

SCIENCE LITERACY

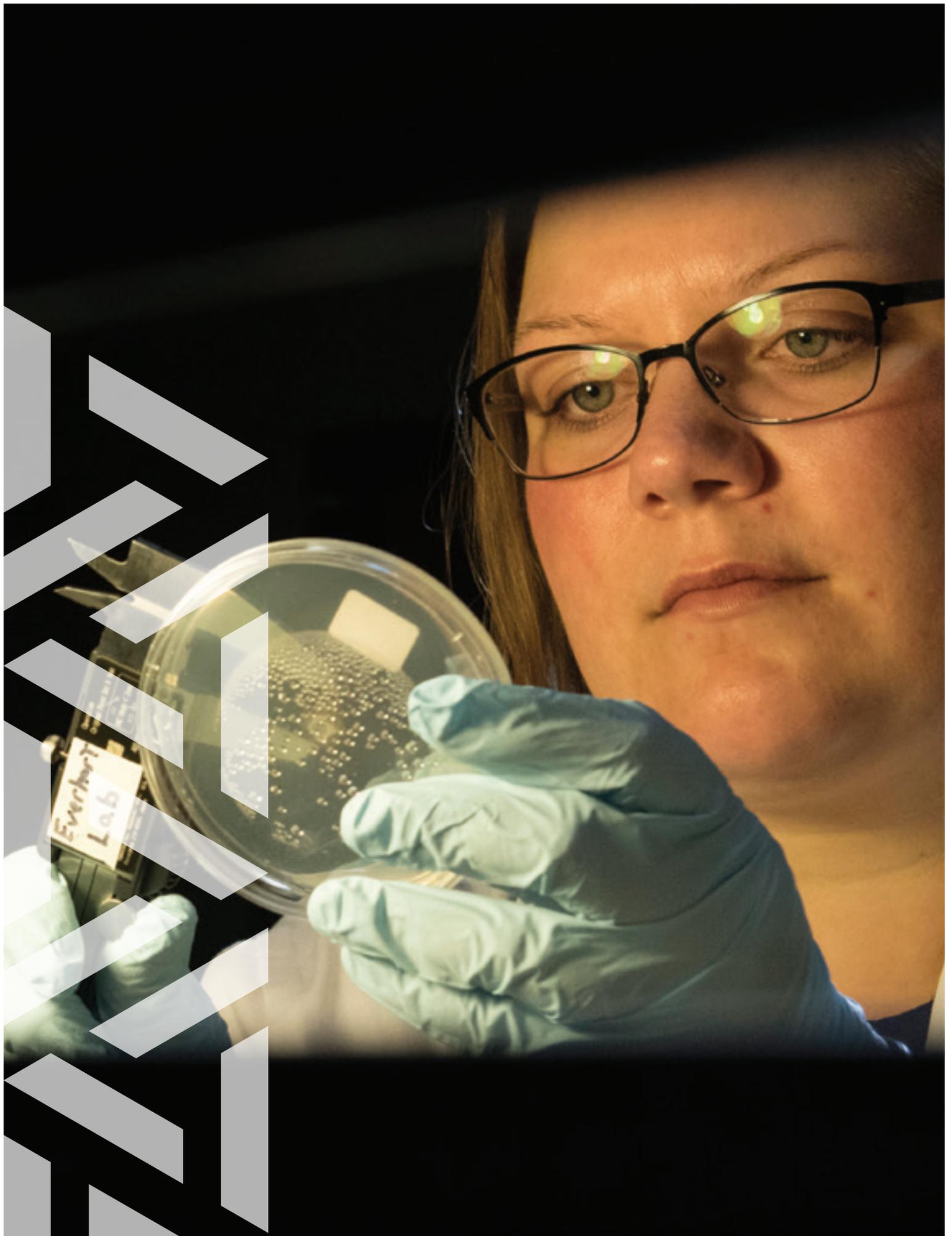
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STRATEGIC
DISCUSSIONS FOR
NEBRASKA 2018

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“Here in Nebraska, not only do we have the science, technology, engineering and math, but we have a natural laboratory to actually put our best science and technology to work and we have the resilient ingenuity of the Nebraska farmers, producers, and ranchers who are willing to work with academics to actually put ideas into practice.”

Michael Boehm

*University of Nebraska Vice President for Agriculture and Natural Resources
University of Nebraska-Lincoln Harlan Vice Chancellor,
Institute of Agriculture and Natural Resources*



THE MORRILL ACT OF 1862

Justin Smith Morrill,
Representative from Vermont, 35th Congress

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. ▲



HATCH ACT OF 1887

The Hatch Act of 1887 provides 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.

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. ▲



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. ▲



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. ▲



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. ▲



INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES

The University of Nebraska–Lincoln Institute of Agriculture and Natural Resources (IANR) is all about 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.

The Institute of Agriculture and Natural Resources 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 Sciences.

The Institute of Agriculture and Natural Resources is committed to growing the future of Nebraska’s people, businesses and communities. ▲



ABOUT STRATEGIC DISCUSSIONS FOR NEBRASKA

Strategic Discussions for Nebraska is part of the University of Nebraska–Lincoln Institute of Agriculture and Natural Resources (IANR). The IANR was created by the Nebraska Legislature in 1973 through the enactment of LB149.

The annual Strategic Discussions for Nebraska publication communicates research-based science so it can be understood by the general public.

A Strategic Discussions for Nebraska publication has been produced annually since 2008, each focusing on a different overall topic.

This year's publication has been produced by a team of university students in the spring semester of 2018 during the capstone course for their major in Agricultural and Environmental Sciences Communication, in the Department of Agricultural Leadership, Education and Communication. The course provides a learning experience similar to those they may encounter in the workplace, emphasizing the accurate, clear and objective communication of science-based information.

During the course, students learn about scientific research being conducted at the university and the diverse funding sources required to support that research. The students interview scientists from many disciplines and write stories based on those interviews.

The stories in this publication were reviewed by the sources and approved for publication.

Media specialists from IANR Media provided videography. University Communication provided photography, graphic design and website expertise. IANR provided funding, business and liaison services for the production of this publication.

As coordinator and editor of this publication, I express sincere appreciation for the original vision and financial support of the Robert and Ardis James Family Foundation, which founded Strategic Discussions for Nebraska in 2007.

Please visit our website, sdn.unl.edu, where you will find this complete publication. ▲

Thank you for your interest in our publication!

Mary Garbacz

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Science Literacy

at the University of Nebraska-Lincoln:

the right focus at the right time



“If you look through history, countries that have closed themselves failed in the end. We need to be part of a global community, learn about other cultures and appreciate our cultural differences to deal with the issues that are of importance, from the local to the global scale.”

Tala Awada



Michael Boehm

SCIENCE LITERACY AND THE NEXT GENERATION: Michael Boehm looks at the university's role in the world's grand challenges



Interview with Michael Boehm

By Shelby Cammack

As the next generation of leaders is entering the educational pipeline, it's important to have an emphasis on science, technology, engineering and mathematics (STEM) to solve the grand challenge of feeding 9 billion people by 2050.

"If we're not paying attention to STEM, we've got big problems," according to Michael Boehm, Vice President for Agriculture and Natural Resources at the University of Nebraska and Harlan Vice Chancellor for the Institute of Agriculture and Natural Resources (IANR) at the University of Nebraska-Lincoln.

"If you don't appreciate science, how can you ever be an advocate for it, how can you write policy and how can you pass laws?" Boehm said.

Science literacy is a key initiative of IANR.

OPPORTUNITIES

Boehm sees STEM careers as vital to the food production industry. He said 40 percent of Americans were involved with food production in

1990; in 2000, fewer than 2 percent were involved in food production. This equates to a 20-fold decrease in the number of Americans who were directly involved with food production. Yet, from post-World War II to the year 2000, technology and advances in science allowed food production to double, Boehm said.

Agriculture is much more broad than a cow and a plow; it includes biochemistry, biology, molecular genetics, food as a tool for health, study of the gut microbiome and how metabolites impact health outcomes and cognition.

"As we think about food production and the global food system, there are many opportunities to attract more people to work on the grand challenge of feeding the world," he said, and agriculture now includes these fields of study.

"Our work at IANR is focused on science. Agricultural literacy is critical to showcasing the range of opportunities to get involved, from genetics and genomics and precision agriculture, to nutrition and health outcomes," he explained.

“Another opportunity is to more actively engage more people from underrepresented groups into our food production system,” he said.

EDUCATION AND POVERTY

According to Boehm, access to educational opportunity and to healthy, safe, nutritious food and clean water shapes society.

“In America, if you can’t read by the third grade, you are four times less likely to graduate from high school. If you don’t graduate from high school, you’re 62 times more likely to be incarcerated,” he said.

“I think part of what we’re focused on here at the institute is producing nutritious, safe, affordable food with fewer inputs so that we maintain the resiliency of our ecosystems but we’re also seriously interested in breaking cycles of poverty and thinking about things like food waste,” Boehm said.

Worldwide, 1 billion people don’t get enough to eat and another billion don’t have the right mix of calories. That means two out every seven people on Earth today are struggling, and that leads to instability, he said.

EFFECTING CHANGE

Looking at the Nebraska state economy, much of what is produced in the state is exported around the world. Boehm describes Nebraska as a living laboratory, allowing the institute’s scientists to delve into the issue of food security, to develop best practices that transfer to other parts of the world.

The university provides the opportunity to address issues related to raising food, crops and animals, along with maintaining a resilient ecosystem. This ultimately leads to the vitality of individuals and the communities, he said.

WATER

“In the course of an hour, any hour you pick, there’s 200 people who will die every hour because they

don’t have access to fresh, potable water. And most of those are children. When you do the math, 200 people per hour, times 24 hours a day, times seven days a week, 365 days a year, we’re talking about a lot. Tens of millions of people, and most of those diseases are preventable but conflict and socio-economic issues get in the way,” he said.

Boehm’s education is in plant pathology; plant pathologists study plant diseases and the interaction between pathogens, the environment and plants, he explained. Through his work, Boehm has developed an appreciation for water security and access to safe fresh water.

“Water is going to be the thing that destabilizes or stabilizes the world. Here in Nebraska, not only do we have the science, technology, engineering and math, but we have a natural laboratory to actually put our best science and technology to work and we have the resilient ingenuity of the Nebraska farmers, producers, and ranchers who are willing to work with academics to actually put ideas into practice,” Boehm said.

Boehm said the nexus – the connection – of food, water and energy systems, along with Nebraska’s natural resources, is one of the strengths in the state. This systems-minded view describes the interdependence of these systems on each other in one landscape.

“I think if we just think about these three things colliding and use corn, and cattle, and ethanol, we have a pretty nice example of the food, water, energy nexus,” Boehm said.

“It also comes back to appreciating the full spectrum of what we have in America and bringing the ability of us to appreciate difference and have, through civil discourse, conversations about things that really matter. That’s why I think STEM and science literacy are important,” Boehm said. ▲



Mark Balschweid and Kathleen Lodl

WHAT IS SCIENCE LITERACY AND WHY IS IT IMPORTANT?

Institute of Agriculture and Natural Resources focus on science literacy opens the doors to the university



Interviews with Kathleen Lodl and Mark Balschweid

By Mary Garbacz

All eyes are on the future, when there is more and more information to consume, available through a voice-activated device or the click of a touch-sensitive button, with only the human brain determining whether that information is fact or fiction.

The people who will make those decisions already are taking over businesses and leadership positions, managing billions of dollars and charting the course for the future of the world. The University of Nebraska-Lincoln Institute of Agriculture and Natural Resources (IANR) has long been planning to be sure it has the science-based information to be successful so future challenges can be met, like feeding 9 billion people by 2050.

DEFINING SCIENCE LITERACY

Science literacy is knowledge of science, as well as the scientific framework by which people make decisions based on facts, research and knowledge, not on opinion or hearsay, according to Kathleen Lodl, associate dean of Nebraska Extension. Lodl, along with Mark Balschweid, head of the Department of Agricultural Leadership, Education

and Communication, provides leadership for the IANR Science Literacy priority area. They are charged with bringing together the best minds across the university to think about the future and engage outside partners in science literacy efforts.

The IANR Science Literacy Initiative includes a cross-disciplinary group of scientists focusing on four goals: improving science literacy among university students; preparing pre-kindergarten through high school students for careers; informing and engaging partners and stakeholders about programs and research; and supporting the public as they interpret, reason and make decisions.

“This is the kind of work for which we’re known and that people rely on for their land-grant university system to do,” Lodl said. The Science Literacy Initiative is bringing together all the academic disciplines and the three land-grant missions of teaching, research and outreach, she added. The system comes together with university researchers who are global experts; with outreach/Extension specialists; and with experts in formal teaching from pre-kindergarten through college, Lodl said.

WHAT'S INCLUDED?

Science literacy includes academic disciplines like agriculture; plant and animal production systems; natural resources; nutrition; physical, mental and emotional health; and early childhood education, among other topics. It all fits in with helping people make informed decisions, Lodl said, and the cross-disciplinary nature of the initiative is exciting.

“The public is starting to get a greater understanding of science. That’s one of the jobs of this initiative,” Lodl said. The IANR initiative intends to broaden public understanding.

The whole concept of “inquiry” includes why one holds certain beliefs, she said.

“Getting the facts and being able to discern fact from opinion or myth, and then using those facts to make a decision – that’s really what science literacy is about,” she explained.

The six IANR priority areas were created through stakeholder input, Balschweid said, taking into account the research strengths in the IANR. Those priority areas are:

- Science Literacy
- Stress Biology
- Healthy Humans
- Healthy Systems for Agricultural Production and Natural Resources
- Computational Sciences
- Drivers of Economic Vitality for Nebraska

Balschweid said the IANR takes every opportunity to “throw open the doors of the university and invite the general public in by communicating the science that’s happening here.” He cited Streaming Science, a college student-driven, project-based science literacy program that introduces public audiences to real-world scientists and critical agricultural and environmental research through interactive communication platforms.

