and natural resources such as heat and oxygen.

"Soil conservation ensures that nutrients and resources will continue to be available into the future," Krupek said.

Preserving soil health can help preserve and protect natural resources and native plant and wildlife populations.

For more information about the Soil Health Initiative and the research being conducted, please visit https://cropwatch.unl.edu/soilhealth.

For more information about the Nebraska On-Farm Research Network, please visit https://on-farm-research.unl.edu/.

Associate Extension Educator Laura Thompson works directly with farmers through the Nebraska On-Farm Research Network.

KEY TAKEAWAYS

1. Soil is the medium that supports life and provides fuel, fiber, and food for all living organisms.
2. The Soil Health Initiative is a collaborative project between university researchers and Extension specialists, Nebraska farmers and ranchers, and the Natural Resource Conservation Service (NRCS) that encourages the adoption of soil health and rangeland management systems through the Nebraska On-Farm Research Network.
3. Soil health is defined as the ability of soil to sustain stressors from plants, animals, and humans. Healthy soil provides clean air and water, sustained crops, and productive land.

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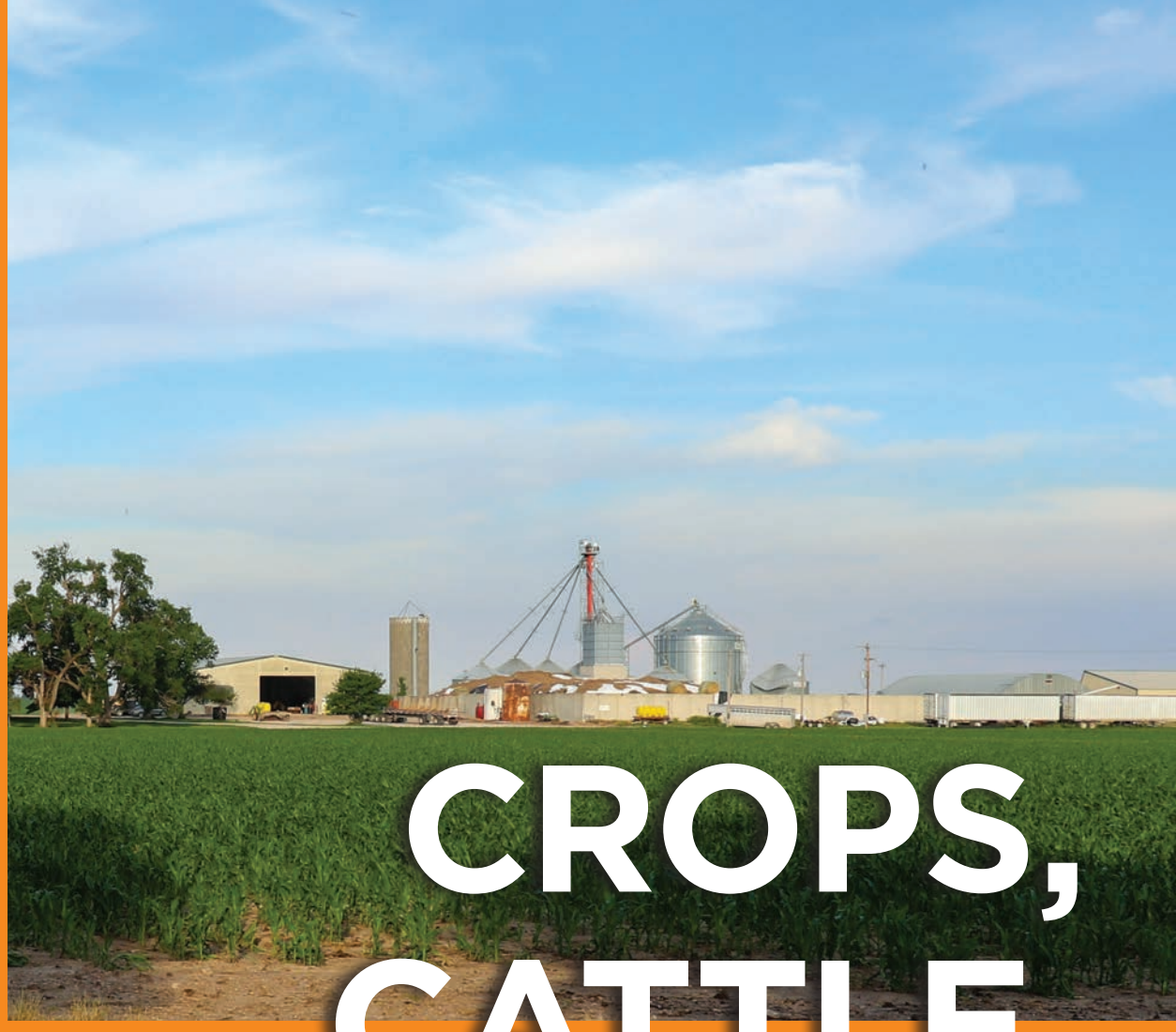


CROPS, CATTLE, COMMUNITY, AND *CRISIS*

Nebraska Extension Addresses Extreme Weather Challenges for State Residents

By Cade Adamson

Volatile weather conditions such as flooding, high winds, hail, blizzards, drought, or even tornados, can destroy entire livelihoods in just minutes – and in Nebraska, these conditions are highly likely. Weather impacts on Nebraska's biological systems can take a toll on Nebraska's agricultural industry.

As a response, Nebraska Extension offers crisis preparation and response programs for Nebraskans to not only mitigate weather damage, but also deal with the aftermath. The resources Nebraska Extension provides remedies the stress and effects they can have on the people, crops, and animals.

Two leaders in these efforts are Daren Redfearn, professor in the Department of Agronomy and Horticulture and Extension forage crop residue specialist, and Jennifer Rees, Extension cropping systems educator at the University of Nebraska–Lincoln.