WHY SCIENCE LITERACY?

“It is becoming increasingly difficult to discern between what is fake and what is real, so we need to communicate the science in ways the public can understand and have that information be timely and relevant to the decisions they have to make,” Balschweid said.

A recent survey conducted by Oklahoma State University, for example, revealed that half of the respondents want food labels to indicate if DNA is in the food. The concern, Balschweid pointed out, is that all living things have DNA, so food prepared from plants or animals will contain DNA.

Science literacy is critical to the public, Lodl said. Scientific knowledge helps people to be better-informed and make the best decisions possible with the best available knowledge. In the long run, she added, great decisions are based on reliable, factual research.

The IANR focus on science literacy begins with pre-kindergarten and extends to people of all ages.

“Nebraska places a high value on education and reasoning and thinking,” she said. “We believe we are one of the first institutions in the country that is looking at science literacy so holistically,” she added.

Lodl said scientific inquiry education reaches into formal school systems, into stakeholder groups, into Extension and 4-H and into other youth-serving organizations. Activities are designed to teach decision-making and inquiry, how information is gathered and how one makes the best possible decisions with the information available. Young people may learn about science through growing a soybean or through wearable technologies or robotics – anything to interest them in the scientific process, she said.

“Young people are a big target population; we want to instill science literacy at a young age. If we start with youth, it becomes ingrained and part of their lives,” she explained. That is important, she said, because future careers need a background

in scientific engagement. “We need to create that pipeline of new workers that is going to fill the needs of the state and help our state’s economy down the road,” she added.

EVERYONE CAN HELP

“All of us who work in the Institute of Agriculture and Natural Resources continually tell people about the good things that are being done,” Balschweid said.

He recently had that opportunity when he found himself on a plane, seated next to a man who said he had heard that Nebraska farms were all owned by “soul-less” corporations.

“I was able to share with him that simply isn’t the case, and that farms in Nebraska are mostly family farms that have been in the family for generations,” he said. “I also told him the people who farm the land and steward the environment would never want to engage in activities that would degrade the land, animals or environment. Yes, we want to maximize the efficiency of the resources, but never to the point that we would not be able to be sustainable for generations to come.” ▲



Tiffany Heng-Moss

SOLVING CHALLENGES ONE PARTNERSHIP AT A TIME: international programs focus on education, leadership



Interview with Tiffany Heng-Moss

By Katherine Mundorf

Solving grand challenges, like a growing world population, requires the combined efforts of great minds from different backgrounds, according to Tiffany Heng-Moss, interim dean of the College of Agricultural Sciences and Natural Resources at the University of Nebraska–Lincoln.

Global partnerships, including interactions with international students, benefit everyone when it comes to solving these problems. “We have been very fortunate to have two more recent programs that we’ve been able to partner with our global institutions from other parts of the world,” Heng-Moss said.

CHINA 3+1 PROGRAM

The “3+1” program partners with Northwest Agriculture and Forestry University (NWAUFU) in Shaanxi Province in China. This is the second-largest agricultural university in China, Heng-Moss said. This program is a partnership with the University of Nebraska–Lincoln Department of Food Science and Technology. Students spend the first three years in the 3+1 program at their home institution, whether that is in China or at the University of Nebraska–Lincoln.

“The cohorts from China come to Lincoln for their fourth year and at the end they earn two degrees,” Heng-Moss said; one from Northwest Agriculture and Forestry University and one from the College of Agricultural Sciences and Natural Resources (CASNR) from the University of Nebraska–Lincoln.

The university’s Department of Food Science and Technology is located in the Food Innovation Center on Nebraska Innovation Campus. The Food Innovation Center, which opened in 2015, provides world-class facilities, including wet and dry lab research space, food grade and non-food grade pilot plant space and a state-of-the-art distance education classroom.

Northwest Agriculture and Forestry University program faculty follow the same program of study as the University of Nebraska–Lincoln Food Science and Technology. During the first two years, the NWAUFU students are taught in English by NWAUFU faculty. In the third year, University of Nebraska–Lincoln faculty travel to China to teach the participating students. In the fourth year, the NWAUFU students come to Lincoln to complete their degrees.

“Our goal with this program would be that we start very early on in the integration with our two student cohorts,” Heng-Moss said. By having students collaborating on projects, although in different parts of the world, these students will be ready and willing to work with each other when they finally meet in person during that fourth year. “The goal is to leverage the unique perspectives and experiences of our students to arrive with a better outcome than any one of us would be able to achieve alone,” she said. The first cohort of this program arrived on the Lincoln campus in the fall of 2018.

RWANDA CUSP PROGRAM

The CASNR Undergraduate Scholar Program (CUSP) is a partnership with Rwanda that allows 50 students a year to come to the University of Nebraska-Lincoln to study in CASNR for four years to earn a Bachelor of Science degree in Integrated Science. The integrated science degree program has three focus areas: conservation agriculture; leadership and entrepreneurship; and agriculture and natural resources, based on the student’s choice of concentration.

Participants are selected based on academic performance and commitment to the goals of the program, Heng-Moss said. Students can explore areas such as animal and plant systems, food production and processing, energy and environmental stewardship, agribusiness and economics, communication, mechanization and irrigation, pest management, Extension education, water systems, to name just a few, she said. Students participating in the CUSP program will return to Rwanda and commit at least five years of their careers to advancing the Rwanda agricultural sector.

“They are the integrated scientists of the future,” Heng-Moss said.

Each student has a mentor in Rwanda who connects with the student virtually to guide her or his professional development. The students return to Rwanda during the summer of their third year in the program to complete an internship before returning to the university to complete their fourth year.

For more information about the 3+1 program, visit <https://foodsci.unl.edu/31-program-study>.

For more information about the CUSP program, visit <https://cusp.unl.edu/>. ▲



Charles Hibberd (second from left)

NEBRASKA EXTENSION GOES GLOBAL: China partnership focusing on sustainable, productive farming



Interview with Charles Hibberd

By Katherine Mundorf

Nebraska Extension has a goal of making agricultural practices more efficient in countries around the world so even more safe food is available for a growing population.

The Nebraska (Yangling) Sci-Tech Park is a demonstration farm in China in a partnership to improve agricultural practices. The farm is 164 acres and is located west of Xi'an in Shaanxi Province, which is Nebraska's sister province.

According to Dean and Director of Nebraska Extension Charles Hibberd, the University of Nebraska-Lincoln and Nebraska Extension have the responsibility to "discover the ways of producing food that are economically sustainable, environmentally sensitive and that help agricultural families be successful in achieving their goals and dreams."

THE NEBRASKA (YANGLING) SCI-TECH PARK

In 2016, Nebraska Governor Pete Ricketts signed an agreement in Yangling, China with the local government to start the demonstration farm, then

broke ground on the farm. The partnership includes Chinese farmers and officials; Northwest Agriculture and Forestry University; Yangling Demonstration Zone; Datang Seed Company; Nebraska Extension; Nebraska Department of Economic Development; and Nebraska equipment manufacturers.

"The purpose was really to create an opportunity to market Nebraska agricultural equipment," like center pivots and grain bins, Hibberd explained. The park officially opened at the Yangling High Tech Agricultural Fair, a yearly exhibition of agricultural practices in the Agricultural Hi-tech Industries Demonstration Zone (AHIDZ) in Shaanxi, in November 2017. AHIDZ has provided most of the funding for the project to bring the new technology into the country, which is the purpose of this demonstration zone in this high agricultural area.

"They have been successful over the years bringing in a dairy, bringing in a tulip farm, just different agricultural operations that create opportunities for local farmers," Hibberd said.

DETAILS

This is a five-year project, Hibberd said; it started in 2017 and will continue until 2022. The first three years build the project and the last two years add technology and learning.

“We intend to bring a no-till farming approach to this demonstration farm, which we believe is important in this environment. There are other technologies we want to promote and encourage over time,” Hibberd said. The farm is to grow corn and wheat, with additional crops in the future, he said, such as potatoes, squash and other horticultural crops. When the crops are harvested, the Chinese partners will find markets for them.

The Chinese partners bring not only funding to the project, but also vision and identification of outcomes for the project, Hibberd said. Nebraska Extension funds costs of Extension professionals travel to China; it also brings expertise and connections to agricultural equipment manufacturers. Extension specialists measure success on the farm through the training Chinese farmers are provided on Nebraska-produced irrigation systems and grain bins. There also is training on no-till farming, preparation of seed beds, scouting for and treating pests and efficient harvesting.

Seventy percent of the Chinese population is involved in agriculture, Hibberd said, and the skills that are taught on the demonstration farm will help all of the country’s farms become more efficient as the global population increases and requires more high-quality food.

Nebraska Extension at the University of Nebraska-Lincoln has a planning team of 20 professionals

led by Assistant Extension Educator Brian Krienke, a soil fertility Extension educator. The team meets regularly to assess satellite information, videos recorded at the farm and sensor-relayed data from the demonstration farm and discuss recommendations they will send to the Chinese farmers to achieve higher yields for their crops. As of the summer of 2018, the first wheat crop was harvested on the demonstration farm.

PARTNERSHIPS

The demonstration farm allows Nebraska-based companies to provide their expertise about agricultural practices and equipment and to learn how agricultural practices in China differ from practices in Nebraska. All equipment that has been provided to the Chinese farmers has been on a loan basis. Extension educators travel to China to help train and educate the farmers during critical crop production times, Hibberd said.

The Nebraska Department of Economic Development also provided support in the launch of the demonstration farm, Hibberd said, by working with Extension and with Nebraska’s manufacturing partners. In addition, DED jointly funded an agronomy intern to work on the farm during the summer of 2018, strengthening the capacity for technology adoption. This will be a huge assist for the effort and a great experience in Chinese culture and farming practice for the intern, Hibberd said.

The farm also allows local schools, including Northwest Agriculture and Forestry University in Yangling, to use the equipment as a teaching opportunity for their faculty and undergraduate and graduate students.

THOUGHTS ABOUT GLOBAL RESPONSIBILITY

By Charles Hibberd, Dean and Director, Nebraska Extension

When I think about global, I really think about all of the opportunities that we have to work with other countries that are trying to feed their people in an environmental and sustainable way and use technologies that are both effective and economically feasible. And when you think about global that way, from an ag perspective, the world is really wide open. I spent 13 years in Scottsbluff at the University of Nebraska Panhandle Research and Extension Center, and one of the projects we were involved in there was a partnership with Bamyán University in Bamyán Province, Afghanistan. And, we sent our folks there; they sent their university professors to Scottsbluff. That was shortly after 9/11, and so it was a really important time for us to be involved with a partner, with a country that was trying to dig itself out of a really bad situation and knew that food and food production was a really important part of the solution to the situation they found themselves in. So the experiences that I've had working in global settings have really helped me understand the need and the opportunity that we have to be a part of the solution relative to that need.

RESPONSIBILITIES OF THE UNIVERSITY

I think our first responsibility as a university and frankly, as Extension, is to come up with, to discover, the ways of producing food that are economically sustainable, environmentally sensitive and ways that help agricultural families be successful in achieving their goals and their dreams. We do this in the context of Nebraska, this amazing agricultural state

that provides so many natural resources for us, like the Ogallala aquifer. We work hard to make irrigation sustainable in this state. We are pretty close to doing that right now in a state that is dependent on irrigation for much of our farm production. We work hard to keep the Nebraska Sandhills intact – that amazing grasslands ecosystem that we have that we want to protect and take care of and not return to a sand dune that it was originally.

We think about that first and foremost in the context of Nebraska, but we also know – this is for me one of the really compelling reasons to be involved in global work – is that the Arab Spring that occurred in the Mediterranean several years ago was certainly fueled by political unrest but it was also fueled by a lack of food. Inadequate food. And when people are hungry, they make decisions they would not make if they were well-fed and well taken care of and they know their children have access to nutritious, wholesome food.

If we want a global society that is less engaged in terrorism, that is less engaged in war, is less engaged in dealing with famine and people dying of starvation and things like that, food is one of the main ingredients to that solution. And we can contribute to that. I think the University of Nebraska and certainly, Nebraska Extension, has an obligation to be part of that solution for our planet. We have the technical know-how. For us to not share that and to not help people become more effective food producers, I think, is frankly unconscionable. ▲



Tala Awada

LOCAL ACTION, GLOBAL IMPACT: Agricultural Research Division scientists work to solve the world's challenges



Interview with Tala Awada

By Emily Frenzen

Imagine a triple-digit-degree summer day or a raw winter storm. Today, luxuries such as air conditioning or heating combat nature's extremes. Unlike human beings, plants are uniquely exposed to all types of weather without an escape from harsh extremes.

Tala Awada's interest in science sparked from her fascination of plants' ability to withstand many environmental stresses.

Awada has been curious about how things work since she was a little girl. At the age of 10, she disassembled her watch and put it back together because she was intrigued by the working parts. This curiosity is what led her to become a faculty member in the University of Nebraska-Lincoln Institute of Agriculture and Natural Resources and eventually, associate dean of research in the Agricultural Research Division (ARD).

The Agricultural Research Division serves the University of Nebraska, as well as the state, by addressing critical issues in the areas of agriculture and natural resources through innovative research that ignites a global difference.

WHY NEBRASKA?

Research in the Agricultural Research Division addresses important current and emerging issues in the areas of food security, human health, science literacy, natural resources, climate variability and economic vitality, Awada said. Since agriculture is Nebraska's leading industry, the ARD is a vital component of the university. Awada serves on a team that supports faculty research, promotes innovation in agriculture and natural resource sciences and advances the ARD mission to meet its strategic goal that focuses on resilient food production systems that support a growing global population.

It's critical work and it requires resources.

The investment in science research at the university is more than the substantial work that goes on in laboratories or in the fields. Education, outreach and Extension efforts across the state are critical for the continuation of sustainability of the agricultural system and for the vitality of rural and urban communities, Awada said.