"Agriculture is a primary industry in Nebraska and crucial for supporting the Nebraska economy," Rees said. "But various stresses can occur impacting agriculture at any time. Nebraska Extension works with residents to reduce these stressors and help with decision-making in the aftermath."

As if the financial benefits at stake are not enough for consideration, the physical and emotional health of industry producers can also be affected.

"Crises take an emotional toll because livelihoods are ruined," Redfearn said. "The emotional toll is something we do not discuss often, but it is really the human component that we also deal with in crisis work."

This emotional toll is what defines the overall response that Nebraska Extension offers state residents as they need it.

NEBRASKA EXTENSION RESPONDS

In response to crises, Nebraska Extension delivers information and offers resources such as guidance, analysis of operations, and mental wellness across the state.

In addition, Extension specialists are present after a catastrophic event, assisting communities in organizing steps forward.

Simply stated – Nebraska Extension adjusts to the needs of the people served in any crisis. Following the initial responses, programming is developed that is shared across the state.

For example, Nebraska Extension responded immediately following the 2013 hailstorm.

"In 2013, Clay County Nebraska had one of the worst hailstorms in recent history, resulting in a no recovery point for corn and beans," Rees said. "Nebraska Extension put an emergency meeting together within 24 hours for local farmers, crop consultants, and insurance representatives to make plans on where to go next."

Then, in 2014, a plan was created to mitigate hail damage – cover crops.

"Early in 2014 after another devastating, widespread hailstorm, Nebraska Extension developed a cover crop module for mitigating hail damage," Redfearn said. "Cover crops were not as popular then, but they were a clear solution."

These above examples then spurred organized

programming – Hail Know, where Nebraska Extension offers guidance to make informed, timely decisions when hailstorms damage crops. For specific information on Hail Know, please visit https://cropwatch.unl.edu/hailknow.

Further, in 2019, Nebraska Extension extensively helped many across the state impacted by the 'bomb cyclone' blizzard and flooding. During this time, significant amounts of snow fell in a short amount of time and the rapid snowmelt following the storm cause historic flooding.

Farms and ranches lost significant numbers of livestock, entire communities were evacuated because they were underwater, and crop production was stunted, if not completely lost for the year. Through all of this, Nebraska Extension promptly responded and partnered with other organizations in the response.

In an effort to organize crisis response programming through Nebraska Extension, a new initiative Weather Ready Nebraska (to include Hail Know, among others) was developed.

WEATHER READY NEBRASKA

Weather Ready Nebraska focuses on crisis response offered through Nebraska Extension.

Within all planning, successful crisis preparation strategies must include not only the physical business assets, but the human needs as well, Redfearn said.

Weather Ready Nebraska helps the state in four critical areas:

- Climate and weather literacy
- Scenario planning
- Field to market sustainability

Weather event preparation related to agricultural needs

By analyzing all weather components in a given area, Rees said, crisis preparation and communication can better tackle local needs and potential problems with effective solutions.

Because weather information is now more readily available, community leaders and agricultural producers can now learn how to best prepare for conditions based on their needs.

"Throughout the year, ranchers can be affected by the same weather events as crop producers," Redfearn said. "But livestock producers also must factor in blizzards and other extreme winter events for being weather ready."

Weather Ready Nebraska is positioned to help residents prepare for these potential situations.

For more information about Weather Ready Nebraska, please visit weather-ready.unl.edu.

KEY TAKEAWAYS

1. Weather impacts on Nebraska's biological systems can impact Nebraska's agricultural industry.
2. Nebraska Extension offers crisis preparation and response programs for Nebraskans to not only mitigate weather damage, but also manage the aftermath.
3. Extension specialists are also present after a catastrophic event, assisting communities in organizing steps forward.
4. Weather Ready Nebraska focuses on crisis response by offering successful crisis preparation strategies for both physical business assets and human needs.

For more information about Weather Ready Nebraska, please visit weather-ready.unl.edu.

"Crises take an emotional toll because livelihoods are ruined. The emotional toll is something we do not discuss often, but it is really the human component that we also deal with in crisis work."

Daren Redfearn

“The National Drought Mitigation Center helps mitigate the impacts of drought with a goal of reducing the economic impact on Nebraskans and the world. We want to be ***THE*** resource for people to come to for any of their drought needs.”

– Mark Svoboda –

Stressors Impact ***Water*** in Nebraska

THE NATIONAL DROUGHT MITIGATION CENTER RESPONDS TO DROUGHT STRESS

Serving Nebraska and the World

By Whitney Steckel

Drought plagues the world every year. The National Drought Mitigation Center (NDMC) helps people recognize and plan for drought stress to help reduce the impact on society and the economy.

Mark Svoboda, director of the NDMC housed at the University of Nebraska–Lincoln, and his team provide information and resources to the public.

"The NDMC helps mitigate the impacts of drought with a goal of reducing the economic impact on Nebraskans and the world," Svoboda said. "We want to be THE resource for people to come to for any of their drought needs." While the NDMC is housed within a university, it is a resource used around the world. The center is home to nearly 25 staff covering the physical and social sciences. "Their expertise is what makes the center so successful" he said.

"We work all over the world. The work starts right here in Nebraska and we grow from there," Svoboda said.

WHAT IS DROUGHT?

Simply stated, drought is when there is not enough water to meet environmental needs.

Drought can be widespread and have different durations that influence the land, people, and resources in the area, Svoboda said.

"We know droughts are a normal part of climate," he said. "This is not new -- drought goes back before people were here, but we certainly deal with it today and need to find innovative ways to mitigate its future effects."

However, the impact of drought hurts plant and animal needs, people, energy, ecosystems and even the economy.

RECOGNIZING DROUGHT

The NDMC uses several resources to monitor drought conditions across the United States, such as weather stations, models, satellites, and airplanes, according to Svoboda.