WHY GLOBAL?

“I think it’s very important to be a global citizen, to develop shared values around issues related to our well-being. In the process, we create a better appreciation of one another and what makes each person and culture unique,” Awada said. “If you look through history, countries that have closed themselves failed in the end. We need to be part of a global community, learn about other cultures and appreciate our cultural differences to deal with the issues that are of importance, from the local to the global scale,” she added.

Research drives innovation for the university’s Agricultural Research Division scientists, who work around the world toward solving these local and global problems. Scientists cannot create sustainable food systems in Africa from an office desk across the globe.

“What we create may work here, but might not work there. We won’t know unless we are on the ground understanding where they’re coming from, their culture and their available resources,” Awada said.

The ARD works to improve the global education of students through research, education, exchange programs and recruitment of national and international students.

“The objective is to build better global citizens. We do not live in a vacuum,” she said. If researchers are going to solve issues of importance from a local to global scale, collaboration is one of the most valuable tools in the toolbox. “We act local, but we are part of a global community,” Awada said.

Nebraska’s role as a primary beef exporter is a prime example of acting local and global, she said.

The scope of this industry goes far beyond the Nebraska cattle rancher.

“Our current research on the resilience of the beef system not only addresses local production, but also addresses the predicted increase in demand for food supply, quality and quantity under dwindling natural resources, and climate variability and change,” she said. “That has global implications.”

WHY SCIENCE LITERACY?

“We are all curious; there’s never a dull moment in science,” Awada said.

Her definition of science literacy, as a teacher and researcher, means educating students in a way that transforms their behavior, strengthens their critical thinking and helps them make better decisions in their daily lives. Taking that definition further, she said communicating science to the public helps people to make better decisions and helps them to separate facts from opinions, helps lead or drive policy and change in the community for the betterment of all human beings and the environment around them.

Researchers have added responsibilities related to communicating science; they conduct relevant research and write their findings in journal articles that are shared with their peers; they attend conferences; they teach seminars.

“The idea is to share your results with larger communities to have a larger impact,” she explained.

Science literacy is the driving force behind the implementation of policies for the betterment of human beings and their environment.

MISSION

The Agricultural Research Division (ARD) is the only public entity in Nebraska charged with conducting agricultural research. It is part of a national network of state agricultural experiment stations at Land Grant Universities across the United States. The ARD’s mission is to conduct problem-solving and fundamental research that:

- Addresses priority issues facing Nebraska’s agriculture and food industries.

- Provides the knowledge base essential for managing our natural resources.
- Promotes family well-being and community development.
- Educates future scientists through hands-on experience. ▲



The Impact of Science

*sharing knowledge that
affects lives and landscapes*



“Every morning when someone wakes up, they should be able to say, ‘I have clean water to drink and food to eat.’ That shouldn’t be something that anyone must question.”

Tiffany Messer



Dirac Twidwell

QUESTIONING THE CULTURE OF PLANTING AN INVASIVE TREE: loss of grassland is at stake in Nebraska Sandhills



Interview with Dirac Twidwell

By Riley Nichols

The Eastern redcedar can be seen everywhere across Nebraska, especially in the Nebraska Sandhills. Many travelers drive past without knowing that this species of tree poses one of the biggest threats to the Nebraska Sandhills.

According to Dirac Twidwell, assistant professor of rangeland ecology at the University of Nebraska-Lincoln, the Eastern redcedar is causing a broad-scale loss of grasslands in Nebraska. The Eastern redcedar has destroyed grasslands in some southern states, and it's happening currently in Nebraska.

"Nebraska now represents the current battlefield for Eastern redcedar," Twidwell said.

HISTORY

The invasive Eastern redcedar is a native tree in Nebraska. It's a historically rare species in the state, but after vigorous planting of the tree for the past century, it has become widely invasive. For the last 90 years, Nebraskans have planted hundreds of thousands of Eastern redcedar trees each year.

Scientists have been studying the consequences of Eastern redcedar invasion and its social and ecological impacts since the 1940s, Twidwell said. Studies started with impacts on soil and nutrient cycling and have slowly shifted to impacts on wildlife and livestock production. Scientists discovered that the Eastern redcedar poses one of the greatest risks to the sustainability of grasslands.

Most of the Nebraska Sandhills is productive grazing land for the millions of cattle Nebraska raises each year. The further invasion of Eastern redcedar would cause a critical decrease in available grazing land for those cattle. According to Twidwell, there is a 75 percent loss in livestock profitability when grasslands are converted into cedar woodlands.

"I can't identify another invasive species that comes into grasslands that has this big of an impact, yet we still widely distribute new seed sources into environments where cedar is rare. We do not follow this logic for other invasive species," Twidwell said.

That culture of tree planting in Nebraska worked when the state was being established, but this particular tree spreads from tree plantings. “People didn’t expect them to spread and invade because they were so difficult to get established initially,” he said.

Globally, grasslands are the least protected of the seven main ecological areas on Earth, called biomes, according to Twidwell. Grasslands have lost the greatest proportion of land compared with other biomes. The Nebraska Sandhills is one of the largest remaining grasslands in North America. That may soon change with the Eastern redcedar taking over.

“If we want to conserve the Sandhills, we know we have to change,” Twidwell said. “It is very difficult to find expansive grasslands anymore. The uniqueness of the Sandhills is so valuable, and we want to be sure Nebraskans are aware of the key risks posed by Eastern redcedar,” he added.

SCHOOL TRUST LANDS

Starting in 1803, funding for public education in the United States was established through land grants from the U.S. Congress, under the leadership of President Thomas Jefferson. Each state received this land grant upon its entry into statehood. Upon its entry into statehood in 1867, Nebraska received nearly 3 million acres of land through the Enabling Act, signed in 1867 by President Abraham Lincoln. The land could be sold or leased to provide revenue for the public schools. The Nebraska Board of Educational Lands and Funds oversees the School Trust Lands and is Nebraska’s largest private landowner. The School Trust Lands are located throughout Nebraska; much of the land is rangeland used for cattle production. The revenue generated from these properties goes to public schools across the state.

However, the rangeland now is affected by the invasive Eastern redcedar. Since 2010, the Nebraska Board of Educational Lands and Funds has had to spend an additional \$250,000 per year to control the invasion of the trees, Twidwell said. The increase of control costs takes away money from all of the public schools in the state, not just in the Nebraska Sandhills.

“No one would expect a tree that invades to affect public education,” Twidwell said, but because of the Eastern redcedar, and the 75 percent loss of grazing revenue following conversion of grasslands to cedar woodlands, land meant to produce support dollars for public schools is at risk. Since 2000, Nebraska’s School Trust Lands generated nearly \$600 million. “Take 75 percent off of that, and that’s your total potential risk,” Twidwell said.

CREATING CONVERSATIONS

Twidwell and his team at the university have been working with multiple groups across the state to get the word out about the Eastern redcedar. They received a five-year, \$3 million National Science Foundation grant to continue their research, more than a million dollars from Nebraska Game and Parks Commission, as well as funding from USDA National Working Lands for Wildlife program. According to Twidwell, there are multiple partnerships between landowners and agencies across Nebraska, including the Nebraska Environmental Trust, Nebraska Game and Parks and the Sandhills Task Force.

“I can’t think of a public state agency that does not have this on their radar right now,” Twidwell said.

From these partnerships, the Eastern Redcedar Science Literacy Project was developed as an Extension resource. It’s an online, comprehensive resource that details all of the research on the Eastern redcedar: <https://agronomy.unl.edu/eastern-redcedar-science-literacy-project>.

CHANGING CULTURE

Through his research, Twidwell discovered that one issue surrounding the Eastern redcedar invasion is the lack of prevention efforts and how this is tied to Nebraska’s culture of tree planting. Since the Great Plains was settled, the planting of trees in grasslands has been a common and well-accepted practice. This is an example of a social-ecological trap, according to Twidwell. Nebraskans are caught in a trap in which tree planting is a generational and cultural identity, but without recognition that the planting of certain species in certain locations is contributing to the loss or resilience of key natural resources in the state.

SOLUTIONS

The real solution, according to Twidwell, is to increase Nebraskans' awareness of the Eastern redcedar invasion across the state and to move towards prevention.

"It's going to be a challenge for Nebraskans, but there are a lot of conversations in rural areas to really meet that challenge," Twidwell said.

A change in culture also will be a hurdle. Nebraska has a history of promoting the Eastern redcedar,

and the state as a whole must change for the betterment of Nebraska's wildlife, beef industry and the public school system.

To learn more about the Eastern Redcedar Science Literacy Project, visit <https://agronomy.unl.edu/eastern-redcedar-science-literacy-project> or email Twidwell at dirac.twidwell@unl.edu for more information. ▲



Nicholas Brozović

STUDYING WATER FOR FOOD: 'There's no place like Nebraska'



Interview with Nicholas Brozović

By Mary Garbacz

Nebraska has more irrigated acres of cropland than any state in the United States; even more than most other countries. As a result, Nebraska has a long history of water use and of designing systems to manage agricultural and other water uses for current and future generations. People from around the world come to Nebraska to learn about its Natural Resources Districts (NRDs), water research at the University of Nebraska and the agriculture - and irrigation - that are the strengths of the state's economy.

Nicholas Brozović is director of policy at the Robert B. Daugherty Water for Food Global Institute (DWFI) at the University of Nebraska and a professor of agricultural economics at the University of Nebraska-Lincoln.

Brozović studies water use in agriculture, including the economics of water use, how agricultural producers make decisions and the design and impact of water policies. He works with decision-

makers at local, state and national levels, but also meets one-on-one with producers around the world to learn how policies affect their operations.

"We focus on agricultural water management and how we can use water efficiently and profitably while maintaining environmental and public health," he explained. DWFI faculty, such as Brozović, work with local, national and international partners that bring a spectrum of perspectives to each project.

FOUNDING AND MISSION

The University of Nebraska founded DWFI in 2010 with a gift from the Robert B. Daugherty Foundation. Bob Daugherty started Valley Manufacturing in Valley, Nebraska, in the 1950s and made and distributed the center pivot, which was a revolutionary system for agricultural irrigation. The company later changed its name to Valmont Industries, and today is one of the largest irrigation companies in the world.

DWFI's mission is to increase food security with less pressure on scarce water resources by improving the use of water in agricultural and food systems.

"We work with many different types of people, from smallholder producers in places like India and sub-Saharan Africa, to large producers in places like western Nebraska, trying to learn something from everyone," Brozović said.

And in turn, people come to Nebraska, from everywhere, to learn.

NRDS AND GLOBAL WORK

Nebraska's NRD system was established in 1972 and is unique in the United States, Brozović said. District boundaries are based on river basins and the NRDs are tasked with managing a range of natural resources. Each of Nebraska's 23 NRDs has different issues related to climate, land and resources, so every district has developed its own programs and priorities.

NRDs attract visitors from around the world who are interested in learning to manage groundwater in agricultural settings, Brozović said. For example, a group from the World Bank visited Nebraska in 2017 and included 11 senior managers from Africa, the Middle East, South Asia and East Asia. During their weeklong tour, the group visited NRDs, equipment manufacturers and dealers, farmers and agronomists, with the goal of sharing knowledge and creating systems in their own countries that improve groundwater governance.

Brozović said the World Bank managers were interested in how the districts were structured, with technical staff and locally elected boards of directors. "They were interested in how the districts interact, how they deal with compliance issues, how they are funded and how decision-making works," he added.

"The World Bank tour group heard again and again that it takes time; it takes decades. You have to build trust very carefully to have a functional system," Brozović said.

One important way to build trust in a management system is through the careful use of technology.

Agricultural water users in Nebraska use a wide range of technology to determine and meet a crop's water needs, from satellites and drones to soil moisture probes and variable-rate irrigation systems. Many of the NRDs have programs to help their producers try new technologies and practices that can conserve resources and increase profits. Importantly, according to Brozović, the usefulness of technology often is not about providing enormous amounts of data. Its real value is to help provide information that can be used not just for day-to-day operations, but also to build longer-term understanding about what decisions might mean over years or decades. When used well, technology can lead to insightful conversations between farmers, and between farmers and others. The importance of those one-on-one conversations sometimes is a surprise to international visitors, Brozović said.

"Often, the reason systems work is due to the human aspect and not the technology on the ground," he said.

Brozović hopes that managers who visit Nebraska will return home and implement lessons they learned to improve groundwater governance in their countries.

"I think we've helped to really put Nebraska firmly on the international water map and now, people regularly talk about what is happening here as a place to look toward for lessons for how you manage water use in agriculture," he said.

HIGH PLAINS AQUIFER

Brozović said visitors often ask questions about the Ogallala Aquifer, which is part of the High Plains Aquifer. The deepest and widest part of the aquifer is under Nebraska.

"It is a common misconception that the High Plains Aquifer is rapidly depleting everywhere, but in Nebraska, that is just not true," he said. "For the most part, it is very stable." In Nebraska, a significant part of that stability is due to the NRD system and its long-term vision for water use, he explained, along with the favorable geography of the Sandhills, which supports refilling of the aquifer.

SCIENCE LITERACY

DWFI has Faculty Fellows across all four campuses of the University of Nebraska system, including all colleges and disciplines. As an agricultural economist, Brozović works with environmental engineers, biological systems engineers, law professors, journalists and faculty in the university's School of Natural Resources, among others - and he shares interdisciplinary resources with students in the courses he teaches.

Besides agricultural economics courses, he co-teaches a freshman-level science literacy course called "Water in Society."

"The course covers all things water and how it has affected people throughout human history," he said.

Brozović and the other course instructors - Cory Forbes, associate professor of science education and Trenton Franz, associate professor in the School of Natural Resources and a hydrogeophysicist - take students through hydrology, water law and policy, stormwater management ... even the Nile river irrigation civilization.

"Working in water is a great area; there is a huge demand for people who like to work in teams to solve socially important problems," Brozović said. "I encourage people to look into careers in the water industry."

For more information on DWFI, go to waterforfood.nebraska.edu. ▲



Lindsay Hastings (center) with graduate students Kate McCain (left) and Hannah Sunderman

THE RIPPLE EFFECT OF GENERATIVE LEADERSHIP: how the transfer of leadership and wealth will affect Nebraska



Interview with Lindsay Hastings

By Alexandria Lundvall

The United States is poised to experience one of its largest transfers of leadership in its history, as evidenced by 56 percent of management occupations currently being held by individuals age 45 and older.

Simultaneously, Nebraska will experience a large transfer of wealth.

Lindsay Hastings is the Clifton Professor of Mentoring Research in the Department of Agricultural Leadership, Education and Communication and serves as the director of Nebraska Human Resources Institute (NHRI) at the University of Nebraska-Lincoln. NHRI is a strengths-based leadership mentoring program founded at the university. Hastings' most recent research focuses on generative leadership.

"Because we will transfer over half of our management occupations in the next 20 years, it's likely that young adults are going to be taking on significant leadership roles earlier in their careers where socially responsible leadership will be demanded of them," Hastings explained.

"Not only will we transfer 56 percent of all management occupations, we will also transfer \$75 trillion from older to younger generations between now and 2060, so this leadership transfer will happen simultaneously with this wealth transfer," she added.

GENERATIVE LEADERSHIP

When people hear the word "science," laboratories, chemicals and equations are probably just a few of the things that instantly come to mind. But what about leadership?

"So often we don't think about leadership as a science, but it's a social science," Hastings explained.

"Generativity is the care and concern one has for establishing and guiding the next generation. Generative leadership is leadership that aims to establish and guide the next generation," she said. This research has shown its importance as the United States approaches a large shift in the workplace.

The goal is to develop generativity and therefore, social responsibility earlier in the young leaders' careers. This will make the transition easier as well as prepare them for the future. Hastings hopes to prepare young leaders to contribute to the transfer of leadership, and not just consume the transfer of wealth.

"Frankly, especially with rural Nebraska communities, the sustainability efforts that have gone on in those rural communities will be dependent upon effective transitions of leadership. This transfer of leadership will remarkably impact those sustainability efforts, bringing either vitality or destruction," Hastings said.

The goal of Hastings' research is to identify effective leadership, but more importantly, when effective transfers of leadership take place.

"Companies, communities and organizations that can be deliberate about effective transfers of leadership will likely see success in being able to weather that transition," Hastings said.

Nebraska depends on the transfer of leadership to go smoothly and that both the wealth and leadership stay in Nebraska, and not move elsewhere. ▲





Dipti Dev (left) with collaborators Santosh Pitla and Ashu Guru

CHANGING CHILDHOOD EATING BEHAVIORS: education, technology combine to help parents and kids



Interview with Dipti Dev

By Alexandria Lundvall

More than 75 percent of young children are cared for in child care or other non-parental settings. Research shows that early childhood is a formative development period for impacting children's eating habits and setting them on a path of a lifetime of good health. Focusing on early childhood behaviors is critical in Nebraska, because the state ranks fourth in the United States in childhood obesity.

"They carry forward these healthy behaviors in adolescence and adulthood. Early childhood is a time when we can really make an impact to prevent obesity," according to Dipti Dev, who is Betti and Richard Robinson Professor of Early Childhood in Extension at the University of Nebraska-Lincoln. Her research focuses on improving feeding practices for children in child care settings. Dev earned her Ph.D. at the University of Illinois at Urbana-Champaign in Nutritional Sciences, with her focus on improving the healthy eating behaviors of young children.

"If we are able to improve children's dietary intake and physical activity behaviors in early childhood, we can prevent obesity in adulthood," Dev said.

EAT FAMILY STYLE DINING

Children in child care settings may eat most of their meals there, Dev said, so helping children, child care providers and parents understand the basics of healthy eating will benefit the child into adulthood.

Dev has developed an online curriculum for child care providers called "Ecological Approach To (EAT) Family Style Dining." The EAT Family Style Dining curriculum includes seven lessons for child care providers. Each lesson includes short videos, pictures, practical strategies and examples of various situations related to improving childhood eating behaviors. The seven lessons are: Role Modeling; Peer Modeling; Sensory Exploration; Supporting Children's Self-Regulation; Children Serving Themselves; Using Praise and Rewards Effectively; and Family Engagement.

Dev said the EAT Family Style Dining program translates her research into engaging videos that resonate with participants.

'SMART PLATE'

What if a plate could measure a child's food intake in a child care setting? Dev collaborated with Santosh Pitla, assistant professor in the university's Department of Biological Systems Engineering, and Ashu Guru, assistant professor of 4-H Youth Development, who has additional expertise in computer science in Extension to develop such a plate.

Dev explained to Pitla the difficulty she was having measuring each child's food intake. He suggested they automate the process and put sensors on a plate. Dev obtained \$40,000 in grant funding; together they gathered an interdisciplinary team of researchers to work on the plate.

Since the fall of 2016, Dev, Pitla and Guru have mentored students at the university's Raikes School of Computer Science and Management to develop a plate that accurately weighs the portions of the food consumed. The prototype of the plate was launched in the summer of 2018.

IMPACT, ACCEPTANCE

Currently, Dev works with a team of undergraduate and graduate students to collect data that measure the impact of the research, Dev said. The team measures food acceptance and consumption.

"Vegetable consumption is a big issue for children. Specifically, eating fewer vegetables has been linked to obesity. Yet, 9 in 10 children don't eat the minimum recommended amount of vegetables (1.5 cups/day) and most of the vegetables eaten are fried potatoes. Therefore, improving children's vegetable consumption is critical to improving dietary quality and preventing obesity," Dev said.

"Professional development curriculum for child care providers, such as EAT Family Style Dining, targets children's vegetable preference and consumption. We show children pictures of different fruits and vegetables and ask about their knowledge, familiarity and whether they think 'yummy, yucky or just okay,'" she added. Then, after the child care setting has completed the curriculum, Dev measures again to see if the children have improved their food acceptance and dietary intake. Dev said the goal is for the interactive plate to weigh and

measure consumption and hopefully, improvement – and then to transmit the data to a mobile app on a smartphone.

IMPROVING KIDS' PREFERENCES AND DIETARY INTAKE

Children eat approximately four to five meals each day in a full-time child care program, including breakfast, mid-morning snack, lunch, and mid-afternoon and late-afternoon snack. Child care programs can be reimbursed for the money spent on food, but to qualify for the reimbursement, they have to meet certain nutrition standards from the USDA Child and Adult Care Food Program (CACFP). The goal is for children to have a well-balanced diet, Dev said, so CACFP requires child care providers to serve healthy meals, snacks and beverages to children and places emphasis on serving fruits, vegetables, whole grain and low-fat dairy.

"If child care providers are following these standards, they are concerned that children will not like the taste of healthy foods and will waste most of the food," Dev explained. "So how do we bridge the disconnect from serving children all these healthy foods but children don't like the taste of some foods, especially vegetables?"

The goal of this EAT Family Style curriculum is to bridge the gap between serving healthy foods and children's preferences while meeting child care providers' challenges and requirements, all the while making mealtime more enjoyable.

"They want to improve children's healthy behaviors, but the curriculum will empower them in how to do so," Dev said. "So these are some ways to impact providers, but most importantly, the children, because that's our ultimate goal."

For example, the third lesson of the curriculum is about sensory exploration, Dev said. Children at this age love to explore everything with their senses. They want to touch, feel and smell everything. Through this curriculum, providers will have the opportunity to incorporate strategies at mealtime that will engage the children's senses. The providers will ask questions such as, "What do you see? What color is this? What do you think will be the texture of the apple versus the pear?"

MAKING A DIFFERENCE

The curriculum is being piloted for one year across Nebraska to eight counties, reaching 600 children and 100 child care providers. The Nebraska Extension educators meet with the child care providers every other week to discuss their goals, challenges and areas for improvement. Based on the results of the first year, the EAT Family Style curriculum will be improved and disseminated to child care programs across Nebraska.

“We want to be able to provide the best resources and address needs of Nebraska child care providers and families to encourage healthy eating habits in children,” Dev said.

If child care providers are interested in participating, Dev can be reached by email at ddev2@unl.edu. ▲



Brad Barker

NEW OPPORTUNITIES IN NEBRASKA: Nebraska Extension working to create makerspaces across the state



Interview with Brad Barker

By Riley Nichols

A makerspace, like a community, is about people. It's about leaders who teach and lead and mentor; it's about building community capacity.

Sidney, Nebraska is a community undergoing changes. It had been the home office of outdoor outfitter Cabela's, which was sold in 2017 to Bass Pro Shops. Uncertainty about Sidney's economic future led Sidney and the town's library to partner with Nebraska Extension to build a makerspace. The goal was to help Sidney residents gain new skills and strengthen community ties.

"There, people can make, create and innovate and really 'bootstrap' that community and help them out. In a community like Sidney, that's really important," according to Brad Barker, Nebraska Extension science and technology specialist and STEM (science, technology, engineering and mathematics) youth engagement coordinator for the Center for Science, Math and Computer Education at the University of Nebraska-Lincoln.

A makerspace is a designated area where people with shared interests can work on projects. The makerspace idea started with robotics and moved to wearable technologies, such as wearable health monitors, and clothing and accessories that change color. Now, though, the makerspace network could potentially help communities establish makerspaces where individuals can learn new skills, build entrepreneurship opportunities – and fill the educational pipeline with young people interested in STEM.

BUILDING COMMUNITY

Barker's goal is to create opportunities with each makerspace. The youth-centered goal is to get middle school and high school students interested in STEM careers early to fill the need for people in STEM careers. By providing a space where learning is more free-choice, he hopes students will have increased interest in STEM disciplines.

Makerspaces also will provide an opportunity for entrepreneurship. Barker's hope is to help community members learn to create items they can sell and turn into a business.

Barker and Nebraska Extension hope to bring together all ages of individuals in communities through makerspaces. The Sidney makerspace has already shown a number of retirees attending.

"They're learning new things, they're excited, and they're sharing knowledge with others," Barker said. Makerspaces create opportunities for learning as well as mentorship. Barker hopes older patrons can learn skills and go on to teach and help younger audiences. For example, some of the older residents are teaching skills in woodworking, Barker said.

SIDNEY MAKERSPACE

The Sidney makerspace officially opened in December of 2017, with funding from the National Science Foundation (NSF). The NSF grant funded the initial equipment for the makerspace, and the community of Sidney also helped to supply space in the local public library. Barker believes that with community interest and investment, makerspaces have a better chance of succeeding.

"Sidney is not unlike other Nebraska communities that need collaborations in order to grow," Barker said.

Collaborations, innovations

In creating the Sidney makerspace, the Sidney Public Library collaborated with Nebraska Innovation Studio (NIS), located on Nebraska Innovation Campus in Lincoln, Nebraska. With the use of telepresence robotics, Barker and his team were able to bridge the gap between the two locations. For example, an engineer on location at NIS can beam into a mobile robot in Sidney to provide presence in the space, but also observe and instruct. This allows experts at the University of Nebraska-Lincoln and other campuses to share their knowledge across the state.

Nebraska Extension also partnered with Know Innovations in Buffalo, New York in creating a

virtual reality environment. According to Barker, virtual reality is an artificial environment created by sensory stimulators. The Sidney makerspace is using the Oculus Rift, a piece of technology that is worn over the eyes to immerse the user in the creative environment. Barker plans to create a virtual makerspace where patrons can create virtual items and then bring them into the world, using machines like 3D printers. This virtual makerspace can be accessed at the Sidney makerspace and is available to everyone who uses the space.

Makerspace equipment, costs

The initial equipment in the Sidney makerspace includes a laser cutter, a Carvey CNC router, several 3D printers, computers, cameras and a vinyl cutter. An hourlong training/certification session is required to use each of the machines. Basic safety and operation of machines will be provided by the makerspace specialists, Barker said.

After completing the training, community members are welcome to use the makerspace. Membership rates for the Sidney makerspace are \$25 per month for adults, and free for children under 18. There is also a suggested \$5 charge for drop-in patrons.

Maker showcase

Barker also introduced the idea of "maker showcase" to the Sidney makerspace. A maker showcase is a fair-type event that allows community members to showcase, and possibly sell the products made at the makerspace. Along with generating income for the community, it also gives patrons new opportunities and purpose.

Bubble wands, magic mirrors

The Sidney makerspace already has begun working with Sidney Public Schools. Students in kindergarten through 12th grade piloted the virtual reality feature as they toured the facility. The students also created a "bubble wand," which is a wand that holds a soap solution and creates a bubble. The bubble wand is created in virtual reality and then printed on a 3D printer. This creates an open-learning environment where kids are more free to choose their learning path, as well as become interested in STEM.

In addition to the bubble wands, NIS is working with the Sidney makerspace to build a magic mirror, which is a two-way mirror with a screen behind it that projects information, such as weather and calendars. Both teams at NIS and the Sidney makerspace hold meetings to discuss project progress. The building process will be documented and sent out to the public so other makerspaces can replicate the project.

TRAVELS

When Barker was researching the idea to establish a statewide network of makerspaces, he went on

a six-month sabbatical to research and learn from other makerspaces across the world. He traveled to Barcelona, Spain, to visit two makerspaces, one in the heart of the city and the other in the mountains overlooking the city. Barker then went to Germany, Romania, Ireland, England and Scotland. He also visited makerspaces in the U.S. on the East Coast, West Coast, and the Midwest.

If you are interested in learning more about the makerspace project, contact Brad Barker at bbarker1@unl.edu. ▲



Jamie Loizzo

STREAMING SCIENCE CREATES INTEREST IN STEM CAREERS:

new online program brings educational opportunities to schools



Interview with Jamie Loizzo

By Riley Nichols

Few people ever go inside a wind turbine. But through video technology, students throughout Nebraska saw the inside of one of these massive machines and learned from a Nebraska Extension educator how electricity is generated from the wind.