"Most commonly, satellites are used to determine if vegetation is under stress," he said.

Through satellite imagery, drought conditions are determined, and the NDMC helps to create action plans for farmers, ranchers, and communities.

Agriculture is a globally connected market, making the need for drought monitoring more important than ever. A drought in one area of the world can impact the demand of grains in the worldwide trade.

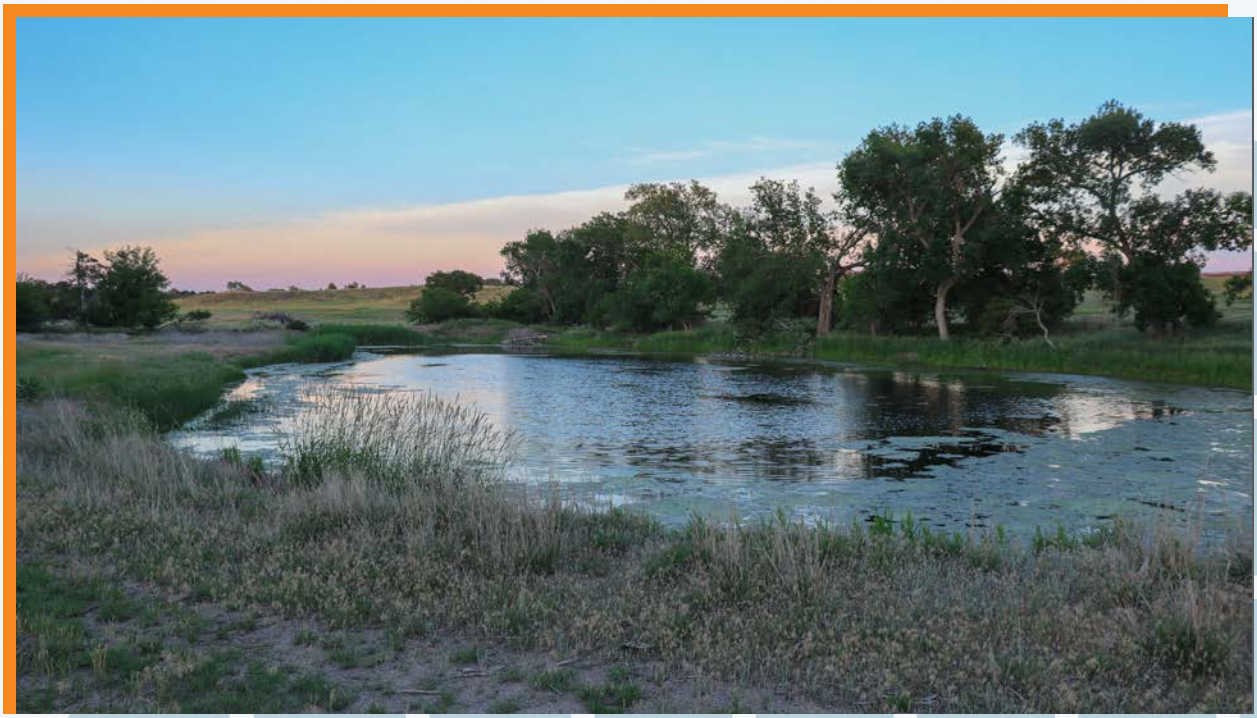
"People are paying attention to soybeans in Brazil, wheat in Russia, China and India, and corn, soybeans and wheat in the United States – everything is tied together," said Svoboda.

Recognizing drought conditions worldwide assists farmers in the United States with crop selection, like the 2021 demand on soybeans due to drought in Brazil.

Drought recognition needs are not limited to agriculture. The recognition of drought has an impact on several sectors of the world economy including tourism (impacted by fires in the western part of the United States each year), energy powered by hydroelectricity, and even community water needs.

Not surprisingly, drought may result in financial strain on families, and dealing with drought impacts brings both physical and emotional stress.

"Drought can cause strain on operations – both farms and ranches – that have been in families for generations," Svoboda said. "Some of these farms and ranches have endured multi-year droughts, which causes significant economic strain and mental stress on families."



NATIONAL DROUGHT MONITOR

A grassroots citizen effort to collect drought-related information is available through the NDMC website, Svoboda said. Condition-monitoring observer reports allow citizens to take images and upload them directly to the NDMC interface.

The NDMC staff combines its information with that from citizens to create the U.S. Drought Monitor (USDM) – the first project of its kind that combines multiple indicators onto one map.

The map provides a one-stop shop for stake-holders to learn more about drought.

"Stakeholders do not want to look at 24 maps and translate them in relation to drought," Svoboda said. "Instead, we developed one map to make the information easily accessible and all in one place."

The scientific basis and methodology behind the USDM has been applied in dozens of counties around the world over the past 20 years.

DROUGHT PLANNING

The NDMC has developed several vegetation stress indicators and monitoring systems that are integrated into the USDM, Svoboda said.

For example, the Vegetation Drought Response Index and the Quick Drought Response Index are both indicators and monitoring systems that display forages or forests in the U.S. that are being stressed or impacted by drought.

"Through these programs and others like Grass-Cast, farmers and ranchers can see the effects of drought on crops and/or rangelands," Svoboda said.

The NDMC has met or worked with hundreds of ranchers from southern Canada to northern Mexico and everywhere in the United States from the Great Plains to the Front Range, developing in-depth plans for agriculturists. A guide and examples of some of these plans are available through a resource called Drought Risk on the Ranch, which can be found at https://drought.unl.edu/Planning/DroughtPlans.aspx.

The network of experts that work with the NDMC has expanded to more than 450 people across the United States, including Puerto Rico, the U.S. Virgin Islands, and even the U.S. Pacific affiliated islands. In addition, the NDMC has worked with over 90 countries around the world since the center began operating in 1995.