Jamie Loizzo created Streaming Science, an undergraduate student-driven project-based learning science literacy program, to help educate students at the university level about communicating science to younger students and create the fascination with science that compels them to become scientists themselves.

Loizzo was an assistant professor of agricultural and environmental sciences communication at the University of Nebraska–Lincoln until the summer of 2018, when she moved to the University of Florida to take a position as assistant professor of agricultural communications.

Loizzo and University of Nebraska–Lincoln students conducted the background research, captured video interviews with university scientists, then took

the science to hundreds of Nebraska schoolchildren through live web-streamed electronic field trips, podcasts, photo essays and videos extended to audiences through websites.

“My role is to work with Extension to get kids interested in science, and to get them to want to be the next scientists,” Loizzo said.

STREAMING SCIENCE

Loizzo piloted classes in 2015, but Streaming Science officially started in 2016. Loizzo said several classes focused on topic themes such as “The Science of Food,” in conjunction with Nebraska Extension educators; “Big Data,” with the university’s Quantitative Life Sciences Initiative; “Ag Econ,” with the university’s Department of Agricultural Economics; “The Science of Corn,” with the Nebraska Corn Board; and “Women in STEM,” with the ADVANCE program. The ADVANCE program began in 2008 as a National Science Foundation grant-funded project and now has been folded into the university’s academic

structure. ADVANCE recognizes that the country's future requires talented men and women in science, technology, engineering and mathematics fields.

Streaming Science partners with Nebraska Extension specialists and educators to introduce topics to the classes. Loizzo and her students also reach out to scientists within the College of Agricultural Sciences and Natural Resources for their expertise, but also work with scientists outside of the college and the university.

ELECTRONIC FIELD TRIPS

With Streaming Science, Loizzo introduced a new way of learning: mobile electronic field trips. According to Loizzo, an electronic field trip is a two-way, live webcast that is produced and recorded on one end and watched by an audience on the other. The field trips are recorded using mobile devices, such as iPads and video cameras. They are recorded on location and streamed to middle and high schools across the state. While students watch the live stream, they can type questions into the streaming website for the scientists to answer. With this new model of teaching, teachers and students can access educational experiences that otherwise wouldn't be possible.

Loizzo and her team of graduate and undergraduate students have put together two electronic field trips in the past: the Ranches, Rivers and Rats field trip was piloted to seven schools across Nebraska in 2017.

In November of 2017, Loizzo launched the Sun Rays and Windy Days electronic field trip. This trip gave

students a look into alternative energy production in Nebraska. A Nebraska Extension specialist led the field trip and taught students about wind turbines and solar panels; the university students worked with the Extension specialist to capture video inside the turbine. The field trip was broadcast to 275 students across Nebraska.

The Ranches, Rivers and Rats electronic field trip was funded by a Food for Health Collaboration Initiative grant. Loizzo partnered with Mary Harner, an associate professor of communication and biology at the University of Nebraska at Kearney. The field trip was in three 15-minute segments; Harner's segment focused on water quality research in Nebraska. A ranch segment taught students about the Sandhills region of Nebraska and what happens on a working ranch. Keith Geluso, a professor of biology at the University of Nebraska at Kearney, presented a segment about kangaroo rats in the Sandhills and their shift in population due to climate change. Loizzo revisited this field trip in spring of 2018, reaching 17 schools and 800 students.

Loizzo believes her role as an educator is to help create the next generation of science communicators. Science communication is an area of study that has been increasing and Loizzo takes pride in taking scientific content and helping the world understand it.

According to Loizzo, "Science literacy is a thread that runs through everything we do." ▲



Tiffany Messer

IMPROVING WATER QUALITY AND QUANTITY FOR EVERYONE:

Messer works on issues that cut across
engineering, ecology, income levels



Interview with Tiffany Messer

By Mary Garbacz, based on an interview by Emily Frenzen

Water quantity and water quality are not just environmental issues; they are people issues. “Every morning when someone wakes up, they should be able to say, ‘I have clean water to drink and food to eat.’ That shouldn’t be something that anyone must question,” according to Tiffany Messer, University of Nebraska–Lincoln assistant professor in the Department of Biological Systems Engineering and the School of Natural Resources.

Messer, her students and collaborators work every day to find solutions to water quality issues using technologies that can be used around the world. Her work crosses into engineering, ecology and chemistry to focus on improving water quality regardless of an individual’s geographic location or socioeconomic class.

Messer looks at water quality in the natural environment, such as that in rivers and streams, because many people in the country, particularly in lower socioeconomic regions, drink water from those sources, she explained.

Drinking water in rural areas is affected by agricultural chemicals, but chemicals applied to lawns and golf courses also affect the water in urban environments.

She also studies global issues, such as water scarcities’ impact on water quality and the effects on human health.

HEALTH ISSUES

“How we treat and care for our water matters for our neighbors,” Messer said. “Water quality is more than addressing what is in the water people are drinking, but also includes the water other species will drink that we have the potential to eat further down the food chain,” she added.

As an example, fish may “bioaccumulate,” which means they hold contaminants in their bodies. Humans eat the fish and ultimately, have that bioaccumulation of contaminants in their own bodies. “It’s not exactly the issue when you first eat

them; it's more like 10-20 years down the road when we start to see these issues come up," Messer said.

Nitrogen – why research is important

"We have massive quantities of nitrogen leaving Nebraska and it impacts human health," Messer said. Nitrogen can enter streams, rivers, lakes and oceans, which has the potential to lead to fish kills, reducing quality and quantity of an essential food source.

One of the top engineering challenges globally is managing the nitrogen budget – applying enough nitrogen essential for growing bountiful crops, but not so much that it leaches into groundwater or runs off the soil into rivers and streams.

"Depending on soil types, nitrogen can take 20 to 30 years or more to flush through a system to a river. Therefore, we likely have seen what we've applied 20 years ago in many regions," Messer said. The way nitrogen moves depends on the soil type; it moves quickly through sandy soils and more slowly through clay soils, but that means the impact of management practices that have been implemented won't be seen sometimes up to 20 years or more after being adopted.

One of the many "unknowns" is how a changing climate will affect nitrogen movement. Extreme events related to a changing climate, such as excessive rainfall episodes, affect the way nitrogen moves through the system, Messer said. She explained that a high concentration of nitrate in groundwater is especially dangerous for expectant mothers. Excessive nitrogen can actually limit oxygen in an expectant mother's uterus and suffocate the infant before it is born, a medical condition known as methemoglobinemia. "This is a critical water quality issue that remains prevalent throughout the Midwest just because of high nitrate concentrations in groundwater drinking wells," she said.

And then there's the "cocktail," or the additional contaminants in the water that interact with each other and with the nitrate, causing even more health issues. "You can look at these issues at the local scale and not just in agricultural communities," she said.

"Don't apply nitrogen unless you have to. It saves you money and also helps the environment," Messer said.

SOCIOECONOMIC IMPACT

A small change in pH, or the acidity or alkalinity of water-soluble substances, also affects water quality – similar to that found in 2014 in Flint, Michigan. That ongoing water quality crisis has impacted many people and their livelihoods, Messer said.

"You will typically find that lower-income areas have worse water quality compared to higher-income areas. This is the same in Cape Town, South Africa; the same throughout the U.S.; and the same in the Midwest," Messer said.

She has chosen to focus her research on rural and low-income communities and how their water qualities and overall health can be improved in the future.

OUTREACH, COLLABORATIONS

"Nebraska is fantastic when it comes to stakeholders and people interested in water. They know their water better than anyone," Messer said. Those individuals want to work with university researchers to improve water quality and also improve their crops. "The quality of the water you apply on your crops does impact your crop production," she added.

Messer collaborates with the Environmental Protection Agency, the Nebraska Department of Environmental Quality and the Natural Resources Districts in Nebraska to improve water quality.

She also works with the Lincoln (Nebraska) Public Schools, educating children about water quality and why it is important. Children can even be looking at water quality in their own homes and at streams in their neighborhoods, she said. Messer also is working with pre-kindergarten children.

"I think it's incredibly important to start young. Pre-kindergarten is critical – and usually, they are the ones who are the most impacted by degraded water quality," she said, since early childhood is when the brain is really developing. Teaching children to recognize issues, understand management practices and ask the right questions is critical. "They can take it home and teach their families," she said.

After all, water is important.

"I believe we will continue to find that water quality emerges as one of the top priorities for how to

provide clean water and good food for our children and families throughout the world," Messer said.

CONSIDER THE FOLLOWING:

- A human can survive about 100 hours without water
 - A human can survive about 21 days without food
 - Eighty percent of the world's water supports agriculture
 - Fresh water only can be used for drinking and for irrigation; salt water cannot
 - Nitrogen is essential for growing crops, but can contaminate groundwater
 - It takes about 20 years for nitrogen to show up in groundwater
 - Lower-socioeconomic areas typically have worse water quality than higher-income areas ▲
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Scott Schrage

WRITING, TALKING TO THE PUBLIC ABOUT SCIENCE: Schrage shares tips, scientific understanding



Interview with Scott Schrage

By Abby Steffen

Scott Schrage knows how to write. He can use the right words, in the right order, for the people who likely will read what he writes. He is skilled with punctuation and with the Associated Press Stylebook. But his job as science writer and editor with University Communication at the University of Nebraska–Lincoln requires more than wordsmithing and style. It requires him to do background homework on scientific topics, on the interviews with university scientists and reviewing – lots and lots of reviewing – to be sure he has relayed the facts correctly.

“Science communicators are translators. They take what is often complex, highly technical information and present it in a form that someone who has little to no background in a scientific discipline can understand,” Schrage said. “I think science communicators can really help provide insight into why research is so vital,” he added.

THE PROCESS

“Science is misunderstood in a lot of ways, but when you take a step back and realize how complicated and technical it can be, you get an appreciation

for why it’s misunderstood,” Schrage said. As a communicator, he tries to give people a better understanding of the science.

“It requires a lot of thought and care, and communicators are trained to provide that and invest in doing that to work toward a broader public understanding of science,” he explained.

It is Schrage’s job to write stories about results of scientific research at the university so the public can understand its importance. He usually learns about it from a contact with a scientist or through peer-reviewed studies in scientific journals. That’s when Schrage begins his own research, learning about the “what,” “so what” and “now what” of the topic.

He looks up terms, practices and processes he may not understand. He takes notes. He learns as much as he can, then begins writing interview questions for a face-to-face meeting with the scientist.

During the interview, Schrage asks the scientist questions about the scientific processes and the significance of the discoveries. One of his stories in early 2018 focused on the negative effect of a

popular insecticide on the queen bumble bee. The headline asked “Could an insecticide topple queen bumble bees?”

The “so what,” or significance, of that story centered around the insecticide’s effect on the queen bumble bee, including her death or incapacitation; the latter resulting in a delay of the queen’s pollination of fruits, vegetables and nuts. The story appeared in University Communication’s Pocket Science, a 200-word-limit glimpse of research conducted by university scientists and engineers. The university scientist Schrage interviewed, Judy Wu-Smart, is a university Extension and research entomologist.

“I think it’s easy to underestimate or overlook how important research is to everyday life – how it has shaped or improved our agriculture, our technology, our health, our economy – pretty much anything that you can imagine,” Schrage said.

Schrage records each interview, then transcribes it himself, writing out the scientist’s responses to his questions. Through the transcription process, Schrage is able to catch details and vocal nuances he might have overlooked during the interview. When the process of transcribing is complete, he begins to write.

WRITING THE STORY

Scientists want people to know about their research; writers and editors want to be sure the story is easy to understand for a public audience. The challenge, he said, is writing to find that “sweet spot” that provides enough information, but not too much.

Schrage begins the writing process by reviewing his own homework and the transcription of the interview to be sure he understands the material. He underlines, highlights and thinks about the audiences that could read the story. Then, he writes a general outline of what he believes should be included in the story, in the order the audience would want to read it.

And finally, the wordsmithing that catches the audience’s attention, first with a headline:

‘Pain in the gut:
Microbe betrays neighbors to trigger IBD
Study offers clue to inflammatory bowel diseases’

The wordsmithing continues in the first paragraph of the story, in which the topic and significance is explained and facts are attributed to the university scientist:

“A colon-dwelling bacterium may trigger inflammatory bowel diseases by raising the immune system’s alarm against its peaceful bacterial community, reports a recent study led by the University of Nebraska–Lincoln.”

That story, featuring Amanda Ramer-Tait, an assistant professor in the Department of Food Science and Technology, includes explanations of terms and processes involved in the complex science Ramer-Tait studies. In this case, Ramer-Tait’s research could change the future for people afflicted with inflammatory bowel disease.

It’s Schrage’s responsibility to explain it to the world.

EXTENDING THE INFORMATION

Schrage works with a team of University Communication experts that includes photographers and videographers, web and social media specialists and communications strategists. They work together to be sure stories about the university have the photos, videos, social media and web presence necessary to reach a variety of audiences.

Everything University Communication produces goes to Nebraska Today, which is the news portal of the university and arrives via email several times a week. A good amount of material also goes out to the local media.

“If we feel like we’re onto something big, we’ll use electronic services that other science communicators regularly check; those are repositories for daily science stories, many of which are coming from universities like ours,” Schrage explained. Sometimes, Schrage and his colleagues assess a story and target it to a regional writer if they believe it could be of interest.

“Ultimately, it’s important to remind people that scientists try to remain impartial in their work, even if that’s not always completely possible. We would ask the same of the people who are approaching research for the first time: try to come at this with an open mind. Communication doesn’t work if it’s a one-way street,” Schrage said.

THREE TIPS FOR WRITING ABOUT SCIENCE

By Scott Schrage

Tip 1: Respect and serve your audience

- Respect your audience's time by promptly getting to the point.
- Explain what's new and why it's important, applicable or, at the very least, interesting.
- Respect your audience's attention by avoiding jargon unless absolutely necessary.
- Write to inform the audience, above all else. Don't try to impress the reader with how much you know.
- Respect your audience's intelligence by delving into specifics that are essential to understanding a concept, a discovery, or the novelty or magnitude of a finding.