For more information about the National Drought Mitigation Center or the plans that they offer for farmers, ranchers, and communities visit https://drought.unl.edu.

"Stakeholders do not want to look at 24 maps and translate them in relation to drought. Instead, we developed one map to make the information easily accessible and all in one place."

Mark Svoboda

KEY TAKEAWAYS

1. The National Drought Mitigation Center (NDMC) helps people recognize and plan for drought to help reduce the impact on society and the economy.
2. Drought is when there is not enough water to meet demand.
3. The U.S. Drought Monitor was the first indicator of its kind that combined multiple indicators onto one map.
4. The NDMC offers drought planning and early warning resources worldwide.

For more information about the National Drought Mitigation Center or the plans that they offer for farmers, ranchers, and communities visit https://drought.unl.edu.

THE WATER AND INTEGRATED CROPPING SYSTEMS (WICS) HUB

New Ways to Bring Water Research to Nebraskans

By Dani Laible

Water is a vital resource that is required by all forms of life. Plants, animals, and people need water to survive, so it is critical to preserve and conserve water from current stressors to guarantee future generations have quality water to use.

The Water and Integrated Cropping Systems (WICS) Hub was created as a springboard to integrate water experts across the university. Their mission: to more effectively share news and updates about water issues and concerns to the Nebraska public as well as scientific findings on water usage and preservation.

"One function of WICS is to serve as a platform for identifying, discussing, and solving problems related to water and cropping systems," said Daren Redfearn, co-leader of the WICS Hub and professor in the Department of Agronomy and Horticulture at the university.

Crystal Powers, Nebraska Water Center research and Nebraska Extension communications specialist within the university is a primary organizer of the WICS Hub meetings.

"The goal of the WICS Hub is to facilitate communication between groups already conducting research and projects within the

university and across the state," Powers said. "WICS is more in the background – the grease on the skids – a place where interdisciplinary research teams can connect and ultimately mitigate water issues impacting the state."

WICS is currently tackling critical biological stressors in Nebraska such as groundwater nitrates, climate change and extreme weather issues, soil care and conservation, cropping systems, and precision agriculture.

COMMUNICATING TO THE PUBLIC

Beyond being a connection point, the WICS Hub also plays a key role in communicating research findings about water to the public through Nebraska Extension.

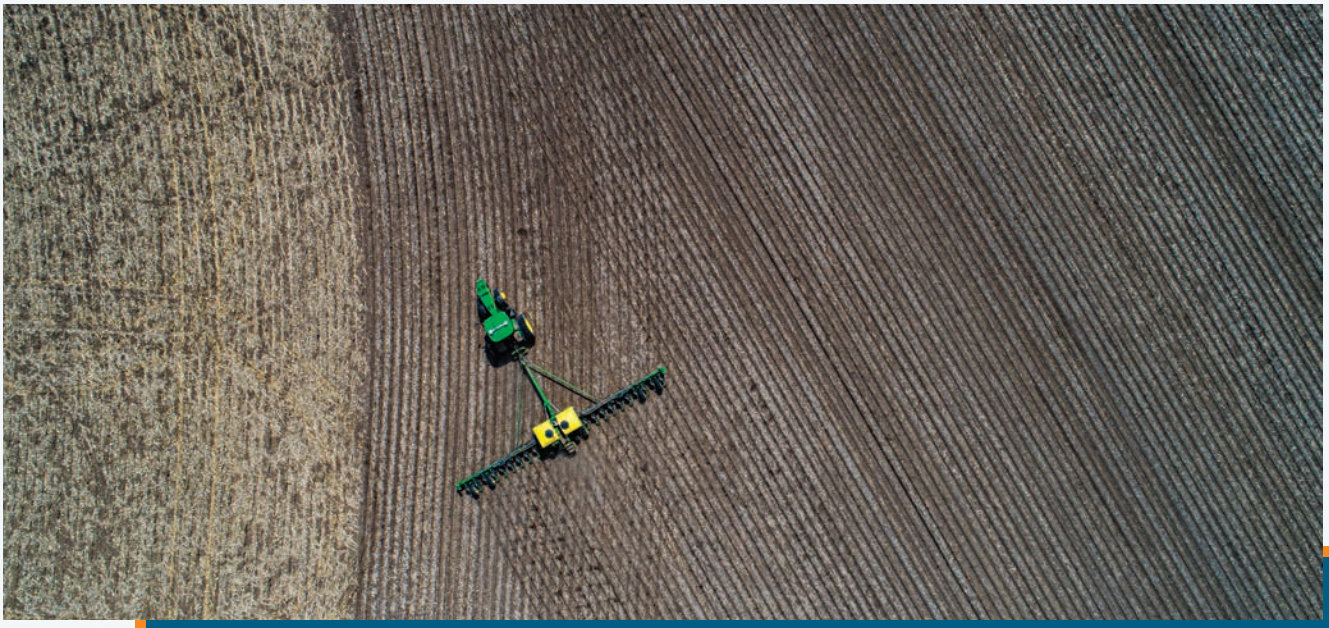
"Nebraska Extension communicates water research across the state as quickly as possible," Powers said. "Recently, collaborations within the WICS Hub between faculty and Nebraska Extension educators allowed us to get innovative research into the hands of farmers even faster – to really connect to the needs of the state."

Specifically, Nebraska Extension hosts clinics, including the Crop Production Clinic, Soybean Management Field Days, and pesticide safety trainings.

These clinics provide producers with information about safe practices of chemical, water, land, and soil usage as well as proper farming and harvesting procedures. Ultimately, the clinics help to address the overuse and misuse of restricted chemicals, water, or amendments in the soil.

The On-Farm Research Network, Animal Manure Management Program, and the TAPS Program are also offered as hands-on opportunities for the public through Nebraska Extension programming – all that benefit from the WICS' interdisciplinary approach.