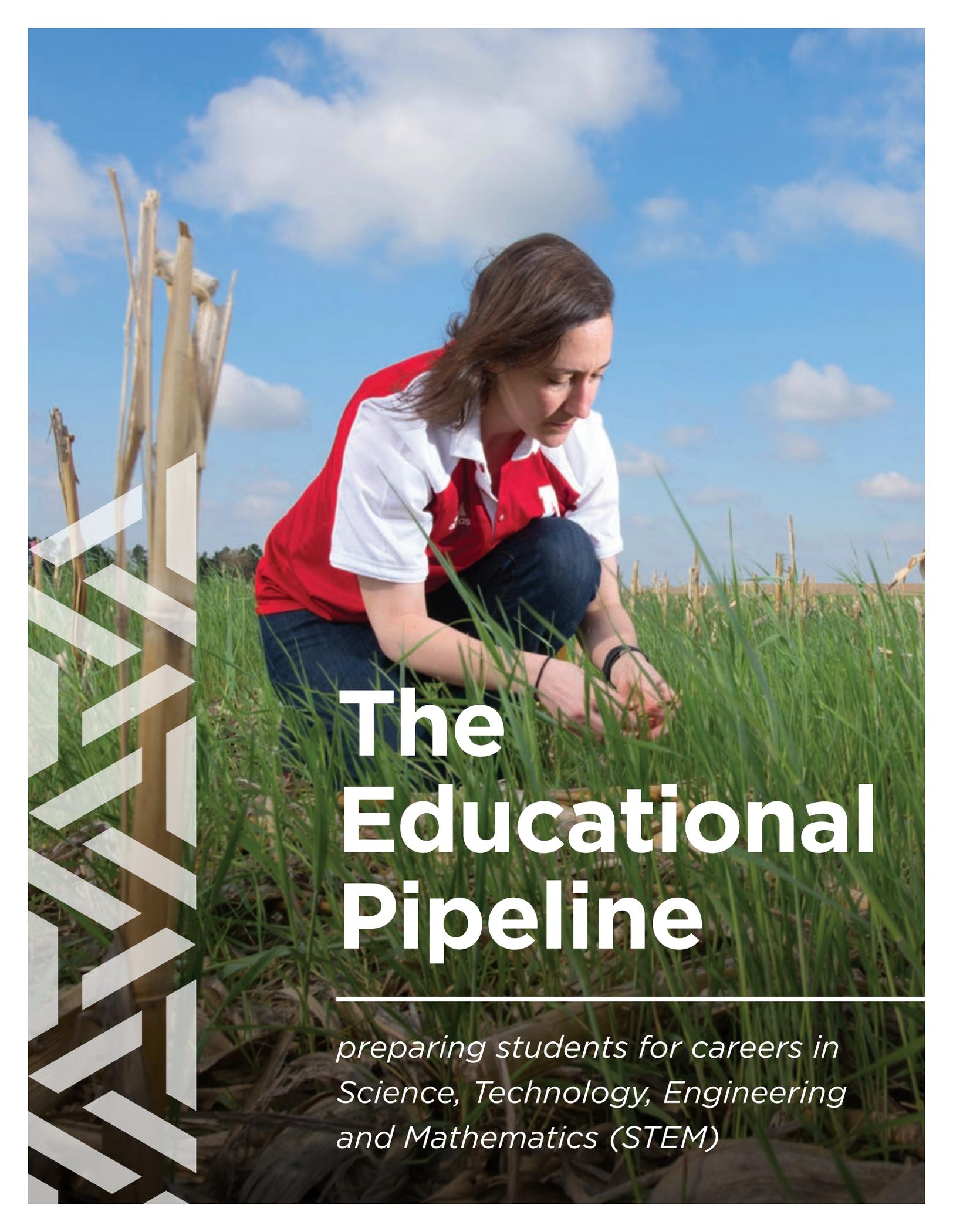
Tip 2: Catch the audience's attention early

- Make a strong and interesting first impression with a story.
- Style matters. If you don't have it, readers might abandon the story before they've consumed the substance.

- Consider leading with an especially surprising or awe-inspiring fact, dropping the reader into the middle of a compelling situation, or connecting the research to an emerging news trend or cultural phenomenon. Pair that with a solid headline and some dynamic imagery.
- Use your imagination. Try to be creative, then decide what approach best suits your story. It is well worth the time that's needed to get it right.

Tip 3: Connect the unfamiliar with the familiar

- Research is usually complex, and many people aren't familiar with scientific concepts. Draw parallels between an unfamiliar concept and a familiar one. Metaphors, analogies and other figurative approaches can help audiences grasp something they might otherwise struggle to understand. It also can help reduce the intimidation many people experience when encountering research from the natural sciences. ▲



The Educational Pipeline

*preparing students for careers in
Science, Technology, Engineering
and Mathematics (STEM)*



“How do we contribute to diversifying opportunities for more young people who want to do more in farming? How do we keep young people in Nebraska? How do we make our systems more adaptable to change?”

Andrea Basche



Jeyam Subbiah (right), with Jenny Keshwani (checked blouse) and Ashu Guru (right, in dark sweater)

INVITING THE WORLD TO FARM THROUGH A VIDEO GAME:

game for middle school and high school students
promotes learning about ag decisions and processes



Interview with Ashu Guru, Jenny Keshwani and Jeyam Subbiah

By Katherine Mundorf

There's a new video game in town – one that educators actually want students to play.

The “AgPocalypse” game helps students understand agriculture, natural resources and make decisions that affect outcomes of both. Jeyam Subbiah, Kenneth E. Morrison Distinguished Professor of Food Engineering, Biological Systems Engineering and Food Science and Technology, formed the game idea, then created a team of University of Nebraska-Lincoln colleagues to pull it all together.

COLLABORATORS

Assistant professors of biological systems engineering Ashu Guru and Jenny Keshwani, assistant professor Colleen Syron of the university's School of Art, Art History and Design, recent university graduate Jacob Eiserman and students from the Raikes School of Computer Science and Management combined their diverse skills to create AgPocalypse 2050.

The game focuses on the corn, water, beef and ethanol systems in Nebraska, but Subbiah is hopeful that it can be expanded to other crops and livestock to match other states' and countries' agricultural practices. The game provides a scenario in which each player has a farm and must make decisions that affect the farm and its success.

SYSTEMS AND DECISIONS

Jenny Keshwani is in charge of the educational component of the game and makes sure the objectives for each level reflect the concept of systems thinking, which teaches students about cause and effect through agricultural systems.

“If a system changes, let's say, how much I water my crops, it's going to affect lots of things down the road,” Keshwani explained. Throughout the game, students are given multiple opportunities to make decisions for their farm, like when to irrigate and what crop to plant. Students are given various

models and resources to help influence their choice for the best possible outcome. This way, students from both urban and rural backgrounds have the knowledge necessary to be successful at this game.

CREATING THE GAME

Guru works with the game's function, while Syron and her students are in charge of the graphic design and visual aspects of the video game.

"The best thing that came out of this project is the collaboration between the engineering students and the art students," Subbiah noted. Student Jacob Eiserman came up with the name AgPocalypse and helped guide the other students working on the graphics to be sure the game has visual appeal.

Guru is a teaching and learning specialist at the university. He guided the students creating the graphics with his experience of more than a decade in computer science and software development. Guru worked with the game platform and game logic associated with the game's levels. Since the audience can range from middle school students to high school students to university undergraduate

students, the video game has to be educational and challenging for all age groups.

"We are developing some board games which allow you to think strategically while physically interacting with the objects," Guru explained.

GAME LAUNCH

The game was launched during 4-H summer camps in the summer of 2018. The game will be more widely released by the summer of 2019. AgPocalypse also will be implemented into the curriculum for the Urban Agriculture and Natural Resources Academy at Omaha's Bryan High School, which currently is the only agricultural program in the Omaha Public Schools district. Subbiah and the rest of the team hope that other schools will adopt the game into their curriculum so that urban students have the opportunity to learn more about agriculture and the decision-making process that farmers go through every day. The video game will start out online, but will be moved to a mobile app to make it easier for users to play. ▲



Jenny Keshwani (right) with CASNR's Julie Obermeyer (left) and graduate student Rachel Ibach

ENCOURAGING EVERYONE TO JOIN STEM CAREER FIELDS:

Cultivate ACCESS focuses on women,
underrepresented minorities in high school



Interview with Jenny Keshwani

By Shelby Cammack

Researchers like Jenny Keshwani are finding ways to increase diversity in science, technology, engineering and mathematics (STEM) fields by incorporating curriculum into high school classrooms. Cultivate ACCESS (Agricultural Career Communities to Empower Students in STEM) encourages women and minorities to consider STEM careers by showing they are capable of pursuing these fields.

Keshwani is an assistant professor in the Department of Biological Systems Engineering at the University of Nebraska–Lincoln, where she teaches biomedical engineering, such as biomaterials. She also works with Nebraska Extension in biomedical engineering youth programs and in nonformal STEM education.

DEFINING CULTIVATE ACCESS

Cultivate ACCESS is a mentoring program for high school juniors and seniors to connect with students who have a passion, even if they don't see themselves as capable of pursuing a career in agriculture, Keshwani said.

Participating students are paired with mentors who are professionals in agriculture STEM careers. Students are matched with these mentors based on as many different demographics as possible. In addition to having mentors, Cultivate ACCESS has University of Nebraska–Lincoln ambassadors who serve as liaisons between the mentors and students. The university students meet face-to-face with participating high school students, Keshwani explained.

Cultivate ACCESS is an opportunity for students to expand their understanding of what STEM careers could really look like, she added.

IMPLEMENTATION

The Cultivate ACCESS project received three years of funding beginning in October 2017 from USDA Women and Minorities in STEM to support 30 students in two years of programming.

“We’re really focused on rural communities,” she said, especially communities that can financially support a high school. If students don’t have internet access at home, they can go to their school or library to access the materials that will primarily be online.

Cultivate ACCESS focuses on the importance of involved parents. Materials are translated in Spanish for families if that is necessary, she said. Keshwani hopes to share with parents the importance of the university’s work and the impact an education in STEM can have on students.

THE CURTAIN LADY

Keshwani grew up on a sugar beet farm outside Fargo, North Dakota. Her interest in working with minority populations developed early in life from watching her grandmother’s work with refugees in Fargo. As “the curtain lady,” Keshwani’s grandmother would go to refugee apartments to take window measurements and then make curtains for them. “I always thought it was really interesting to meet all of these people from totally different places and backgrounds who spoke different languages,” Keshwani said.

Through her college and professional years, Keshwani has continued volunteering in her communities by tutoring students and working at homeless shelters. “Now that there are opportunities

like this where I can interweave what I like to do in my personal time with my work time, it’s really kind of exciting to put those things in motion and to be able to combine passions,” Keshwani said.

As a female in a predominantly male profession, Keshwani has worked hard to encourage students from all backgrounds and demographics to consider careers in engineering. “When I explain it to students, I say that engineers solve problems and that whatever word you put in front of engineering either describes what tools you’ll use or what problems you’re solving. A mechanical engineer uses mechanical tools, a biomedical engineer solves biomedical problems,” Keshwani said.

TEAM MEMBERS AND CONTRIBUTORS

Other Cultivate ACCESS team members join Keshwani from other university and state entities: Department of Plant Pathology; Nebraska Human Resources Institute; Department of Biological Systems Engineering; Nebraska Department of Education; Department of Agricultural Leadership, Education and Communication; College of Agricultural Sciences and Natural Resources Dean’s office; Department of Agronomy and Horticulture; and Social and Behavioral Sciences Research Consortium.

Visit cultivate.unl.edu for more information. ▲





Matt Kreifels

MERGING STATE AND UNIVERSITY FOR NEBRASKA'S AG STUDENTS:

Kreifels' mission to improve and expand
agricultural education programs



Interview with Matt Kreifels

By Alexandria Lundvall

Today, fewer than 2 percent of people in the United States are farmers and ranchers, but more than 300 career opportunities are related to agriculture, representing a spectrum of opportunities for Nebraska's young people.

Matt Kreifels serves as an associate professor of practice in the Department of Agricultural Leadership, Education and Communication at the University of Nebraska-Lincoln and as the career field specialist in agricultural, food and natural resources in the Nebraska Department of Education. As an associate professor of practice, Kreifels' primary role is to prepare future agricultural education teachers; at the Nebraska Department of Education, Kreifels is the primary contact for schools and current teachers within the high school agricultural education program across Nebraska.

Undergraduate agricultural education students have the opportunity to know the latest information before they enter the workforce. At the same time, information taught at the university is taken to teachers across the state.

As of the 2017-2018 school year, 184 schools in Nebraska offer agricultural education programs, Kreifels said. "That means there is an agriculture teacher there; they have an FFA chapter; and they're helping students do what we call 'supervised agricultural experience programs,'" he explained. Since 2010, 50 schools across Nebraska added an agricultural education program, bringing the total to 70 percent of high schools in the state.

"We want our students to be exposed to Nebraska's No. 1 industry. We want our students to have a teacher in the school who can help them find a passion within the industry that employs one out of four Nebraskans. That just makes sense," Kreifels said.

INFORM AND PREPARE

Agricultural education has two main goals: to help individuals make informed decisions about agriculture, and to help students find their passion and prepare them for careers in agriculture.

Not every student who goes through the agricultural education program wants a career in agriculture, but the program very intentionally offers students the opportunity to become informed consumers, Kreifels said.

Agricultural education adopts and embraces the science, technology, engineering and mathematics (STEM) principles across the state, Kreifels said. STEM concepts are integrated into the teacher preparation program at the university, so teachers are able to integrate it into the classroom later.