Further, Nebraska Extension also serves as "boots-on-the-ground," where they are able to relay local problems in smaller communities to others within the Hub, so research can be conducted, and solutions can be developed.



"WICS serves as a platform for identifying, discussing, and solving problems related to water and cropping systems."

Crystal Powers

"Nebraska Extension educators are ingrained at the local or regional level, so they are aware of current issues in the state," Redfearn said. "With similar situations scattered across the state, Extension educators bring issues to the others in Hub so we can develop programming that is more encompassing and broader-based."

Bottom line: Faculty and Extension educators within the Hub utilize resources and knowledge to decipher and resolve water problems in Nebraska – particularly those impacted by typical Nebraska stressors.

In working towards solutions to the big problems, or biological stressors on water, WICS helps balance Nebraska's agricultural economy and conserve vital resources for the future of Nebraska's environment.

FUTURE DEVELOPMENTS

The WICS Hub officially launched in the fall of 2020 to help Nebraska Extension and university faculty to collaborate on water efforts and develops new initiatives every day.

More than 120 university and Nebraska Extension faculty are involved with the group. The Institute of Agriculture and Natural Resources (IANR) research, extension, and educational administration campuses and all UNL Research, Extension, and Education Centers are spread across Nebraska.

Current leaders of the WICS Hub include Ron Yoder, IANR senior associate vice chancellor; Chittaranjan Ray, Nebraska Water Center director; Daran Rudnick, associate professor in the Department of Biological Systems Engineering; and Daren Redfearn, professor in the Department of Agronomy and Horticulture.

For more information on the WICS Hub, contact Crystal Powers at cpowers2@unl.edu.

KEY TAKEAWAYS

1. The Water and Integrated Cropping Systems (WICS) Hub was created to integrate water experts in an effort to more effectively share news and updates about water issues and concerns to the Nebraska public as well as scientific findings on water usage and preservation.

2. The goal of the WICS Hub is to facilitate communication between groups conducting research and Extension projects of Nebraska within the university and across the state of Nebraska.

3. WICS is currently tackling critical biological stressors in Nebraska such as groundwater nitrates, climate change and extreme weather issues, soil conservation, cropping systems, and precision agriculture.

4. Beyond being a connection point, the WICS Hub also plays a key role in communicating research findings about water to the public through Nebraska Extension.

For more information on the WICS Hub, contact Crystal Powers at cpowers2@unl.edu.

“Bees play an important role in the ability to inform us about the status of the environment. We treat bees as biological indicators to help us promote and foster better conservation practices.”

– Judy Wu-Smart –

Stressors Impact the ***Health*** of Nebraska

Nebraska One Health

Improving and Understanding the Interactions Between All Organisms

By Bella Chaffin

Humans share the Earth with many other living things – what happens to them impacts us, and what we do impacts them.

Louise Lynch-O'Brien, assistant professor in the Department of Entomology at the University of Nebraska–Lincoln, explores how all living things interact through working with Nebraska One Health.

"Nebraska One Health educates people on connections between different types of health spheres and brings researchers and stakeholders together towards One Health issues such as drought or insects that pose public health concerns," Lynch-O'Brien said. "The outcome is to ultimately help people and help the environment."

Nebraska One Health research highlights connections between humans, animals, and the environment and helps people understand how all life is intertwined.

In her research on improving animal, plant and human health, Lynch-O'Brien works closely with Elizabeth VanWormer, Nebraska One Health coordinator and associate professor in the School of Veterinary Medicine and Biomedical Sciences and the School of Natural Resources.

"Innately, we all have a connection to the natural world – we are all interested in it to one degree or another," Lynch-O'Brien said. "Nebraska One Health is here to educate people on ways to connect and improve the environment – together."

Nebraska One Health has a number of community projects and networks to do just that.

CITIZEN SCIENCE PROJECTS

One Health topics are not limited to researchers. Everyone can help bridge gaps, Lynch-O'Brien said, and make connections between animal, plant, and human health.

"We live in an interconnected world where there are strong links between the health of people, animals, plants, and our shared environments," VanWormer said.

Nebraska One Health offers fun opportunities for Nebraskans to be more directly involved with science.

"It is important to look at volunteers and community scientists as ambassadors," Lynch-O'Brien said. "Citizen science projects provide opportunities for Nebraskans to get involved in research."

Two specific citizen science projects currently underway are Tick Tag Go and Bio Blitzes.

TICK TAG GO

Tick Tag Go encourages citizen participation in research with Nebraska One Health.

Using the iNaturalist app, Nebraskans can upload photos of ticks they see in their area and have them reviewed by a scientist to help identify new species of ticks, Lynch-O'Brien said. Doing so also allows for tracking of the ticks.

"The Tick Tag Go project asks people to photograph ticks," Lynch-O'Brien said. "The goal is for the public to help us identify where this new species is found across the state."

For example, Lynch-O'Brien said a new species of tick, the blacklegged tick, has recently appeared in eastern Nebraska. This species is likely to continue to move across the state, and researchers are working to gain more information on it.

"Innately, we all have a connection to the natural world – we are all interested in it to one degree or another. Nebraska One Health is here to educate people on ways to connect and improve the environment – together."

Louise Lynch-O'Brien

The app provides researchers data that tracks where the ticks are located, as well as their physical attributes. By uploading photos, Nebraskans play an active role in this tracking process.

BIO BLITZES

Having conversations about research on various trees, forbs, plants, animals, or insects provides the opportunity for the public to discover new information. Bio blitzes are typically 24-hour events that create an environment in which connections between different organisms can be found, Lynch-O'Brien said.

"The goal of Bio Blitzes is to help improve appreciation of biodiversity and all the different roles that different animals and plants play in making the fabric that we all rest on – the fabric that holds us up and lets our ecosystem function," Lynch-O'Brien said.

People who are in the environment every day have a strong connection to the land, VanWormer said, and the group truly appreciates having them join the One Health conversations.