Agricultural education began in 1917, with the adoption of the Smith-Hughes Act (formally called the National Vocational Education Act). The Smith-Hughes Act provided federal funds to states to promote vocational education in agriculture, trades and industry.

When agricultural education started nationwide, a large portion of the United States population was directly involved with farming and ranching, Kreifels said. As the agricultural industry evolves, so does agricultural education, he added. It has broadened to prepare students for various careers within the agricultural industry, not just farming and ranching.

'AGRICULTURE IS COOL AGAIN'

Agriculture is Nebraska's top industry, Kreifels said. The agricultural economy partially mitigated the state and its residents from the effects of the economic recession of 2007-2009 and helped Nebraskans realize the economic impact of agriculture in Nebraska, he explained. When other states didn't quickly rebound from the recession, school administrators, parents, community members – and students themselves – realized agriculture is a strong career field.

"The impact that it's had on school-based agricultural education in Nebraska has been phenomenal," Kreifels said. "We have been adding programs every year since 2010."

In 2010, the only Class A school with an agricultural education program was Norfolk. Since then, several more have been added and Kreifels sees the trend continuing. When an agricultural program is added to a large school, it creates a "buzz" about agriculture, he said. Students who are less familiar with the agricultural industry are given new opportunities to be involved in the program and become informed

consumers. They may even look at and consider careers in agriculture for themselves.

"Agricultural education helps students think about themselves in a career within agriculture, to develop a passion and follow that passion," Kreifels said.

INDUSTRY CONSTANTLY EVOLVING

"Agriculture today is different than it was 30 years ago, but even five years ago, precision agriculture in that particular aspect alone has changed dramatically," Kreifels explained.

As the industry evolves, so does the agricultural education. Kreifels' split role between the Department of Education and the university has streamlined communication between current and future agricultural educators.

"One of the best aspects has been that we're able to take the new information at the federal level or state level that's happening at the department of education within agricultural education and integrate it into our pre-service teacher program," Kreifels explained.

Undergraduate students learn what's new and innovative, Kreifels said. The undergraduate students are able to master new skills before stepping into the workforce. On the other hand, the Department of Education also is able to take what is happening in teacher education to the people in the state of Nebraska.

"My goal in this position has been to help people involved in agricultural education feel as if we are truly a family," Kreifels said.

DEMAND FOR AGRICULTURAL EDUCATORS

The University of Nebraska-Lincoln houses the only agricultural teacher education program in the state, Kreifels said. As the number of agricultural education programs in Nebraska increases, so does the demand for agricultural educators. Additionally, many current teachers are approaching retirement. This leads to many opportunities for students interested in becoming agricultural educators.

In the 2015-2016 school year, Nebraska had 45 agricultural education positions open, Kreifels said, and 38 openings in the 2016-2017 school year, he added. ▲



Jenny Dauer

SCIENCE AND DECISION-MAKING FOR A COMPLEX WORLD: knowledge, competency and contexts for today's students



Interview with Jenny Dauer

By Andrea Wach Tenney

Science Literacy 101 is a course for almost 600 students in the College of Agricultural Sciences and Natural Resources each year. Through this course, students are challenged to think about what science is and why it is necessary. Students are introduced to scientific, social, economic, political, cultural and ethical dimensions of current food, energy and water issues.

It is all part of the Science Literacy Initiative focus area in the University of Nebraska-Lincoln's Institute of Agriculture and Natural Resources. The goal is for students to develop an enhanced capacity to make decisions grounded in science. The initiative includes and invites input from the public and from partners in business and industry; it offers professional development; and it provides higher education opportunities.

Jenny Dauer, assistant professor in the university's School of Natural Resources, developed the course to help students think objectively about challenging issues, explore their values on these issues, and use both science and values to think about the best way to solve complex societal problems. Her interest in student learning emerged after earning her doctorate in biogeochemistry and ecosystem

ecology, she said.

"I began to be interested in how people think about climate change, because it's a very complicated issue, both in terms of the science and how we solve the problem," she said.

That led to today, when she challenges students to think, understand and lead.

Dauer earned her Bachelor of Science degree in secondary education, biology and environmental science and her Master of Science in ecology, both from Penn State University. She went on to Oregon State University to earn her doctorate. Now, Dauer studies how students think about complex issues and build their science literacy skills.

The restructured course focuses on decision-making, media literacy and systems thinking.

"The goal of the course is not to change student's values, but rather to help students learn more about who they are and have a process by which to scientifically support and defend their ideas about how to solve challenging problems that we will face long into the future," Dauer said.

“Students get practice thinking about tradeoffs among the things that they value instead of just making a decision based on their initial gut reaction,” she added.

DEFINING SCIENCE LITERACY

Science literacy is not just about science content knowledge, but what a person does with that knowledge, Dauer said. It might be the ability to investigate and observe, which are the basic science process skills; it might also be using science skills in the decision-making process, which even non-scientists need to be able to do.

“Science literacy is also understanding the science in the news and applying that science to decisions you have to make in your everyday life,” Dauer said. “To teach for science literacy, it’s changing the focus from just science knowledge and memorization to doing something with science.”

The decision-making process

In the class, Dauer uses a structured decision-making framework that commonly is used in wildlife management, business, military and other fields. The first step in the decision-making framework is defining an issue. Once the students understand what decision is being made, they are challenged to think about their values, she said. Once students know their values that relate to the issue, Dauer has them explore different options or choices to solve the problem.

Dauer asks students to use science to predict the consequences of their choices by gathering evidence from popular media and peer-reviewed sources.

“The students then do a tradeoffs analysis to think about how to optimize conflicting elements of the issue that resonate most with them, for example conservation of natural resources and economic profitability,” she said. This process focuses on students comparing ideas and perspectives while identifying the student’s core values. The final step is communicating an argument for an option or choice that is informed by a reasoned analysis and backed by scientific evidence.

Systems thinking

Throughout the course, students engage in systems thinking, which Dauer defines as thinking about the interaction of multiple components in a system and their dynamic nature. For example, when explaining the water cycle, the discussion

moves beyond a static view of the water cycle to investigating Nebraska’s entire quantifiable water balance. She challenges them to think how much water is in the aquifer, how much water comes down in rainfall, how much water has evaporated and how much water is used in irrigation. This process then leads to discussion about the water system as a whole instead of a more static view of aquifers, precipitation, rivers and lakes. As a result, conversations can be addressed about what happens to the aquifer and the whole water system over time when water is used for agriculture.

Measuring growth

Students are primarily assessed to determine their decision-making skills and their ability to apply scientific information, rather than simply what they know about each topic, Dauer said.

Students in the course are graded on open-ended assessments instead of multiple-choice tests. “If we’re really interested in decision-making, there’s not really any multiple-choice tests that the students can take to demonstrate their skill in decision-making,” Dauer said.

During the last five weeks of the course, student groups pick a topic of their own to research and analyze. They use the same decision-making steps to identify a solution to the problem they selected, and they are graded on their ability to implement the skills from the semester.

“As the culminating activity for the semester, student groups present their work in a public poster session to communicate their analysis with an audience outside of the class,” Dauer said.

EVOLVING IDEAS

Many people in science education are interested in the method, format and techniques used in the course and are considering adopting the approach in their own courses, she said.

The class continues to evolve as Dauer studies what skills the students have learned in the class and how to better teach them. And, the issues used in the class change over time, she added. The class has covered issues such as biofuels, water use, pollinator conservation, hunting of mountain lions, prairie dog conservation and food insecurity. She expects those topics to continue changing based on what is happening in Nebraska and what topics are interesting to students. ▲



Deepak Keshwani

DEVELOPING LEARNERS WHILE BUILDING LEADERS



Interview with Deepak Keshwani

By Andrea Wach Tenney

“I think everybody deserves the chance to have their story be a good one. As an educator, if I can help in that story-writing process, I think that’s a win for me. I feel like I’ve made a difference.”

Deepak Keshwani, associate professor of biological systems engineering at the University of Nebraska–Lincoln, helps to ensure the success of each student through research and teaching. Keshwani earned his Bachelor of Science degree in biological systems engineering and Master of Science in agricultural and biological systems engineering at the university. He then went on to North Carolina State University for his doctorate in biological and agricultural engineering before returning to teach and research at the University of Nebraska–Lincoln.

As a biological systems engineer by training, Keshwani develops models to help better understand biological systems, predict what might happen in different situations and be able to control the systems.

FROM LAB TO LESSONS

Keshwani links his research to topics his class is learning. He said this method helps students see the value of the topic and how people will use the

information. It then also allows him to talk about his research in an accessible manner to his students.

Outside of research and teaching, Keshwani coordinates the Ag Futures: Entrepreneurship, Leadership & Service first-year learning community and serves as the faculty adviser. The learning community connects first-year students who live on the same dormitory floor and take similar courses, while the faculty adviser helps them adjust to college. Keshwani sees educational inequality translating into students’ academic careers, whether it be a lack of knowledge, lack of awareness of a certain career path, or preconceived notions that students have about themselves.

One of the strategies Keshwani uses during the first semester is to have students explore their chosen majors and explore what the major entails. He brings alumni or students who have completed internships to speak with his students. He has each student explore his or her degree program and build a four-year course plan. He then encourages his students to set goals for themselves and really understand what their personal, academic and professional paths are for the next four years. These goals are then written out and kept for both him and the student to reference.

BUILDING LEADERS

“If you really want to effectively engage with people, you need to understand a little bit about yourself,” Keshwani said. He challenges students to think about what they are interested in, and why they are drawn to different issues. This requires them to think about themselves and create a sense of self-awareness, which he believes helps build confidence.

“I work really hard to try to empower my students to realize that they’re in control,” he said. He wants to help give them confidence to make decisions while they are in the safety net of college. “Taking a wrong turn is not the worst thing. The worst thing is not taking a turn at all.” He said one of his mentors said it’s not about what’s being taught, it’s what’s being learned by the students and with that mentality he tailors all his lessons to his students.

Helping students maximize their potential is a goal Keshwani has from his experience at the university. Many of the professors he had as a student at the university still mentor him. They helped him realize the impact that a professor can have on a student, and he desires to do the same.

BEYOND THE COLLEGIATE EXPERIENCE

The College of Agricultural Sciences and Natural Resources’ tagline is “Science with a purpose.” Keshwani believes that by taking an active role in each student’s growth he’s able to empower students to take what they’re learning in the classroom to go out into the world. He wants students to recognize the responsibility they have of being ambassadors for the university and caretakers of the knowledge base they acquire, which means helping people in their communities and solving problems within society.

Keshwani wants every student he interacts with to have the benefit of his attention. For him, measuring success is based on his interactions with others. He asks, “Did my interaction move the needle forward? Did it elevate a conversation? Was I able to help somebody toward a better place?” One of Keshwani’s mentors told him that “our students will move mountains. We just have to equip them, and they’ll do it.” ▲



Joseph Dauer

HOW DO STUDENTS LEARN BIOLOGY?

Combining biology, education and cognitive psychology helps students connect knowledge ‘chunks’



Interview with Joseph Dauer

By Andrea Wach Tenney

Experts in a discipline can easily access information from memory within their field of study. An expert’s brain can easily sort and store information, building bigger “chunks” of knowledge, but students are still developing this skill. Joseph Dauer’s research at the University of Nebraska–Lincoln is working to equip students with a skill he refers to as “chunking.”

An assistant professor of life sciences education, Dauer studies how undergraduate students learn biology. Through his research, he believes students can leave the university better prepared for retaining and using the information when they begin their careers.

Dauer found that experts use techniques to help them connect new information they consume to their prior knowledge. He questioned that if experts do that, educators also need to understand how students can develop and implement those skills. He often found his students memorizing the terms, theories, images and ideas but rarely connecting them. He is working to help students take concepts and put them together to explain the biology they observe all around them.

CHUNKING

Experts in biology practice chunking. By chunking, Dauer’s students take information and connect it to a larger picture. Dauer said the ability to chunk can be developed by interpreting and creating through graphs, charts, patterns, equations – any tool that helps network pieces of information. Although it takes time, students eventually will have an easily accessible inventory of deeper understanding on a variety of subjects, Dauer said. This also will help them to better make informed decisions and use the stored knowledge to their advantage.

Dauer believes students can improve the ability to network information throughout college. However, the process of understanding how to draw models of scientific ideas and problems, problem-solve and think critically should begin at the introductory level of understanding biology to help better inform their decision-making.

That begins through chunking information together.

IMPLEMENTING CHUNKING

Dauer wants students to draw connections of life events for themselves and realize how they've been shaped. He hopes to challenge them to connect the ideas they are learning in college to the regional and global community around them.

"My view as an instructor is to be more of a supporter of your learning rather than the person that's in charge of your learning. We need to work on moving that power to the students and away from the instructor. That is what I'm trying to do in the classroom," Dauer said.

MEASURING GROWTH

"Learning isn't something you can put a ruler on," Dauer said. He and his collaborators are developing a

library of lessons for an undergraduate introductory biology sequence. The lessons are created so 800 to 1,200 students can use computational models at the University of Nebraska-Lincoln. Other universities also are beginning to learn about and implement Dauer's learning models, he said.

Dauer has begun to move into deeper understanding of the brain behind the chunking process by working with Carrie Clark, assistant professor of educational psychology at the University of Nebraska-Lincoln. Together, they're working to better understand the neurobiology of students' minds by tracing what parts of the brain are functioning and which neurons are activated when students create models of what they are learning. ▲



Sydney Everhart

PLANT PATHOLOGIST AND MENTOR: for Sydney Everhart, they go together



Interview with Sydney Everhart

By Abby Steffen

Sydney Everhart is known as a quantitative ecologist to some; to others, a plant disease epidemiologist. And to many more, she is known as a role model and mentor.

Everhart is an assistant professor in the Department of Plant Pathology at the University of Nebraska–Lincoln. She studies diseases and disorders of plants, how they occur and what management practices can be used to stop them.

“If we understand where these organisms occur and what factors contribute to these epidemics, we can refine our management approaches to target the disease,” Everhart said.