The Bio Blitzes offer this opportunity to anyone who wants to be involved.

COMMUNITY SCIENTISTS OF NEBRASKA NETWORK

The Community Scientists of Nebraska Network also works with a variety of researchers, stakeholders, and scientists to collaborate on different issues such as public health and the environment.

"The Community Scientists of Nebraska Network was designed to fill that gap between different specialties and bring different projects together," Lynch-O'Brien said. "One person might focus on birds, another might look at deer and other animals, and another on soil – if we start talking to each other, we create that collaborative approach to find connections between organisms."

The Community Scientists of Nebraska Network is housed at the university but includes a wide variety of participants such as Nebraska Game and Parks, many universities across the state, citizen scientists and community scientists.

Young children learning at the East Campus Discovery Days and Farmers Market.

"When working with researchers from different disciplines and different stakeholders," Lynch-O'Brien said, "There is no one piece. Everything is part of a system."

For more information about Nebraska One Health, citizen science projects, the Community Scientists of Nebraska Network, and how you can get involved, please visit https://nebraskaonehealth.unl.edu/, https://communitysciencene.unl.edu/welcome, or https://scistarter.org/.

KEY TAKEAWAYS

1. Nebraska One Health educates people on connections among human, animal, plant, and ecosystem health.
2. The One Health approach brings researchers and stakeholders together to understand and address complex health issues such as shared diseases, pollution, drought or insects that pose public health concerns.
3. Two Citizen Science projects are available to Nebraskans who want to get involved in science: Tick Tag Go and Bio Blitzes.
4. Nebraska One Health participates in the Community Scientists of Nebraska Network that connects people across the state who want to work on these efforts.

For more information about Nebraska One Health, citizen science projects, and how to get involved, please visit https://nebraskaonehealth.unl.edu/.

BEES

A Canary in the Coal Mine

Bees Help to Understand Pollution Impacts on Water, Soil, and Human Health

By Sophia Svanda

Exposure to high levels of pollution in the soil, water, and air is not only detrimental to the health of surrounding ecosystems, wildlife, and insects, but can also cause ramifications to human health.

Judy Wu-Smart, associate professor and Extension specialist in the Department of Entomology at the University of Nebraska–Lincoln, explores the harm pesticide pollution poses to bee health and through her research has uncovered even larger implications.

"Bees play an important role in the ability to inform us about the status of the environment," Wu-Smart said. "We treat bees as biological indicators to help us promote and foster better conservation practices."

Nebraska is an ecologically diverse state, and protecting its biodiversity from outside stressors, like pollution is important in order to preserve it for the future.

Judy Wu-Smart with a beehive at the University of Nebraska–Lincoln Bee Lab located near Mead, Nebraska.

BIOINDICATORS OF SOMETHING SERIOUSLY WRONG

Bees are vital to ecosystem integrity. Bees are bioindicators and can be used to monitor change in ecosystem and environmental quality, according to Wu-Smart.

"Bees are highly sensitive to certain compounds," Wu-Smart said. "That is why we call them bioindicators of the environment or 'canaries in the coal mine.' Bees can indicate issues with the environment typically before the issues reach human health."

Through the research done to understand why the bee colonies were dying, Wu-Smart and her team pinpointed pollutants and work on ways to mitigate the problem.

"Beyond the loss of bees, there are potentially long-term ramifications at the ecological level that are critically important to consider with this type of pollution," Wu-Smart said.

UNDERSTANDING THE IMPACTS

There are still many unknowns surrounding certain pollution impacts to the environment and human health, Wu-Smart said. However, looking at local ramifications, such as water pollution, helps researchers to understand and communicate future impacts.

For example, when there are persistent chemical loads in the soil, air, and water, Wu-Smart said, farmlands can develop chemical resistance, meaning that a pesticide no longer controls the insect or disease it was engineered to fight. Dead zones are also created in waterways, causing aquatic life to die due to low oxygen levels and lack of food or nutrients, and it is harder to support any kind of life or biodiversity.

However, there are still a number of unknown factors and health concerns for humans, other wildlife, and local communities that reside downstream where pollutants were released into the environment.

"We have to think about what it means to live in an area with chronic exposure to chemicals," Wu-Smart said. "For instance, 'What does it mean for children developing in areas where there are chemical loads in the air, water and plants?' We are still working to determine these impacts."

Even while the research is still being conducted, Wu-Smart said, we can only make assumptions based on potential impacts on soil and water health, as there is currently little information about human exposure and what that means in terms of health risks.

THE ALT-EN DISASTER

Since 2015, the AltEn corn ethanol plant, located in Mead, Neb., has been one of the largest stockpilers of excess seed corn in the United States. These piles of ethanol byproduct known as "wetcake" are rotting and causing health issues for local residents and wildlife.

In 2017, Wu-Smart started to notice many bees at the Eastern Nebraska Research and Extension Canter (ENREC) facility and around Mead were becoming sick and dying. After encountering this unusual trend, she dedicated her work to understanding how and why the bees were dying.

After years of research, Wu-Smart determined the residue of clothianidin, a pesticide commonly used to coat seeds, was found on milkweed plants, exceeding the level deemed safe by the Environmental Protection Agency (EPA) for food and water.

"The levels found were far exceeding what we had seen in previously published research with known application amounts," Wu-Smart said. "That is when we realized that bees dying was potentially stemming from waterway contamination, rather than something that was happening on the fields."

AltEn closed in February 2021, after the Nebraska Department of Environment and Energy issued an emergency order to cease operations at the plant after numerous environmental violations. Researchers are currently looking into how far and to what extent these contaminants from the plant have moved.

For more information on updated research, visit: https://entomology.unl.edu/faculty/dr-judy-wu-smart.

"We have to think about what it means to live in an area with chronic exposure to chemicals."

Judy Wu-Smart

KEY TAKEAWAYS

1. Exposure to high levels of pollution in the soil, water, and air is detrimental to all kinds of life in Nebraska's ecosystem.
2. Nebraska is an ecologically diverse state and protecting its biodiversity from outside stressors like pollution is important in order to preserve it for the future.
3. Bees are vital to ecosystem integrity and can be used to monitor change in ecosystem and environmental quality.
4. Persistent chemical loads in the air, water, and soil can be very harmful to Nebraska's farmland, water resources, and the health of humans in surrounding areas.

For more information visit: https://entomology.unl.edu/faculty/dr-judy-wu-smart or https://www.unmc.edu/publichealth/departments/environmental/mead/.

> “The Nebraska Integrated Beef Systems (NIBS) Hub is dedicated to ensuring that Nebraska can raise beef in a way that the animal does not feel stressors, while being comfortable and healthy in their environment.”

– Rick Rasby –

Beef and Livestock Stressors

Keeping Nebraska at the Forefront of the Beef Industry

NIBS Hub Helps Beef Producers Adapt to Industry Stressors

By Malina Lindstrom

The Nebraska Integrated Beef Systems (NIBS) Hub provides Nebraska beef producers with access to cutting-edge technology and research to adapt to stressors and maintain their position as an industry leader.

Beef is a nutritious protein source to feed the world, making it an economic driver for the state of Nebraska. The NIBS Hub serves as a platform for scientists, producers, and others in the industry to discuss emerging issues and needs for beef production.

Rick Rasby, associate dean of Nebraska Extension at the University of Nebraska–Lincoln, explores how the NIBS Hub is impacting Nebraska beef producers and ways Nebraska Extension can further this research.

"The NIBS Hub better positions beef producers to access new technology and utilize that technology to enhance quality of life, add sustainability to resources, and increase profitability," Rasby said.

The job of a beef producer is to keep cattle comfortable in every environment and circumstance, and the Hub provides producers with the most recent research on best practices.

"We are dedicated to ensuring that we can raise beef in a way that the animal does not feel stressors and performs while being comfortable and healthy in their environment," Rasby said.

SOCIAL AND ECOLOGICAL STRESSORS

John Pollak, research professor at the university, and Walter Schacht, former interim director of the Center for Grassland Studies, and co-leaders of the NIBS Hub both said social and ecological stressors impact the beef industry.

"The stress placed on beef systems is also caused by social and ecological aspects that impact consumer perceptions," Schacht said. "We respond with the research that informs our education programs."

Public perception of animal welfare and handling issues may also drive changes.

"Even though some stressors are not biological, and not impacting animals directly, they are impacting our social license to produce those animals in the environments we are using," Pollak said.

The NIBS Hub pulls together a broad range of perspectives impacting the beef industry.

"The Hub is the mechanism that allows for the nimble assembly of unique groups doing research to provide short-term strategies, and long-term programs to meet these needs of the beef industry," Pollak said.

NEBRASKA EXTENSION SHARES NEW TECHNOLOGIES

Nebraska Extension is an important part of the NIBS program as Extension educators share new technologies and developments suggested by research with people around the state.

"Nebraska Extension has the opportunity to take current and forward-thinking research, package it in a way that is understandable to producers, and then help them see how it could fit into their management system," Rasby said.

Using various platforms like social media and in-person events allows Nebraska Extension to connect with beef producers.

"The idea is to take research done at the university and share it with producers using workshops, conferences, field days, on-ranch research, Twitter, YouTube videos, our beef website podcasts and the Beef Report," Rasby said.

CENTERS FOCUSED ON STRESS RESEARCH

NIBS Hub faculty members are launching several key research projects to address critical stressors within the beef industry. Two new research centers will be key to that effort: the Feedlot Innovation Center and the Ranch Innovation Center.

The Feedlot Innovation Center, expected to be operational by summer 2023, will allow controlled testing of multiple environments for feedlot production. Housing innovations will improve animal welfare with the potential to minimize stress.

Its production scale positions it as an ideal test bed for new and emerging technologies with immediate application to producers around the state and beyond.

The Ranch Innovation Center, funded by the USDA, supports rangeland precision livestock management. Researchers will use the latest technology including GPS, virtual fencing, unmanned aerial vehicles, and novel electronic feeding systems with the goal to select cattle which are efficient and resilient to climate change including drought.

UNL is positioned to be leaders in this area, in Nebraska, nationally, and internationally.

NIBS HUB FUTURE

The NIBS Hub is the site of critical conversations about beef production systems. University faculty, Nebraska Extension, the College of Agricultural Sciences and Natural Resources, our statewide network of research, education, and extension centers, and a broad, engaged external advisory committee are instrumental in keeping Nebraska beef at the top of the industry for generations to come.

"The advisory committee of NIBS, along with the NIBS Hub platform," Rasby said, "create a co-learning environment that envisions the needs of the industry years down the road."

New leadership to the NIBS Hub has begun in 2022, following the retirement of both Pollak and Schacht.

Galen Erickson, professor in the Department of Animal Science is the Lead, and Craig Allen, professor in the School of Natural Resources and Director of the Center for Resilience in Agricultural Working Landscapes (CRAWL), and Jerry Volesky, professor in the Department of Agronomy and Horticulture and interim director of the Center for Grassland Studies, are both facilitators.

The Hub has a renewed vision, and mission, and is working on a three-year action plan, including new branding.

To follow the latest activities of the NIBS Hub, visit beef.unl.edu.

"The advisory committee of NIBS, along with the NIBS Hub platform, create a co-learning environment that envisions the needs of the industry years down the road."