ECONOMIC IMPORTANCE

Plant diseases are caused by microbial plant pathogens, she explained. A microbial plant pathogen is a disease-causing agent, such as an organism, fungus or bacteria, that is detrimental to the plant host, limiting yield potential or leading to plant death. Everhart has researched many pathogens and diseases, but when she came to the University of Nebraska–Lincoln, she decided to target organisms that are important to Nebraska’s

economy, such as *Sclerotinia sclerotiorum*, a fungus that causes white mold disease in soybean. In her lab, Everhart uses advanced molecular tools to better understand the way a disease works and how it is spread. One of these tools is genetic fingerprinting.

“We use the same types of markers in this plant pathogen that are used in human forensics,” she said, explaining that a genetic analysis is done to determine the individual pathogen’s genetic code. “This type of genetic profiling helps us figure out if Farmer A’s pathogen is more closely related to Farmer B’s pathogen or Farmer C’s pathogen, which might indicate there was some type of spread between one or the other,” she said.

In the future, Everhart also hopes to study diseases that affect other crops, such as the frosty pod rot that threatens the cacao plant, from which chocolate is made. Frosty pod rot disease, scientifically known as *Moniliophthora roreri*, can reduce cacao production by up to 80 percent, Everhart said. By collaborating with researchers from other countries, Everhart hopes to help find solutions for plant diseases that threaten crops around the world.

Plant pathologists also determine the most efficient and economical ways of eliminating plant diseases.

Sometimes, the solutions seem drastic, Everhart said. She shared an example of the Citrus Canker disease outbreak that occurred in citrus trees in Florida about 15 years ago. The trees are important economic drivers, contributing to Florida's standing as one of the top two orange-producing states in the United States. They also can be grown in backyards by homeowners, Everhart said. Florida instituted an eradication program and then began removing trees from both orchards and homeowners' backyards to stop the disease-causing organism from spreading to even more fruit trees.

The Florida homeowners were unhappy and sued the state; the result was that the homeowners won the lawsuit.

"The public did not have a good understanding of how important this management decision was and that it could have saved the citrus industry," Everhart said. "This is a case where educating the public on these plant diseases is extremely important."

SCIENCE LITERACY

Understanding what the public needs to know and how they need to receive it can make a difference. So can adopting new communication technologies, Everhart said; she has a personal website and social media platforms like Twitter, which she uses to discuss scientific research and understanding.

"We absolutely need to invest in this," she said.

MENTORING

Even when she was young, Everhart had an interest in plants, partly because of her father. "He was my mentor throughout my career. He was a community college teacher who taught horticulture and plant

identification, and later became an Extension horticulture field specialist. We would spend a lot of the time in the woods looking for morel mushrooms, but also identifying things. He played a central role in getting me to where I am today as a scientist."

In an effort to provide others with positive relationships, Everhart was a founding leader in the Cultivate ACCESS program, or Cultivate Agriculture Career Communities to Empower Students in STEM. Cultivate ACCESS was started at the University of Nebraska-Lincoln and is funded by the United States Department of Agriculture National Institute of Food and Agriculture (USDA-NIFA). It focuses on pairing mentors from underrepresented groups with high school students who can relate to their mentor in that aspect.

"These mentors are people who appear like them. So, they may be women or maybe another underrepresented group from the agricultural science careers," Everhart explained. "Scientific studies have shown that this increases participation and that people may not think of going into plant pathology or other ag fields because they don't see people who look like them in those fields."

According to Everhart, a real positive, driving force in students' lives comes from having someone who supports their career goals, whether this is a mentor or a parent. Even though Everhart may not be involved in the mentoring aspect of Cultivate ACCESS, she is a mentor for several graduate students and undergraduates who are working in her lab or taking her classes. In this way, Everhart has turned her father's mentorship into a personal goal of training the next generation of scientists, saying, "There's no way I could ever repay the lifetime of mentorship that my father provided me, so my only option is to pay it forward." ▲



Andrea Basche

TOMORROW'S SCIENTISTS: Improving Communities, Improving the World Basche teaches students to communicate their science



Interview with Andrea Basche

By Shelby Cammack

Policy affects everything – and Andrea Basche is teaching her University of Nebraska–Lincoln students to understand the role of policy in the agriculture that helps to feed the world.

Basche believes science supports the policies that promote conservation of water, soil and other natural resources. “Policy matters because all the rules govern what we do,” Basche explained.

Basche is an assistant professor of cropping systems in the university’s Department of Agronomy and Horticulture, where she challenges undergraduate students in her crop management classes to think about the sustainable use of natural resources in crop production.

It’s all to meet the goal of feeding the 9 billion people who are expected to live on Earth by 2050.

Basche thinks about policies as ways to improve communities and applies the term broadly, from local to university, to state, federal and international levels. She looks for ways to better use science to support policies and programs related to agriculture, the environment and sustainability.

“Everything we do is embedded in a political system. The crops that we grow and livestock that we raise in large part relate to what our environment allows us to do – but they also are a result of the economics and market infrastructure that support them,” Basche said.

RESILIENCY

“I think a lot about what our soils are going to look like 30 years from now. If we continue to have heavier storms and more variable weather, what will happen to our soils?” she asked. So, Basche studies soil management and diverse landscapes with the goal of having a more resilient, more prosperous landscape in Nebraska’s future.

“Resilience” to Basche means having a landscape, an environment and people who can bounce back from extreme events. “If you have a bad drought in the future – which we anticipate we will continue to have – do you have people who can stay in business because of that? Do you have communities that stay afloat?”

Basche also considers the state of the farm economy when she thinks of resilience. “How do we

contribute to diversifying opportunities for more young people who want to do more in farming? How do we keep young people in Nebraska? How do we make our systems more adaptable to change?” she asked.

Basche joined the university in December 2017, attracted to the land-grant system at the University of Nebraska and the “bigger purpose” that system serves. She earned her Bachelor of Science degree from Fordham University in biological sciences, a master’s degree from Columbia University in applied climate science and a doctorate in crop production and sustainable agriculture from Iowa State University.

COMMUNICATING SCIENCE

Science communication is important because people are more likely to appreciate scientific research if they see the value it has in their own lives, she said. She works with her agronomy students to be sure they can communicate their own science.

“I think about how a general public wants to know ‘why does this matter for me?’ The research we do all fits into these larger questions that have societal value. Being able to articulate that is really important,” Basche said.

Because of her interest in how the broader impacts of science are used in democracy and throughout the world, she said she has taken it upon herself to become a better communicator. “Science communication is not an innate skill; it’s an intentional skill some scientists have worked to cultivate, myself included,” she said.

“As a woman in STEM (Science, Technology, Engineering and Mathematics) and not being from a farm, I think those are things I can share as a teacher and as a mentor,” she said.

She also works with her students to become more conscious of agricultural jargon. “I think some people can feel left out if they don’t understand the terminology of production agriculture,” she said.

FINDING DATA, DOING RESEARCH

“We live in an age where there is so much information; how can we extend the information that already exists? Part of science literacy is knowing where to find good, reliable data and making more of what already is available,” she said. “Data mining” is the process of finding reliable research information that already has been produced by scientists, she said.

“There is so much information and scientific research that’s already been published. There’s so much data that gets collected by the government and by other entities. How do we pull that all together to say more?” Basche asked. She has worked on meta-analysis projects that have helped scientists understand how agricultural management impacts environmental outcomes, such as nitrous oxide emissions and soil water storage.

Making the most of soil’s water-holding capacity makes moisture more available during dry periods, so she researches management techniques that can increase it, such as planting cover crops to hold the soil, improving grazing techniques and tilling the soil only when absolutely necessary.

AGRICULTURE DECISIONS

Basche hopes to influence the next generation of decision-makers so they are able to make more systems-oriented decisions.

“I try to bring in examples that demonstrate that the decisions that are made on farms are not made ‘in a vacuum,’ but rather to show how they’re imbedded in this policy and human institutional system. It’s not just about the environment, but the factors that influence it. My students will be the next generation of leaders. These are people who are going to be influencing decision-making in some way. If they can see their roles in the bigger system I think that will be a good contribution I can make to their work in the future,” Basche said.

Anyone involved in agriculture can be considered a decision-maker, she said; not only farmers and ranchers, but also agronomists, insurance agents, seed salespeople and co-op employees. “Consumers also are decision-makers,” she added.

THE BIG PICTURE

Tomorrow’s scientists should be prepared to deal with resiliency in the face of challenges such as water pollution, climate change and shifting consumer demands that impact the world, she said.

“I have to try to get students to see the bigger picture and be interested in not just the production side of agriculture, but also the environmental sustainability and the communication sides,” Basche said. “I think the long-term goal will be whether we have a resilient future. I hope I can contribute to some solutions that have to do with resiliency of our landscape and protecting soil and water resources.” ▲



Julie Obermeyer

AG, NATURAL RESOURCES CAREERS FOCUS ON SCIENCE: college's Obermeyer helps students prepare, stays current on jobs, internships



Interview with Julie Obermeyer

By Mary Garbacz

Statistics from the U.S. Department of Agriculture indicate there are more jobs available than there are students in the educational pipeline to fill them. Another statistic indicates that by the time a student graduates from college, there will be 60 percent more jobs available than when the student started college.

But how do college students prepare for and learn about these careers?

Julie Obermeyer is career development and corporate relations director for the College of Agricultural Sciences and Natural Resources (CASNR) at the University of Nebraska-Lincoln. She teaches employment preparation classes and helps students prepare for the work world, both educationally and professionally. At the same time, she stays in contact with employers to learn about the professional trajectory of each company and the jobs being created as a result.

“A key component of my role is connecting students and employers, and to ensure students find a clear path to career success upon graduation,” Obermeyer said.

CAREER DEVELOPMENT

“One of the main parts of my job is educational; preparing students and helping them build their career toolkits to be successful,” she said. The Employment Seminar course she teaches covers basics such as résumés, cover letters, interview skills, networking and interpersonal skills. A second course, Job Survival, prepares students for the transition to full-time employment. A seminar called Dean’s Scholars in Experiential Leadership is offered by CASNR and is available at no cost to freshmen. The seminar focuses on identifying and tapping into individual strengths and talents and on developing communication skills and confidence. All these opportunities, Obermeyer said, help students prepare educationally and professionally for their careers.

CAREER FAIRS, JOBS

Obermeyer said the corporate relations segment of her job gives her the chance to network with industry and learn about new career opportunities for students. She also can expand the growing list of employers who want to hire the college’s

graduates, either for internships or for full-time career positions after graduation.

She also is able to discover where companies are headed in the future and how many positions they'll be hiring for each year. Since internships are required by many academic programs, Obermeyer helps companies establish internship programs and publicizes them.

Career fairs

Obermeyer organizes three career fairs during each academic year, where employers and students can meet one-on-one. There are two large career fairs – one in the sixth week of the fall semester and another about the same time in the spring semester, she said. A third, smaller career fair is held in late January, specifically timed for life sciences and natural resources students and employers.

“We’ve had significant growth and interest in our career fairs. In 2017, we hosted more than 100 employers at the fall fair alone, whereas a few years ago we tended to hold steady between 60 and 75 employers. About 600 students attend the fall career fair, making it a great opportunity for both students and employers to find each other,” she said. During the fall career fair, more than 200 interviews are conducted, with more occurring in the days following the fair. Hiring managers are interviewing for full-time employment and for summer internships, she added.

A CASNR career fair is big business – and employers are there to hire. In fact, employers increasingly are looking at younger students who they see as having potential. And, they’re willing to wait for them.

“Employers are starting to look at students earlier in their academic careers. They keep track of students they’re really interested in, that they can’t hire just yet but want to stay connected to. That way, when students are closer to graduation and ready for full-time positions employers have already built strong relationships,” she said. “It’s increasingly important for students to attend career fairs, network and become involved early in their academic careers.”

More and more employers are looking for people with high scientific knowledge and technical skills, Obermeyer said, but they’re also looking for

“employability skills.” She explained that those are soft skills, such as communication and problem-solving as well as science literacy and basic, well-rounded scientific knowledge.

Jobs

The College of Agricultural Sciences and Natural Resources includes more than a dozen academic programs with areas of study ranging from professional golf management to entomology; from animal science to food science; from natural resources to leadership, education and communication.

More than 60 percent of CASNR students were placed in jobs within Nebraska in 2016, Obermeyer said. That statistic exceeds the percentage of students who specifically wanted to stay in Nebraska, most of whom were seeking positions within 45 minutes of their hometowns. Fifty percent of CASNR students said they would go anywhere for the right job.

‘ENSURING YOUR FUTURE’ GUARANTEE

“Ensuring Your Future” is a program unique to CASNR, Obermeyer said; no other peer institution offers this guarantee. The program is a comprehensive approach to preparing the college’s graduates for that first job, focusing on academics, involvement and experience.

“The program guarantees a student a job within six months of graduation – in the student’s field of study if he or she completes all the program requirements. It’s everything an employer or faculty member would say the students need to do to be successful,” she said. To qualify for this guarantee, the college student needs to maintain a 3.0 or higher grade point average; complete an internship; have another discovery experience; be involved in at least two student organizations; and be in an honor society. Specific details about the Ensuring Your Future program can be found at <https://casnr.unl.edu/ensuring-your-future>.

For more information about careers in the College of Agricultural Sciences and Natural Resources, go to casnr.unl.edu/careers.

Julie Obermeyer can be contacted by email at jobermeyer@unl.edu.

OUR GUARANTEE:

The college guarantees that any CASNR graduate who completes the Ensuring Your Future program and actively seeks employment will receive at least one job offer relevant to his or her academic program within the first six months after graduation. If you do not receive at least one employment offer, the College will pay for any course that is

documented by an employer who interviewed you and found your degree program lacking critical elements. Career Services will administer an active résumé referral service, post job openings, provide help with résumé preparation and prepare you for interviews with employers who are recruiting University of Nebraska-Lincoln students. ▲