John Pollak

KEY TAKEAWAYS

1. The Nebraska Integrated Beef Systems (NIBS) Hub is integral in giving Nebraska beef producers the tools to adapt to industry stressors and maintain their position as an industry leader.
2. New technology and research discovered by NIBS hub members will allow beef producers to remain profitable and sustainable for many generations.
3. Nebraska Extension is an important part of the NIBS Hub as Extension educators deliver research findings to producers and facilitate evaluation in a live production setting.
4. The Feedlot Innovation Center and Ranch Innovation Center are working to make further advancements to improve beef cattle's adjustment to stressors.

To follow the latest activities of the NIBS Hub, visit beef.unl.edu.

IANR COMMUNITIES OF PRACTICE AND DISCOVERY

In 2011, six IANR communities of practice and discovery were formed as intentional focus areas of strength within IANR in an effort to propel Nebraska forward. The six communities include:

Computational Sciences – striving to efficiently and effectively analyze and report large sets of high-quality data in ways to be shared with the public.

Science Literacy – encouraging members of society to analyze complex challenges and make science-informed decisions in real-world situations.

Healthy Systems for Agricultural Production and Natural Resources – building on expertise in soil health, water resources, ecology, risk analysis, and plant and animal systems to help Nebraskans develop resilient agricultural production and natural resources systems.

Drivers of Economic Vitality for Nebraska – strengthening Nebraska's entrepreneurial approaches to stimulate economic development and increase the vitality of Nebraska's communities and the quality of life of its people.

Healthy Humans – establishing a research-based understanding to advance human health in relationships to healthy communities by conducting studies from basic biomedical research directed to understand disease, to nutritional foods and strategies that promote physical and mental well-being.

Stress Biology – improving production, health, and well-being for animal, plant, and human systems to better understand how organisms and systems adapt to stressors such as drought, insects, heat, and cold.

In recent years, Strategic Discussions for Nebraska (SDN) has rotated through the IANR communities as a publication theme as a way of highlighting these intentional IANR focus areas.

To date, SDN topics have included:

2017 – Computational Sciences

2018 – Science Literacy

2019 – Healthy Systems for Agricultural Production and Natural Resources

2020 – Drivers of Economic Vitality

2021 – Healthy Humans

Every year, the goal of SDN is to provide a snapshot of IANR research, teaching, and Extension efforts.

In 2022, SDN is rounding out the IANR communities by covering research and projects on *Stress Biology.*

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The ARD is the major research unit of the Institute of Agriculture and Natural Resources and is the Agricultural Experiment Station. [ard.unl.edu]

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BRIEF HISTORY OF THE LAND-GRANT MODEL OF PUBLIC EDUCATION

By Mary Garbacz

The University of Nebraska is one of more than 100 land-grant institutions in the United States and its territories. Although the University of Nebraska–Lincoln was the original campus of the University of Nebraska, the land-grant mission extends to all four campuses of the University of Nebraska system. The land-grant college system was established by the passage of the Morrill Act in 1862.

THE MORRILL ACT OF 1862

On July 2, 1862, President Abraham Lincoln signed into law a bill that donated land to each state for the establishment of colleges to provide a liberal and practical education to the "industrial class," or the common person. These colleges would provide instruction in agriculture, military tactics, the mechanic arts and classical studies. Because of the land granted to each state and territory, the Morrill Act of 1862 became known as the land-grant act.

Sponsored by U.S. Congressman Justin Smith Morrill of Vermont, the bill allotted 30,000 acres of public land for each sitting senator and representative in Congress to establish these colleges. Morrill could not have known the future impact this law would have in providing equal opportunity to education to people in the United States and its territories.

Today, there are more than 100 land-grant institutions in the United States and its territories, each focusing on teaching, research and outreach – taking new knowledge to the people.

The University of Nebraska was founded on February 15, 1869 and designated a land-grant institution under the 1862 Morrill Act. The land-grant system formed the framework for the land-grant institutions' missions of teaching, research and Extension.

HATCH ACT OF 1887

Twenty-five years after the Morrill Act was passed, the Hatch Act of 1887 provided funding for agricultural research programs at state land-grant agricultural experiment stations in the 50 states of the United States, the District of Columbia and the U.S. territories. The Hatch Act established agricultural experiment stations in connection with the land-grant colleges so research could be conducted and applied in practice.

Named for Congressman William Henry Hatch, the Hatch Act established not only experiment stations, but also distribution of information to the people of the United States on subjects connected with agriculture. The Hatch Act also provided an annual payment to each state and territory for the expenses of research, as well as for printing and distributing the results.

Hatch research activities involve a range of options related to agriculture, land use, natural resources, family, human nutrition, community development, forestry and more and can be local, state, regional or national in scope. A further requirement of the Hatch Act of 1887 is that new information is to be extended to the public.

THE MORRILL ACT OF 1890

The Morrill Act of 1890 also established funding for land-grant institutions specifically for African-Americans. These institutions are sometimes called "1890 schools." These 16 public institutions, plus one private institution, are among the more than 100 historically black colleges and universities in the United States. The Morrill Act of 1890 also forbade racial discrimination in admissions policies for institutions receiving these federal funds.

SMITH-LEVER ACT OF 1914

The Smith-Lever Act of 1914 created a Cooperative Extension Service within each land-grant institution. Cooperative Extension, a partnership between the U.S. Department of Agriculture and agricultural colleges, helps to extend information produced by the research of scientists within each college's experiment station.

EQUITY IN EDUCATIONAL LAND-GRANT STATUS ACT OF 1994

The Equity in Educational Land-Grant Status Act of 1994 provided land-grant status for certain American Indian colleges and institutions, bringing higher education to reservation communities. The act directed the U.S. Secretary of the Treasury to establish a 1994 Institutions Endowment Fund and the U.S. Secretary of Agriculture to make capacity-building grants to these institutions.

“Nebraska One Health educates people on connections between different types of health spheres and brings researchers and stakeholders together towards One Health issues that pose public health concerns. The outcome is to ultimately help people and help the environment.”

– Louise Lynch-O’Brien –

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